Greater Chapita Wells Natural Gas Infill Project

Draft Environmental Impact Statement

DOI-BLM-UT-G010-2014-0004-EIS



Vernal Field Office/Utah

Bureau of Land Management

March 2018

BLM Mission Statement

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times.

Management is based upon the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife, wilderness, air and scenic, scientific, and cultural values.

DOI-BLM-UT-G010-2014-0004-EIS

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Green River District Office
170 South 500 East
Vernal, UT 84078
http://www.blm.gov/utah

In Reply Refer To:
1790 (LLUTG00000) P
DOI-BLM-UT-G010-2014-0004-EIS

Dear Reader:

The Draft Environmental Impact Statement (DEIS) for the Greater Chapita Wells Natural Gas Infill Project is enclosed, and available online at http://go.usa.gov/csKAz, for your review.

The DEIS discloses impacts anticipated from EOG Resources Inc.'s proposed Greater Chapita Wells development project, which is located approximately 25 miles south of Vernal Utah. It includes four detailed alternatives: 1) the No Action Alternative; 2) the Proposed Action Alternative, 3) the Resource Protection Action Alternative (BLM-preferred), and 4) the Other Protections Action Alternative. Under the Proposed Action up to 2,808 new gas wells would be drilled in the 43,071 acre project area.

This DEIS is not a decision document; its purpose is to inform the public and the decision maker of the impacts associated with implementing the proponent's drilling proposal and alternatives, and to solicit comments from other agencies and the public. Written comments on the DEIS will be accepted by e-mail, letter, website, or fax for 45 days following the publication of the Notice of Availability in the Federal Register by the Environmental Protection Agency. The exact dates will be posted on the BLM NEPA Register at: http://go.usa.gov/csKAz and in the local papers. All comments are welcome, but the most useful comments will: 1) contain new technical or scientific information, 2) identify data gaps in the impact analysis or will provide technical or scientific rationale for opinions or preferences, and 3) will include references to page numbers and chapters whenever possible. Please refer to the Greater Chapita DEIS in your correspondence.

If you have any questions, please contact Stephanie Howard of this office at (435) 781-4469.

Sincerely,

Gary Torres
District Manager

Enclosures

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Draft Environmental Impact Statement
EOG Resources, Inc.
Greater Chapita Wells Natural Gas Infill Project

Lead Agency: U.S. Department of the Interior, Bureau of Land Management

Project Location: Uintah County, Utah

Comments and Further Information on the Draft EIS

Stephanie Howard, Project EIS Team Lead
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BLM Authorized Officer Responsible for Preparing Draft EIS: Gary Torres

Abstract

EOG Resources, Inc. (EOG) proposes to develop oil and gas resources within the 43,071-acre Greater Chapita Wells Project Area (GCWPA) located in Uintah County, south of Vernal, Utah. The GCWPA is partially developed within the Natural Buttes Gas Field, including 1,247 existing oil and gas wells and associated infrastructure (including access roads, surface and buried pipelines, water disposal facilities, compressors, and power lines) with an estimated disturbance of 3,975 acres. The Proposed Action would include the development of an additional 2,808 wells on 40-acre surface spacing from 233 new well pads and up to 960 existing pads that would be expanded to accommodate additional wells. Estimated new surface disturbance would be approximately 1,875 acres. Construction would begin after issuance of the Final Environmental Impact Statement (EIS) and Record of Decision, approval of individual Applications for Permit to Drill, and approved Rights-of-Way grants. Construction and drilling would require approximately 15 years, with the productive life of the project estimated at up to 60 years.

Four alternatives were analyzed in detail in this Draft EIS. They are the No Action Alternative, Proposed Action Alternative, Resource Protection Alternative, and Other Protections Action Alternative. The No Action Alternative would consist of denying EOG's proposed development of its federal leases, but would include new development on federal leases (up to 462 wells and associated facilities) as disclosed through previously approved National Environmental Policy Act decision documents. The Proposed Action would consist of EOG's proposal for developing the GCWPA. The Resource Protection Alternative would incorporate a number of additional design features and mitigations protective of various resources, in particular of air quality and Uinta Basin hookless cactus. The Other Protections Action Alternative would add design features protective of the White River visual environment, increased Uinta Basin hookless cactus protections, and require burial of all new pipelines. The Resource Protection Alternative is the Bureau of Land Management (BLM) preferred alternative for this Draft EIS.

Under all of the action alternatives, EOG would have the ability to develop up to 2,808 new wells. Under all alternatives, development would continue on state and private leases including roads and pipelines crossing federal lands to access the State and private leases. In addition to EOG's commitment to voluntarily apply the applicant-committed environmental protection measures listed in Chapter 2 of this document, alternative design features and additional mitigations are recommended that would lessen the environmental effects of the proposed project.

Written comments on the Draft EIS will be accepted by the Vernal Field Office of the BLM throughout a 45-day public comment period beginning on the date the United States Environmental Protection Agency publishes a Notice of Availability for this EIS. A summary of the comments and responses to the comments will be provided in the Final EIS.

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Executive Summary

EOG Resources, Inc. (EOG) has notified the Bureau of Land Management's (BLM's) Vernal Field Office (VFO) that it proposes to conduct the Greater Chapita Wells Natural Gas Infill Project to develop the hydrocarbon resources from existing oil and gas leases owned or operated by EOG within the Greater Chapita Wells Project Area (GCWPA) in Uintah County, Utah (**Figure ES-1**). EOG intends to explore and develop all potentially productive subsurface formations underlying the GCWPA.

The GCWPA consists of approximately 43,071 acres in an existing gas producing region in the Natural Buttes Gas Field in the Uinta Basin in northeastern Utah. The GCWPA is located primarily on lands owned by the United States (U.S.) but also includes lands owned by the State of Utah, the Ute Indian Tribe, Tribal allottees, and private parties. Much of the Tribal land in the GCWPA is split estate, with Tribal surface ownership and federal mineral ownership. The BLM has determined that the proposed project constitutes a major federal undertaking requiring the development of an environmental impact statement (EIS).

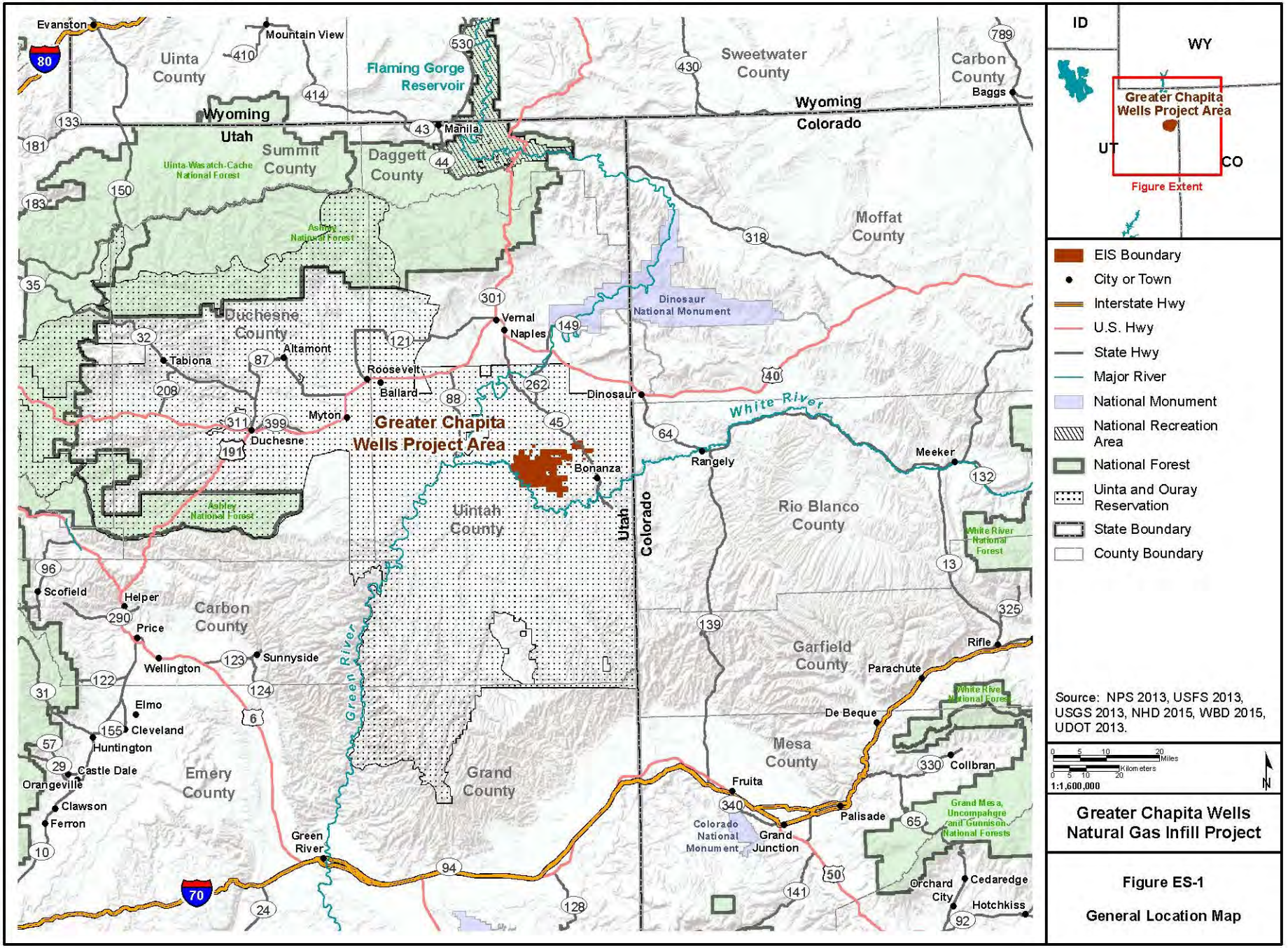
This EIS analyzes and discloses effects resulting from the implementation of the proposed project and alternatives to the proposed project, including an alternative of no action. Analysis of the effects assumes implementation of applicant-committed environmental protective measures, protective design features included in each alternative, and additional mitigations added as a result of the analysis process.

ES.1 Purpose and Need

The BLM's purpose for this action is to respond to the proposal while minimizing environmental effects in accordance with its mandate to manage the public lands for multiple uses while protecting other resource values. The Federal Land Policy and Management Act of 1976 (Public Law 94 579, 43 United States Code [USC] 1701 et seq.) recognizes oil and gas development as one of the "principal" uses of public lands. Federal mineral leasing policies (Mineral Leasing Act of 1920, 30 USC 188 et seq.) and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands so long as undue and unnecessary environmental degradation is not incurred.

The BLM's need with regard to this project is to respond to EOG's request to develop its valid existing leases covering the subject lands. BLM will determine whether the proposed project, or an alternative to the proposed project, would best respond to EOG's request in a manner consistent with existing contractual obligations between EOG and the U.S., as well as BLM's multiple use mandate.

EOG's objective is to develop its leases and efficiently produce the oil and gas resource. EOG estimates that the proposed project would yield cumulative volumes of 4.17 trillion cubic feet (Tcf) of natural gas and over 60 million barrels of condensate. Taxes and royalties received from this production would be supportive of federal, state, Tribal, and local governments.



Greater Chapita Wells Natural Gas Infill Project

Figure ES-1

General Location Map

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6/20/2017

ES.2 EIS Decision Framework

This EIS is prepared in accordance with the National Environmental Policy Act (NEPA) and in compliance with the Council of Environmental Quality regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508), U.S. Department of Interior NEPA implementation regulations (40 CFR Part 36), and guidelines listed in the BLM NEPA Handbook (H-1790-1, BLM 2008a). The BLM is the lead federal agency tasked with the preparation of the EIS.

This EIS evaluates and discloses the environmental effects of four alternatives: the No Action (Alternative A), the Proposed Action (Alternative B), the Resource Protection Action (Alternative C, the BLM preferred alternative), and the Other Protections Action (Alternative D).

This EIS is *programmatic* in nature; the final locations of the wells and well pads, associated access roads and supporting pipelines, and other ancillary facilities have not been finally determined, but are conceptually addressed in this document. However, the degree to which each of the proposed alternatives has been defined is sufficient to allow realistic analyses representative of the anticipated effects resulting from project implementation. Project implementation would not actually occur until completion of additional *site-specific* NEPA analysis and disclosure of the effects associated with the actual determined locations of project facilities.

Following completion of the initial analysis of environmental effects, the EIS is issued in draft form for review by governmental agencies and by the general public. Comments received from reviewers of the Draft EIS are considered by the BLM, responses to each comment are developed, and changes to the EIS, including the incorporation of additional mitigations or analysis of an additional alternative, may be made. The revised document is then issued as the Final EIS.

Following an additional round of review by governmental agencies and the general public, BLM will issue a Record of Decision (ROD), approving a development plan for the federal surface and minerals within the GCWPA. Comments received during the second review process may be incorporated in the ROD. The approved plan may include continuation of current management plans within the GCWPA (No Action Alternative), which would essentially disallow the project proponent's development proposal. Or, the approved plan may be one of the action alternatives, or a new alternative combining features from a combination of the analyzed alternatives.

ES.3 Conformance with Land Management Plans and Other Laws and Policy Considerations

The proposed development of valid existing leases is in conformance with the Vernal Resource Management Plan (RMP) (BLM 2008b). Management decisions within the RMP recognize valid existing rights. EOG owns 100 percent of GCWPA leases, or is the designated operator as a result of contractual agreements with other working interest percentage owners. EOG is responsible for ensuring that lease stipulations are followed during oil and gas development.

The State of Utah has established the Uintah Basin Energy Zone (Utah Code 63J-8-105.5). The Zone, which includes the GCWPA, was established for the purpose of maximizing efficient and responsible development of energy and mineral resources. The legislation calls upon the federal agencies which administer lands and mineral estate within the Zone to cooperate with local counties in expediting mineral resource development and refraining from implementing policies that would be contrary to accomplishing that purpose. The Utah State Institutional Trust Lands Administration has leased 100 percent of state mineral estate within the GCWPA to obtain revenues to support the public schools. The proposed project is consistent with objectives of the State of Utah.

A formal management plan does not exist for the Uintah and Ouray Reservation. However, the elected Ute Tribe Business Committee and the Bureau of Indian Affairs (BIA) are responsible for approvals of land and/or mineral use activities on Tribal Lands. Production from tribal leases provides royalties, tax revenues, and surface access and use fees to the Tribe, which contributes to the Tribe's economic well-being. The proposed project is consistent with the regulatory responsibilities of the BIA, which include promoting the economic development objectives of the Ute Tribe under its government-to-government relationship with, and trust responsibility to, the Ute Tribe.

Uintah County has amended the existing County General Plan regarding development on public lands within the County. The Uintah County General Plan emphasizes: 1) multiple-use management practices and 2) responsible use and optimum utilization of public land resources. Multiple use is defined in the plan as including, but not limited to, the following historically and traditionally practiced resource uses: grazing, recreation, timber, mining, oil and gas development, agriculture, wildlife habitat, and water resources. The proposed project is consistent with the Uintah County Plan.

ES.4 Scoping and Issues Identification

The BLM conducted internal and public scoping to solicit input and identify environmental issues and concerns associated with the proposed project. Internal scoping for this project was conducted by a BLM interdisciplinary team and was subsequently updated as of February 2017. The results of internal scoping have been summarized in **Appendix A**, which lists resources that the BLM VFO resource specialists have determined could be affected as a result of implementing the proposed project.

The public scoping process was initiated on September 9, 2009, with the publication of a Notice of Intent (NOI) in the Federal Register. The BLM prepared a scoping information notice and provided copies to the public, governmental agencies, and applicable Tribes. These announcements included information on the public scoping and information open house, which was held at the Utah Field House Museum of Natural History in Vernal, Utah, on September 29, 2009. The official scoping period ended October 9, 2009. Public response to the NOI and meetings included a total of nine letters: two from federal agencies, one from a county agency, two from a non-government organization, and four from industry or private individuals. Issues and concerns identified during public scoping are summarized in Chapter 1.0, **Table 1-3**.

ES.5 Alternatives

Chapter 2.0 of this EIS describes the existing and approved oil and gas facilities within the GCWPA, as well as the proposed development alternatives, including an alternative of no action. Because air quality is a resource of particular concern in the Uinta Basin, Chapter 2.0 also includes an overview of EOG's air quality emissions control strategy.

In developing alternatives, BLM followed guidance included in 40 CFR 1500-1508, the BLM NEPA Handbook H-1790-1, and BLM Instruction Memorandum No. 2005-247, Attachment 1, which provides recommendations on developing a range of reasonable alternatives for oil, gas, and geothermal development activities. Based on this guidance, the BLM developed four alternatives for analysis in this EIS.

For the purposes of this document, March 2014 was selected as the date for which data would be used for the analysis. A cutoff date is required because information changes and often the length of time required to prepare a typical EIS extends beyond multiple data collection periods.

ES.5.1 Development Activities Common to All Alternatives

Development Strategy The new infill wells would be drilled to the Green River, Wasatch, Mesaverde (including the Blackhawk), Mancos "B," and, possibly Dakota formations. Most of the new wells would be

drilled to the Wasatch Formation, to depths ranging between 6,000 and 8,000 feet, and to the Mesaverde Formation, to depths ranging from 8,000 to 11,000 feet below the surface.

Most existing well development within the GCWPA consists of vertically drilled wells located on well pads spaced at a density of one pad every 40 acres. Because the wells are vertical, the bottom hole spacing also is 1 hole every 40 acres. To drill wellbores more closely spaced than the well pad density on the surface, wellbores would be directionally drilled from the well pads. The bottom hole locations of these wellbores would be horizontally offset from the well pad locations to create a subsurface well spacing pattern with the bottoms of the wellbores spaced more closely than the surface well pads.

Subsurface well spacing is largely a function of reservoir quality. Throughout the GCWPA, reservoir quality in the Wasatch Formation has been determined by EOG to require maximum commercial development at a bottom hole spacing of one well for every 20 acres. Within the GCWPA, reservoir quality within the Mesaverde Group has been determined by EOG to be more variable. In the northern and northeastern portions of the GCWPA, reservoir characteristics require maximum commercial development at a bottom hole density of one well for every approximately 10 acres. Over the rest of the GCWPA, maximum commercial development requires a bottom hole location as dense as every 5 acres as a result of different reservoir characteristics within the Mesaverde.

Existing Infrastructure: As of March 2014, the GCWPA contained 1,247 active natural gas wells located on 960 well pads as well as ancillary facilities. Approximately 257 miles of roads are located within the GCWPA. About 64 percent of the road mileage consists of relatively short (average 1,000 feet) well pad access roads. The remainder consists of various through roads, including some county-maintained roads. Existing infrastructure includes the Phase 1 portion of a liquids gathering system (LGS) intended to reduce existing and future project air emissions. Total existing disturbance in the GCWPA is approximately 3,975 acres, or 9.2 percent of the GCWPA. An additional 1,000 acres of prior disturbance has been reclaimed.

ES.5.2 Alternative A—No Action

Alternative A represents the continuation of current land management practices in the GCWPA. This alternative assumes that approval of EOG's proposed project is denied and only those wells analyzed in previous NEPA documents and approved in accompanying decision-making documents would be drilled on federal surface or mineral estate. This alternative would result in the construction of up to 425 new well pads, drilling of up to 462 new wells, and construction of related facilities. This alternative also includes site-specific disturbance of 1,034 acres for the construction and operation of Phase 2 of a LGS intended to reduce existing and future oil and gas air pollutant emissions. The BLM has determined that this portion of Alternative A would carry forward regardless of the alternative selected for this EIS.

New surface disturbance associated with this alternative would be up to 2,685 acres, in addition to 3,975 acres of existing disturbance. For the purposes of estimating production, it was assumed that this alternative would be developed over 10 years. The productive life of individual wells is estimated to be up to 40 years. Final reclamation following cessation of production is expected to take at least 5 years to complete.

ES.5.3 Alternative B—Proposed Action

Alternative B is EOG's proposal for development of oil and gas resources within the GCWPA. This alternative provides for construction of new well pads at a density of not greater than one well pad per 40-acre surface spacing. The alternative would result in the expansion of up to 960 existing well pads to permit drilling of multiple wells, construction of up to 233 new well pads, drilling of up to 2,808 new wells, and construction of related facilities. An average new well pad would be approximately 3.75 acres in size. Adding additional wells to new or existing well pads would incrementally add 0.25 acre per added well. Drilling and completion of each well would require up to 16,850 barrels of fresh and re-cycled water.

A minimum of 51 percent of proposed wells would be connected to the LGS to assist in air emissions control.

New surface disturbance associated with this alternative would be up to 1,875 acres, in addition to 1,034 acres of site-specific No Action disturbance and 3,975 acres continued use of existing disturbance. EOG has estimated that this alternative would be developed over 15 years with an average annual drilling rate of 187 wells. Well lives and reclamation rates are expected to be the same as those for Alternative A.

ES.5.4 Alternative C—Resource Protection Action

Alternative C is the BLM preferred alternative. Alternative C is similar to Alternative B, but would place more emphasis on protection of GCWPA resources. Within portions of the GCWPA, new well pads would be restricted to a spacing of not more than one pad per 80 acres of surface. There would be restrictions on new wells and well pads within U.S. Fish and Wildlife Service *Sclerocactus*-identified protection areas. The alternative would result in the construction of up to 162 new well pads, the expansion of up to 960 existing well pads to accommodate the drilling of multiple wells, and the drilling of up to 2,808 wells. Well pad sizes, water requirements, and percentage of wells connected to the LGS would be the same as for Alternative B.

New surface disturbance associated with this alternative would be up to 1,514 acres, in addition to 1,034 acres of site-specific no action disturbance and 3,975 acres continued use of existing disturbance. EOG has estimated that this alternative would again be developed over 15 years with an average annual drilling rate of 187 wells. Well lives and reclamation rates are expected to be the same as those for Alternative A.

ES.5.5 Alternative D—Other Protections Action

Alternative D encompasses most features of Alternative C, but would place additional emphasis on mitigating project effects on certain resources. Restrictions on development within *Sclerocactus* core areas would be increased; a visual buffer along the White River would be enforced; additional air quality mitigation would be included, and all new pipelines would be buried. Development would be more limited in portions of the northern part of the GCWPA and along the White River. The alternative would result in construction of up to 157 new well pads, the expansion of up to 880 existing well pads to accommodate the drilling of multiple wells, and the drilling of up to 2,808 wells. Well pad sizes, water requirements, and percentage of wells connected to the LGS would be the same as for Alternative B.

New surface disturbance associated with this alternative would be up to 1,595 acres, in addition to 1,034 acres of site-specific No Action disturbance and 3,975 acres continued use of existing disturbance. EOG has estimated that this alternative would be developed over 15 years with an average annual drilling rate of 187 wells. Well lives and reclamation rates are expected to be the same as those for Alternative A.

ES.5.6 Alternatives Considered but Eliminated from Detailed Analysis

In addition to the alternatives described above, a number of other possible alternatives were examined, but eliminated from further consideration. An alternative can be dismissed because:

1. It does not meet the Agency's purpose and need;
2. It is technically or economically unfeasible;
3. Its implementation is remote or speculative;
4. It is similar in design to another alternative analyzed;

5. It would have similar effects to an alternative analyzed; or
6. It would result in greater effects than the Proposed Action.

Use of Produced Water for Waterflood Projects - Waterflood projects are a type of enhanced oil and gas recovery method in which water is injected into wells in the vicinity of a producing well, typically using re-cycled produced water. In the GCWPA, produced water is obtained almost entirely from the Mesaverde Group. This water is corrosive, has high scaling tendencies, and contains variable levels of poisonous hydrogen sulfide, making produced water unsuitable for drilling or completing wells within the field. Use of produced water for waterflood projects would entail similar difficulties. It was determined that this alternative is technically or economically unfeasible, would result in effects greater than the Proposed Action, and is not analyzed in detail in this EIS.

All Project Wells would be Connected to the LGS - EOG's current Proposed Action connects as many wells to the electrified LGS as is feasible, based on available electric power in the GCWPA. Presently, the area electric utilities do not have sufficient capacity to supply additional electricity beyond what EOG has committed to use beginning in late 2015. A Federal Energy Regulatory Commission jurisdictional boundary subdividing the GCWPA provides further complications in obtaining and transferring electric power within the field. Expansion of a non-electrified LGS beyond what EOG has proposed would not substantially decrease project facility emissions and would not achieve the desired air quality benefits. Therefore, this alternative was evaluated as being technically or economically unfeasible and is not analyzed in detail in this EIS.

All Field Facilities would be Electrified using Commercial Power Sources - This proposed alternative is evaluated as being technically or economically unfeasible for the same lack of available electrical power reason as the previously considered but eliminated alternative.

All Field Facilities would be Electrified using Solar Panels - EOG currently uses solar power for small voltage electronics. The amount of solar power that would need to be generated to electrify the entire GCWPA would require solar panels covering an area of 200 acres at a cost of $300 million. A solar development of this scale also would likely result in effects to sensitive species such as Uinta Basin hookless cactus, and require considerable amounts of water for cooling. Backup power via gas-fired generators would be needed due to the unreliability of solar power, especially during the winter inversions. This would mean that additional ozone precursor emissions would be generated during the period of highest sensitivity to ozone effects. This alternative would negate EOG's current investments and plans for using commercial sources for field electrification. Therefore, this alternative was evaluated as being technically or economically unfeasible and is not analyzed in detail in this EIS.

Full Field Development - EOG's original proposal for the project approximated a full field development of 7,028 wells drilled over a 15-year period. When the issue of high concentrations of winter-time ground level ozone in the Uinta Basin was recognized, EOG felt that the proposed project would be difficult to achieve without substantial deleterious effects to the airshed. Accordingly, this alternative was evaluated as having effects greater than the Proposed Action and is not analyzed in detail in this EIS.

Additional alternatives considered but not analyzed in detail are discussed in Chapter 2.0, Section 2.10.5.

ES.5.7 Affected Environment

Chapter 3.0 describes the current condition of those resources and values which occur in the vicinity of the GCWPA and which comprise the natural and human environment. The resources discussed in this chapter are considered to have the potential to be affected by implementation of the Proposed Action or another project alternative as documented in **Appendix A**. The current condition of these resources

establishes a baseline against which direct, indirect, and cumulative effects from the Proposed Action or other alternatives may be measured and compared.

ES.5.8 Environmental Consequences

Effects to environmental resources or values resulting from implementation of an analyzed alternative may be either beneficial (positive) or detrimental (negative) and may vary in duration from short-term (until completion of interim or final reclamation), typically 5 or more years in this portion of the Uinta Basin, to long-term, which would encompass project life and may be permanent in the absence of successful restoration or reclamation. Effects may be negligible (little or no effect to the resource), low (effects are difficult to detect and cause minimal change to the resource), moderate (effects are readily apparent but do not meet the criteria of significant effects), or significant.

Effects may be either direct, occurring at the same time and place as the Proposed Actions, or indirect, occurring at another time or location. Residual effects would be those remaining following completion of reclamation activities and application of all incorporated design features and added mitigations.

Implementation of any alternative may result in the irreversible and irretrievable commitment of resources. Examples include the depletion of the oil or gas resource during field development, permanent loss of cultural resources, or permanent destruction of wetlands. These are effects which are permanent and cannot be reversed, precluding future options for the use of the resource. Effects also may be beneficial, as in economic returns from resource development projects.

Estimated surface disturbance and other direct and indirect effects from the analyzed action alternatives (Alternatives B, C, and D) would be additive to effects and disturbance from site-specific actions relating to the Phase 2 LGS and electrical distribution system summarized in Alternative A, as well as to the existing surface disturbance. These effects are analyzed in Chapter 4.0.

A summary of surface disturbance associated with each of the alternatives is indicated in **Table ES-1**. A summary of direct and indirect effects associated with each resource under the various alternatives is indicated in **Table ES-2**.

ES.5.9 Cumulative Effects

In addition to an evaluation of direct and indirect effects, NEPA requires consideration of the potential for proposed cumulative effects. Cumulative effects are defined as the impact on the environment that results from the incremental impact of an action when added to other past and present actions and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects are analyzed in detail in Chapter 5.0.

The geographic scope used for analysis varies for each resource. Resources, which are more mobile in nature, such as air quality, tend to have larger analysis areas assigned to capture the extent of cumulative effects. Activities in the vicinity of the proposed project, which have had the greatest effect on the surrounding environment are assumed to be those most likely to also be important in the future. Some activities, such as low-level saleable minerals extraction, occur at “background” levels that do not vary greatly over time, while others, such as oil and gas development, can display highly variable activity levels. Activities in the vicinity of the GCWPA, which have had substantial effects on the human environment, and for which reasonably available data sources exist, include minerals extraction, roads construction, and livestock grazing.

A summary of the cumulative analysis areas selected for each resource, the cumulative surface disturbance associated with each of the alternatives, and a general summary of cumulative effects anticipated for each resource, is indicated in **Table ES-3**.

Table ES-1 Comparison of Estimated Surface Disturbance among Alternatives

Facility	Size (acres) or Disturbance Width (feet)	Alternative A No Action			Alternative B Proposed Action			Alternative C (Preferred) Resource Protection Action			Alternative D Other Protections Action		
		Multiplier: Well Pads (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)	Multiplier: Well Pad (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)	Multiplier: Well Pad (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)	Multiplier: Well Pad (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Area Facilities													
Single New Well Pads	2.50	425	425	1,063	0	0	0	0	0	0	0	0	0
New Well Pads	3.75	0	0	0	233	233	874	162	162	608	157	157	589
Expandable Well Pads [1]	0.25	37	37	9	960	2,575	644	960	2,646	662	880	2,651	663
Additional Disposal Wells	3.75	0	0	0	3	3	11	3	3	11	3	3	11
Total Area Facilities				1,072			1,529			1,280			1,263
Linear Facilities													
New Well Pad Access Roads [2]	40	87.5		424	44.1		214	30.7		149	29.7		144
Surface Gas Pipelines - Non-LGS New Pads [3]	30	40.2		146	36.4		132	23.1		84	0.0		0
Buried Gas Pipelines - Non-LGS New Pads [3]	70	0.0		0	0.0		0	0.0		0	22.2		188
Total Linear Facilities				571			346			233			332
Other Facilities													
Compressor Station Expansion				8			0			0			0
Site-specific No Action Carried Forward													
LGS Central Facilities	6.60	18		119	18		119	18		119	18		119
LGS Central Facility Access Roads	50	5.11		31	5.11		31	5.11		31	5.11		31
LGS Buried Pipelines	70	89.6		760	89.6		760	89.6		760	89.6		760
Electrical Distribution System	Variable	32.8		124	32.8		124	32.8		124	32.8		124
Total No Action Carried Forward				1,034			1,034			1,034			1,034
Alternative Disturbance (acres)				2,685			1,875			1,514			1,595
Alternative + No Action Carried Forward Disturbance (acres)				NA			2,909			2,548			2,629
Estimated Reclaimable Surface Disturbance [4]													
Well Pads Interim Reclamation (acres)				128			171			175			175
Roads Interim Reclamation (acres)				223			107			74			72
Pipelines Interim Reclamation (acres)				921			132			84			188
Total Reclaimable Surface Disturbance (acres)				1,272			410			333			435
Total Reclaimable % of GCWPA				3.0%			1.0%			0.8%			1.0%
GCWPA Total Disturbance (acres)													
Approved Disturbance % of GCWPA				6.2%			4.4%			3.5%			3.7%
Existing Disturbance (acres)				3,975			3,975			3,975			3,975
No Action Site-specific Disturbance (acres)				NA			1,034			1,034			1,034
Alternative + No Action + Existing Disturbance (acres)				6,660			6,884			6,523			6,604

[1] Each additional well expansion adds 0.25 acre disturbance to available new or existing expansion well pads.
[2] Access roads assumed to 1,000 feet long, based on field experience. Long-term road running width is 20 feet in 40-foot ROW.
[3] Surface and buried pipelines for all available new pad locations outside LGS coverage area, 1000 feet/pad.
[4] Assumes 0.3 acs. for 1-well pads + incremental 0.12 acs. for each additional well connected to LGS centralized facilities (reclamation would not occur for wells added to existing pads that are not connected to LGS centralized facilities) , 18 to 20-foot road running surface (within a 40 foot ROW), and 100% pipeline reclamation.

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
General					
Short-term Surface Disturbance (acres)	2,685	1,875	1,514	1,595	Sections 2.5, 2.7, 2,8, and 2.9
Geology, Minerals, and Energy Production					
Recoverable Gas Resources Over the Life of the wells (Tcf)	0.52	4.17	4.17	4.17	Sections 4.2.1.1, 4.2.1.2, 4.2.1.3, and 4.2.1.4
Recoverable Condensate Resources Over the Life of the Wells (millions barrels)	4.9	60.5	60.5	60.5	Sections 4.2.1.1, 4.2.1.2, 4.2.1.3, and 4.2.1.4
Air Quality and Greenhouse Gas Emissions					
Air Quality (exceed National Ambient Air Quality Standards [NAAQS])	Possible O_3 exceedance some areas	Yes O_3 exceedance some areas (Max 5.9 ppb)	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Hazardous Air Pollutants (exceed acute Reference Exposure Level [REL])	Same or less than Alternative B	No	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Nitrogen Deposition (exceed critical load threshold)	Same or less than Alternative B	Yes Exceedance most modeled areas.	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Sulfur Deposition (exceed Depositional Analysis Threshold)	Same or less than Alternative B	No	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Acid Neutralizing Capacity (exceed 10% change)	Same or less than Alternative B	No	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Visibility Class I Areas (annual days exceeding 0.5 delta (change) deciviews [Δdv change])	Same or less than Alternative B	0	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Visibility Class II Areas (annual days exceeding 0.5 Δdv change)	Same or less than Alternative B	Up to 356	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Maximum Annual Greenhouse Gas Emissions carbon dioxide equivalent (million tons per year)	Same or less than Alternative B	0.49	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Water Resources					
100-year Floodplains (incremental acres disturbed)	Minimal	Minimal	Minimal	Minimal	Sections 2.6.9, 2.8.3, 2.9.3
Drilling and Completion Total Project Fresh Water Use (acre-feet)	122	742	742	742	Sections 2.5.2, 2.6.3.3, 2.7.2.2, 2.8.2.3, and 2.9.2.3
Drilling and Completion Total Project Recycled Water Use (acre-feet)	881	5,357	5,357	5,357	Sections 2.5.2, 2.6.3.3, 2.7.2.2, 2.8.2.3, and 2.8.2.3
Maximum Produced Water Injected (acre-feet per year)	78	2,117	2,117	2,117	Sections 2.5.2, 2.7.2.4, 2.8.2.3, and 2.9.2.3
Additional produced water disposal wells required?	0	3	3	3	Sections 2.5.2, 2.7.2.4, 2.8.2.3, and 2.9.2.3
Soils					
High Constraint (incremental acres disturbed)	2,245	1,637	1,332	1,404	Table 4.5-1
Moderate Constraint (incremental acres disturbed)	275	201	152	159	Table 4.5-1
Low Constraint (incremental acres disturbed)	165	37	30	32	Table 4.5-1
Vegetation (Including Special Status Species)					
Vegetation Type (estimated incremental acres disturbed)					Tables 4.6-2, 4.6-3, 4.6-4, and 4.6-5
Badlands	657	468	385	383	
Cliff/Canyon	160	114	88	80	
Developed/Disturbed	179	131	107	117	
Grassland	119	85	67	61	
Sagebrush shrubland	451	312	255	300	
Salt-desert shrubland	1,119	765	612	653	
Wetland/Riparian	0	0	0	0	

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Uinta Basin Hookless Cactus					Sections 2.6.9, 2.8.3, 2.9.3, 4.6.1.2, 4.6.1.3, 4.6.1.4, and 4.6.1.5
Individual Plants will be Avoided	Yes	Yes	Yes	Yes	
New Well Pads in Core 1 Areas	Allowed	Allowed	Disallowed	Disallowed	
New Well Pad Restrictions in Core 2 Areas	No	No	Yes	Yes	
Wildlife and Fisheries (Including Special Status Species)					
Big Game Habitat (estimated incremental acres disturbed)					Sections 2.8.1.2 and2.8.3 Tables 4.7-2, 4.7-3, 4.7-4, and 4.7-5
Mule Deer Year-long Crucial	143	105	77	40	Table 4.7-1
Pronghorn Year-long Crucial	2,382	1,739	1,417	1,547	Table 4.7-2
Rocky Mountain Bighorn Sheep Year-long Crucial	184	134	101	57	Table 4.7-3
Bison Year-long Crucial Range	58	42	19	2	Table 4.7-4
Black-footed Ferret Prime Management Zone (estimated incremental acres disturbed)	165	121	96	120	Table 4.7-5
Prairie Dog Colonies (estimated incremental acres disturbed)	121	89	71	76	Table 4.7-6
Greater Sage-grouse Proposed General Habitat (estimated incremental acres disturbed)	88	64	52	64	Table 4.7-7
Western Yellow-billed Cuckoo Habitat (estimated incremental acres disturbed)	0	0	0	0	Sections 4.7.1.1, 4.7.1.2, 4.7.1.3, and 4.7.1.4
Fisheries	Potential for increased sediment transport to local streams.	Potential for increased sediment transport to local streams.	Potential for increased sediment transport to local streams.	Potential for increased sediment transport to local streams.	Sections 4.7.1.1, 4.7.1.2, 4.7.1.3, and 4.7.1.4

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Paleontological Resources					
Potential Fossil Yield Classification Class 4 or 5 areas (potential incremental acres disturbed)	1,897	1,312	1,148	1,254	Section 4.8.1
Cultural Resources and Traditional Cultural Values					
Sites potentially encountered (incremental due to new surface disturbance)	19 to 48	14 to 35	11 to 27	11 to 28	Section 4.9.1
Socioeconomic Resources					
Revenues and Spending					
Cumulative Value of Oil and Gas Production (billions of dollars)	2.2	20.2	20.2	20.2	Section 4.10
Direct Total Project Spending (billions of dollars)	1.8	11.3	11.3	11.3	Sections 4.10.1.2, 4.10.1.3, 4.10.1.4, and 4.10.1.5
Employment (number jobs)					
Peak Direct On-site - Development Phase	109	345	345	345	Section 4.10 Figures 4.10-5 through 4.10-7
Average Direct On-site - Production Phase	95	279	279	279	Section 4.10.1.2, 7.10.1.3, and 4.10.1.4 Figure 4.10-14 Table4.10-7
Average Secondary - Development Phase	84	222	222	222	Section 4.10.1.2, 7.10.1.3, and 4.10.1.4 Figure 4.10-14 Table4.10-7

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Average Secondary - Production Phase	12	62	62	62	Section 4.10.1.2, 7.10.1.3, and 4.10.1.4 Figure 4.10-14 Table4.10-7
Population and Housing (workers / housing units)	313/128	1068/478	1,068/478	1,068/478	Sections 4.10.1.2, 4.10.1.3, 4.10.1.4, 4.10.1.5, and 4.10.1.6 Table 4.10-8
Average Temporary Workers - Development Phase	70	199	199	199	Section 4.10.1.4 Table 4.10-8
Average Temporary Workers - Production Phase	6	66	66	66	Section 4.10.1.4 Table 4.10-8
Average New Resident Workers - Development Phase	231	712	712	712	Section 4.10.1.4 Tables 4.10-7 and 4.10-8
Average New Resident Workers - Production Phase	48	222	222	222	Section 4.10.1.4 Tables 4.10-7 and 4.10-8
Average Temporary Housing Units - Development Phase	64	236	236	236	Section 4.10.1.4 Table 4.10-8
Average Temporary Housing Units - Production Phase	2	49	49	49	Section 4.10.1.4 Table 4.10-8
Average Conventional Housing Units - Development Phase	63	173	173	173	Section 4.10.1.4 Table 4.10-8
Average Conventional Housing Units - Production Phase	20	64	64	64	Section 4.10.1.4 Table 4.10-8

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Public Sector Revenues (cumulative millions of dollars)					Sections 4.10.1.2, 4.10.1.3, 4.10.1.4, and 4.10.1.5
Cumulative Projected Ad Valorem Tax (Uintah County and School District)	27.9	256.1	256.1	256.1	
Cumulative Utah Severance Taxes	80.8	749.6	749.6	749.6	
Cumulative Federal and Tribal Mineral Royalties	116.4	1,084.5	1,084.5	1,084.5	
Cumulative State Royalties (49.0% of federal royalties)	107.7	1,002.9	1,002.9	1,002.9	
Cumulative Royalties to the State Permanent Public School Fund	15.1	140.4	140.4	140.4	
Combined Public Sector Revenues	348.0	3,233.5	3,233.5	3,233.5	
Percent Increase over No Action	N/A	829%	829%	829%	
Livestock Grazing and Rangeland					
Animal Unit Months (AUMs) Lost – BLM	213	137	107	112	Table 4.12-1
AUMs Lost – BIA	12	9	9	7	Table 4.12-1
Total AUMs Lost	225	145	115	119	Table 4.12-1
Access and Transportation					
New Access Roads (miles)	92.6	44.1	28.6	27.7	Section 4.13.1
Increase in Maximum Traffic Loads - Main Access Roads (average annual daily trips)	169	446	446	446	
Increase in Maximum Traffic Loads - Main Access Roads (percentage of existing)	10%	28%	28%	28%	
Number of Annual Incidents (mostly minor accidents and spills)	1	6	6	6	

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Visual Resources					
Impacts to People and Scenery	Build-out would result in moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Decreased scenic effects in comparison to Alternatives B, C, and D.	Moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Increased effects in comparison to Alternatives C and D.	Moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Reduced effects in comparison to Alternative B and similar to Alternative D.	Moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Reduced effects in comparison to Alternative B and similar to Alternative C.	Section 4.14.1
Conformance with Visual Resource Management (VRM) Class Objectives	Strong contrasts to landform and vegetation would result in non-conformance with VRM Class III Objectives.	Mitigation to landform would result in reduction of strong contrasts and conformance with VRM Class III.	Mitigation to landform would result in reduction of strong contrasts and conformance with VRM Class III.	Mitigation to landform would result in reduction of strong contrasts and conformance with VRM Class III.	Section 4.14.1
Recreation					
Effects to the Red Wash Off-highway Vehicle Area	No burial of new pipelines.	No burial of new pipelines.	No burial of new pipelines.	Rider conflicts will be minimized by burial of new pipelines.	Section 4.15.1
Effects on Recreational Use of the White River	Increase in industrial nature of surroundings proportional to development levels.	Increase in industrial nature of surroundings proportional to development levels.	Increase in industrial nature of surroundings proportional to development levels.	Increase in industrial nature of surroundings proportional to development levels.	Section 4.15.1

Table ES-2 Comparison of Direct and Indirect Effects among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Effects to the Fantasy Canyon Special Resource Management Area (SRMA)	Limitations on facilities development in or near the SRMA.	Limitations on facilities development in or near the SRMA.	Limitations on facilities development in or near the SRMA.	Limitations on facilities development in or near the SRMA.	Section 4.15.1

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Geology, Minerals, and Energy Production	GCWPA (43,071 acres)	6,798	7,022	6,661	6,742	Recoverable energy resources over the life of the project would be 0.52 Tcf of natural gas and 4.9 million barrels of condensate under Alternative A and 4.17 Tcf of gas and 60.5 million barrels of condensate under the action alternatives.
Air Quality	Uinta Basin + nearby Class I and Sensitive Class II areas (4,479,458 acres)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Cumulative effects to criteria pollutants as predicted from modeling would be below NAAQS standards for all pollutants except ozone, which would exhibit NAAQS exceedances in portions of the cumulative effects analysis area (CEAA). Near-field hazardous air pollutant (HAP) concentrations were all below the acute REL and non-carcinogenic HAP RfCs and showed cancer risks within acceptable limits. The predicted cumulative visibility change at Class I viewsheds ranged from 0.43 deciviews (dv) in the West Elk Wilderness Area to 11.3 dv in Rocky Mountain National Park. The maximum visibility impact for any of the areas analyzed is predicted to be 11.4 dv in the Uintah and Ouray Indian Reservation. Cumulative deposition values are generally predicted to exceed the nitrogen critical loads for most areas analyzed; however, no exceedances of the sulfur critical load are predicted for any area analyzed.
Water Resources	Surface water - twelve 6th-order watersheds intersecting the GCWPA (262,735 acres)	21,507	21,731	21,370	21,451	For surface water, implementation of any of the project alternatives would result in incremental increases in the potential for increased sediment transport to local drainages and spills. Design features and mitigations incorporated into all alternatives would minimize the probability of occurrence of these effects. Disturbance to the White River floodplain is prohibited under all alternatives. The proposed project would represent approximately 6.8 to 12.5 percent of the past, present, and foreseeable disturbance, depending on the alternative.

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Water Resources (cont.)	Groundwater - GCWPA + 2-mile buffer(124,718 acres)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	The proposed project would incrementally increase the potential for spills and releases or casing failures, but design features and mitigations included for all alternatives would minimize the potential for damage to local aquifers. The proposed project would represent approximately 11.0 to 20.1 percent of the past, present, and foreseeable disturbance, depending on the alternative.
Soils	Twelve 6th-order watersheds intersecting the GCWPA (262,795 acres)	21,507	21,731	21,370	21,451	This increased cumulative soil disturbance acreage would likely reduce soils productivity within the CEAA for the life of oil and gas operations until post-decommissioning reclamation is determined to be successful in terms of soil stability and productivity. Cumulative effects to disturbed soils could include accelerated erosion and soil loss and reduced soil productivity as measured by amounts and types of vegetative cover and forage as well as biological soil crust cover.
Vegetation	Twelve 6th-order watersheds intersecting the GCWPA (262,795 acres)	21,507	21,731	21,370	21,451	Implementation of any of the project alternatives would result in incremental increases in disturbance to local vegetation communities, in particular to salt desert shrub, sagebrush, and badlands communities, which comprise approximately 80 percent of the GCWPA. Opportunities for spread of invasive species would be increased. The proposed project would represent approximately 6.8 to 12.5 percent of the past, present, and foreseeable disturbance, depending on the alternative. Cumulative losses for vegetation resources potentially would include the reduction of numerous habitat functions including soil stability, erosion control, species biodiversity, wildlife forage and habitat, and available forage for livestock grazing operations.

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Special Status Plants	For *Sclerocactus*, the 2013 FWS potential habitat polygon (537,56 acres)	35,722	36,171	35,904	35,926	The proposed project would incrementally increase surface disturbance within *Sclerocactus* habitat, but mitigations included for all alternatives would minimize the potential for loss of individual plants or local populations. The proposed project would represent approximately 3.0 to 5.6 percent of the past, present, and foreseeable disturbance, depending on the alternative.
	For other sensitives, the 12 6th-order watersheds (262,795 acres)	21,507	21,731	21,370	21,451	General effects to other special status plant species would be similar to those expected for general vegetation.
Wildlife and Fisheries	General Wildlife 12 6th-order watersheds (262,795 acres)	21,507	21,731	21,370	21,451	Wildlife species that are most susceptible to cumulative effects associated with the proposed project are those that have specific habitat or range requirements that are increasingly exposed to disturbance or loss. Big game species, including mule deer, pronghorn, Rocky Mountain bighorn sheep, and bison, have year-long crucial range in the GCWPA. Implementation of any of the alternatives would disturb fractional additional percentages of the respective analysis areas.
	Utah Division of Wildlife Resources (UDWR) pronghorn range(1,148,043 acres)	66,658	66,932	66,610	66,731	
	UDWR mule deer range (3,862,142 acres)	43,904	44,900	44,872	44,829	
	UDWR Rocky Mt. bighorn sheep range (1,047,147 acres)	11,011	11,995	11,962	11,913	

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Special Status Animals	UDWR greater sage-grouse range (1,501,962 acres)	22,615	23,623	23,611	23,623	Cumulative effects to the habitat of other special status species would contribute less than 1 percent of additional surface disturbance.
	For land species: Combined UDWR big game and greater sage grouse ranges in Uintah and Duchesne counties (4,867,970 acres)	106,400	106,624	106,263	106,344	Implementation of any of the Greater Chapita Wells alternatives would result in additional disturbance to less than one percent of the greater sage-grouse CEAA.
	For endangered fish: 4th-order watersheds within the VFO (5,421,310 acres)	112,151	112,375	112,014	112,095	Potential cumulative effects to the Colorado River Endangered fishes include sedimentation caused by surface disturbing activities, water depletion of the Green River, and the potential for leaks or spills of industrial fluids, fuels, or other liquids that could contaminate occupied habitats in the White River. Implementation of any of the project alternatives would result in additional disturbance to less than one percent of the Colorado River endangered fishes CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and reasonably foreseeable actions would result in cumulative disturbance to two percent of the CEAA.
Paleontology	GCWPA (43,071 acres)	6,798	7,022	6,661	6,742	Approximately 76 percent of the CEAA is underlain by rocks which have been shown to contain scientifically important fossil remains. Loss of paleontologic information typically results from destruction during bedrock excavation from surface-disturbing activities. Requirements to conduct pre-construction surveys and monitoring of surface disturbing activities, in some cases, would likely mitigate the potential for loss of paleontologic information. Fossils recovered during these activities would add to our general understanding of Middle Eocene conditions in the area.

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Cultural Resources	GCWPA plus a 1-mile buffer (88,666 acres)	10,173	10,397	10,036	10,117	Cumulative effects to cultural resources within the CEAA would result from actions associated with surface and subsurface disturbances related to the development of natural resources, primarily oil and gas. Other actions pertaining to transportation corridors, recreation, and grazing also may contribute to cumulative effects to the archaeological record in the foreseeable future. Effects to cultural resources also may result from management decisions that result in atmospheric, visual, or auditory effects that may affect the integrity of eligible historic properties or traditional places. Under any of the alternatives, total cumulative surface disturbance would affect up to approximately 11 percent of the CEAA.
Socioeconomics (and Environmental Justice)	Uintah and Duchesne counties (4,961,230 acres)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Combined public sector revenues would be approximately $348 million under Alternative A and $3,234 million under the action alternatives. Total direct project spending is estimated to be approximately $1.8 billion under Alternative A and $11.7 billion under the action alternatives. The action alternatives production represents approximately 150 percent of the total Utah oil and condensate production in 2014 and nine times the total Utah gas production in 2014.
Livestock and Grazing	Entirety of grazing allotments intersecting the GCWPA (339,649 acres)	21,273	21,497	21,136	21,101	Cumulative past, present, and foreseeable surface disturbance would represent a forage loss of 463 to 575 AUMs, depending on the alternative. The levels of surface disturbance could incrementally increase herding difficulties and fragmentation of lambing areas. The proposed project would represent approximately 6.9 to 12.6 percent of the past, present, and foreseeable disturbance, depending on the alternative.

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Access and Transportation	GCWPA + primary access roads (Not Applicable)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Potential positive effects would be the additional maintained roads accessing previously inaccessible (un-roaded) areas where new oil and gas development would occur that would secondarily support expanded recreational activities. Negative effects resulting from vehicle accidents, including associated releases of trucked product and produced water, could result from increased project-related traffic. Adverse effects would include road use by oil and gas project-related traffic combined with increased recreational uses. Overall traffic would build during the construction, drilling, and completion phase, coupled with increasing production haul traffic, but would then begin to decrease for the remaining years of production.
Visual Resources	GCWPA viewshed to 15 miles (926,733 acres)	37,992	38,216	37,855	37,936	Cumulative oil and gas development projects have been and would be the most likely to introduce visual contrast within the visual resources CEAA. Nearly all of the identified development would be located in VRM Class III and VRM Class IV areas. It is anticipated that the visual disturbance would meet the standards of the VRM Class IV objective but would not meet the VRM Class III objective, unless tanks are painted to mimic the colors of the surrounding landscape and pads are reshaped to repeat the form elements of the background topography. Implementation of the reclamation measures consistent with the BLM's Green River District Reclamation Guidelines and the assumption that similar standard reclamation requirements would be required for permitting of future projects, the cumulative effects to visual resources would be minimized to the degree possible.

Table ES-3 Comparison of Cumulative Effects among Alternatives by Resource

Resource	Selected CEAA (area)	Cumulative Surface Disturbance (acres)				Cumulative Effects General Summary
		Alternative A	Alternative B	Alternative C	Alternative D	
Recreation	GCWPA + 2-mile buffer (124,718 acres)	13,350	13,574	13,213	13,294	Project implementation would both add and subtract from recreational opportunities within the CEAA. Positive effects could result from the expansion of road-oriented recreational activities such as OHV, motor bike, mountain bike, site-seeing, and improved access for hunting. Implementation of any of the alternatives would add to the existing oil and gas road network. Negative effects could result from temporary restrictions of road use and reduced opportunities and/or experiences for dispersed recreational activities, including access to and use of Fantasy Canyon and the White River.

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
AADT	Average Annual Daily Traffic
AAQS	Ambient Air Quality Standard
ACEPM	applicant-committed environmental protection measure
AMP	Allotment Management Plan
amsl	Above mean sea level
ANC	acid neutralizing capacity
AO	Authorized Officer
APD	Application for Permit to Drill
AQRV	air quality related value
AQS	air quality standard
ARMS	Air Resources Management Strategy
ARPA	Archaeological Resources Protection Act of 1979
AUM	Animal Unit Month
BACT	Best Available Control Technology
bbls	barrels
BCC	Birds of Conservation Concern
BCF	billion cubic feet
BGEPA	Bald and Golden Eagle Protection Act
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
BMSG	base of moderately saline groundwater
BSC	biological soil crust
BWPD	barrels of water per day
CAA	Clean Air Act
CCA	core conservation area
CDP	Census Designated Place
CEAA	Cumulative Effects Analysis Area
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CMAQ	Community Multi-scale Air Quality
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent

COA	Condition of Approval
COP REA	Colorado Plateau Rapid Ecoregional Assessment
CR	County Road
CWA	Clean Water Act
CWSA	Chapita Wells-Stagecoach Area
CWU	Chapita Wells Unit
DR	Decision Record
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EOG	EOG Resources, Inc.
ESA	Endangered Species Act of 1973
FERC	Federal Energy Regulatory Commission
FLAG	Federal Land Manager's Air Quality Guidance
FLPMA	Federal Land Policy and Management Act of 1976
FMR	federal mineral royalty
GCW	Greater Chapita Wells
GCWPA	Greater Chapita Wells Project Area
GHG	greenhouse gas
GHMA	General Habitat Management Area
GIS	geographic information system
GMU	Game Management Unit
GNBPA	Greater Natural Buttes Project Area
GWP	Global Warming Potential
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HMU	Herd Management Unit
HUC	Hydrologic Unit Code
IM	Instruction Memorandum
IPCC	Intergovernmental Panel on Climate Change
km	kilometer
KOP	Key Observation Point
LGS	liquids gathering system
MACT	maximum achievable control technology
MATS	Modeled Attainment Test Software
MBTA	Migratory Bird Treaty Act
MCD	Multi-County District
MCF	thousand cubic feet
MEI	maximum exposed individual
mg/L	milligrams per liter
MLA	Mineral Leasing Act of 1920
MLE	most likely exposure
MMCFD	million cubic feet per day

MOU	Memorandum of Understanding
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standard
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NH_3	ammonia
NHPA	National Historic Preservation Act of 1966
NM	National Monument
NO_2	nitrogen dioxide
NOI	Notice of Intent
NO_X	nitrogen oxides
NP	National Park
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWIS	National Water Information System
O_3	ozone
OHV	off-highway vehicle
P.L.	Public Law
PFYC	Potential Fossil Yield Classification
PIF	Partners in Flight
PILT	payments-in-lieu of taxes
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PMZ	Primary Management Zone
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
REA	Rapid Ecoregional Assessment
REL	Reference Exposure Level
RfC	reference concentrations for chronic inhalation
RFFA	Reasonably foreseeable future action
RIPRAP	Recovery Implementation Program Recovery Action Plan
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
RV	recreational vehicle
SHPO	State Historic Preservation Officer
SITLA	State Institutional Trust Lands Administration
SO_2	sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasures Plan
SR	State Route

SRMA	Special Resource Management Area
SWD	salt water disposal
SWReGAP	Southwest Regional GAP Analysis Project
TCF	trillion cubic feet
TDS	total dissolved solids
tpy	tons per year
TSD	Technical Support Document
TSL	Toxic Screening Level
TSS	total suspended sediment
U.S.	United States
UDAQ	Utah Division of Air Quality
UDEQ	Utah Department of Environmental Quality
UDOGM	Utah Division of Oil, Gas, and Mining
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UIC	Underground injection control
USBEA	U.S. Bureau of Economic Analysis
USC	United States Code
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USDW	underground sources of drinking water
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFO	Vernal Field Office
VOC	volatile organic compound
VRI	Visual Resource Inventory
VRM	visual resource management
WA	Wilderness Area
WMU	Wildlife Management Unit
Zone	Uinta Basin Energy Zone
Δdv	Delta (change) deciviews

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1.0 Introduction and Background

1.1 Proposed Project Location and Background

EOG Resources, Inc. (EOG) has notified the Bureau of Land Management's (BLM's) Vernal Field Office (VFO) that it proposes to conduct the Greater Chapita Wells Natural Gas Infill Project to develop the hydrocarbon resources from existing oil and gas leases owned or operated by EOG within the Greater Chapita Wells Project Area (GCWPA) in Uintah County, Utah (**Figure 1-1**).

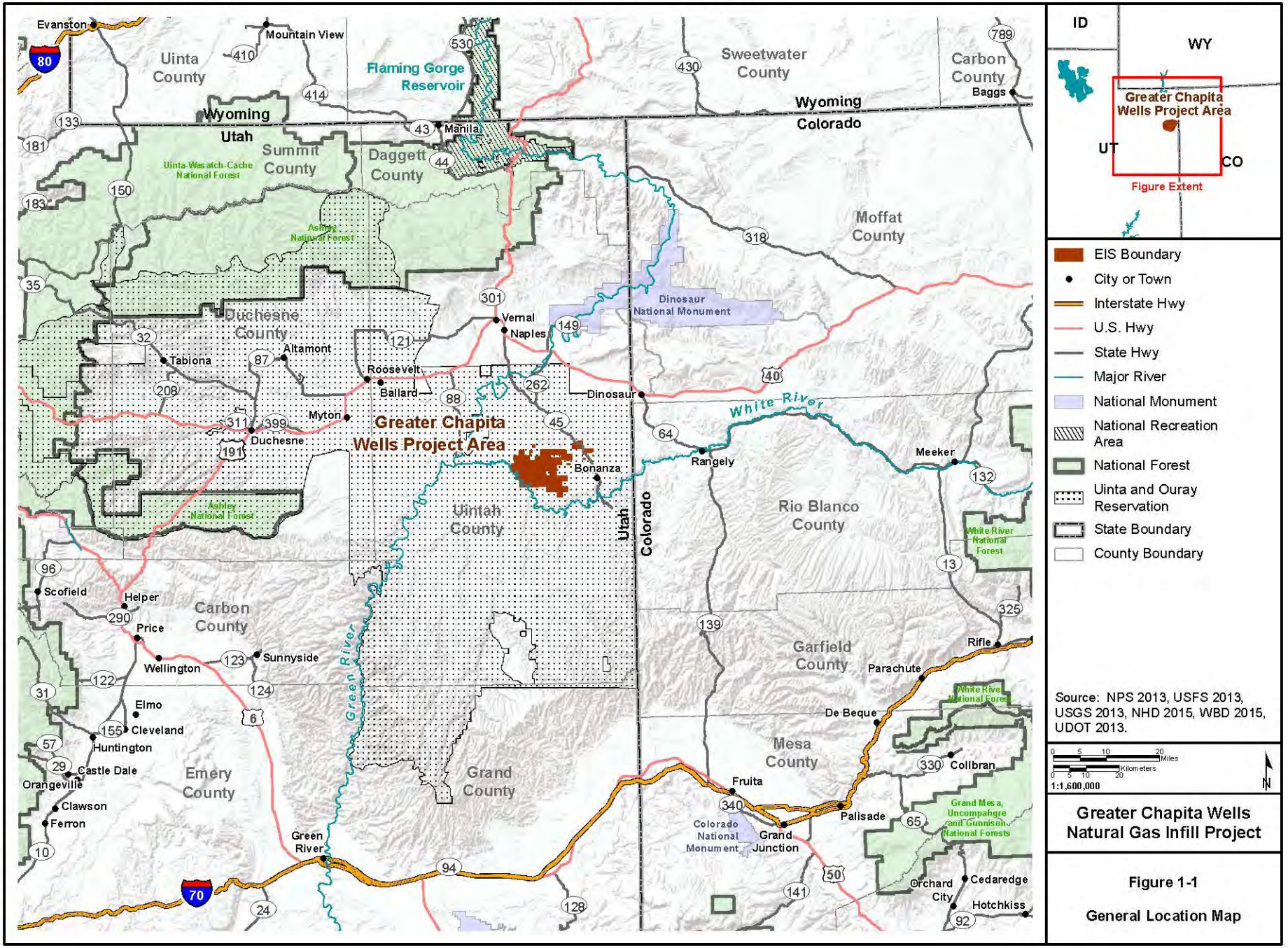
EOG intends to explore and develop all potentially productive subsurface formations underlying the GCWPA. The formations include, but are not limited to, the Green River, Wasatch, Mesaverde Group (including the Price River, Castlegate, and Blackhawk), Mancos, and Dakota. The Wasatch and Mesaverde are the primary objectives. EOG is the designated operator, as a result of owning 100 percent of the working interest in the leasehold or due to contractual agreements with other working interest owners, for nearly all of the GCWPA. EOG's lease rights include the right to occupy and use as much of the surface as is reasonably necessary to explore, develop, operate, and produce the subsurface oil and gas resources subject to any lease stipulations.

The GCWPA consists of approximately 43,071 acres in an existing gas producing region (Township 8 South [T8S], Ranges 22 through 24 East [R22E through R24E], T9S, R22E and R23E, and T10S, R23E [Salt Lake Meridian]). The GCWPA is located primarily on lands owned by the United States (U.S.) but also includes lands owned by the State of Utah, the Ute Indian Tribe, tribal allottees, and private parties. Lands with differing surface and mineral ownership are known as "split estate lands." Much of the tribal land in the GCWPA is split estate, with tribal surface ownership and federal mineral ownership. Surface and mineral ownership is summarized in **Table 1-1**, and illustrated in **Figure 1-2**. Federal lands in the GCWPA are under the jurisdiction of the BLM VFO.

Table 1-1 Surface and Mineral Ownership in the GCWPA

Surface Owner	Surface Ownership (acres)	Surface Percentage of GCWPA	Mineral Ownership (acres)	Mineral Percentage of GCWPA
United States	32,860	76.29	39,059	90.69
Ute Tribe/Allottees	6,577	15.27	775	1.80
Ute Tribe	*6,577*	*15.27*	*165*	*0.38*
Allottees	*0*	*0*	*610*	*1.42*
State of Utah	1,954	4.54	2,674	6.21
Private/Fee	1,680	3.90	563	1.30
TOTAL	**43,071**	**100**	**43,071**	**100**

Oil and gas exploration began in the Uinta Basin in the late 1920s, with the first well drilled in the Chapita Wells area in 1952. As of March 1, 2014, the GCWPA contained 1,247 active natural gas wells located on 960 individual or multi-well pads. The GCWPA comprises a portion of the Natural Buttes gas field.



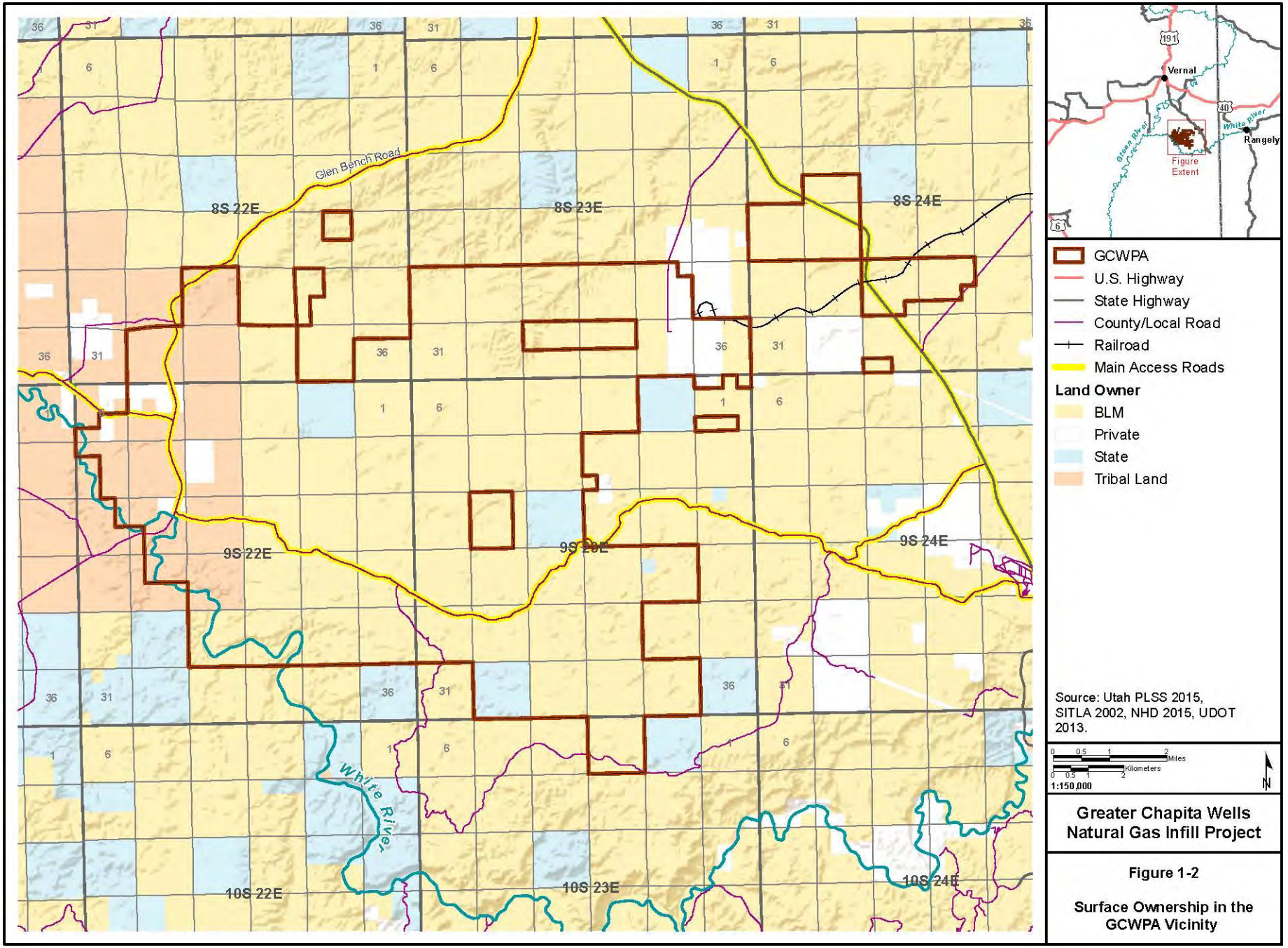
Greater Chapita Wells Natural Gas Infill Project

Figure 1-1

General Location Map

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6/20/2017



Greater Chapita Wells Natural Gas Infill Project

Figure 1-2

Surface Ownership in the GCWPA Vicinity

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4/4/2016

In 2009, EOG proposed to develop the GCWPA by drilling up to 7,028 wells from up to 1,679 new and expanded well pads. The 2009 Proposed Action would have represented essentially full development of the GCWPA and would have resulted in well pads located at an average density of 1 well pad for every 20 acres of surface being constructed throughout the GCWPA.

In early 2013, in response to recently recognized concerns regarding levels of winter-time ozone (O_3) in the Uinta Basin (Energy Dynamics Laboratory 2011), EOG reviewed and revised its proposed project. The current Proposed Action for this environmental impact statement (EIS) includes various mitigations designed to reduce air emissions, particularly those of O_3 precursor pollutants.

The VFO has determined that the proposed Greater Chapita Wells Natural Gas Infill Project, pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969, constitutes a major federal action requiring the development of an EIS. This EIS serves the purpose of analyzing and disclosing potential environmental effects from development within the GCWPA after the application of resource protection measures. Resource protection measures (applicant-committed environmental protective measures, or ACEPMs) to be implemented by EOG as part of the proposed project are presented in Chapter 2.0, Section 2.6.8.

1.2 Summary and Rationale for the Proposed Project

The Proposed Action would accomplish the following EOG objectives:

- Allow the recovery of hydrocarbon resources from lands within the GCWPA in a way that would provide an acceptable return on investment;
- Mitigate existing field gas production decline, estimated to be approximately 50 percent in 8 years;
- Refine drilling and completion techniques to maximize the recovery of the hydrocarbon resources while minimizing surface disturbance by drilling directionally from new or existing well pads;
- Generate taxes which would be supportive of federal, Tribal, state, and local governments and royalty revenues from production;
- Result in employment opportunities and expenditures which would be supportive of Tribal, state, and local economies; and
- Support national energy goals by supplying domestically produced hydrocarbons.

1.3 Purpose and Need

The BLM's purpose for this action is to respond to the proposal while minimizing environmental impacts in accordance with its mandate to manage the public lands for multiple uses while protecting other resource values. The Federal Land Policy and Management Act of 1976 (FLPMA) (Public Law [P.L.] 94-579, 43 United States Code [USC] 1701 et seq.) recognizes oil and gas development as one of the "principal" uses of public lands. Federal mineral leasing policies (Mineral Leasing Act of 1920 [MLA], 30 USC 188 et seq.) and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands so long as undue and unnecessary environmental degradation is not incurred.

The BLM's need with regard to this project is to respond to EOG's request to develop its valid existing leases covering the subject lands. BLM will determine whether the proposed project, or an alternative to the proposed project, would best respond to EOG's request in a manner consistent with existing contractual obligations between EOG and the U.S., as well as BLM's multiple use mandate.

1.4 Environmental Analysis Process and Decision to be Made

This EIS is prepared in accordance with NEPA and in compliance with FLPMA, Council of Environmental Quality regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508), U.S. Department of the Interior (USDOI) regulations (43 CFR Part 46), guidelines listed in the BLM NEPA Handbook, H-1790-1 (BLM 2008a) and the Utah BLM NEPA Guidebook (BLM 2010a).

According to the terms of the MLA, the BLM is the agency authorized to manage federal mineral interests underlying federal or split estate lands. Approximately 76 percent of the surface of the GCWPA and 91 percent of the mineral interests underlying the GCWPA are owned by the U.S. and administered by the BLM. Therefore, the BLM is the lead agency in this process, and will issue a Record of Decision (ROD) for this EIS.

Uintah County, the State of Utah's Public Lands Policy and Coordination Office, and the U.S. Fish and Wildlife Service (USFWS) are cooperating agencies on the NEPA process through a formal Memorandum of Understanding (MOU). The Bureau of Indian Affairs (BIA) was offered cooperating agency status but has not responded. Regardless, coordination with BIA is ongoing. Cooperating agencies are integrally involved in the preparation of this EIS prior to distribution to the public. The USFWS and Utah Division of Wildlife Resources (UDWR) have integrally participated in the preparation of this EIS through the Pilot Office program set up by the Energy Policy Act of 2005. The U.S. Environmental Protection Agency (USEPA) is a cooperating agency in addition to participating on air quality modeling issues through the National Air Quality MOU. The Ute Indian Tribe has been consulted regarding proposed development on those portions of the GCWPA overlapping Tribal lands. In addition to general comments on the EIS, the USEPA has been involved in air quality modeling issues through the MOU executed among the BLM, USEPA, and other federal agencies. The Utah Air Resource Technical Advisory Group (RTAG) is a group of representatives from various federal and state agencies (BLM, USEPA, National Park Service [NPS], USFWS, U.S. Forest Service [USFS], and Utah Department of Environmental Quality [UDEQ]) advising on air quality issues. The group has been involved in oversight of the air quality modeling studies conducted for this EIS.

1.4.1 EIS Decision Framework

After the Final EIS is prepared, and within the ROD, the BLM Authorized Officer (AO) will determine:

- Whether the analysis is adequate to make an informed decision;
- Whether the proposed project or other alternatives are in conformance with the applicable land and resource management plan (RMP);
- Determine what is reasonably necessary to explore, develop, operate, and produce under existing leasing rights;
- Whether to approve the proposed project, select an alternative, or a combination of alternatives; and
- What Conditions of Approval (COAs), if any, should be included in the ROD.

The BLM ROD will only apply to federal lands and mineral ownership, including "split estate" lands. However, the analyses in this EIS will consider the impacts from all connected and cumulative activities regardless of surface ownership.

1.4.2 Subsequent Decision to be Made

This EIS is programmatic in nature (i.e., the final locations of proposed well pads, roads, and other facilities are conceptual at this time). Although the ROD may approve the proposed oil and gas field development plan on a conceptual basis, a site-specific review of areas proposed for surface

disturbance and sub-surface mineral extraction will be completed to determine the final location of facilities based on site-specific environmental constraints.

Before each component of the project can be implemented, EOG or other proponents would submit a site-specific application (Application for Permit to Drill [APD], Sundry Notice, or Right-of-Way [ROW] Grant Request) to the appropriate agency. On BLM-administered lands or minerals, the BLM would conduct an environmental review and attach appropriate measures to the permit to protect natural and cultural resources. Approval of site-specific applications on Tribal surface or mineral estate would be approved by the BIA and the Ute Indian Tribe. The Utah State Institutional Trust Lands Administration (SITLA) would approve surface disturbance activities on State lands, and APDs on state or privately owned minerals would be approved by the Utah Division of Oil, Gas, and Mining (UDOGM).

1.5 Legal and Policy Considerations

1.5.1 Leases and Leasing History and BLM Management Plan Conformance

The proposed development of valid existing leases is in conformance with the Vernal RMP (BLM 2008b). Management decisions within the RMP recognize valid existing rights (p. 21 of the RMP). EOG owns 100 percent of GCWPA leases, or is the designated operator as a result of contractual agreements with other working interest percentage owners. EOG is responsible for ensuring that lease stipulations are followed during oil and gas development.

All leases covering BLM-administered minerals within the GCWPA were issued before the BLM VFO RMP and ROD (BLM 2008b) was completed. Many leases were issued prior to approval of the preceding BLM Vernal District Office ROD and Rangeland Program Summary for the Book Cliffs RMP (BLM 1985), and therefore, may not contain stipulations other than standard lease terms. The proposed GCWPA natural gas infill project is consistent with the Vernal RMP, which states that valid pre-existing rights are not affected by decisions in the RMP. Additional information regarding the past development decisions in the GCWPA is contained in the following project-specific NEPA documents:

- ROD for EOG Resources, Inc. Chapita Wells-Stagecoach Area Natural Gas Development (BLM 2008c);
- Finding of No Significant Impact and Decision Record (DR) Environmental Assessment for EnCana Oil & Gas (USA), Inc.'s North Chapita Natural Gas Well Development Project (BLM 2006a); and
- Finding of No Significant Impact and DR, Chapita Wells Unit (CWU) Liquids Gathering System Phase 1 Project Environmental Assessment (BLM 2013a).
- Finding of No Significant Impact and DR, Chapita Wells Electric Power Distribution System Rights-of-Way (BLM 2014a – in progress).

Typical restrictions that may apply to federal oil and gas leases in the GCWPA include:

- Stipulations to protect lands in oil shale withdrawal, Executive Order (EO) 5327 of April 15, 1930;
- Requirements to conduct field surveys to determine the presence of cultural resource sites; National Historic Preservation Act of 1966 (NHPA);
- Surface disturbance restrictions to protect erosive soils and sensitive plants;
- Seasonal restrictions to protect raptor species and other wildlife; and
- Stipulations to protect Threatened and Endangered Species, Endangered Species Act of 1973 (ESA), as amended.

1.5.2 Consistency with Other Federal and Local Land Management Plans and Policies

The proposed project is designed to comply with BLM's Utah Public Lands Health Standards (BLM 2009a).The proposed project also would be required to comply with federal policies related to protection of riparian habitats, floodplains, and groundwater, including Presidential EO 119883 (Floodplain Management), Secretarial Order 330 and Draft – Regional Mitigation, Manual 1794, BLM Utah Instruction Memorandum (IM) 2005-091 (Riparian Policy), and BLM Utah IM 2010-005 (Groundwater Protection). The proposed project is designed to be consistent with requirements of the ESA (16 USC 1531 et seq) and Section 106 of the NHPA (36 CFR Part 800). Additional laws and policies that will impact this project are listed in **Table 1-2**.

A formal management plan does not exist for the Uintah and Ouray Reservation. However, the elected Ute Tribe Business Committee and the BIA are responsible for approvals of land and/or mineral use activities on Tribal Lands. Production from tribal leases provides royalties, tax revenues, and surface access and use fees to the Tribe, which contributes to the Tribe's economic well-being. The proposed project is consistent with the regulatory responsibilities of the BIA, which include promoting the economic development objectives of the Ute Tribe under its government-to-government relationship with, and trust responsibility to, the Ute Tribe.

The State of Utah has established the Uintah Basin Energy Zone (Utah Code 63J-8-105.5). The Zone, which includes the GCWPA, was established for the purpose of maximizing efficient and responsible development of energy and mineral resources. The legislation calls upon the federal agencies which administer lands and mineral estate within the Zone to cooperate with the local counties in expediting mineral resource development and refraining from implementing policies that would be contrary to accomplishing that purpose.

SITLA has leased all of the state lands within the GCWPA for oil and gas production. The objectives of SITLA are to produce funding for the state school system. Because production on federal leases could lead to further interest in drilling state leases in the area, implementation of the proposed project or alternatives is consistent with the State of Utah's objectives.

Uintah County has amended the existing County General Plan (Uintah County 2012) regarding development on public lands within the County. The Uintah County General Plan emphasizes: 1) multiple-use management practices and 2) responsible use and optimum utilization of public land resources. Multiple use is defined in the plan as including, but not limited to, the following historically and traditionally practiced resource uses: grazing, recreation, timber, mining, oil and gas development, agriculture, wildlife habitat, and water resources. The proposed project is consistent with the Uintah County Plan.

1.5.3 Authorizing Actions and Project Relationships to Statutes and Regulations

Private exploration and production from federal oil and gas leases is an integral part of the BLM oil and gas leasing program under authority of the MLA and FLPMA. The BLM oil and gas leasing program encourages development of domestic oil and gas reserves in accordance with the Mining and Minerals Policy Act, and the reduction of U.S. dependence on foreign energy sources. Natural gas is an integral part of the energy future for the U.S. due to its availability and the presence of an existing market delivery infrastructure. Furthermore, the Energy Policy Act Amendments of 2000 and the Energy Policy Act of 2005 emphasize the development of domestic natural gas reserves for supply and economic stability.

Table 1-2 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project

Issuing Agency	Name and Purpose of Permit/Approval	Regulatory Authority (if appropriate)
FEDERAL AGENCIES		
USDOI		
BLM	Permit to Drill, Deepen, or Plug Back (APD/Sundry Process) – controls drilling for oil and gas on federal onshore lands and for plugging and abandonment of wells	MLA (30 USC 181 *et seq*.; 43 CFR 3100); National Mining and Minerals Policy Act of 1970, the Federal On Shore Oil and Gas Leasing Reform Act of 1987, (Onshore and Gas Orders #1 and #2 [43 CFR 3160]), Environmental Obligations (43 CFR 3162.5-1)
	ROW Grants and Temporary Use Permits grant ROW use on BLM-managed lands	MLA as amended (30 USC 185); 43 CFR 2880; FLPMA (43 USC 17611771; 43 CFR 2800)
	Antiquities, Cultural, and Historic Resource Permits to inventory, excavate, or remove cultural or historic resources from federal lands	Antiquities Act of 1906 (16 USC Section 431-433); Archaeological Resources Protection Act of 1979 (ARPA) (16 USC Sections 470aa4701 1); Section 106 of the NHPA
	Approval to dispose of produced water controls disposal of produced water from federal leases	MLA (30 USC 181 *et seq*.; 43 CFR 3160); Onshore Oil and Gas Order No. 7
	Measurement of gas and oil produced from federal leases	Onshore Oil and Gas Order No. 5 and Onshore Oil and Gas Order No. 4
	Regulation of hydraulic fracturing on federal and Indian lands	Onshore Oil and Gas Operations, 43 CFR 3160.3-3
	Pesticide Use Permit	BLM Authorization for pesticide use on Federal Lands
	Federal Noxious Weed Act	Federal Noxious Weed Act of 1974, as amended (USC 2801-2814)
	Initiation of Section 7 consultation with USFWS	Section 7 of the ESA, as amended (16 USC et seq.)
	Mineral Material Sales Permit for use of BLM-managed borrow pits in road construction	Materials Act of 1947 as amended (30 USC, 601 et seq.)
	Management and preservation of paleontological resources including Paleontological Resource Use Permits for surveys and potential data collection at well pads and road sites	FLPMA (302[b]), IM 2016-124 - Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands; Omnibus Public Lands Act of 2009 – Paleontological Resources Preservation

Table 1-2 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project

Issuing Agency	Name and Purpose of Permit/Approval	Regulatory Authority (if appropriate)
BLM (Continued)	Protection of Groundwater Associated with Oil and Gas Leasing, Exploration, and Development	550 – IM No. UT 2010-055- Protection of Groundwater Associated with Oil and Gas Leasing, Exploration, and Development – Utah BLM doc
BIA	ROW Grants and Temporary Use Permits ROW – use on Tribal Lands	25 CFR 169
	Approval of drilling operations	25 CFR 211.48
	Tribal/Allotted Land Activities – In coordination with the Ute Indian Tribe, the BIA has authority to approve any and all activities on Tribal/allotted lands	25 CFR 225
USFWS	ESA Section 7 consultation	Section 7 of the ESA, as amended (16 USC et seq.)
	Migratory Bird Treaty Act (MBTA) consultation	MBTA of 1918, as amended (15 USC 703-712); EO 13186
	Bald and Golden Eagle Protection Act (BGEPA) consultation	Bald Eagle Protection Act of 1940, as amended (16 USC 668-668d)
	Section 404 Permit Consultation and review of permit for compliance with ESA	Consultation as established under the Fish and Wildlife Coordination Act
Advisory Council on Historic Preservation	Cultural resources compliance (Section 106); in coordination with the Utah State Historic Preservation Officer (SHPO)	NHPA, Section 106
U.S. Department of Defense		
Army Corps of Engineers – Sacramento District	Section 404 permit (Nationwide and Individual) controls discharge of dredged or fill materials into waters of the U.S.	Section 404 of the Clean Water Act (CWA) (33 USC 1344, 33 CFR 323)

Table 1-2 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project

Issuing Agency	Name and Purpose of Permit/Approval	Regulatory Authority (if appropriate)
USEPA Region 8		
	The entire proposed GCWPA is located within the former Uncompahgre Reservation portion of what is currently the Uintah and Ouray Indian Reservation. Pursuant to relevant case law, all lands within the former Uncompahgre Reservation portion of the Uintah and Ouray Indian Reservation are Indian Country. Ute Indian Tribe v. Utah, 521 F. Supp. 1072, 1155 (D. Utah 1981); Ute Indian Tribe v. Utah, 716 F.2d 1298 (10th Cir. 1983), Ute Indian Tribe vs. Utah, 773 F.2d 1087 (10th Cir. 1985) (en banc) cert denied, 479 U.S. 994 (1986); Hagen v. Utah, 510 U.S. 399 (1994), Ute Indian Tribe v. Utah, 935 F. Supp. 1473 (D. Utah 1996), Ute Indian Tribe vs. Utah, 114 F.3d 1513 (10th Cir. 1997), cert denied, 522 U.S. 1107 (1998), and Ute Indian Tribe v. Utah, 790 F.3d 1000 (10th Cir. 2015), cert. denied, 2016 U.S. LEXIS 1969 (Mar. 21, 2016). The USEPA has not approved the State of Utah or the Ute Indian Tribe to implement federal environmental programs in Indian Country. Therefore, the USEPA is the appropriate governmental authority to issue federal environmental permits, conduct inspections, take enforcement actions, and take any other actions pursuant to the Clean Air Act (CAA), the CWA and other federal environmental statutes relevant to this proposed project that is located on Indian Country land.	NEPA, as amended, 42 USC 4321 *et seq*, P.L. 91-190 Stat. 852; Clean Air Act (CAA), Section 309.

Table 1-2 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project

Issuing Agency	Name and Purpose of Permit/Approval	Regulatory Authority (if appropriate)
	The entire proposed GCWPA is located within the former Uncompahgre Reservation portion of what is currently the Uintah and Ouray Indian Reservation. Pursuant to relevant case law, all lands within the former Uncompahgre Reservation portion of the Uintah and Ouray Indian Reservation are Indian Country. Ute Indian Tribe v. Utah, 521 F. Supp. 1072, 1155 (D. Utah 1981); Ute Indian Tribe v. Utah, 716 F.2d 1298 (10th Cir. 1983), Ute Indian Tribe vs. Utah, 773 F.2d 1087 (10th Cir. 1985) (en banc) cert denied, 479 U.S. 994 (1986); Hagen v. Utah, 510 U.S. 399 (1994), Ute Indian Tribe v. Utah, 935 F. Supp. 1473 (D. Utah 1996), Ute Indian Tribe vs. Utah, 114 F.3d 1513 (10th Cir. 1997), cert denied, 522 U.S. 1107 (1998), and Ute Indian Tribe v. Utah, 790 F.3d 1000 (10th Cir. 2015), cert. denied, 2016 U.S. LEXIS 1969 (Mar. 21, 2016). The USEPA has not approved the State of Utah or the Ute Indian Tribe to implement federal environmental programs in Indian Country. Therefore, the USEPA is the appropriate governmental authority to issue federal environmental permits, conduct inspections, take enforcement actions, and take any other actions pursuant to the CAA, the CWA and other federal environmental statutes relevant to this proposed project that is located on Indian Country land.	CAA, as amended, 42 USC Annotated Section 7410-762 (P.L. 95-604, P.L. 95-95) Federal Water Pollution Control Act, as amended by the CWA, 33 USC Annotated Section 1251-1376 (P.L. 92-500, P.L. 95-217) Safe Drinking Water Act, 452 USC Annotated Section 300F 300J-10 (P.L. 93-523)
U.S. Department of Transportation Utah	Approves construction and operation of natural gas pipelines. Prescribes minimum safety requirements for pipeline facilities and the transportation of natural gas	Pipeline safety regulations (49 CFR Parts 190 to 199)

Table 1-2 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project

Issuing Agency	Name and Purpose of Permit/Approval	Regulatory Authority (if appropriate)
STATE AGENCIES		
Utah Division of State History (Utah SHPO)	Section 106 compliance process; approves cultural resource clearances; and provides for protection of cultural resources	Utah Code Annotated 9-8-404
	Principal Investigator Permit to conduct archaeological investigations on state and private lands	Utah Administrative Rule R694-1-4 Qualifications of Permit Holders
Governor's Public Lands Policy Coordination Office	Permit to Survey regulates all archaeological surveys on state and private lands	Utah Administrative Rule R694-1-5 Application for Permit to Survey
	Permit to Excavate regulates all archaeological excavations on state and private lands	Utah Administrative Rule R694-1-6, Application for Permit to Excavate
Utah Department of Natural Resources UDOGM	Regulates activities associated with drilling of oil and gas wells in state, including pressure monitoring and permitting of injection wells, pollution control, and well spacing, and site restoration	Permitting of wells, Utah Administrative Rules R649-3-4 *et seq*, R649-3-18, Underground Injection Control Rules, Utah Administrative Rules R649-5 and R649-3-2, Spacing of wells, Utah Adm. Rules R649-3-2., Site restoration, Utah Adm. Rules R649-3-24 & R649-3-34.
Utah Division of Water Rights	Review and issuance of stream alteration permit	Utah Code Annotated, 73-3-29
	Approval to Appropriate Water; grants permission to appropriate water	Utah Code Annotated, 73-3-2
Utah Division of Water Resources	Determination of adequate water supply and cumulative impacts on water supply: Section 401, CWA Water Quality Certification	CWA as it pertains to state government (Section 401)
Utah Division of Wildlife Resources (UDWR)	Participation in the Section 404 Permit process and review of the Draft EIS to promote protection and management of state wildlife and fish resources	Utah Code 23-13 through 21
Forestry, Fire, and State Lands	ROW grant for construction activities on State lands	Utah Administrative Rule R652
UDEQ Division of Water Quality	Construction Dewatering Permit for discharge of dewatering and hydrostatic test waters from property to U.S. waters	Utah Code 19-5-108, Utah Administrative Rule 317-8

Table 1-2 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project

Issuing Agency	Name and Purpose of Permit/Approval	Regulatory Authority (if appropriate)
Utah Department of Transportation (UDOT)	Transport Permit authorizes oversize, over length, and overweight load transportation on state highways	Utah Administrative Rule 909
	Encroachment Permit authorizes pipeline crossings of access roads that tie into state or federal highways	Utah Administrative Rule 933-3
Utah SITLA	ROW grant/permit for construction and use activities on State Trust Lands	Utah Administrative Rule 850-41
LOCAL AGENCIES		
Uintah County	County zoning/land use plan consultation	Uintah County Code, Uintah County General Plan
	Road Use and Operating permits	Uintah County Code, Title 10, Chapter 10.04
	Construction permits, licenses	Uintah County Code, Title 12, Chapter 12.04
	Noxious Weed Act enforcement	Uintah County Code, Title 8, Chapter 8.06
	Solid Waste Disposal permits	Uintah County Code, Title 8, Chapter 8.24

Operations associated with the exploration, development, and production of oil and gas deposits from federal and/or Indian trust leases are governed by the regulations in Section 3160 of the 43 CFRs. Additional requirements determined to be necessary to implement and supplement the 3160 regulations are authorized in 43 CFR 3164, which include:

- Onshore Order No. 1 – Approval of Operations
- Onshore Order No. 2 – Drilling Operations
- Onshore Order No. 3 – Site Security
- Onshore Order No. 4 – Measurement of Oil
- Onshore Order No. 5 – Measurement of Gas
- Onshore Order No. 6 – Hydrogen Sulfide Operations
- Onshore Order No. 7 – Disposal of Produced Water
- Onshore Order No. 8 – Well Completions/Workovers/Abandonment (Proposed Rule)
- Onshore Order No. 9 – Waste Prevention and Beneficial Use of Oil and Gas (Not Published)
- Notices to Lessees
- Hydraulic Fracturing

In addition to the BLM, numerous other federal, state, and local governmental agencies may be involved in regulation of oil and gas development. A summary of the key permits, approvals, and authorizing actions that may apply to the proposed project is provided in **Table 1-2**.

The GCWPA is located in the Uintah and Ouray Indian reservation and is Indian Country land. The USEPA directly implements federal environmental programs, including the CWA, CAA, and Safe Drinking Water Act, on Indian Country lands in Utah. The USEPA has not approved the Ute Indian Tribe or the State of Utah to implement federal environmental programs in Indian Country. Because the project is located on Indian Country lands within the Uintah and Ouray Indian Reservation, the USEPA is the appropriate governmental authority to issue federal environmental permits, conduct inspections, take enforcement actions, and take any other actions pursuant to its environmental statutes and authorities.

1.6 Scoping

The BLM conducted internal and public scoping to solicit input and identify environmental issues and concerns associated with the proposed project. Results of the scoping process are summarized in the following sections.

1.6.1 Internal Scoping

Prior to external scoping, internal scoping for this project was conducted by a BLM interdisciplinary team. A meeting was held at the VFO on November 14, 2013, to introduce the Revised Proposed Action and solicit comments on alternatives. In addition to VFO staff, representatives of USEPA, Utah Public Lands Policy Coordinating, UDOGM, UDWR, Utah Division of Air Quality (UDAQ), and Uintah County attended. Additional invitees included BLM Washington Office. Internal scoping was subsequently updated as of July 2015. **Appendix A**, Interdisciplinary Team Checklist, lists resources that the BLM VFO resource specialists have determined could be affected as a result of implementing the proposed project.

1.6.2 Public Scoping

The public scoping process was initiated on September 9, 2009, with the publication of a Notice of Intent (NOI) in the *Federal Register*. The BLM prepared a scoping information notice and provided copies to the public, governmental agencies, and applicable Tribes. These announcements included information on the public scoping and information open house, which was held at the Utah Field House Museum of Natural History in Vernal, Utah, on September 29, 2009. The official scoping period ended October 9, 2009. Public response to the NOI and meetings included a total of nine letters: two from federal agencies, one from a county agency, two from a non-government organization, and four from industry or private individuals.

1.6.3 Issues and Concerns

During the scoping period, key concerns were identified for consideration in preparing the Greater Chapita Wells EIS, as indicated in **Table 1-3**.

In addition to resource-specific comments, BLM received comments of a more general nature or relating to the NEPA process. These comments have been considered in development of alternatives and the purpose and need for the project.

Table 1-3 Identified Internal and Public Scoping Concerns

Resource or Issue Area	Key Concerns	Location in EIS
Special Management Areas	The analysis should address: • UDWR riparian focus area; • At Risk Essential Habitat (White River lowland riparian and cottonwood gallery forest); and • Heart of the West Book Cliffs core area.	See footnote* 3.6.1.5; 4.6.1
Reclamation	Proposed reclamation measures in the EIS must demonstrate effectiveness to fully reclaim proposed disturbed areas before crediting the reclamation toward potential disturbance caps.	2.1.3; 2.5.1
Geology & Paleontology	The analysis should address potential conflicts between oil and gas development and the development of other mineral resources of the predominantly federal mineral estate within the GCWPA. Describe the extent paleontological resources have been surveyed in the GCWPA.	4.2.1.1; 4.2.1.2; 4.2.1.3; 4.2.1.4; 3.8.1
Water Resources	EIS should disclose the potential effects on existing groundwater aquifer conditions/quality and standards, recharge zones, and confining layers (including Birds Nest and Douglas Creek aquifers and White River alluvium) from hydraulic fracturing, from produced water disposal, and from natural fractures that might allow migration of hydrocarbons.	4.4.2.1; 4.4.2.3
	EIS should disclose the potential effects on existing surface water features and resources, including quality/standards and quantity, from accidental releases of chemicals, including hydraulic fracturing chemicals, from containment structures (including reserve pits).	4.4.1.1; 4.4.1.3
	EIS should evaluate the application of mitigation measures to protect surface water and groundwater resources including backflow preventers, adequate casing, and pit lining.	4.4.1.2; 4.4.2.2
	EIS should evaluate and disclose the cumulative effects of increased levels of erosion and sedimentation.	5.4.3.1
	Perennial seeps, springs, and wetlands should be delineated on maps to foster avoidance.	Figures 3.3-1, 3.3-2, 3.6-1
Air Quality	Air quality analyses, including modeling, in support of the EIS should address the following issues and concerns as related to the GCWPA, the region (cumulative impacts), and applicable standards:	N/A
	Should analyze and disclose the proposed project's direct and indirect impacts on all criteria pollutants and measures to limit and control the release of criteria pollutants.	4.3.1.1; 4.3.1.2; 4.3.1.3; 4.3.1.4; 4.3.2
	Should address and analyze the proposed project's generation of dust (particulate matter with an aerodynamic diameter of 2.5 microns or less [$PM_{2.5}$] or smaller particulates) and deposition, its effects on the natural and human environment, including climate change, and the application of mitigation measures effective in dust suppression and control.	4.3.1.1; 4.3.1.2; 4.3.1.3; 4.3.1.4; 4.3.2
	Should address and analyze for O_3 and its effects on the natural and human environment.	4.3.1.1; 4.3.1.3; 4.3.1.2; 4.3.1.4

Table 1-3 Identified Internal and Public Scoping Concerns

Resource or Issue Area	Key Concerns	Location in EIS
Air Quality (con't)	Should address and analyze for greenhouse gas (GHG) emissions, especially methane, and control or mitigation measures to limit the proposed projects contribution to potential climate change and to consider adaptation of the proposed project to the effects of potential climate change.	4.3.1.1; 4.3.1.2; 4.3.1.3; 4.3.1.4; 4.3.2
	Should address and disclose the potential impacts on concentrations of hazardous air pollutants, including formaldehyde, benzene, toluene, ethyl benzene, xylene, and n-hexane.	4.3; 4.3.1.1; 4.3.1.2; 4.3.1.3; 4.3.1.4
	In addition, the air quality analysis for this project should:	N/A
	Clearly differentiate between monitor data and model estimates.	4.3; 4.3.1.2
	Include available results of field monitoring in analyses, including as data input to air quality models.	4.3.1.2
	Use data for inputs to models that are reflective of actual data collected in the area.	4.3.1.2
	Air quality modeling should address and amend shortcomings of the Uinta Basin Air Quality Study.	4.3
	Air quality modeling should address and disclose the proposed project's potential effect on Prevention of Significant Deterioration (PSD) increments and air quality related values (AQRVs) in nearby Class I areas.	4.3.1.2
	An air quality workgroup comprised of UDAQ, Ute Tribe, USFS, National Parks Service, and USEPA should be tasked with supporting BLM in developing and completing an air quality analysis (modeling effort) and determining appropriate mitigation for the proposed project.	Appendix J was reviewed by this group (RTAG)
Soils	Analysis should include the potential for the proposed project to destabilize soils, including the potential to produce dust.	4.5.1.1; 4.5.1.2; 4.5.1.3; 4.5.1.4
	EIS should evaluate and disclose the cumulative effects of increased levels of erosion and sedimentation.	4.5.1.2; 4.5.3
Vegetation	EIS should evaluate potential impacts and mitigations from possible introduction or further proliferation of noxious species.	4.6.1.1; 4.6.1.2; 4.6.1.3; 4.6.1.4; 4.6.3; 4.6.4
Wetlands, Riparian Zones	EIS should address and analyze potential impacts to wetlands, streams, and riparian zones plus potential mitigation measures to avoid or minimize impacts.	4.4.1.1; 4.6.1.1; 4.6.1.2; 4.6.1.3; 4.6.1.4
Wildlife and Fisheries	EIS should evaluate and disclose anticipated direct, indirect, and cumulative impacts including habitat loss, displacement, and fragmentation for big game species including mule deer and pronghorn and other wildlife species of concern from project implementation with emphasis on critical seasonal times for affected species.	5.4.6.1
	Project implementation should avoid or minimize impacts to migratory bird habitat with emphasis on USFWS' List of Birds of Conservation Concern and the Partners in Flight (PIF) Priority List.	4.7.2
	EIS should disclose the extent to which aquatic habitat, including seasonal and spawning habitats, could be impaired by proposed project activities.	4.7.1.1; 4.7.1.2; 4.7.1.3; 4.7.1.4

Table 1-3 Identified Internal and Public Scoping Concerns

Resource or Issue Area	Key Concerns	Location in EIS
Special Status Species	EIS should document the extent of sensitive or endemic plant surveys in the GCWPA.	4.6.1.2; 4.6.1.3; 4.6.1.4; 4.6.1.5
	EIS should address potential impacts, including fragmentation of habitat, and the application of Best Management Practices (BMPs)/mitigations for the Uinta Basin hookless cactus (*Sclerocactus wetlandicus*).	4.6.1.1; 4.6.1.2; 4.6.1.3; 4.6.2.4; Table 4.6-6
	EIS should address potential impacts and mitigations for white-tailed prairie dogs.	4.7.1.1; 4.7.1.2; 4.7.1.3; 4.7.1.4; Table 4.7-8
	EIS should consider potential impacts and possible measures to reduce impacts to the black-footed ferrets reintroduced within the Coyote Basin Complex with input from the USFWS and UDWR (adopted Northeastern Black-footed Ferret Management Plan).	4.7.1.1; 4.7.1.2; 4.7.1.3; 4.7.1.4; Table 4.7-8
	EIS should consider application of effective mitigation measures for sage grouse consistent with the Western Association of Fish and Wildlife Agencies sage-grouse conservation plan.	Table 4.7-8
	EIS should address and disclose potential impacts and mitigations, including those associated with nest buffers, for pertinent migratory birds, including raptors.	4.7.1.1; 4.7.1.2; 4.7.1.3; 4.7.1.4; Table 4.7-8
	EIS should disclose potential impacts, including water depletion and habitat degradation, and mitigations for critical habitats for the special status Colorado River fish.	4.7.1.1; 4.7.1.2; 4.7.1.3; 4.7.1.4; Table 4.7-8
	The analysis should address potential cumulative effects to habitat for special status plant and animal species.	5.4.5; 5.4.6
Cultural Resources	Describe the extent cultural resources have been surveyed in the GCWPA.	4.9; Table 4.9.1
Range Management	EIS should assess and disclose potential impacts to livestock in terms of mortality and ewe and lamb separation; loss or damage of range management facilities (stock ponds, fences, cattle guards, and corrals), including gates being left open; and loss or damage of grazing forage due to clearing of vegetation ahead of construction and dust deposition and the protracted loss of grazing forage for portions of affected lands due to poor post-disturbance reclamation/revegetation success.	4.12.1.1; 4.12.1.2; 4.12.1.3; 4.12.1.4; 4.12.3
Socioeconomics	EIS should address the conflict between livestock grazing livelihoods and lifestyles and proposed oil and gas development.	4.10.1.1; 4.10.1.2; 4.10.1.3; 4.10.1.4; 4.10.1.5
	EIS should recognize the historical contributions of oil and gas development to the Uintah County economy and disclose the speculative, uncertain nature (range) of future price and costs scenarios as part of assessing the local and regional effects of oil and gas development on socioeconomic conditions including employment, public services, and tax revenues.	4.10; 4.10.1.1; 4.10.1.2

*Footnote: UDWR designated focus areas have not been identified in the GCWPA. Review of Heart of the West Conservation Plant discussion of Book Cliffs covered areas south of the GCWPA.

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2.0 Proposed Action and Alternatives

This chapter explains the Proposed Action as presented by EOG, as well as the alternatives identified by the BLM and Cooperators. Alternative actions are described beginning with Alternative A—No Action, which discusses activities that would continue under current management guidance and prior approvals in the absence of the proposed project. Each of the action alternatives is then discussed in terms of alternative specific activities, schedule, ACEPM, and surface disturbance summaries. For this EIS, alternatives analyzed include:

- Alternative A—No Action: Alternative A represents the continuation of current land management practices in the GCWPA. This alternative assumes that approval of EOG's proposed project is denied and only those wells analyzed in previous NEPA documents and approved in accompanying decision-making documents would be drilled on federal surface ("federal lands") or mineral estate. This alternative would result in the construction of up to 425 new well pads, drilling of up to 462 new wells, and construction of related facilities. This alternative also includes site-specific disturbance of 1,034 acres for the construction of Phase 2 of a liquids gathering system intended to reduce existing and future oil and gas air pollutant emissions. This portion of Alternative A would carry forward regardless of the alternative selected for this EIS. New surface disturbance associated with this alternative would be up to 2,685 acres, in addition to 3,975 acres of continued use (Section 2.5).
- Alternative B—Proposed Action: Alternative B is EOG's proposal for development of oil and gas resources within the GCWPA. This alternative provides for construction of new well pads at a density of not greater than 1 well pad per 40-acre surface spacing. The alternative would result in the expansion of up to 960 existing well pads to permit drilling of multiple wells, construction of up to 233 new well pads, drilling of up to 2,808 new wells, and construction of related facilities. Surface disturbance associated with this alternative would be up to 1,875 acres, in addition to 1,034 acres of site-specific No Action disturbance and 3,975 acres continued use of existing disturbance (Section 2.7).
- Alternative C—Resource Protection Action: Alternative C is similar to Alternative B, but would place more emphasis on protection of GCWPA resources. Within portions of the GCWPA, new well pads would be restricted to a spacing of not more than one pad per 80 acres of surface. There would be restrictions on surface disturbing activities within USFWS *Sclerocactus* identified protection areas. The alternative would result in the construction of up to 162 new well pads, the expansion of up to 960 existing well pads to accommodate the drilling of multiple wells, and the drilling of up to 2,808 wells. Surface disturbance associated with this alternative would be up to 1,514 acres, in addition to 1,034 acres of site-specific No Action disturbance and 3,975 acres continued use of existing disturbance (Section 2.8).
- Alternative D—Other Protections Action: Alternative D encompasses most features of Alternative C, but would place additional emphasis on mitigating project impacts on certain resources. Restrictions on development within *Sclerocactus* core areas would be increased. Additional air quality mitigations would be included. A visual buffer along the White River would be enforced; and all new pipelines would be buried. Development would be limited in portions of the northern part of the GCWPA and along the White River. The alternative would result in construction of up to 157 new well pads, the expansion of up to 880 existing well pads to accommodate the drilling of multiple wells, and the drilling of up to 2,808 wells. Surface disturbance associated with this alternative would be up to 1,595 acres, in addition to 1,034 acres of site-specific No Action disturbance and 3,975 acres continued use of existing disturbance (Section 2.9).

This chapter also describes the GCWPA boundaries along with the existing and approved oil and gas facilities within the GCWPA, and explains management guidance and mitigations that would be applied to all alternatives.

2.1 Greater Chapita Wells Natural Gas Infill Project Area

The GCWPA is located in the Uinta Basin in eastern Utah. It includes the lands analyzed by the 2008 Final EIS and Biological Assessment for EOG's Chapita Wells-Stagecoach Area (CWSA) Natural Gas Development Project, UTU-080-2005-0010 (BLM 2008c); the 2006 North Chapita Natural Gas Well Development Project, Uintah County, Utah, Environmental Assessment (EA) UT-080-2003-0307V (BLM 2006a); the 2013 CWU Liquids Gathering System Phase 1 Project EA, UT G010 2012 113 (BLM 2013a); 2014 Chapita Wells Electrification EA [DOI-BLM-UT-G010-2014-0166-EA] (BLM 2014b); and the 2015 Northern CWU Liquids Gathering System Project EA (BLM TBD). Nearby leased acreage to the north and northeast of these areas is included in the GCWPA because EOG anticipates that future development in all of these leaseholds would be similar in terms of well and pad density, drilling, completion, and production operations. **Figure 2-1**, illustrates existing oil and gas development within the GCWPA.

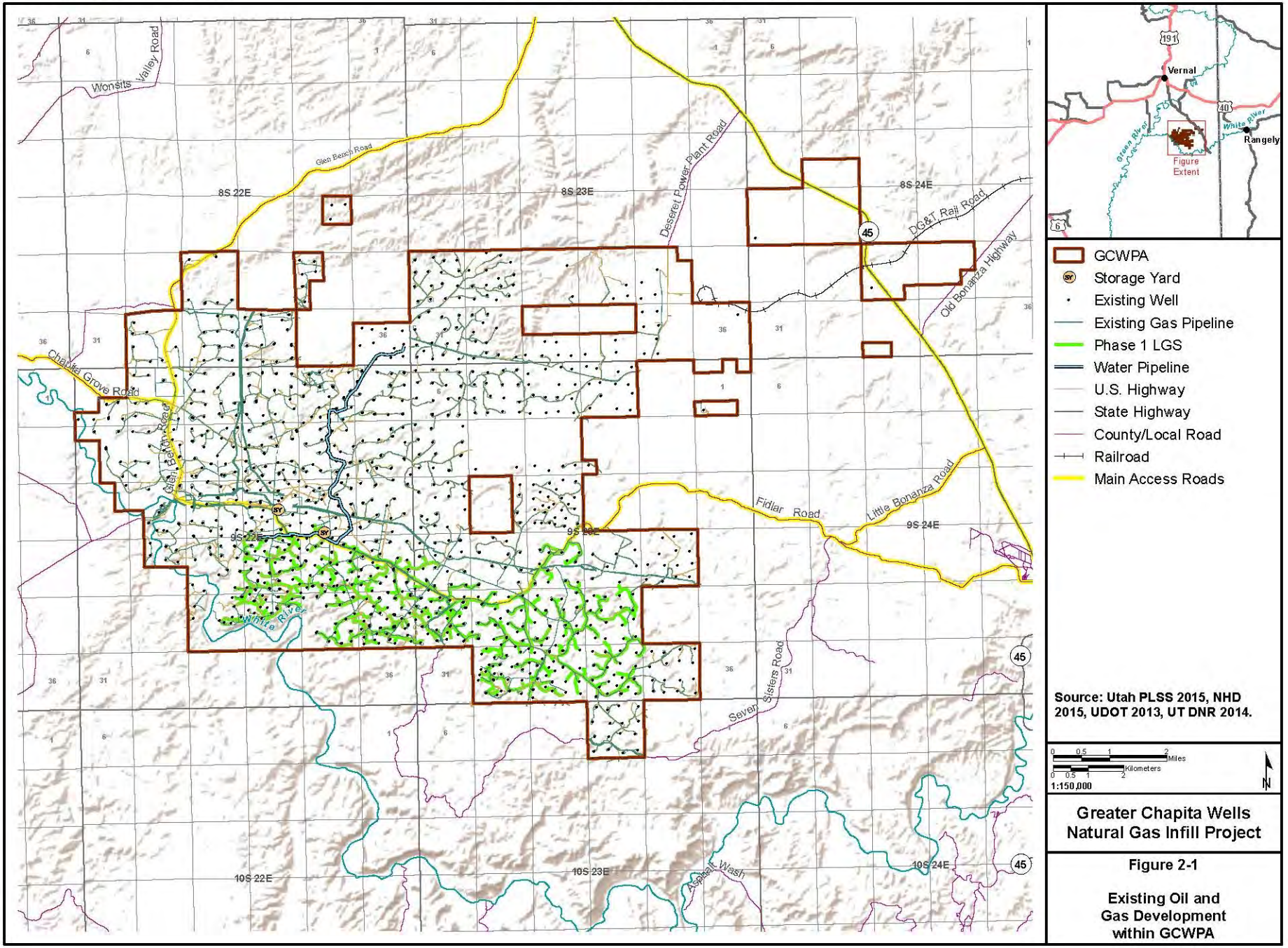
The GCWPA contains the Chapita Wells (UTU 63013X), Stagecoach (UTU 63027X), and Badlands (UTU 60917X) federal units, in addition to non-unitized lands. The three federal units were approved in the public interest by the BLM to foster adequate and timely exploration and development within each unit without regard to internal ownership boundaries while agreeing to an allocation of unitized production and compensation on the basis of percent ownership. Approximately 18,952 acres (44 percent) of the 43,071-acre GCWPA are located outside unitized areas. Well spacing within the units would not be subject to conventional spacing rules. In areas outside these units, well spacing would be subject to regulations and formal well spacing orders prescribed by the Utah Board of Oil, Gas, and Mining.

The entirety of the Chapita Wells and Stagecoach Units, comprising 21,373 and 1,760 acres, respectively, is contained within what has been designated the Chapita Wells-Stagecoach Units portion of the GCWPA, and includes approximately 72 percent of the area analyzed in the 2008 CWSA EIS (**Figure 2-2**). Within the Chapita Wells-Stagecoach Units, mineral ownership differences preclude commingling of produced natural gas and associated liquids from separate reservoirs.

2.1.1 Objective Horizons and Drilling Strategy

The new infill wells would be drilled to the Green River, Wasatch, Mesaverde Group (including the Blackhawk), Mancos “B,” and, possibly Dakota formations. Most of the new wells would be drilled to the Wasatch Formation, to depths ranging between 6,000 and 8,000 feet, and to the Mesaverde Group, to depths ranging from 8,000 to 11,000 feet below the surface. Wells to the Dakota Formation would be to depths of 12,500 to 15,000 feet below the surface. Drilling depths generally increase south to north.

Most existing well development within the GCWPA consists of vertically drilled wells located on well pads spaced at a density of 1 pad every 40 acres. Because the wells are vertical, the bottom hole spacing also is 1 hole every 40 acres. To drill wellbores more closely spaced than the well pad density on the surface, wellbores would be directionally drilled from the well pads. The bottom hole locations of these wellbores would be horizontally offset from the well pad locations to create a subsurface well spacing pattern with the bottoms of the wellbores spaced more closely than the surface well pads. The addition of wellbores in this manner would be described as “downspacing” or “infill” drilling. The objective is to increase natural gas recovery.



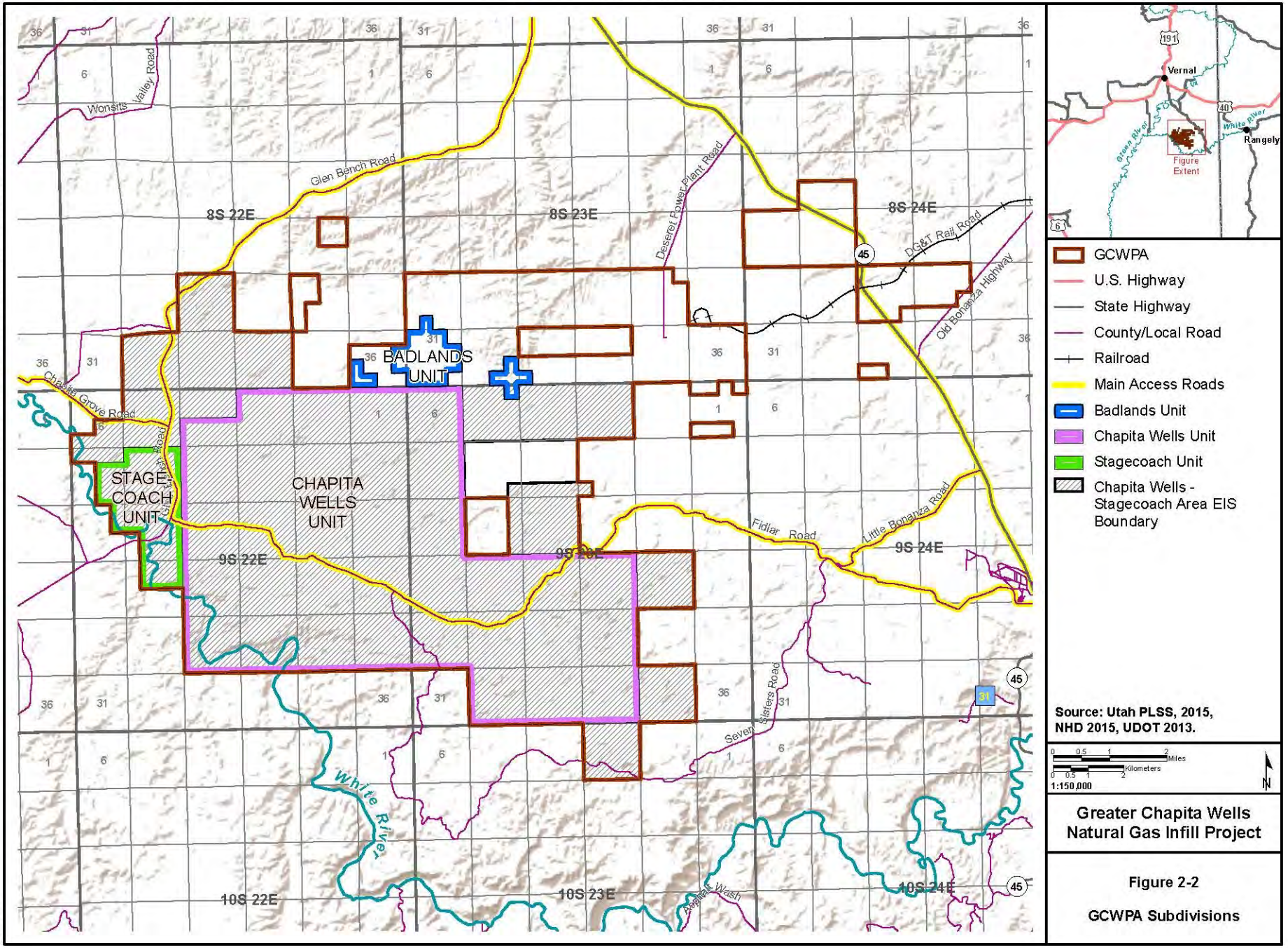
Greater Chapita Wells Natural Gas Infill Project

Figure 2-1

Existing Oil and Gas Development within GCWPA

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Greater Chapita Wells Natural Gas Infill Project

Figure 2-2

GCWPA Subdivisions

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Drilling strategy in the GCWPA is affected by the depths to the objective reservoirs, which determine the ability to use directional drilling techniques to reach specific bottom hole targets while penetrating the objective formation vertically to permit successful completions. Because of the shallower depth of the Wasatch Formation, it is EOG's opinion that directional drilling does not currently provide an economically viable production strategy for Wasatch reservoirs in the GCWPA. Therefore, it is EOG's opinion that development of the Wasatch Formation by the Proposed Action would utilize vertical wells. However, based on the experience of other operators in the area, BLM does not agree with EOG's assertion. The analysis in this EIS has allowed for the possibility of directional Wasatch wells. The greater depths to the Mesaverde Group allows for the use of directional drilling techniques to economically reach multiple bottom hole locations from a single surface well pad.

2.1.2 Reservoir Quality and Subsurface Well Spacing

Subsurface well spacing is largely a function of reservoir quality (i.e., the area of the producing horizon), which can be effectively and economically drained of oil and gas resources by a single wellbore. Throughout the GCWPA, reservoir quality in the Wasatch Formation has been determined by EOG to require maximum commercial development at a bottom hole spacing of one well for every 20 acres.

Within the GCWPA, reservoir quality within the Mesaverde Group has been determined by EOG to be more variable. In the northern and northeastern portions of the GCWPA, reservoir characteristics require maximum commercial development at a bottom hole density of one well for every approximately 10 acres. However, within the CWSA portion of the GCWPA, maximum commercial development requires a bottom hole location as dense as every five acres as a result of different reservoir characteristics within the Mesaverde.

2.1.3 Surface Disturbance Reclamation Rates

Local climate and soil conditions make reclamation of surface disturbance a difficult task in the GCWPA. Data on reclamation rates, assuming conformance with reclamation standards indicated in the Green River District guidelines (**Appendix B**), have been determined. BLM experience with soil stabilization and vegetation recovery associated with buried pipeline projects suggests attainment of a 40 percent basal cover takes approximately 4 to 7 years. If a 40 percent cover is obtained, BLM has determined from experience that reclamation will generally proceed to full recovery. Based on these data, this analysis has assumed that average surface disturbance involving excavation of the soil would attain a 40 percent basal cover within 5 years, assuming compliance with the BLM's Green River District's Reclamation Guidelines. For surface disturbance which does not involve excavation or disruption of the soil, such as laying of surface pipelines, restoration has been assumed to occur within 3 years.

2.2 EOG Air Emissions Control Strategy

Results from the limited number of air quality monitoring stations within the Uinta Basin revealed several periods of elevated daytime O_3 concentrations during the winter of 2009-2010. Eight-hour averages above 100 parts per billion (ppb) were measured (Energy Dynamics Laboratory 2011), which exceeded the current 8-hour National Ambient Air Quality Standard (NAAQS) of 75 ppb (USEPA 2012). Elevated O_3 levels have been identified as causing negative health impacts to exposed individuals. The results were unexpected, but similar to equally unanticipated high winter O_3 levels identified in the Upper Green River Basin in Wyoming during the winters of 2005 and 2006. In July 2012, USEPA designated portions of the Upper Green River Basin as a marginal non-attainment area with respect to the national O_3 standard (Wyoming Department of Environmental Quality 2014). Elevated O_3 levels in the Uinta Basin have continued to be detected during specific winter meteorological conditions (Utah State University et al. 2013).

Prior to these discoveries, formation of elevated values of ground-level O_3 was generally considered to be a summertime phenomenon typically observed in urban areas. O_3 is known to be created by complex photochemical reactions involving certain precursor chemicals, in particular various volatile organic

compounds (VOCs) and nitrogen oxides (NO_X). These precursor chemicals are known to be emitted by, among other sources, oil and gas development activities. Ongoing studies of winter O_3 in the Uinta Basin have suggested that oil and gas development is the source for the majority of O_3 precursors and controlling O_3 formation will likely require reducing oil and gas precursor emissions (Utah State University et al. 2013). It is possible that the Uinta Basin also could be designated a non-attainment area with respect to the national O_3 standard, which would likely result in stringent emissions controls being applied to oil and gas facilities.

In response to the recognition of elevated ozone levels in the Uinta Basin, EOG has developed a comprehensive strategy for minimizing the generation of additional ozone precursor emissions as indicated in **Appendix C**, Ozone Management Strategy.

2.2.1 Liquids Gathering System Overview

Beginning in August 2010, in response to the identification of elevated winter O_3 levels in the Basin, EOG began examining its oil and gas development operations with the intention of instituting controls to reduce or eliminate emissions of O_3 precursors. The most important contributor to these control mitigations is a liquids gathering system (LGS), which is in the process of being constructed within the GCWPA. The LGS would reduce O_3 precursor emissions from approximately 47 percent of the existing wells within the GCWPA, as well as a minimum of 51 percent of the EIS project wells in the future (BLM 2013a, 2014b, 2015a). Construction of the LGS has been authorized via NEPA analyses separate from this EIS to allow early reductions in emissions from existing GCWPA wells.

The LGS is designed to provide substantial near-term reductions in air emissions from existing and future project wells within the GCWPA. Criteria pollutant and hazardous air pollutant emissions from existing LGS-connected wells have been or would be reduced by between 62 percent and 96 percent, depending on the pollutant (BLM 2013a). Truck traffic to wells connected to the LGS would be minimal.

The LGS consists of a network of buried pipelines located, in almost all cases, within or adjacent to existing common utility corridors in addition to a number of centralized processing facilities. The LGS is designed to be constructed in two phases, although timing of construction of each phase may somewhat overlap, depending on EOG priorities. Phase 1 of the LGS has been constructed principally within the southern half of the CWU portion of the GCWPA and was approved by BLM in 2013 (BLM 2013a). Phase 2 covers parts of the CWU not served by the Phase 1 facilities, as well as portions of the GCWPA north, east, and south of the CWU. Evaluation of Phase 2 under NEPA is in progress (BLM TBD). LGS operations include the:

- Transport of combined fluids (gas, oil, and water) from the wells to centralized processing facilities;
- Transport of produced water to existing and future disposal wells;
- Distribution of freshwater for drilling and completion purposes throughout the system; and
- Transport of some produced gas from the centralized facilities back to the wells for re-injection to support gas lift enhanced recovery operations.

A maximum of 49 percent of proposed EIS wells would not be connected to the LGS. Transport of fluids from wells not connected to the LGS would continue to be done by truck. Produced water from these wells would be transported by truck to centralized offloading facilities. The water would then be pumped to the injection wells via underground pipelines which are either already existing or would be constructed as part of the LGS.

The project would be supported by existing sales gas compression facilities, so additional compression for gas transmission pipelines would not be required. New compression would be localized at the central

facilities to support gas lift operations. For LGS-connected wells, new combined gas and liquids buried pipelines would transport natural gas from the wellhead to lateral and/or trunk pipelines, and then to centralized processing facilities. Based on existing development, each new project well pad is assumed to be serviced by an access road averaging approximately 1,000 feet long. Wells on new or expansion pads not connected to the LGS is assumed to be serviced by existing gas pipelines. Wells on new pads connected to the LGS would be serviced by new combined gas and liquids pipelines averaging approximately 1,000 feet long. Expansion pads connected to the LGS system would require new buried pipelines. The anticipated emissions reductions when existing wells and central facilities within the GCPWA are connected to the LGS are shown in **Table 2-1**.

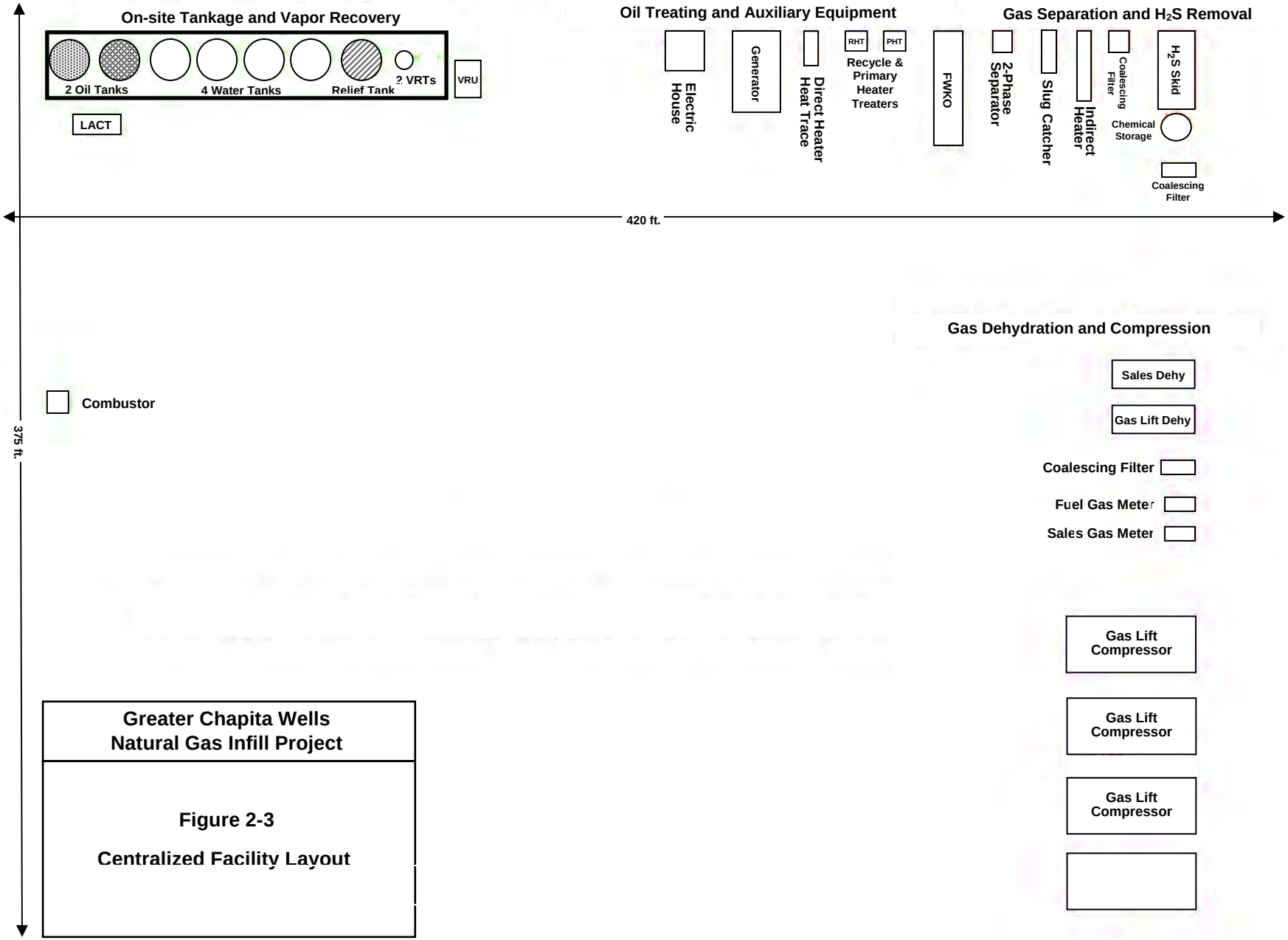
Table 2-1 Emission Reductions Anticipated when Existing Wells and Central Facilities are Connected to the LGS

	Annual Emissions Reductions Summary (short tons, except CO_2e in metric tonnes)										
Year	NO_X	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2	HAPS	CO_2	CH_4	N_2O	CO_2e (MMt)
1	-23	-2,674	-18	-10	-4	-1	-251	-24,503	-8,734	-0.4	-0.2
2	-33	-5,347	-26	-21	-6	-1	-503	-34,384	-17,467	-0.6	-0.4
3	-42	-8,021	-33	-29	-9	-2	-754	-44,079	-26,200	-0.8	-0.5
4	-49	-10,694	-39	-34	-10	-2	-1,005	-53,565	-34,933	-1.0	-0.7
5	-47	-10,649	-35	-37	-11	-2	-1,004	-50,510	-34,881	-0.9	-0.7
6	-45	-10,649	-33	-32	-10	-2	-1,004	-50,163	-34,881	-0.9	-0.7
7	-44	-10,648	-32	-27	-9	-2	-1,004	-49,896	-34,881	-0.9	-0.7
8	-43	-10,648	-31	-23	-8	-2	-1,004	-49,647	-34,881	-0.9	-0.7
9	-42	-10,648	-30	-20	-7	-2	-1,004	-49,450	-34,881	-0.9	-0.7
10	-41	-10,648	-29	-17	-7	-2	-1,004	-49,258	-34,881	-0.9	-0.7
11	-41	-10,648	-29	-14	-6	-2	-1,004	-49,072	-34,881	-0.9	-0.7
12	-40	-10,648	-28	-11	-5	-2	-1,004	-48,928	-34,881	-0.9	-0.7
13	-40	-10,648	-28	-9	-5	-2	-1,004	-48,823	-34,881	-0.9	-0.7
14	-40	-10,648	-28	-7	-5	-2	-1,004	-48,712	-34,881	-0.9	-0.7
15	-40	-10,648	-28	-6	-4	-2	-1,004	-48,642	-34,881	-0.9	-0.7
16	-40	-10,648	-28	-6	-4	-2	-1,004	-48,656	-34,881	-0.9	-0.7
17	-40	-10,648	-28	-6	-4	-2	-1,004	-48,656	-34,881	-0.9	-0.7
18	-40	-10,648	-28	-5	-4	-2	-1,004	-48,634	-34,881	-0.9	-0.7
19	-40	-10,648	-28	-4	-4	-2	-1,004	-48,603	-34,881	-0.9	-0.7
20	-40	-10,648	-28	-4	-4	-2	-1,004	-48,567	-34,881	-0.9	-0.7
21	-23	-2,674	-18	-10	-4	-1	-251	-24,503	-8,734	-0.4	-0.2

Source: Derived from **Appendix J**.

2.2.2 LGS Centralized Facility Operations

A schematic illustration of a typical layout for a centralized facility is included as **Figure 2-3**. Centralized facilities are described below and include four different operational functions: 1) oil treating and auxiliary equipment operation; 2) on-site tankage and vapor recovery; 3) gas separation and hydrogen sulfide removal; and 4) gas dehydration and compression.



Greater Chapita Wells Natural Gas Infill Project

Figure 2-3

Centralized Facility Layout

Source: BLM 2013a.

1. Oil Treating and Auxiliary Equipment Operation

This function would primarily involve separation of oil from other produced fluids, oil measurement, and operation of the facility electrical source. Typical equipment would include:

- One electrical equipment house;
- One electrical generator;
- One direct heat trace heater;
- One primary oil heater treater;
- One recycle oil heater treater; and
- One free water knockout.

2. On-site Tankage and Vapor Recovery

This function would involve storage of oil, produced water, and potentially freshwater. It also would provide for recovery or destruction of tank-associated vapors and gaseous emissions and would be the oil sales point. Typical equipment would include:

- Two 400-barrel oil tanks;
- Four 400-barrel produced water tanks;
- One 400-barrel relief tank;
- Two vapor recovery towers for oil and water;
- One vapor recovery unit;
- One combustor; and
- One lease automated custody transfer.

3. Gas Separation and Hydrogen Sulfide Removal

This function would involve additional gas/liquid separation and equipment designed to remove hydrogen sulfide (H_2S) from the gas stream. Typical equipment would include:

- One two-phase vertical separator (2P);
- One slug catcher;
- One indirect heater;
- Two coalescing filters;
- One H_2S skid; and
- One chemical (H_2S scavenger) storage container.

4. Gas Dehydration and Compression

This function would involve removal of water liquid and vapors from the gas stream, gas volume measurement, and compression of some portion of the gas stream for return transport to the well sites for use in gas lift pressure maintenance. Typical equipment would include:

- One glycol dehydration unit for sales gas;
- One glycol dehydration unit for gas lift gas;
- One coalescing filter;

- One fuel gas meter;
- One gas purchase meter; and
- Up to four small compressors for gas lift operations.

A flow diagram illustrating these processes has been included as **Figure 2-4**.

The LGS centralized facilities would be operated using three-phase electrical power. Electrical power within the GCWPA is addressed in a separate NEPA document (Chapita Wells Electrification EA DOI-BLM-UT-G010-2014-0166-EA [BLM 2014b]). Water disposal wells would require the use of injection pumps. These injection pumps are either currently electrified or would be electrified. The power lines installed would be secondary lines originating from the nearest substation. Equipment operating at the central facilities and injection pumps would be electrically powered as soon as feasible, following construction of power lines to service the LGS central facilities. Electrically powered equipment would have zero point source air emissions.

As discussed in more detail in Section 2.9, limitations on electrical power availability in the vicinity of the GCWPA restricts the areal extent of the LGS. A Federal Energy Regulatory Commission (FERC) jurisdictional boundary limits power from EOG's supplier, Rocky Mountain Power, to approximately the southern half of the GCWPA. EOG has contracted for the electrical power that is currently reasonably available within the vicinity of the GCWPA for use in powering the LGS.

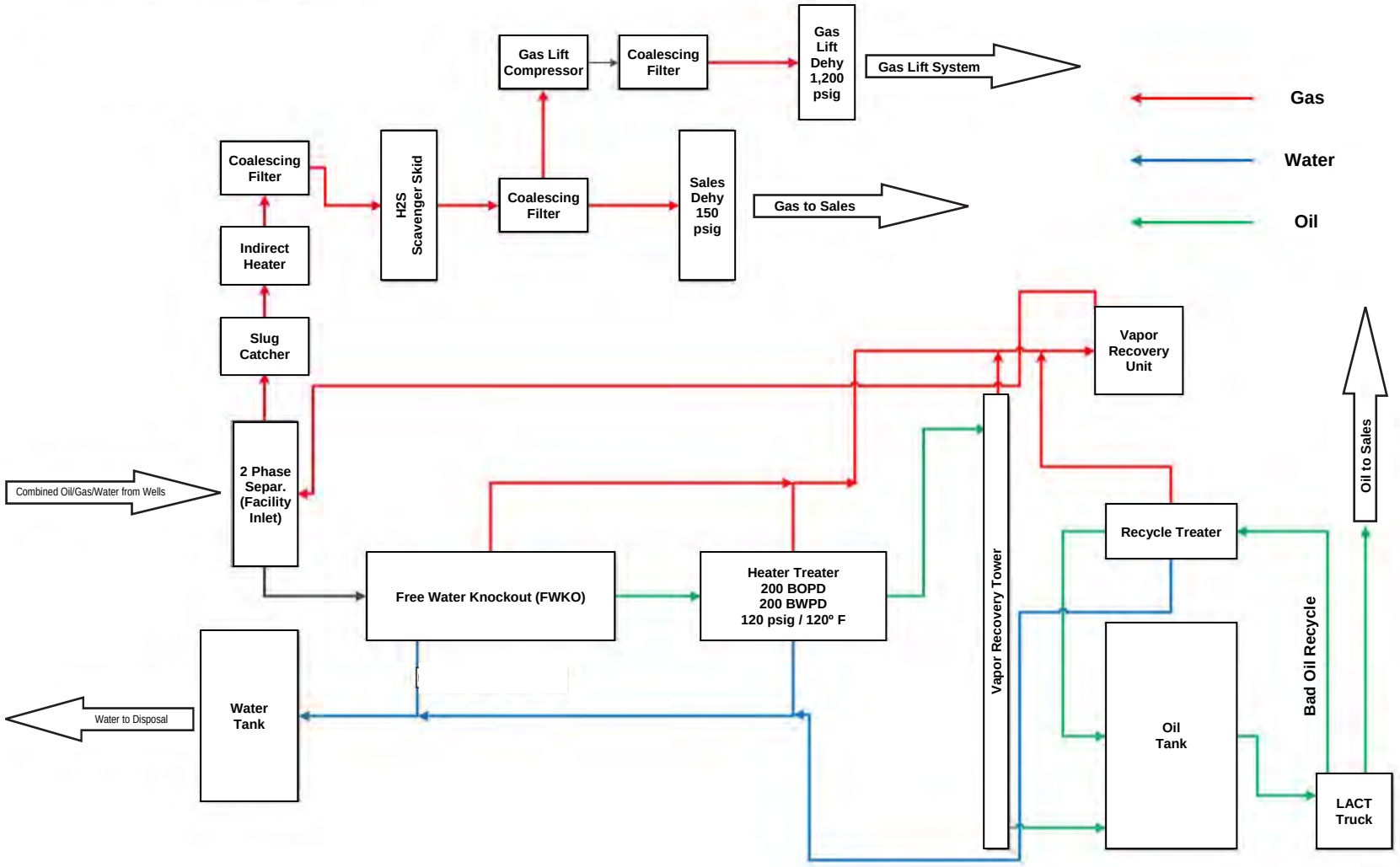
2.3 Existing Oil and Gas Infrastructure in the GCWPA

Oil and gas exploration began in the Uinta Basin in the late 1920s, with the first well drilled in the Chapita Wells area in 1952. As of March 2014, the GCWPA contained 1,247 active natural gas wells located on 960 well pads. Approximately 257 miles of roads are located within the GCWPA. About 64 percent of the road mileage consists of relatively short (average 1,000 feet) well pad access roads. The remainder consists of various through roads, including some county-maintained roads.

Phase 1 of the LGS discussed in Section 2.2 has either been constructed or is currently in the process of construction and has been included within existing disturbance estimates for this analysis.

Based upon EOG aerial imagery obtained in June 2008, approximately 268 miles of pipeline ROWs (445 acres) were located within the GCWPA. As discussed in Section 2.6.7, surface disturbance within the GCWPA is in various stages of reclamation. However, almost all pipelines in the GCWPA are laid on the surface, typically adjacent to roads, and do not result in additional surface disturbance. Subsequent to obtaining aerial imagery, approximately 150 well pads and associated facilities and 230 wells have been developed in the GCWPA. Updates to the 2008 imagery from other sources have been used to estimate the existing disturbance in the area.

Total existing disturbance in the GCWPA is approximately 3,975 acres, or 9.2 percent of the GCWPA. An additional 1,000 acres of prior disturbance has been reclaimed. A summary of existing facilities and interim reclamation acreages within the GCWPA is indicated in **Table 2-2**. The existing disturbance represents a baseline for comparison with the action alternatives.



Greater Chapita Wells Natural Gas Infill Project

Figure 2-4
Centralized Facility Process Flow Diagram

Source: BLM 2013a.

Table 2-2 GCWPA Existing Facilities Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or ROW Width (feet)	Existing Wells (count)	Estimated Surface Disturbance (acres)
Area Facilities				
Well Pads and Wells	960	1.90	1,247	1,824
Evaporation Ponds, Disposal Wells, Power Plant, Storage Yards, and Compressor Stations				701
LGS Central Facilities	14	4.0		56
Total Area Facilities				2,581
Linear Facilities				
Roads [1]				
Through Roads	93.4	30		340
Non-through Roads	163.6	20		396
LGS Central Facility Access Roads	4.0	20		10
Total Roads				**746**
LGS Buried Pipelines	76.4	70		648
Total Linear Facilities				**1,394**
GCWPA Total Existing Disturbance				3,975
GCWPA Total Area (acres)				43,071
Existing Disturbance % of GCWPA				9.2%
Estimated Previously Reclaimed Surface Disturbance				
Well Pads Interim Reclamation (acres) [2]				545
Roads Interim Reclamation (acres) [2]				11
Pipelines Interim Reclamation (acres) [3]				444
Total Reclaimed Surface Disturbance (acres)				1,000
Total Reclaimed % of GCWPA				2.3%

[1] Width is long-term running surface plus adjacent drainage control features.

[2] Reclaimed acreage measured from 6/2008 imagery.

[3] Pipeline disturbance from 6/2008 imagery assumed reclaimed.

2.4 Management Actions Common to all Alternatives

Following completion of the NEPA process and issuance of the ROD, project initiation would require application for various permits and compliance with specific regulatory requirements and standard operating procedures prior to any disturbance. A summary of the most important of these requirements has been indicated in **Table 1-2**. Required approvals may be issued by various federal or state agencies.

2.5 Alternative A—No Action

Alternative A represents the continuation of current land management practices in the GCWPA. This alternative assumes that only those wells or related facilities analyzed in previous NEPA documents and approved in accompanying previous decision-making documents would be drilled or constructed on federal surface ("federal lands") or mineral estate. The ability to select Alternative A may be limited because of existing contractual obligations between the U.S. and EOG, which were conferred with the granting of oil and gas leases.

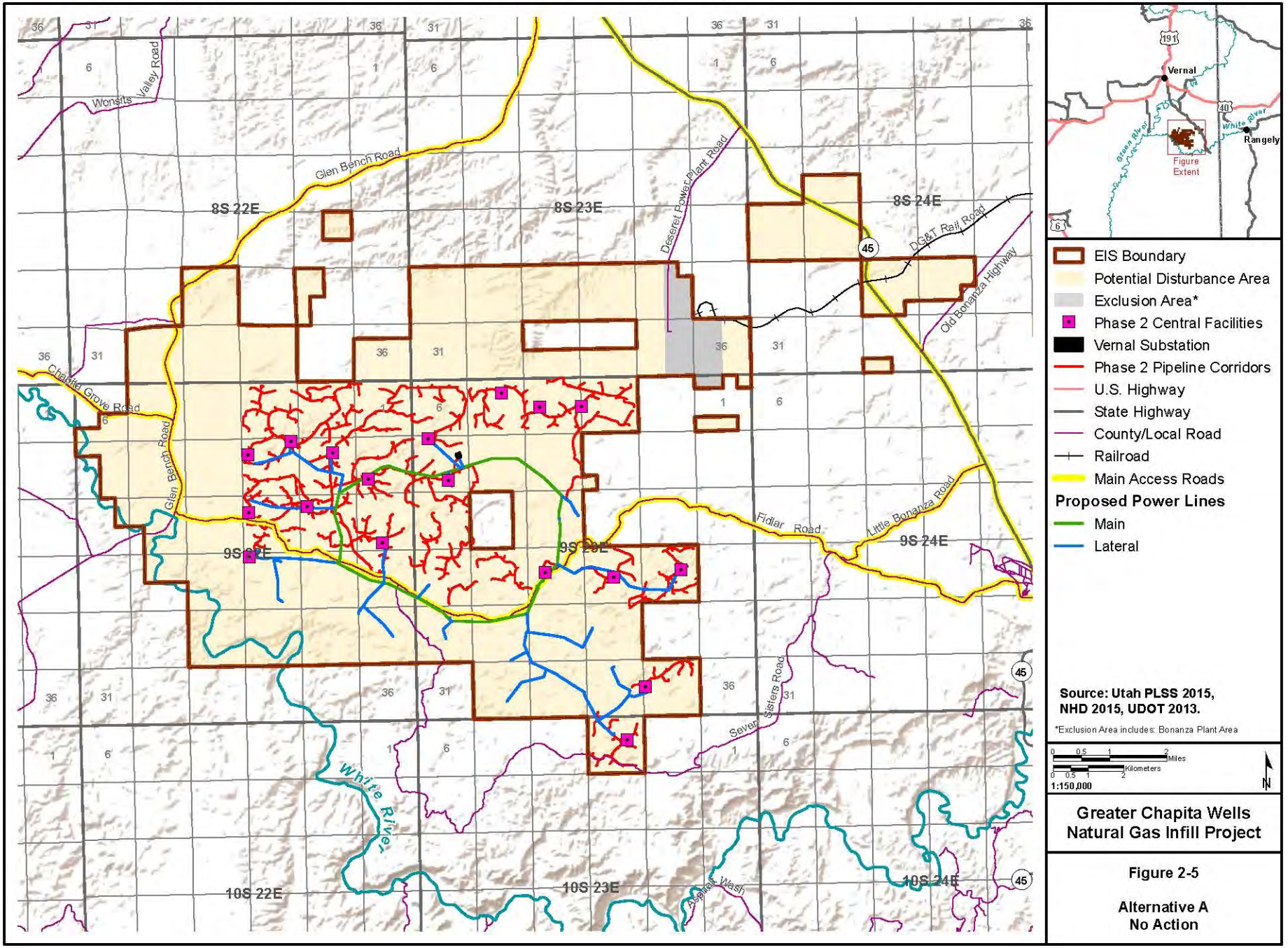
Approximately 94 percent of the GCWPA has been analyzed in recently completed NEPA documents. Prior NEPA analyses for oil and gas development include the 2008 CWSA Final EIS [UTU-080-2005-0010] and the 2003 North Chapita Natural Gas Well Development Project [UT-080-2003-0307V]. The ROD for the CWSA EIS approved 473 new well pads plus an additional 154 twin wells on existing pads in addition to associated surface pipelines and access roads. The North Chapita EA DR approved 264 new single well pads plus associated pipelines, access roads, compressors, and dehydrators and was the first NEPA evaluation of that portion of the GCWPA. Numerous other field development and site-specific EAs also have previously been prepared and implemented on lands within the GCWPA boundary. All other published NEPA documents are assumed to be fully developed and are counted as existing development. Implementation of Alternative A, therefore, would include limited new oil and gas development within the GCWPA as analyzed and approved through the Chapita EIS/ROD and North Chapita EA/DR.

2.5.1 Field Development Plan

According to information provided by EOG, facilities for which development effects were disclosed in previous NEPA analyses, but which remain unconstructed within the GCWPA include approximately 425 additional well pads and 462 additional wells (**Figure 2-5**). These well pads and wells, and their associated surface disturbance, would be in addition to the 960 existing well pads and 1,247 existing active wells as of March 2014 (**Table 2-2**). Alternative A disturbance estimate is based on the total conceptual disturbance per well pad for remaining approved pads, including associated pipelines and roads. In addition to approved well pads, new well pad and LGS central facility access roads, buried pipelines, and surface pipelines could be constructed and one compressor station expanded, as indicated in **Table 2-3**. For the purposes of estimating production it was assumed that this alternative would be developed over 10 years. The final locations for these components of Alternative A have not been determined and no on-site inspections have been conducted.

NEPA analysis of the second phase of the proposed LGS is in process (BLM TBD), and construction on this portion has not yet commenced. The BLM VFO has determined that selection of an action alternative in the EIS ROD would supersede programmatic drilling approved under previous NEPA as estimated in Alternative A. However approved site-specific projects, such as Phase 2 of the LGS, would proceed under the previous NEPA approvals regardless of which alternative is selected in the EIS ROD. Approximately 85 percent of this disturbance would undergo interim reclamation immediately following construction. Total previously NEPA-approved surface disturbance within the GCWPA is approximately 2,685 acres or 6.0 percent of the GCWPA. Up to 1,272 acres of the 2,685 acres disturbance would be reclaimable.

A summary of surface disturbance associated with implementation of Alternative A, including numbers of approved wells and well pads, is presented in **Table 2-3**. This includes facilities approved but not yet constructed as of March 2014. Disturbance estimates are based on prorating the disturbance area in proportion to the estimated number of remaining approved well pads. The locations of NEPA-approved new well pads are not known at this time. For this analysis, half of the new well pads are assumed to be located outside the LGS and would require surface natural gas pipelines. Because reclamation is difficult to achieve in the Uinta Basin, based on basin reclamation rates estimated by VFO personnel, all disturbance is assumed to exist for approximately 5 years, assuming compliance with reclamation guidance from the VFO (**Appendix B**).



Greater Chapita Wells Natural Gas Infill Project

Figure 2-5

Alternative A
No Action

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Table 2-3 Alternative A—No Action Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or Disturbance Width (feet)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Area Facilities				
Single New Well Pads	425	2.50	425	1,063
Expandable Well Pads	37	0.25	37	9
Total Area Facilities	462		462	1,072
Linear Facilities				
New Well Pad Access Roads [1]	87.5	40		424
Surface Pipelines - Non-LGS New Pads [2]	40.2	30		146
Total Linear Facilities				571
Other Facilities				
Compressor Station Expansion	1			8
Site-specific LGS Facilities Carried Forward under Action Alternatives [3]				
LGS Central Facilities	18	6.60		119
LGS Central Facility Access Roads	5.1	50		31
LGS Buried Pipelines	89.6	70		760
Electrical Distribution System	32.8	Variable		124
Total Site-specific Facilities				1,034
GCWPA Alternative Disturbance				2,685
Estimated Alternative Reclaimable Surface Disturbance [3]				
Well Pads Interim Reclamation (acres)				128
Roads Interim Reclamation (acres)				223
Pipelines Interim Reclamation (acres)				921
Total Alternative Reclaimable Surface (acres)				1,272
Total Alternative Reclaimable % of GCWPA				3.0%
GCWPA Total Disturbance				
Alternative Disturbance % of GCWPA				6.2%
Existing Disturbance GCWPA (acres)				3,975
Alternative-Specific + Existing Disturbance (acres)				6,655

[1] Roads assume a 20-foot long-term running surface in a 40-foot ROW.

[2] Pipelines assumed located adjacent to road ROW, minimal additional disturbance, 100% reclamation.

[3] Site-specific facilities would be developed regardless of selected alternative.

[4] Reclaimable surface disturbance based upon current EOG field operations.

1

Interim reclamation would be applied to disturbed areas. The amounts of reclaimable acreage listed in **Table 2-3** have been estimated using numbers included in the previously approved NEPA documents and current field development activities. For example, roads would be narrowed from a 40-foot construction width to an 18- to 20-foot long-term running surface width, well pad disturbance would be variably reduced depending on the original pad size and location, and all pipeline ROWs would be reclaimed following installation, including reclamation of any disturbance associated with pipeline installation. Residual disturbance remaining for the life-of-project would be the initial disturbance less the interim reclaimable acreage.

2.5.2 Alternative-specific Activities

The size of new well pads under Alternative A is assumed to be 2.5 acres. For approximately 37 new wells drilled from expansion pads, EOG field experience is that each expansion well adds approximately 0.25 acre of new surface disturbance to the existing pad. Construction of new access roads and surface pipelines would be restricted to new well pad locations. New access roads would clear a ROW width of up to 40 feet. Installation of surface pipelines assumes a cleared ROW width of 30 feet. Other proposed facilities would include the addition of up to three 1,500-horsepower compressor engines at an existing compressor station with a resulting increased surface disturbance of approximately 8 acres.

Water required for drilling and completing the wells would depend upon the geologic horizons targeted. Assuming all the wells were drilled to the deepest proposed depth, average water volumes required to drill and complete each well, based on current field practices, would be approximately 16,850 barrels (2.17 acre-feet), including 2,050 barrels of fresh and 14,800 barrels of recycled water. Total water requirement for the estimated 462 approved wells would be up to approximately 122 acre-feet of fresh water and 881 acre-feet for recycled water for a total of 1,003 acre-feet.

Produced water from approved wells which are connected to the LGS would be piped to central facilities through existing or previously approved buried pipelines. Produced water would be removed from non-LGS producing well locations by truck and delivered to approved disposal facilities within the GCWPA.

Activities associated with construction of the Phase 2 LGS are described in the Northern CWU Liquids Gathering System Project Environmental Assessment (BLM TBD). Under this alternative, assuming a 10-year development schedule, maximum produced water would be approximately 607,000 barrels per year (78 acre-feet). Produced water could be accommodated with existing trucks and disposal wells.

2.6 Field Development Activities Common to All Action Alternatives

The following sections summarize general pre-construction, construction, drilling and completion operations, production and maintenance operations, and abandonment and reclamation procedures that would apply to all action alternatives.

2.6.1 Pre-construction Actions

Prior to the start of construction activities, EOG would:

- Survey and stake the expanded or new location;
- Submit site-specific applications (Notice of Staking/APD/ROW application);
- Submit detailed construction plans, as needed;
- Perform cultural resource, paleontological, biological, and/or other surveys, as requested by the AO;
- Participate in an onsite inspection; and

- Obtain the necessary permits or other approvals required prior to commencing surface disturbing activities.

2.6.2 Construction

Construction operations would conform to standards described in Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development ("Gold Book") (BLM and USFS 2007), lease stipulations, and EOG-committed project design features. Construction operations generally occur during daylight hours.

Each new well pad and access road would be constructed by a crew of four to six workers accessing the location using an average of three light trucks. An average of four pieces of heavy equipment (e.g., bulldozers and motor graders) would be used to perform the earth-moving operations. A new access road and well pad typically can be constructed within 7 to 14 days. Time and manpower requirements for an expanded well pad would typically be less than that for a new well pad, depending on specific site conditions. Manpower and equipment requirements for gas gathering pipeline installation are included with estimates discussed under well pad and access road construction.

2.6.2.1 Access Roads

New roads would be constructed and existing roads upgraded where needed for vehicle access. Road design and construction specifications on federal lands would conform to Gold Book standards and BLM Handbook 9113-1 – Roads Design (BLM 2011a). Locations of proposed access roads would be modified as necessary at the time of onsite inspections and site-specific requirements would be incorporated on a case-by-case basis using COAs attached to the APD.

New roads would be built and maintained to provide year-round access to new well pads and LGS centralized facilities as necessary. Construction would utilize standard BLM grading techniques. Construction materials for access roads would consist of native borrow and soil accumulated during construction operations. Bulldozers, graders, and other heavy equipment would be used to construct and maintain the road system.

Upgrades to existing roads would meet standards appropriate to the anticipated traffic flow and all weather road requirements. Upgrading may include ditching, drainage, graveling, crowning, and capping the roadbed as necessary to provide a well-constructed safe roadway. Construction or upgrading would not occur during muddy conditions. Where operations would involve the use of county roads or where a project road would connect to a county road (CR), EOG would coordinate activities with the CR department.

Running surfaces of new roads, including any marginal drainage control structures, are typically 18 to 20 feet wide. Access road disturbance has been calculated using an average construction disturbance that extends to the full width of a 40-foot ROW, which corresponds to a typical road ROW in the GCWPA. The actual amount of surface disturbance resulting from road construction would depend upon the number of new well pads ultimately constructed.

2.6.2.2 Well Pads and Wells

Well pad size would be related to the number of proposed wells on a location, not a function of whether vertical or directional well bores are drilled. All well pads are potentially expandable and the final number of wells would depend upon technical and economic factors during the life of the project. EOG would expand existing well pads or construct new well pads to a size appropriate to the number of wells it expects to drill from that pad. Well pad disturbance areas have been determined by field experience supported by field-wide computer analysis of aerial imagery of existing well pads augmented by spot checks of pad sizes using geographic information system (GIS) imagery. An example layout for a typical multi-well pad is illustrated in **Figure 2-6**.

EOG RESOURCES, INC.

TYPICAL RIG LAYOUT FOR

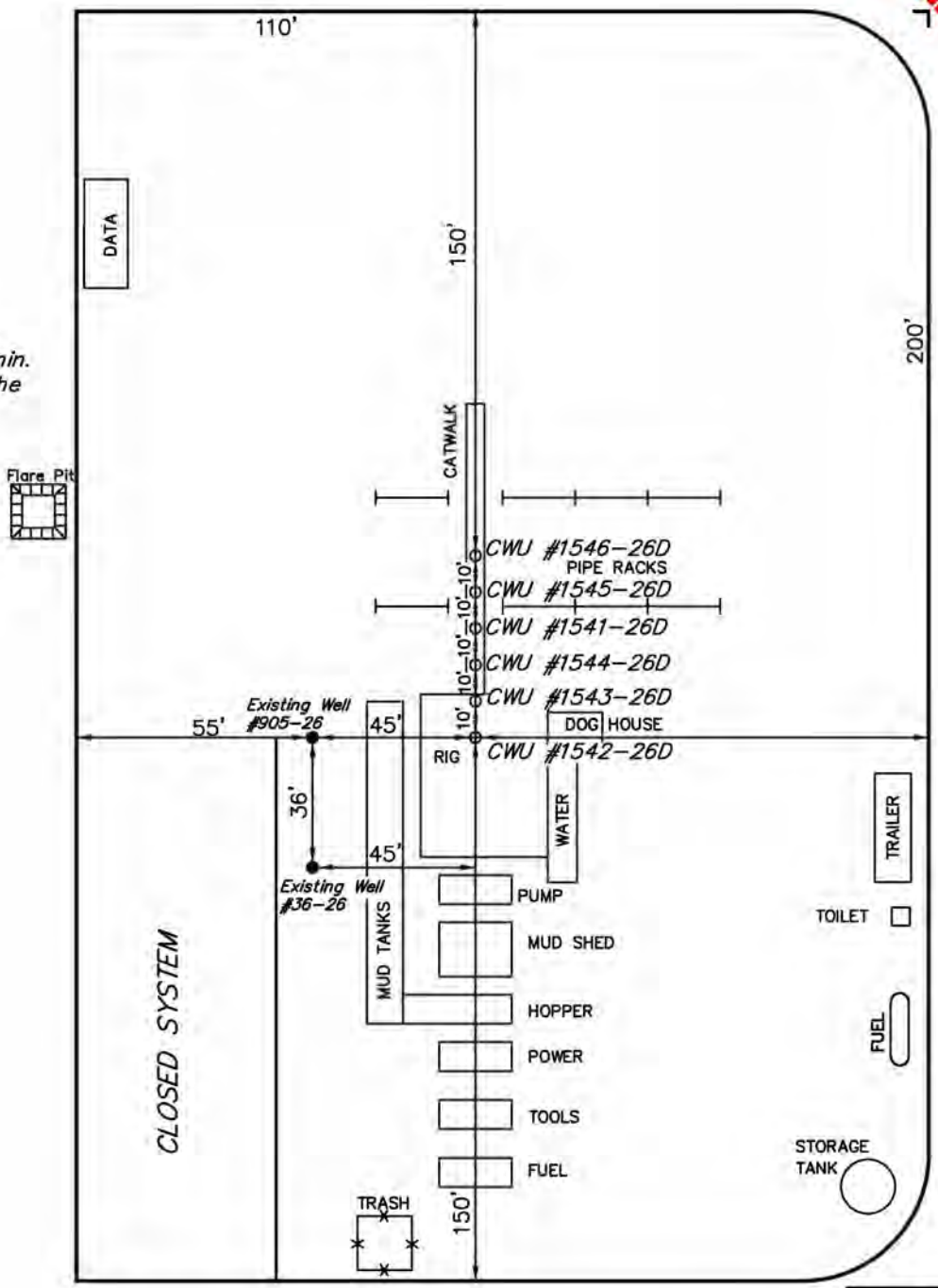
CWU #1541–26D, #1542–26D, #1543–26D
#1544–26D, #1545–26D & #1546–26D
SECTION 26, T9S, R22E, S.L.B.&M.
NE 1/4 NE 1/4

FIGURE #3

SCALE: 1" = 50'
DATE: 10–20–09
Drawn By: D.R.B.
Rev: 02–08–10 D.R.B.

REGISTERED LAND SURVEYOR
No. 161319
ROBERT L. KAY
STATE OF UTAH

NOTE:
Flare Pit is to be located a min. of 100' from the Well Head.



Greater Chapita Wells
Natural Gas Infill Project

Figure 2-6
Typical Rig Layout

UINTAH ENGINEERING & LAND SURVEYING
85 So. 200 East * Vernal, Utah 84078 * (435) 789–1017

A well pad would be expanded or constructed from the native sand/soil/rock materials present. Mineral materials from outside the GCWPA for use in construction would not be required. Cut-and-fill areas would be balanced, to the extent feasible, to provide a level working surface and to facilitate retention of topsoil. Prior to disturbance, vegetation would be cleared and topsoil would be salvaged and stockpiled for subsequent use during interim reclamation. Blasting could be required for excavations or leveling well pads where bedrock is near the surface; however, blasting would not be used within 800 feet of the Fantasy Canyon Special Resource Management Area (SRMA). Blasting would be conducted according to applicable safety standards. A well pad would include excavations for a cellar and flare pit.

EOG would use a closed-loop drilling fluids circulation system and no reserve pit would be constructed. A well pad for a single vertical well would be approximately 3.75 acres, including cuts and fills. For each additional well drilled on the same pad, an additional 0.25 acre of surface disturbance is assumed. For 6-well pads, therefore, the anticipated pad size would be 5.0 acres.

2.6.2.3 Gas Gathering Pipelines

EOG proposes to connect at least 51 percent of the proposed wells in the GCWPA to the existing and/or an expanded LGS (Section 2.2.1).

For wells not connected to the LGS, natural gas would be transported from the well pads via gathering pipelines (“lines”) installed to lateral pipelines. The new gathering lines would typically be constructed of steel pipe and installed on the surface to minimize surface disturbance.

Typically, a single gathering line with an outside diameter of 3 to 8 inches would be installed to transport natural gas from all new wells on new well pads. Pipeline segments would be assembled on disturbed areas in the ROW and dragged into place. A new gathering line would typically be installed parallel to a well pad access road, generally within the area disturbed during the construction of the access road. The exact location of a gathering line ROW would be determined at the time of the onsite inspection in consideration of topography and/or gathering system constraints. For purposes of estimating surface disturbance, a temporary 30-foot-wide construction disturbance ROW has been assumed with an 8-foot-wide permanent ROW disturbance for pipeline maintenance and monitoring. The permanent ROW would be reclaimed, but used for periodic pipeline inspections.

Installing surface gathering lines would not preclude access to the GCWPA. Road crossings would be constructed where necessary to facilitate safe passage. At crossings, pipe would be buried below the road surface. The effects from buried pipelines have been previously analyzed within the GCWPA (BLM 2008c). While pipeline burial mitigates visual impacts to a certain extent, negative aspects of pipeline burial include:

- Requiring sawing, ripping, or blasting of a pipeline trench because the GCWPA is dominated by surface or near-surface bedrock;
- Difficult and lengthy revegetation due the arid climate in the area;
- Increased risk of introducing invasive species when the vegetative cover is destroyed;
- Reduction in the wildlife and livestock forage available; and
- A long-term visual impact until the surface is restored to a state approximating that of adjacent, non-disturbed areas.

For these reasons, burial of natural gas pipelines may not be a realistic BMP for the GCWPA. Burial of pipelines carrying commingled fluids (including water) would be required to prevent freezing of the pipe contents and transport failure during the winter.

2.6.3 Well Drilling and Completion

2.6.3.1 Drilling Operations

On multi-well pads, EOG would typically drill all wells on a particular pad sequentially. EOG would drill the first well, then skid the rig to drill another well, until all wells on a pad are drilled. Wells would be drilled directionally and may include a vertical well. After the final well on a pad is drilled, the drilling rig would be dismantled and demobilized from the location. EOG would not perform interim reclamation until all planned wells on a pad have been drilled.

Following construction of the access road and well pad, a drilling rig would be transported to the well site and erected on the well pad. Wells would be drilled utilizing a conventional mobile drilling rig. Drilling operations would typically consist of drilling a surface hole, “running” (inserting into the hole) and cementing in place the surface casing below all aquifers in the area suitable for domestic or agricultural uses, drilling a deeper and smaller diameter production hole, and running and cementing production casing.

Drilling fluids typically consist of water-based mud. EOG would use a closed-loop drilling fluid system on all wells. All drilling fluids would be contained entirely within temporary aboveground tanks. After drilling operations are finished for a particular well, the liquid contents of the drilling mud would be recycled for use in drilling additional wells, either on the same well pad or on another well pad. Trucks would transport the used drilling mud to another well pad or to the existing EOG mud facility. Mud that is no longer suitable for re-use in subsequent drilling operations would be removed from the mud facility by trucks and disposed of at a state approved waste facility. Drill cuttings would be separated from the drilling mud by a shale shaker and deposited in a steel catch tank. As drilling continues, the cuttings would be removed from the tank to a cuttings pile on the well pad. Cuttings would be used within the containment berms and spread on the well pad and access road. Excess volumes would be disposed of at an authorized site. Disposal sites used by EOG include, but are not limited to, facilities run by RN Industries and Brennan Bottom Disposal Company in Roosevelt, and Dalbo, Inc. in Vernal.

During drilling operations, a blowout preventer would be installed on the surface casing to provide protection against uncontrolled entry of reservoir fluids into the wellbore in the event that reservoir pressures exceed the hydrostatic pressure of the wellbore fluid. In addition, a flow control manifold consisting of manual and hydraulically operated valves would be installed at ground level. All pressure control devices would comply with the provisions of BLM's Onshore Oil and Gas Order No. 2.

The casing and cementing program would be designed to protect wellbore integrity, isolate and protect the shallower formations encountered in the wellbore, and prohibit pressure communication or fluid migration between zones. In addition, the cement would protect the well by preventing formation pressure from damaging the casing and by retarding corrosion by minimizing contact between the casing and formation fluids. EOG also may run downhole evaluation logs prior or subsequent to setting and cementing production casing. After drilling operations at the well pad are completed, the drilling rig would be dismantled and removed from the location and a completion rig would be moved in. All casing and cementing operations would be conducted to protect usable groundwater in conformance with guidance provided by BLM Utah IM UT 2010-055 and by Onshore Oil and Gas Order No. 2. Detailed site-specific casing and cementing plans for each well would be included with each federal APD package and approved by a BLM petroleum engineer.

Drilling operations could require from 8 to 20 persons who would access a well pad with 4 to 10 vehicles. The duration of drilling operations on a given well can vary depending on well depth, wellbore geometry, and/or conditions encountered while drilling. Directional or horizontal wells require more time to drill. The amount of time required to drill and move a drilling rig from a vertical well would range from 5 to 10 days. The amount of time required to drill and move a drilling rig from a directional well would range from 10 to

14 days. These estimates assume problems are not encountered during the drilling operation. Drilling operations are generally conducted 24 hours daily, 7 days per week.

2.6.3.2 Completion Operations

Completion operations consist of perforating the production casing, stimulating the formation(s) using hydraulic fracturing techniques, flowing back the fracturing fluids to the surface, flow testing to determine post fracture productivity, and installation of production equipment. EOG plans to complete all new wells on a particular pad sequentially after all drilling on a well pad has been completed.

After production casing is perforated, stimulation would consist of hydraulically fracturing the producing formation. A water/sand slurry would be used with gels and other additives to ensure the quality of the fracture fluid. Slurry would be pumped down the well bore through perforations in the casing and into the formation. Pumping pressures and slurry flow rates would be increased to the point at which fractures propagate outward from the perforations into the formation and the slurry flows rapidly into the fractures. The sand serves as a proppant to keep the created fracture open after the pressure drops, thereby allowing reservoir fluids to move more readily into the well. Hydraulic fracturing is a well understood and commonly employed technology used on potentially productive reservoirs at depths below usable aquifers. There are differing regulatory requirements by the various regulatory agencies for hydraulic fracturing operations and all necessary approvals would be acquired from the applicable regulatory agency prior to initiating hydraulic fracturing operations, along with adhering to applicable reporting requirements. Information regarding the constituents of fracturing fluids used on various EOG wells within the GCWPA is available from the FracFocus website (http://fracfocus.org/).

EOG would complete new wells according to design features included in Section 2.6.9 to preclude the venting or flaring of natural gas. Wells are connected to permanent production facilities and wells are immediately turned to production through those facilities. Post stimulation flow tests allow for recovery of stimulation fluids and evaluation of well productivity. Recovered fluids include variable amounts of produced water in addition to stimulation fluids. Flow testing duration would vary depending on individual well performance but typically would be conducted only long enough for fluid rates to drop to a level that permanent production equipment can safely process. Portable and/or permanent production equipment would be utilized to separate fluids from the flow back stream, allowing recovered fluids to be directed to storage tanks and gas to a sales outlet. Fluids recovered during flow back operations would be transported from the storage tanks to a Utah state-approved disposal facility. Oil would be contained in tanks and ultimately sold.

When operational conditions require the temporary flaring of gas (i.e., lack of a gas sales outlet or contamination of the gas stream) the gas would be flared at a sufficient distance from the wellhead and surface equipment to ensure personnel safety. Up to 200 thousand cubic feet (MCF) per event may be flared during workover events. Flaring would be facilitated through the use of vertical flare stacks in conformance with NTL-4A, Onshore Order No. 5, and UDOGM Rule R649-3-20.

Completion operations could require from 4 to 30 persons who would access a well pad with 2 to 20 vehicles. Completion operations typically require approximately 4 to 10 days, depending primarily on the number of completion intervals in the wellbore.

2.6.3.3 Water Requirements

Fresh water and/or recycled water would be used for drilling and completion operations. Water requirements would vary for each well, depending on the formation objective, wellbore conditions, and completion needs specific to each well.

EOG would re-use drilling mud. Approximately 85 percent of the drilling fluid needed to drill a well would consist of recycled drilling mud. In the GCWPA, produced water is obtained almost entirely from the Mesaverde Group. According to EOG's production department, produced and flowback completion water is unsuitable for re-use, even with currently available treatment options, for a number of reasons:

- The water is corrosive, with high scaling tendencies;
- The chloride content is too high to allow for use in cementing operations;
- The chloride content is too high to allow for use making linear gels which are common components of drilling and completion fluids;
- The water contains high concentrations of sulfates which react negatively with barite muds resulting in congealing and solidification of the drilling mud; and
- The water contains variable amounts of hydrogen sulfide, up to 500 parts per million (ppm) at atmospheric pressure, such that moving or mixing the water would involve a safety issue for personnel.

A detailed listing of produced water chemistry is indicated in **Appendix D**. All of the water required for implementing the proposed project would be obtained from the Deseret Generation and Transmission Cooperative's Bonanza power plant. The plant would provide both fresh water obtained directly from the Green River as well as re-cycled water obtained from the plant's cooling ponds. EOG anticipates utilizing recycled fresh water to supplement the re-used drilling mud if large losses of drilling fluid occurred due to drilling through under-pressured formations. Fresh water obtained from the Green River through the Bonanza power plant also may be used during drilling operations for general uses (i.e., rig cleaning or for cementing operations). Currently, water used for cooling at the Bonanza power plant is stored, recycled, and used for completion operations. Water for the Bonanza power plant is obtained from the Green River under Water Right 49-225, with a priority date of August 31, 1959. The water right was perfected effective February 24, 1999.

EOG also uses recycled water obtained from the Bonanza power plant for road compaction where needed. Recycled water is not typically used for fugitive dust abatement during the construction of well pads and/or access roads because topsoil in the GCWPA is thin and exhibits large amounts of stony material, which reduces construction dust production. Some water may be used occasionally during summer months on roads that are traveled by large numbers of trucks, or where road surfaces are more conducive to producing dust; however, water for this purpose is infrequently used. During 2011, EOG used approximately 17,000 barrels of water (2.19 acre-feet) for dust suppression on approximately 185 miles of roads, or about 92 barrels per mile of road annually.

Currently, only water is used for dust suppression. If commercial dust suppressants were required in addition to water, the commercial dust suppressant applications to roads would be of a type and application process subject to approval by the AO. Commercial dust suppressants would not be used in the vicinity of federally listed plant species. Produced water, oil, and other byproducts would not be applied to roads or well pads for control of dust or weeds.

Drilling and completion of commingled wells requires the maximum amounts of water. Commingled wells are those in which oil and/or gas from two or more different reservoirs are combined downhole and produced together through the same wellbore. As the exact mix of commingled and solely Mesaverde wells is not currently known, water usage has been conservatively estimated assuming that all wells are commingled, as indicated in **Table 2-4**.

Table 2-4 Summary of Drilling and Completion Water Use

Formation	Per-Well Drilling (barrels)		Per-Well Cementing (barrels)	Per-Well Completion (barrels)	Per-Well Total (barrels)	
	Fresh	Recycled	Fresh	Recycled	Fresh	Recycled
Mesaverde Wells	1,400	800	650	10,000	2,050	10,800
Commingled Wells	1,400	800	650	14,000	2,050	14,800

2.6.4 Gas Production, Distribution, and Maintenance

2.6.4.1 Well Site Production Facilities

Well production facilities would vary according to whether they are connected to LGS centralized facilities or stand-alone facilities.

Wells Connected to Stand-alone Facilities (Non-LGS Facilities)

In general, stand-alone production facilities on a well pad would include the wellhead, valves, piping, separator, dehydrator, tanks, and emissions control and gas metering equipment. Due to technological advances, future production facilities may vary somewhat from those facilities described in this section. EOG would install the minimum number of separators, tanks, and dehydrators needed on a well pad in consideration of its ability to combine production streams and technical production requirements.

Separators, dehydrators, and meters would typically be housed on the well pad. Containers of treatment chemicals and associated injection pumps would be located on well pads, as necessary. Artificial lift equipment may be installed to provide liquids removal when production volumes for a well drop and reservoir pressure alone is unable to efficiently propel liquids to the surface. All gas would be measured electronically, and EOG would install telemetry equipment to remotely operate and monitor wells.

The number of tanks that would be installed on a particular location would be a function of ownership interests and fluid production volumes. A well pad containing 5 or 6 wells would typically include 8 to 16, 400-barrel tanks to contain initial volumes of produced water and oil. Up to five tanks may be removed from a location as produced water volumes decrease over the lives of the wells.

Wells Connected to LGS Centralized Facilities

In general, production facilities on a well pad supporting wells connected to the LGS would include the wellhead, valves, piping, separator, allocation meters, and one 400-barrel emergency tank. Due to technological advances, future production facilities may vary somewhat from those facilities described in this section. An additional tank of up to 400 barrels also would be left on a well pad containing a stand-alone Wasatch well, for a maximum of two tanks per well pad following LGS installation.

Gas and liquid volumes would be separated and measured at the well site using a non-fired separator. Following measurement, the fluids would be recombined and transported for processing as a combined stream to the centralized facilities. Transport would be via buried pipeline. All of the well site production equipment would be equipped with low-bleed valves to reduce air pollutant emissions.

All Well Pads

All constructed or installed structures that would remain on a location 6 months or longer would be painted a flat, non-reflective, earth-tone color as specified by the AO to reduce visual contrast with the landscape, where such painting does not conflict with safety requirements. All facilities requiring painting would be painted within 6 months of facilities installation for the last well on a pad.

Hydrogen Sulfide

Some wells within the GCWPA have been found to contain varying levels of H_2S, including levels that could prove lethal to unprotected humans. There are approximately 150 locations in the GCWPA in which an H_2S scavenging agent is being injected into wells. Observed average concentrations are approximately 4 ppm for Green River Formation, 7 ppm for Wasatch Formation, and 8 ppm for Mesaverde Group. Commingled Wasatch/Mesaverde/Price River wells have an average concentration of approximately 36 ppm. The measured concentrations are taken from the gas sales lines, and downhole concentrations may be higher. Hydrogen sulfide has been found in gas produced from all productive formations. Operations on wells containing hydrogen sulfide will be conducted in conformance with Onshore Oil and Gas Order # 6.

In response to safety concerns, EOG has implemented various mitigation procedures. All personnel working in the field are required to have H_2S monitors for personal protection in addition to standard personal protection equipment. EOG trains company personnel and works with contractors to make sure all personnel in the field are trained in the hazards of working in an H_2S environment. All personnel involved with the handling of production streams are trained in the use of Self-contained Breathing Apparatus. Testing and monitoring of production streams, equipment, and wells are being utilized. Trained safety personnel are being used to sample and test wells on a scheduled basis in critical areas where H_2S can become concentrated. When H_2S levels are recorded, EOG implements a plan specific to each location. Locations that have recorded levels of H_2S are then monitored on a scheduled basis.

When wells, locations, and facilities are identified as having lethal levels of H_2S, a Cascade Air System is installed on the tank battery, and warning signs are posted at the entrance to such locations. Individual treatment plans also may be implemented at wells or facilities having lethal levels of H_2S. Treatment plans could include wellbore cleanouts, production tank and vessel cleanouts, and chemical treatments to the well and/or production stream at the facility. In many areas, EOG is implementing H_2S scavenger towers on the gas gathering system to treat the gas stream prior to going into gas plants. In areas outside the LGS, the towers have been co-located on existing surface disturbance where feasible; however, new pads for the towers may be necessary in some instances where existing pads are not present along the gas gathering system. Within the coverage area of the LGS, the scavenger towers would be located at the centralized facilities. Because the number and locations of these towers cannot be predicted at this time, approval would be authorized by the BLM separately from this analysis.

EOG will restrict public access to facilities that may endanger the public. In consultation with the Authorized Officer (AO), EOG will install warming signs at locations where public access could result in potential safety issues.

2.6.4.2 Compression and Gas Processing

EOG does not anticipate utilizing well site sales compression. Natural gas would be transported from the wellhead by one of two methods.

1. On stand-alone wells (not connected to the LGS), surface gathering lines would move gas to existing buried lateral pipelines that would transport the natural gas to existing centralized sales compression and gas processing facilities, and then into downstream distribution pipelines.
2. Wells connected to LGS centralized facilities would have combined fluids (produced natural gas, oil, and water) transported in buried pipelines to the centralized facilities. Gas and fluids separation would occur at the LGS centralized facilities and gas would be sent to the existing sales compression or would be compressed and returned to the wellheads for use in gas lift operations. Gas that has been sent from the centralized facilities to centralized sales compression would then be sent to gas processing facilities and then into downstream distribution pipelines.

Based on existing field compression capacity estimates provided by the gas processor, EOG does not anticipate that the increased production would require increases in current sales gas compression capacity or increases in sales gas pipeline capacity. Electrically powered compressors would be installed at each of the LGS centralized facilities for use in transporting gas lift gas back to the wellheads.

2.6.4.3 Electrical Power

The LGS centralized facilities would be operated using three-phase electrical power. Electrical power within the GCWPA is addressed in a separate NEPA document (Chapita Wells Electrification EA DOI-BLM-UT-G010-2014-0166-EA [BLM 2014b]).

Water disposal wells would require the use of injection pumps. These injection pumps are either currently electrified or would be electrified. The power lines installed would be secondary lines originating from the nearest substation.

2.6.4.4 Maintenance

Well locations would require visits by well maintenance personnel (“pumpers”). Pumpers would visually inspect well sites to ensure production equipment integrity and optimal operation and to monitor operations not reported by telemetric methods. Surface gathering pipelines also would be visually inspected and maintained on a regular basis. Most surface pipelines run parallel to roads and are viewed daily by field personnel. Flanges and valves are monitored at least annually during maintenance on valves and fittings. Pressures are monitored daily using supervisory control and data acquisition remote systems. Field experience indicates that surface pipelines result in few environmental problems.

Buried pipelines are constructed of composite materials that are internally and externally corrosion resistant and are designed for high pressure transport of contained fluids. Where metal buried pipelines are installed, the pipe contains various alloys and coatings designed to resist corrosion. Belowground metal connections and valves are located in accessible containers which allow monthly visual inspection. Steel corrosion joints have been installed that are pre-measured. These joints are removed and weighed annually to monitor and track corrosion of metal pipelines. Supervisory control and data acquisition systems monitor pressures daily, similar to the surface pipelines, and pigging operations are conducted, typically, annually.

Maintenance on access roads within the GCWPA during drilling and construction would be the responsibility of EOG and would be consistent with BLM and/or county specifications. Repairs may be necessary to correct excessive soil movement, rutting, and/or damage to cattle guards or gates. EOG would monitor the GCWPA roads and perform appropriate repairs for the duration of the project on an as-needed basis. EOG would coordinate with the county in connection with maintenance of county roads.

LGS buried pipeline ROWs would be inspected periodically and pressures would be monitored to detect possible leaks. Gas pipelines would undergo pigging operations, as necessary, to remove fugitive liquids. Centralized facility operations would be monitored on an ongoing basis by facility personnel.

Automation and telemetry equipment would be installed on well locations and centralized facilities. The primary purpose of the equipment is to provide remote monitoring and control of well sites and centralized facilities. This would reduce the number of site visits, thereby reducing truck traffic. At locations where control valves are in place, wells can be shut in remotely in the event of an emergency. Automation and telemetry equipment would not affect the size or orientation of a facility, as it would be installed on vessels, wellheads, combustors, etc.

2.6.4.5 Workovers and Recompletions

Periodically, EOG may perform a workover on a well to keep the well operating efficiently. Workovers may be necessary to repair the wellbore equipment (casing, tubing, etc.) and/or the wellhead, or to improve well performance. EOG also may recomplete a well to produce natural gas from a different interval in a wellbore.

Both workover and recompletion operations generally occur during daylight hours. A typical workover or recompletion operation would require approximately 3 days; however, they can range from 1 to 10 days, or more, depending on the complexity of the work required. Manpower requirements for these operations average 6 persons, ranging from 4 to 30 persons at a particular time. The frequency for this type of work cannot be accurately projected since workovers and/or recompletions vary by well and depend on well-specific circumstances. Neither operation would result in additional surface disturbance.

2.6.5 Produced Water Management and Disposal

Produced water is disposed of through injection wells. EOG owns 12 disposal ponds within the VFO area. These pits are in the process of being reclaimed. Nine of 12 are either in process of reclamation or will begin reclamation by third quarter 2015.

2.6.5.1 Wells Not Connected to the LGS Centralized Facilities

Produced water would be initially confined to a storage tank(s) prior to being transported by water hauling trucks to existing and new centralized produced water offloading facilities. Produced water may be confined to a storage tank for a period not to exceed 90 days after initial production. Prior to the end of the 90-day period, the produced water would be transported by water hauling trucks to offloading facilities or new or existing underground injection wells.

EOG Resources has four underground produced water disposal facilities, three of which are located within the GCWPA, capable of injecting produced water into nine injection wells. As of January 2014, the three facilities within the GCWPA are connected with underground pipelines. Each facility may serve more than one disposal well. Additionally, EOG has two stand-alone truck offloading facilities connected to the same underground pipeline system. No plans exist to add additional truck offloading facilities. However, as central facilities are built and underground pipelines are further connected to the infrastructure, some central facilities may have truck offloading facilities added. The central facility truck offloading facilities would be temporary until all wells in the area could be connected via underground pipelines. For example, the Davies Road Central facility located in Section 33, T9S, R23E was built with the ability to easily add truck offload capabilities to the facilities if determined necessary to have trucks offload to shorten hauling distances to water. Any new truck offloading facilities would be contained within the footprint of the proposed central facility and would not result in additional surface disturbance. The locations of the central facility produced water offloading sites would be chosen to minimize distances from producing wells and would reduce truck traffic needed to haul water along major traffic routes.

The produced water underground disposal facilities with truck offload are:

- CWU 550-30N facility, Section 30, T9S, R23E (two wells, **Figure 2-1**);
- Hoss saltwater disposal (SWD) facility, Section 36, T8S, R22E (six wells, **Figure 2-1**); and
- Coyote SWD facility, Section 16, T9S, R22E (one well, **Figure 2-1**).

The stand-alone water offloading facilities are:

- Red Wash facility, Section 2, T9S, R22E; and
- White River facility, Section 15, T9S, R22E.

Currently, approximately 26 trucks transport an average volume of 14,800 barrels of water each day via multiple loads per truck per day. A maximum of 49 percent of proposed wells would not be connected to the LGS and would still require produced water transport by truck.

2.6.5.2 Wells Connected to the LGS Centralized Facilities

Produced water from at least 51 percent of the proposed wells would be transported as combined fluids from the wellhead to the LGS centralized facilities, where it would be separated and stored temporarily in tanks at the facility. From the tanks, the produced water would be pumped through underground pipelines to existing or proposed disposal wells for re-injection in the disposal formation.

2.6.5.3 Produced Water Disposal Wells

Produced water would be disposed of via underground injection. EOG currently operates nine produced water disposal/SWD wells in the GCWPA. A listing of current disposal wells is indicated in **Table 2-5** and **Figure 2-1**. Water disposal wells in the GCWPA are permitted through the USEPA. Water is injected into the "Birds Nest" aquifer within the Green River Formation at depths ranging from 1,700 feet to 2,400 feet. Groundwater in the aquifer at these locations has total dissolved solids (TDS) levels exceeding 10,000 milligrams per liter (mg/L) (Vanden Berg et al. 2013). The SWDs are interconnected by pipelines. Electrically operated transfer pumps power movement of water among the various wells.

Table 2-5 Current Produced Water Disposal Wells

Well Name	Section	Township	Range
Hoss SWD 901-36	36	8S	22E
Hoss SWD 903-36	36	8S	22E
Hoss SWD 904-36	36	8S	22E
Hoss SWD 905-31	31	8S	23E
Hoss SWD 906-31	31	8S	23E
Hoss SWD 907-31	31	8S	23E
CWU 550-30N SWD	30	9S	23E
CWU 2-29 SWD	29	9S	23E
Coyote 1-16 SWD	16	9S	23E

Source: EOG 2015.

Produced water is offloaded at the disposal facilities via water truck or pipeline into large settling tanks. The water is treated with a combination FeS dissolver biocide and a combination scale / corrosion inhibitor. If determined to be necessary to control corrosion, an oxygen scavenger also is used. The large tanks are used to slow the velocity of the input fluid. The velocity change in combination with the referenced chemical treatment breaks up any emulsions in the produced water, releasing dissolved oil. Any separated oil floats to the top of the fluid where it can be recovered and sold. Suspended solids settle to the bottom of the tank. The tanks are cleaned several times annually and the solids are hauled to an approved disposal site. The remaining produced water is then pumped out of the settling tanks through a filter bank for final solids removal before being pumped down the injection wells.

Produced water is off-loaded at the disposal facilities via water truck or pipeline into large settling tanks. The water is treated with a combination FeS dissolver biocide and a combination scale / corrosion inhibitor. If determined to be necessary to control corrosion, an oxygen scavenger also is used. The large tanks are used to slow the velocity of the input fluid. The velocity change in combination with the referenced chemical treatment breaks up any emulsions in the produced water, releasing dissolved oil. Any separated oil floats to the top of the fluid where it can be recovered and sold. Suspended solids settle to the bottom of the tank. The tanks are cleaned several times annually and the solids are hauled to an approved disposal site. The remaining produced water is then pumped out of the settling tanks through a filter bank for final solids removal before being pumped down the injection wells.

All necessary federal, state, and local permits would be obtained prior to commencing construction of any required additional wells and associated facilities. Produced water disposal well design would be done in conformance with guidelines contained in Utah BLM IM 2010-055 Attachment D, and in conformance with guidelines contained in Onshore Oil and Gas Order 2 for protection of aquifers.

2.6.6 Hazardous Materials and Solid Waste

A variety of chemicals, including lubricants, paints, and additives, would be used during drilling and completion operations. Some constituents of these materials contain hazardous substances. Hazardous materials can include some greases or lubricants, solvents, acids, paint, and herbicides, among others. These materials would not be stored at well locations, although they may be kept in limited quantities on drilling sites and at production facilities for short periods of time. The U.S. Department of Transportation, under 49 CFR, Parts 171-180, regulates transportation of these materials to the well location. U.S. Department of Transportation regulations pertain to the packing, container handling, labeling, vehicle placarding, and other safety aspects. In compliance with Occupational Health and Safety Administration requirements, Safety Data Sheets are maintained and hazard communications are made available to employees and contractors for on-site hazardous substances at EOG's Vernal office and online. At the centralized SWD facilities Safety Data Sheets are kept on location.

None of the chemicals that would be used during drilling, completion, or production operations meet the criteria for being an acutely hazardous material/substance or meet the quantities criteria per BLM Instruction Memorandum No. 93-344. Chemicals subject to reporting under Title III of the Superfund Amendments and Reauthorization Act in quantities of 10,000 pounds or more would be used, produced, stored, transported, or disposed of annually while drilling or completing a well in the GCWPA. In addition, extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, may be used, produced, stored, transported, or disposed of while drilling or completing a well.

Most wastes that would be generated at project locations are excluded from regulation by the Resource Conservation and Recovery Act under the exploration and production exemption in Subtitle C (40 CFR 261.4(b)(5)). These wastes are typically called solid wastes. Solid wastes include those generated at the wellhead and through the production stream and gas plant. Exempt wastes include produced water, production fluids (i.e., drilling mud or well stimulation flow-back fluids) and soils affected by spills of these fluids. Drill cuttings would be disposed in compliance with regulation R649-9-2, Utah Administrative Code.

Any unintentional release of oil, gas, salt water, or other such fluids would be immediately addressed by onsite remediation and/or removal to an approved disposal site. The spills would be reported to the AO, State of Utah, and other appropriate authorities. EOG would develop and maintain a Spill Prevention, Control, and Countermeasures (SPCC) Plan for each well in the GCWPA. A typical SPCC Plan from the field has been included as **Appendix E**. To satisfy SPCC Plan requirements, any necessary storage facilities or tanks would be constructed in accordance with applicable containment regulations.

Trash containers and portable toilets would be located on construction sites. Garbage, trash, and other waste materials would be collected in portable, self-contained, fully enclosed trash cages during

construction, drilling, and completion operations and disposed of at an approved landfill. Trash would not be burned on location.

2.6.7 Reclamation and Abandonment

Local climate and soil conditions make reclamation of surface disturbance a difficult task in the GCWPA. Therefore, EOG would develop a reclamation plan and perform reclamation activities in conformance with reclamation requirements issued in the BLM's Green River District Reclamation Guidelines (**Appendix B**). EOG's reclamation strategy will remain flexible in order to address results from ongoing monitoring and will implement advances in reclamation. EOG's reclamation goals would include:

- Developing procedures and strategies to ensure successful interim and final reclamation operations in the GCWPA;
- Modifying procedures and strategies as needed throughout the life of the project;
- Developing procedures for reclamation monitoring and reporting; and
- Evaluating reclamation performance on an ongoing basis in terms of successful site stabilization.

2.6.7.1 Interim Reclamation

EOG would perform interim reclamation on all disturbed areas of a well pad and road not needed for long-term production operations. In general, interim reclamation would occur as soon as feasible following initial development of a particular well pad. Suitable topsoil for reclamation in the GCWPA is generally shallow and susceptible to degradation upon repeated disturbance. To minimize repeated disturbance EOG would implement in-place topsoil banking. This banking process involves reducing the number of times the topsoil is stripped and re-spread. Topsoil would be stripped during initial well pad construction and would remain stockpiled during drilling and completion operations. Upon completion of the initial phase of drilling operations all salvaged topsoil would be re-spread over areas not needed for production operations. The topsoil would be spread and graded with a relatively smooth surface devoid of larger aggregate and then reseeded with a seed mixture prescribed by VFO. Subsequent drilling and well maintenance operations could be conducted without the need to re-strip and stockpile the topsoil. Minimal surface disturbance and soil compaction would occur.

Based upon prior EOG field experience, interim reclamation of a single-well pad would restore approximately 0.3 acre of disturbance. For expanded well pads connected to LGS centralized facilities, 0.12 acre would be reclaimed, incrementally, for each additional well. For expanded well pads not connected to LGS centralized facilities, space required for tanks and other facilities would generally preclude interim reclamation.

EOG would develop a site-specific reclamation schedule in coordination with the AO if EOG determines that further drilling will occur on a well pad that does not have interim reclamation. Topsoil stripped during road building would be re-spread along the borrow ditches and reseeded. Cut and fill slopes would be stabilized and BMPs would be implemented to reduce potential erosion. Ongoing monitoring of the reclaimed area would indicate if reseeding or other reclamation activity would need to be implemented to promote vegetation regrowth and soil stabilization.

2.6.7.2 Final Reclamation

At final abandonment of a well, the casing would be cut off at the base of the cellar or 3 feet below the final restored ground level, whichever is deeper. EOG would follow the final abandonment procedures prescribed by the VFO.

All surface equipment (including surface pipeline) would be removed from the well pad and pipeline ROW when no longer needed by any of the remaining producing wells on a well pad. Buried pipelines would undergo final "pigging" (cleaning) for removal of fluids, be opened to the air, and then abandoned in place to avoid unnecessary surface disturbance. Final reclamation of a well pad and its access road, where required by the AO, would be performed after all wells on a well pad cease production. After salvage of all topsoil from the interim reclaimed portions of the well pad and access road, the entire well pad location and access road corridor would be re-contoured to preexisting profile, topsoil would be redistributed, and the surface would be planted with a seed mixture specified by the appropriate surface management agency. An abandoned well pad, its road, and other disturbed areas would be restored as near as practical to its original condition. Details of interim and final reclamation are indicated in **Appendix B**.

2.6.7.3 Monitoring

Reclamation goals, monitoring efforts, and expectations for bond release would be developed by EOG in coordination with the AO and in accordance with the Green River District Reclamation Guidelines (**Appendix B**).

2.6.8 Project Mitigation Strategy

Mitigation, in the broad sense, refers to protective measures implemented to reduce or eliminate deleterious effects to the human environment that would otherwise occur. Such protective measures include:

- Applicant-committed measures, which are voluntary commitments by the project proponent to reduce effects from a proposed action;
- Design features, which are protective measures determined by the surface management agency and which are incorporated into alternative approaches to meeting the purpose and need of a proposed action; and
- Mitigations, which are protective measures additional to design features which are imposed as a result of the environmental analysis process.

The BLM determines which design features and mitigations to include during the environmental analysis process based upon understanding of the proposed action and in-depth knowledge of existing local conditions. The analysis objective is to accurately describe a range of effects to permit a fully informed decision Applied design features and mitigations may be derived from other BLM documents, such as the Vernal RMP, or from other sources. In the case of leases which pre-date the RMP, as in the GCWPA, RMP-based stipulations could be applied to land use authorizations (such as ROW grants) or permits (such as APDs) following analysis in project-specific NEPA.

Conditions of Approval, including mitigations resulting from the NEPA process, may be attached to the ROD of the EIS. These COAs may apply development restrictions additional to the lease terms, under FLPMAs mandate to "prevent unnecessary or undue degradation" of the public lands (Section 302[b]), as well as other laws, but may not violate the applicant's pre-existing rights.

A listing of all design features and mitigation measures incorporated within each alternative is described in **Appendix F**.

2.6.9 Applicant-committed Environmental Protective Measures

EOG commits to the implementation of the following environmental protective measures.

Surface Disturbance

- EOG will perform interim reclamation of well locations and access roads soon after the initial phase of development on a well pad is completed or after all the wells on a pad are put into production as agreed upon by the AO. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances. Timing for interim reclamation on multi-well pads will be coordinated with the AO.
- EOG will modify procedures and strategies as needed and will evaluate reclamation performance on an ongoing basis in terms of successful site stabilization.
- EOG will design and construct all new roads to a safe and appropriate standard "no higher than necessary" to accommodate their intended use. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances.
- EOG will perform final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances.
- EOG will utilize shared well pads to the extent possible, in consideration of technical, environmental, and economic viability, to minimize the amount of total surface disturbance in the GCWPA.
- EOG will consolidate production facilities on shared well pads. EOG will minimize the amount of production equipment utilized on shared well pads to the extent allowable by varying ownership interests and production volumes, primarily liquid flow rates.
- EOG will locate gathering lines adjacent to access roads where possible.

Air Quality – General

- EOG reduced the size of the proposed project by approximately 60 percent (from 7,000 to 2,800 wells) in response to identified air pollution problems in the Uinta Basin, particularly winter ground-level O_3.
- EOG will use water and/or water with commercial suppressants for dust abatement on access roads, if needed.
- The use of carpooling will be encouraged to minimize vehicle traffic and related emissions. EOG also will commit to minimize idling when safety is not a risk.
- Operator will meet a stationary internal combustion engine standard of 2 grams NO_X/brake horsepower per hour for engines <300 horsepower and 1 gram NO_X/brake horsepower per hour for engines >300 horsepower.
- EOG will reclaim and reseed 9 evaporation ponds within the GCWPA.

Air Quality – Drilling and Completion

- Tier II or better drilling rig engines will be required.
- EOG will recover gas that would otherwise be vented or flared during testing operations for new or recompleted wells. These completions may use portable flow-back equipment and/or permanent production equipment, depending on site-specific conditions. Use of this equipment would allow the transport of gas and oil to sales and prevent waste.

Air Quality – Production: General

- EOG will retrofit all existing pneumatic controllers to meet the standards established for pneumatic controller affected facilities that are constructed, modified or reconstructed on or after September 18, 2015, as specified in 40 CFR 60, Subpart OOOOa Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution.
- Pneumatic devices on separator/dehydration units on existing and new units will be low/no bleed pneumatic devices. All existing dehydration units will be equipped with a Kimray Model 2015 glycol circulation pump which has lower circulation rates and therefore results in lower emissions from the dehydration units. Pneumatic pumps on all wells connected to the centralized facilities will be eliminated.
- Bottom filling of tanker trucks to control fugitive emissions will be required.

Air Quality – Production: Liquids Gathering System

- EOG is in the process of constructing a liquids gathering system covering approximately 52 percent of the most heavily developed portions of the GCWPA. The purpose of the gathering system is to reduce emissions of O_3-precursor pollutants in response to the identified winter O_3 problem in the Uinta Basin. Approximately 47 percent of all existing wells and a minimum of 51 percent of project wells would be connected to the system. The system also will reduce water and condensate haul truck traffic and associated emissions.
- EOG will construct an electrical distribution system to provide power for their liquids gathering system.
- Truck traffic will be reduced for wells connected to the LGS.
- Truck traffic will be reduced through the use of water offloading facilities.

Air Quality – Production: Central Facilities

- All production equipment at the centralized facilities will be fitted with low-bleed pneumatic or electric valves.

Air Quality – Production: Well Pads

- Use of tanks for wells connected to EOG's LGS will be eliminated except for one tank on most well pads, which may be used for emergencies or blowdowns.
- All production equipment at well sites and at the centralized facilities will be fitted with low-bleed pneumatic or electric valves.
- Dehydrators and fired separators will be removed from wells and well pads connected to the LGS. Non-fired separators may continue to be used for fluids measurement purposes. Truck loading and transport of liquids will be eliminated from LGS-connected wells.
- Where technically feasible, wells that utilize plunger lift systems (or otherwise automated systems) shall be operated so as to minimize fugitive emission from well pressure fluctuation and liquid accumulation within the well.
- EOG will implement a telemetry monitoring system on wells not connected to the LGS for the effective management of production and reduction in the number of vehicle trips and miles traveled.

Air Quality – Management and Monitoring Program

- EOG will conduct Audio-Visual-Olfactory (AVO) leak inspections on all existing and new facilities within the GCWPA on an annual basis and repair observed leaks. EOG will utilize IR Camera observations in place of AVO inspections for at least 10% of facility inspections. If future

regulations are implemented to address leak detection and repair requirements, the regulatory program will replace the voluntary inspection program.

- EOG will comply with the leak inspections for all new, reconstructed, or modified facilities as required by 40 CFR Part 60, subpart OOOOa.
- EOG will provide an annual report listing the facilities where leaks were observed, the date the leak was observed, the cause of the leak, and the date corrective actions were completed at such facilities.
- EOG will manage the Project such that new stationary sources authorized by the ROD will not result in net increases of volatile organic compounds (VOC) emissions within the GCWPA from a 2012 baseline year. This will be accomplished by achieving reductions of VOC emissions from existing stationary sources within the GCWPA prior to operating new sources, balanced on a calendar year annual basis.
- EOG will incorporate in its current employee training program ozone awareness and specific actions for reducing ozone precursor emissions.
- EOG will develop an Ozone Action Management Plan which includes an operator training component as well as a list of Project activities that could be delayed or minimized during ozone episodes. The Ozone Action Management Plan will be submitted to BLM prior to signing of the Record of Decision.

Water Use

- EOG will re-use drilling mud for new wells to the maximum possible extent.

Water Quality and Soils

- EOG will use closed-loop drilling systems.
- EOG will incorporate site-specific BMPs to control storm water runoff, including appropriate measures to prevent sedimentation.
- All construction and maintenance activities will cease if soils or road surfaces become saturated to the extent that construction equipment is unable to stay within the ROW, and before activities cause irreparable harm to roads, soils, or excessive siltation of nearby lakes, reservoirs, or live flowing streams.

Floodplains, Wetlands, and Riparian Areas

- If project operations will create new surface disturbance within active floodplains or within 100 meters of riparian areas, and assuming there are no practical alternatives, EOG will work with the AO to evaluate site-specific design features to maintain and protect wildlife habitat, water quality, and appropriate land uses. The decision to implement site-specific design features within an active floodplain or within 100 meters of a riparian area will be determined on a well-by-well basis during the APD approval process.

Vegetation and Noxious/Invasive Species

- EOG will control invasive and noxious weeds along access roads, pipeline routes, well sites, or other facilities as specified by BLM, state, and county regulations. A list of noxious weeds will be obtained from the BLM or the appropriate County Extension Office. On BLM-administered land, a Pesticide Use Proposal will be approved prior to the application of herbicides or pesticides.

Raptors

- EOG will adhere to seasonal and spatial buffers applicable to occupied raptor nests in the GCWPA in consideration of applicable guidelines (BLM 2008b).

Threatened, Endangered, Candidate, or Sensitive Species

- If directed by the AO, prior to any surface disturbance, well pad sites and access roads will be examined by a wildlife biologist and botanist to determine if any listed threatened, endangered, candidate, or sensitive species of animals or plants or their habitat are present. If present and prior to initiating any surface disturbance activities, appropriate avoidance or mitigation measures shall be implemented. Site-specific clearances will be performed at the time of the onsite inspection.

Migratory Birds

- EOG will install bird-excluding devices that prevent the perching and entry of migratory birds on or into its new fired vessel exhaust stacks in nesting habitat of high-priority bird species. In addition, EOG will retrofit existing exhaust stacks in these areas.

Cultural and Paleontological Resources

- A Class III archeological survey will be conducted on all federal lands in the GCWPA when new surface disturbance is proposed. If historic or archaeological materials were to be uncovered during construction, EOG will immediately stop surface disturbing activities that might further disturb such materials and contact the AO.
- All EOG personnel will refrain from collecting artifacts and from disturbing any National Register of Historic Places (NRHP) eligible cultural resources in the area. EOG will be responsible for informing all persons in the area who are associated with this project that they may be subject to prosecution for knowingly disturbing historic or archaeological sites or for collecting artifacts. All vehicular traffic, personnel movement, construction, and restoration activities will be confined to the areas examined, as referenced in the archaeological report, and to the existing roadways and/or evaluated access routes.
- EOG will conduct a paleontological survey in sensitive fossil areas (PFYC Classes 4 or 5) where bedrock is exposed or located sufficiently close to the surface to be disturbed by excavation activities. All EOG personnel will refrain from collecting fossils and from disturbing any scientifically important fossil in the GCWPA. If fossils were to be uncovered during construction, EOG will immediately stop surface disturbing activities that might further disturb such materials and contact the AO.
- Monitoring of all bedrock excavations will be performed by a qualified paleontologist when required by the AO.

Access and Transportation

- Future transportation routes will be developed incrementally as new locations are developed and additional information becomes available. EOG will coordinate with government agencies having jurisdiction over transportation routes to accomplish transportation goals.
- Existing and future resource roads accessing individual well sites will be reclaimed and returned to the natural conditions similar to those existing prior to natural gas development activities.
- EOG anticipates that Uintah County roads will be retained in an upgraded status as will improvements to surface management agency designated roads. From the County roads, EOG uses various existing collector, local, and resource roads to travel to individual locations.

Recreation and Visual Resources

- EOG will maintain adequate sight distances along routes accessing Fantasy Canyon and the White River to avoid traffic conflicts by implementing construction measures developed in conjunction with the AO. Such measures will include taking out high points on rises and by

laying back cut slopes near blind turns. EOG will post signs along routes accessing Fantasy Canyon and the White River warning motorists of heavy truck traffic.

- Blasting will not be used for construction within 800 feet of Fantasy Canyon (ENSR 1999).
- EOG will paint all new facilities a color which best allows the facility to blend with the background, as specified by the AO. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances.
- Unpainted steel pipe will be used for surface gathering pipelines, which, after rusting, will blend with the existing landscape. Pipeline surface rust would not compromise the containment integrity of the gas pipe.

Pipeline Construction

- EOG will utilize BLM Hydraulic Considerations for Pipeline Crossings of Stream Channels (Hadley and Fogg 2007) where possible.
- All new pipeline construction activities will conform to requirements of the VFO RMP.

Safety

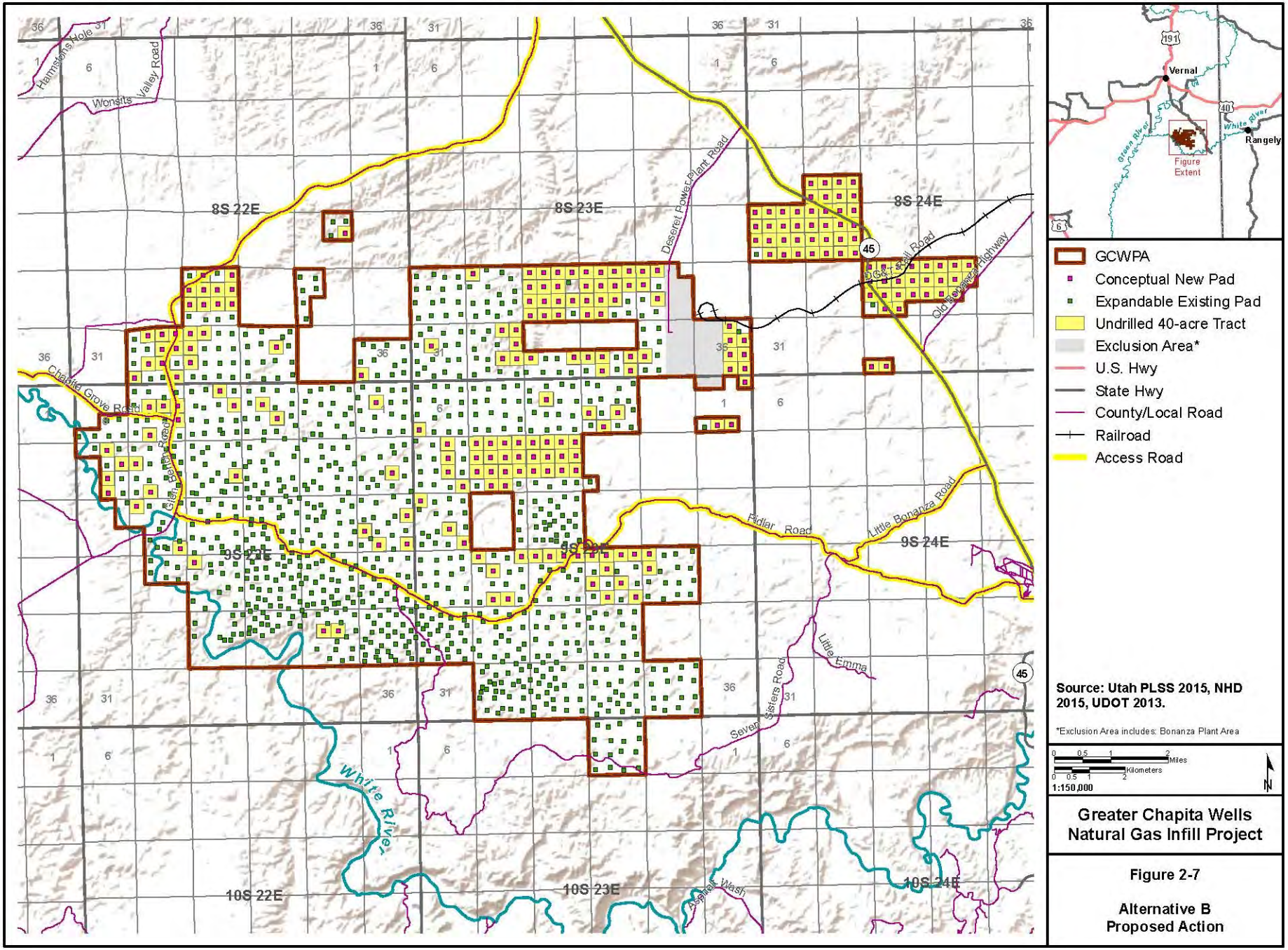
- EOG will restrict public access to facilities that may endanger the public. In consultation with the AO, EOG will install “warning” signs at locations where public access could result in potential safety issues.
- All personnel working in the field are required to have H_2S monitors for personal protection in addition to standard personal protection equipment. EOG trains company personnel and works with contractors to make sure all personnel in the field are trained in the hazards of working in an H_2S environment. All personnel involved with the handling of production streams are trained in the use of Self-contained Breathing Apparatus. Testing and monitoring of production streams, equipment, and wells are being utilized. Trained safety personnel are being used to sample and test wells on a scheduled basis in critical areas where H_2S can become concentrated. When H_2S levels are recorded, EOG implements a plan specific to each location. Locations that have recorded levels of H_2S are then monitored on a scheduled basis.
- When wells, locations, and facilities are identified as having lethal levels of H_2S, a Cascade Air System is installed on the tank battery, and warning signs are posted at the entrance to such locations. Individual treatment plans also may be implemented at wells or facilities having lethal levels of H_2S.
- EOG will restrict public access to facilities that may endanger the public. In consultation with the Authorized Officer (AO), EOG will install warming signs at locations where public access could result in potential safety issues.

2.7 Alternative B—Proposed Action

Alternative B is EOG's proposal for development of oil and gas resources within the GCWPA, which has been revised from the original proposal submitted to the BLM on September 29, 2009.

2.7.1 Field Development Plan

EOG proposes to drill up to 2,808 new infill natural gas wells to continue development of currently known productive formations underlying lands in the GCWPA (**Figure 2-7**). The number of new wells represents a compromise between a conceptual maximum development scenario, as originally proposed (approximately 7,000 wells), and a sustainable exploitation effort which would maintain emissions of most production phase air pollutants near or below current (“baseline”) levels. In particular, the development strategy focuses on controlling emissions of pollutants known to result in near-surface O_3 formation.



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4/1/2016

EOG would drill infill wells at an average rate of approximately 187 wells per year, with a maximum annual rate of about 252 wells. Drilling all the proposed wells at the estimated average rate would require approximately 15 years. Actual drilling rates would depend upon future drilling technical, economic, and/or regulatory conditions which cannot be predicted at this time. The productive life of each well would be approximately 40 years. For the purpose of analysis in this EIS, based on field experience, all wells are assumed to be productive. The ultimate recovery from each well would vary depending on individual reservoir conditions.

EOG would utilize the existing infrastructure by drilling vertically and directionally from existing well pads. EOG would expand existing and previously approved well pads to accommodate new wells. The number of new wells on an existing or previously approved well pad would depend upon the existing number of wells on the pad and EOG's development requirements. In addition, EOG would construct up to 233 new well pads and associated access roads. New well pads would be limited to a maximum density of one new well pad per 40 acres of surface. Conceptually, most existing, previously approved, and proposed well pads within the GCWPA would contain more than one well. In addition to the wells, EOG would construct access roads, pipelines, and associated production support facilities as needed. Maximum project surface disturbance would be up to 1,875 acres, or 4.4 percent of the GCWPA. Up to 410 acres of the 1,875 acres would be reclaimable.

Similar to the case for Alternative A—No Action (described in Section 2.5), the project would be supported by existing sales gas compression facilities. For LGS-connected wells, new combined gas and liquids pipelines would transport natural gas from the wellhead to lateral and/or trunk pipelines, and then to centralized compression and processing facilities. Based on existing development, each new well pad is assumed to be serviced by an access road averaging approximately 1,000 feet long. Each new well pad is assumed to be serviced by either an existing gas-only pipeline (non-LGS-connected wells) or new combined gas and liquids pipeline (LGS-connected wells) averaging approximately 1,000 feet long. Expansion pads are not anticipated to require additional surface pipelines for non-LGS pads. Expansion pads connected to the LGS system would require new buried pipelines.

Produced water would be disposed of through permitted underground injection wells. EOG operates nine disposal wells in the GCWPA. Development of the Proposed Action is expected to require drilling and completion of an additional three produced water disposal wells, depending on the rate of field development. Produced water would be delivered to the injection wells by truck and underground pipelines.

The potential locations of new well pads which could be constructed for the Proposed Action, assuming a maximum density of 1 well pad per each 40 acres of surface, are indicated in **Figure 2-7**. A summary of surface disturbance associated with the Proposed Action is indicated in **Table 2-6**.

Interim reclamation would be applied to disturbed areas. The amounts of reclaimable acreage listed in **Table 2-6**, have been estimated using numbers furnished by EOG based on current field practices. In some cases, these estimates differ from similar numbers based on prior NEPA approvals. For example, roads width would be reduced from a 40-foot construction width to a 20-foot long-term running surface, well pad disturbance would be variably reduced depending on the original pad size and location, and all pipeline ROWs would undergo final reclamation following installation, including reclamation of any disturbance associated with surface pipelines. Residual disturbance remaining for the life-of-project would be the initial disturbance less the reclaimable acreage.

Table 2-6 Alternative B—Proposed Action Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or Disturbance Width (feet)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Area Facilities				
New Well Pads	233	3.75	233	874
Expandable Well Pads [1]	960	0.25	2,575	644
Additional Disposal Wells	3	3.75	3	11
Total Area Facilities				1,529
Linear Facilities				
New Well Pad Access Roads	44.1	40		214
Surface Gas Pipelines - Non-LGS New Pads [2]	36.4	30		132
Total Linear Facilities				346
GCWPA Alternative Disturbance				1,875
Site-specific LGS Facilities Carried Forward under Action Alternatives				
LGS Central Facilities	18	6.60		119
LGS Central Facility Access Roads	5.1	50		31
LGS Buried Pipelines	89.6	70		760
Electrical Distribution System	32.8	Variable		124
Total Site-specific Facilities				1,034
Estimated Alternative Reclaimable Surface Disturbance [3]				
Area Facilities Interim Reclamation (acres)				171
Roads Interim Reclamation (acres)				107
Pipelines Reclamation (acres)				132
Total Alternative Reclaimable Surface (acres)				410
Total Alternative Reclaimable % of GCWPA				1.0%
GCWPA Total Disturbance				
Alternative Disturbance % of GCWPA				4.4%
Existing Disturbance GCWPA (acres)				3,975
Alternative-Specific + No Action + Existing Disturbance GCWPA (acres)				6,884

[1] Each additional well expansion adds 0.25 acre disturbance to a maximum 960 existing well pads.

[2] Surface pipelines for all available new pad locations outside LGS coverage area, 1,000 feet/pad.

[3] Assumes 0.3 acre for 1-well pads + incremental 0.12 acre for each additional well connected to LGS centralized facilities (reclamation would not occur for wells added to existing pads that are not connected to LGS centralized facilities) , 18- to 20-foot road running surface (within a 40-foot ROW), and 100% pipeline reclamation.

1

2.7.2 Alternative-specific Activities

Alternative B design features which would differ from the design features common to all action alternatives include:

2.7.2.1 Well Pads and Wells

EOG would limit new well pad construction to locations in which there are no existing well pads and no plans for previously approved well pads to be located within a 40-acre tract. This would permit a maximum of approximately 233 new well pads to be constructed. In addition to the initial well on each new well pad, up to 2,575 wells could be drilled from existing or new pads by expanding the pad to accommodate additional wells.

2.7.2.2 Water Requirements

Fresh water and/or recycled water would be used for drilling and completion operations. Water requirements would vary for each well, depending on the formation objective, wellbore conditions, and completion needs specific to each well. Maximum amounts of water for drilling and completion purposes are used in commingled wells. Commingled wells are those in which oil and/or gas from two or more different reservoirs are combined downhole and produced together through the same wellbore. Water also would be used for dust suppression purposes. For the Proposed Action, annual use of water for dust suppression, based on current usage, would be approximately 0.5 acre-feet following full buildout.

All of EOG's required fresh water would be obtained from the Bonanza power plant. Assuming all 2,808 wells are commingled EOG would use an average of approximately 49.5 acre-feet (384,000 barrels) of fresh water from the plant that had been directly obtained from the Green River and 357.1 acre-feet (2,771,000 barrels) of water originally from the Green River that is recycled from the Bonanza power plant annually, assuming 15 years of drilling wells. Total life-of-project water use would be approximately 742 acre-feet (5,757,000 barrels) of fresh water and 5,357 acre-feet (41,565,000 barrels) of recycled water. This estimate is highly conservative and almost certainly overestimates maximum water use, since ownership of the mineral rights to different horizons is held by different entities within the Chapita Wells and Stagecoach units and precludes commingling of wellbore fluids.

2.7.2.3 Compression and Gas Processing

EOG expects that total field production as a result of the proposed action would grow from an average of 150 million cubic feet per day to approximately 597 million cubic feet per day 10 years after project approval. Based on existing field compression capacity estimates provided by the gas processor, EOG does not anticipate that the increased production would require increases in current sales gas compression capacity or increases in sales gas pipeline capacity.

2.7.2.4 Produced Water Management

EOG expects that increased gas production as a result of the proposed action would increase the volume of water produced. Maximum daily water production is forecast to occur in years seven and eight to approximately 5.8 acre-feet (45,000 barrels) or 2,117 acre-feet per year. This increase in produced water would require additional produced water disposal wells. Assuming an average disposal capacity of 4,000 barrels of water per day (BWPD) for each disposal well, EOG anticipates construction of up to three additional produced water disposal wells to increase the field-wide capacity to 48,000 BWPD. Each produced water disposal facility would occupy approximately 3.75 acres. Seven to eight vertical storage tanks and other facilities for produced water underground injection would be needed in the GCWPA. Placement of tanks at produced water disposal facilities would not result in additional surface disturbance.

EOG's forecast of water production, required produced water disposal wells, and produced water transport trucks is indicated in **Table 2-7**. Gas production would increase through year 10 and water production would increase through year 8 following project implementation. The differing rates result from the fact that individual well water production rates decline more rapidly than do those for gas and oil production, so that field water production rates build more slowly over project life than does gas production. Accordingly, no additional water disposal facilities would be needed after the seventh year of project implementation.

Assuming a 5-year build out of the LGS, EOG anticipates that the current number of water trucks (26) would decrease and then modestly increase by 9 truckloads per day to a maximum of approximately 35 trucks to transport an average water volume of approximately 41,205 barrels per day in 2024, an estimated 7 years after project approval.

Table 2-7 Forecast Alternative B—Water Production, SWDs, and Required Transport Trucks

Year	Proposed Action (barrels per year)	Existing Wells (barrels per year)	Total Annual Water Production (barrels)	Daily Water Production (barrels)	Total SWDs Required	Number of Required Trucks [1]
2015	0	5,425,293	5,425,293	14,864	3.7	23
2016	0	4,970,007	4,970,007	13,616	3.4	19
2017	818,929	4,604,870	5,423,799	14,860	3.7	18
2018	2,806,237	4,297,278	7,103,515	19,462	4.9	20
2019	5,778,849	4,025,280	9,804,129	26,861	6.7	24
2020	8,493,545	3,783,003	12,276,549	33,634	8.4	29
2021	10,021,541	3,560,857	13,582,398	37,212	9.3	32
2022	11,086,511	3,356,045	14,442,556	39,569	9.9	34
2023	11,869,736	3,163,641	15,033,377	41,187	10.3	35
2024	12,053,695	2,986,160	15,039,854	41,205	10.3	35
2025	11,927,872	2,821,361	14,749,233	40,409	10.1	35
2026	11,998,851	2,664,891	14,663,742	40,175	10.0	35
2027	11,680,112	2,519,205	14,199,317	38,902	9.7	33
2028	10,773,677	2,381,813	13,155,490	36,042	9.0	31
2029	9,978,872	2,251,871	12,230,744	33,509	8.4	29
2030	9,154,298	2,129,165	11,283,462	30,914	7.7	27
2031	8,292,969	2,012,341	10,305,310	28,234	7.1	24
2032	6,579,034	1,901,495	8,480,529	23,234	5.8	20
2033	4,486,858	1,790,050	6,276,908	17,197	4.3	15
2034	3,372,701	1,685,639	5,058,341	13,858	3.5	12
2035	2,603,102	1,590,734	4,193,836	11,490	2.9	10
2036	2,038,952	1,501,954	3,540,906	9,701	2.4	8
2037	1,612,018	1,412,806	3,024,824	8,287	2.1	7
2038	1,282,365	1,329,756	2,612,121	7,156	1.8	6
2039	1,024,331	1,254,085	2,278,416	6,242	1.6	5
2040	820,385	1,179,240	1,999,625	5,478	1.4	5

[1] Truck numbers assume LGS phase-in over 5 years.

Source: EOG 2015.

2.7.3 Alternative-specific Design Features

Protective measures specific to this alternative are the same as those discussed under Section 2.6.9, Applicant-committed environmental protective measures.

2.8 Alternative C—Resource Protection Action (BLM-Preferred)

Alternative C is similar to Alternative B, but would place more emphasis on protection of GCWPA resources. In accordance with 43 CFR 1502.14 (e), the lead agency is required to “identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.” For this EIS, BLM has identified Alternative C as the Preferred Alternative.

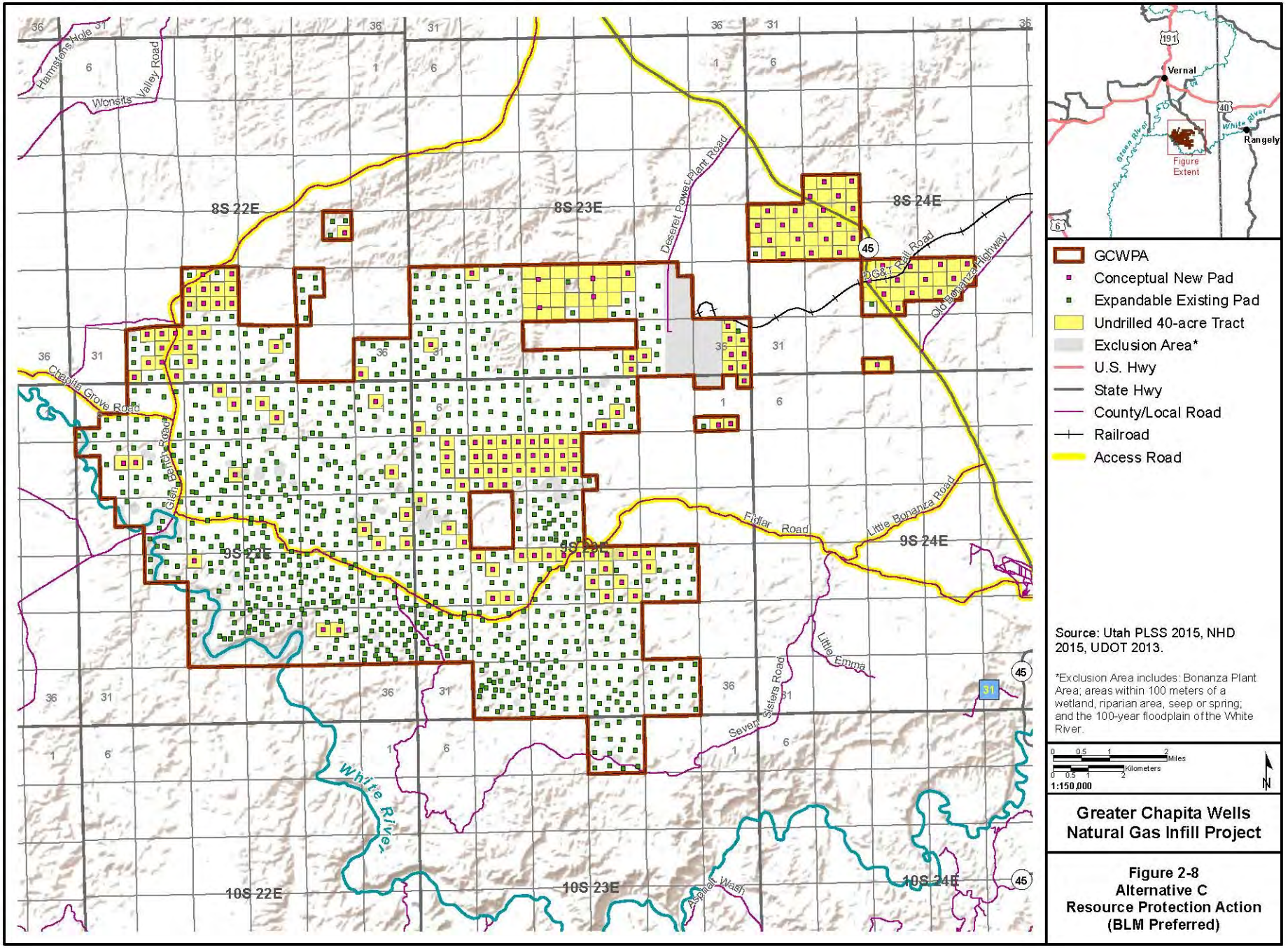
2.8.1 Field Development Plan

Implementation of Alternative C would result in the drilling of up to 2,808 new infill natural gas wells to continue development of currently known productive formations underlying lands in the GCWPA (**Figure 2-8**). Alternative C resource protection restrictions would allow a maximum of 162 new well pads, or 71 fewer new pads than under Alternative B. The number of available existing expandable pads would remain at 960, the same as under Alternative B, for a total of 1,122 new and existing well pads available for drilling new directional wells to bottom hole locations not situated vertically beneath the well pads. Maximum project surface disturbance would be up to 1,514 acres, or 3.5 percent of the GCWPA. Up to 333 acres of the 1,514 acres would be interim reclaimable.

Alternative restrictions on locations of new well pads would limit the locations of potential bottom hole oil and gas well locations. An analysis of the potential for directional drilling technology to reach bottom hole locations at a density greater than the surface well pad spacing was made for this EIS (**Appendix G**). This analysis indicates that all but approximately 1,151 acres (97 percent) of the Mesaverde reservoir beneath the GCWPA would be accessible from new and expandable well pads. The excluded area would be largely beneath the power plant and along the White River. These areas could accommodate an additional 93 downhole locations for Mesaverde wells on BLM surface.

For the Wasatch reservoir, a shorter directional horizontal offset means that about 4,746 acres of the formation beneath the GCWPA could not be reached under Alternative C. Approximately 89 percent of the GCWPA would be accessible for Wasatch wells (**Figure 2-8**, and **Appendix G**, **Figure G-1**). With 1,122 existing and new expandable well pads available under this alternative, drilling an average of 2.5 expansion wells per pad would still allow drilling of all 2,808 wells as proposed under Alternative B. Since EOG has demonstrated the ability in the field to drill up to 8 wells from a single well pad, Alternative C also would allow the drilling and completion of 2,808 wells across the entirety of the GCWPA. However, development within portions of the northern part of the GCWPA and in the western portion of the GCWPA in the vicinity of the White River would be restricted. Accessible portions of the GCWPA would accommodate an additional 1,262 Wasatch wells. The excluded area would be largely beneath the power plant and along the White River. These areas could accommodate an additional 237 downhole locations for Wasatch wells on BLM surface.

While certain alternative-specific design features would restrict well locations in parts of the GCWPA, EOG's ability to drill all 2,808 wells proposed under Alternative B would remain. The restricted areas would be confined to BLM surface. These restrictions would not affect the ability of EOG to drill to Tribal or State of Utah mineral estate.



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This analysis has assumed that EOG would drill infill wells under this alternative at the same rate as proposed under Alternative B, an average of 187 wells annually for 15 years. Actual drilling rates would depend upon future drilling technical, economic, and/or regulatory conditions which cannot be predicted at this time. The productive life of each well is approximately 40 years and, as with Alternative B, all wells are assumed to be productive. Other aspects of Alternative C, including support by existing sales gas compression, use and specifications of connections to the LGS, and water disposal techniques would be as described for Alternative B.

The potential approximate locations of new well pads which could be constructed for Alternative C are indicated in **Figure 2-8**. A summary of surface disturbance associated with Alternative C is indicated in **Table 2-8**.

2.8.2 Alternative-specific Activities

Alternative C design features, which would differ from the design features common to all action alternatives include the following:

2.8.2.1 Well Pads and Wells

Locations of new well pads and wells would be restricted under this alternative:

Black-footed Ferret and Greater Sage-grouse Restrictions

Within those portions of the GCWPA containing UDWR-identified greater sage-grouse winter or brood habitat, or within the black-footed ferret Primary Management Zone (PMZ), construction of new well pads would be limited to a spacing of one new pad per 80-acre tract. New well pads could only be constructed where there is currently no existing well pad within the 80-acre tract. The 80-acre new pad restriction would apply to approximately 3,275 acres (7.6 percent) of the GCWPA.

Table 2-8 Alternative C - Resource Protection Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or Disturbance Width (feet)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Area Facilities				
New Well Pads	162	3.75	162	608
Expandable Well Pads [1]	960	0.25	2,646	662
Additional Disposal Wells	3	3.75	3	11
Total Area Facilities				1,280
Linear Facilities				
New Well Pad Access Roads	30.7	40		149
Surface Gas Pipelines - Non-LGS New Pads [2]	23.1	30		84
Total Linear Facilities				233
GCWPA Alternative Disturbance				1,514
Site-specific LGS Facilities Carried Forward under Action Alternatives				
LGS Central Facilities	18	6.60		119
LGS Central Facility Access Roads	5.1	50		31
LGS Buried Pipelines	89.6	70		760

Table 2-8 Alternative C - Resource Protection Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or Disturbance Width (feet)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Electrical Distribution System	32.8	Variable		124
Total Site-specific Facilities				1,034
Estimated Alternative Reclaimable Surface Disturbance [3]				
Area Facilities Interim Reclamation (acres)				175
Roads Interim Reclamation (acres)				74
Pipelines Reclamation (acres)				84
Total Alternative Reclaimable Surface (acres)				333
Total Alternative Reclaimable % of GCWPA				0.8%
GCWPA Total Disturbance				
Alternative Disturbance % of GCWPA				3.5%
Existing Disturbance GCWPA (acres)				3,975
Alternative-Specific + No Action + Existing Disturbance GCWPA (acres)				6,523

[1] Each additional well expansion adds 0.25 acre disturbance to a maximum 960 existing well pads

[2] Surface pipelines for all available new pad locations outside LGS coverage area, 1000 feet/pad.

[3] Assumes 0.3 acre for 1-well pads + incremental 0.12 acre for each additional well connected to LGS centralized facilities (reclamation would not occur for wells added to existing pads that are not connected to LGS centralized facilities) ,18- to 20-foot road running surface (within a 40-foot ROW), and 100% pipeline reclamation.

Uinta Basin Hookless Cactus Restrictions

The USFWS has designated areas of heightened protections around populations of the federally listed Uinta Basin hookless cactus (*Sclerocactus wetlandicus*). Areas with highest plant density located within 400 meters of identified plant populations are designated as Core 1 areas. Areas located within 1,000 meters of identified plant populations are designated as Core 2 areas. The USFWS has recommended differing levels of site-specific plant mitigations for the two buffers. Well pad construction and expansions would be restricted within core areas, as indicated in Section 2.8.3. See **Appendix H** for detailed survey and management guidelines.

Core 1 areas cover approximately 2,548 acres, or 5.9 percent of the GCWPA. Approximately 625 acres of Core 1 areas (25 percent of the GCWPA Core 1 total) overlap the areas of 80-acre well pad spacing described above. Core 2 areas cover an additional approximately 5,882 acres outside the Core 1 areas (8,430 acres total), or a total of 19.6 percent of the GCWPA for both Core 1 and Core 2 areas. Approximately 1,417 acres of Core 2 areas (24 percent of the GCWPA Core 2 total) overlap the areas of 80-acre PMZ well pad spacing described above. On Tribal or allotted surface, Core 1 areas cover approximately 1,010 acres. An additional approximately 2,019 acres of Core 2 area is located on Tribal surface outside the Core 1 areas.

2.8.2.2 Pipelines

Duplication of surface pipelines would be prohibited. Should additional pipeline capacity be required, a new, larger diameter line would be used in place of the original. All pipelines greater than 12-inch-diameter would be buried. Pipeline construction widths would be minimized to the extent possible through the use of brushhogging, rather than clearing vegetation from the entire ROW width.

2.8.2.3 Water Requirements

Water use would be as described for Alternative B. Since the same number of wells would be drilled under Alternative C as under Alternative B, water required for implementation of this alternative would be the same as under Alternative B. Assuming all 2,808 wells are commingled EOG would use an average of approximately 49.5 acre-feet of water directly from the Green River and 357.1 acre-feet of water originally from the Green River that is recycled from the Bonanza power plant annually, assuming 15 years of drilling wells. Total life-of-project water use would be 742 acre-feet of fresh water and 5,357 acre-feet of recycled water.

2.8.2.4 Produced Water Management

Since the same number of wells would be drilled under Alternative C as under Alternative B, and assuming the same drilling schedule, produced water would be managed in the same manner as under Alternative B. Water production rates would be the same as forecast in **Table 2-7**. No additional water disposal facilities would be needed after the seventh year of project implementation.

2.8.3 Alternative-specific Design Features

Design features specific to this alternative in addition to those discussed under Section 2.6.9, Applicant-committed Environmental Protective Measures, include:

Surface Disturbance

- Should additional pipeline capacity be required, a new, larger diameter line will be used in place of the original. Duplication of pipelines will be prohibited, unless necessitated by site-specific circumstances.
- All pipelines greater than 12-inch-diameter will be buried.
- Pipeline construction widths and associated disturbance of vegetative cover and soils will be minimized to the extent possible through the use of brush-hogging, rather than clearing vegetation from the entire ROW width.
- Mats will be used for drilling pads or access roads where feasible to reduce surface disturbance and improve reclamation success.

Water Quality and Soils

- A long-term water resources monitoring plan will be developed during analysis for the EIS and will be included as an appendix (**Appendix I**) to the EIS.
- Back flow preventers, automatic shut off valves, and or pressure block valves on liquids pipelines that cross 100-year floodplains will be required.
- Compliance with BLM memorandum UT IM 10-055 on groundwater protection will be required.
- Soils BMPs (silt fences, erosion devices, secondary containment, rip rap, etc.) will be utilized as site-specific conditions warrant and in accordance with the Gold Book guidance.

Floodplains, Wetlands, and Riparian

- No surface disturbance will be allowed in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas

Vegetation and Noxious/Invasive Species

- Project implementation will incorporate the VFO Weed Policy.

- EOG will obtain and comply with a Pesticide Use Permit prior to herbicide use. The Pesticide Use Permit will specify buffer distances between herbicide treatment and special status plants based on the BLM herbicide use programmatic EIS (BLM 2007a), and with then-current VFO policy.

Uinta Basin Hookless Cactus (*Sclerocactus wetlandicus*)

- This project includes areas important to the recovery of Uinta Basin hookless cactus. The USFWS has identified core habitat areas that may require additional conservation measures. On Tribal lands, a Tribal Cactus Management Plan will be approved by both the Tribe and USFWS. Surveys will be required in potential habitat prior to surface disturbing activities in accordance with protocol and surface disturbance will avoid identified plants by at least 300 feet, where possible. Identified plants on Tribal surface will be avoided by a minimum of 100 feet.

Within Core 1 areas on BLM surface, the following restrictions will apply:

- No new well pads will be constructed. Expansion of existing well pads to accommodate additional wells will be allowed, where such expansion does not disturb existing cactus plant populations. Installation of new pipelines to accommodate increased production will be permitted, where necessary, and such pipelines will be installed aboveground.
- Where populations or individuals of Uinta Basin hookless cactus are located within 300 feet of the proposed edge of the expansion pad, pipeline ROW, or access road ROW, the following actions will be taken to minimize the impacts:
  - Pad expansion construction or pipeline installation work will occur outside the flowering period (March 15 to June 15).
  - All disturbed areas will be revegetated with native species comprised of species indigenous to the area and non-native species that are not likely to invade other areas.
  - Silt fencing will be used to protect cacti that are within 300 feet and down slope or downwind of surface disturbance. Fencing is intended to prevent sedimentation or dust deposition and will be evaluated for effectiveness by a qualified botanist.
  - A qualified botanist will be on site to monitor surface-disturbing activities when cacti are within 300 feet of any surface disturbance.
  - Dust abatement will occur during construction where plants are closer than 300 feet from surface disturbing activities. Abatement will be designed to minimize potential for dust plume generation and will use water only.
  - Cacti within 300 feet of a proposed surface disturbance will be flagged immediately prior to surface-disturbing activities and flags will be removed immediately after surface-disturbing activities are completed. Leaving cacti flagged for as short a time as possible will minimize drawing attention to the cacti and reduce the potential for theft.
  - New pipelines will be sited to maximize the distance from adjacent Uinta Basin hookless cactus.
  - Project personnel associated with construction activities will be instructed to drive at a speed limit of 15 miles per hour on unpaved roads and to remain on the existing roads and ROWs at all times.

Within Core 2 areas on BLM surface, the following restrictions will apply:

- New well pads will be allowed, however the density of new and existing well pads will not exceed four pads per section (160-acre spacing) in most of the GCWPA. In T8S, R23E, where current drilling density is low, new well pads will be allowed at a density of 1 new pad per

160-acre tract, if that tract does not contain an existing well pad. Well pad expansions to accommodate additional wells, and surface pipeline installation, where necessary to accommodate additional production, will be permitted.

Ute Ladies'-tresses (*Spiranthes diluvialis*)

- Surveys will be required in suitable habitat prior to surface disturbing activities in accordance with protocol and surface disturbance will avoid identified populations by at least 300 feet.

BLM Sensitive Plant Species

- Pre-construction surveys for *Yucca sterilis*, *Townsendia strigosa* var. *prolixa*, and *Astragalus equisolensis* will be required. Identified populations will be avoided by at least 150 feet. Future protective measures will comply with then-current VFO policy.

Raptors

- Project implementation will incorporate the BLM Raptor BMPs (VFO RMP/ROD Appendix A [BLM 2008b]), in particular for ferruginous hawk, burrowing owl, short-eared owl, golden eagle, red-tailed hawk, and prairie falcon.

Migratory Birds

- This alternative will comply with the Memorandum of Understanding between the BLM and the USFWS to Promote the Conservation of Migratory Birds (2010) and the BLM Strategic Plan for Migratory Bird Conservation (April 2013). Future mitigation and best management practices to be developed through this MOU and Strategic Plan will be incorporated as appropriate on a site-specific basis.

Black-footed Ferrets and White-tailed Prairie Dogs

- Inside and outside the black-footed ferret PMZ – Construction activities will be conducted with the objective of avoiding white-tailed prairie dog colonies whenever possible. Otherwise, activities will be designed to impact the smallest area possible and/or those areas with the lowest prairie dog densities. Surface disturbing activities proposed from May 1 through July 15 shall be surveyed for the presence of black-footed ferrets. All surveys will be completed by a BLM biologist or BLM-approved biologist. Previously existing or permitted operations that may occur within these boundaries will continue normal operations.
- Within the PMZ – new well pad construction will be limited to a spacing of not more than 1 new well pad per 80 acres and only in areas in which the existing well pad spacing is less than 1 pad per 80 acres.
- Inside the black-footed ferret PMZ – The development or construction of temporary or permanent facilities and associated surface disturbance will be prohibited within 1/8-mile (660 feet) of known home ranges of female ferrets during the "critical" period from May 1 through July 15. No new surface disturbances will be initiated at these sites during the "critical" period.
- Outside the black-footed ferret PMZ – If a black-footed ferret is found in the GCWPA, BLM or UDWR shall live-trap and remove the ferret prior to the beginning of construction.

Greater Sage-grouse

- Within those portions of the GCWPA containing General Habitat Management Areas (GHMAs), new well pad construction will be limited to a spacing of not more than one new well pad per 80 acres and only in areas in which the existing well pad spacing is less than one pad per 80 acres.

- Within greater sage-grouse GHMA, existing roads and facilities will be utilized to the extent possible.
- Road maintenance activities during the greater sage-grouse breeding season (between February 15 and June 15) will be minimized.
- Within greater sage-grouse GHMA, off-site tanks or central tank batteries will be considered where technically and administratively feasible.
- Within greater sage-grouse GHMA, interim reclamation seed mixes will be designed to provide habitat for greater sage-grouse.
- This alternative will fully comply with required design features applicable to greater sage-grouse general habitat management areas as indicated within Appendix C of the Utah Greater Sage-grouse Land Use Plan Amendment, including mitigation.
- Within GHMA, new surface disturbance will be mitigated at a 2:1 acreage ratio.

Western Yellow-billed Cuckoo

- USFWS guidelines will be followed for identification of suitable breeding, nesting, and foraging habitat for WYBC.
- If construction activities are sited within occupied habitat, the following will be implemented:
  - Machinery will be equipped with mufflers to minimize increases in baseline noise levels.
  - Insecticides and herbicides will not be used to preclude loss of cuckoo prey.
  - Control measures will be implemented to prevent project-related sediment from moving downstream.
- Vegetation management, including removal, mowing, drive-and-crush, and application of herbicides or insecticides will not occur within 300 feet of suitable habitat.
- Temporary disturbance within suitable habitat shall be reclaimed to preclude invasion of noxious plants such as tamarisk and Russian olive.
- Permanent impacts to suitable habitat shall be offset at a 3:1 acreage ratio. Restoration may include treatment of noxious weeds, planting of native cottonwoods and willows, and other measures beneficial to WYBC.
- No surface disturbing activities shall occur within suitable habitat between June 1 and August 31.

Colorado River Endangered Fish

- No surface disturbance will be allowed in the 100-year floodplain of the White River.

Access and Transportation

- Appropriate permits will be obtained from the County prior to placing temporary or permanent pipelines in a CR ROW.

Range and Livestock

- Existing Range Improvement Project's should be avoided by 200 meters by well locations and associated infrastructure. If this is not possible, the Range Improvement Project's should be relocated and/or reconstructed at Applicant's cost.

Visual Resources

- All constructed or installed structures that would remain on a location six months or longer would be painted a flat, non-reflective, earth-tone color as specified by the AO to reduce visual contrast with the landscape, where such painting does not conflict with safety requirements. All facilities requiring painting would be painted within 6 months of facilities installation for the last well on a pad.

2.9 Alternative D—Other Protections Action

Alternative D is similar to Alternative C, but would require burial of all new pipelines and would implement increased protections for *Sclerocactus,* air quality, and visual resources. All of the alternative-specific design features included with Alternative C would apply to this alternative, except where modified or expanded, as discussed in Section 2.9.2.

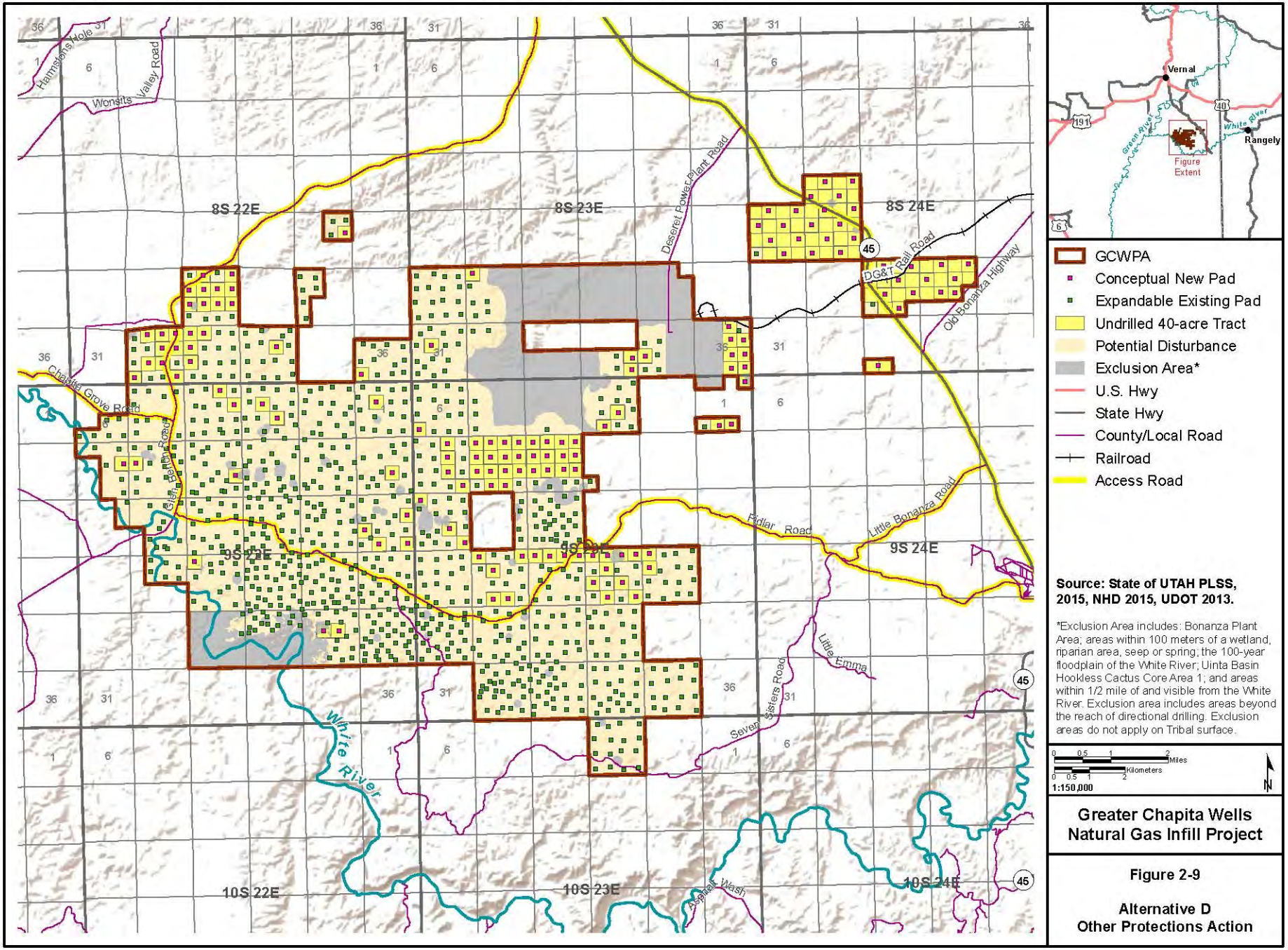
2.9.1 Field Development Plan

Implementation of Alternative D would result in the drilling of up to 2,808 new infill natural gas wells to continue development of currently known productive formations underlying lands in the GCWPA (**Figure 2-9**). Alternative D resource protection restrictions would allow a maximum of 157 new well pads, or 76 fewer new pads than under Alternative B. The number of available existing expandable pads would be reduced to 880, 80 fewer than under Alternative B, for a total of 1,040 new and existing well pads available for drilling new directional wells to bottom hole locations not situated vertically beneath the well pads. Maximum project surface disturbance would be up to 1,595 acres, or 3.7 percent of the GCWPA. Up to 435 acres of the 1,595 acres would be reclaimable. The higher disturbance levels vs. Alternative C result from the burial of all new pipelines.

Based on the directional drilling analysis done for this EIS (**Appendix G**), well pad placement and expansion restrictions under Alternative D (Section 2.9.2) would place approximately 5,170 acres of the Mesaverde reservoir beneath the GCWPA beyond the reach of current directional drilling technology. These exclusion areas are located in the northern part of the GCWPA and along the White River (**Figure 2-9** and **Appendix G**, **Figure G-2**). Approximately 88 percent of the GCWPA would be accessible for development, sufficient to accommodate approximately 4,280 downhole Mesaverde locations. Considering the respective bottom hole spacing in the two areas, Alternative D restrictions would result in exclusion areas sufficient to accommodate an additional 587 Mesaverde wells on BLM surface.

For the Wasatch Formation, the shorter horizontal directional offset results in a larger exclusion area of approximately 8,212 acres. Approximately 81 percent of the GCWPA would be accessible for development, sufficient to accommodate approximately 1,165 downhole Wasatch locations. The downhole acreage not accessible under this alternative would be sufficient to accommodate approximately 410 additional Wasatch wells on BLM surface.

While certain alternative-specific design features would restrict well locations in parts of the GCWPA, EOG's ability to drill all 2,808 wells proposed under Alternative B would remain. The restricted areas would be confined to BLM surface. These restrictions would not affect the ability of EOG to drill to Tribal or State of Utah mineral estate.



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Under this alternative, an average of 2.9 expansion wells per pad would allow drilling of all 2,808 wells proposed under Alternatives B and C. Since EOG has demonstrated the ability to drill up to eight wells from a single well pad, Alternative D also would allow the drilling and completion of 2,808 wells across the entirety of the GCWPA. As a result of an identical proposed well count, this analysis has assumed that EOG would drill infill wells under this alternative at the same rate as proposed under Alternatives B and C, an average of 187 wells annually for 15 years. Actual drilling rates would depend upon future drilling technical, economic, and/or regulatory conditions which cannot be predicted at this time. The productive life of each well is approximately 40 years and, as with Alternatives B and C, all wells are assumed to be productive. Other aspects of Alternative D, including support by existing sales gas compression, use and specifications of connections to the LGS, and water disposal techniques would be as described for Alternatives B and C. All design features included within Alternatives B and C are assumed also to be included within Alternative D, except as modified or expanded as described in Section 2.9.2.

A summary of surface disturbance associated with Alternative D is indicated in **Table 2-9**.

2.9.2 Alternative-specific Activities

Alternative D design features which would differ from the design features common to all action alternatives include the following:

2.9.2.1 Well Pads and Wells

Locations of new well pads and wells would be restricted under this alternative resulting in fewer new well pads than Alternatives B or C. Restrictions would be similar to, but more extensive than, those indicated for Alternative C.

2.9.2.2 Pipelines

All new or replacement pipelines would be buried.

2.9.2.3 Water Requirements

Water use would be as described for Alternative B. Since the same number of wells would be drilled under Alternative D as under Alternative B, water required for implementation of this alternative would be the same as under Alternative B.

Table 2-9 Alternative D—Other Protections Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or Disturbance Width (feet)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Area Facilities				
New Well Pads	157	3.75	157	589
Expandable Well Pads [1]	880	0.25	2,651	663
Additional Disposal Wells	3	3.75	3	11
Total Area Facilities				1,263
Linear Facilities				
New Well Pad Access Roads	29.7	40		144
Buried Gas Pipelines - Non-LGS New Pads [2]	22.2	70		188
Total Linear Facilities				332

Table 2-9 Alternative D—Other Protections Estimated Surface Disturbance

Facility	Multiplier: Well Pads (count) or ROW Length (miles)	Size (acres) or Disturbance Width (feet)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
GCWPA Alternative Disturbance [3]				1,595
Site-specific LGS Facilities Carried Forward under Action Alternatives				
LGS Central Facilities	18	6.60		119
LGS Central Facility Access Roads	5.1	50		31
LGS Buried Pipelines	89.6	70		760
Electrical Distribution System	32.8	Variable		124
Total Site-specific Facilities				1,034
Estimated Alternative Reclaimable Surface Disturbance [4]				
Area Facilities Interim Reclamation (acres)				175
Roads Interim Reclamation (acres)				72
Pipelines Reclamation (acres)				188
Total Alternative Reclaimable Surface (acres)				435
Total Alternative Reclaimable % of GCWPA				1.0%
GCWPA Total Disturbance [4]				
Alternative Disturbance % of GCWPA				3.7%
Existing Disturbance GCWPA (acres)				3,975
Alternative-Specific + No Action + Existing Disturbance GCWPA (acres)				6,604

[1] Each additional well expansion adds 0.25 acre disturbance to a maximum 960 existing well pads.

[2] Buried pipelines for all available new pad locations outside LGS coverage area, 1,000 feet/pad.

[3] Disturbance exceeds Alternative C as a result of burial of all new pipelines.

[4] Assumes 0.3 acre for 1-well pads + incremental 0.12 acre for each additional well connected to LGS centralized facilities (reclamation would not occur for wells added to existing pads that are not connected to LGS centralized facilities) ,18- to 20-foot road running surface (within a 40-foot ROW), and 100% pipeline reclamation.

2.9.2.4 Produced Water Management

Since the same number of wells would be drilled under Alternative D as under Alternative B, and assuming the same drilling schedule, produced water would be managed in the same manner as under Alternative B. Water production rates would be the same as forecast in **Table 2-7**.

2.9.3 Alternative-specific Design Features

Mitigation measures specific to this alternative and additional to those discussed under Section 2.6.9, Applicant-committed Environmental Protective Measures, and Section 2.8.3, Alternative-specific Design Features, include the following.

Surface Disturbance

- All new or replacement pipelines would be buried.

Air Quality – Drilling/Completion

- The use of Tier IV drill rig engines will be phased in by 2018.

Air Quality – Production

- Well site dehydrator VOC emissions will be controlled to +95 percent efficiency.
- Well site tank VOC emissions will be controlled to +95 percent efficiency.
- Blowdown emissions at LGS-connected well sites will be reduced approximately 83 percent.
- Well site pneumatic devices will achieve a control efficiency of approximately 75 percent.
- Central facility tank emissions will be controlled to +95 percent efficiency.
- Existing and new three-way oil/water/gas separators will be controlled via combustor or otherwise reroute vapors to sales lines.
- No intentional non-emergency venting will occur.
- Flaring will be allowed on a site-specific basis and must be consistent with air quality modeling assumptions.

Uinta Basin Hookless Cactus Restrictions

On BLM surface:

- Construction of new well pads, expansion of existing pads to accommodate additional wells, and creation of other facilities would be prohibited within Core 1 areas.
- New well pads and expansion of existing well pads would be allowed within Core 2 areas. However, new and existing well pads must not exceed a density of 4 pads per section (or 160-acre spacing). New well pads and expansion of existing well pads would be prohibited where GCWPA surface disturbance exceeds 5 percent of the area of the affected cactus population (Bonanza or White River).
- If the 5 percent disturbance cap is already exceeded, no additional surface disturbance will occur until disturbed areas are successfully reclaimed. Reclamation standards will be developed in the final USFWS recovery plan for each *Sclerocactus* species. In the interim, proposed successful reclamation standards for this project would be approved by USFWS.

White River

- To protect the White River visual environment, no new wells or well pads would be permitted on BLM surface within 0.5 mile of the river, unless such wells would not be visible from the river because of intervening topography.

Recreation

- No surface pipelines will be laid within the Red Wash open ride area, including placement along existing roads (all new pipelines within the Red Wash open ride area will be buried).

2.10 Alternatives Considered but Eliminated from Further Consideration

In addition to the alternatives described above, a number of other possible alternatives were examined, but eliminated from further consideration. Regulations implementing NEPA require examination of a "range of all reasonable alternatives," and further require that the reason(s) for eliminating an alternative from detailed consideration be disclosed (40 CFR §1502.14 (a)). An alternative can be dismissed because:

- It does not meet the Agency's purpose and need;
- It is technically or economically unfeasible;
- Its implementation is remote or speculative;
- It is similar in design to another alternative analyzed;
- It would have similar impacts to an alternative analyzed; or
- It would result in greater impacts than the Proposed Action.

2.10.1 Use of Produced Water for Waterflood Projects

Waterflood projects are a type of enhanced oil and gas recovery method in which water is injected into wells in the vicinity of a producing well. The water advances towards the producing well, assists in maintaining reservoir pressures, and sweeps the oil and gas towards the producing wellbore. Produced water is often reinjected and used as the waterflood medium. A possible alternative would require that GCWPA produced water be transported for use in waterflood operations in adjacent fields. Small waterflood projects are being conducted by QEP Energy in the Wonsits Valley and Redwash fields, 5 and 7 miles northwest and north, respectively, of the GCWPA. A large waterflood is being conducted by Newfield in the Monument Butte Field, about 25 miles to the west of the GCWPA.

In the GCWPA, produced water is obtained almost entirely from the Mesaverde Group. According to EOG's production department, the water is corrosive, has high scaling tendencies, and contains variable levels of H_2S. For these reasons, produced water is not used for drilling or completing wells within the field. Use of produced water for waterflood projects would entail similar difficulties. In order to use the water, water treatment methods which would address the quality deficiencies and safety issues would be required. In addition to the costs of the treatments, there would be additional costs, and associated air quality impacts, involving transport of the water from the GCWPA to the waterflood injection sites. Since these issues have prohibited re-use of produced water within the GCWPA, it is determined that this alternative is technically or economically unfeasible, would result in effects greater than the Proposed Action, and is not analyzed in detail in this EIS.

2.10.2 All Project Wells would be Connected to the LGS

EOG's current Proposed Action connects as many wells to the electrified (LGS) as is feasible based on available power in the GCWPA. Presently, the area electric utilities, Rocky Mountain Power and Moon Lake Power, do not have capacity to supply additional electricity beyond what EOG has committed to use beginning in late 2015. EOG has contracted with Rocky Mountain Power and is obligated to use that power solely within Rocky Mountain Power's jurisdictional boundary set by the FERC. The FERC boundary between Moon Lake Electric and Rocky Mountain Power divides EOG's acreage. Moon Lake and Rocky Mountain Power use the same sources for electrical power and EOG cannot cross this boundary with its own distribution lines.

In addition to the lack of additional capacity available to Moon Lake and Rocky Mountain Power the FERC boundary prohibits EOG from committing to power expansion into the northern portion of the GCWPA where power distribution is done by Moon Lake. Therefore, expansion of the LGS would require operating large engines for compressors and/or generators that operate on hydrocarbon-based fuels. EOG has committed to reducing project emissions to the maximum extent feasible. Expansion of a non-electrified LGS beyond what EOG has proposed would not substantially decrease project facility emissions and would not achieve the desired air quality benefits. Therefore, this alternative is technically or economically unfeasible and is not analyzed in detail in this EIS.

2.10.3 All Field Facilities would be Electrified

See previous response in Section 2.10.2.

2.10.4 Achieve Field-wide Electrification Using Solar Panel Generation

EOG currently uses solar power for small voltage electronics. The amount of solar power that would need to be generated to electrify the entire GCWPA (an estimated 40 megawatts), would require that an area covering about 200 acres be dedicated to solar panels and associated equipment (batteries, etc.). The cost for this magnitude of solar power would be an estimated $300 million. These figures are based on EOG's review of literature associated with similarly sized solar projects. A solar development of this scale also would likely result in impacts to sensitive species such as Uinta Basin hookless cactus, and require considerable amounts of water for cooling.

In addition to these issues, backup power via gas-fired generators would be needed due to the unreliability of solar power, especially during the winter inversions that occur regularly within the basin. This would mean that during the periods of greatest concern with regard to air quality in the basin (i.e., winter inversions that lead to the formation of O_3), power within the GCWPA would be generated by gas-fired generators, leading to additional air quality impacts.

Further, EOG has already contracted with Rocky Mountain Power to construct necessary transformers to provide electricity to the field, which will result in substantial reductions in air emissions. This commitment will require additional costs for building the necessary electrical substation and associated distribution system. As such, changing course would negate the millions of dollars in investments that EOG has already made.

Therefore, this alternative is evaluated as being technically or economically unfeasible and is not analyzed in detail in this EIS.

2.10.5 Other Alternative Elements Considered

2.10.5.1 New Roads would be Limited to a 14-foot Running Surface

During periods of high activity and/or traffic, road widths need to be 18 feet or greater. Trucks hauling loads need a stable safe surface, which a 14-foot running surface does not provide. Smaller vehicles such as pickups cannot pass each other on 14-foot-wide roads, let alone larger trucks. As trucks with heavy loads near the edge of roads, the weight of the truck can cause the road margin to slump, causing trucks to lean and potentially to tip over. Because of safety concerns, this alternative is not analyzed in detail in this EIS.

2.10.5.2 Within the White River Viewshed, new Wellheads would be Placed Below Ground Level

Alternative D would preclude further surface disturbance within the 100-year floodplain of the White River by prohibiting new wells or well pads within 0.5 mile or line-of-sight of the White River. Even if wellheads are placed belowground, at least one aboveground tank would remain on every well pad. The aboveground tank would have a much greater visual impact than an aboveground wellhead. Therefore, this alternative is not analyzed in detail in this EIS because it is sufficiently similar to Alternative D and because it does not provide a visual benefit over other alternatives that are analyzed in detail.

2.10.5.3 Full Field Development

EOG's original proposal for the project approximated a full field development of 7,028 wells drilled over a 15-year period. When the issue of high concentrations of winter-time ground level O_3 in the Uinta Basin was recognized, EOG felt that the proposed project would be difficult to achieve without substantial deleterious effects to the airshed. Accordingly, the original proposal was re-worked in a number of ways

to reduce emission of pollutants, in particular emission of O_3 precursors. A part of this revised development strategy included a 60 percent reduction in proposed wells.

2.11 Comparison of Alternatives

A summary of surface disturbance associated with each alternative is provided in **Table 2-10**. A comparison of effects to each resource by alternative is provided in **Table 2-11**.

Table 2-10 Comparison of Estimated Surface Disturbance Among Alternatives

Facility	Size (acres) or Disturbance Width (feet)	Alternative A No Action			Alternative B Proposed Action			Alternative C (Preferred) Resource Protection Action			Alternative D Other Protections Action		
		Multiplier: Well Pads (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)	Multiplier: Well Pad (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)	Multiplier: Well Pad (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)	Multiplier: Well Pad (count) or ROW Length (miles)	Proposed Wells (count)	Estimated Initial Surface Disturbance (acres)
Area Facilities													
Single New Well Pads	2.50	425	425	1,063	0	0	0	0	0	0	0	0	0
New Well Pads	3.75	0	0	0	233	233	874	162	162	608	157	157	589
Expandable Well Pads [1]	0.25	37	37	9	960	2,575	644	960	2,646	662	880	2,651	663
Additional Disposal Wells	3.75	0	0	0	3	3	11	3	3	11	3	3	11
Total Area Facilities				1,072			1,529			1,280			1,263
Linear Facilities													
New Well Pad Access Roads [2]	40	87.5		424	44.1		214	30.7		149	29.7		144
Surface Gas Pipelines - Non-LGS New Pads [3]	30	40.2		146	36.4		132	23.1		84	0.0		0
Buried Gas Pipelines - Non-LGS New Pads [3]	70	0.0		0	0.0		0	0.0		0	22.2		188
Total Linear Facilities				571			346			233			332
Other Facilities													
Compressor Station Expansion				8			0			0			0
Site-specific No Action Carried Forward													
LGS Central Facilities	6.60	18		119	18		119	18		119	18		119
LGS Central Facility Access Roads	50	5.11		31	5.11		31	5.11		31	5.11		31
LGS Buried Pipelines	70	89.6		760	89.6		760	89.6		760	89.6		760
Electrical Distribution System	Variable	32.8		124	32.8		124	32.8		124	32.8		124
Total No Action Carried Forward				1,034			1,034			1,034			1,034
Alternative Disturbance (acres)				2,685			1,875			1,514			1,595
Alternative + No Action Carried Forward Disturbance (acres)				NA			2,909			2,548			2,629
Estimated Reclaimable Surface Disturbance [4]													
Well Pads Interim Reclamation (acres)				128			171			175			175
Roads Interim Reclamation (acres)				223			107			74			72
Pipelines Interim Reclamation (acres)				921			132			84			188
Total Reclaimable Surface Disturbance (acres)				1,272			410			333			435
Total Reclaimable % of GCWPA				3.0%			1.0%			0.8%			1.0%
GCWPA Total Disturbance (acres)													
Approved Disturbance % of GCWPA				6.2%			4.4%			3.5%			3.7%
Existing Disturbance (acres)				3,975			3,975			3,975			3,975
No Action Site-specific Disturbance (acres)				NA			1,034			1,034			1,034
Alternative + No Action + Existing Disturbance (acres)				6,660			6,884			6,523			6,604

[1] Each additional well expansion adds 0.25 acre disturbance to available new or existing expansion well pads.
[2] Access roads assumed to 1,000 feet long, based on field experience. Long-term road running width is 20 feet in 40-foot ROW.
[3] Surface and buried pipelines for all available new pad locations outside LGS coverage area, 1000 feet/pad.
[4] Assumes 0.3 acs. for 1-well pads + incremental 0.12 acs. for each additional well connected to LGS centralized facilities (reclamation would not occur for wells added to existing pads that are not connected to LGS centralized facilities) , 18 to 20-foot road running surface (within a 40 foot ROW), and 100% pipeline reclamation.

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
General					
Short-term Surface Disturbance (acs)	2,685	1,875	1,514	1,595	Sections 2.5, 2.7, 2,8, and 2.9
Geology, Minerals, and Energy Production					
Recoverable Gas Resources Over the Life of the wells (trillion cubic feet [Tcf])	0.52	4.17	4.17	4.17	Sections 4.2.1.1, 4.2.1.2, 4.2.1.3, and 4.2.1.4
Recoverable Condensate Resources Over the Life of the Wells (millions barrels)	4.9	60.5	60.5	60.5	Sections 4.2.1.1, 4.2.1.2, 4.2.1.3, and 4.2.1.4
Air Quality and Greenhouse Gas Emissions					
Air Quality (exceed NAAQS)	Possible O_3 exceedance some areas	Yes O_3 exceedance some areas (Max 5.9 ppb)	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Hazardous Air Pollutants (exceed acute resource exposure level [REL])	Same or less than Alternative B	No	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Nitrogen Deposition (exceed critical load threshold)	Same or less than Alternative B	Yes Exceedance most modeled areas.	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Sulfur Deposition (exceed Depositional Analysis Threshold)	Same or less than Alternative B	No	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Acid Neutralizing Capacity (exceed 10% change)	Same or less than Alternative B	No	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Visibility Class I Areas (annual days exceeding 0.5 Δdv change)	Same or less than Alternative B	0	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Visibility Class II Areas (annual days exceeding 0.5 Δdv change)	Same or less than Alternative B	Up to 356	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4
Maximum Annual GHG Emissions carbon dioxide equivalent (CO_2e) (million tons per year)	Same or less than Alternative B	0.49	Same or less than Alternative B	Same or less than Alternative B	Sections 4.3.1.1, 4.3.1.2, 4.3.1.3. and 4.3.1.4

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Water Resources					
100-year Floodplains (incremental acres disturbed)	Minimal	Minimal	Minimal	Minimal	Sections 2.6.9, 2.8.3, 2.9.3
Drilling and Completion Total Project Fresh Water Use (acre-feet)	122	742	742	742	Sections 2.5.2, 2.6.3.3, 2.7.2.2, 2.8.2.3, and 2.9.2.3
Drilling and Completion Total Project Recycled Water Use (acre-feet)	881	5,357	5,357	5,357	Sections 2.5.2, 2.6.3.3, 2.7.2.2, 2.8.2.3, and 2.9.2.3
Maximum Produced Water Injected (acre-feet per year)	78	1,938	1,938	1,938	Sections 2.5.2, 2.7.2.4, 2.8.2.3, and 2.9.2.3
Additional produced water disposal wells required?	0	2	2	2	Sections 2.5.2, 2.7.2.4, 2.8.2.3, and 2.9.2.3
Soils					
High Constraint (incremental acres disturbed)	2,245	1,637	1,275	1,331	Table 4.5-1
Moderate Constraint (incremental acres disturbed)	275	201	144	142	Table 4.5-1
Low Constraint (incremental acres disturbed)	165	37	29	34	Table 4.5-1
Vegetation (Including Special Status Species)					
Vegetation Type (estimated incremental acres disturbed)					Tables 4.6-2, 4.6-3, 4.6-4, and 4.6-5
Badlands	657	468	385	383	
Cliff/Canyon	160	114	88	80	
Developed/Disturbed	179	131	107	117	
Grassland	119	85	67	61	
Sagebrush shrubland	451	312	255	300	
Salt-desert shrubland	1,119	765	612	653	
Wetland/Riparian	0	0	0	0	
Uinta Basin Hookless Cactus					Sections 2.6.9, 2.8.3, 2.9.3, 4.6.1.2, 4.6.1.3, 4.6.1.4, and 4.6.1.5

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Individual Plants will be Avoided.	Yes	Yes	Yes	Yes	
New Well Pads in Core 1 Areas	Allowed	Allowed	Disallowed	Disallowed	
New Well Pad Restrictions in Core 2 Areas	No	No	Yes	Yes	
Wildlife and Fisheries (Including Special Status Species)					
Big Game Habitat (estimated incremental acres disturbed)					Sections 2.8.2.1 and 2.8.3 Tables 4.7-2, 4.7-3, 4.7-4, and 4.7-5
Mule Deer Yearlong Crucial	143	105	77	40	Table 4.7-1
Pronghorn Yearlong Crucial	2,382	1,739	1,417	1,547	Table 4.7-2
Rocky Mountain Bighorn Sheep Yearlong Crucial	184	134	101	57	Table 4.7-3
Bison Yearlong Crucial Range	58	42	19	2	Table 4.7-4
Black-footed Ferret Prime Management Zone (estimated incremental acres disturbed)	165	121	96	120	Table 4.7-5
Prairie Dog Colonies (estimated incremental acres disturbed)	121	89	71	76	Table 4.7-6
Greater Sage-grouse Proposed General Habitat (estimated incremental acres disturbed)	88	64	52	64	Table 4.7-7
Western Yellow-billed Cuckoo Habitat (estimated incremental acres disturbed)	0	0	0	0	Sections 4.7.1.1, 4.7.1.2, 4.7.1.3, and 4.7.1.4
Fisheries	Potential for increased sediment transport to local streams.	Potential for increased sediment transport to local streams.	Potential for increased sediment transport to local streams.	Potential for increased sediment transport to local streams.	Sections 4.7.1.1, 4.7.1.2, 4.7.1.3, and 4.7.1.4
Paleontological Resources					
PFYC Class 4 or 5 areas (potential incremental acres disturbed)	1,897	1,312	1,148	1,254	Section 4.8.1
Cultural Resources and Traditional Cultural Values					
Sites potentially encountered (incremental due to new surface disturbance)	19 to 48	14 to 35	11 to 27	11 to 28	Section 4.9.1

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Socioeconomic Resources					
Revenues and Spending					
Cumulative Value of Oil and Gas Production (billions of dolllars)	2.2	20.2	20.2	20.2	Section 4.10
Direct Total Project Spending (billions of dollars)	1.8	11.7	11.7	11.7	Sections 4.10.1.2, 4.10.1.3, 4.10.1.4, and 4.10.1.5
Employment (number jobs)					
Peak Direct On-site - Development Phase	109	345	345	345	Section 4.10 Figure 4.10-5 through 4.10-7
Average Direct On-site - Production Phase	95	279	279	279	Section 4.10.1.2, 4.10.1.3, 4.10.1.4 Figure 4.10-14 Table 4.10-7
Average Secondary - Development Phase	84	222	222	222	Section 4.10.1.2, 4.10.1.3, 4.10.1.4 Figure 4.10-14 Table 4.10-7
Average Secondary - Production Phase	12	62	62	62	Section 4.10.1.2, 4.10.1.3, 4.10.1.4 Figure 4.10-14 Table 4.10-7
Population and Housing (workers / housing units)					Sections 4.10.1.2, 4.10.1.3, 4.10.1.4, and 4.10.1.5
Average Temporary Workers - Development Phase	70	199	199	199	Section 4.10.1.4 Table 4.10-8
Average Temporary Workers - Production Phase	6	66	66	66	Section 4.10.1.4 Table 4.10-8
Average New Resident Workers - Development Phase	231	712	712	712	Section 4.10.1.4 Tables 4.10-7 and 4.10-8

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Average New Resident Workers - Production Phase	48	222	222	222	Section 4.10.1.4 Tables 4.10-7 and 4.10-8
Average Temporary Housing Units - Development Phase	64	236	236	236	Section 4.10.1.4 Table 4.10-8
Average Temporary Housing Units - Production Phase	2	49	49	49	Section 4.10.1.4 Table 4.10-8
Average Conventional Housing Units - Development Phase	63	173	173	173	Section 4.10.1.4 Table 4.10-8
Average Conventional Housing Units - Production Phase	20	64	64	64	Section 4.10.1.4 Table 4.10-8
Public Sector Revenues (cumulative millions of dollars)					Sections 4.10.1.2, 4.10.1.3, 4.10.1.4, and 4.10.1.5
Projected Ad Valorem Tax (Uintah County and School District)	27.9	256.1	256.1	256.1	
Utah Severance Taxes	80.8	749.6	749.6	749.6	
Federal and Tribal Mineral Royalties	116.4	1,084.5	1,084.5	1,084.5	
State Royalties (49.0% of federal royalties)	107.7	1,002.9	1,002.9	1,002.9	
Royalties to the State Permanent Public School Fund	15.1	140.4	140.4	140.4	
Combined Public Sector Revenues	348.0	3,233.5	3,233.5	3,233.5	
Percent Increase over No Action	N/A	829%	829%	829%	
Livestock Grazing and Rangeland					
AUMs Lost – BLM	213	136	106	112	Table 4.12-1
AUMs Lost – BIA	12	9	9	9	Table 4.12-1
Total AUMs Lost	225	147	115	121	Table 4.12-1
Access and Transportation					
New Access Roads (miles)	92.6	44.1	28.6	27.7	Section 4.13.1
Increase in Maximum Traffic Loads - Main Access Roads (average annual daily trips)	169	446	446	446	

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Increase in Maximum Traffic Loads - Main Access Roads (percentage of existing)	110.5%	127.5%	127.5%	127.5%	
Number of Annual Incidents (mostly minor accidents and spills)	1	6	6	6	
Visual Resources					
Impacts to People and Scenery	Build-out would result in moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Decreased scenic effects in comparison to Alternative B, C, and D.	Moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Increased effects in comparison to Alternative C and D.	Moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Reduced effects in comparison to Alternative B and similar to Alternative D.	Moderate to strong contrasts to form, line, and color of the characteristic landform and vegetation. Reduced effects in comparison to Alternative B and similar to Alternative C.	Section 4.14.1
Conformance with Visual Resource Management (VRM) Class Objectives	Strong contrasts to landform and vegetation would result in non-conformance with VRM Class III Objectives.	Mitigation to landform would result in reduction of strong contrasts and conformance with VRM Class III.	Mitigation to landform would result in reduction of strong contrasts and conformance with VRM Class III.	Mitigation to landform would result in reduction of strong contrasts and conformance with VRM Class III.	Section 4.14.1
Recreation					
Effects to the Red Wash OHV Area	Rider conflicts will be minimized by burial of new pipelines.	Rider conflicts will be minimized by burial of new pipelines.	Rider conflicts will be minimized by burial of new pipelines.	Rider conflicts will be minimized by burial of new pipelines.	Section 4.15.1
Effects on Recreational Use of the White River	Increase in industrial nature of surroundings proportional to development levels.	Increase in industrial nature of surroundings proportional to development levels.	Increase in industrial nature of surroundings proportional to development levels.	Increase in industrial nature of surroundings proportional to development levels.	Section 4.15.1

Table 2-11 Comparison of Effects Among Alternatives by Resource

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Resource Protection Action (BLM Preferred)	Alternative D Other Protections Action	Additional Discussion
Effects to the Fantasy Canyon SRMA	Limitations on facilities development in or near the SRMA.	Limitations on facilities development in or near the SRMA.	Limitations on facilities development in or near the SRMA.	Limitations on facilities development in or near the SRMA.	Section 4.15.1

3.0 Affected Environment

This chapter describes the current condition of those resources and values which occur in the vicinity of the GCWPA and which comprise the natural and human environment. Based on internal and public scoping, as indicated in Chapter 1.0 (Section 1.6), the resources discussed in this chapter are considered to have the potential to be affected by implementation of the Proposed Action or another project alternative. The technical staff of the VFO has determined that certain resources are either not present in the vicinity of the GCWPA or are not likely to be affected by the proposed project. Other resources and values are determined to likely be affected and these have been brought forward for analysis in this EIS. The rationale for the selection of these resources is documented in **Appendix A**.

The current condition of these resources establishes a baseline against which effects from the Proposed Action or other alternatives may be measured and compared, as described in Chapter 4.0. In general, the level of analysis is commensurate with the anticipated degree of potential project-related effects.

3.1 Regional Setting

Current conditions of the resources and values discussed in this analysis may have resulted from factors which operate on both local and regional scales. For some resources, such as paleontological remains, these factors are almost entirely local in extent. For other resources, such as air quality, local conditions may be determined by factors operating over very broad areas. This section discusses the regional setting of the proposed project. Discussion of the local environment and operating factors are included within each of the following resource sections.

The regional setting also is commonly identified as a landscape-scale view. Landscapes are large, connected geographical regions having similar environmental characteristics, such as the Colorado Plateau. These landscapes span administrative boundaries and can encompass all or portions of multiple BLM field offices.

3.1.1 Colorado Plateau Rapid Ecoregional Assessment

A function of landscape-scale analysis has been the development of Rapid Ecoregional Assessments (REAs) of a given region. REAs synthesize the best-available data regarding resources and trends within a landscape or ecoregion. The assessments are developed fairly rapidly, over a roughly 18-month period, to assess the current baseline conditions of specific conservation elements, resources of high ecological value, including indicators such as: a) representative vegetation communities; b) certain terrestrial and aquatic wildlife species; c) designated sites of importance; and d) ecological functions or services, such as soils and aquatic resources. Thus, the REA is not a complete evaluation of a landscape, but instead examines key indicators of the health of the regional ecosystem.

Over time, changing environmental conditions may alter the baseline states of the indicators. BLM has determined that these principal change agents include: a) climate change; b) human development (of all types, but particularly energy development and urbanization); c) wildland fire; and d) invasive species.

The Colorado Plateau represents the landscape containing the GCWPA. As analyzed in the Colorado Plateau Rapid Ecoregional Assessment (COP REA) (Bryce et al. 2012), the Colorado Plateau is generally conterminous with the Level III Colorado Plateaus Ecoregion (Ecoregion 10.1.6). Ecoregions are landscape designations based on the types of biotic and physical phenomena that affect or result from differences in ecosystem quality and integrity (Omernik 1987, 1995). Ecoregions may be differentiated using broad criteria (Level I), or more narrowly focused factors (Level IV). The Colorado Plateau encompasses an area of 32,387 square miles covering parts of 4 states and 16 BLM field

offices. The local ecoregion containing the GCWPA is the Level IV Uinta Basin Floor (Ecoregion 20f), encompassing approximately 2,613 square miles (1,672,490 acres), or about 8 percent of the Colorado Plateau (Woods et al. 2000). The conservation elements selected for evaluation in the COP REA are indicated in **Table 3.1-1**.

Colorado Plateau baseline conditions are, to some extent, identified by the degree of intactness (quantifiable estimate of naturalness measured on a gradient of anthropogenic influence and based on available spatial data) remaining at the time of the assessment versus the degree of existing disturbance. Intactness is the metric chosen to evaluate ecological/ecosystem integrity (i.e., the degree to which all ecosystem components and their interactions are represented and functioning).

3.1.2 Existing Conditions

The Colorado Plateau encompasses a broad dissected and elevated tableland. The Plateau is roughly situated between the Wasatch Range and Aquarius Plateau on the west and the Southern Rockies on the east. Current ecological conditions within the Colorado Plateau, as indicated by the level of terrestrial and aquatic intactness, are illustrated in **Figures 3.1-1** and **3.1-2**. The location of the GCWPA indicates that it is sited in an area of generally very low terrestrial intactness and moderately low aquatic intactness. The Uinta Basin is indicated as being an area of moderately to very low terrestrial intactness and moderately low to very low aquatic intactness. The generally low intactness levels reflect the high levels of oil and gas development within the Basin. Overall, roughly half of the Colorado Plateau exhibits generally low (moderately to very low) terrestrial intactness, with approximately 27 percent being in the low to very low classification. For aquatic intactness, the values are even lower, with about two thirds of the Plateau being classified as generally low and approximately one third as low to very low (Bryce et al. 2012).

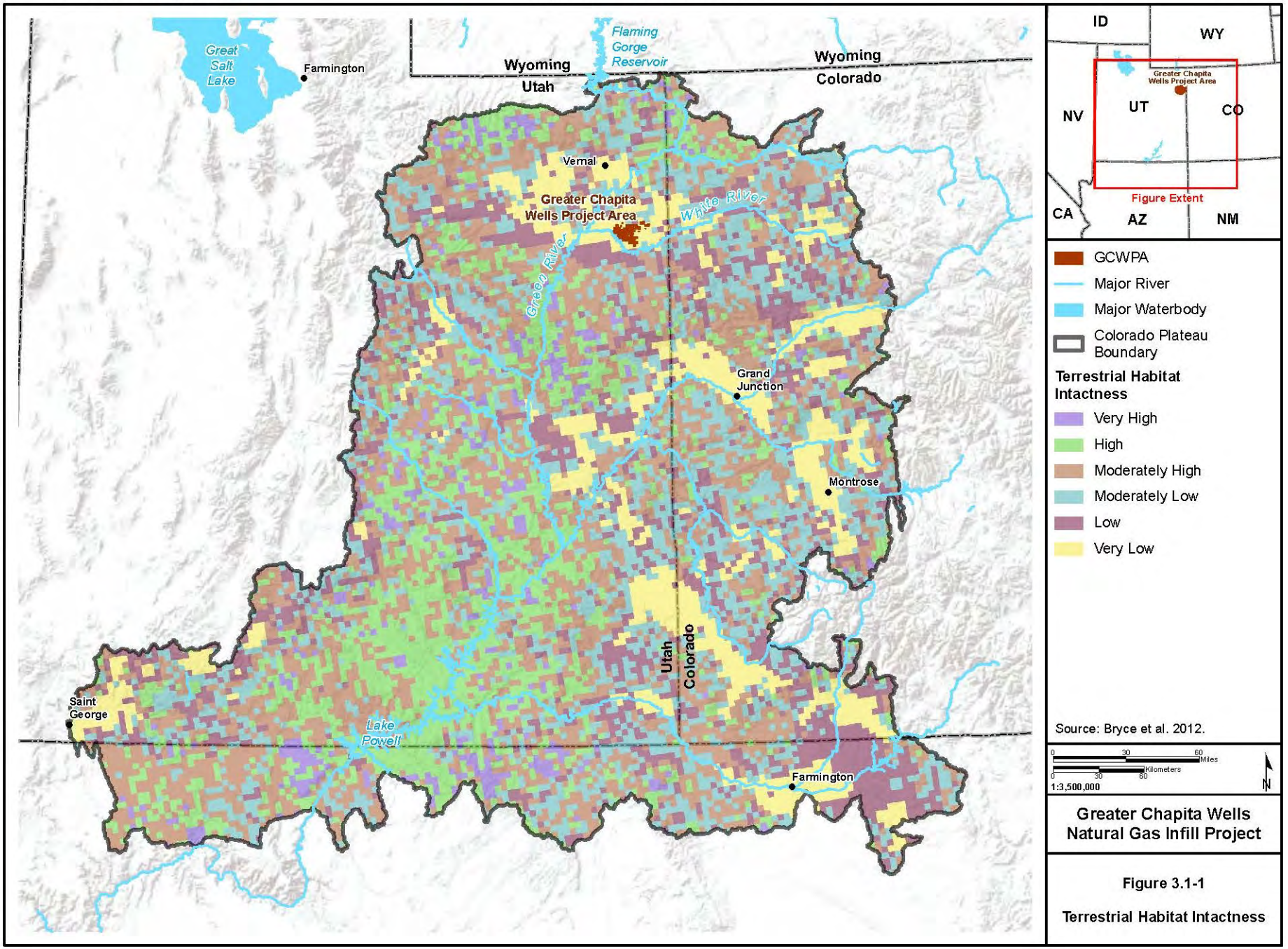
Eight ecological systems (vegetative communities) from the Southwest Regional GAP Analysis Project (SWReGAP) classification were assessed for the COP REA, representing approximately two thirds of the Plateau landcover. Three of these are relatively common within the GCWPA: the inter-mountain basins mixed salt desert scrub and the Colorado Plateau mixed bedrock canyon and tableland are present throughout the GCWPA, while the inter-mountain basins big sagebrush shrubland is common in the southeastern portion of the area. A fourth community, the Colorado Plateau pinyon-juniper shrubland is present sporadically, mostly along the White River. GCWPA SWReGAP vegetative communities of importance not assessed by the COP REA include the inter-mountain basins shale badland (common in the northern part of the GCWPA), inter-mountain basins greasewood flat, inter-mountain basins semi-desert grassland, and inter-mountain basins mat saltbrush shrubland. Of the three main GCWPA communities assessed in the COP REA, the inter-mountain basins big sagebrush shrubland has seen disturbance to approximately 4.5 percent of its Plateau-wide distribution in the past 10 to 20 years (Bryce et al. 2012).

Of the 18 assessed wildlife species, all except the desert bighorn sheep, Gunnison's prairie dog, Gunnison sage-grouse, Mexican spotted owl, and Colorado River cutthroat trout have at least the potential to occur within or in the immediate vicinity of the GCWPA. For each species, a map of the existing animal's range was overlaid on the intactness models to estimate habitat intactness for the species. It is important to note that the modeled intactness of species habitats do not directly equate to acreage percentages of categorized areas. Rather, the intactness model values represents the numeric output of a “fuzzy logic” model, which used various input data, including degree of vegetation development, level of habitat fragmentation, development levels, fire effects, and levels of invasives penetration. The numeric output was divided into six classes of intactness from very low to very high.

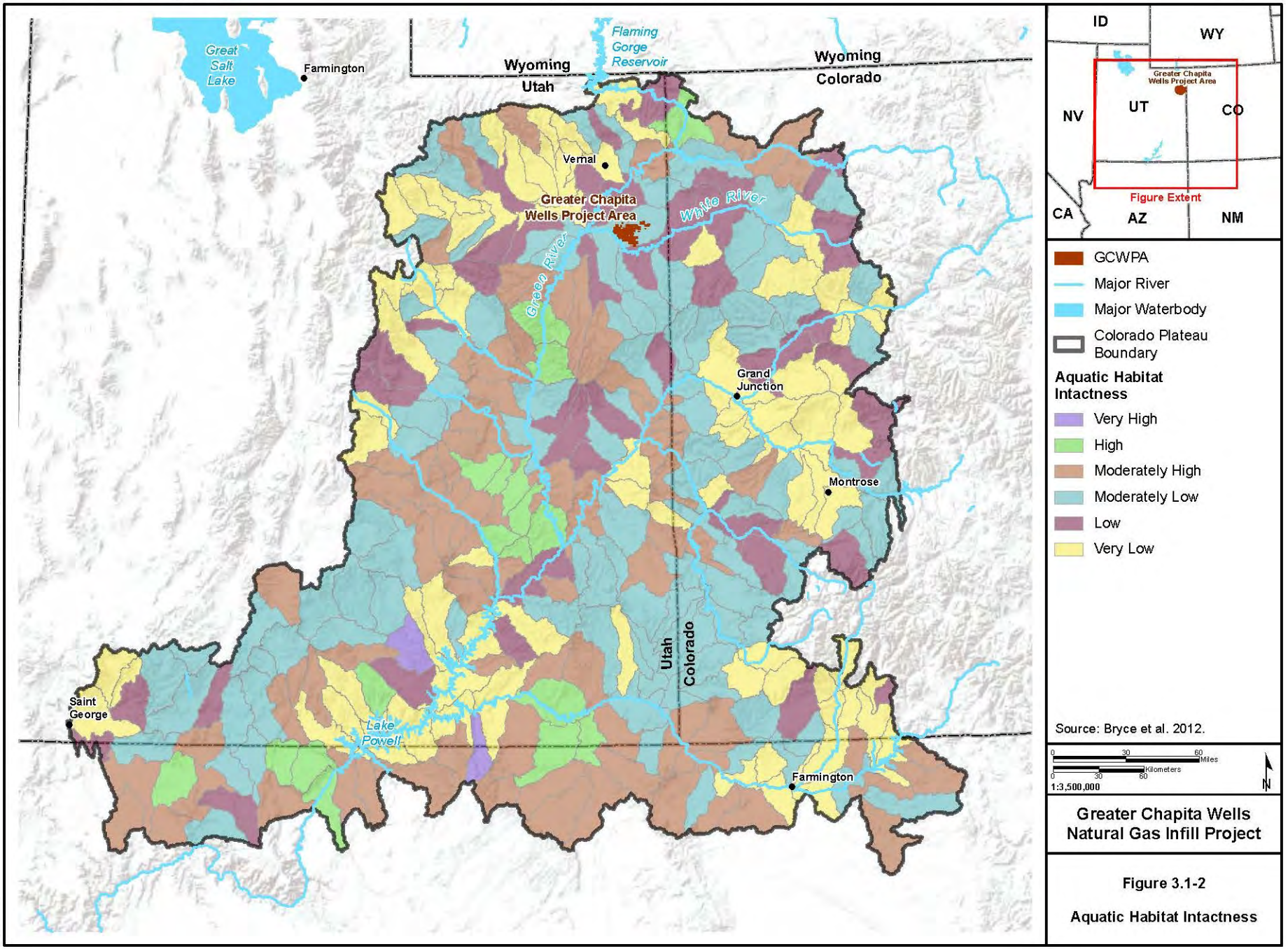
Table 3.1-1 COP REA Conservation Elements

Ecological Systems	Region %	Wildlife Species Terrestrial Species	Designated Sites Terrestrial Sites	Ecosystem Functions and Services Terrestrial Functions
Colorado Plateau Pinyon-Juniper	20.4	Black-footed ferret	The Nature Conservancy Portfolio Sites	
Inter-Mountain Basins Big Sagebrush	9.1	Desert bighorn sheep	Important bird areas (Audubon)	Soil stability
		Gunnison's prairie dog	Historic and Nationally Designated Trails	
Inter-Mountain Basins Montane	3.9	Mountain lion	Wilderness Areas	Biological soil crust
		Mule Deer	Wilderness Study Areas	
Colorado Plateau Mixed Bedrock	10.6	Pronghorn antelope	Historic Districts	Water Availability
		White-tailed prairie dog	National Wildlife Refuges	
Rocky Mountain Gambel Oak-Mixed	4.5	American peregrine falcon	Monuments	Aquatic systems (streams, lakes, ponds)
		Burrowing owl	National and State Parks	
Colorado Plateau Pinyon-Juniper Shrubland	6.3	Ferruginous hawk	National Conservation Areas	Springs/seeps/wetlands
		Golden eagle	BLM Areas of Critical Concern	
Colorado Plateau Blackbrush-Mormon-Tea Shrubland	6.3	Greater sage-grouse	USFS Research Natural Areas	Riparian areas
		Gunnison sage-grouse	State Wildlife Management Areas	
Inter-Mountain Basins Mixed Salt Desert Scrub	5.4	Mexican spotted owl	Wild and Scenic Rivers	High quality and impaired waters
		Yellow-breasted chat	Designated Recreation Management Areas	
TOTAL	66.5	**Aquatic Species**	**Aquatic Sites**	Groundwater aquifers
		Colorado River cutthroat trout	The Nature Conservancy Portfolio Sites	
		Flannelmouth sucker		
		Razorback sucker		

Source: Bryce et al. 2012.



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Greater Chapita Wells Natural Gas Infill Project

Figure 3.1-2

Aquatic Habitat Intactness

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The percentage values in each class represent the percentages within the distribution of the numeric output, rather than a direct measure of the ground acreage percentages. The modeled output values are, however, likely to be representative of the degree of varying levels of intactness of each species habitat. A table summarizing general intactness values by species is included as **Table 3.1-2**.

Table 3.1-2 Indicator Wildlife Species Intactness within the Colorado Plateau

Species	Intactness Class (% of Model Distribution) [1]					
	Very High	High	Medium High	Medium Low	Low	Very Low
Terrestrial Species						
Black-footed ferret	0	0	14	32	22	32
Mountain lima	4	16	3	1	0	76
Mule deer	3	13	29	24	17	14
Pronghorn antelope	3	10	29	23	17	18
White-tailed prairie dog	0	1	13	25	19	42
American peregrine falcon	4	24	33	20	14	5
Burrowing owl	3	16	29	20	15	17
Ferruginous hawk	3	17	28	20	15	17
Golden eagle	4	18	31	22	15	10
Greater sage-grouse	1	5	35	34	16	9
Yellow-breasted chat	1	8	26	30	21	14
Aquatic Species						
Flannelmouth sucker	2	8	25	25	22	18
Razorback sucker	1	11	25	17	19	27

[1] Percentage values in each intactness class represent the percentages in each of six numeric model distribution classes based on output model values of -1.0 to 1.0. The percentages do not relate directly to percentage of species intactness area within the Colorado Plateau.

Source: Bryce et al. 2012.

Of 16 types of sites of conservation concern, 2 sites overlap portions of the GCWPA. The BLM Red Wash Open OHV Area overlaps approximately 230 acres of the extreme northern portion of the GCWPA. Within the GCWPA is located the BLM Fantasy Canyon Special Recreational Management Area, a site of geological interest encompassing approximately 70 acres.

3.2 Geology, Minerals, and Energy Production

3.2.1 General Geology and Physiography

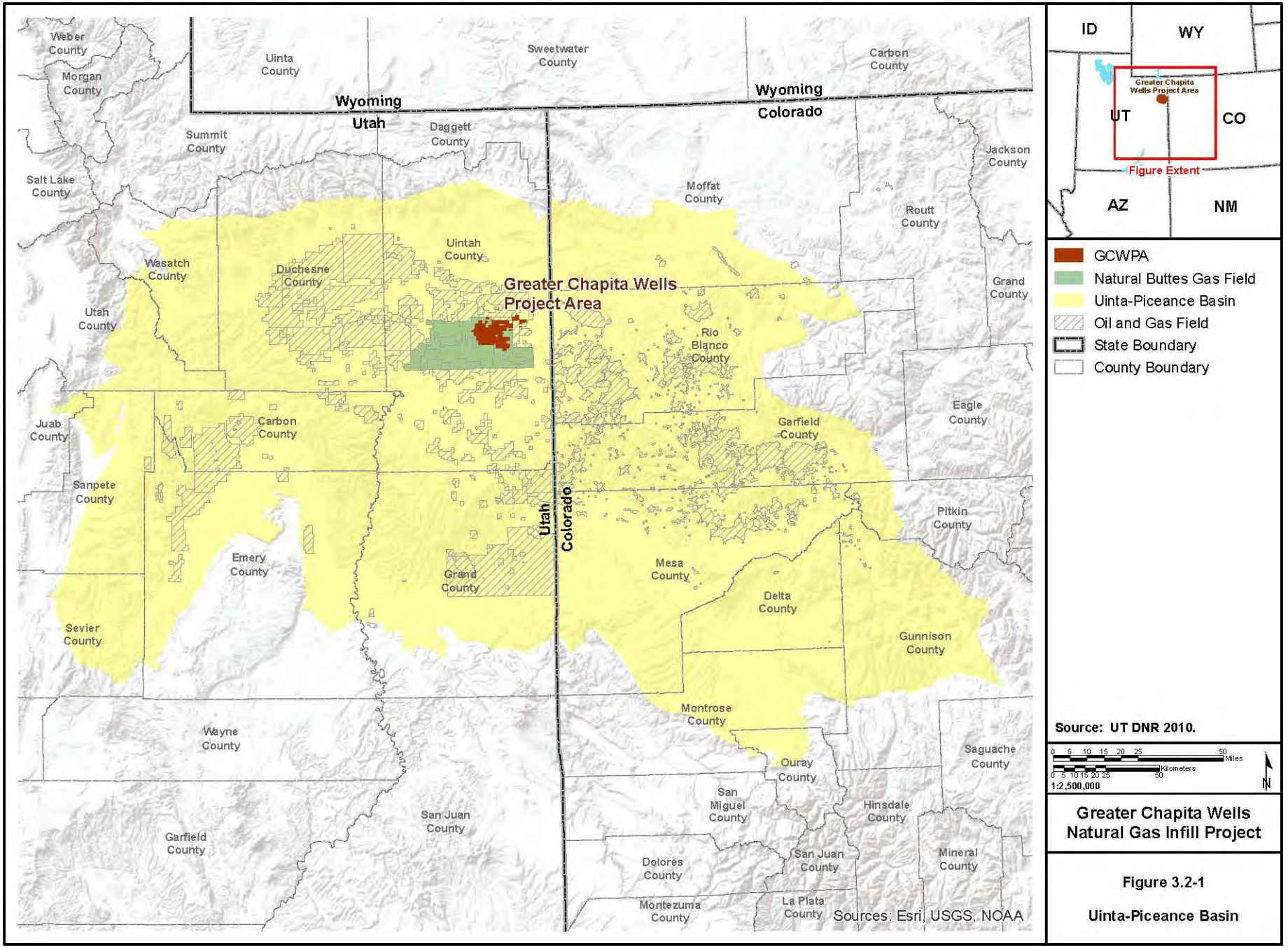
Topography in the GCWPA is controlled by a series of generally southwesterly or northeasterly trending streams (e.g., Red Wash) that are tributary to west-northwesterly streams (e.g., Coyote Wash and the White River). Elevations range from approximately 4,700 feet where the White River exits the GCPWA, to 5,600 feet in the southeastern portion. The terrain is moderately to heavily dissected upland, with prominent badlands associated with the Duchesne River Formation in the northeastern portion of the GCWPA that reach elevations up to 5,300 feet. An additional prominent topographic feature is the White River Canyon, which crosses the extreme southwestern portion of the GCWPA. Canyon wall slopes may exceed 75 percent with numerous vertical cliffs and relief of up to 200 feet. The floodplain is well developed and, within the GCWPA, varies from approximately 500 to 2,500 feet wide.

Physiographically, the GCWPA is located within the East Tavaputs Plateau portion of the Colorado Plateau province (Fenneman 1931), and the east central portion of the Uinta Basin (Stokes 1977). Tectonically, the Uinta Basin is an east-west trending asymmetrical structure with the deepest portion closer to the steeply dipping northern margin formed by the Uinta Mountains uplift. The more gently dipping southern portion of the basin, including the GCPWA, terminates to the south in a series of prominent regional cliffs (Badland, Book, and Roan cliffs). The western margin is formed by the Wasatch Plateau and the eastern margin by the Douglas Creek Arch, which separates the Uinta Basin from the Piceance Basin to the east. The Uinta Basin is considered to have formed contemporaneously with uplift of the adjacent Uinta Mountains during the Laramide Orogenic episode of Paleocene and Eocene time (Hintze 1988). The Uinta-Piceance Basin province and general location of the GCWPA are illustrated in **Figure 3.2-1**. Rocks in the GCWPA generally dip north northwest towards the center of the basin.

Geologic mapping of the entire GCWPA has been accomplished at a scale of 1:100,000 (Sprinkel 2007, 2009). Geologic units exposed within the GCWPA are described in **Table 3.2-1** and illustrated in **Figure 3.2-2**. Almost 24 percent of the area (10,283 acres) is underlain by various unconsolidated to semi-consolidated clastic units of Quaternary age. The majority of these units are a mix of alluvium or alluvium and colluvium. Alluvial fan deposits are present in the northeastern part of the GCWPA with slump deposits occurring along a small portion of the White River south of Coyote Wash on Tribal lands. Formations exposed within and near the GCWPA are described in a stratigraphic column (**Figure 3.2-3**).

Approximately 75 percent of the surface in the GCWPA (32,098 acres) is formed by portions of the Middle Eocene Uinta Formation. A small area (690 acres) in the north portion of the GCWPA is formed by the Brennan Basin Member (lower portion) of the overlying Middle-Late Eocene Duchesne River Formation. The exposed portions of the Duchesne River Formation often consist of cross-stratified sandstone interbedded with finer grained clastics. The formation is largely fluvial in origin, deposited by south-flowing streams running from the Uinta Mountains. Deposition of the formation resulted in the final filling of the Uinta Basin (Andersen and Picard 1972; Stokes 1986).

The Uinta formation consists of fluvial sediments with some interbedded tuffs and may exceed 1,600 feet in thickness. The formation represents encroachment of highland-derived fluvial sediments from the north onto the margins of ancient Lake Uinta, the depositional setting for the underlying and semi-contemporaneous Green River Formation rocks. The two formations exhibit complex interfingering relationships (Franczyk et al. 1992; Hail 1987). The Uinta Formation is subdivided into an upper Myton Member and lower Wagonhound Member, which are exposed within the GCWPA. A sedimentary section in excess of 20,000 feet in thickness underlies the GCWPA (Osmond 1992).



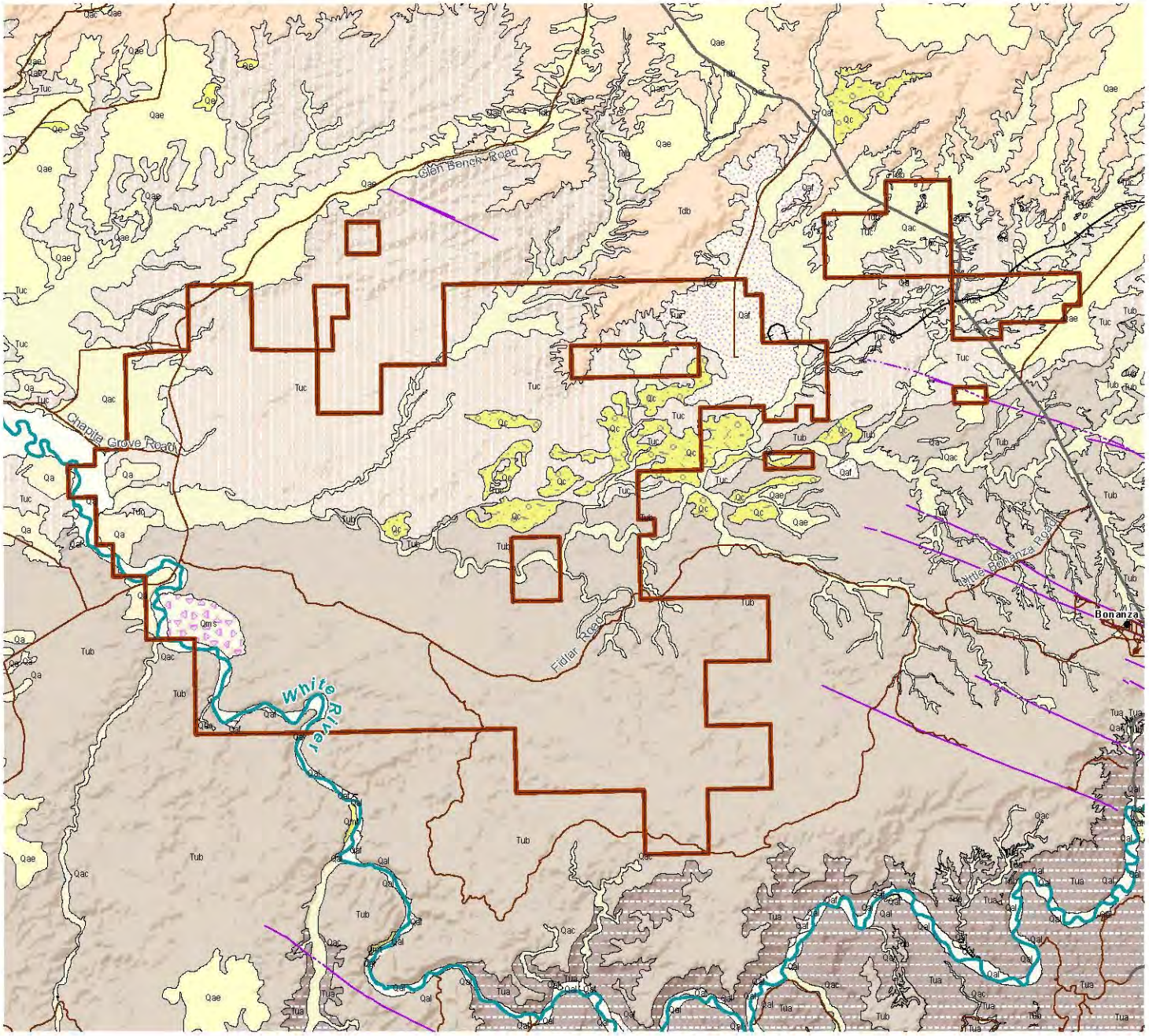
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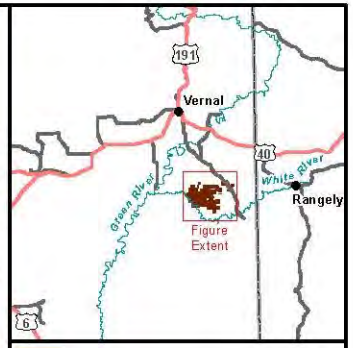
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Table 3.2-1 Geologic Units Exposed within the GCWPA

Symbol	Unit	Age	Description	Exposure	
				(acres)	(%)
Qal	Quaternary Alluvium	Holocene	Unconsolidated silt, sand, and gravel found along the White River (thickness <100 feet).	871	2.0
Qaf	Quaternary Alluvial Fan Deposits	Holocene	Unconsolidated, poorly sorted boulders, gravel, sand, and silt, Sections 26, 27, 34-36, T8S, R23E (thickness <100 feet).	1,550	3.6
Qac	Quaternary Mixed Alluvium and Colluvium	Holocene	Unconsolidated mud, silt, sand, and gravel in intermittent drainages and areas of low relief in the north half of the GCWPA (thickness <30 feet).	4,615	10.7
Qae	Quaternary Mixed Alluvium and Eolian Deposits	Holocene	Unconsolidated mixed alluvial and windblown mud, silt and sand in the extreme northeastern portion of the GCWPA (thickness <30 feet).	274	0.6
Qc	Quaternary Colluvium	Holocene	Heterogeneous mix of boulders, cobbles, gravel, sand, and silt which grades into alluvial or talus deposits, mainly in flat uplands north of Coyote Wash (thickness up to 100 feet).	1,804	4.2
Qms	Quaternary Slides and Slumps	Holocene and Pleistocene	Earth flow, rotational slumps, and slides in formations prone to slope failure, one area east side of White River and south of Coyote Wash.	531	1.2
Qa	Piedmont and Basin Alluvium	Holocene and Pleistocene	Variably consolidated, poorly to moderately sorted sand, gravel, and cobbles on flat bedrock, along the White River and at the mouth of Coyote Wash (thickness <10 feet).	640	1.5
Tdb	Brennan Basin Member of Duchesne River Formation	Middle Eocene	Fine- to medium-grained lithic sandstone and siltstone, minor mudstone and conglomerate, intertongues with Uinta Formation, forms badlands in central North Chapita area (thickness 750 to 2,000 feet).	690	1.6
Tuc	C Member (Myton Member equivalent) of Uinta Formation	Middle Eocene	Mudstone, claystone, and minor sandstone, forms much of the surface north of Coyote Wash and forms the badlands topography at Fantasy Canyon (thickness 200 to 800 feet).	13,516	31.4
Tub	B Member (Upper Wagonhound Member equivalent) of Uinta Formation	Middle Eocene	Mudstone and claystone with interbeds of fine-grained sandstone, minor conglomerate and tuffaceous beds, contains gilsonite deposits and forms most of the surface south of Coyote Wash thickness about 900 feet).	18,581	43.1

Source: Sprinkel 2007, 2009.





GCWPA
Gilsonite vein, well located
Gilsonite vein, approximately located
Gilsonite vein, concealed
Contact, well located
Qal Stream alluvium
Qa Piedmont alluvium, undivided
Qat Terrace deposits
Qaf Alluvial-fan deposits
Qac Mixed alluvium and colluvium
Qae Mixed alluvium and eolian deposits
Qe Eolian deposits
Qc Colluvium
Qmt Talus deposits
Qms Mass movements, slides, slumps and flows
Tdb Brennan Basin Member of Duchesne River Formation
Tuc Member C of Uinta Formation
Tub Member B of Uinta Formation
Tua Member A of Uinta Formation

Source: UGS 2009, NHD 2015, UDOT 2013, Utah PLSS 2015.

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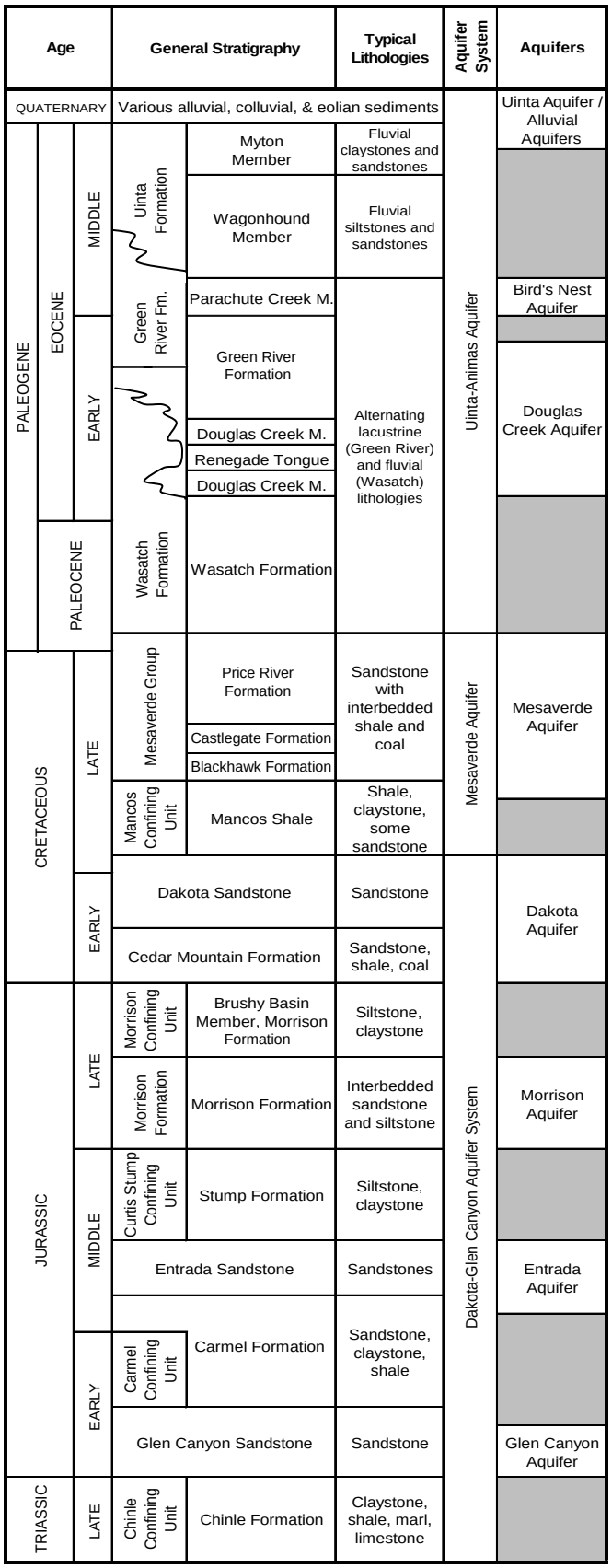
Greater Chapita Wells Natural Gas Infill Project

Figure 3.2-2

Geologic Formations in the GCWPA Vicinity

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Source: Robson and Banta 1995; BLM 2012c.

Gray Units are Resistant to Groundwater Flow

Greater Chapita Wells Natural Gas Infill Project

Figure 3.2-3

General Stratigraphy and Water Bearing Units

3.2.2 Oil and Gas Resources

The Uinta Basin is a prolific producer of oil and gas. In 2013, Uintah and Duchesne counties, which comprise the bulk of the basin, ranked first and third, respectively, for gas production and second and first, respectively, for oil production in the State of Utah (UDOGM 2014a). The major productive horizons include the Tertiary Green River and Wasatch formations, the Cretaceous Mesaverde Group and Dakota Sandstone Formation, the Jurassic Navajo Formation, and the Pennsylvanian Weber Formation.

The GCWPA overlaps portions of the UDOGM-recognized Natural Buttes and Big Valley gas fields (Wood and Chidsey 2015). Production is attained from stratigraphic traps on northwest regional dips. Reservoirs in the area include lacustrine marginal sandstones of the Green River Formation, fluvial sandstones of the Wasatch Formation, various fluvial, alluvial fan, and deltaic sandstones of the Mesaverde Group, and limited production from other stratigraphic units. Oil production, typically exhibiting rapid decline, has been obtained from fewer than 100 wells located mainly in the northern portions of the area. The gas sands within the Wasatch and Mesaverde reservoirs tend to be “tight” (i.e., having low permeabilities) with resultant low flow rates. A rapid development phase in the area followed completion of the Natural Buttes field discovery well in 1952 (Osmond 1992), and all but the extreme northeast portions of the GCWPA are assigned by UDOGM to the Natural Buttes Field. Approximately 960 acres of the northeast portion of the GCWPA, containing two producing wells, is assigned to the Big Valley Field by UDOGM. As of March 2014, there were 1,247 productive (producing, temporarily abandoned, or shut-in awaiting pipeline connection) wells within the GCWPA. According to February 2014 UDOGM GIS data, the GCWPA includes approximately 25 percent of all productive and shut-in wells within the Natural Buttes Field (UDOGM downloadable GIS data).

Individual well production for years since 1984 is available from the UDOGM online database. Production from 45 wells completed prior to 1984 has not been determined. Since 1984, cumulative production for the GCWPA by productive reservoir is indicated in **Table 3.2-2**.

Since 1984, cumulative gas production from the Natural Buttes Field exceeds 2,907 billion cubic feet (BCF) and the field has been the largest single gas producer in Utah since 2005. In 2013, the field was responsible for 58 percent of total gas production in the state, and the GCWPA represents approximately 20 percent of cumulative field production. Higher gas prices and improved technology for producing tight gas sands has resulted in steadily increasing field production since 1997, as illustrated in **Figure 3.2-4**.

Until recently, the Wasatch Formation represented the principal producing zone in the GCWPA. Almost all of the remaining production is from the Mesaverde Group or combined production from the Wasatch and Mesaverde Group. Cumulative production from the two formations through 2013 is nearly equal. Both the Wasatch and Mesaverde productive sandstones are classified as “tight” sands, with average permeabilities of less than 0.1 millidarcy, with Mesaverde reservoirs generally being tighter and slightly overpressured. Maximum porosities are 18 percent with average porosity of 10 to 14 percent for the Wasatch and 8 to 12 percent for the Mesaverde reservoirs. The produced natural gas has heating values of 1,048 to 1,179 British thermal units per cubic foot (Osmond 1992).

Instruments lowered into the oil and gas wells which measure various rock properties are known as electric logs. A type electric log illustrating the subsurface geology in the GCWPA is shown in **Figure 3.2-5**. A subsurface cross-section of the GCWPA is illustrated in **Figure 3.2-6**.

Table 3.2-2 GCWPA Cumulative Production by Reservoir, 1984 through 2013

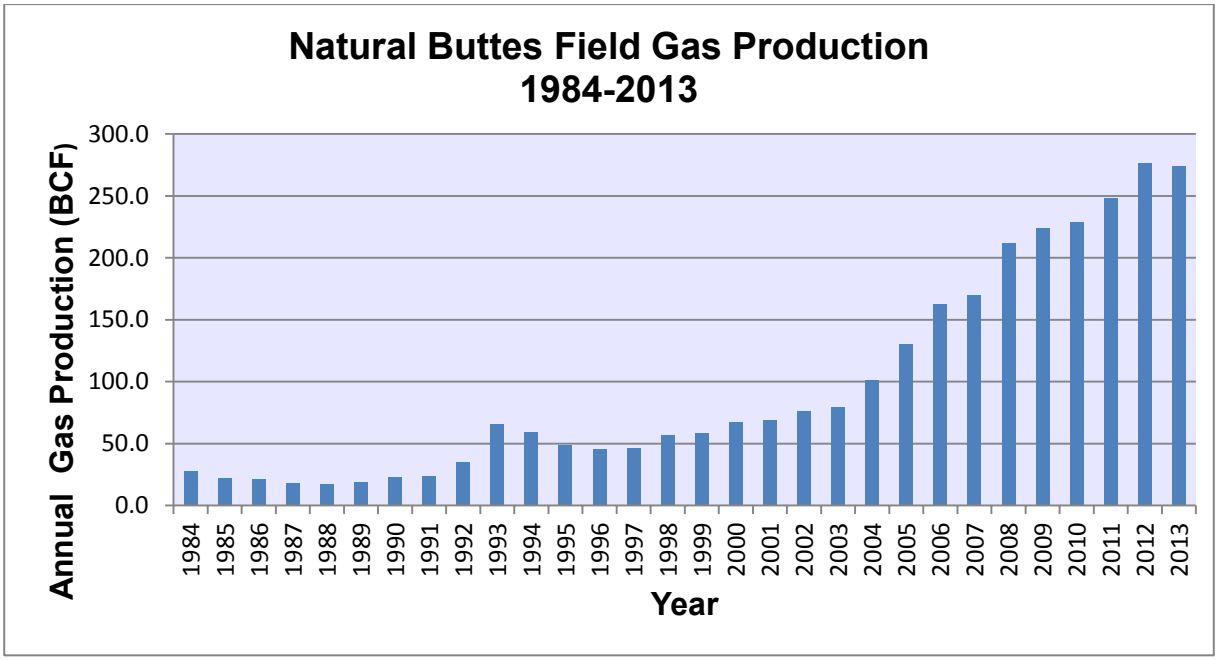
Reservoir	Productive Wells	Cumulative Oil[1] (barrels)	Cumulative Gas (MCF)	Cumulative Water (barrels)
Green River	3	4,901	875,660	31,816
Green River/Wasatch	6	227,670	227,034	144,330
Wasatch	424	571,347	248,840,377	3,326,129
Wasatch/Mesaverde	208	2,217,411	74,140,803	17,094,785
Mesaverde	602	6,585,822	256,081,041	35,088,728
Mesaverde/Mancos	4	68,429	2,958,634	141,016
Total	1,247	9,675,580	583,123,549	55,826,804

[1] UDOGM does not separately track oil versus condensate.

Source: EOG and UDOGM 2014.

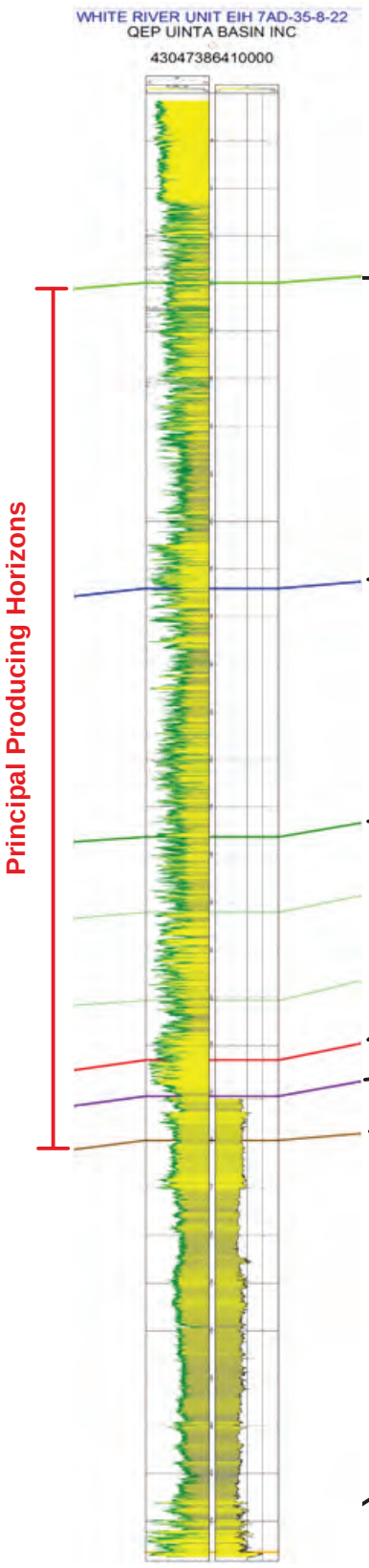
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4 Source: Osmond 1992; UDOGM 2014a.

5 **Figure 3.2-4 Cumulative Natural Buttes Field Gas Production Since 1984**



Principal Producing Horizons

Green River
Lacustrine & Deltaic
Tertiary
~ 2600' – 3200' thick
~ 1500' – 2600' net sand

Wasatch
Fluvial & Deltaic
Tertiary
~ 2000' – 2500' thick
~ 750' – 1400' net sand

Mesaverde Group

Price River
Fluvial
Upper Cretaceous
~ 2000' – 2500' thick
~ 1200' – 1700' net sand

Castlegate
Fluvial
Cretaceous
~ 350' – 650' thick
~ 200' – 350' net sand

Blackhawk
Shoreline
Cretaceous
~ 350' – 650' thick
~ 50' – 300' net sand

Mancos
Marine mudstone
Cretaceous
~ 3500' – 4500' thick

1,000 ft.

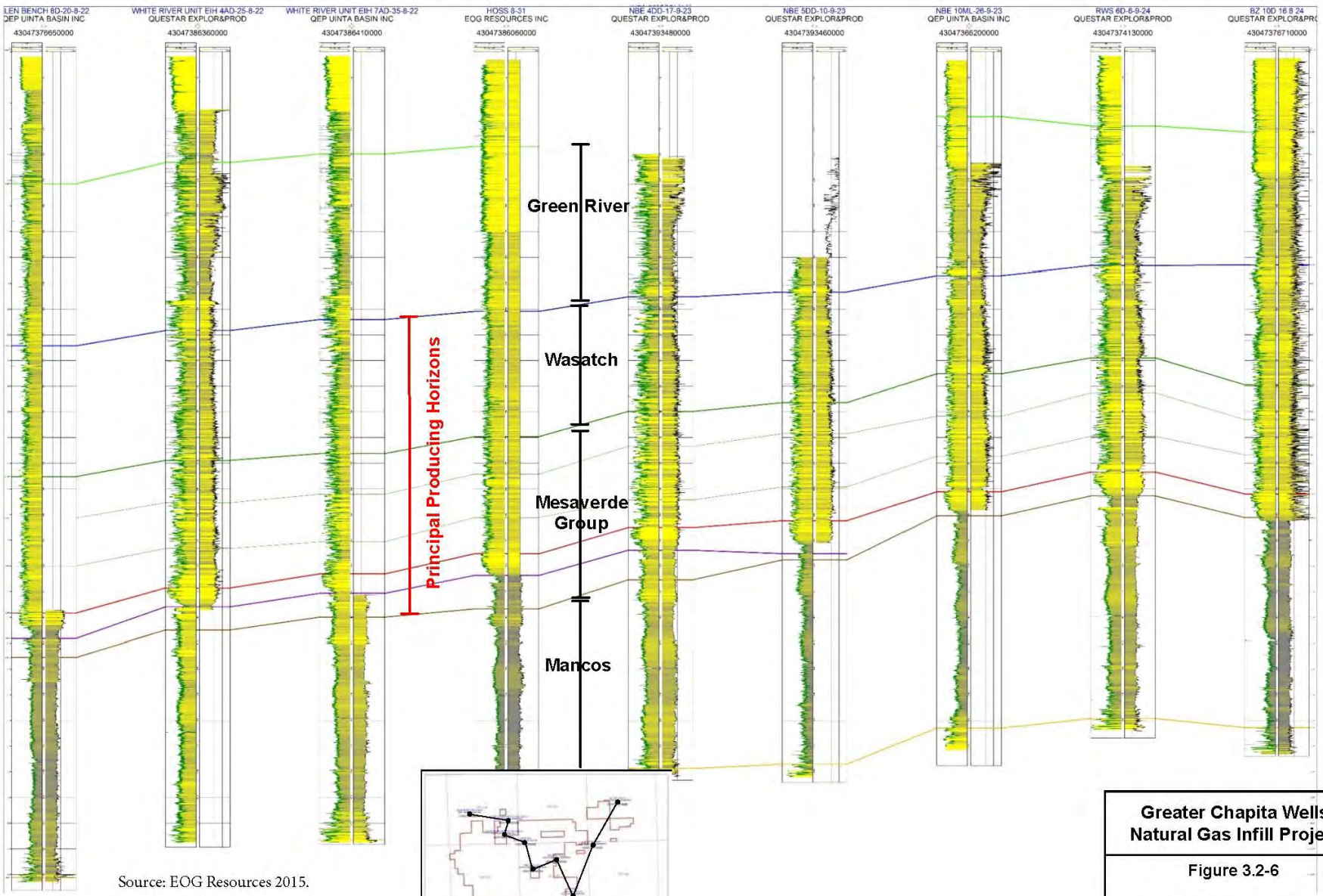
Dakota
Fluvial, Shoreface, & Marine
Lower Cretaceous
Logs cover the uppermost Dakota only due to insufficient TD depths

Source: EOG Resources 2015.

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Figure 3.2-5

GCWPA Type Electric Log with Subsurface Geology



Source: EOG Resources 2015.

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Figure 3.2-6

GCWPA Subsurface Cross-Section

3.2.3 Mineral Resources

3.2.3.1 Gilsonite

Gilsonite is the American Gilsonite Company's trademarked name for the mineral uintaite or uintahite. Gilsonite is a black hydrocarbon resin similar to coal or asphalt in appearance. The mineral's chemical properties make it useful in the production of dark-colored printing inks and paints, oil well drilling muds and cements, asphalt modifiers, and various chemical products (BLM 2002a). The origin of the gilsonite is believed to be the oil shale-rich portions of the Green River Formation. During times of maximum burial, hydrocarbon generation and fluid expulsion in the oil shales is believed to have led to forceful emplacement of bitumen into vein fractures in overlying strata (Monson and Parnell 1992).

The vicinity of the GCWPA coincides with sets of concentrated gilsonite-bearing veins over an area of approximately 30 by 64 miles. At least 71 veins have been mapped in the area. The veins are vertical, vary from a few inches to up to 30 feet wide, and extend in a roughly north 60 degrees west direction for distances of up to 12 miles. The gilsonite-bearing veins represent the world's largest known deposit, with original resources estimated at around 45 million tons, and the Uinta Basin is the only known place where large quantities are commercially produced. Nearby mapped veins that contain, or have the potential to contain, gilsonite are identified with the Bonanza Area vein set and are mapped to the east and just north of the GWCPA. Only one vein crosses an extreme eastern portion of the GCWPA (Boden and Tripp 2012).

In recent years, all of Utah's gilsonite production has been obtained from three active mines located near Bonanza, Utah, which were owned by American Gilsonite Company, Ziegler Chemical and Minerals Company, and Lexco, Inc. The American Gilsonite and Ziegler mines are situated within 3 to 5 miles to the east of the GCWPA, while the Cottonwood (Lexco) mine is located approximately 8 miles to the southwest (Bon and Heuscher 2008; Bon and Wakefield 2008). Ziegler Chemical and Minerals Company operates a plant and mill at Little Bonanza, but purchases most of its ore from independent mines. Lexco was acquired by American Gilsonite in 2008 and the mine and mill have been inactive since 2010. Production of gilsonite in recent years (up through 2009) has been 60,000 to 80,000 tons annually (Boden and Tripp 2012). As of June 2009, 200 acres of one authorized federal gilsonite lease and 1,820 acres of pending federal prospect permits were located within the GCWPA (BLM 2009b) and a review of November 2013 BLM LR2000 land records indicate that portions of the GCWPA are within known gilsonite leasing areas. A number of prospecting permits are currently in force. There are no active state gilsonite leases located within the GCWPA (SITLA GIS data). There are no active gilsonite mines located within the GCWPA.

3.2.3.2 Other Mineral Resources

The potential for other mineral resource development within the GCWPA is limited. Kerogen-rich members of the Green River Formation underlie the entire GCWPA and these “oil shales” can be processed to produce oil. In 2012, the BLM revised a final Programmatic EIS that amended 10 RMPs in Utah, Colorado, and Wyoming that made approximately 2 million acres of public lands potentially available for oil shale leasing and 430,000 acres potentially available for leasing for tar sands development. The 2008 ROD for that Programmatic EIS was revised in a 2013 ROD for a revised Programmatic EIS. The main result of the second Programmatic EIS was to reduce the lands potentially available for oils shale and tar sands leasing from those made available in 2008.

Almost the entire GCWPA overlying federal mineral estate has been identified as being within the area potentially developable for oil shale as defined by BLM, indicating areas with inferred high probability for development (BLM 2013d), and approximately 2,680 acres of State mineral estate within the GCWPA has been leased for oil shale development (SITLA mineral leasing GIS data). However, depths to the primary oil shale layers are covered by more than 2,000 feet of overburden over almost the entire GCWPA, making the area less economically desirable for development than areas further to the south.

An existing research and demonstration development oil shale lease is located approximately 6 miles southeast of the GCWPA. As of June 2014, no federal oil shale leases or active mines have been identified within the GCWPA.

Special Tar Sand Areas, indicating the presence of potentially major accumulations of tarry, degraded oil (bitumen), occur mainly around the margins of the Uinta Basin. The discontinuous Chapita Wells minor tar sand area (7.5 to 8 million barrels of bitumen) overlaps southern portions of the GCWPA (BLM 2002a). There are no identified Special Tar Sand Areas located within 6 miles of the GCWPA (BLM 2013d).

Approximately 8,280 acres of federal lands along principal drainages in the GCWPA are open for extraction of mineral materials (i.e., sand and gravel) (BLM 2008b).

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3.3 Air Quality and Greenhouse Gas Emissions

Air quality within the GCWPA has the potential to be affected by activities such as emissions from the construction and operation of oil and gas facilities, access roads, and other elements of the proposed project. Regional air quality also is affected by natural events such as windstorms and wildfires. Natural events generally are short lived, lasting from several hours to perhaps several days. The effects during these events may impact human health and the environment, and generally are considered part of the natural and physical environment. The GCWPA air quality study area is defined as the Uinta Basin. This section describes the existing air quality resource of the region and the applicable air regulations that would apply to the Proposed Action and alternatives.

3.3.1 Air Quality

Air quality in a given location is defined by pollutant concentrations in the atmosphere and is generally expressed in units of ppm or micrograms per cubic meter ($\mu g/m^3$). Both long-term climatic factors and short-term weather fluctuations are considered part of the air quality resource because they control dispersion and affect concentrations. Physical effects of air quality depend on the characteristics of the receptors and the type, amount, and duration of exposure.

3.3.1.1 Regulatory Framework

Ambient air quality and the emission of air pollutants are regulated under federal and state regulations as discussed below.

Federal Clean Air Act

The Federal Air Pollution Control Act ("Clean Air Act," [CAA]) amendments of the 1990s require all states to control air pollution emission sources so that the National Ambient Air Quality Standards (NAAQS) are met and maintained. In addition to these requirements, the NPS Organic Act requires the NPS to protect the natural resources of the lands it manages from the adverse effects of air pollution. Nearby national parks and distances from GCWPA include Arches National Park (130 kilometers [km]), Canyonlands National Park (170 km), and Capitol Reef National Park (230 km).

A list of the pollutants regulated under the CAA for which specific concentration levels have been established (criteria pollutants), and the applicable ambient air quality standards (AAQS) are listed in **Table 3.3-1**. Primary standards set limits to protect public health, including the health of "sensitive" populations (i.e., asthmatics, children, and the elderly). Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. Areas in which standards may be exceeded, but for which adequate monitoring data are not available, are designated as being "unclassifiable."

The CAA directs the USEPA to delegate primary responsibility for air pollution control to state governments. The State of Utah has adopted the NAAQS as state air quality standards. Collectively these are referred to as AAQS.

Table 3.3-1 Ambient Air Quality Standards

Pollutant	Averaging Time	Utah Standards	National Standards		Form of the National Standards
		Concentration	Primary	Secondary	
Ozone (O_3)	8-Hour (ppm)	0.070	0.070	0.070	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Carbon Monoxide (CO)	1-Hour (ppm)	35	35	-	Not to be exceeded more than once per year
	8-Hour (ppm)	9	9	-	
Sulfur Dioxide (SO_2)	1-Hour (ppb)	75	75	-	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	3-Hour (ppm)	0.5[1]	-	0.5	Not to be exceeded more than once per year
Nitrogen Dioxide (NO_2)	1-Hour (ppb)	100	100	-	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Annual Average (ppb)	53	53	53	Annual Mean
PM_{10}[2]	24-Hour ($\mu g/m^3$)	150	150	150	Not to be exceeded more than once per year on average over 3 years
$PM_{2.5}$[2]	24-Hour ($\mu g/m^3$)	35	35	35	98th percentile, averaged over 3 years
	Annual Average ($\mu g/m^3$)	15	12	15	annual mean, averaged over 3 years
Lead	Rolling 3 Month Average ($\mu g/m^3$)	0.15	0.15	0.15	Not to be exceeded

[1] Secondary standard.

[2] PM_{10} indicates particulate matter smaller than 10 microns in aerodynamic diameter, $PM_{2.5}$ is particulate matter smaller than 2.5 microns in aerodynamic diameter.

Source: USEPA 2017a; UDEQ 2010.

Prevention of Significant Deterioration

PSD regulations apply to proposed new or modified major sources located in an attainment area that have the potential to emit criteria pollutants in excess of predetermined *de-minimis* values (40 CFR Part 51). PSD regulations restrict the degree of ambient air quality deterioration that would be allowed. Increments for criteria pollutants are based on the PSD classification of the area. Class I areas are assigned to federally protected wilderness areas (such as national parks) and allow the lowest amount of permissible deterioration. Class II areas[1] are designed to allow for moderate, controlled growth, and Class III areas allow for heavy industrial use. Currently there are no areas designated as Class III nationally

Federal PSD Class I areas, which include certain national wilderness areas, national memorial parks, and national parks, are afforded the highest level of protection. Ambient air modification criteria that apply within Class I areas are more stringent than those that apply to other areas. In addition to more stringent ambient air increments, Class I areas also are protected by the regulation of air quality related values (AQRVs) within their borders. Federal Land Managers (FLMs) are responsible for the management of PSD Class I areas. The nearest Class I area to the GCWPA is Arches National Park, which is approximately 80 miles (130 km) south of the GCWPA.

Predicted air concentrations of SO_2, NO_2, $PM_{10,}$ and/or $PM_{2.5}$ would be compared with PSD increments as part of federal and state air permit requirements if project emissions exceed regulatory thresholds. The assessment of Proposed Action impacts relative to PSD increments presented in Chapter 4.0 is for informational purposes only and does not represent a regulatory PSD increment consumption analysis. The allowable PSD increments for Class I and Class II areas are given in **Table 3.3-2**.

Table 3.3-2 Class I and Class II Area PSD Increments

PSD Class	Pollutant	Allowable Increment (µg/m^3)		
		Annual Arithmetic Mean	24-hour Maximum	3-hour Maximum
Class I	NO_2	2.5	-	-
	SO_2	2	5	25
	PM_{10}	4	8	-
	$PM_{2.5}$	1	2	-
Class II	NO_2	25	-	-
	SO_2	20	91	512
	PM_{10}	17	30	-
	$PM_{2.5}$	4	9	-

Source: 40 CFR 52, §52.21.

Hazardous Air Pollutants

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

[1] Federal recreation areas, national monuments, national lakeshores, national seashores, and other Non-Class I wilderness areas are generally considered to be sensitive Class II areas. The designation of these Class II areas as 'sensitive' is left to the discretion of the FLM agencies that administer them.

Existing sources of HAPs in the GCWPA include compressors (which emit benzene, ethylbenzene, formaldehyde, toluene, and xylenes) and glycol dehydrators (which emit benzene, toluene, ethyl benzene, hydrogen sulfide, and xylenes). Neither the State of Utah nor the USEPA have established HAP standards. However, the 1990 CAA amendments established a program to regulate emissions of 187 HAPs from particular industrial sources. The Act required the USEPA to regulate emissions of these HAPs by developing and promulgating technology-based emissions standards based on the best-performing similar facilities in operation. The national emission standards for hazardous air pollutants established by USEPA are commonly called maximum achievable control technology (MACT) standards. MACT standards are designed to reduce HAP emissions to a maximum achievable degree, taking into consideration the cost of reductions and other factors.

The significance criteria used by the USEPA to assess HAP impacts are reference concentrations (RfC) for chronic inhalation exposure and RELs for acute inhalation exposures. The RfC represents the maximum concentration at which no appreciable risk of harmful health effects would occur with the human population, including sensitive groups. The REL is the maximum acute concentration (i.e., 1-hour average) for which no adverse health effects would occur with the human population. The UDAQ has developed criteria for use in evaluating potential health and environmental impacts and obtaining more detailed information during the air permitting process. The Division has adopted Toxic Screening Levels (TSLs) based upon threshold values developed by the American Conference of Governmental Industrial Hygienists as guidelines for potential HAPs emissions of permitted facilities. Reference concentrations and TSLs for HAPs commonly associated with oil and gas development are indicated in **Table 3.3-3**.

Table 3.3-3 Selected Hazardous Air Pollutants Reference and Screening Levels

HAP	Acute REL[1] (1-hour Exposure) ($\mu g/m^3$)	Non-Carcinogenic Reference Concentration for Chronic Inhalation[2] (Annual Average) ($\mu g/m^3$)
Benzene	1,300	30
Toluene	37,000	5,000
Ethylbenzene	350,000[3]	1,000
Xylenes	22,000	100
n-Hexane	390,000[3]	700
Formaldehyde	55	9.8

[1] USEPA Air Toxics Database, Table 2 (USEPA 2014a).

[2] USEPA Air Toxics Database, Table 1 (USEPA 2014b).

[3] No REL available for these HAPs. Values shown are from Immediately Dangerous to Life or Health (IDLH/10), USEPA Air Toxics Database, Table 2 (USEPA 2014a).

3.3.1.2 Regional Air Quality

Criteria Pollutants

Representative ambient background levels of certain criteria pollutants are shown in **Table 3.3-4**.

Table 3.3-4 Uinta Basin Background Ambient Air Quality Estimates

Pollutant	Averaging Period	Units	Ambient Concentrations			Ambient Air Quality Standard (AQS) Station ID
			2010	2011	2012	
CO	8-hour[1]	ppm			1.9	49-047-5632: Vernal, UT
	1-hour[1]	ppm			4	
NO_2	1-hour[2]	ppb	32	34	25	49-047-2002: Vernal, UT
	Annual[3]	ppb	5	5	4	
O_3	8-hour[4]	ppm	0.098	0.1	0.067	49-047-2002: Vernal, UT
$PM_{2.5}$	Annual[3]	µg/m^3			6	49-013-0002: Duchesne County, UT
	24-hour[5]	µg/m^3			26	
PM_{10}	24-hour[1]	µg/m^3			104	
SO_2	1-hour[6]	ppb	27	18	20	49-035-0012: Salt Lake City, UT
	3-hour[7]	ppm	0.031	0.02	0.029	

[1] Annual maximum value.

[2] 98th percentile of 1hour daily maximum.

[3] Annual mean.

[4] Annual fourth-highest daily maximum 8-hour concentration.

[5] 98th percentile of 24-hour concentrations.

[6] 99th percentile of 1-hour daily maximum concentrations.

[7] Annual highest second high 1-hour daily maximum concentration.

Source: USEPA 2015a.

Ozone is a criteria pollutant of concern in areas of oil and gas development in the western U.S. Ozone is formed when a subset of hydrocarbons (also known as volatile organic compounds, or VOCs) and NO_X chemically react in the presence of sunlight. Hydrocarbons are emitted from automobiles, gasoline stations, paint, degreasers, cleaning fluids, and many other sources, including equipment and facilities associated with oil and gas development. Plants also emit some reactive hydrocarbons (such as terpenes from pine trees). NO_X are emitted by automobiles, power plants, engines, turbines, and other combustion processes.

One of the main air quality concerns in the Uinta Basin is the elevated ground level ozone levels measured during the winter. Several winter episodes of elevated 8-hour ozone concentrations have been measured in the Uinta Basin since monitoring began in 2009. The AAQS for the 8-hour average ozone concentration is 70 ppb, computed as the annual fourth-highest daily maximum concentration averaged over three consecutive years. In the Uinta Basin, observed 8-hour average concentrations have exceeded 130 ppb during the early spring in 2013. These episodes of elevated ozone concentrations occur for at least a few days most winters and typically in the late winter and early spring when a stable high-pressure system forms and when the basin has uniform snow cover (Energy Dynamics Laboratory 2011). Sustained ozone concentrations of 60 to 70 ppb are evident in these areas during summer conditions as well (USEPA 2016a). The 2012-2014 design value for Uintah County is 76 ppb (USEPA 2016b). A design value is a statistic that describes the air quality status of a given location relative to the level of the NAAQS (USEPA 2017a).

Utah has been in attainment to the federal ozone standard since the early 1990s. In 1997, the USEPA changed the national ozone standard from a 1-hour standard (0.120 ppm) to a multi-year 8-hour standard (0.08 ppm). Since that change, Utah has continued to attain the 8-hour standard.

On March 12, 2008, the USEPA tightened the 8-hour standard to 0.075 ppm. Then on October 1, 2015, USEPA further tightened the 8-hour standard to 0.070 ppm.

The GCWPA is located within Uintah County within the Uinta Basin. In April 2012, the USEPA designated the ozone attainment status for Duchesne and Uintah counties within the Uinta Basin as unclassifiable based on inadequate available monitoring information. On September 29, 2016, Utah Governor Herbert requested a nonattainment designation from USEPA for portions of Duchesne and Uintah counties within the Uinta Basin (Utah State 2016). USEPA issued a response to Governor Herbert on December 20, 2017, stating that USEPA generally agrees with Utah's recommendation and USEPA intends to designate those portions of Duchesne and Uintah counties below 6,250 feet as nonattainment for the 2015 ozone standard. The GCWPA is in the proposed nonattainment area. Designations are anticipated to be finalized by spring 2018. Background ozone monitoring data available from the Air Quality System Network for the Dinosaur National Monument, approximately 50 km (30 miles) north of the GCWPA, and from the community of Ouray, immediately west of the GCWPA, are shown in **Table 3.3-5**. The CAA provides that conformity requirements are not applicable to newly designated nonattainment areas until 1 year after the effective date of the final nonattainment designation (see 176(c)(6) of the Act and 40 CFR 93.153 (k)).

Table 3.3-5 Air Quality System (AQS) Monitored Ozone Values

Air Quality System	Year	1-Hour Values (ppm)					8-Hour Values (ppm)					
		1st Max	2nd Max	3rd Max	4th Max	Measure Days	1st Max	2nd Max	3rd Max	4th Max	Measure Days	Exceedance days
Ouray (ID: 490472003)	2014	-	-	-	-	-	0.091	0.088	0.083	0.079	119	7
	2013	0.164	0.160	0.155	0.144	246	0.141	0.137	0.134	0.133	352	40
	2012	0.086	0.077	0.076	0.075	150	0.074	0.073	0.072	0.070	149	0
	2011	0.149	0.147	0.139	0.126	225	0.139	0.139	0.133	0.116	261	22
Dinosaur National Monument (ID: 490471002)	2014	0.073	0.070	0.070	0.069	145	0.069	0.065	0.064	0.064	140	0
	2013	0.130	0.124	0.123	0.123	229	0.126	0.120	0.120	0.114	305	31
	2012	0.095	0.091	0.09	0.088	145	0.083	0.080	0.075	0.075	137	2
	2011	0.112	0.112	0.111	0.090	150	0.106	0.106	0.103	0.090	263	8

Source: USEPA 2015a.

Hydrogen Sulfide

H_2S is a flammable, colorless gas that can be toxic at extremely low concentrations. Natural gas from portions of the GCWPA contain variable amounts of H_2S. Natural gas containing H_2S, which is often referred to as sour gas, is typically processed to remove H_2S. The amount of H_2S in the natural gas streams varies depending on the formation. EOG intends to explore and develop all potentially productive subsurface formations underlying the GCWPA including, but not limited to, the Green River, Wasatch, Mesaverde Group (including the Blackhawk), Mancos, and Dakota. **Table 3.3-6** shows the average H_2S concentration in the natural gas stream by formation based on samples collected by EOG Resources.

Importantly, the concentrations shown in **Table 3.3-6** are based on natural gas composition, not ambient air concentrations. When natural gas that contains H_2S is emitted into the atmosphere, the H_2S is diluted and ambient H_2S levels are anticipated to be lower than shown in **Table 3.3-6**. While the USEPA does

not regulate H_2S as a HAP (USEPA 2015b), human exposure to H_2S has side effects ranging from mild to severe. Prolong human exposure of H_2S at ambient levels between 2 and 5 ppm may cause nausea, tearing of the eyes, headaches or loss of sleep. Exposure of H_2S at ambient levels of 20 ppm may cause fatigue, loss of appetite, irritability, poor memory and dizziness. At higher ambient levels, H_2S can damage organs, nervous systems, and respiratory systems potentially leading to death (Occupational Safety and Health Administration 2015). To address H_2S safety concerns, the State of Utah regulates drilling practices for areas known to have elevated quantities of H_2S (R649-3-12). Regulations require safety equipment, such as first aid supplies and protective gear, personal H_2S detection and monitoring systems, and a flaring system on the drill site (Utah 2015).

Table 3.3-6 Average Hydrogen Sulfide Concentrations by Formation

Formation	Average H_2S Concentrations (ppm)
Green River	3.94
Mesaverde	8.46
Mesaverde/Price River	7.53
Wasatch	6.87
Wasatch/Mesaverde/Price River	35.55
Wasatch/Mesaverde/Price River/Blackhawk	0.83
Wasatch Island	3.05

Source: EOG Resources 2015.

3.3.1.3 Pollutant Sources and Characteristics

Most of the current emission sources in the GCWPA consist of oil and gas development facilities and mining sites. However, other stationary sources of criteria pollutants in Uintah County include the Bonanza Power Plant, Vernal Asphalt Plant, and Vernal Phosphate Operations. There also are fugitive dust sources associated with these sites, construction activities, and roadways.

Table 3.3-7, contains an estimate of the total emissions from oil and gas operations in the Uinta Basin for the year 2010.

Table 3.3-7 Estimate of 2010 Emissions from Oil and Gas Operations, Uinta Basin

County	NO_X (tpy)	VOC (tpy)	CO (tpy)	Sulfur Oxides (tpy)	Particulate Matter (PM) (tpy)
Carbon	1,300	3,154	1,249	8	46
Duchesne	5,517	35,417	29,925	7	217
Emery	167	537	195	0	6
Grand	355	2,358	505	1	10
Uintah	9,190	68,239	17,001	17	322
Wasatch	0	0	0	0	0
Total	**16,529**	**109,705**	**48,875**	**32**	**601**

Source: AECOM 2013a.

Principal facility sources of criteria pollutants in Duchesne and Uintah counties, and the estimated amounts emitted in 2011 based on the 2011 USEPA National Emissions Inventory (NEI), are indicated in **Table 3.3-8**.

Table 3.3-8 Principal Source Facility Criteria Pollutant Emissions, Duchesne/Uintah Cos.

Pollutant Emissions (tpy)							Year[2]	Facility	Industry Standard Industrial Classification
CO	NH_3[1]	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC			
Uintah County									
385.1	23.1	6,589.6	525.9	432.8	1,177.6	46.3	2011	Bonanza Power Plant	4911 - Electric Services
36.3	-	0.86	0.50	0.38	0.16	3.75	2011	Vernal Airport	4581- Airports, Flying Fields, and Services
Duchesne County									
44.8	0.041	995.1	3.6	3.6	0.14	126.4	2011	Altamont Main Gas Processing Plant	1311 - Crude Petroleum & Natural Gas
79.2	0.005	351.5	4.3	4.3	0.06	68.0	2011	Altamont East Compressor Station	1311 - Crude Petroleum & Natural Gas
9.1	00.5	216.9	0.7	0.7	0.03	43.0	2011	Altamont West Compressor Station	1311 - Crude Petroleum & Natural Gas
50.4	0.0	455.2	2.9	2.9	0.06	42.1	2011	Altamont South Compressor Station	1311 - Crude Petroleum & Natural Gas

[1] NH_3 = ammonia.

[2] Source: USEPA 2015c.

Principal facility sources of hazardous air pollutants in the Uinta Basin, and the estimated amounts emitted in 2011 based on the 2011 NEI, are indicated in **Table 3.3-9**. Hazardous air pollutants emissions for Duchesne County sources are not provided in the 2011 NEI.

Table 3.3-9 2011 Principal Source Facility Hazardous Air Pollutant Emissions, Uintah Co.

Facility	Pollutant Emissions (tons/year)					
	Benzene	Ethylbenzene	Formaldehyde	Hexane	Toluene	Xylenes (Mixed Isomers)
Uintah County						
Bonanza Power Plant	1.003	0.072	0.185	0.052	0.185	0.028
Vernal Airport	0.071	0.011	0.427	0.002	0.055	0.016

Source: USEPA 2015c.

A detailed listing of emission sources in and around the GCWPA, along with information on how specific sources are addressed in the air quality modeling, is available in **Appendix J** and **Appendix K**.

3.3.1.4 Air Quality Related Values

AQRV thresholds, including potential air pollutant effects on visibility, atmospheric deposition, and the acidification of lakes and streams, are applied to PSD Class I areas and set a level of acceptable change for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. There are no Class I areas located within 100 km of the GCWPA. The High Uintas Wilderness in the Ashley National Forest and Dinosaur National Monument, located approximately 65 and 40 km (40 and 25 miles) north of the GCWPA, respectively, are Class II sensitive areas (Utah Air Quality Board 2006). In addition to the previously mentioned sensitive areas, the following Class I areas and sensitive Class II areas are analyzed as part of the air quality analysis:

- Arches National Park (Class I)
- Bryce Canyon National Park (Class I)
- Canyonlands National Park (Class I)
- Capitol Reef National Park (Class I)
- Dinosaur National Monument (Class II)
- Flaming Gorge National Recreation Area (Class II)
- Goshute Indian Reservation (IR) (Class II)
- High Uintas Wilderness Area (Class II)
- Mesa Verde National Park (Class I)
- Paiute IR (Class II)
- Skull Valley IR (Class II)
- Uintah and Ouray IR (Class II)

Visibility

Visibility can be defined as the distance one can see (a standard visual range) or by the ability to perceive changes in color, contrast, and detail. The most commonly used reference for the latter method is the deciview, which is defined as a change in visibility that is just perceptible to the average person. Scattering and absorption of light by fine pollutant particles results in what is referred to as "haze" and visibility reduction.

Regional haze is visibility impairment caused by the cumulative air pollutant emissions from numerous sources over a wide geographic area. Visibility impairment is caused by particles and gases in the atmosphere. Some particles and gases scatter light while others absorb light; the combination of light scattering and absorption is referred to as total light extinction. The primary cause of regional haze in many parts of the country is light scattering resulting from fine particles (i.e., $PM_{2.5}$) in the atmosphere. Additionally, coarse particles between 2.5 and 10 microns in diameter can contribute to light extinction. Light extinction can be naturally occurring or the result of human activity. Deciview values are calculated from either measured or estimated light extinction values in units of inverse megameters. A dv value of zero indicates a pristine atmosphere. The natural levels of these species result in some level of visibility impairment, in the absence of any human influences, and will vary with season, daily meteorology, and geography (USEPA 2003).

Background visibility data are not available for the Uinta Basin, but visibility is considered to be very good based on nearby measurements. Visibility data measured at the Canyonlands National Park Interagency

Monitoring of Protected Visual Environments (IMPROVE) site has a deciview of about 12 under poor and hazy conditions with a deciview of about 4 on the clearest days over the years 2002 to 2012 (IMPROVE 2015). A standard annual visual range of approximately or greater than 260 km (162 miles) has been calculated for Canyonlands and Arches national parks and the Flat Tops Wilderness areas using data from the Federal Land Manager's Air Quality Guidance (FLAG) Phase I report-Revised (FLAG 2010).

Atmospheric Deposition and Acid Neutralization Capacity

Atmospheric deposition is the process whereby airborne particles and gases are removed from the atmosphere and deposited on the Earth's surface.

Wet deposition is defined as the portion of atmospheric deposition contained in precipitation. Dry deposition is the fraction deposited in dry weather through such processes as settling, impaction, and adsorption. The factors that influence dry deposition include whether the substance is in gaseous or particulate form, the solubility of the species in water, the amount of precipitation in the region, and the terrain and type of surface cover. Wet deposition is monitored by the National Atmospheric Deposition Program (NADP), a consortium of a large number of federal, regional, and state agencies and academic institutions. The USEPA's Clean Air Status and Trends Network (CASTNET) is the principal source for data relating to dry deposition of atmospheric pollutants. Neither program has a monitor located in the Uinta Basin (CASTNET 2015; NADP 2015).

Acidic compounds in the atmosphere can lead to acid deposition. Acidic wet deposition is called acid precipitation or, more commonly, acid rain. Acidity in precipitation is measured by collecting samples of rain and measuring its pH, which is lower when acidic compounds are present. "Clean" or unpolluted rain has a slightly acidic pH of 5.6, because CO_2 and water in the air react together to form carbonic acid, a weak acid. Throughout much of the western U.S., pH in rain is around 5.5 compared to eastern U.S. where the pH in rain is typically less than 4.5 (USEPA 2015c).

Acid deposition occurs when SO_2, NO_X, and NH_3 in the atmosphere react to form sulfuric acid, nitric acid, and ammonium. These pollutants originate from natural sources (i.e., forest fires and volcanoes) as well as anthropogenic ones (i.e., the burning of fossil fuels in power plants and motor vehicles, and agricultural practices). Low pH in lakes and streams harms fish and other aquatic organisms, alters forest soils, degrades the growing conditions for some tree species, and affects other vegetation.

The ability of surface waterbodies to resist acidification, the acid neutralizing capacity (ANC), is a measure of the health of terrestrial and aquatic ecosystems. Higher acidity in rain or snow is observed downwind (often at significant distances) from areas with many large sources of SO_2 and NO_X. The effects of acidification are not as wide-spread in the western relative to the eastern U.S, because sulfur deposition tends to be lower in the western U.S. In areas of lower deposition, nitrogen enrichment effects are often observed prior to the onset of acidification effects. However, high elevation aquatic ecosystems in the west can still be sensitive to acidification, to which both sulfur and nitrogen deposition contribute.

The sensitive lakes included in this study assessed for changes in ANC are listed below. These sensitive lakes were selected for analysis as they are located within 100 km of the Uinta Basin study area.

- Dean Lake, Class II High Uintas Wilderness Area;
- Fish Lake, Class II High Uintas Wilderness Area;
- Heart Lake, Class II High Uintas Wilderness Area;
- Walk Up Lake, Class II Ashley National Forest;
- 4D2-039, Class II High Uintas Wilderness Area; and
- 4D1-044, Class II High Uintas Wilderness Area.

3.3.2 Climate

The current regional climate in the vicinity of the GCWPA, global and regional climate change, and the effects of greenhouse gas emissions on climate are described in the following sections.

3.3.2.1 Regional Climate

The GCWPA is located within the Uinta Basin, an area surrounded by the Uinta Mountains to the north, the Wasatch Range to the west and the Tavaputs Plateau to the south. The climate in the vicinity of the GCWPA is characterized as arid, with cold winters and hot summers. Annual precipitation (rainfall and snowfall) in the region ranges from 8 to 10 inches. A monthly climate summary for data collected at Vernal, Utah, is presented in **Table 3.3-10**.

Table 3.3-10 Monthly Climate Summary, Vernal Airport, Utah

Period of Record : 1/1/1894 to 12/31/2010													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Avg. Max. Temp. (°F)	29.3	36.9	50.0	62.2	72.3	82.5	89.1	86.7	77.4	63.6	46.9	32.3	60.8
Avg. Min. Temp. (°F)	5.0	11.1	22.5	31.1	39.0	46.5	52.3	50.6	41.7	31.3	20.5	9.0	30.0
Avg Total Precip. (in.)	0.51	0.51	0.68	0.80	0.85	0.66	0.57	0.68	0.90	1.06	0.58	0.62	8.42
Avg Total Snow Fall (in.)	5.2	3.6	2.2	0.4	0.0	0.0	0.0	0.0	0.0	0.3	1.3	5.4	18.5
Avg Snow Depth (in.)	2	2	0	0	0	0	0	0	0	0	0	1	0

°F = degrees Fahrenheit.

Source: Western Regional Climate Center 2017.

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, stability, and wind (speed and direction). Mixing height is the height aboveground within which pollutant concentrations are well mixed in the atmosphere by convection and turbulence. Local atmospheric conditions, terrain, and source locations affect concentrations of pollutants in this mixed layer. Mixing heights vary diurnally, with the passage of weather systems, and with season. On average, mean annual morning mixing heights in the area are approximately 1,000 feet, whereas mean annual afternoon mixing heights are more than 7,800 feet (Holzworth 1972).

When air temperatures near the ground are colder than the temperatures above it is referred to as a temperature inversion. Temperature inversions typically are characterized as a having a low mixing height and very stable atmospheric conditions. Inversions are common in basins and valleys near the region. Inversions can hinder air pollutant dispersion by preventing emissions from mixing with the ambient air in the vertical direction. During the winter, inversions may persist for several days or more in the absence of synoptic (continental scale) storm systems. Inversions commonly occur in winter when snow accumulates on the ground, daylight hours are relatively short, and the presence of mountain ranges confine cold air. Winter temperature inversions are often associated with low clouds, fog, freezing precipitation, air stagnation and elevated levels of air pollution in the basin (Neeman et al. 2015).

Although winter inversions are generally quite shallow, they tend to be more stable than summer inversions because of the reduced solar surface heating. In summer, inversions dissipate rapidly when early morning sunlight warms the air near the ground surface. Afternoon conditions during the warmer months tend to be neutral to unstable because of the rapid heating of the surface under clear skies. Unstable summer conditions lead to convective activity and enhanced pollutant dispersion.

Air pollutant dispersion in the GCWPA also is dependent on wind direction and speed. Surface winds in the vicinity of the project site are influenced by the local terrain. Because of the typically dry atmosphere, bright sunny days and clear nights frequently occur. This in turn allows rapid heating of the ground surface during daylight hours and rapid cooling at night. Since heated air rises, and cooled air sinks, winds tend to blow uphill during the daytime and down slope at night. This upslope and downslope cycle generally occurs in areas with topographical features, such as mountain ranges or river courses. These surface level, thermally driven winds also are influenced by larger scale upper-level wind systems, referred to as synoptic winds. Synoptic winds in the region are predominantly west to east. Synoptic winds also are characterized by daily or seasonal weather variations that enhance or diminish the surface winds.

3.3.2.2 Climate Change

Climate change refers to any significant change in measures of climate (e.g., temperature or precipitation) lasting for an extended period (decades or longer). Climate change may result from natural processes, such as changes in the sun's intensity or within the climate system (such as changes in ocean circulation) as well as human activities that change the atmosphere's composition (such as burning fossil fuels) and the land surface (such as urbanization) (Intergovernmental Panel on Climate Change [IPCC] 2013). Climate is both a driving force and limiting factor for ecological, biological, and hydrological processes, and has great potential to influence resource management.

In recent years, emissions of anthropogenic GHGs since the onset of the Industrial Revolution have been suspected as a driver for climate change. GHGs act to trap solar heat, resulting in atmospheric heating (IPCC 2013).

Since the assessment of GHG emissions and climate change is in its formative phase it is currently not feasible to predict the exact impacts the Proposed Action or alternatives would have on climate. However, for the purpose of NEPA analysis this EIS includes a quantitative analysis of possible greenhouse gas emissions that could occur as a result of reasonably foreseeable oil and gas development. As with any field of scientific study, there are uncertainties associated with the science of climate change; however, this does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty because they are based on well-known physical laws and documented trends (USEPA 2011a). The effects of anthropogenic (man-made) GHG emissions and changes in biological carbon sequestration due to land management activities on global climate have been identified as the likely causes of the increased rate of average surface temperature of the planet. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect on the atmosphere, primarily by impeding the rate of heat energy radiated by the earth back into space.

Although GHG levels naturally exhibit cyclical patterns over the millennia, recent industrialization and burning of fossil carbon sources have caused CO_2e concentrations to increase dramatically and are likely to contribute to overall global climatic changes. Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially CO_2 and CH_4) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo) of the earth-atmosphere system by resulting in the surface absorbing more or less radiation. It is important to note that many GHGs have a sustained climatic impact because of their long atmospheric lifetimes. For example, recent emissions of CO_2 may influence climate for 100 years (Intergovernmental Panel on Climate Change [IPCC] 2013).

The IPCC reports that since 1750, the largest contribution to total radiative forcing, is caused by the increase in atmospheric concentration of CO_2 (IPCC 2013). Radiative forcing is the difference between sunlight energy absorbed by the Earth and energy emitted back to space. In addition, "the atmospheric concentrations of CO_2, CH_4, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. CO_2 concentrations have increased by 40 percent since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions" (IPCC 2013). The current global mean CO_2 concentration is approximately 400 ppm, while pre-industrial levels were 280 ppm (National Oceanic and Atmospheric Association 2015).

According to the National Climate Assessment (Melillo et al. 2014), U.S. average temperature have increased by 1.3°F to 1.9°F since record keeping began in 1895, and most of this increase has occurred since 1970.

While the earth has had many episodes of warming/cooling in the past, the IPCC recently concluded that the recent warming of the climate system is very unique when compared to those past episodes. Additionally, most of the observed increase in globally average temperatures since the mid-20th century is due to the observed increase in anthropogenic GHG concentrations (IPCC 2013). During the last 30 years, northern portions of the Great Plains have seen average winter temperatures rise to 7°F above historical averages (USEPA 2014c).

In 2013, the IPCC projected that by the year 2100, global average surface temperatures will likely be 0.3 degrees Celsius (°C) to 4.8°C above the 1986-2005 average. The range in temperature increase is due the different model simulations. (IPCC 2013) The National Academy of Sciences (2008) has confirmed these projections, but also has indicated that there are uncertainties regarding how climate change may affect different regions. The equilibrium climate sensitivity quantifies the response of the climate system to constant radiative forcing on multicentury time scales. It is defined as the change in global mean surface temperature at equilibrium that is caused by a doubling of the atmospheric CO_2 concentration. Equilibrium climate sensitivity is likely in the range 1.5°C to 4.5°C (high confidence), extremely unlikely less than 1°C (high confidence), and very unlikely greater than 6°C (medium confidence). No best estimate for equilibrium climate sensitivity can now be given because of a lack of agreement on values across assessed lines of evidence and studies (IPCC 2013). Computer model predictions indicate that increases in temperature would not be equally distributed, but are likely to be accentuated at higher latitudes. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Warming during the winter months is expected to be greater than during the summer. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict. During this century, projections indicate temperatures in the Great Plains will continue increasing and northern areas of this region may become wetter (USEPA 2014c).

It is difficult to discern whether climate change is already affecting resources globally, let alone those in the vicinity of the proposed project. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change may not be measurably discernible within the reasonably foreseeable future. Existing climate prediction models are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on the GCWPA and vicinity. However, general predictions can be made using computer models for larger spatial areas.

3.3.2.3 Regional Climate Trends

Fundamentally, the climate in the Intermountain West is highly variable due to the location with respect to atmospheric circulation patterns and complex topography. Temperatures in North America are projected to increase with a greater than 66 percent probability (Christensen et al. 2007). Global Climate Models predict that temperatures in the western U.S. will increase between 2.5°C and 6°C, relative to pre-1900 levels, over the next 100 years (Christensen et al. 2007). The largest summertime changes in

North America are predicted to occur in the American Southwest (Field et al. 2007). Wintertime precipitation in the intermountain region is typically in the form of snow and the accumulation and timing of snow melt are important for ecological and economic resources. It is predicted that there will be a decline in snowpack associated with warmer temperatures due to a later onset and earlier spring melting (Field et al. 2007). A declining snowpack has already been documented in much of the western U.S. (Jin et al. 2006; McCabe and Wolock 1999; Miller and Piechota 2008; Pierce et al. 2008; Regonda et al. 2005).

Climate change is not shown to have a direct effect on any criteria pollutants other than ozone. It has been found that concentrations of ground level ozone are likely to increase due to increasing temperatures (Wise 2009). This indicates that areas currently designated as "maintenance" status for ozone are likely to have added difficulty maintaining levels below the ozone standard. Although no other criteria pollutants have been shown to be directly impacted by climate change, potential future regulations aimed to reduce GHG emissions may have an indirect effect on other pollutants (i.e., NO_2 or SO_2) co-emitted with GHG.

3.3.2.4 Greenhouse Gas Emissions

GHGs consist of compounds in the earth's atmosphere that absorb outgoing long-wave radiation emitted from the earth's surface, resulting in a warming of the atmosphere. Naturally occurring GHGs include water vapor, CO_2, methane (CH_4), nitrous oxide, and O_3. CO_2 and other GHGs are naturally occurring gases in the atmosphere whose status as a pollutant is not related to their toxicity, but to the added long-term impacts they may have on climate due to their increased levels in the earth's atmosphere. Because they are non-toxic and non-hazardous at normal ambient concentrations, CO_2 and other naturally occurring GHGs do not have applicable ambient standards or emission limits under the major environmental regulatory programs.

On October 30, 2009, the USEPA issued the final mandatory reporting rule for major sources of GHG emissions (40 CFR Part 98). The rule requires a wide range of sources and source groups to record and report selected GHG emissions, including CO_2, methane (CH_4), nitrous oxide, and some halogenated compounds. Various oil and gas operations are required to monitor and report GHG emissions under this regulation. Mandatory reporting of GHG emissions is required if sources emit 25,000 tons of carbon dioxide equivalent per year.

On June 3, 2010, the USEPA issued the Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule. The rule tailors the applicability criteria that determine which stationary sources become subject to permitting requirements for GHG emissions under the PSD and Title V programs of the CAA (USEPA 2013). On June 23, 2014, the Supreme Court ruled that the USEPA lacked the authority to require PSD and Title V Permits based on the above emissions thresholds for sources that would not otherwise require such a permit. The Court also held that PSD permits that are otherwise required (based on emissions of other pollutants) may continue to require limitations on GHG emissions based on the application of BACT. On April 10, 2015, the D.C. Circuit issued an amended judgement, which vacated the PSD and title V regulations under review in that case to the extent that they require a stationary source to obtain a PSD or title V permit solely because the source emits or has the potential to emit GHGs above the applicable major source thresholds. In the future, USEPA intends to conduct future rulemaking action to make appropriate revisions to the PSD and operating permit rules (USEPA 2015d).

This project is not considered a major source, the USEPA rules do not require any controls or establish any standards related to GHG emissions or impacts. Therefore, there is no evident requirement at this time that would affect development of the proposed project under the USEPA rules.

GHGs are often presented using the unit of Metric Tons of CO_2 equivalent (MT CO_2e) or Million Metric Tons (MMT CO_2e), a metric to express the impact of each different greenhouse gas in terms of the

amount of CO_2 making it possible to express greenhouse gases as a single number. For example, 1 ton of methane would be equal to 25 tons of CO_2 equivalent, because it has a global warming potential (GWP) 25 times that of CO_2 (USEPA 2016h).

As defined by USEPA, the GWP provides "ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that of one kilogram of CO_2." The GWP of greenhouse gas is used to compare global impacts of different gases and used specifically to measure how much energy the emissions of one ton of gas will absorb over a given period of time (e.g., 100 years), relative to the emissions of one ton of CO_2. The GWP accounts for the intensity of each GHG's heat trapping effect and its longevity in the atmosphere. The GWP provides a method to quantify the cumulative effects of multiple GHGs released into the atmosphere by calculating carbon dioxide equivalent for the GHGs.

- Carbon dioxide (CO_2), by definition, has a GWP of 1 regardless of the time period used because it is the gas being used as the reference. CO_2 remains in the climate system for a very long time; CO_2 emissions cause increases in the atmospheric concentrations of CO_2 that will last thousands of years (USEPA 2016b).
- Methane (CH_4) is estimated to have a GWP of 28-36 times that of CO_2 over 100 years. CH_4 emitted today lasts about a decade on average, which is much less time than CO_2. But CH_4 also absorbs much more energy than CO_2. The net effect of the shorter lifetime and higher energy absorption is reflected in the GWP. The methane GWP also accounts for some indirect effects, such as the fact that methane is a precursor to ozone, and ozone is in itself a greenhouse gas (USEPA 2016b).
- Nitrous Oxide (N_2O) has a GWP of 265-298 times that of CO_2 for a 100-year timescale. N_2O emitted today remains in the atmosphere for more than 100 years, on average (USEPA 2016b). **Table 3.3-11**. contains GHGs regulated by USEPA and global warming potentials.

Table 3.3-11 GHG Regulated by USEPA and Global Warming Potentials

Air Pollutant	Chemical Symbol/ Acronym	Global Warming Potential
Carbon Dioxide	CO_2	1
Methane	CH_4	25
Nitrous Oxide	N_2O	298
Hydrofluorocarbons	HFCs	Varies
Perfluorocarbons	PFCs	Varies
Sulfur hexafluoride	SF_6	22,800

Source: USEPA 2016b.

Because GHGs circulate freely throughout Earth's atmosphere, climate change is a global issue. The largest component of global anthropogenic GHG emissions is CO_2. Global anthropogenic carbon emissions reached about 7,000,000,000 MT per year in 2000 and an estimated 9,170,000,000 MT per year in 2010 (Boden et al. 2013). Oil and gas production contributes to GHGs such as CO_2 and CH_4. Natural gas systems were the largest anthropogenic source category of CH_4 emissions in the U.S. in 2014 with 176.1 MMT CO_2e of CH_4 emitted into the atmosphere. Those emissions have decreased by 30.6 MMT CO_2e (14.8 percent) since 1990 (USEPA 2016c). In 2006, natural gas production accounted for 8 percent of global CH_4 emissions, and oil production accounted for 0.5 percent of global CH_4 emissions (URS Corporation 2010).For this project the primary greenhouse gas emissions are CO_2 and CH_4, are quantified and assessed in Section 4.3.

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3.4 Water Resources

3.4.1 Surface Water Resources

Surface water resources are regulated through federal and state laws, as well as agency policies and planning documents. The CWA, originally the Federal Water Pollution Control Act of 1948 (with major amendments in 1972 and 1977), is the framework that regulates water quality standards and pollutant discharges into waters of the U.S. Sections 303(d) and 305(b) of the CWA require that water quality of streams, rivers, and lakes are assessed on a regular basis; that waters found to be in violation of water quality standards are listed as impaired; and that priorities are set for actions to improve water quality. Section 402 of the CWA created the National Pollutant Discharge Elimination System, which is administered by the State of Utah and includes requirements for storm water permits for construction areas. Section 404 of the CWA regulates dredging and filling of waters of the U.S.; permits for such activities are issued by the U.S. Army Corps of Engineers.

The Safe Drinking Water Act (amended in 1996) established national standards for the quality of drinking water. The State of Utah administers drinking water standards under the Utah Safe Drinking Water Act, and has established Wellhead Projection and Underground Injection Control Programs to protect drinking water resources in the state. UDOGM also maintains requirements for oil and gas development that include protection measures for surface and groundwater resources.

The Colorado River Basin's water quality is administered under the Colorado River Basin Salinity Control Act, which is enacted through a forum. The purposes of the forum are to: 1) coordinate salinity control efforts among the states, 2) coordinate with federal agencies on the implementation of the Colorado River Basin Salinity Control Program, 3) work with Congress on the authorization and funding of the program, 4) disseminate information on salinity control, and 5) otherwise promote efforts to reduce the salt loading to the Colorado River (Colorado River Basin Salinity Control Forum 2014).

Water use in Utah is administered by the state under Utah Code, Title 73 in the form of prior appropriation doctrine. EO 11988 (Floodplain Management) and EO 11990 (Protection of Wetlands) also regulate surface disturbance in floodplains and wetlands on federally managed lands.

The BLM VFO RMP (BLM 2008b) contains standard stipulations and BMPs that protect water resources, such as compliance with the "Gold Book" (USDOI and U.S. Department of Agriculture [USDA] 2007). In addition, agency BMPs for oil and gas development are encouraged in Onshore Oil and Gas Order Number 1.

3.4.1.1 Surface Water Quantity and Local Watersheds

The GCWPA study area for surface water resources is located within the Uinta Basin, along the lower reaches of the White River, a tributary to the Green River (**Figure 1-1**). Their confluence is located west of the GCWPA. The southwest portion of the GCWPA is crossed by the White River. Bordered by higher topography on all sides, the Uinta Basin is located in a "rain shadow" and receives little precipitation. Average annual precipitation at Ouray, Utah, and Bonanza, Utah, is approximately 6.8 inches and 8.9 inches, respectively (Western Regional Climate Center 2009). Runoff volume from the GCWPA itself is relatively low.

The White River is the only named perennial stream within the GCWPA. Flow in the river largely results from snowmelt and rainfall at higher elevations to the east in Colorado. Most of the river's flow in summer and fall is made up of groundwater contributions from adjacent alluvial aquifers or from runoff originating in Colorado. Larger tributaries may exhibit intermittent flow near their confluences with the river (Lindskov and Kimball 1984; USGS-National Water Info System [NWIS] 2009), but the vast majority of channels in the GCWPA and surrounding region exhibit only ephemeral flows. Ephemeral streams flow

only for brief periods in direct response to snowmelt or excess rainfall. Intermittent flows are more seasonal, and typically include contributions from groundwater surfacing into streams.

Within the GCWPA, snowmelt may cause brief flows in Coyote Wash, Antelope Draw, Red Wash, and other tributaries to the White River. Summer thunderstorms also create brief flows in these and other channels. When present, flows in the White River tributaries (i.e., Coyote Wash or Red Wash) are highly variable but typically less than 5 cubic feet per second (cfs). However, flows in these tributaries may exceed 100 cfs during spring runoff or storm events (USGS-NWIS 2009). Flows are limited by the short runoff duration, seepage into streambeds, and the region's high evaporation rate. Due to the rocky nature and limited soil cover for much of the GCWPA, runoff is likely to be rapid and accompanied by sheet and rill erosion. Additional information on soil resources and soil characteristics is presented in Section 3.5.

The USGS measured flows in the White River and its tributary, Coyote Gulch. General characteristics for selected USGS gaging stations in the vicinity of the GCWPA are indicated in **Table 3.4-1**. From this table, it can be inferred that relatively little flow contribution normally occurs from the 1,100 square miles of drainage area between the White River gages.

Table 3.4-1 Selected USGS Gaging Stations, Vicinity of GCWPA

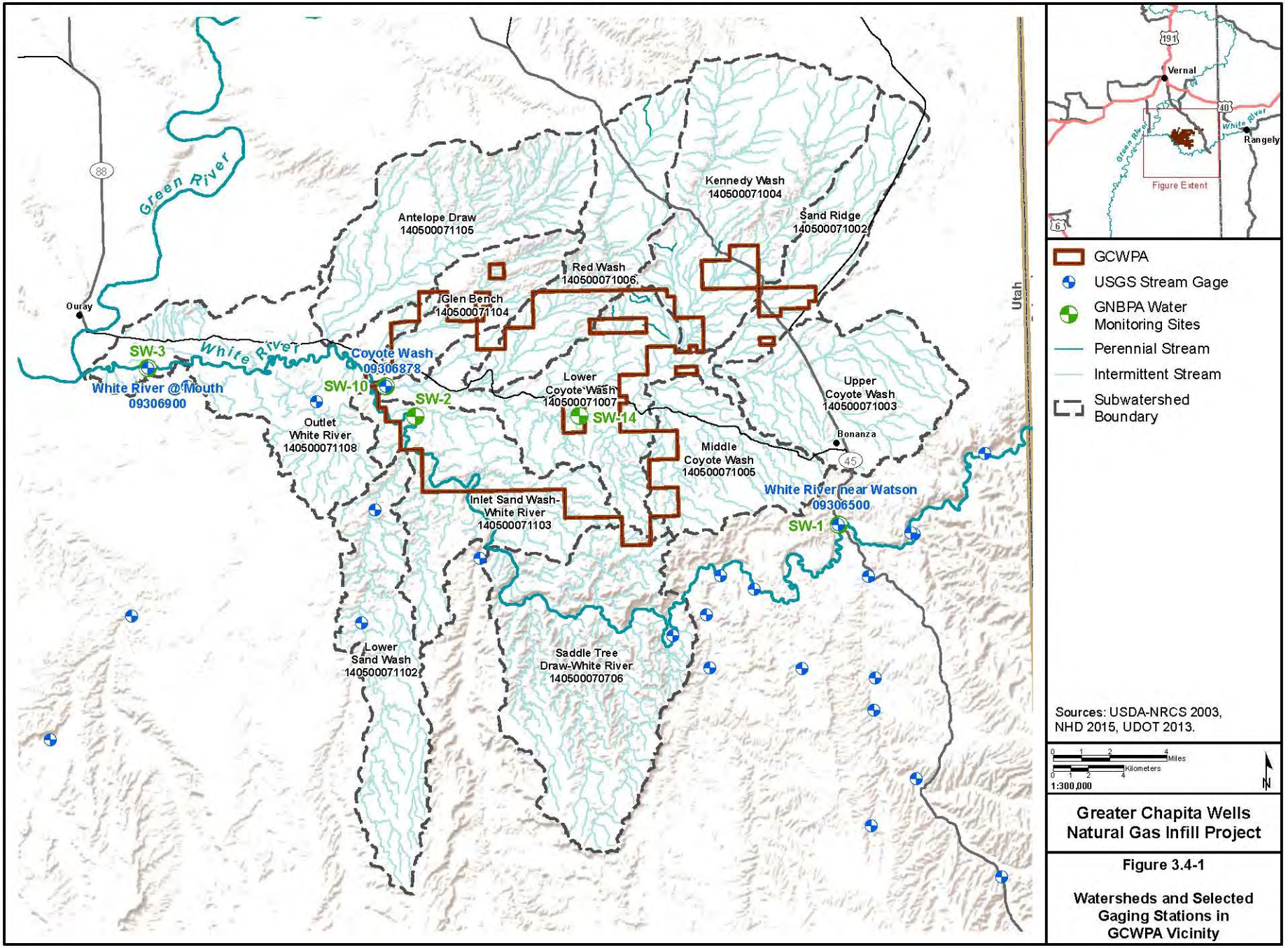
Stream or River[1]	Basin Area (square miles)	Mean Annual Flow (cfs)	Highest Mean Daily Flow (cfs)	Lowest Mean Daily Flow (cfs)
Coyote Wash near mouth, near Ouray, Utah. Site 09306878	228	4.6	548.0	0.0
White River near Watson, Utah. Site 09306500	4,020	700.4	5,560	13.0
White River at mouth, near Ouray, Utah. Site 09306900	5,120	719.2	5,240	7.3

[1] Source: Boyle et al. 1984; USGS-NWIS 2009. Data are shown for the common period of record consisting of water years 1977 through 1983, with some data projected from the nearby USGS gage 09306395 (White River near Colorado State Line, Utah).

Watersheds in the region and the locations of gaging stations are depicted on **Figure 3.4-1**. The USGS categorizes watersheds on the basis of Hydrologic Unit Codes (HUCs), which can be identified to increasing specificity at more detailed map scales. Eleven drainage areas depicted at the HUC 12 Subwatershed level for the GCWPA and nearby region are indicated in **Table 3.4-2**.

Recent baseline groundwater sampling conducted by the Utah Geological Survey did not identify springs in the GCWPA (Wallace 2012). Review of historical and recent USGS topographic maps did not identify springs (USGS 1968a-d, 2014a-d) and no springs were identified by other sources (Holmes and Kimball 1987; Utah Geological Survey 2002). A seep along the White River upstream of the GCWPA was investigated by USEPA in 2014 (USEPA 2014d).

Impoundments in or near the GCWPA include a number of small ponds and some larger industrial ponds mainly used for evaporation. There are approximately 54 small ponds that could serve stock use that occupy approximately 36 acres within the GCWPA (Utah Division of Water Resources 2012).



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Figure 3.4-1

Watersheds and Selected Gaging Stations in GCWPA Vicinity

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Table 3.4-2 Subwatersheds in the GCWPA

HUC 12 Number	HUC 12 Subwatershed Name	Surface Area within GCWPA (acres)	Total HUC 12 Subwatershed Surface Area (acres)
140500070706	Saddle Tree Draw-White River	329	36,413
140500071002	Sand Ridge	1,116	13,142
140500071003	Middle Coyote Wash	5	20,100
140500071004	Kennedy Wash	2,409	32,391
140500071005	Middle Coyote Wash	1,374	14,705
140500071006	Red Wash	5,415	18,179
140500071007	Lower Coyote Wash	18,838	23,980
140500071102	Lower Sand Wash	<1	19,961
140500071103	Inlet Sand Wash-White River	9,585	22,835
140500071104	Glen Bench	3,190	9,488
140500071105	Antelope Draw	76	24,392
140500071108	Outlet White River	734	27,286

Source: U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) 2003.

3.4.1.2 Flood Hydrology and Floodplains

Floods in small watersheds in the semi-arid West often result from localized, intense summer thunderstorms. Based on theoretical work by Lindskov and Kimball (1984), the mean annual peak flow for Coyote Wash near its mouth is estimated to be 638 cfs, although the largest flow actually recorded from 1976 to 1983 was 548 cfs in February 1980 (USGS-NWIS 2009). This tributary to the White River is the largest drainage in the GCWPA. **Table 3.4-3**, indicates that still higher flood flows may recur at less frequent intervals (Lindskov and Kimball 1984).

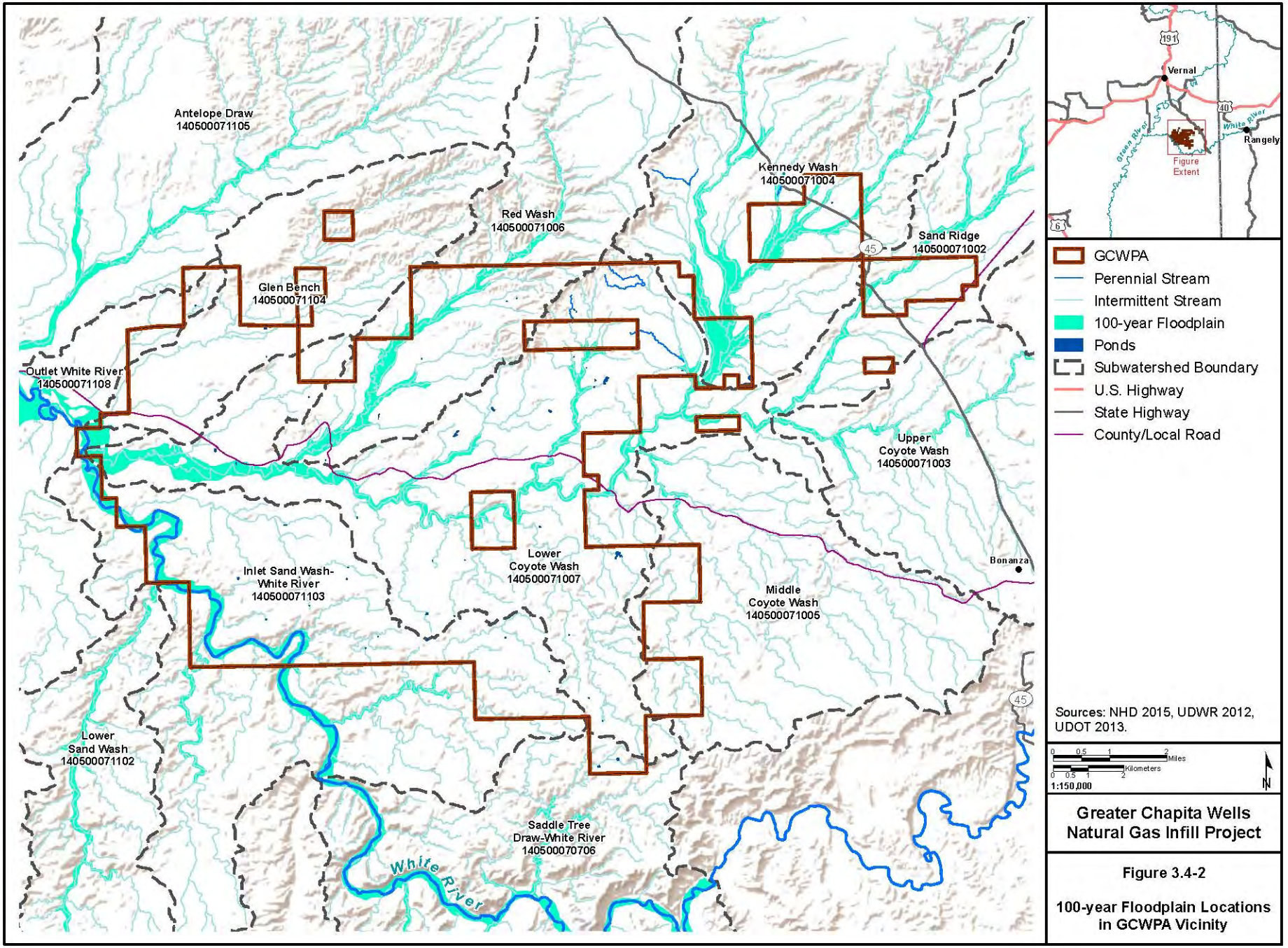
Table 3.4-3 Estimated Flood Flows for Coyote Wash

Stream	10-Year Flood Peak Flow[1] (cfs)	25-Year Flood Peak Flow[1] (cfs)	100-Year Peak Flow[1] (cfs)
Coyote Wash mouth, near Ouray, Utah	2,800	4,800	9,600

[1] The 10-year flood has a 10 percent chance of occurring in any given year; the 25-year flood has a 4 percent chance of occurring in any given year; and the 100-year flood has a 1 percent chance of occurring in any given year.

No recorded flows in Coyote Wash approach the values indicated in **Table 3.4-3**. Several smaller snowmelt and thunderstorm events also are recorded during that data period. Floods in Red Wash and smaller unnamed streams would have smaller peak flows resulting from smaller drainage areas, but it is likely such floods could still reach magnitudes in the hundreds or thousands of cfs.

Zones that would be flooded by a 100-year, 24-hour flood in the GCWPA and surrounding vicinity were identified by reviewing maps developed by the Federal Emergency Management Agency and provided by BLM from special studies in the area (Rhino Engineering 1999), and by reviewing topographic maps and aerial photos (Terraserver USA 2009). One hundred-year floodplain locations are depicted on **Figure 3.4-2**. Based on these delineations, the estimated extent of 100-year, 24-hour floodplains within the GCWPA is 3,595 acres.



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Figure 3.4-2

100-year Floodplain Locations in GCWPA Vicinity

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3.4.1.3 Surface Water Quality

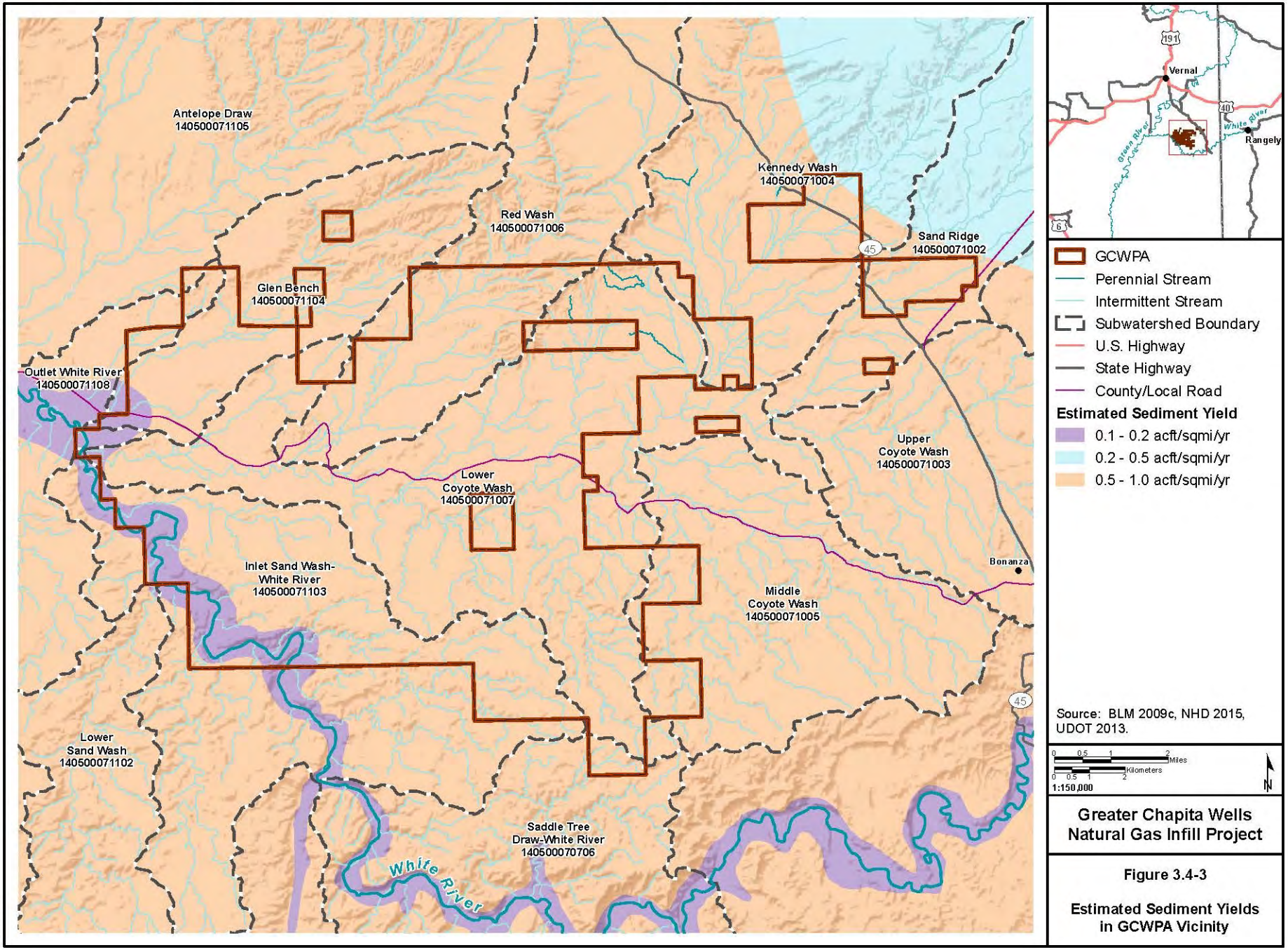
Surface water quality in the study area reflects geologic source materials, land use, and source events (i.e., snowmelt or thunderstorms). As flows seasonally increase from snowmelt higher in the basin, water quality generally improves. After the snowmelt from upstream areas has passed in the spring, contributions from the lower part of the White River watershed make up a larger portion of flow in the river through the GCWPA. During these periods of smaller flows, water quality in the lower White River generally deteriorates. This is primarily due to naturally occurring salts from exposed and eroding geologic formations in the lower basin, flows returning from irrigated fields, and high sediment loads.

In general, water quality standards are established based on existing water uses. Beneficial uses of surface water are officially designated by the State of Utah (Utah Administrative Code 2009). The White River and its tributaries, which include streams in the GCWPA, are categorized as supporting secondary contact recreation (boating, wading, or similar uses), warm-water game fish and aquatic life, and agricultural uses. There are no impairments to these uses within the Lower White River watershed (UDEQ-Division of Water Quality 2010).

Estimated sediment yields in the region are indicated in **Figure 3.4-3** from BLM GIS information. In areas dominated by dry basin uplands, sediment yield generally ranges from 0.5 to 1.0 acre-feet per year from a square mile. Approximately 39,360 acres of the GCWPA are in this range. Along the White River, sediment yields likely range from approximately 0.1 to 0.2 acre-feet per year per square mile. Approximately 2,589 acres of the GCWPA are in this range. An additional 78 acres in the northwestern part of the GCWPA are estimated to yield from 0.2 to 0.5 acre-feet per year per square mile.

Salinity concentrations are a potential additional water quality factor in the GCWPA and the White River drainage. To reduce salinity in runoff, Congress passed the Colorado River Salinity Control Act in 1974. In 1984, an amendment to the act directed BLM to control salt loads in runoff from lands it administers. Water quality was sampled in Coyote Wash by the USGS (Site 09306870, **Figure 3.4-1**) in the late 1970s and early 1980s. These data indicate that typically, high salinity does not characterize flows originating from the GCWPA. Specific conductance, as an indirect measure of salt content in water, generally ranged from approximately 330 to 450 microsiemens per centimeter at 25°C, based on late winter and early spring data (USGS-NWIS 2009). In summer, at lower discharges, specific conductance data ranged from approximately 350 to 1,000 microsiemens per centimeter. These are within typical values for rivers or streams in the region, and follow the general regional pattern of better water quality during larger flows. This trend occurs in the White River as well (Boyle et al. 1984; Lindskov and Kimball 1984).

The White River has two established water quality monitoring locations in proximity to the GCWPA; one location upstream near Bonanza, and one downstream near Ouray (Sites 09306500 and 09306900, respectively, **Figure 3.4-1**). These locations have had water quality monitoring through the majority of the 1990s, and again during 2006 and 2011 for some constituents (UDEQ 2014a). This water quality monitoring data shows high variability in the total suspended sediment (TSS) in the White River, with a range of 10-8,300 mg/L at the upstream location and 20-29,100 mg/L at the downstream location. The downstream location generally exhibited higher TSS concentrations when compared to the upstream location; however there are several sampling dates where the upstream location shows a substantially higher concentration of TSS. Salinity and TDS exhibit variability to a lesser extent, with TDS ranging from 188 to 786 mg/L at the upstream location and 206-828 at the downstream location. There are no sampling dates that show the upstream location with a substantially higher TDS concentration.



Greater Chapita Wells Natural Gas Infill Project

Figure 3.4-3

Estimated Sediment Yields in GCWPA Vicinity

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More specific surface water quality information in or near the GCWPA is available from an ongoing monitoring program in the vicinity (InterTech 2015). In particular, development on the Greater Natural Buttes Project Area (GNBPA) has included sampling at several stream sites. These include two surface water monitoring locations on Coyote Wash (GNBPA SW-10 and SW-14) and one on the White River (GNBPA SW-2) (**Figure 3.4-1**). These monitoring data are being collected as part of nearby activities, and have been submitted to the BLM and other agencies as public information. With respect to the GCWPA, the Coyote Wash locations are in upstream and downstream positions along that stream, and the White River monitoring location is at the Glen Bench Road bridge in the west-central part of the GCWPA. Further information from these sites is summarized in **Table 3.4-4** (InterTech 2015).

Table 3.4-4 Surface Water Quality Summary

Monitoring Location[1]	Coyote Wash Upstream (one sample)	Coyote Wash Downstream (five samples)	White River at Glen Bench Road (nine samples)
Ca	5,720	5,320 to 28,200	50,100 to 71,700
Cl	285	10.8 to 167	6.9 to 20.2
Mg	4,280	1,960 to 13,800	14,900 to 26,400
Na	1,710,000	116,000 to 1,290,000	46,400 to 97,000
HCO_3	2,260	523 to 1,700	167 to 270
pH	9.1	8.8 to 9.4	8.4 to 8.6
SO_4	744	50 to 700	90.4 to 172
SpC	6,520	581 to 3,300	471 to 899
TDS	4,740	1,020 to 3,480	331 to 527
TSS	209	18 to 11,400	78 to 812
Turbidity	79.3	36.1 to 3,960	18.5 to 376
As	11.1	ND[2] to 22.8	ND[2]
B	8,090	403 to 6,340	103 to 349
Fe	757	240 to 27,100	ND[2] to 50.6

[1] Ranges of data are reported where more than one sampling event has been recorded. All values are in micrograms per liter (µg/L) except for TDS and TSS (milligrams per liter), pH (standard units), Specific Conductance (µmhos/cm) and Turbidity (nephelometric turbidity units).

[2] "ND" means not detected.

Chemical symbols: Ca (Calcium); Cl (Chloride); Mg (Magnesium); Na (Sodium); HCO_3 (Bicarbonate); SO_4 (Sulfate); SpC (Specific Conductance); TDS (Total Dissolved Solids); TSS (Total Suspended Solids); As (Arsenic); B (Boron); Fe (Iron).

Source: InterTech 2015.

Results indicate that cadmium, mercury, silver were not detected at these stations. Methyl ethyl ketone, phenol, styrene, toluene, trichloroethene and vinyl chloride also were not detected in Coyote Wash samples or in the White River, except for one value of trichloroethene (0.94 µg/L) on the river in May 2014. Chromium, lead, nickel and zinc were generally not detected in the six samples taken along Coyote Wash, except for one chromium value (39 µg/L), one lead value (22.3 µg/L), one nickel value (26.7 µg/L), and one zinc value (85.8 µg/L) at the downstream site in August 2014. Total suspended solids, turbidity, calcium, chromium, magnesium, iron, and arsenic were highest at that site for the August sample as well. There may have been some channel disturbance at an unknown time before sampling, or low flow conditions may have increased concentrations (a common phenomenon in arid climates) in the August 2014 sample at downstream Coyote Wash. There was no upstream sample taken at that time. Iron and zinc were each detected once out of nine samples on the White River

(GNBPA Site SW-2), with values of 50.6 and 94 µg/L, respectively. Nickel was detected in one river sample (August 2014), with a value of 2 µg/L. Chromium was not detected in river samples.

There are particularly high concentrations of sodium and boron, as well as elevated concentrations of calcium, magnesium, Total Dissolved Solids, and others present (see **Table 3.4-4**). Coyote Wash contributes these constituents to the White River, as do other tributaries outside the GCWPA. It is likely that a substantial amount of the elevated cations result from the extensive natural exposures of badlands or poorly developed saline/alkaline soils in or near the GCWPA.

The USEPA investigated reports of a black, oil-like substance discharging from a seep in 2014 along the White River, outside, but just upstream of the GCWPA. The conclusion of the investigation was that the substance was consistent with gilsonite, which is common in the area, and that no visible petroleum sheen or odor existed in or near the seep. Based on samples taken upstream and downstream of the seep, there appeared to be no impact to water quality from the discharge (USEPA 2014d).

3.4.1.4 Waters of the U.S. and Wetlands

Waters of the U.S. include all non-tidal waters that are currently used for interstate commerce, or were in the past, or may be susceptible to being used for interstate commerce. They include wetlands, rivers, streams (including perennial, intermittent, and ephemeral streams and channels), mud flats, sand flats, sloughs, wet meadows, playa lakes, and other related features. Disturbance to Waters of the U.S. is regulated by the U.S. Army Corps of Engineers and USEPA under Section 404 of the CWA. Waters of the U.S. within the GCWPA include the White River and its tributaries (i.e., Red Wash and Coyote Wash, as well as their tributaries). Based on GIS coverage provided by BLM, approximately 195 miles of ephemeral or intermittent streams, and approximately 12 miles of perennial streams (mainly the White River), occur in the GCWPA. These would be considered waters of the U.S., and would be subject to regulatory jurisdiction under Section 404 of the CWA.

A wetland is an area inundated by surface water or saturated by groundwater often enough to support vegetation adapted to saturated soils. Wetlands generally include wet meadows, bogs, moist vegetated fringes along streams, and similar areas. Within the GCWPA, the extent of wetlands are generally contained within the extent of riparian vegetation as shown in **Figure 3.6-1**. Based on the complete coverage of vegetation cover GIS information from BLM, the extent of riparian zones within the GCWPA is approximately 431 acres. Since some areas of riparian vegetation may lack hydric soils, the extent of federally defined jurisdictional wetlands under the CWA may be less than this. Additional discussions of wetlands and riparian zones are presented in Section 3.6.

3.4.2 Groundwater Resources

Three major regional groundwater systems of the Colorado Plateau that underlie the GCWPA study area for groundwater resources consist of the Uinta-Animas, Mesaverde, and Dakota-Glen Canyon aquifer systems (Robson and Banta 1995). The generalized systems contain discrete water-bearing units as depicted in **Figure 3.2-3**. These aquifer systems also are present in the Uinta Basin and have varying degrees of importance to the Project. In addition to the major aquifer systems, alluvial aquifers provide important sources of groundwater. These aquifer systems and relevance to the proposed project are described below.

3.4.2.1 Alluvial Aquifers

Alluvial aquifers are associated with the major drainages that include the White River, Coyote Wash, and Red Wash. They also include both unconsolidated Quaternary sediments overlying the Uinta formation. The alluvial aquifers are recharged by infiltration of stream flow and leakage from consolidated-rock aquifers (Holmes and Kimball 1987). Groundwater modeling indicates that most of the discharge from alluvial aquifers is to streams or to consolidated-rock aquifers (Holmes and Kimball 1987). The alluvial aquifers also may be recharged from consolidated bedrock aquifers.

In the vicinity of the GCWPA, the alluvial aquifers can produce significant quantities of water (maximum yields to individual wells up to 1,000 gallons per minute) from the floodplain deposits of the Green and White rivers. Wells located in the ephemeral or intermittent drainages generally produce smaller quantities from alluvial deposits (Hood 1976; Schlotthauer et al. 1981).

3.4.2.2 Uinta-Animas Aquifer System

In the GCWPA, the Uinta-Animas aquifer system consists of aquifers in the lower Tertiary Duchesne River, Uinta and Green River formations (Robson and Banta 1995). Water-yielding zones in the Uinta-Animas aquifer are separated from each other by claystone, shale, marlstone, or limestones that do not easily transmit water. The major aquifers in the Uinta-Animas aquifer system are briefly described below.

Duchesne River Formation

A small area of the GCWPA in T8S-24E is underlain by the Brennan Basin Member of the Duchesne River Formation which is composed primarily of sandstone and siltstone with minor amounts of conglomerate and claystone (Sprinkel 2007). Because of its varied lithology, there is a wide range of permeability (hydraulic conductivities ranging from 0.000033 to 3.28 feet per day) in water-bearing beds, but permeability may be enhanced by fracturing (Hood 1976). Since the Duchesne River Formation is near its southern limit in this part of the GCPWA it is less than 50 feet thick and probably may be under unconfined conditions.

Uinta Formation

The Uinta Formation is approximately 4,000 feet thick and water-bearing zones in the formation consist of discontinuous, permeable, fine- to coarse-grained sandstones bodies surrounded by low permeability siltstones and mudstones. The sandstones are up to 50 feet thick and were deposited in a meandering stream environment (Williams 1950). However, the Uinta Formation becomes more fine-grained towards the center of the basin with the depositional environment grading to a lacustrine (lake) setting (Howells et al. 1987). The Uinta Formation forms the surface bedrock over most of the GCWPA and the base of the formation varies from approximately 1,000 to 2,500 feet deep over much of the area.

Hydraulic conductivities in the Uinta Formation range from less than 0.5 feet per day to more than 500 feet per day. The hydraulic conductivity is enhanced by faults and fracture systems in some locations (Hood 1976; Schlotthauer et al. 1981). In most cases, the formation yields only a couple of gallons per minute to wells and springs (Howells et al. 1987).

Green River Formation

The Green River Formation consists largely of fine-grained lacustrine deposits (siltstones, mudstones, limestone and marlstone) and widespread oil shale beds (Howells et al. 1987). Aquifers in the Green River Formation include the Birds Nest Aquifer of the Parachute Creek Member and the Douglas Creek Aquifer (**Figure 3.2-3**).

Bird's Nest Aquifer

The informally named Bird's Nest Aquifer occurs within the Parachute Creek Member of the Green River Formation and overlies the Mahogany Oil Shale zone. The aquifer is so-named because in outcrop, weathering of nahcolite nodules has formed large openings which birds use for nests (Cashion 1967). Generally the Bird's Nest is composed of claystone, siltstone, and very fine-grained sandstone and also is characterized by fractures and nodules that contain saline minerals, commonly nahcolite and shortite (Vanden Berg et al. 2013). The dissolution of the saline minerals has resulted in high porosity and permeability. Regionally correlated organic-rich oil shale beds occur with the Bird's Nest. Recharge occurs at outcrops on the southern and eastern portions of the Uinta Basin and flow is generally from

southeast to northwest, coincident with the regional dip of the sedimentary rock units (**Figure 3.4-4**). In the GCWPA, the top of the Bird's Nest aquifer occurs approximately 1,500 to 3,000 feet below the ground surface and the gross interval thickness is about 300 feet (Vanden Berg et al. 2013).

Douglas Creek Aquifer

The Douglas Creek aquifer is associated with the Douglas Creek Member of the Green River Formation and the Renegade Tongue of the Wasatch Formation (Holmes and Kimball 1987). It is composed of sandstone and limestone and thickness ranges from 500 feet to 1, 000 feet with thickening to the north. The Douglas Creek aquifer is recharged from outcrops on south side of the Uinta Basin and water flows in the same general direction of regional dip from south to north. The Douglas Creek aquifer immediately overlies the Wasatch Formation, a primary objective for gas production. Transmissivities were estimated for modeling purposes to range from 20 to 1,270 square feet per day (Holmes and Kimball 1987).

3.4.2.3 Deeper Aquifer Systems

Deeper aquifers which occur in GCWPA include water-bearing zones in the Mesaverde and Dakota-Glen Canyon aquifer systems (**Figure 3.2-3**). The Mesaverde aquifer system occurs at depths greater than 6,500 feet and the Dakota-Glen Canyon occurs at depths greater than 13,000 feet (Anderson et al. 2012) and are not considered sources of usable water. In addition, the Mesaverde formation is a principal gas producing objective and the Dakota Formation also has a potential gas-bearing zone, but has limited production because it is over 6,000 feet deeper than the Tertiary and Upper Cretaceous oil and gas zones. The Morrison, Entrada, and Glen Canyon aquifers also are too deep to provide usable water.

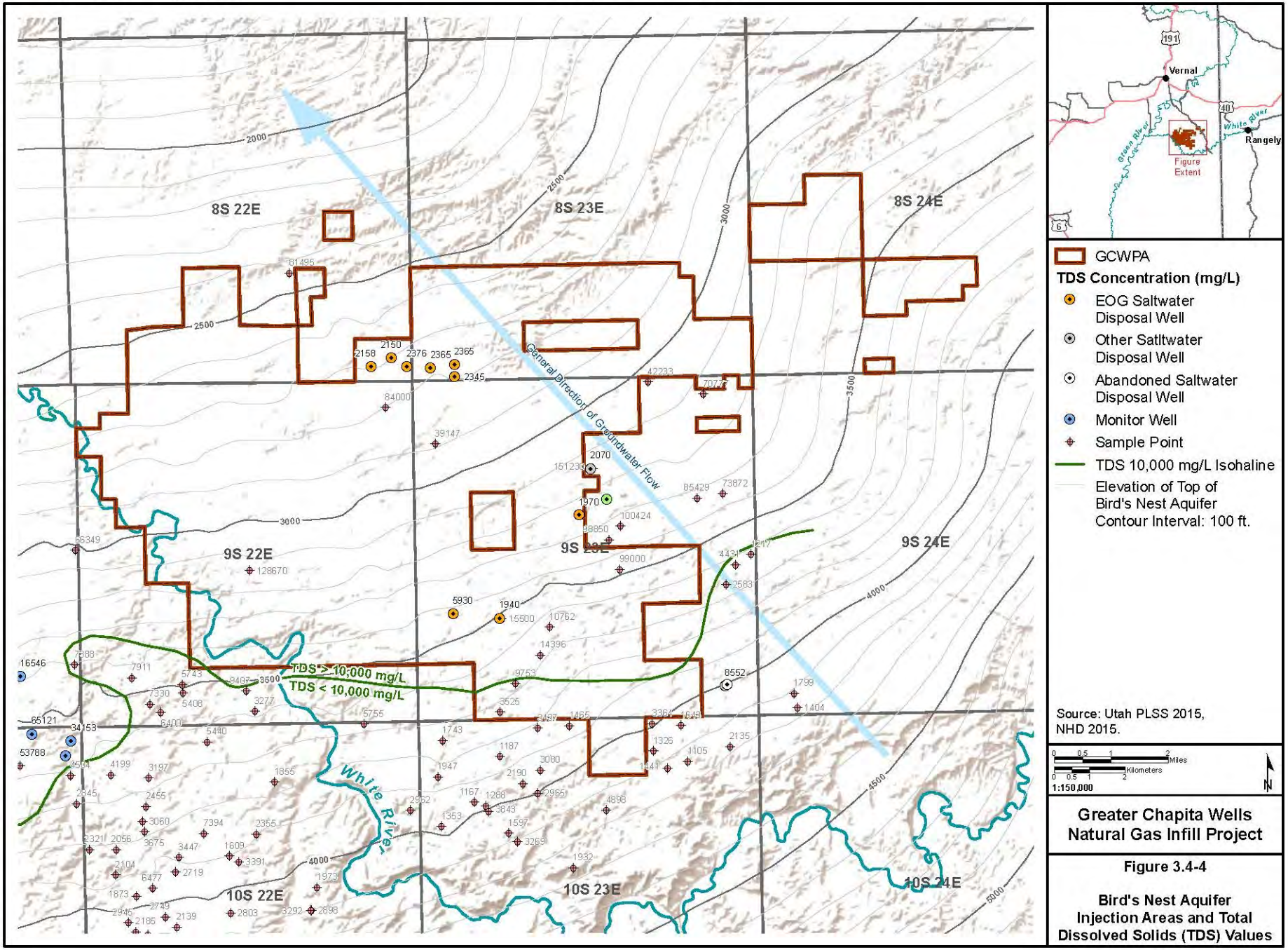
3.4.2.4 Groundwater Quality

For protection and management purposes, the UDEQ categorizes groundwater according to four classes and subclasses, as indicated in **Table 3.4-5**. These are determined for aquifer sources primarily on the basis of TDS concentrations and other chemical or physical standards.

Table 3.4-5 Utah Groundwater Protection Classes

Class	Subclass Description	TDS Level (mg/L)	TDS Limits for Discharges to Groundwater Class (mg/L)
I	Ia - Pristine	Less than 500	1.25 times background value, or background plus 2 standard deviations
	Ib - Irreplaceable		1.1 times background level or 2,000 mg/L
	IC - Ecologically Important		Applicable surface water standard
II	Drinking Water Quality	500 to 3,000	1.25 times background value, or background plus 2 standard deviations
III	Limited Use	3,000 to 10,000	1.25 times background value, or background plus 2 standard deviations
IV	Saline	Over 10,000	As established by the Executive Secretary

Source: UDEQ 2014b.



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Figure 3.4-4

Bird's Nest Aquifer Injection Areas and Total Dissolved Solids (TDS) Values

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For purposes of describing water quality, the concentration of TDS in terms of salinity will be used and are as follows:

- Fresh – 0 to 1,000 mg/L
- Slightly saline – 1,000 to 3,000 mg/L
- Moderately saline – 3,000 to 10,000 mg/L
- Very saline – 10,000 to 35,000 mg/L
- Briny – greater than 35,000 mg/L

Widespread groundwater development in the southern Uinta Basin for domestic, livestock, or industrial uses has been limited because of generally poor water quality (BLM 2008b). TDS values of less than 500 mg/L have been recorded from wells screened in alluvial deposits to over 4,000 mg/L for wells screened in the Green River Formation. TDS can exceed 10,000 mg/L locally in the Uinta Formation (BLM 2006b), and the salinity of groundwater in the basin generally increases with depth in the bedrock aquifers (Price and Miller 1974). The salinity of groundwater in the shallow alluvial aquifers also generally increases toward the lower elevation areas in the interior of the basin. Groundwater salinity in the region ranges from 200 mg/L in shallow alluvial aquifers to over 100,000 mg/L in deep aquifers associated with oil production (BLM 2008b).

An important aspect of the groundwater quality in the Uinta Basin is the depth at which water becomes very saline (greater than 10,000 mg/L) or what is referred to as the base of moderately saline groundwater (BMSG) (Howells et al. 1987). The depth of BMSG is important because of the USEPA definition of underground sources of drinking water (USDW). A USDW is defined in 40 CFR Section 144.3 as an aquifer or part of an aquifer that supplies a public water system or contains a sufficient quantity of water for such a supply, and currently is used for drinking water for human consumption or contains less than 10,000 mg/L of TDS (USEPA 2001). The BMSG was originally mapped by Howells et al. (1987), but recently the Utah Geological Survey undertook a study in order to remap the depth of the BMSG because of the availability of more data and the necessity of defining the BMSG more precisely to prevent degradation of potential USDWs (Anderson et al. 2012). In the GCWPA, the BMSG ranges from 1,000 to 3,000 feet below the ground surface.

Alluvial Aquifers

Recent measurements of the chemical quality of the alluvial groundwater in the eastern Uinta Basin indicate TDS values from less than 250 to approximately 3,000 mg/L (Wallace 2012). Although TDS values vary seasonally, generally the best quality water is associated with alluvial aquifers of the Green and White Rivers. The TDS concentrations were measured on groundwater samples in smaller, isolated drainages. In the GCWPA, data presented by Holmes and Kimball (1987) indicated a range of TDS concentrations from 450 to 1,840 mg/L measured in water samples from the alluvium of Red Wash.

Duchesne Aquifer

Near the surface and in recharge areas, water in the Duchesne aquifer may be fresh, but at greater depths the water may range from slightly saline to briny (Howells et al. 1987).

Uinta Formation Aquifers

The wells in aquifers of the Uinta Formation, yield fresh to slightly saline water, there may be elevated concentrations of fluoride and boron (Howells et al. 1987).

Bird's Nest Aquifer

Within the GCWPA, water quality in the Birds Nest Aquifer is very saline with TDS levels exceeding 10,000 mg/L (Vanden Berg et al. 2013), which would result in a Class IV designation for the aquifer. The

aquifer is the principal injection zone used by oil and gas operators for disposal of waste water produced from gas wells (see Section 3.13.2.5).

Douglas Creek Aquifer

The quality of water in the Douglas Creek aquifer is fresh to slightly saline with TDS concentrations ranging from 640 mg/L in the southern parts of the aquifer to 1,980 mg/L in the northern part of the aquifer where it underlies the GCWPA (Holmes and Kimball 1987).

Deeper Aquifer Systems

Water quality in the Wasatch Formation and Mesaverde Aquifers ranges from very saline to briny (20,000 to 50,000 mg/L) and are associated with hydrocarbon production. Water in the deeper aquifer systems also would expect to be saline (Anderson et al. 2012). The average TDS concentration of produced water from the Mesaverde Formation is 34,087 mg/L and the average TDs concentration of Wasatch Formation produced water is 25,864 mg/L (EOG 2015,see **Appendix D**).

Water samples taken from 4 wells during hydraulic fracturing flowback operations were found to have similar TDS concentrations to the formation water averages shown above. TDS concentrations in flowback water analyzed over a 1-month period ranged from 21,940 to 28,589 mg/L (EOG 2015).

3.4.2.5 Groundwater Use

In Uintah County, groundwater accounted for 341 acre-feet of municipal water use out of a total 11,794 acre-feet (Utah Division of Water Resources 2014a). There are four water wells located within 2 miles of the GCWPA (Utah Division of Water Rights 2014b) (**Figure 3.4-5**) (**Table 3.4-6**). The stated water use for these wells include domestic and stock. As indicated in Chapter 2.0, EOG intends to use water from cooling ponds at the Deseret Power Station. Numerous other wells have been drilled in the southeast potion of T8S, R23E (outside of the GCWPA) and are associated with the Deseret Power Station. Most of these wells were permitted as corrosion protection wells, but there also are monitoring wells and dewatering wells, but no wells listed as water supply wells (Utah Division of Water Resources 2014a). There are no recorded springs located within the GCWPA (Kimball 1981).

Authorized by the Safe Drinking Water Act, source water protection plans are used to protect and lessen the risk of contamination to drinking water sources (UDEQ 2014c). Plan development involves the delineation of protection zones, identification of potential contamination sources, and plans for risk abatement. An outcome of the source water protection plan is establishment of a buffer around a drinking water source or sources which is known as a drinking water source protection zone. No drinking water source protection zones are located within or near the GCWPA. According to the UDEQ database, the closest drinking water source protection zone is located around water supply wells for Bonanza, the boundary of which is more than 5 miles from the GCWPA (UDEQ 2014c).

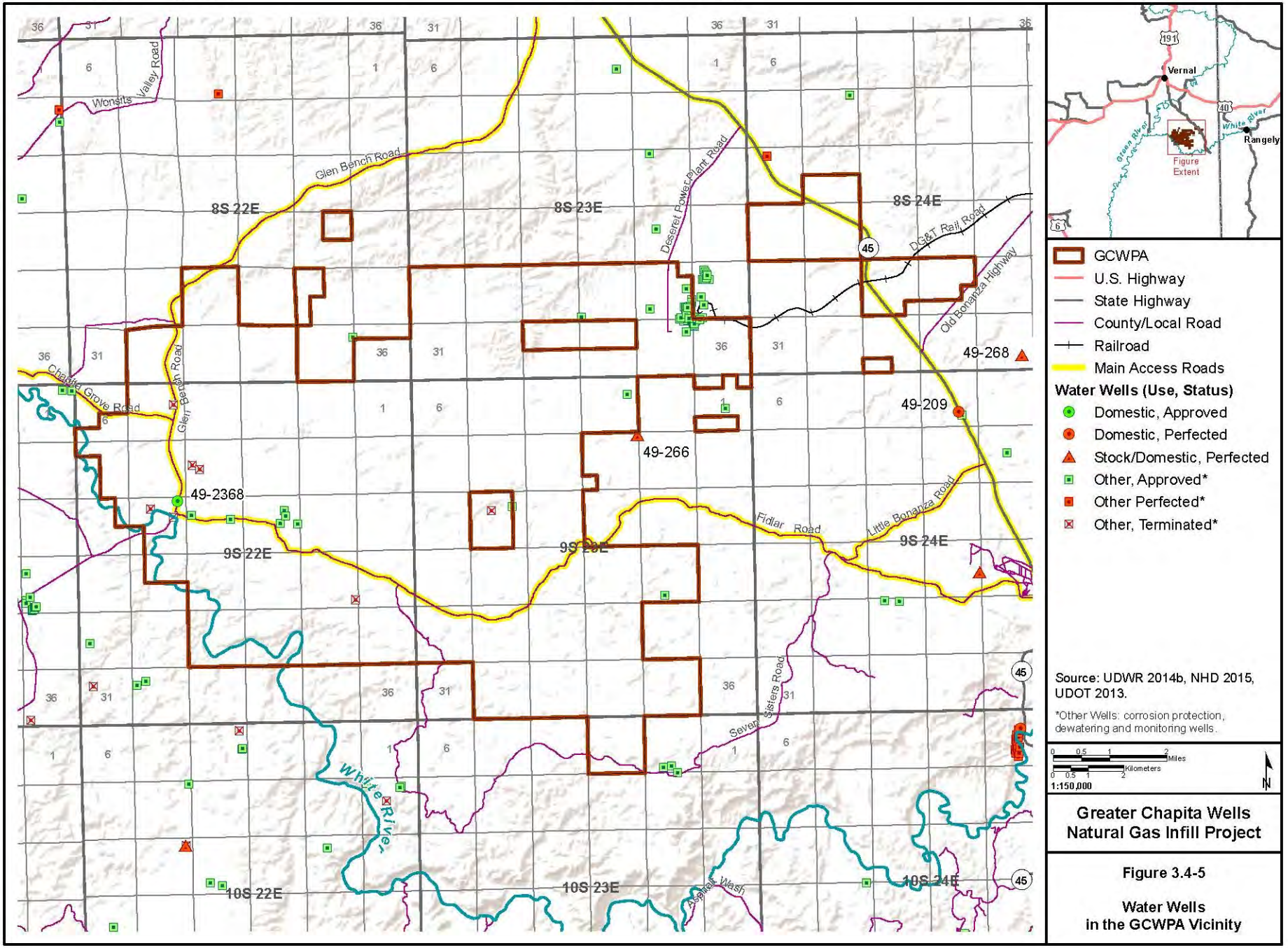
3.4.2.6 Produced Water Disposal

The major waste of oil and gas production is produced water. Since the salinity of produced water varies from moderately saline to very saline to briny, the most efficient and environmentally secure way to deal with the water is through deep injection disposal. There are 10 active produced water disposal wells (commonly referred to as salt water disposal wells or SWDs) in or near the GCWPA which are listed on **Table 3.4-7** and shown on **Figure 3.4-4**. EOG operates nine wells and QEP operates the tenth well. Average annual injection is about 604,000 barrels of water per well for a total of over 6 million barrels of injected water over a normalized year. In the GCWPA, produced water is into the Bird's Nest Aquifer. Since large areas of the Bird's Nest Aquifer has salinities less than 10,000 mg/L, disposal wells that inject into the Bird's Nest Aquifer are located in areas where water is very saline or briny (greater than 10,000 mg/L) as shown on **Figure 3.4-4.**

In addition to injection wells, there are commercial disposal facilities in the vicinity of the GCWPA that handle produced water and other qualified oil field waste (UDOGM 2014b).

3.4.2.7 Groundwater Contamination

There is no evidence of groundwater contamination in the GCWPA and there are no remediation sites in the area (UDEQ 2014d).



Greater Chapita Wells Natural Gas Infill Project

Figure 3.4-5

Water Wells in the GCWPA Vicinity

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Table 3.4-6 Water Wells within 2 miles of the GCWPA

Water Right Number	Location (QQ-Section-Township-Range)	Owner	Use	Well Depth (ft bgs)	Water Level (ft bgs)
49-268	NESE 35-8S-24E	J.P. Hacking	Stock/Domestic	26	Not Recorded
49-2368	NENE 17-9S-22E	Anadarko Uintah Midstream	Domestic	500	Dry Well
49-266	NENE 10-9S-23E	M.M. Hall	Stock/Domestic	Not Recorded	Not Recorded
49-209	NWSE 3-9S-24E	G.S. Zeigler & Co.	Domestic	100	12

ft bgs: feet below ground surface.

Source: Utah Division of Water Resources 2014b.

Table 3.4-7 SWDs Wells in or near the GCWPA

API Number	Operator	Well Name	Well Status	Qtr/Qtr Section-Township-Range	Annual Injection[1] (barrels)
43-047-50290	EOG RES INC.	HOSS 901-36 SWD	Active	NESE 36-8S-22E	481,474
43-047-50302	EOG RES INC.	HOSS 903-36 SWD	Active	NWSE 36-8S-22E	463,185
43-047-50304	EOG RES INC.	HOSS 904-36 SWD	Active	NESW 36-8S-22E	292,279
43-047-50300	EOG RES INC.	HOSS 906-31 SWD	Active	NESE 31-8S-23E	446,150
43-047-50301	EOG RES INC.	HOSS 907-31 SWD	Active	SESE 31-8S-23E	339,135
43-047-50303	EOG RES INC.	HOSS 905-31 SWD	Active	SESW 31-8S-23E	381,067
43-047-38875	QEP ENERGY	NBE 12SWD-10-9-23	Active	NWSW 10-9S-23E	246,323[2]
43-047-50806	EOG RES INC.	COYOTE 1-16 SWD	Active	SENE 16-9S-23E	749,975
43-047-38434	EOG RES INC.	CWU 2-29 SWD	Active	NENW 299S-23E	2,239,644
43-047-33116	EOG RES INC.	CWU 550-30N	Active	NWNE 30-9S-23E	405,027[3]
TOTAL					6,044,259

[1] Injection for 12 months ending 12/1/12 except where noted.

[2] Injection for 12 months ending 10/1/2013.

[3] Injection for 12 months ending 6/1/2013.

Source: UDOGM 2014c.

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3.5 Soils

3.5.1 Soils Characterization

Soils within the GCWPA study area have developed on a variety of land surfaces remaining after the differential erosion of plateau surfaces of the gently dipping strata of the underlying principally Uinta Formation (Leishman et al. 2003; USDA-NRCS 1995). Soil mapping units of the GCWPA and their respective characteristics important to the assessment of impacts on soils as described by Leishman et al. (2003) are presented in **Appendix L** (Leishman et al. 2003). These data are used to develop the subsequent descriptions of the soils that are presented for the GCWPA. Detailed soil survey mapping by Leishman et al. (2003) covers approximately 35,837 acres (83 percent) of the 43,071-acre GCWPA. The remaining 7,234 acres, for which soils were not surveyed and mapped as part of the Leishman et al. (2003) survey, are covered by a U.S. General Soil Map for Utah (STATSGO) soil survey (USDA-NRCS 1995), which provides only broad area mapping and soil interpretations. The lands for which a detailed soil survey was not conducted correspond to Tribal, allotted, and privately owned lands within the boundaries of the Ute Tribes' Uintah and Ouray Reservation.

A total of 18 soil map units (including a mapping unit for water) occur in that portion of the GCWPA covered by the Leishman et al. (2003) soil survey (**Appendix L**). Based on reviews of topographic, geomorphological, geological conditions, and an evaluation of both the detailed and general soil surveys, the soil mapping units identified and described in the detailed survey and summarized in (**Appendix L**) are expected to extend into and occur on comparable landscapes of those Tribal and private lands within the Uintah and Ouray Reservation covered by only the general STATSGO soil survey within the GCWPA. Based on both detailed soil survey (Leishman et al. 2003) and the general STATSGO soil survey, the following assessment of soils within the GCWPA was developed.

3.5.1.1 Upland Soils

Upland soils in the GCWPA formed on smooth to undulating plateau surfaces, erosion remnants, structural benches, and smaller benches interspersed with areas of high relief comprised of escarpments, hills, tableland breaks, badlands, and slopes of dissected, incised stream valleys. In the valley bottoms, soils formed in alluvium on pediments, alluvial fans, terraces, floodplains, and alluvial flats. The residual, colluvial, and alluvial parent materials consist of interbedded shales and sandstones of the Uinta Formation, and to a lesser extent, the formation's limestones and quartzite deposits. Areas of eolian sand deposits occupy portions of plateau surfaces and moderately sloping hillsides interspersed between areas of badlands and other soils throughout the GCWPA. Upland soils total approximately 38,067 acres, approximately 88 percent of the GCWPA's soil resource. This total acreage for upland soils within the GCWPA proportionally includes at 88 percent of the Tribal and private lands that lack detailed soil survey which together with the remaining bottomlands comprises the GCWPA total of 43,071 acres.

Approximately 21,830 acres (57 percent) of the mapped upland soils are occupied by soil types and complexes that are typically sandy or loamy in texture, contain coarse rock fragments, and are very shallow to shallow in depth. The remaining 16,237 acres (43 percent) of upland soils are occupied by soil types and complexes that typically range from sandy to clayey in texture, are moderately deep to deep in soil depth to rock, and contain elevated levels of salinity and/or sodicity.

3.5.1.2 Bottomland Soils

The finer textured, moderately deep to deep bottomland soils of the valley fans, floodplains, flats, and terraces comprise approximately 12 percent of the GCWPA, again proportionally, including at 12 percent the Tribal and private lands lacking detailed soil survey. Throughout the GCWPA, bottomland soils may have elevated levels of salts (16 milliohms per centimeter or higher) and/or adsorbed sodium (sodium adsorption ratio values of 30 to 60). Coarse rock fragments also occur in several of the alluvial soils of

intermittent and ephemeral drainages that are tributary to the White River. Alluvial soils along the White River are mostly free of coarse rock fragments.

3.5.2 Soil Constraints

Soils in the GCWPA were grouped based on constraints to reclamation of disturbance associated with construction, operation, and reclamation of the natural gas wells and related facilities. The primary goal for interim and final reclamation is to establish soil stability and restore soil productivity. The grouping of soils by constraining characteristics provides a means of assessing the disturbances that would result from project-related blading, excavation, and compaction of soils beneath equipment or facilities.

Specific constraints on soil reclamation potential in the GCWPA are primarily: 1) shallow depth to bedrock that is indicative of droughty and poor nutrient soil conditions, 2) elevated salinity levels that can affect plant establishment and water uptake, 3) elevated sodicity (comparably higher concentrations of sodium in place of calcium and magnesium that are adsorbed to soil particles) that can affect soil water and oxygen availability to plants, and 4) high coarse fragment content that can exacerbate low water and nutrient availability to plants. In addition, compaction of soils during construction or operational activities can reduce soil water and oxygen availability. Compaction of sodic soils can exacerbate the reduced water and oxygen availability conditions already posed by elevated adsorbed sodium levels.

Exposed, loosened soil materials left on steeper slopes (cut and fill slopes) would be subject to accelerated soil erosion in response to precipitation events due to runoff combined with high soil erodibility (high K-factor) (USDA-NRCS 1994). The potential for accelerated water erosion increases with slope angle and slope length and can be exacerbated by removal of protective vegetative or rock cover and loss of soil aggregation. Accelerated water and wind erosion can lead to soil loss, slope instability (cut and fill slopes), and subsequent mass wasting that can affect project operations. Several soil components are present in the GCWPA that are rated high for potential wind erosion and associated soil loss should the soils be disturbed.

Leishman et al. (2003) identified 6 major soil type components in 6 of the 17 soil map units that had a topsoil and reclamation material quality rating of fair to good. The remaining 11 soil map units were rated poor or were not rated due to the relative absence of soil materials in areas mapped as badlands and/or rock outcrops (**Appendix L**). Based on: 1) the percentage composition of the soil types and components comprising each of the six soil map units that include soils with fair to good ratings and 2) the extrapolation of the detailed soil survey soil interpretations to the entire GCWPA, approximately 11.9 percent (5,125 acres) of soils within the GCWPA have topsoil and reclamation suitability ratings of fair to good. The remaining approximately 37,946 (88 percent) of soils within the 43,071-acre GCWPA have characteristics that are considered poor in terms of topsoil and reclamation material suitability.

Based on the type and prevalence of constraining soil characteristics in the GCWPA and the arid conditions that have been exacerbated by recent years of drought, the 17 soil map units have been grouped into 3 categories of constraint levels:

1. High constraint soils that pose the greatest limitations to construction and reclamation;
2. Soils with moderate constraints; and
3. Soils with low or few constraints.

(**Appendix L**) identifies the factors used to develop the constraint groupings. **Figure 3.5-1** depicts the distribution of these groupings within non-Tribal portions of the GCWPA. Acreages of constraints were extrapolated to Tribal lands using those percentages for high, moderate, and low constraint derived from interpretation of soils characteristics for the portion of the GCWPA covered by the Leishman et al. (2003) soils survey. The extrapolation of constraint mapping to Tribal and private lands within the Uintah and Ouray Reservation was based on the observed similarity of topography, mapped parent materials, and anticipated soil characteristics supported by data provided for the reservation's portion of the GCWPA in the STATSGO general soil survey (USDA-NRCS 1995).

3.5.2.1 High Constraint Soils

As a group, high-constraint soils singularly or in combination:

- Are located on slopes greater than 20 percent;
- Are shallow to bedrock;
- Contain high percentages of coarse fragments;
- Have a high water erosion potential;
- Contain elevated salinity and/or sodium levels; and/or
- Include areas of limited soil cover both in terms of areal extent and thickness where badlands have developed and where rock outcrops are exposed.

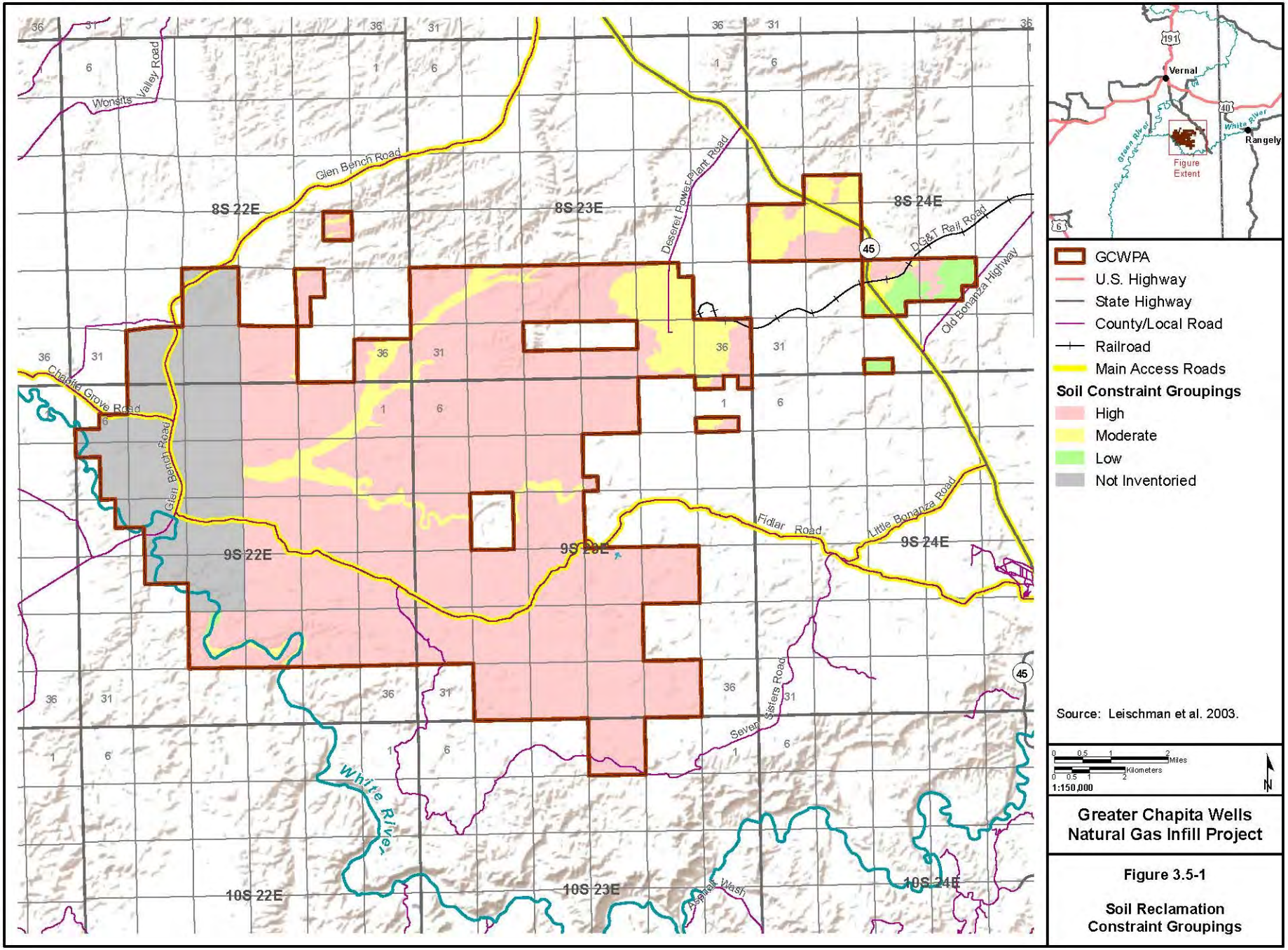
This group of high constraint soils occupies approximately 84 percent (36,180 acres) of the GCWPA (**Appendix L** and **Figure 3.5-1**).

3.5.2.2 Moderate Constraint Soils

As a group, moderate-constraint soils singularly or in combination:

- Are located on slopes of 8 to 20 percent;
- Are generally moderately deep or deep to bedrock;
- Contain moderate to high percentages of coarse fragments;
- Have a moderate water erosion potential principally due to reduced slopes and coarse fragment content;
- Contain moderate levels of salinity and/or sodium; and
- Include areas of sandy (droughty) textured materials with high to very high wind erosion potential.

This group of moderate constraint soils occupies approximately 14 percent (6,030 acres) of the GCWPA (**Appendix L** and **Figure 3.5-1**).



Greater Chapita Wells Natural Gas Infill Project

Figure 3.5-1

Soil Reclamation Constraint Groupings

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3.5.2.3 Low Constraint Soils

As a group, low constraint soils:

- Occupy level to gently sloping drainages and alluvial bottoms less than 8 percent slope;
- Are generally deep soils;
- Contain low to moderate levels of coarse fragments;
- Have low to moderate water erosion potential, due to minimal slopes; and
- Contain slight to moderate levels of salinity and/or sodium.

This group of low constraint soils occupies approximately 2 percent (861 acres) of the GCWPA (**Appendix L** and **Figure 3.5-1**).

3.5.3 Biological Soil Crusts

Biological soil crusts (BSCs), consisting of various organisms including bacteria, green algae, lichens, mosses, and micro-fungi, likely occur within the GCWPA on the surface of mostly undisturbed soils supporting the dominant salt desert shrubland, sagebrush shrubland, grassland, and to a lesser extent pinyon-juniper woodland vegetation types (Belnap et al. 2001). The BSC organisms symbiotically form a rough carpet on the soil surface underlain by a soil-binding matrix within the upper few inches of the soil below. BSCs typically occupy interspaces of open ground between vascular plants (grasses, forbs, shrubs, or trees) or below their canopies. A full range of soil types from shallow to deep, clayey to sandy textures, and moist to drier conditions on slopes ranging from level to steep can provide habitat for BSCs. The matrix of organisms can support soil conditions for higher plants by fixing carbon and nitrogen, raising soil temperature, increasing water infiltration rates, and stabilizing soils by reducing both water and wind erosion. Adverse effects to BSCs can arise from damage or loss due to disturbance including fire, drought, weed infestations, livestock trampling, human foot traffic, motorized vehicle passage, and excavation of BSC-occupied soils as part of construction activities. Rates for natural recovery of BSCs, where disturbed depend on the nature of the disturbance and the ability and availability of BSCs to recover and re-colonize damaged and lost BSC cover, respectively.

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3.6 Vegetation

3.6.1 General Vegetation

The GCWPA is located within the Uinta Basin Floor subregion of the Colorado Plateau ecoregion (Woods et al. 2001). Seven distinct vegetation community types have been defined within the GCWPA; they include salt desert shrub, sagebrush shrubland, grassland, cliff/canyon, wetland/riparian, badlands, and developed (**Table 3.6-1** and **Figure 3.6-1**). These communities were defined using land cover descriptions developed by the USGS for the SWReGAP and high resolution aerial imagery (USGS 2004). As described in the subsections below, some of these communities represent a broader mosaic of multiple land cover types as defined by SWReGAP. Other communities include a single SWReGAP cover type but have been named differently to remain consistent with wildlife habitat types described later in the document.

The composition and distribution of vegetation community/land cover types in the GCWPA are influenced by variations of factors including geology, soils, moisture, elevation, aspect, and slope. Vegetation community/land cover types are further modified by historic and current land uses (i.e., livestock grazing, agricultural development, and energy exploration and development). Descriptions of each vegetation community/land cover type are provided below.

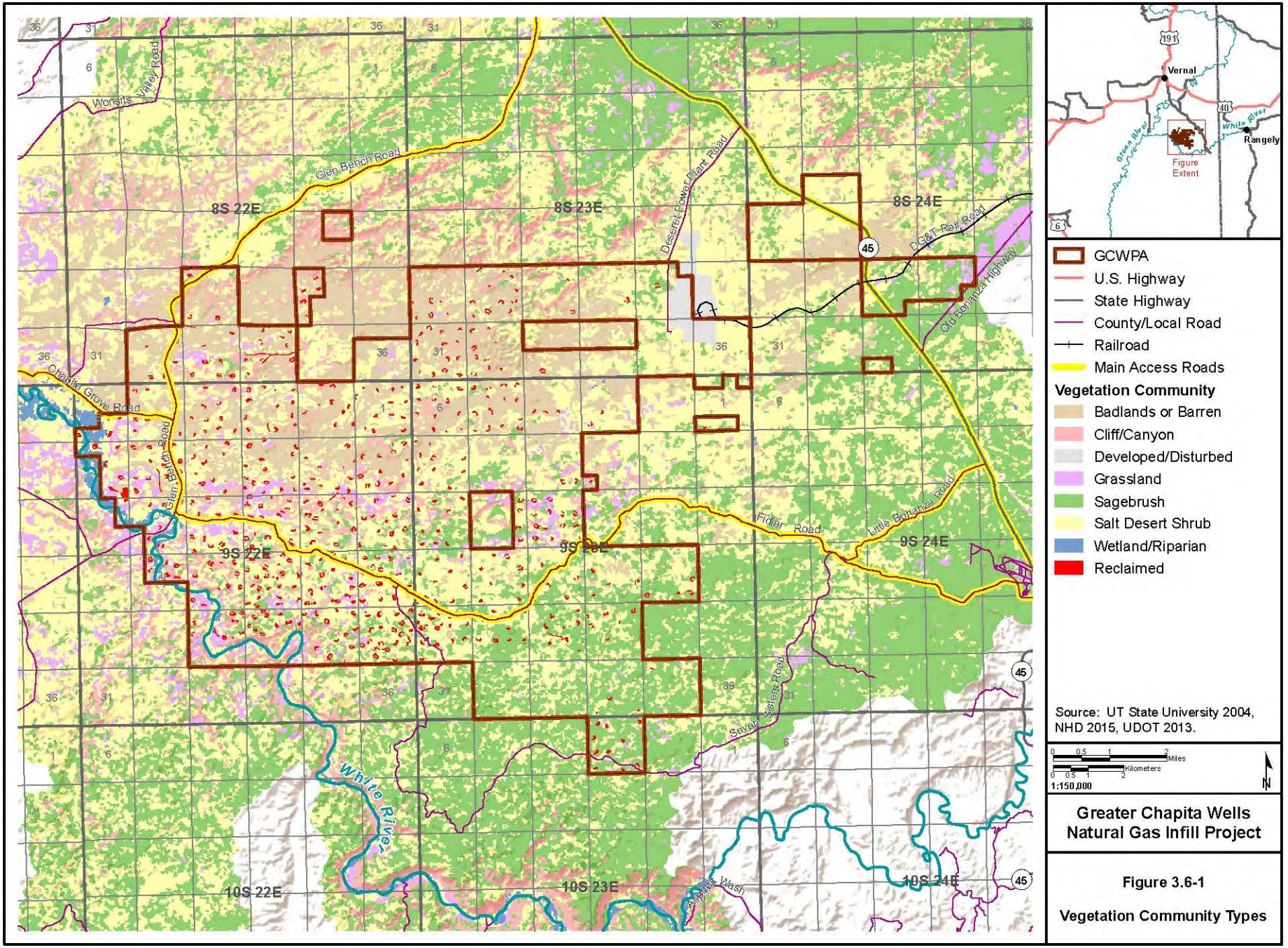
Table 3.6-1 Vegetation Community Types that Occur within the GCWPA

Vegetation Community/Land Cover Type	Acres	Percent of GCWPA
Badlands	10,440	24
Cliff/Canyon	2,527	6
Developed/Disturbed	3,309	8
Grassland	1,885	4
Sagebrush Shrubland	6,976	16
Salt Desert Shrub	17,383	40
Wetland/Riparian	551	1
Total	**43,071**	

Source: SWReGAP 2004a.

3.6.1.1 Salt Desert Shrub

Salt desert shrub is the dominant vegetation community and covers approximately 40 percent of the GCWPA (**Table 3.6-1**, Vegetation Community Types that Occur within the GCWPA; **Figure 3.6-1**, Vegetation Community Types). This community includes inter-mountain basins mat saltbush shrubland, inter-mountain basins mixed salt desert scrub, inter-mountain basins semi-desert shrub steppe, and inter-mountain basins greasewood flat SWReGAP cover types. This community is generally characterized by open-canopied shrublands that are present throughout the intermountain western U.S. Salt desert shrub is common in basins, plains, and on alluvial deposits of floodplains, alluvial fans, and pediment slopes. This community typically is found on medium- to fine-textured alkaline soils with saline



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and calcareous substrates. Dominant shrub species typically include shadscale (*Atriplex confertilfolia*), four-winged saltbush (*Atriplex canescens*), Gardner's saltbush (*Atriplex gardneri)*, big sagebrush (*Artemisia tridentata*), rabbitbrush (*Ericameria* spp.), Mormon tea (*Ephedra nevadensis*), spiny hopsage (*Grayia spinosa*), winterfat (*Krascheninnikovia lanata*), and horsebrush (*Tetradymia* spp.). The understory is comprised of galleta (*Pleuraphis jamesii*), Indian ricegrass (*Achnatherum hymenoides*), blue grama (*Bouteloua gracilis*), thickspike wheatgrass (*Elymus lanceolatus*), western wheatgrass (*Pascopyrum smithii*), and a small variety of forbs including primrose (*Camissonia* sp., *Oenothera* spp.), yarrow (*Achillea* spp.), and annual buckwheat (*Eriogonum* spp.) (Goodrich and Neese 1986; USDA 2006a; USGS 2004).

3.6.1.2 Sagebrush Shrubland

Sagebrush shrubland communities occur in broad basins between mountain ranges, open plains, and in the foothills regions throughout the western U.S. (USGS 2004). These communities are common within the GCWPA and include the Colorado plateau pinyon-juniper shrubland, inter-mountain basins big sagebrush shrubland, and Colorado plateau mixed low sagebrush shrubland SWReGAP cover types: in the Uinta Basin, sagebrush communities occur at elevations from 5,000 to 8,000 feet. Wyoming big sagebrush and black sagebrush are the dominant sagebrush species. Black sagebrush occurs in shallow rocky soils that are high in carbonates (Goodrich and Neese 1986), while Wyoming big sagebrush typically is found in xeric sites adjacent to valley bottoms (Welsh et al. 1993). Sagebrush communities account for approximately 16 percent of the GCWPA (**Table 3.6-1**) and are concentrated in the southern and northeastern portions of the GCWPA (**Figure 3.6-1**) (USGS 2004). Other species found in sagebrush vegetation communities include rubber rabbitbrush, yellow rabbitbrush, greasewood, and various saltbush species in areas of elevated soil salinity levels. Soils are typically well drained, moderately deep to deep, and non-saline. This community typically has a minor understory component that is comprised of grasses and forbs. Grass and forb species that commonly are associated with the sagebrush community include Indian ricegrass, blue grama, thickspike wheatgrass, Idaho fescue, Sandberg bluegrass, needle-and-thread grass, and Great Basin wildrye (USDA 2006a; USGS 2004).

3.6.1.3 Grassland

The grasslands community contains the inter-mountain basin semi-desert grassland and invasive annual grassland SWReGAP cover types. Grassland vegetation communities typically are found in the western U.S. on well drained sandy or loamy soils occupying xeric playas, mesa tops, plateau parks, alluvial flats, and plains between 4,750 to 7,610 feet in elevation (USGS 2004). Within the Uinta Basin, the grassland community is most prevalent on soils developed on exposures of the Uinta and Green River formations on gravelly or rocky sites at elevations from 5,000 to 10,000 feet (Goodrich and Neese 1986; Welsh et al. 1993). The GCWPA contains less than 5 percent of this community (**Table 3.6-1** and **Figure 3.6-1**) (USGS 2004). Dominant plant species of grassland communities are generally drought-resistant and include Indian ricegrass, three-awn species, blue grama, needle-and-thread grass, muhly species, galleta grass, and to a lesser extent scattered dwarf-shrub varieties of sagebrush, saltbush, Mormon tea, winterfat, and snakeweed species (USDA 2006a; USGS 2004). Cheatgrass, a widespread, invasive species, also is abundant throughout the GCWPA (Goodrich and Neese 1986).

3.6.1.4 Cliff/Canyon

The cliff/canyon vegetation community is composed of the Colorado plateau mixed bedrock canyon and tableland SWReGAP cover types. Cliff/canyon vegetation communities generally are sparsely vegetated with less than 6 percent plant cover (USGS 2004). These communities commonly occupy cliff faces, steep slopes of narrow canyons, and open tablelands of shallow soils dominated by exposed bedrock surfaces. Geologic composition of this cover type includes sedimentary rock, primarily of limestone, shale, and sandstone, with some eroding shale layers embedded between the harder rock layers (NatureServe 2009). Cliff/canyon communities make up approximately 6 percent of the GCWPA (**Table 3.6-1** and **Figure 3.6-1**) (USGS 2004). Species in this community are common species from the salt desert shrub, sagebrush, and grassland communities (USDA 2006a; USGS 2004).

3.6.1.5 Wetland/Riparian

As discussed in Section 3.4.1.4, Waters of the U.S. and Wetlands, wetlands consist of areas inundated by surface water or saturated by groundwater often enough to support vegetation adapted to saturated soils. The wetlands/riparian community is composed of the open water, Rocky mountain lower montane riparian woodland and shrubland, and invasive Southwest riparian woodland and shrubland SWReGAP cover types. Wetlands are lands transitional between terrestrial and aquatic systems where the soil or substrate is at least periodically saturated with water (Cowardin et al.1979). Frequent water saturation is the determining factor in development of hydric soils and hydrophytic vegetative communities (Cooper 1989). Wetlands in the GCWPA primarily occur within riparian corridors of drainage bottoms and floodplains along the White River (**Figure 3.6-1**) (USGS 2004). Wetlands, for the purpose of this discussion, are generally distinguished from riparian habitats based on vegetation strata. Wetlands are typically dominated by herbaceous and shrubby species. Riparian corridors are characterized by a tree dominated mixture of multiple communities with a diverse shrub component (NatureServe 2009). This community is adjacent to and affected by groundwater or perennial or ephemeral surface waterbodies (i.e., rivers, streams, lakes, and ponds). These areas have distinctly different vegetation than adjacent upland areas or have species similar to surrounding areas that exhibit a more vigorous or robust growth form. This mosaic of communities is influenced by differences in floodplain width, elevation, stream gradient, and is dependent upon annual or episodic flooding within the floodplains of the White River and intermittent streams within the GCWPA. Dominant species in this community include Fremont cottonwood, willow, and tamarisk (USGS 2004).

Small pockets of marsh wetlands also are present within the GCWPA in intermittent and ephemeral drainages. These marsh wetland locations are characterized by emergent vegetation and shrubs but generally lack trees. Although wetland and riparian communities are limited within the GCWPA and do not constitute an extensive cover type, less than 2 percent (**Table 3.6-1**) (USGS 2004), they provide valuable habitat for many wildlife species. Dominant plant species include cattails, sedges, rushes, and saltgrasses.

3.6.1.6 Badlands

The badlands vegetation community is identical to the SWReGAP inter-mountain basins shale badland cover type. The badlands cover type makes up approximately 24 percent of the GCWPA and is composed of barren and sparsely vegetated substrates of exposed geologic materials derived from marine shale, siltstones, and mudstones (NatureServe 2009). Badlands are widespread in the intermountain western U.S., and are extensive within the GCWPA (**Table 3.6-1** and **Figure 3.6-1**). Badlands experience high rates of soil erosion and therefore provide little soil material to support plant establishment and growth. The badlands vegetation community typically consists of sparse herbaceous and dwarf-shrub cover. Common species include mat saltbush, Gardner's saltbush, sagebrush, and herbaceous vegetation (USDA 2006a; USGS 2004).

3.6.1.7 Developed

The developed land cover includes developed and open space-low intensity cover types. Developed areas within the GCWPA include the Deseret Power Plant, multiple produced water evaporation facilities, and all disturbed areas (i.e., existing roads, pipeline corridors, and well pads). Developed areas encompass less than 10 percent of the GCWPA (**Table 3.6-1** and **Figure 3.6-1**). These areas do not typically support vegetation or associated wildlife habitats (USGS 2004), but may be utilized by wildlife species.

3.6.2 Invasive, Non-native Plants and Noxious Weeds

Invasive plants include plants that have been introduced to an environment in which they did not evolve and are likely to cause ecological, economical, or human health harm (USDA 2006b). The proliferation of these species, especially in areas of recent disturbance, and their negative impacts upon the

environment, has become a major area of concern for the BLM and the State of Utah. Of particular concern is the infestation and spread of some invasive, non-native plant species known as noxious weeds.

Noxious weeds commonly are defined as plants possessing the potential to either directly or indirectly cause harm or damage to natural resources, agricultural interests, the environment, or to public health (USDA 2016). The federal Noxious Weed Act of 1974, as amended (7 USC 2801 et seq), requires cooperation with state, local, and federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. The most common invasive species in the GCWPA are halogeton and cheatgrass (**Table 3.6-2**). Although additional noxious weed species including Canada thistle, field bindweed, hoary cress, Russian knapweed, Scotch thistle, and perennial pepperweed are known to occur in the region and Uintah County, these species currently are not known to occur within the GCWPA; however, they have the potential to spread into the GCWPA.

Table 3.6-2 Designated Noxious Weeds and Invasive Species with the Potential to Occur within the GCWPA

Common Name[1]	Scientific Name[1]	Noxious Weeds List/ Invading Species of Concern[2]		
		State of Utah[3]	Uintah County[4]	BLM VFO[5]
Cheatgrass	*Bromus tectorum*	I	I	I[6]
Hoary cress	*Cardaria draba*	B	B	B
Musk thistle	*Carduus nutans*	B	C	B
Diffuse knapweed	*Centaurea diffusa*	A	A	A
Meadow knapweed	*Centaurea pratensis*	--	--	X
Russian knapweed	*Centaurea repens*	B	C	B
Yellow starthistle	*Centaurea solstitialis*	A	A	X
Spotted knapweed	*Centaurea stoebe*	A	B	A
Squarrose knapweed	*Centaurea virgata* ssp. *squarrosa*	B	A	--
Oxeye daisy	*Chrysanthemum leucanthemum*	A	A	X
Chicory	*Cichorium intybus*	--	--	X
Canada thistle	*Cirsium arvense*	C	C	C
Bull thistle	*Cirsium vulgare*	--	--	I
Poison hemlock	*Conium maculatum*	B	A	X
Field bindweed	*Convolvulus arvensis*	C	C	C
Bermuda grass	*Cynodon dactylon*	B	A	--
Houndstongue	*Cynoglossum officinale*	C	B	C
Common teasel	*Dipsacus fullonum*	--	A	X
Russian olive	*Elaeangus angustifolia*	--	C	I
Quackgrass	*Elytrigia repens*	C	C	--
Redstem filaree	*Erodium cicutarium*	--	--	X
Leafy spurge	*Euphorbia esula*	A	B	X
Halogeton	*Halogeton glomeratus*	--	--	I
Venice mallow	*Hibiscus trionum*	--	--	X
Black henbane	*Hyoscyamus niger*	A	A	A

Table 3.6-2 Designated Noxious Weeds and Invasive Species with the Potential to Occur within the GCWPA

Common Name[1]	Scientific Name[1]	Noxious Weeds List/ Invading Species of Concern[2]		
		State of Utah[3]	Uintah County[4]	BLM VFO[5]
Dyers woad	*Isatis tinctoria*	B	A	B
St. John's wort	*Hypericum perforatum*	A	A	A
Perennial pepperweed	*Lepidium latifolium*	B	C	B
Dalmation toadflax	*Linaria genistifolia*	B	A	X
Yellow toadflax	*Linaria vulgaris*	A	A	A
Purple loosestrife	*Lythrum salicaria*	A	A	A
Scotch thistle	*Onopordum acanthium*	B	A	B
Sulfur cinquefoil	*Potentilla recta*	A	A	X
Perennial sowthistle	*Sonchus arvensis*	--	--	X
Perennial sorghum	*Sorghum almum*[5,7]	X	I	I
Johnsongrass	*Sorghum halepense*	A	A	A
Medusahead	*Taeniatherum caput-medusae*	A	A	A
Saltcedar	*Tamarix ramosissima*	C	C	C
Common tansy	*Tanacetum vulgare*	--	--	--
Puncturevine	*Tribulus terre*	--	B	--
Common mullein	*Verbascum thapsus*	--	--	--

[1] Species nomenclature is consistent with the USDA-NRCS Plants Database (USDA 2006a).

[2] Noxious weeds list or invading species of concern species include designated (A, B, or C listing) or not designated (--). Class A weeds have a moderate population throughout the state and are of highest priority, being an Early Detection Early Response weed. Class B weeds have a moderate population throughout the state and generally are thought to be controllable in most areas. Class C weeds are found extensively in the state and are thought to be beyond control. Statewide efforts would generally be towards containment of smaller infestations.

[3] Officially designated and published as "noxious" in the State of Utah, as per the authority vested in the Commissioner of Agriculture under Section 4-17-3, Utah Noxious Weed Act (Utah State Legislature 2007). www.utahweed.org/weeds.htm and https://plants.usda.gov/java/noxious.

[4] County-listed weeds based on www.uintahweeds.org. All property owners and custodians of public land are required by Law (4-17-7) to control weeds on lands under their jurisdiction (Uintah County Weed Department 2004).

[5] Species designated as a priority species per the BLM VFO; species known to occur in Rio Blanco County, Colorado (abutting Uintah County, Utah).

[6] Species designated as Invasive by BLM VFO listing.

[7] Species designated as a noxious weed species per the Utah State Legislature; however, this species is not designated as a noxious weed species per the Utah Weed Control Association (Utah State Legislature 2010).

3.6.3 Special Status Plants

Special status species include those plant and animal species that are federally listed under the ESA, as amended, as threatened, endangered, proposed, and/or candidate species, BLM sensitive species, or State of Utah species of concern. The ESA provides protection to federally listed threatened, endangered and candidate species from any action that may jeopardize their existence. In accordance with the ESA, the lead federal agency, in coordination with USFWS, must ensure that any federal action to be authorized, funded, or implemented would not adversely affect a federally listed threatened or

endangered species or its critical habitat. Special Status Species Management Policy 6840 requires the BLM to manage and protect any USFWS candidate species, BLM sensitive species, or State of Utah species of concern to prevent the need for future federal listing. A full listing of these species is presented in **Appendix M**. This appendix table lists the species' scientific names, status, habitat and distribution, and potential for occurrence in the GCWPA. Potential for occurrence within the GCWPA was evaluated for each of these species based on their habitat requirements and/or known distribution.

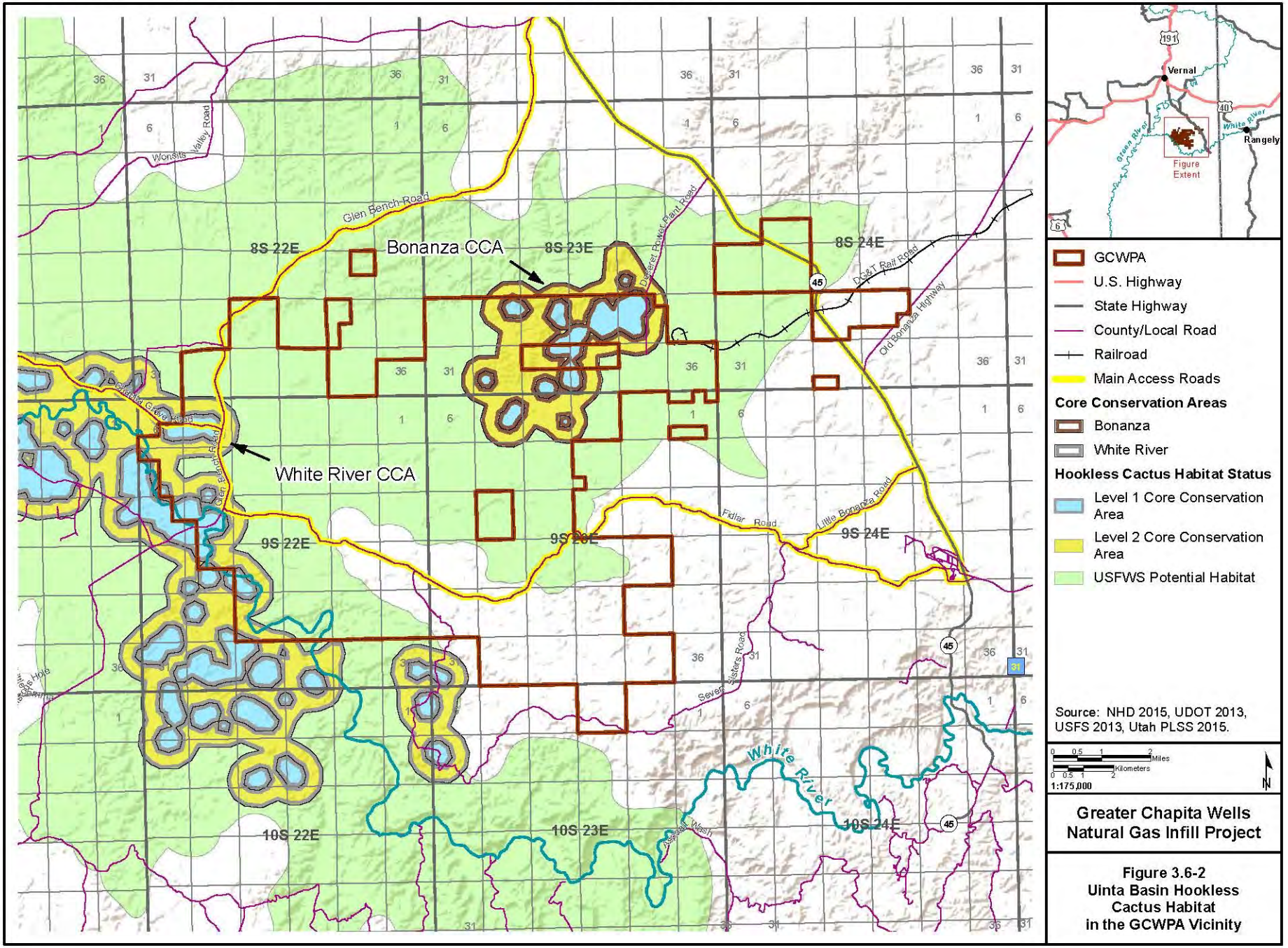
There are 26 special status plants potentially occur within Uintah County, Utah (USFWS 2014a; Utah Rare Plant Guide 2010). Of the 26 species, only 4 species: Uinta Basin hookless cactus (*Sclerocactus wetlandicus*), Ute ladies'-tresses orchid (*Sprianthes diluvialis*), horseshoe milkvetch (*Astragalus equisolensis*), and sterile yucca (*Yucca sterilis)* have the potential to occur within the GCWPA.

3.6.3.1 Uinta Basin Hookless Cactus

Uinta Basin hookless cactus is a federally listed threatened species (**Figure 3.6-2**). This species formerly was recognized as *Sclerocactus glaucus*, which included a complex of three distinct phenotypes including *S. glaucus*, *S. glaucus wetlandicus*, and *S. glaucus brevispinus*. USFWS announced a taxonomic change of the *S. glaucus* complex into three distinct species including Colorado hookless cactus (*S. glaucus*), Uinta Basin hookless cactus (*S. wetlandicus*) and Pariette cactus (*S. brevispinus*) on September 18, 2007 (USFWS 2007). Colorado hookless cactus does not occur in Utah and the extremely limited range of Pariette cactus is not concomitant with the GCWPA.

The habitat description of the *S. glaucus* complex prior to the taxonomic change included: gravelly hills and terraces in salt desert shrub and pinyon-juniper communities on river benches, valley slopes, and rolling hills of the Duchesne River, Green River, and Mancos Formations between 4,500 to 6,600 feet (Utah Native Plant Society 2003-2009). This habitat description represented all *S. glaucus* spp. and is not accurate for Uinta Basin hookless cactus, which includes additional habitats and is not found in pinyon-juniper woodlands. *S. wetlandicus* occurs on hills, terraces, flats, drainages, most commonly in alluvial round cobble, but also has been found in angular shale, mudstone, and sandstone. *S. wetlandicus* primarily is associated with a sparse low-desert scrub vegetation type that includes a variety of species (i.e., Indian ricegrass, galletta grass, fourwing saltbush, and Gardner's saltbush). Uinta Basin hookless cactus can be solitary or found in small to large colonies. This green to gray colored cactus is depressed hemispheric, obovid, ovoid, or cylindric in shape and can range from 1 to 35 centimeters tall or more. The species spines are found on tubelercules that occur along ridges that form upward spirals on the plant. Clusters of straight aerial spines (7 to 12 or more) occur around one (occasionally 2 to 3) central spine that is hooked, curved, or not present on some individuals (Welsh et al. 1993).

The known range of the species occurs within approximately 20 miles of the Green River. The northernmost population is documented in T3S, R2E near the confluence of the Duchesne and Uinta rivers; the southernmost population is documented in T12S, R18E on the northern side of Rock House Canyon. Population density appears to drastically increase in proximity to perennial waters including the Duchesne, Green, and White rivers as well as Pariette Draw. The USFWS estimate approximately 50,000 Uinta Basin hookless cactus rangewide with over 8,100 documented occurrence locations within the BLM VFO (BLM 2009d). Known occurrence locations can represent an individual plant, but also frequently represent a cluster of plants or an entire population (upwards of 100 individuals). Approximately 2,273 *S. wetlandicus* occurrence records have been documented within the GCWPA (approximately 5 percent of the total estimated population) (BLM 2009d).



Greater Chapita Wells Natural Gas Infill Project

Figure 3.6-2
Uinta Basin Hookless Cactus Habitat in the GCWPA Vicinity

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Within Uintah and Duchesne counties, potential habitat and core conservation areas (CCAs) for the Uinta Basin hookless cactus have been identified by USFWS (2016) across its range. Approximately 392,165 acres of potential habitat have been identified. Although Uinta Basin hookless cactus populations can be found outside of these areas, they tend to be more isolated and occur in low densities (BLM 2012a). Approximately 28,929 acres, or 7 percent, of all potential habitat exists (USFWS 2016) within the GCWPA. The GCWPA includes portions of the White River and Bonanza CCAs, where substantial disturbance has already occurred (USFWS 2012a). CCAs contain the densest known concentrations of cacti (BLM 2012a). There are two levels of CCAs (1, 2) based on pollinator travel distance and habitat connectivity between populations and individuals. Level 1 CCAs were developed using a 400-meter buffer around plants to allow for pollinator travel and include the densest concentrations of cactus locations and the most restrictive management recommendations. Level 2 CCAs were developed using a 1,000-meter buffer around plants while incorporating less-dense cactus areas and less restrictive management recommendations. Approximately 2,549 acres of Level 1 CCAs (1,482 acres within the Bonanza CCA and 1,066 acres within the White River CCA) and 5,882 acres of Level 2 CCAs (3,445 acres within the Bonanza CCA and 2,437 acres within the White River CCA) are found within the GCWPA. The location of CCAs, as well as additional potential habitat identified by the USFWS (2016), within the GCWPA is depicted in **Figure 3.6-2**.

3.6.3.2 Ute Ladies'-tresses Orchid

The Ute ladies'-tresses orchid was listed as threatened pursuant to the ESA on January 17, 1992 (57 *Federal Register* 2048), due to adverse impacts such as grazing, loss or fragmentation of habitat as a result of noxious weed species invasion, and shifts in the species-dependent hydrologic regime. Additional threats to Ute ladies'-tresses orchid include habitat loss and modification, over-collection, noxious and invasive species, herbicide drift, recreation activities, mowing, livestock grazing, hydrologic modifications, herbivory, loss of pollinators, drought, and loss of mycorrhizal symbionts. The species is aquatic or wetland-dependent, and typically occupies moist to very wet, somewhat alkaline or calcareous native meadows near streams, springs, seeps, lake shores, or abandoned stream meanders that still retain ample groundwater (Fertig 2000; USFWS 2016). The orchid appears to require moisture in the rooting zone, typically provided by a high groundwater table, through the growing season and into late summer or early autumn. Plants usually occur as small scattered groups and occupy relatively small areas within the riparian system. Elevations range from 4,200 to 7,000 feet above mean sea level (amsl) over the entire range of the species. The species typically flowers from July to August, but can vary from late June to late September depending on the state/region (Fertig 2000; USFWS 2016).

The Ute ladies'-tresses orchid is known to occur in central and northeastern Utah, northwestern Colorado, and eastern Nevada (USFWS 2016). Habitat for the Ute ladies'-tresses orchid also is found in southeastern Wyoming (USFWS 2016). The species has not been documented within the GCWPA, but potential habitat is present and it has a long history of occurrence within Uintah County. Critical habitat has not been designated for this species. Because this species is associated with wetland and riparian habitats, approximately 551 acres of potential habitat is found within the GCWPA.

3.6.3.3 Horseshoe Milkvetch and Sterile Yucca

Horseshoe milkvetch and sterile yucca are BLM sensitive species with potential to occur within the GCWPA (BLM 2011b). These species are associated with salt desert shrub, juniper, sagebrush and shadscale communities. Approximately 24,358 acres of potential habitat for these species occur within the GCWPA. Special status plant surveys conducted within the GCWPA, identified 14 records of the sterile yucca within the GCWPA. No known populations of the horseshoe milkvetch have been documented within the GCWPA.

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3.7 Wildlife and Fisheries

3.7.1 Wildlife

The GCWPA and adjacent lands study area provides a variety of habitats for wildlife species that are influenced by the combination of terrain, elevation, and vegetative cover. Terrain varies across the GCWPA from floodplains and higher terraces of the White River bottomlands to upland plains, broad valleys and hills to more rugged escarpments of the dissected Uinta Basin. Elevations range from approximately 4,700 feet amsl along the White River to 5,500 feet amsl in the southeastern portions of the GCWPA. Dominant vegetation/cover types in the GCWPA include badlands, cliff/canyon, developed/disturbed, grasslands, sagebrush, salt desert shrub, and wetland/riparian as described in **Table 3.6-1** (SWReGAP 2014). Current land uses include mineral extraction, livestock grazing, and other dispersed recreation. Detailed descriptions of the vegetation community types within the GCWPA are discussed in Section 3.6, Vegetation.

3.7.1.1 General Wildlife

The GCWPA supports a diverse wildlife community of large and small mammals, migratory birds, reptiles, and amphibians. Occurrence and density of wildlife species within the GCWPA are dependent upon a variety of factors including the size and mobility of the animal, food habits, water, existing and ongoing development, and overall habitat carrying capacities (Prior Magee 2007). The dominant vegetation communities within the GCWPA combine to form a mosaic of different wildlife habitats. Wildlife species may utilize several different habitat types or vegetation communities in different seasons or throughout their life cycles.

Many common wildlife species are widespread throughout the region where suitable habitats are present. Small mammals that occur in the GCWPA include shrews, mice, rats, ground squirrels, rabbits, badger (*Taxidea taxus*), coyote (*Canis latrans*), fox, and bats including Pallid bat and canyon bat. Reptile species including sagebrush lizard (*Sceloporus graciosus*), cornsnake (*Elaphe guttata*), midget faded rattlesnake (*Crotalus oreganus concolor*), gopher snake (*Pituophis catenifer*), and greater short-horned lizard (*Phrynosoma hernandesi*) are locally abundant and occur throughout the GCWPA. Common amphibian species that occur within the limited aquatic habitats, wetland, and riparian zones, which are associated primarily with the White River and some of its intermittent tributaries include basin spadefoot toad (*Spea intermontana*), Woodhouse's toad (*Bufo woodhousii*), and northern leopard frog (*Rana pipiens*).

All wildlife species present in the GCWPA are important members of a functioning ecosystem and wildlife community, but most are common and have wide distributions in the region. Consequently, the relationships of most of these species to the proposed Project are not discussed in the same depth as species that are threatened, endangered, sensitive, of special concern, of special economic interest, or otherwise of high public interest or unique value.

3.7.1.2 Big Game

The big game species that are known to occur in the GCWPA include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*), and bison (*Bos bison*). Big game populations are managed by the UDWR within areas designated as Wildlife Management Units (WMUs) or Herd Management Units (HMUs), respectively. The GCWPA is mostly located within Wildlife Management Unit 9 (South Slope). A small amount of acreage and that portion of the GCWPA located on the southwestern side of the White River are located within the Wildlife Management Unit 10 (Book Cliffs). Herd size and viability of big game populations are dependent on the combination, availability, and quality of seasonal ranges. Seasonal ranges are not mutually exclusive and fulfill different requirements for resident and migratory big game populations. UDWR has identified several types of seasonal ranges (i.e., summer, winter, yearlong, etc.) ranked according to their relative biological value. UDWR designates big game habitat as either crucial or

substantial. Local populations depend on crucial habitat areas for survival because alternative ranges and/or habitats are unavailable. Crucial value habitat is essential to the life history requirements of a wildlife species. Degradation or unavailability of crucial habitat could lead to significant declines in carrying capacity and negatively affect populations. A substantial value habitat is used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat will not lead to significant declines in carrying capacity and/or numbers of the wildlife species in question.

Mule deer and pronghorn are relatively common and yearlong crucial range for both species exists within the GCWPA (**Table 3.7-1** and **Figure 3.7-1** and **Figure 3.7-2**. Bighorn sheep and bison are not expected to occur within the GCWPA with any regularity and when present would only consist of a small number of individuals. However, because of ongoing reintroduction efforts, UDWR has designated yearlong crucial bison and bighorn sheep range within the GCWPA (**Table 3.7-1** and **Figures 3.7-2, 3.7-3**, and **3.7-4**, respectively). Areas of overlapping crucial range are of greater importance because they provide crucial habitat for more than one species of big game. Overlapping crucial ranges for mule deer, big horn sheep, and bison occur along or the White River corridor within the GCWPA.

Table 3.7-1 Big Game Yearlong Crucial Ranges within the GCWPA

Species	Acres	Percent of GCWPA
Mule Deer	2,351	5.5
Pronghorn	40,115	93.1
Rocky Mountain Bighorn Sheep	3,016	7
Bison	930	2.2

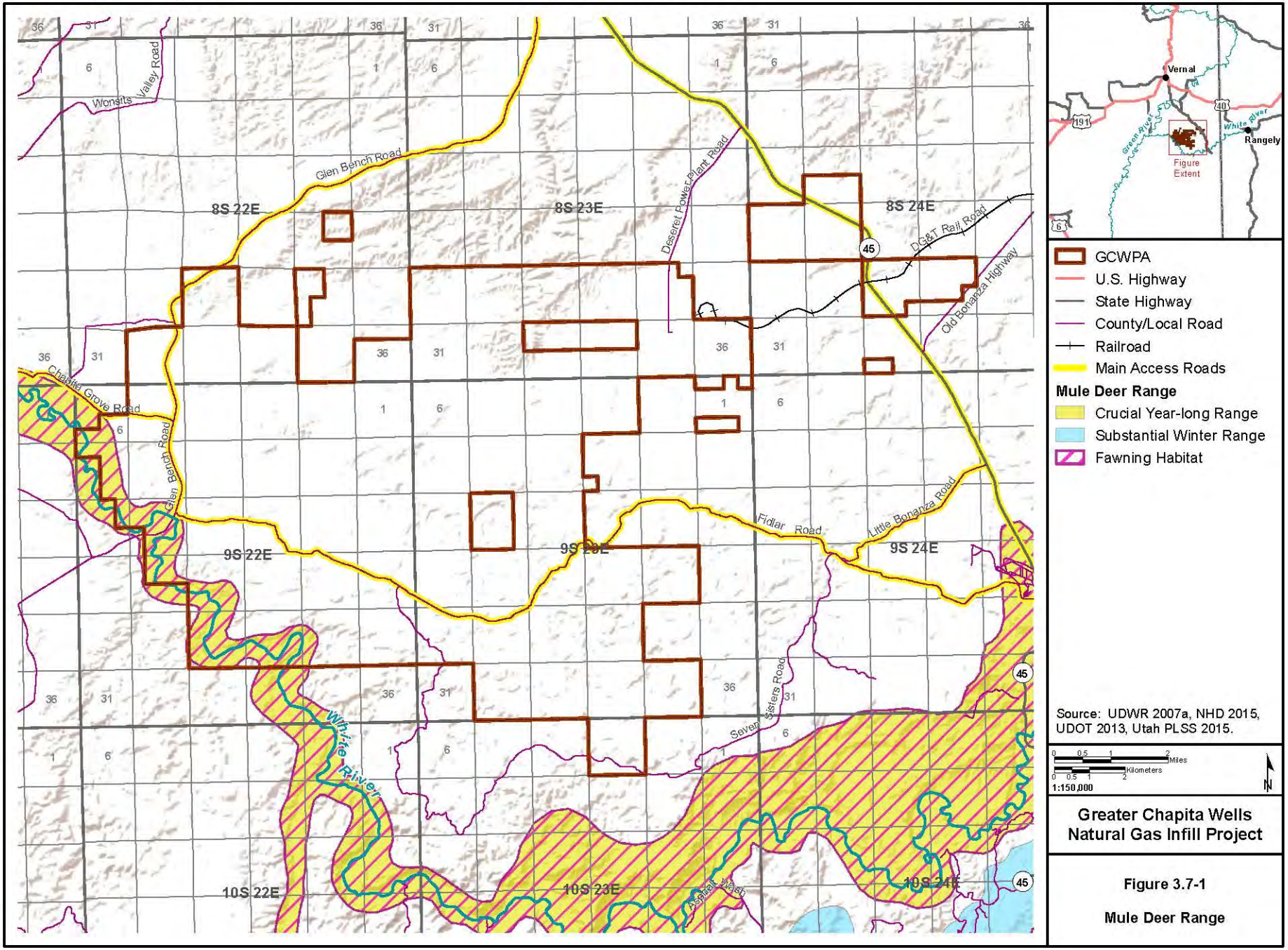
Source: UDWR 2014a.

Although elk, moose, black bear, mountain lion, and mountain goat occur within the VFO, the majority of the GCWPA is predominantly unsuitable habitat for these species. Black bears, mountain lions, and elk are common in forested habitats throughout the Book Cliffs, approximately 20 miles to the south of the GCWPA (BLM 2008d). It is unlikely that these species would be present within the GCWPA with any consistency. However, dispersing individuals might sporadically travel along the White River corridor while moving between areas of suitable habitat.

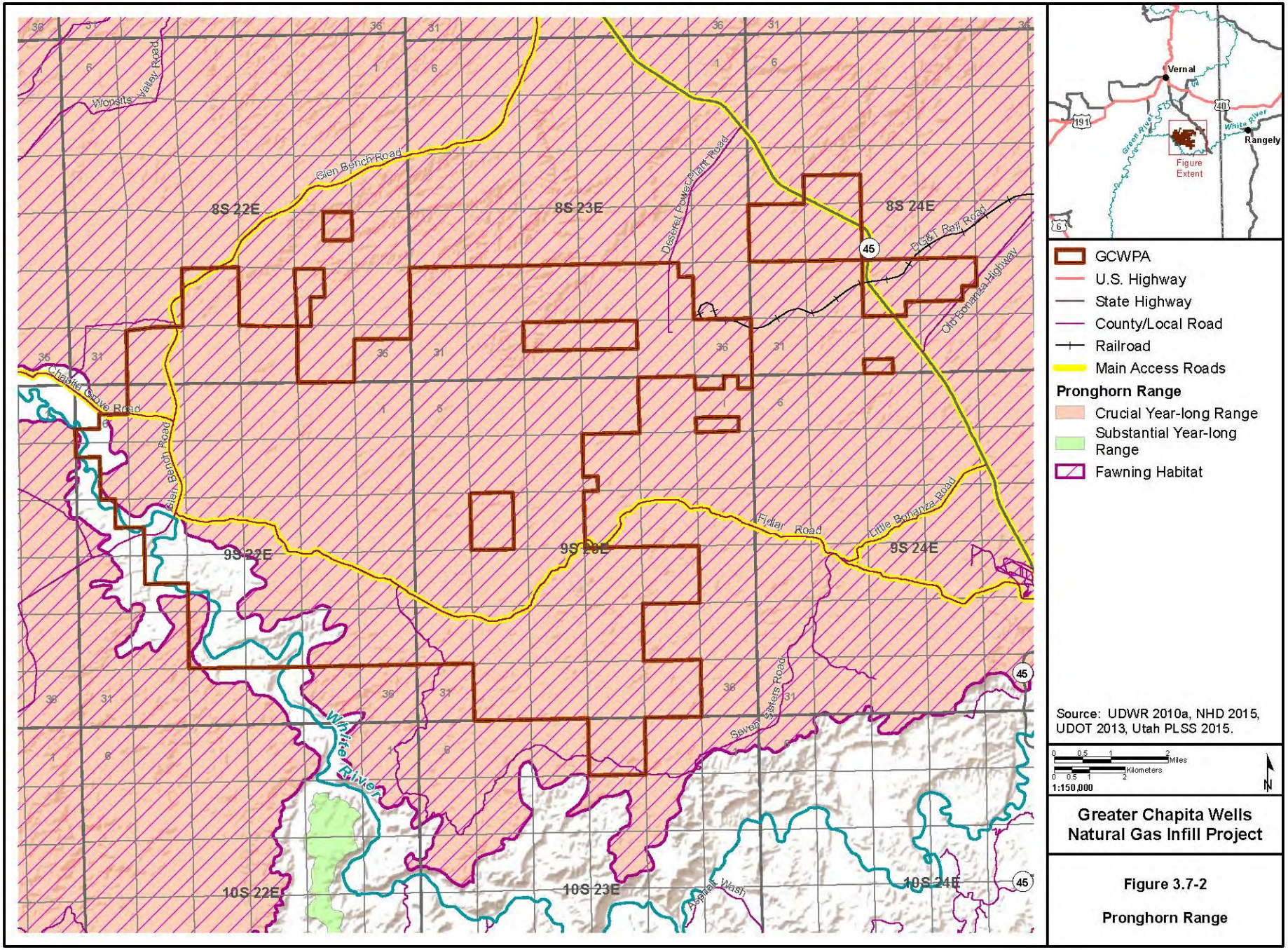
Mule Deer

Mule deer is a common big game species with a range that extends across much of western North America. This species is found in a wide variety of habitats from northern boreal forests to the deserts of the southwest and from the coastal rainforests to the Great Plains (UDWR 2008). Mule deer diets are highly variable and depend on season and habitat, but primarily consist of shrubs and other woody plants, forbs, and grasses. Populations often migrate from high mountainous areas in the summer to lower elevations in the winter. Breeding occurs in late fall and parturition (giving birth to offspring) takes place in late spring to early summer (Fitzgerald et al. 1994). In Utah, mule deer attain their greatest densities in areas of broken, rough terrain offering abundant browse and cover (UDWR 2008).

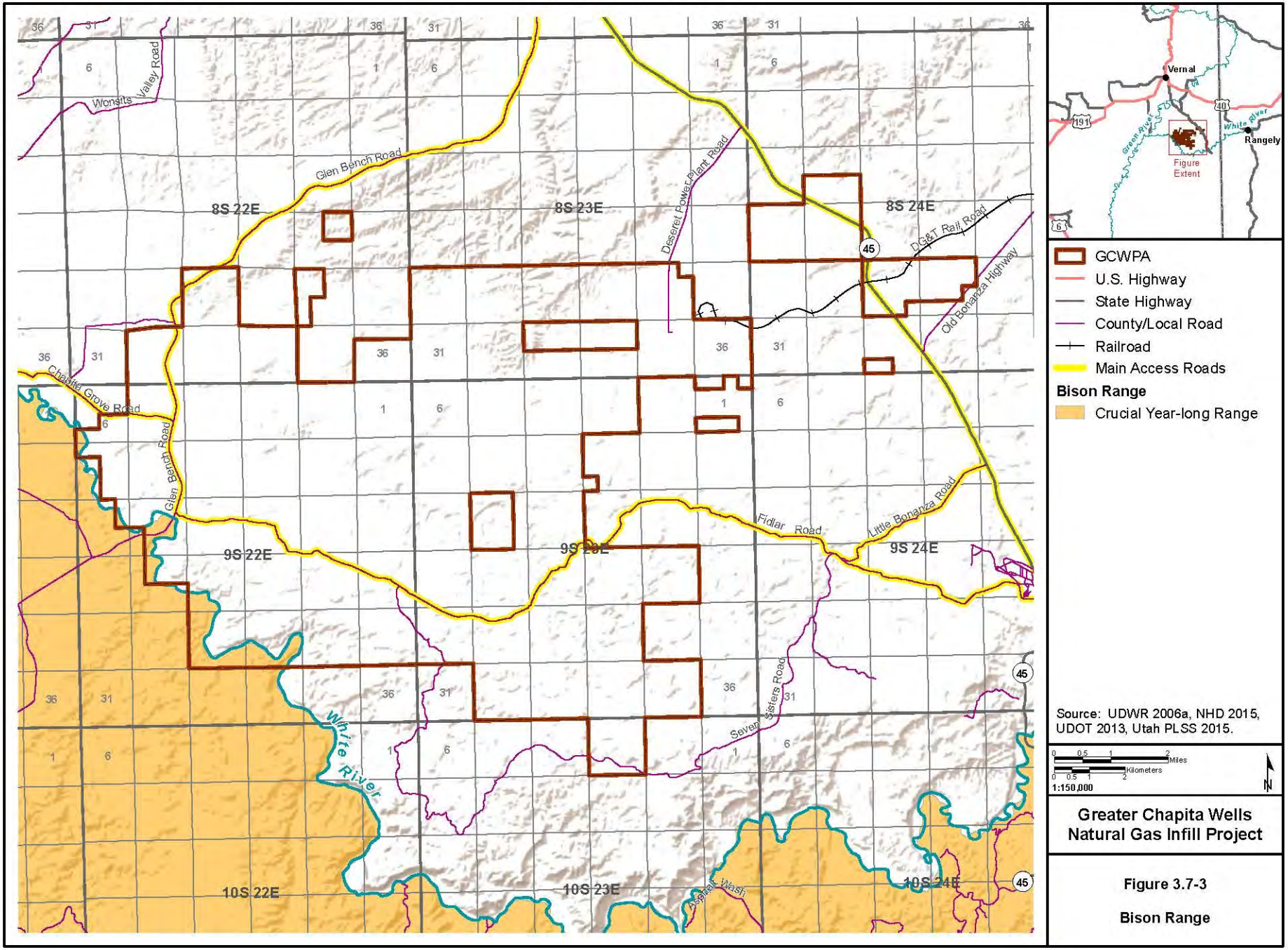
Within the GCWPA, mule deer range (crucial yearlong/fawning habitat) is limited primarily to the White River corridor and adjacent uplands (**Figure 3.7-1** and **Figure 3.7-2**). UDWR has set a population objective for the South Slope Vernal/Diamond Mountain WMU at 13,000 individuals. The most recent population estimate for the unit (winter 2013) was 11,100 individuals (UDWR 2014c).



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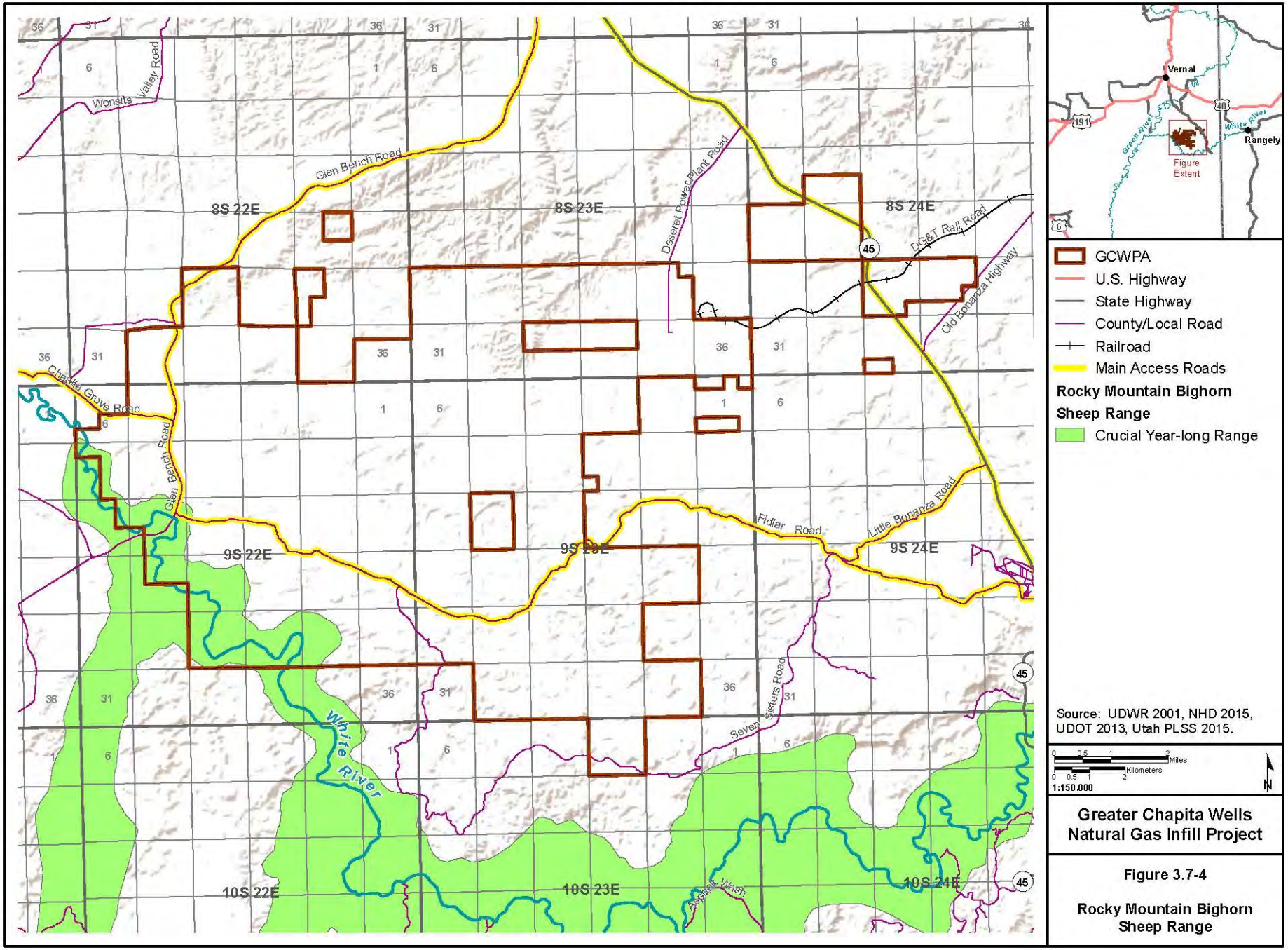


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Pronghorn

Pronghorn are common within grassland and shrub steppe habitats throughout western North America from Mexico north to southern Canada. Pronghorn primarily consume sagebrush with a minor component of their diet consisting of grasses and succulents (UDWR 2009). In Utah, pronghorn are found only in shrub steppe habitats. Shrub steppe habitats are widespread within the GCWPA and consist of the salt desert shrub, sagebrush, and grassland communities. UDWR has mapped nearly the entire GCWPA as yearlong crucial range/fawning habitat (**Table 3.7-1** and **Figure 3.7-2**). The Bonanza pronghorn herd occupies the majority of the GCWPA on a year-round basis. The South Slope Unit 9d Bonanza population is combined with the South Slope Unit 9c Diamond Mountain population for management purposes. The combined WMUs were estimated to have 775 individuals in 2008 with a downward population trend being documented over the previous 5 to 10 years (UDWR 2009).

Bison

Bison historically occurred within the Uinta Basin based on records from early expeditions into the area and Native American rock art. The species was extirpated from the Book Cliffs and possibly from the Uinta Basin for most of the 20th Century. Efforts to reestablish bison in the Uinta Basin were initiated by the Ute Tribe in 1986 with an initial reintroduction of six individuals to the Hill Creek area of the Reservation. Since then the population has been supplemented periodically with additional animals, and the most current winter herd estimate (2006-2007) was 580 individuals (UDWR 2007b).

Although a very small portion of the GCWPA is considered yearlong crucial range for bison (south and west of the White River), this area does not consistently support bison (**Figure 3.7-3**). When reintroduction efforts began, the White River was selected as the northern extent of the Book Cliffs, Bitter Creek, and Little Creek HMU. However, most of the bison are found in the Book Cliffs to the south of the GCWPA. Future releases are planned throughout the Book Cliffs, but the anticipated future range of the species would remain within the existing HMU (UDWR 2007b). Nevertheless, individual bison may move outside of the current designated range, outside of the defined HMU boundary and north of the White River into that portion of the GCWPA north of the White River.

Rocky Mountain Bighorn Sheep

Rocky Mountain Bighorn Sheep are found in the western U.S. from Canada to Mexico and from California to the Dakotas. Bighorn sheep are native to Utah with historic accounts of relatively large populations. Two subspecies of bighorn sheep, the desert bighorn and Rocky Mountain bighorn, occur in Utah. The Rocky Mountain bighorn is the predominant subspecies in the VFO. Rocky Mountain bighorn sheep occupy open areas adjacent to steep, rocky, rugged terrain (UDWR 2013a). Open habitats are utilized for foraging grounds and typically support preferred food items (i.e., grasses, forbs, and shrubs). Steep, rugged escape terrain is critical aspect of suitable bighorn sheep habitats (Fitzgerald et al.1994).

Bighorn sheep habitat within the GCWPA is limited to the breaks and canyons adjacent to the White River corridor (**Figure 3.7-4**). Bighorn sheep are uncommon in the GCWPA; the majority of the local population is concentrated in the Book Cliffs south of the GCWPA (UDWR 2013a).

Native populations of Rocky Mountain bighorn sheep were nearly extirpated from Utah following emigrant settlement in the latter half of the 19th Century. However, sporadic observations of the species continued through the first half of the 20th Century. In an effort to return viable bighorn populations to Utah, UDWR began an aggressive reintroduction program in 1966. Over 1,000 Rocky Mountain bighorn sheep have been reintroduced into Utah since these efforts began. The population estimate for the Book Cliffs HMU 10 was 182 individuals in 2011, with a decreasing population trend (UDWR 2013a).

3.7.1.3 Small Game and Furbearers

The State of Utah recognizes several species of wildlife as upland game and as furbearing species. Many of these species are common and are likely to occur within the GCWPA. The diversity and

population density for these species is likely to increase with proximity to the White River corridor. Many furbearer species are associated with wetland and riparian habitats and may be expected to frequent the White River for water and protective cover. Based on the existing level of development throughout the GCWPA, small game hunting is not a common activity within the GCWPA. Common small game and furbearer species with the potential to occur in the GCWPA include desert cottontail(*Sylvilagus audubonii*), bobcat (*Lynx rufus*), coyote, raccoon (*Procyon lotor*), American beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), badger, long tailed weasel (*Mustela frenata*), gray fox (*Canis lupus*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale gracilus*), ringtail (*Bassariscus astutus*), mink (*Mustela vison*), and muskrat (*Ondatra zebethicus*).

3.7.1.4 Upland Game Birds

Greater sage-grouse (*Centrocercus orophasianus*), mourning dove (*Zenaida macroura*), chukar (*Alectoris chukar*), California quail (*Callipepla californica*), ring-necked pheasant (*Phasianus colchicus*), and Rio Grande wild turkey (*Meleagris callopavo intermedia*) are upland game bird species with the potential to occur within the GCWPA. Populations of these species are heavily influenced by annual climatic conditions and habitat availability. Upland game birds are managed by the UDWR within Upland Game Management Areas. The greater sage-grouse has been designated as sensitive by the State of Utah and the BLM and is discussed in Section 3.7.4, Special Status Wildlife Species.

3.7.2 Migratory Birds

Migratory birds are protected under the MBTA of 1918 (16 USC 703-711) and EO 13186 (66 Federal Register 3853). Pursuant to EO 13186, a MOU among the BLM and USFWS was drafted to promote conservation and protection of migrating birds. EO 13186 sets forth the responsibilities of federal agencies to implement 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.

A list of Birds of Conservation Concern (BCC) was developed as a result of a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that the USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973" (USFWS 2008a). The purpose of the BCC program is to identify and proactively manage BCC species and encourage conservation actions, and that these species would be consulted on in accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (USFWS 2008a). BCC species that potentially could occur within the GCWPA and their associated habitat types are identified in **Appendix N**.

In addition to the MBTA, the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) are protected under the BGEPA (16 USC 668 et seq.). This statute prohibits anyone without a permit from committing a "take" of bald and golden eagles, including their parts, nests, and eggs. "Take" is defined as the actions to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. In 2009, the USFWS implemented two rules authorizing new permits under BGEPA.

- 50 CFR 22.26 authorizes limited "take" of bald and golden eagles where the "take" is associated with, but is not the purpose of, an activity and cannot practicably be avoided.
- 50 CFR 22.27 authorizes the intentional take of eagle nests where necessary to alleviate safety hazards to people or eagles; to ensure public health and safety; where a nest prevents the use of a human-engineered structure; and when an activity, or mitigation for the activity, will provide a net benefit to eagles. Only inactive nests are allowed to be taken, except in the case of safety emergencies.

BGEPA provides the Secretary of the Interior with the authority to issue eagle-take permits only if he/she is able to determine that the take is compatible with the preservation of the eagle. This take must be "…consistent with the goal of increasing or stabilizing breeding populations." For golden eagles, current data indicate a negative population trend in the lower latitudes, such as the southwestern U.S., while data indicate a positive population trend in the northern Bird Conservation Regions. These trends may simply indicate movement patterns; however, evidence may demonstrate a lack of resiliency in golden eagle populations.

The bald eagle is discussed further below under special status species. The golden eagle is typically associated with open country where it feeds on small mammals, snakes, birds, juvenile ungulates, and carrion. Golden eagles are known to nest on cliffs or in large trees, and to often use the same nest in consecutive years. Suitable nesting and foraging habitats exist throughout the GCWPA. This species is known to nest throughout the VFO, with 23 known recorded nests within the GCWPA and surrounding mile buffer.

3.7.2.1 Raptors

There are several species of raptors known to occur within the VFO, with records of at least nine species nesting within the GCWPA (BLM 2012b). Of these species, several are considered Special Status Species and are included in **Appendix O**, with their scientific name, status, habitat and distribution, and potential for occurrence. Special status raptor species also are discussed in Section 3.7.3, Special Status Species. Those species and all other raptor species known to occur within the GCWPA are included in the following section.

Raptor surveys are conducted by UDWR throughout the VFO. In addition, site-specific surveys are conducted by BLM and independent contractors. Data from these surveys are compiled by BLM and UDWR. Based on these data, 110 raptor nests have been documented within the GCWPA and within 1 mile of the GCWPA boundary (BLM 2012b). Raptor species that have been documented to nest within the GCWPA include burrowing owl, great-horned owl, prairie falcon, red-tailed hawk, ferruginous hawk, Cooper's hawk, northern harrier, American kestrel, golden eagle, and several historic nesting locations where the species is unknown (BLM 2012b). Other raptor species (i.e., bald eagle, peregrine falcon, Swainson's hawk, turkey vulture, and the short-eared owl) may use the GCWPA for hunting or nesting (UDWR 2014d). All raptor species and their nests are protected from take or disturbance under the MBTA.

3.7.3 Fisheries

Aquatic habitats associated with portions of the White River that are coincident with the GCWPA are expected to support a variety of fish species and amphibians including the great basin spadefoot, Great Plains toad (*Bufo cognatus*), northern leopard frog, tiger salamander (*Ambystoma tigrinum*), and Woodhouse's toad. The White River is the only perennial stream in the GCWPA (**Figure 1-1**). Portions of the White River are coincident with the southwestern portion of the GCWPA (**Figure 3.4-2**). An estimated 7.8 miles of the White River are within the GCWPA. The reaches of the White River that flow through the GCWPA are part of the lower White River stream segment that begins at Taylor Draw Dam (near Rangely, Colorado) and ends at the river's confluence with the Green River. Hydrology of the White River is characterized by high spring flows caused by runoff from snow melt followed by low, relatively stable, base flows between August and February. Several tributaries to the White River that drain portions of the GCWPA, including Antelope Draw, Red Wash, and Coyote Wash, are principally ephemeral drainages with intermittent seasonal flows occurring in lower reaches of these drainages during years of higher precipitation. The mostly ephemeral nature of Antelope Draw, Red Wash, and Coyote Wash does not include flows of sufficient volume and duration to support fish species. Additional information regarding surface water flows and volumes is described in Section 3.4, Water Resources.

Twelve fish species without special designation (non-threatened, endangered, candidate proposed, and non-BLM sensitive) have been documented in the lower White River (**Table 3.7-2**). Seven of the 12 are

non-native sport fish. Three species are non-native, non-game species. The remaining two, the most common native fishes in the White River, include the speckled dace and flannelmouth sucker (Lentsch et al. 2000). Flannelmouth sucker and other special status fish species known to occur in the White River are discussed further in Section 3.7.4, Special Status Species.

Table 3.7-2 Non-special Status Fish Species with the Potential to Occur within the GCWPA

Common Name	Scientific Name	Classification[1]	Designation[2]	Spawning Period[3]
Black bullhead	*Ameiurus melas*	n-n	S	Late spring to early summer
Black crappie	*Pomoxis nigromaculatus*	n-n	S	Spring to early summer
Channel catfish	*Ictalurus punctatus*	n-n	S	Late spring and summer
Common carp	*Cyprinus carpio*	n-n	n-g	Spring and summer
Fathead minnow	*Pimephales promelas*	n-n	n-g	Spring and summer
Green sunfish	*Lepomis cyanellus*	n-n	S	Spring and summer
Mottled sculpin	*Cottus bairdii*	N	n-g	Late winter through spring
Northern pike	*Esox lucius*	n-n	S	Spring
Rainbow trout	*Oncorhynchus mykiss*	n-n	S	Spring
Red shiners	*Cyprinella lutrensis*	n-n	n-g	Spring and summer
Speckled dace	*Rhinichthys osculus*	N	n-g	Spring and summer
Walleye	*Stizostedion vitreum*	n-n	S	Spring
Sand shiner	*Notropis stramineus*	n-n	n-g	Mid-summer
Smallmouth bass	*Micropterus dolomieu*	n-n	S	Late-spring, early summer

[1] Fisheries classifications include native (N) and non-native (n-n) species (UDWR 2014b).

[2] Sport fish designation include sport fish (S) and non-game (n-g) species (UDWR 2014b).

[3] Spawning Period (UDWR 2015).

Source: Lentsch et al. 2000.

3.7.4 Special Status Species

Special status species include those plant and animal species that are federally listed under the ESA, as amended, as threatened, endangered, proposed, and/or candidate species, BLM sensitive species, State of Utah species of concern, and PIF species of concern. The ESA provides protection to federally listed threatened, endangered, proposed, and candidate species from any action that may jeopardize their existence. In accordance with the ESA, the lead federal agency, in coordination with USFWS, must ensure that any federal action to be authorized, funded, or implemented would not adversely affect a federally listed threatened or endangered species or its critical habitat. Special Status Species Management Policy 6840 requires the BLM to manage and protect any USFWS candidate species, BLM sensitive species, or State of Utah species of concern to prevent the need for future federal listing. A full listing of these species is presented in **Appendix O**. This appendix table lists the species' scientific names, status, habitat and distribution, and potential for occurrence in the GCWPA. Potential for occurrence within the GCWPA was evaluated for each of these species based on their habitat requirements and/or known distribution. Also included in the table is a determination for being eliminated from further analysis.

A review of special status species that have the potential to occur in Uintah County, Utah, including species with special designations by the USFWS, BLM, State of Utah, and PIF were evaluated for their potential to occur in the GCWPA and for the availability of potentially suitable habitats to exist in the GCWPA. Several species were initially evaluated that were not selected for further analysis either based on a known distribution that did not include the GCWPA and/or the absence of suitable habitats in the GCWPA. Refer to **Appendix O** to review habitat descriptions, evaluation of potential to occur in the GCWPA, and determinations for additional analysis for each special status species. Special status species selected for analysis are described in the following sections.

3.7.4.1 Mammals

Black-footed Ferret (*Mustela nigripes*)

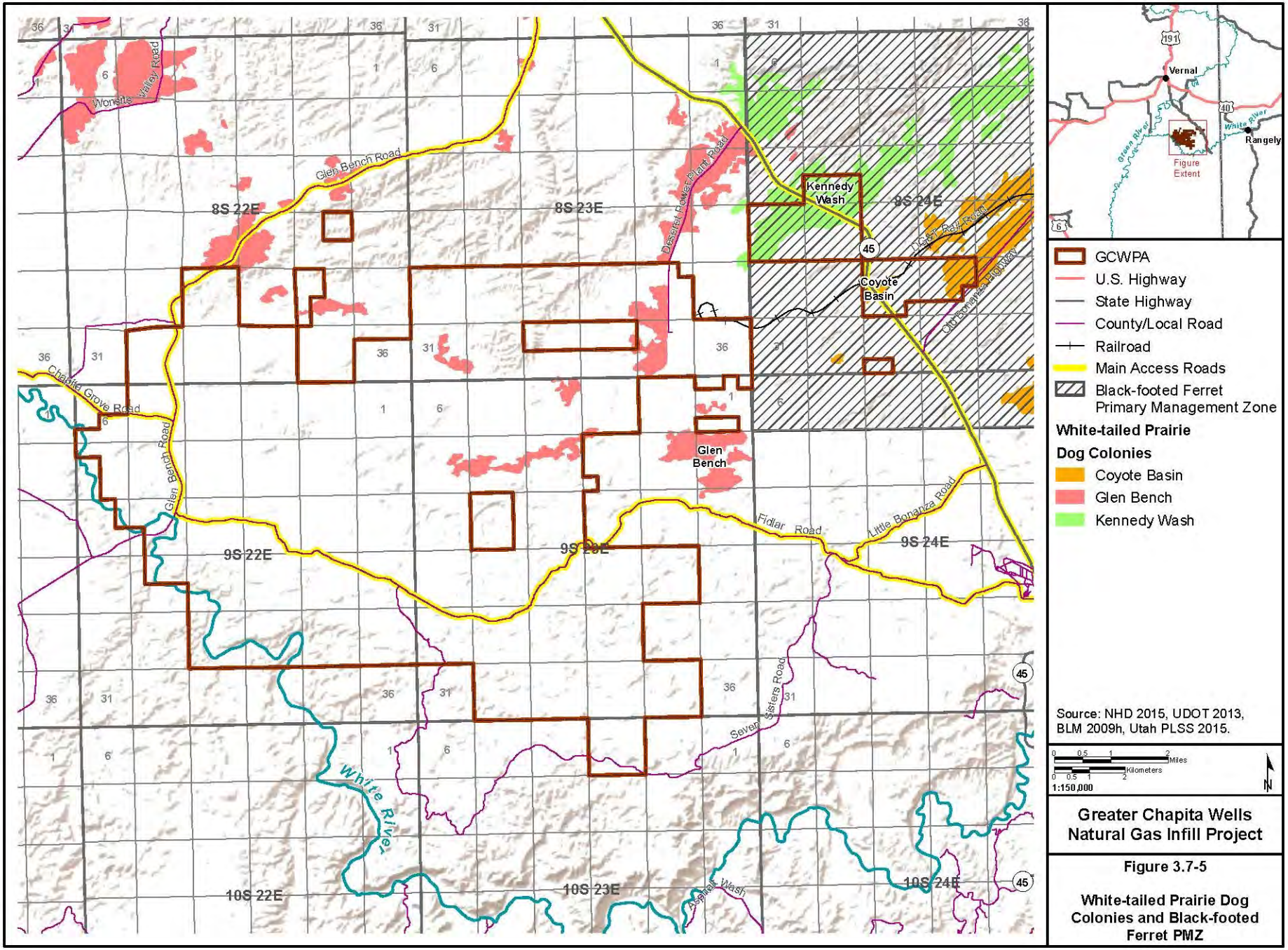
The black-footed ferret is a federally listed endangered species (USFWS 1967). No natural wild populations of this species are known to exist. All black-footed ferret occurring in the wild are the result of re-introductions supported by a captive breeding program. Historically, the black-footed ferret occurred throughout the Great Plains, mountain basins, and semi-arid grasslands of North America; always closely associated with active prairie dog colonies. This species relies on prairie dogs for food and their burrows for shelter. In Utah, non-essential experimental populations have been reintroduced in Coyote Basin, in Uintah County, Utah (USFWS 2013b).

In Coyote Basin, a Primary Management Zone (PMZ) was established where reintroduction and management efforts are focused. In addition to the PMZ, a larger surrounding experimental area also was designated to provide a buffer area for ferrets to eventually disperse. The experimental area encompasses all of Uintah and Duchesne counties, Utah. Portions of the Coyote Basin prairie dog complex, as well as portions of the black-footed ferret PMZ and the larger Management Zone, overlap with portions of the GCWPA. Approximately 2,758 acres of the GCWPA is located within the PMZ, and all of the GCWPA is located within the larger Management Zone. UDWR has mapped approximately 2,027 acres (5 percent) of the GCWPA as supporting prairie dog colonies that provide suitable habitat for black-footed ferrets (**Figure 3.7-5**). Black-footed ferrets of the nonessential, experimental population are known to occur in the GCWPA and have been observed as recently as 2011 (BLM 2015a).

As a protected and species with a “nonessential, experimental” status, the black-footed ferret population occurring within the GCWPA is managed as a “proposed to be listed” species to allow for greater compatibility with established human activities within the reintroduction area (USFWS 1998).

White-tailed Prairie Dog (*Cynomys leucurus*)

The white-tailed prairie dog is listed as a wildlife species of concern by the State of Utah. Colonies of this species occur primarily in mountain valleys, semi-desert grasslands, and open shrublands (Fitzgerald et al. 1994). White-tailed prairie dogs are distributed in relatively large, sparsely populated complexes and typically occur in lower densities than other prairie dog species (Lupis et al. 2007). This species is the main food source of the endangered black-footed ferret (Fitzgerald et al. 1994; USFWS 2013b). UDWR has mapped an estimated 2,027 acres (5 percent of the GCWPA) of white-tailed prairie dog colonies within the GCWPA (**Figure 3.7-5**) (UDWR 2014a).



Greater Chapita Wells Natural Gas Infill Project

Figure 3.7-5

White-tailed Prairie Dog Colonies and Black-footed Ferret PMZ

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Townsend's Big-eared Bat (*Corynorhinus townsendii*)

The Townsend's big-eared bat is listed as a sensitive species by the BLM and a wildlife species of concern by the State of Utah. This species occupies semidesert shrublands, pinyon-juniper woodlands, and open montane forests (Fitzgerald et al. 1994). The Townsend's big-eared bat typically uses caves and abandoned mines for day roosts, but also will use abandoned buildings and rock crevices for refuge (Fitzgerald et al. 1994). The distribution of the species is widespread in Utah (Oliver 2000). Potentially suitable habitats may exist in the GCWPA.

Spotted Bat (*Euderma maculatum*)

The spotted bat is listed as a wildlife species of concern by the State of Utah. This species occupies are variety of habitats during the summer months including lowland riparian in the desert shrub community, sagebrush and rabbitbrush, ponderosa pine forest, montane grassland, and montane forest and woodland (Oliver 2000). This species is likely to occur throughout Utah, where suitable roosting habitat exists, including the GCWPA.

Fringed Myotis (*Myotis thysanodes*)

The fringed myotis is listed as a sensitive species by the BLM and a wildlife species of concern by the State of Utah. In Utah, this species has been documented in a variety of habitats including lowland riparian, desert shrub, juniper-sagebrush, sagebrush-rabbitbrush, pinyon-juniper-sagebrush, pinyon-juniper, mountain meadow, ponderosa pine forest, and montane forest (Oliver 2000). Maternal colonies in Utah are typically associated with the attics of abandoned buildings and possibly caves. Based on the availability of potentially suitable habitats and the expected broad range of this species in Utah, this species has the potential to occur in the GCWPA.

Big Free-tailed Bat (*Nyctinomops macrotis*)

The big free-tailed bat is listed as a sensitive species by the BLM and a wildlife species of concern by the State of Utah, In Utah, this species has been documented to occur in a variety of habitats including lowland riparian, desert shrub, and montane forest (Oliver 2000). Oliver (2000), reports the Utah distribution of this species to include the southern half of the state, north to the Wyoming border in the east. Based on unpublished results from mist netting and acoustical surveys, this species is likely to occur in suitable habitats in the GCWPA (Maxfield 2015).

3.7.4.2 Birds

Western Yellow-billed Cuckoo (*Coccyzus americanus*)

In 2014, The USFWS listed the Western yellow-billed cuckoo as a threatened distinct population segment under the ESA (79 *Federal Register* 59991 60038) (USFWS 2014b). This species is a neotropical migrant breeding throughout the U.S. and Canada and wintering in South America (USFWS 2001). The current range of this species is limited to disjunct fragments of suitable riparian habitats throughout many of the western states and Mexico, including Utah. This species nests in large tracts of dense lowland riparian vegetation, particularly cottonwoods and willows (USFWS 2008a). Dense understory foliage is an important factor in nest selection, while cottonwood trees are important foraging habitats (USFWS 2008b). The current distribution of this species in Utah is poorly understood, though it appears to be an extremely rare breeder in lowland riparian habitats statewide (Parrish et al. 2002). Stands of cottonwoods associated with portions of the White River that are coincident with the GCWPA may provide suitable habitat for this species.

Greater Sage-grouse (*Centrocercus urophasianus*)

In 2015, the USFWS published its determination that this species is not warranted for listing and protection under the ESA (USFWS 2015). Based on this determination the greater sage-grouse is not afforded protection under the ESA and, as such, states are responsible for the management of this

species. The State of Utah has designated this species as a wildlife species of concern and the BLM has assigned sensitive species status to this species.

This species is described as a sagebrush obligate. Individuals require shrub-steppe sagebrush habitats throughout their life cycle. This species is typically associated with sagebrush grasslands, foothills, and mountain valleys (USFWS 2010). Leks, strutting or dance grounds, are important areas for this species. Leks are inherently important to the species for reproduction; and are often located between or proximal to brood-rearing and wintering habitats (Call and Maser 1985).

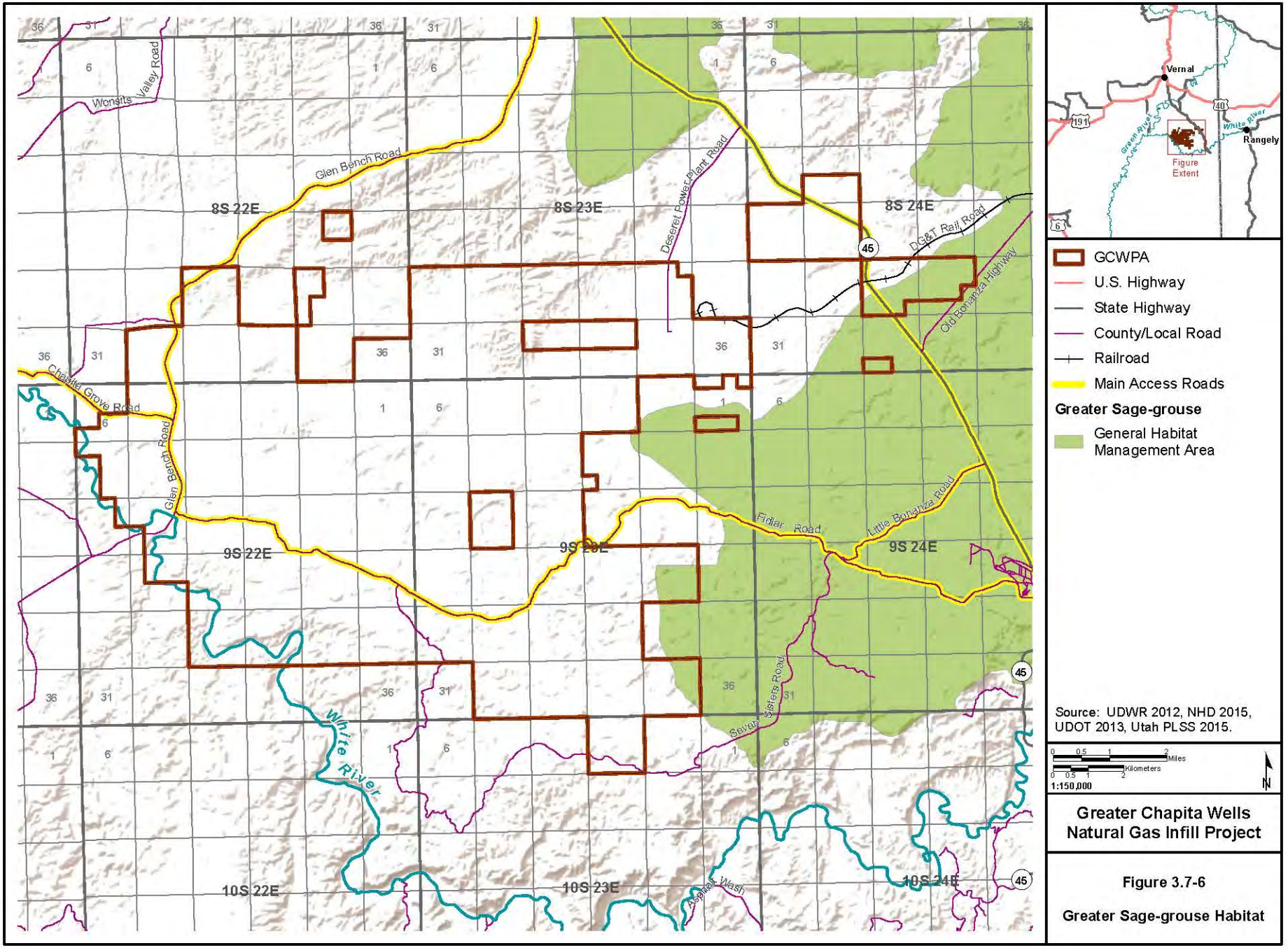
The BLM Washington Office IMs No. 2012-043 and 2012-044 (BLM 2011c,d) supplement the BLM's 2004 National Strategy for sage-grouse and identify those management actions necessary to sustain sage-grouse populations, while achieving the USDOI's energy-related priorities. The UDWR has yet to identify priority habitat. A priority habitat designation is the highest conservation value that can be given relative to maintaining suitable sage-grouse populations range-wide. The Governor's task force finalized the Conservation Plan for Greater Sage-grouse in Utah in February 2013 (UDWR 2013b), in which 11 sage-grouse management areas are identified and to which all sage-grouse conservation efforts are focused. In June 2015, the BLM released its Proposed Land Use Plan Amendment-Final EIS titled *Utah Greater Sage-grouse Proposed Land Use Plan Amendment and Final Environmental Impact Statement* (BLM 2015b). On September 18, 2015, the BLM released the associated ROD and Approved Resource Management Plan Amendment. The Plan identifies Priority Habitat Management Areas (PHMAs), Sagebrush Focal Areas (SFAs), and GHMAs for sage-grouse in accordance with IM 2012-044.

Within the GCWPA, there is an estimated 1,228 acres of greater sage-grouse GHMA. Mapped GHMA in the GCWPA is limited to the extreme eastern portions of the GCWPA (**Figure 3.7-6**) and represent an estimated 3.3 percent of the total GCWPA. No SFAs or PHMAs are mapped in the GCWPA. There are no known leks in the GCWPA (Maxfield 2015; UDWR 2013c), and the nearest known lek is the North Deadman Lek, located an estimated 5.5 miles northeast of the GCWPA. It has been more than 12 years since UDWR has recorded a greater sage-grouse observation in the GCWPA (Maxfield 2015).

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is listed as a wildlife species of concern by the State of Utah and retains protection under both the BGEPA and the MBTA. This species commonly nests in large cottonwood or conifer trees located near open water (UDWR 2010b). Breeding habitat is typically associated with forested areas adjacent to large bodies of water. The bald eagle nests almost exclusively in large mature trees. Nests occur in mature old-growth forests with some edge habitat that is near water that provides suitable foraging opportunities (Buehler 2000). As of 2010, 11 pairs of bald eagles were known to nest in Utah (UDWR 2010b).

In Utah, migratory bald eagles are known to roost and forage during winter months in riparian areas, low elevation forests, and in desert habitats (UDWR 2010b). Wintering bald eagles may number as many as 1,200 eagles in Utah (UDWR 2010b). Several winter roost sites have been documented along the Duchesne, Green, and White rivers (BLM 2008d). The VFO nesting raptor database does not include any known records of bald eagle nests within the GCWPA. Potentially suitable nesting and winter roosting habitats for the bald eagle may exist along the White River corridor within the GCWPA.



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6/20/2017

Ferruginous Hawk (*Buteo regalis*)

The ferruginous hawk is listed as a wildlife species of concern by the State of Utah. This species inhabits grasslands, agricultural lands, sagebrush/saltbush/greasewood shrublands, and the periphery of pinyon-juniper woodlands (Parrish et al. 2002). This species often selects nest sites that are elevated, including boulders, cliffs, buttes, and large shrubs (Bechard and Schmutz 1995). Suitable nesting and foraging habitat exists throughout much of the GCWPA. This species is known to nest throughout the VFO, including within the GCWPA. There are at least 24 known ferruginous hawk nests located within the GCWPA and the associated 1-mile buffer around the GCWPA boundary.

Burrowing Owl (*Athene cunicularia*)

The burrowing owl is listed as a wildlife species of concern by the State of Utah. Breeding habitats for this species are typically associated with open, treeless areas within grassland, steppe, and desert ecosystems. Nesting habitats are typically flat or gently sloping with low to sparse vegetation. Natural and undisturbed settings are associated with high densities, particularly active prairie dog colonies (Poulin et al. 2011). The burrowing owl typically nests in abandoned underground mammal burrows, but also will nest in culverts, drain pipes, and cracks and crevices associated with irrigation canals. In undisturbed habitats, burrowing owls are typically associated with active prairie dog colonies, utilizing the burrows as nest sites and shelter. The burrowing owl is known to nest throughout the VFO, including the GCWPA. Active white-tailed prairie dog colonies, which are highly suitable nesting and foraging habitats for this species, are known to exist within the GCWPA. The BLM nesting raptor base (2013) includes 25 known records of burrowing owl nests in the GCWPA and the surrounding 1 mile.

Grasshopper Sparrow (*Ammodramus savannarum*)

The grasshopper sparrow is listed as a wildlife species of concern by the State of Utah and a PIF species of concern. The breeding range for this species extends from the eastern U.S., through the central plains, and throughout the Rocky Mountains. Although this species has a relatively broad distribution, its occurrence is often limited or rare in many parts of its range (Vickery 1996). This species inhabits dry grasslands characterized by short to mid-height clumps of grass with few to no shrubs. The only known occurrences of this species in Utah are concentrated in the northernmost regions of the state (UDWR 2014e). Grassland habitat, that may be suitable nesting habitats for this species, exist in the GCWPA.

Prairie Falcon (*Falco mexicanus*)

The prairie falcon is designated as a species of concern by PIF. The prairie falcon occurs throughout the western U.S., portions of southwestern Canada, and northern and central Mexico. It is typically found in open habitats, including shrub-steppe desert, grasslands, mixed shrub and grasslands, and alpine tundra, where cliffs and bluffs are available for nesting. Foraging habitats are typically associated with open grasslands (Steenhof 2013). There are up to 59 records of this species nesting in the VFO, including two within the GCWPA (BLM 2012b). Suitable nesting and foraging habitats, although potentially limited, are likely to exist within the GCWPA. The BLM raptor nesting database includes three records of potential prairie falcon nests in the GCWPA and the surrounding mile.

Brewer's Sparrow (*Spizella breweri*)

The Brewer's sparrow is designated as a species of concern by PIF. The breeding range for this species is largely associated with the Great Basin and includes portions of Oregon, Washington, Montana, Wyoming, western Colorado, northern Arizona and New Mexico, and all of Nevada and Utah. The Brewer's sparrow breeding range is most often associated with shrublands that are dominated by big sagebrush (Rotenberry et al. 1999). Based on the availability of shrubland habitats in the GCWPA and the known range of this species, the Brewer's sparrow is expected to occur and nest in the GCWPA.

Sage Sparrow (*Artemisiospiza nevadensis*; formerly *A. belli*)

The sage sparrow is designated a species of concern by PIF. This species is known as a breeding resident throughout the Great Basin, including portions of Washington, Oregon, Idaho, Wyoming, western Colorado, and most of Nevada and Utah. In portions of central and southern California, southern Nevada, southern Utah, and northern Arizona, this species is described as a year-round resident. In Utah, the sage sparrow is typically associated with habitats that are dominated by big sagebrush (Martin and Carlson 1998). Based on the known range of this species and the availability of potentially suitable shrublands, the sage sparrow is expected to occur in the GCWPA.

Sage Thrasher (*Oreoscoptes montanus*)

The sage thrasher is designated a species of concern by PIF. In the U.S., this species is known to breed throughout the Great Basin including parts of Washington, Oregon, Idaho, Montana, Wyoming, western Colorado, Nevada, all of Utah, and northern Arizona and New Mexico. As a sagebrush obligate, this species is typically associated with shrub-steppe habitats dominated by big sagebrush (Reynolds et al. 1999). Based on the known distribution of this species and the availability of suitable habitats, the sage thrasher is expected to occur in the GCWPA.

3.7.4.3 Fish

Federally Listed Fish Species

Bonytail (Gila elegans)

The bonytail chub was first listed as endangered by the USFWS in 1980 (USFWS 1980). This species is the rarest native fish in the Colorado River Basin. In recent years, captures have been from Dinosaur National Monument on the Yampa River, Desolation and Gray Canyons on the Green River, and Black Rocks and Cataract Canyon on the Colorado River. Based on recent captures, this species is known to occur in portions of the White River (McDonald 2015). This fish species is adapted to mainstream rivers, where it is typically observed in pools and eddies (USFWS 1994).

In 1994, the USFWS designated critical habitat for the bonytail in the Colorado River Basin (USFWS 1994). In Utah, 139 miles of the Green and Colorado Rivers were designated as critical habitat. Designated critical habitat does not exist in the GCWPA.

Colorado Pikeminnow (Ptychocheilus lucius)

The Colorado pikeminnow (squawfish) is a federally listed endangered species (USFWS 1967). This species is the only living representative of the genus Ptychocheilus that is endemic to the Colorado River Basin. Native populations of this species are now restricted to the Upper Basin of the Colorado River in Wyoming, Utah, Colorado, and New Mexico. Tagged and untagged individuals of this species have been found throughout the White River (McDonald 2015). Post-spawning adult Colorado pikeminnow use a variety of riverine habitats including eddies, backwaters, shorelines, and others. During winter months, adult fish are typically associated with shallow, ice-covered shoreline areas. During spring and early summer months, when river flows are highest, adult fish use shorelines and flooded lowland habitats (USFWS 1994).

In 1994, the USFWS designated critical habitat for the Colorado pikeminnow in the Colorado River Basin (USFWS 1994). In Utah, 726 miles of the Green, Colorado, White, and San Juan rivers were designated as critical habitat. Designated critical habitat for this species exists within the GCWPA.

Humpback Chub (Gila cypha)

The humpback chub (is a federally listed endangered species (USFWS 1967). This Colorado River native fish species is presently restricted to remote, white water canyons of the Upper and Lower Basins of the Colorado River Basin. The Lower Basin, including the Little Colorado and Colorado rivers,

supports the largest remaining populations of this species. In the Upper Basin, this species is found in the Black Rocks/Westwater Canyon and Cataract Canyon of the Colorado River, Desolation and Gray Canyons of the Green River, and Yampa and Whirlpool Canyons on the Green and Yampa rivers in Dinosaur National Monument. This species is commonly associated with canyon riverine habitats, including pools, riffles, and eddies (USFWS 1994).

In 1994, the USFWS designated critical habitat for the humpback chub in the Colorado River Basin (USFWS 1994). In Utah, 139 miles of the Green and Colorado Rivers was designated as critical habitat. Designated critical habitat for this species does not exist in the GCWPA.

Razorback Sucker (Xyrauchen texanus)

The razorback sucker is as federally listed endangered species (USFWS 1991). This species was once abundant and widely distributed in rivers of the Colorado River Basin. In the Lower Basin, this species remains in the Colorado River from the Grand Canyon to near the border with Mexico. In the Upper Basin, this species occurs in the lower Yampa and Green Rivers, mainstream of the Colorado River, and the lower San Juan River. The largest current population of this species occurs in the upper Green River Basin. Tagged and untagged individuals also have recently been found in the White River (McDonald 2015). Reproducing adults in the Upper Basin, move into flooded areas over rocky runs and gravel bars to spawn. Non-reproducing adults typically occur in impounded and riverine areas, eddies, backwaters, gravel pits, flooded bottoms, and flooded mouths of smaller tributaries (USFWS 1994).

In 1994, the USFWS designated critical habitat for the razorback sucker in the Colorado River Basin (USFWS 1994). In Utah, 688 miles of the Green, Colorado, Duchesne, White, and San Juan rivers was designated as critical habitat. Designated critical habitat for this species exists within the GCWPA.

Sensitive Fish Species

The bluehead sucker, flannelmouth sucker and roundtail chub are BLM sensitive species and State of Utah sensitive species. In Utah, these species are managed under a conservation and management plan (UDWR 2006a) and a range-wide conservation agreement and strategy (UDWR 2006b). The goal of these conservation plans is to conserve existing populations and habitats for these species and to avoid the listing of these species under ESA. These documents share similar objective and conservation actions including: completing status assessments of these three species; establishing and maintaining past, present and future information regarding populations, threats, and other actions; studying and characterizing these fish populations toward better understanding their life histories, habitat requirements, threats, and conservation needs; morphological and genetic descriptions of these species; expand population distributions, create and improve habitats; minimize competition from non-native species; establish long-term monitoring of populations and habitats: and expand public awareness of these fish species and their habitats.

Bluehead Sucker (Catostomus discobolus)

The bluehead sucker is a species receiving special management consideration as a BLM sensitive species. This species utilizes warm to cool, swift velocity, high gradient streams with rocky substrates. The bluehead sucker is a bottom dwelling species with a mouth modified to scrape algae, the species main food source, from the surface of rocks. This species is known to inhabit the Colorado River drainage and is commonly found in the White River (Lentsch et al. 2000). Fast flowing water in high gradient reaches of mountain rivers has been identified as important habitat for this species. This species is known to occur throughout all rivermiles of the White River in Utah, including portions within the GCWPA (McDonald 2015).

Flannelmouth Sucker (Catostomus latipinnis)

The flannelmouth sucker is a species receiving special management as a BLM sensitive species. This species inhabits large rivers, where they are found in deep pools of slow flowing, low-gradient reaches. Populations of flannelmouth suckers have been reduced due to flow alteration, habitat loss or alteration, and the introduction of non-native fish species (UDWR 2006b). This species is known to occur in the lower White River and has been identified as one of the most common fish species captured in the White River (Lentsch et al. 2000; UDWR 2006b). This species is known to occur throughout all rivermiles of the White River in Utah, including portions of the White River that are within the GCWPA (McDonald 2015).

Roundtail Chub (Gila robusta)

The roundtail chub is a species receiving special management consideration as a BLM sensitive species. This species occurs in the mainstem of major rivers and smaller tributary streams, using a variety of substrates in murky to clear waters (UDWR 2006b). This species occurs in most of the Colorado River system and has been documented in the lower White River (Lentsch et al. 2000; UDWR 2006b). This species is known to occur throughout all rivermiles of the White River, including portions that are within the GCWPA (McDonald 2015).

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3.8 Paleontology Resources

Paleontological resources comprise the fossil record of past life forms that provide data vital to interpretation of earth history.

3.8.1 Paleontology Environment

Approximately 24 percent of the GCWPA study area is underlain by unconsolidated to semi-consolidated alluvial, colluvial, aeolian, and slump deposits of Quaternary age, generally found along the major drainages. Fossils of scientific importance have not been recovered from these units and therefore these units are not considered potentially important areas for paleontologic resources. The remaining GCWPA is underlain by predominantly fluvial rocks of Middle Eocene age. Less than 2 percent of the GCWPA surface, located in the northern portion of the GCWPA, is underlain by the Brennan Basin Member of the Duchesne River Formation, while the remaining 75 percent of the GCWPA is underlain by the Uinta Formation. The northern portion of the GCWPA has the upper Myton Member of the Uinta Formation exposed at the surface with the underlying Wagonhound member forming the surface further to the south, a result of gentle northerly dips into the Uinta Basin (**Figure 3.2-2**) (Sprinkel 2007, 2009). Both the Uinta and Duchesne River formations are known to produce scientifically important fossils and represent the type units for the Uintan and Duchesnean North American Land Mammal ages, respectively. Therefore, they both have continent-wide biostratigraphic importance (Rasmussen et al. 1999a,b).

Both the BLM and the Utah Geological Survey maintain a database of recorded occurrences of scientifically important fossils. A Class I inventory of these records was conducted in support of this project (Sandau 2009). The inventory provided a report for each of 77 sections that overlap the GCWPA indicating fossil types recovered and locations in the databases. Of the 74 sections containing areas underlain by Eocene formations, 64 sections contain 1 to 13 recorded fossil locations (86 percent). Based upon the most recent geologic mapping of the area (Sprinkel 2007, 2009), the identified fossils were assigned to the appropriate formation and member. As the fossil locations were not identified more precisely than to the section level, the stratigraphic assignment to member has some potential for error. This inventory was subsequently updated based upon additional survey results (Sandau 2012a-f) from investigations done in conjunction with EOG's proposed liquids gathering system (BLM 2013b).

Five GCWPA sections overlap portions of the Brennan Basin Member of the Duchesne River Formation. Fossils identified from rocks that are likely assigned to the Brennan Basin Member are limited to miscellaneous fish (i.e., gar), mammalian, and turtle fragments. All of the remaining recorded fossils were obtained from the Uinta Formation. Of 45 identified taxa, 38 were assignable to the Myton Member and 21 to the Wagonhound Member of the Uinta Formation. They total more than 45 because many taxa were assignable to both members, as well as a few to the Duchesne River Formation. Turtle remains are by far the most common fossil found, particularly the genera *Echmatemys* and *Apalone*. Other common fossils found include miscellaneous brontothere and other mammalian fragments. A summary of the fossil taxa recorded from the GCWPA are tabulated in **Appendix P**.

Most paleontological investigations within the GCWPA have been conducted in connection with construction of oil and gas facilities. Fossil locations are well distributed across most of those portions of the GCWPA with exposed bedrock, although site densities appear to be higher in those sections underlain by the Myton Member than in those underlain by the Wagonhound Member. Some of this difference may be a result of marginally higher oil and gas facility densities in Myton Member areas, but most is likely a result of innately higher fossil densities within the Myton Member (Sandau 2009).

3.8.2 Fossil Occurrence Classification System and GCWPA Ranking

As of October 2007, BLM has adopted the PFYC system as the standard for evaluating potential impacts to paleontological resources on public lands (BLM 2016, 2007b). This system uses a five-part classification of geologic units with respect to their potential for the production of scientifically important

fossils. The evaluation scale runs from 1 (very low probability) to 5 (very high probability), based upon the unit's lithology, age, depositional setting, risk for adverse impacts, and history of producing fossils. Subclasses are assigned depending upon the degree of exposure of the unit. Approval of surface-disturbing activities affecting geologic formations rated 4 or 5 is likely to require surveys by a qualified paleontologist prior to or during construction. BLM also may apply protective mitigations and local field offices may alter the rankings based upon site-specific knowledge. In the vicinity of the GCWPA, the VFO has evaluated the PFYC classification for both the Uinta and Duchesne River formations as 4 or 5, indicating high to very high paleontologic potential.

In addition to protections provided under the PFYC system, Title VI, Subtitle D of the Omnibus Public Land Management Act of 2009 (P.L. 111-11) provides for expanded penalties for unauthorized collection of fossil materials from the public lands.

3.9 Cultural Resources and Native American Traditional Values

The study area for cultural resources and traditional cultural values is defined as the GCWPA and surrounding lands within approximately 1 mile of the GCWPA boundary.

3.9.1 Regulatory Framework

3.9.1.1 National Environmental Policy Act

NEPA provides federal policy for the protection of historic, cultural, and natural aspects of national heritage in regard to various types of federally sanctioned undertakings. Section 102 of the act requires that impacts to cultural resources be taken into account during project planning and when determining the context and intensity of significant impacts in regards to a proposed action (40 CFR 1509.14).

3.9.1.2 Section 106 of the National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to evaluate the effects of projects on federal land or using federal monies will have on historic properties (16 USC Section 470(f)), where historic properties are those resources that are listed on or are eligible for listing on the NRHP (36 CFR 800.1(c)). Listed historic properties, or those eligible for listing, meet at least one of the following criteria:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

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

Adverse effects, as defined in the Section 106 regulation 36 CFR 800.5(a)(1), occur when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association.

3.9.2 Defining Cultural Resources

The term "cultural resource" is not defined in NEPA or any other federal law; however, NEPA and other laws stipulate that such resources be examined and considered in various types of federally sanctioned undertakings. NEPA requires that federal agencies identify and evaluate the consequences of an undertaking on all aspects of the human environment, which "shall be interpreted comprehensibly to include the natural and physical environment and the relationship of people with that environment (40 CFR 1509.14)." In this sense, cultural resources would include all types of cultural uses of the physical environment, the built environment, and sociocultural institutions. NHPA deals with specific types of cultural resources defined as historic properties. A historic property, or historic resource, is "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register (16 USC Section 470(w)(5)." Other pieces of federal legislation deal with other specific types of cultural resources. For example, the ARPA is concerned with protecting archaeological resources, which are defined as "any material remains of past human life or activities which are of archaeological interest (16 USC 479(bb)(1), and the Native American Graves Protection and

Repatriation Act (NAGPRA) concerns itself with burial sites and cultural items that include associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony (25 USC 3001(1), (3)(A-D). Since there are many different types of cultural resources covered by multiple federal laws, a broad definition of cultural resource for use in this study is derived not only from NEPA, NHPA, ARPA, and NAGPRA, but the American Indian Religious Freedom Act, Archaeological and Historic Preservation Act, and with definitions developed by the BLM, which are closely tied to Section 106 of the NHPA (BLM 2004).

For the purpose of this examination, a cultural resource refers prehistoric, historic, and modern sites, structures, remains, artifacts, or specific areas deemed significant, important, or sacred by cultural groups with traditional ties to the area or have other values and characteristics deemed important or significant as defined in the existing historic preservation laws. The phrase cultural resource will be used in generic terms. It is not used synonymously to mean or specify any other legal definitions such as historic property or archaeological resource.

3.9.3 Regional Contexts

Unless otherwise noted, the information in this section has been adapted from the "Class I Existing Data Review for EOG's GCWPA, Uintah County, Utah (Patterson and Thomas 2015)."

3.9.3.1 Prehistoric Context

The cultural chronological sequence represented in the Uinta Basin includes the Paleoindian, Archaic, Fremont, Protohistoric, and European American periods. The earliest inhabitants of the region are representatives of the Paleoindian period (ca. 12,000-8000 B.P.), which is characterized by extremely mobile foragers hunting Pleistocene and Early Holocene megafauna. While no Paleoindian habitations or camps have yet been found in the Uinta Basin, their presence is indicated by the discovery of isolates Clovis and Folsom fluted points (ca.12,000 B.P.-10,000 B.P.), Plano Complex lanceolate points (ca. 10,000 B.P.-7000 B.P.), and Great Basin Stemmed points (11,000-7,000 B.P.) (Copeland and Fike 1998; Spangler 2002).

The Archaic Period (ca. 8000 B.P.-1500 B.P.) spans much of the Holocene and is characterized by people using a foraging strategy characterized by wide-spectrum hunting and gathering of seasonally exploited plant and animal species in a variety of ecozones. Dependence on seasonally available resources entailed regularly moving camps and establishing semipermanent camps and conducting logistical forays into surrounding areas to acquire wild food stuffs and other resources, such as tool stone. The shift to an Archaic life way is marked by the appearance of new projectile point types and the development of the atlatl, perhaps in response to a need to pursue smaller and faster game (Holmer 1986). In the Uinta Basin, evidence of Early Archaic presence is relatively sparse compared to the subsequent Middle and Late Archaic periods. Early Archaic (ca. 6000-3000 B.C.) sites in the Basin include sand dune sites and rock shelters primarily clustered in the lower White River drainage (Spangler 2002). Early Archaic projectile points recovered from Uinta Basin contexts include Pinto Series, Humboldt, Elko Series, Northern Side-notched, Hawken Side-notched, Sudden Side-notched, and Rocker Base Side-notched points (Patterson et al. 2008). The Middle Archaic (ca. 3000-500 B.C.) is characterized by improved climatic conditions and an increase in human population on the northern Colorado Plateau. Several stratified Middle Archaic sites have been excavated and dozens of sites have been documented in the Uinta Basin. The use of rock shelters and overhangs for shelter was common, as was the open camp. Many of these temporary camps were revisited over time probably due to their proximity to desired environmental resources (Spangler 2002). Subsistence data from Middle Archaic components indicate gathering and processing of plants as well as a wide variety of animals (e.g., mule deer, antelope, bighorn sheep, cottontail rabbit, muskrat, prairie dog, beaver, and birds) (Simms 2008). The Late Archaic period (ca. 500 B.C.-A.D. 500) is characterized by additional changes in subsistence strategies and settlement patterns. By about A.D. 100, maize horticulture is added to subsistence practices, which in turn affects settlement strategies, mobility, and population (Talbot and Richens 2004).

Even limited horticultural development required a greater level of sedentism, which is evidenced by semi-permanent architecture and storage features; however, seasonal mobility is not entirely abandoned (Madsen and Simms 1998).

The Formative period (A.D. 500-1300), which includes a greater reliance on horticulture, greater sedentism, increased regional interaction, substantial changes in technology, and considerable population growth. The Uinta Basin's Formative inhabitants were the Fremont Indians. The Fremont culture, as defined by archaeologists is a catchall term for Formative Period peoples occupying large portions of the Northern Colorado Plateau and the Eastern Great Basin with very similar lifeways. Through time, populations grew and sedentism increased resulting in the amalgamation of the population in larger and larger communal sites. In the Uinta Basin, larger village sites include White Rocks and Caldwell villages (Ambler 1966). Hunting technology shifted from atlatls with large stone tipped darts to bows and arrows tipped with small, gracile stone points. Pottery also begins to be manufactured. This variant is represented by shallow, saucer-shaped pithouses with randomly placed postholes and off-center fire pits, some of which were adobe-rimmed. Traits considered unique to Uinta Basin Fremont include calcite-tempered pottery, two-handled wide-mouth vessels, the use of gilsonite for pottery repair, and some types of specialized ground stone used in processing grains. Rock art styles are often used as culturally diagnostic attributes of the Fremont. Based on radiocarbon dating, the Fremont peoples of the Uinta Basin appear to have mostly abandoned the region prior A.D. 1000 (Spangler 2000).

Archaeological evidence suggests that Numic peoples appeared in east-central Utah at approximately A.D. 1100 or shortly before the disappearance of Formative peoples (Reed 1994). The archaeological remains of Numic-speaking Utes consist primarily of lithic scatters with low quantities of brownware ceramics, rock art, and wickiups. The cultural history of the Eastern Ute, comprising the bands living east of the Green River, has been divided into four phases. The earliest and most tenuous phase is the Chipeta Phase, dated between ca. 1250 and 1400. Diagnostic artifacts include Desert Side-notched, Cottonwood Triangular, and small corner-notched arrow points and possibly Shoshonean knives. The Canalla phase (ca. A.D. 1400-1650) designates the period between the appearance of well-dated Uncompahgre brown ware ceramics and the adoption of an equestrian lifeway. Diagnostic artifacts include Uncompahgre Brown Ware ceramics, Desert Side-notched and Cottonwood Triangular points, and Shoshonean knives. The pedestrian hunter and gatherers probably lived in wickiups. Near the end of the phase, some groups may have obtained trade items from Spanish settlements in New Mexico. The Antero phase (ca. A.D. 1650-1881) represents a shift to a fully equestrian lifestyle and integration of Euro-American trade goods into Ute material culture. The early Utes in Uintah County were Uinta-ats, a small band of a few hundred members (Burton 1996:20; Duncan 2000). In pre-horse days, Ute family groups lived largely independently of others with key gathering, hunting, and fishing sites being communal and granted to all, within both the local and extralocal Ute communities. All Ute groups made tripod or conical houses with a three or four-pole foundation and a circular ground plan - some 10 to 15 feet in diameter - with a covering of brush or bark. The Ute were hunters and gatherers who exploited various fauna and flora resources. According to macrobotanical and faunal data from dated components, deer, elk, pronghorn, bison, and small game were acquired (Reed 1994). Plant materials thought to have been exploited for food include goosefoot, grass seeds, pinyon nuts, juniper berries, squawbush berries and leaves, hackberry seeds, and possibly saltbush seeds, knotweed, chokecherry, and chickweed.

3.9.3.2 Historic Context

The earliest written accounts of northeast Utah, including the Uinta Basin, were made by two Franciscan Friars attempting to make their way from Santa Fe to Monterey in 1776. The Dominguez-Escalante Expedition headed north from Santa Fe and into northwestern Colorado where they turned west headed for Utah Valley via the Uinta Basin. It would be another 40 or 50 years before more Europeans made their way in to the basin when mountain men, such as Etienne Provost, Antoine Robidoux, William Becknell, and Kit Carson, trapped in the basin. Several of these frontiersmen established trading posts in the Uinta Basin; these include Fort Uinta, (ca. 1831), Fort Kit Carson (ca. 1933), and Fort Robidoux (ca.

1837). Despite some troubles between the traders and local Ute Indians, the establishment of the forts brought the area to the attention of U.S. government surveyors and scientists sparking several major expeditions, including those of John Fremont and John Wesley Powell.

Despite the establishment of the trading posts, the basin and its surrounding mountains and highlands remained the haunt of explorers, surveyors, mountain men and several Native American groups. In 1961, Brigham Young sent a party to survey the area's potential for settlement, but the party reported that the area was too remote and too harsh to properly settle. The area was soon after set aside as the Ute Indian Reservation to which many Ute Indians from Utah Valley were relocated. Despites the basin's purported desolation, cattle ranchers began pushing into the Uinta Basin and its major watersheds in search of adequate grazing for the fast growing cattle industry. Settlers shortly thereafter started settling in the well watered Ashley Valley and began expanding out into other locations throughout the region. This resulted in conflict between the Utes and settlers and eventually a succession of military posts were established in response to growing hostilities between them.

In the late 1880s, Gilsonite was discovered in the Uinta Basin and Congress was persuaded to apportion 7,040 acres from the reservation so the mineral could be mined (Remington 1959). A number of Gilsonite camps were established along the Utah-Colorado border. During this time, freight and stagecoach traffic increased between key settlements and Uintah Railway stations located in the mining districts such as Dragon and Watson. The population in the basin grew slowly until August of 1905 when much of the Uintah Indian Reservation was opened for settlement by the U.S. government. This brought thousands of peoples into the Uinta Basin with hopes of free land for agriculture and livestock (Burton 1996). Initially, livestock was the main industry of white homesteaders in Uintah County. Two factors - free grass and the availability of water - influenced men to move their cattle into the county. Most of the land in the area was part of the public domain and no territory or state could tax it. Cattle rustling became an increasingly large problem as cattle herds grew, and conflict resulted between the small and large cattle companies. In 1912, the Uintah Cattle and Horse Growers Association was organized to protect the livestock industry from thieves and to issue an authorized brand book (Daughters of the Utah Pioneers 1947).

The sheep industry later became part of Uintah County's economic backbone, and contributed to the decline of the cattle industry. Sheep were able to survive the hard winters much better than cattle. By the mid-1890s, more than 50,000 head of sheep were in the region; and the production of wool became very important (Patterson 2013). In 1897, C.S. Carter began building shearing corrals. In 1899, 500,000 pounds of wool were shipped from the county and sold for 12.5 cents per pound (Burton 1996). In 1906, the Uintah Railway Company built shearing pens on the Green River to encourage the shipping of wool by train; and in 1912, pens were built at Bonanza and Dragon. Beginning in the 1940s Mexican sheep-shearing crews and Greek sheepmen from the Price and Helper areas came into the area. The Taylor Grazing Act was passed in 1934, allotting specific areas or "districts" to stockmen for livestock grazing that required permits. Several historic temporary camps, trash scatters, and historic inscriptions within the study area are likely associated with sheep herders.

Uintah County also is known for its natural resources. Coal, copper, iron, asphalt, shale, and especially Gilsonite, were important to the mining industry. Gilsonite is a light-weight lustrous black hydrocarbon mineral that was in buggy paints and beer-vat linings (Remington 1959). Today it is used in over a hundred products ranging from printing inks to explosives and automobile body sealer and radiator paint (Burton 1996). The Uintah Railway narrow gauge railroad was constructed in 1904, principally to transport Gilsonite from Watson, Dragon, and the Rainbow mines to the main Denver and Rio Grande Western Railroad at Mack, Colorado (Remington 1959). At the same time, a system of roads and telephone/telegraph lines were built. Roads were constructed from Green River to Vernal and Fort Duchesne; only segments between the Green River and Dragon were operated as toll roads. One of the main routes between these areas was the Ouray to Rangley wagon road, later known as the Watson Road. Teamsters taking the Watson Road route usually crossed the Green River near Ouray at the Alhandra ferryboat station, stopping at the way station at Chipeta Wells or Kennedy's Hole, then

continued southeast across the White River toll-bridge crossing at Ignatio, and arriving at Dragon within 4 to 7 days depending on breakdowns (Burton 1996). By 1916, most of the freight cargo from Watson to Vernal and Fort Duchesne was transported by motor vehicles due to the improvement of the roads. The Chipeta Wells way-station (42Un3324) was operated by the Uintah Toll Road Company from 1906 to sometime in the late 1930s or early 1940s. The station served travelers and freighters for more than 20 years until better roads designed for trucks took the traffic to the north (Burton 1996).

The modern economic livelihood of Uintah County is largely dependent upon oil and natural gas exploration. In the early 1900s, Uintah Development Company made several unsuccessful attempts to extract oil and gas from the Asphalt Ridge area, near Vernal. In the 1920s, paleontologist Earl Douglass encouraged further exploration in the Uinta Basin. His instincts proved correct, and in April 1925, the first major gas gusher was struck between Vernal and Jensen near Ashley Creek (Burton 1996). As the oil market declined during the Depression years, very little exploration was undertaken in the Uinta Basin. Petroleum became one of the Uinta Basin's major industries in the 1940s, when highly productive wells were drilled in Ashley Valley and the Uinta Basin. In 1949, the Gusher and Roosevelt oil fields were opened, and drilling began in Red Wash in 1951 and Walker Hollow in 1953. Since the mid-1950s, the prosperity of the county has hinged on oil and natural gas exploration booms. In 1995, it was estimated that 30 percent of jobs in Uintah County were related to mining and petroleum, and between 35 to 40 percent of county wage income was generated by these industries (Burton 1996).

3.9.4 Cultural Resources Investigations in the GCWPA

3.9.4.1 Class I Inventories

Numerous Class I inventories, which are extensive reviews of existing documentation pertaining to cultural resources within a given area, have been completed within the GCWPA. In 2004, Grand River Institute completed a Class I review for the Chapita Wells/Stagecoach Project Area (Grand River Institute 2004), which covers much of the same area as the GCWPA. The Class I considered all archaeological inventories conducted in the Chapita Wells/Stagecoach Project Area between 1978 and 2004; the review identified 87 sites and 376 projects. In 2008, Montgomery Archaeological Consultants completed a Class I review for the Natural Buttes EIS project, which also overlapped substantially with the GCWPA. The Natural Buttes Unit Class I review identified 1,830 inventories and 1,214 archaeological resources in the Natural Buttes Unit Project Area (Patterson et al. 2008). Finally, Montgomery Archaeological Consultants completed a Class I literature review for the current GCWPA (Patterson and Thomas 2015 [In Progress]). It includes all inventories between 2004 and 2014. The BLM considers inventories older than 10 years as inadequate due to changes in survey methods and dynamic landscape processes. All sites in the GCWPA, regardless of the date when they were initially discovered, are included in the most recent Class I. The review identified 477 inventories and 331 archaeological sites.

3.9.4.2 Class III Inventories

Since 2004, archaeologists have conducted 477 cultural resource inventories cumulatively covering 28,500 acres, or approximately 66 percent the GCWPA. A detailed list of each inventory and its results is presented in **Appendix Q**. Inventories were conducted for a number of different types of projects including well pads, access routes, pipelines, a variety of infrastructure facilities (e.g., loadouts, compressors, etc.), and seismic exploration. All the recent cultural resource inventories were conducted for NHPA Section 106 compliance.

3.9.4.3 Class III Inventory

Based on Recent Class III inventories, as well as others dating back to 1978, 331 archaeological sites have been identified in the GCWPA. The Utah Division of State History site records also contain one fossil locality located within the GCWPA; this locality is not considered a cultural resource and is not included in this chapter. **Appendix R** contains a complete list of all the known archaeological resources

identified during Class III cultural resource inventories in the GCWPA since 1978. The following sections define and described the different types of archaeological sites that have been recorded in the GCWPA.

3.9.4.4 Class II Inventories

Archaeologists have made several attempts to create scientific models that predict the location of archaeological sites based on certain types of environmental and proxy data such as the distance to permanent water, the distance to certain types of land forms, and the presence or absence of different plant and animal species. The BLM and others have used a qualitative and highly modified version of the Larralde and Chandler model (Larralde and Chandler 1981), developed on studies done on Seep Ridge, near and partially overlapping the GCWPA, to classify the site potential of areas contained in various RMP and EIS documents. The qualitative version of the model takes two or three of the variables used in the original model, such as distance to water, distance to pinyon and juniper resources, and slope, to classify site location probability. These classes are typically defined as high and low probability zones.

Prehistoric sites in the GCWPA are located in areas defined as medium and low probability locations identified in the Seep Ridge study. In that study, over 90 percent of the identified sites in the corresponding area to the GCWPA fell within the area of medium probability. Overlaying the medium probability area defined in the Seep Ridge study upon the corresponding portions of the GCWPA identifies a distinct trend in site locations within the region. Approximately 88 percent of prehistoric sites located within GCWPA occur in the medium probability zone. The majority of the historic sites (58 percent); however, tend to be located in the low probability zone. Overall, 71 percent of all known sites within the GCWPA occur within the medium probability zone.

Study results subsequent to the 1981 research, based on additional field surveys in the vicinity, indicate that site densities are higher than originally anticipated and that clustering of sites applies to both historic and prehistoric locations. The average site density, based on all known sites, is approximately 4.7 per square mile. The actual per square mile densities range from 0, even in the moderate probability area, to a maximum of 12 sites per square mile. Knowing that there exists a propensity for sites to be clustered and that site densities are considerably higher than previously thought, the study results provide useful tools in considering what types of potential effects exist and what types of effects, if any, are likely to occur to the cultural resources within the GCWPA.

3.9.4.5 Prehistoric Site Types

Prehistoric archaeological resources in the GCWPA can be classified based on several criteria including the types and frequencies of artifacts present, the number and types of features present, its topographical setting, and presumed function. Prehistoric sites consist of rock art, artifact scatters, temporary camps, rock shelters, habitations, storage sites, complex sites, and miscellaneous sites..

Prehistoric rock art sites consist of petroglyphs and pictographs. Petroglyphs include those elements of rock art that are etched, carved, or pecked onto a rock surface, and pictographs are painted with organic or mineral pigments. Rock art ranges from individual elements pecked on a boulder to cliff faces covered with numerous panels and hundreds of individual images. The rock art previously identified in the GCWPA consist of individual images on boulders.

Prehistoric burials consist of human remains and probable burial sites. Probable burial sites include rock concentrations, cists, and other types of features that may contain human remains. Certain features are classified based on their archaeological or ethnographic similarities to other similar features known to have been used as graves. Burials may be associated with other features and artifacts.

Prehistoric artifact scatters consist of sites containing lithic and ceramic debris scattered across the surface. Rarely, because of site exposure to the elements, do organic artifacts occur on the surface of

these types of sites. Artifact scatters do not contain any features such has hearths, grinding slicks, or architecture.

Prehistoric lithic procurement sites are a specific type of artifact scatter located in a tool stone source area that includes artifacts directly related to the testing and reduction of tool stone. These scatters typically include high percentages of tested nodules, cores, and primary reduction debitage.

Prehistoric temporary camps are those sites that include an artifact scatter, as discussed above, and the presence of ephemeral features such as hearths. Temporary camps were likely used for several days or weeks. The artifact assemblage and different types of features typically reflect several different types of domestic activities at the locality.

Prehistoric rock shelters are those sites that include artifacts, ephemeral features, or both, that occur in a natural rock alcove. Alcoves typically occur as natural recesses in cliff faces, though they can occur near isolated boulders or bedrock outcrops. Rock shelters may or may not contain architecture, such as a stone wall, but they do commonly contain features such as hearths, cists, and rock alignments. Rock shelters could serve as short-term camps or could be used for more extensive habitation.

Prehistoric habitations consist of those sites containing architectural features as well as artifacts and ephemeral features. The assumption is that considerable time and energy were spent to construct walls, pit houses, and granaries indicating that a substantial amount of time was spent at the location. Habitations are in open air settings.

Prehistoric Cairns are piled or stacked stone monuments used to mark specific locations on the landscape and trails. Prehistoric cairns in the Uinta Basin tend to be relative small and poorly constructed, especially when compared with historic cairns, which are much more common.

A storage site consists of one or more architectural features located in alcoves, along narrow cliff benches, or under boulders with the presumed function of foodstuff storage or caching. A site classified as a storage site can include granaries, cists, and caches. The prehistoric miscellaneous site category consists of sites that do not fit into the above defined categories.

3.9.4.6 Historic Site Types

Historic archaeological resources in the GCWPA can be classified based on several criteria including the types and frequencies of artifacts present, the number and types of features present, its topographical setting, and presumed function. Historic site types identified in the GCWPA consist of inscriptions, artifact scatters, temporary camps, cairns, corrals, burials, habitations, transportation corridors, wells, and miscellaneous sites. Historic site types include inscriptions, artifact scatters, temporary camps, habitations, ranching land-use sites, and miscellaneous.

Historic inscriptions include sites with dated inscriptions or images and the use of English characters that are inscribed, etched, or carved into a rock surface. It also includes inscriptions that are “painted” on rock surfaces with axle grease or some similar substance. More often than not, historic inscriptions consist of a name or set of initials with a date etched into stone, though images of sheep, horses, and people are relatively common.

Historic artifact scatters consist of historic artifacts (cans, glass, ceramics, etc.) within a well-defined area. No features are present on simple artifact scatters.

Historic temporary camps generally referred to as cowboy camps or sheepherder camps that typically include an artifact scatter associated with ephemeral features such as camp fire rings, tent platforms, or wood chip piles. Temporary camps were likely used for only a few days. The presence and types of artifacts reflect various activities that occurred at the site.

Historic habitations include cabins and homesteads. Habitations typically contain some form of domicile, or the remains thereof, outbuildings, planted vegetation, and landscape features such as corrals and fences. Various types of artifacts and smaller features are associated with habitations.

Historic Cairns are piled or stacked stone monuments used to mark specific locations on the landscape and trails. Cairns can range from a low mound of piled rocks to large, intricately stacked rock monuments that are up to 6 feet tall or higher. In the Uinta Basin, cairns have been used to mark section corners, mining claims, elevation markers, various types of sheep herding camps, and various wagon and riding trails. Cairns are a very common sight on top of many mesas and ridges throughout the GCWPA.

Corrals include all livestock enclosures found in the GCWPA. This site category includes common cattle corrals, sheep pens, and lambing pens. Most corrals are constructed of a combination of wood and metal; however, ephemeral corrals may be constructed from brush, stone, or even changes in topography.

Historic burials consist of human remains, marked graves, and unmarked graves. Probable grave sites include certain rock concentrations that may contain human remains. Unmarked graves are classified on their archaeological or ethnographic similarities to other similar features known to have been used as graves. Burials may be associated with other features and historic artifacts.

Wells are either hand or machine excavated reservoirs used for obtaining underground water. Travel Corridors include all historic roads, trails, and railways. The historic miscellaneous site category consists of sites that do not fit into the above defined types.

3.9.4.7 Prehistoric Archaeological Resources in the GCWPA

Of the 331 archaeological sites in the GCWPA 184 (or 56 percent) are single component prehistoric sites. **Table 3.9-1** provides a summary of the frequency of prehistoric sites in the GCWPA by both site type and affiliation. Sites from all prehistoric temporal periods are present, including Paleoindian, Archaic, Formative, and the Late Prehistoric. Ninety percent of the prehistoric sites, however, lack defined cultural or temporal affiliations. This is common in the Uinta Basin and other areas in northeastern Utah where diagnostic artifacts, such as projectile points or ceramics, are not particularly common. All but two affiliated sites date to the Archaic and Formative periods. Common site types in the GCWPA include artifact scatters, temporary camps, and lithic procurement sites. Rock art sites, rock shelters, prehistoric cairns, and storage sites, while present in the GCWPA, are extremely uncommon. No prehistoric burials or human remains have been documented in the GCWPA.

3.9.4.8 Historic Archaeological Resources in the GCWPA

The GCWPA contains 133 historic archaeological sites, which is 40 percent of the total number of archaeological sites identified during the Class I review. **Table 3.9-2** provides a summary of the frequency of historic sites in the GCWPA by both type and affiliation. The majority of the historic sites, approximately 87 percent, have European American origins. Historic sites affiliated with the Ute Indians account for 13 percent of total. A single site is attributed to a Hispanic affiliation based on the surname found in a historic inscription. Historic artifact scatters, cairns, and temporary camp site types each account for approximately 25 percent of the total number of historic sites in the GCWPA and the majority of these sites are related to sheep herding. The remaining 25 percent of historic sites include 2 old roads, 1 water well, several historic inscriptions, 4 corrals, and at least 6 probable historic Ute burials. The two sites included in the miscellaneous site category include an ambiguous rock alignment and the remains of an old telegraph line.

Table 3.9-1 Cross Tabulation of Prehistoric Site Types and Cultural Affiliation for Identified Sites in the GCWPA

Site Type	Cultural Affiliation					Total
	Paleoindian	Archaic	Fremont	Numic	Unknown Aboriginal	
Artifact Scatter	1	5	0	1	82	89
Cairn	0	0	0	0	1	1
Lithic Procurement	0	0	0	0	10	10
Miscellaneous	0	0	0	0	3	3
Rock Art	0	0	0	0	1	1
Rock Shelter	0	0	0	0	4	4
Storage	0	0	0	0	1	1
Temporary Camp	0	7	3	1	64	75
Total	1	12	3	2	166	184

Source: Patterson and Thomas 2015.

Table 3.9-2 Cross Tabulation of Historic Site Types and Cultural Affiliation for Identified Sites in the GCWPA

Site Type	Cultural Affiliation			Total
	European American	Hispanic	Numic	
Artifact Scatter	35	0	1	36
Burial	0	0	5	5
Burial/Temporary Camp	0	0	1	1
Cairn	34	0	0	34
Cairn/Artifact Scatter	7	0	0	7
Corral	4	0	0	4
Habitation	1	0	1	2
Inscription	3	1	0	4
Inscription/Artifact Scatter	1	0	0	1
Miscellaneous	2	0	0	2
Temporary Camp	26	0	8	34
Travel Corridor	2	0	0	2
Well	1	0	0	1
Total	**116**	**1**	**16**	**133**

Source: Patterson and Thomas 2015.

3.9.4.9 Multicomponent Archaeological Resources in the GCWPA

A total of 14 sites, 4 percent of the total, in the GCWPA have both prehistoric and historic components. A summary of the site types and affiliations are presented in **Table 3.9-3**. The most common multicomponent sites contain European American and Unknown Aboriginal components, though two sites have Formative components, and two more have late prehistoric Numic components. These sites tend to have mixed artifact assemblages or features representing each of the components.

Table 3.9-3 Cross Tabulation of Multicomponent Site Types and Cultural Affiliation for Identified Sites in the GCWPA

Site Type	Cultural Affiliation			Total
	Fremont/ European American	Numic/ European American	Unknown Aboriginal/ European American	
Artifact Scatter/Artifact Scatter	1	2	1	4
Artifact Scatter/Corral	0	0	1	1
Artifact Scatter/Temporary Camp	0	0	3	3
Habitation/Temporary Camp	1	0	0	1
Rock Shelter/Inscription	0	0	2	2
Temporary Camp/Corral	0	0	1	1
Temporary Camp/Temporary Camp	0	0	2	2
Total	2	2	10	14

Source: Patterson and Thomas 2015.

3.9.4.10 Assessment of Historic Properties

All but one of the archaeological sites documented in the GCWPA have been evaluated as historic properties for inclusion on the NRHP based on the criteria described in Section 3.9.2. Currently, 147 sites in the GCWPA are eligible for listing on the NRHP (**Table 3.9-4**). This is only 44 percent of all the known sites in the GCWPA. No historic properties currently listed on the NRHP occur within the GCWPA.

Table 3.9-4 Eligibility of Archaeological Sites in the GCWPA to the NRHP

Era	NHRP Assessment			Total
	Eligible	Not Eligible	Unevaluated	
Prehistoric	121	62	1	184
Historic	17	116	0	133
Multicomponent	9	5	0	14
Total	**147**	**183**	**1**	**331**

Source: Patterson and Thomas 2015.

3.9.5 Native American Traditional Values

3.9.5.1 Ethnographic Overview

The information provided in this section has been adapted from the "Class I Existing Data Review for EOG's GCWPA, Uintah County, Utah" (Patterson and Thomas 2015 [In Progress]).

Ute Indians can be divided into eastern and western groups. The eastern Utes inhabited the high plateaus and Rocky Mountain parks of Colorado and northern New Mexico, and consisted of the Yamparka and Parianuc (White River Utes), the Taviwac (Uncompahgre Utes), and the Wiminuc, Kapota, and Muwac (Southern and Ute Mountain Utes). The western or Utah Utes inhabited the central and eastern two-thirds of the state. Utah Ute bands included the Cumumba or Weber Utes, the

Tumpanuwac, Uinta-ats, Pahvant, San Pitch, and Sheberetch. The bands traded and intermarried with each other, but did not form large tribal organizations. Principally hunters and gatherers, the semi-nomadic Utah Utes gathered seeds and berries in season, dug roots, fished, hunted small game, and occasionally killed mountain buffalo.

Utes in Colorado acquired horses from the Spanish by 1640; however, the Utah Ute, being farther away from the Spanish frontier, acquired horses sometime later, possibly by 1680. With acquisition of the horse, the Ute quickly adopted the horse and buffalo culture of the Plains Indians. They became noted raiders and traded horses between the Spanish Southwest and the northern plains. Utes actively participated in Spanish attacks against Navajo and Apache raiders, and conducted their own slave trade with the Spanish against the Southern Paiute and Navajo.

Beginning in 1847, Utes experienced the full impact of European American contact with the arrival of Mormon settlers in the Salt Lake region. The Mormons rapidly extended their settlements south into the Utah Valley, a major trade crossroads and subsistence area for the Ute People. As conflicts increased between the Mormons and Utes, the federal government was pressured by the Mormons to put the Indians on a reservation. In 1861, Abraham Lincoln issued an executive order creating the Uintah Valley Reservation, comprising 2,039,400 acres in the Uinta Basin. By 1870, most members of the Tumpanuwac, San Pitch, Pahvant, Sheberetch, Cumumba, and Uintah-at bands of Utah Utes (collectively called the Uintah Band) resided on the Uintah Valley Reservation. In 1881, the Yamparka and Parianuc bands were forced by the federal government to join the Uintah Band on the Uintah Valley Reservation. In 1882, the Taviwac were moved to their own reservation, the 1,912,320-acre Uncompahgre (Ouray) Reservation, south of the Uintah Valley Reservation. The Uintah and Uncompahgre reservations were combined into the present Uintah and Ouray Reservation in 1886. Today, the Yamparka, Parianuc, and Taviwac are collectively called the Northern Ute Tribe.

In 1905, the federal government allotted the reservations and opened the remainder for non-Indian entry. Each Ute received an 80- to 160-acre plot for farming and access to a communal grazing district. By 1909, the Uintah and Ouray Reservation shrank from nearly 4 million acres in 1882 to a jointly owned 250,000-acre grazing reserve and 1,283 individual allotments totaling 103,265 acres. Sales of individual allotments further reduced Ute holdings.

Following the Indian Reorganization Act of 1934, the Northern Ute Tribe began repurchasing alienated reservation lands. In 1948, the federal government returned some 726,000 acres to the Tribe in what is now called the Hill Creek Extension. In a 1986 decision, the U.S. Supreme Court upheld an Appeals Court ruling granting the Northern Ute Tribe “legal jurisdiction” over 3 million acres of alienated reservation lands. In the 1990s, the Northern Ute Tribe had grown to 3,000 members and became an increasingly powerful force in local and state politics. The Uintah and Ouray Reservation now encompasses approximately 4.5 million acres.

3.9.5.2 Regulatory Framework

Federal law and BLM Manual H-8160-1 require the BLM to consult with Native American Tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on BLM-administered lands. This consultation includes the identification of places of traditional cultural importance to Native American Tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Additionally, some of these locations may be considered sacred to particular Native American individuals or Tribes.

In 1992, the NHPA was amended to explicitly allow that "properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the NRHP." If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property. The term "traditional cultural property" first came into use within the federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1998) defines a traditional cultural property as "one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that a) are rooted in that community's history and b) are important in maintaining the continuing cultural identity of the community." To qualify for nomination to the NRHP, a traditional cultural property must be more than 50 years old, must be a place with definable boundaries, must retain integrity, and must meet certain criteria as outlined for cultural resources.

In addition to NRHP eligibility, some places of cultural and religious importance also must be evaluated to determine if they should be considered under other federal laws, regulations, directives, or policies. These include, but are not limited to, NAGPRA, American Indian Religious Freedom Act, ARPA, and EO 13007.

NAGPRA established a means for Native Americans, including Indian Tribes, to request the return of human remains and other sensitive cultural items held by federal agencies or federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and sensitive cultural items.

The American Indian Religious Freedom Act established a federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

ARPA requires notification of the appropriate Indian tribe before approving a cultural resource use permit for the excavation (testing and data recovery) of archaeological resources, if the responsible federal land manager determines that a location having cultural or religious importance to the tribe may be harmed or destroyed.

EO 13007 defines a sacred site as any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, provided that the tribe or appropriately authoritative representative has informed the federal agency of the existence of such a site.

3.9.5.3 Native American Consultation

The BLM is currently consulting with 12 Native American tribes including the Northern Ute, the Eastern Shoshone, the Ute Mountain Ute, the Hopi, the Goshute, the NW Band of the Shoshone, the White Mesa Ute, Laguna Pueblo, Santa Clara Pueblo, Zia Pueblo, and the Navajo Nation. Consultation with the aforementioned tribes will be ongoing throughout the undertaking. Responses from the tribes will be updated when they are received.

3.10 Socioeconomic Resources

3.10.1 Study Area for Socioeconomics

The GCWPA is located in Uintah County. The study area for socioeconomics encompasses Uintah County and the eastern portion of neighboring Duchesne County in east-central Utah. Collectively these two counties are commonly referred to as the Uinta Basin. A highway network links the two counties, integrating local economic and social resources. The principal communities in the region are Vernal (Uintah County) and Roosevelt (Duchesne County). Together these communities host many firms and much of the labor force comprising the Uinta Basin's oil and gas industry. A substantial number of residents live in the unincorporated areas of each county. The Uintah and Ouray Indian Reservation encompasses large areas of both counties, including the western portion of the GCWPA. The socioeconomic resources study area was defined to encompass the geographic area capturing the majority of the project's anticipated effects to the economy, population, housing, facilities and services, and fiscal conditions at a local level.

3.10.2 Background on the Role of Oil and Gas Development in the Region

Oil and gas development is a major force driving the contemporary economic and social development of the Uinta Basin. The Uinta Basin is the historical center of oil and gas production of Utah. Although major discoveries have been made outside of the Uinta Basin in recent years, more than 90 percent of all new oil and gas well starts in Utah over the last 4 years and most producing wells in the state are located in these two counties (**Table 3.10-1**). More than 960 new wells had drilling initiated in 2013 alone, with completions of new wells raising the total number of producing wells in the Uinta Basin to 10,612, or 91 percent of all producing oil and gas wells in the state, which collectively produced more than two-thirds of the statewide annual oil and gas production (UDOGM 2014d-f). Most of the new development activity in the Uinta Basin in recent years has been for natural gas in Uintah County. However, Duchesne County leads Uintah County in terms of annual oil production.

Table 3.10-1 County Population Trends

	2009	2010	2011	2012	2013	Change
New Wells Spud						
Duchesne County	164	423	348	420	443	170%
Uintah County	316	461	525	635	524	66%
Two-County Share of State	93%	91%	89%	95%	97%	+ 4 pts.
Producing Wells						
Duchesne County	2,062	2,340	2,611	2,841	3,093	50%
Uintah County	5,837	6,182	6,564	7,055	7,519	29%
Two-County Share of State	88%	89%	89%	89%	91%	+ 3 pts
Natural Gas Produced (MCF)						
Duchesne County	28,876,429	35,831,642	40,298,392	41,672,250	44,445,343	54%
Uintah County	283,453,642	283,352,521	298,602,384	328,184,701	325,915,495	15%
Two-County Share of State	69%	73%	73%	75%	79%	+ 10 pts.
Barrels of Oil Produced						
Duchesne County	8,767,934	10,916,561	11,940,217	14,423,037	16,527,775	89%
Uintah County	6,702,465	6,609,784	7,021,694	8,348,503	10,487,706	56%
Two-County Share of State	67%	71%	72%	75%	77%	+ 10 pts.

Source: UDOGM 2014d-f.

The Uinta Basin's mining sector, which consists predominately of oil and gas development and production, saw the total number of jobs grow more than five-fold over the past 4 decades, from 928 in 1969 to 5,809 in 2012 (U.S. Bureau of Economic Analysis [USBEA] 2014). In 2012, the mining sector directly accounted for nearly one of every five jobs in the Uinta Basin. The sector's economic significance becomes even greater when the indirect and induced effects are considered. Economic data for 2012 indicate that each direct job in oil and gas exploration, development, and production supports between 0.4 and 1.0 additional jobs in the regional economy, through what is commonly referred to as the "multiplier effect" (IMPLAN Group LLC 2014). Assuming an average of 0.8 additional jobs per direct job, the mining sector was responsible for approximately one-third of the region's employment in 2012. The contribution of oil and gas exploration and development would be even higher if public sector employment supported by tax revenues generated by the industry, high levels of trucking employment, and other ancillary activities are considered. The industry's influence extends beyond jobs into many aspects of the region's economic, fiscal, and social structure. For example, population growth and migration patterns tend to mirror the industry's expansionary and contractionary cycles, which ripple through the labor market to the housing market, as well as the region's retail trade sector, local tax collections, and public school enrollment.

An expansionary period began in 2002 when the area became one of several major centers of renewed natural gas development centers in the Rocky Mountains. The pace of development activity grew over time, with more than 900 new wells started in each of the past 3 years. That activity triggered sharp increases in the numbers of jobs, population growth, and historic lows in local unemployment. Despite strong long-term demand for natural gas, the region was not immune to the effects of the recent global economic slowdown. As production and development activity declined, the region witnessed marked changes as local unemployment rates and number of unemployed more than quadrupled between September 2008 and June 2009: in Duchesne County the number of unemployed rose from 215 to 1,121 with a corresponding increase in the unemployment rate from 2.0 percent to 10.5 percent. In Uintah County the rates were comparable; the number of unemployed grew from 327 to 1,899 and the unemployment rate increased more than five-fold from 1.7 percent to 10.4 percent. In recent years, however, the economy has vastly improved, with the unemployment rate for Uintah County and Duchesne County down from the recessionary highs to 3.2 and 3.0 percent, respectively as of June 2014 (U.S. Bureau of Labor Statistics 2014a).

Current conditions constitute the background for assessing the potential social and economic effects of the proposed project, in addition to the post-slowdown conditions and trends that were reflective of energy policy and market conditions conducive to higher levels of oil and gas exploration and development. The remainder of this section characterizes social and economic conditions in the study area, focusing on local trends over the past several years as the local communities responded to growth pressures associated with high levels of oil and natural gas development.[1]

3.10.3 Local Population

In 2013, Uintah County had a population of 35,555 and Duchesne County had 20,308 residents (**Table 3.10-2**). Between 2000 and 2010, the resident population of Duchesne and Uintah counties both grew at a compounded annual rate of 2.6 percent, more rapid than the 1.0 to 1.5 percent compounded growth rates generally accepted as manageable. The majority of the local population growth is attributed to energy resource development.

[1] For this analysis, the Affected Environment for socioeconomics is characterized based on information and data available in 2014 when this section was prepared. In many instances the data reflect 2013 conditions, in others 2012 or mid-2014 conditions and trends. In the ensuing period the pace of oil and gas development has declined sharply, affecting local employment, unemployment, resident population, housing availability, school enrollments, and local fiscal conditions that are not reflected in the historical data.

Some new residential development in recent years has been of an infill nature or in subdivisions within the principal cities of Vernal and Roosevelt. However, much of the new development and hence, the population growth, has occurred in the unincorporated communities and outlying areas of the two counties (**Table 3.10-3**).

Table 3.10-2 Resident Population, 2000 - 2013

Year	Uintah County	Duchesne County	State of Utah (millions)
2000 (Census)[1]	25,224	14,371	2.23
2010	32,588	18,607	2.76
2011	33,157	18,838	2.81
2012	34,540	19,245	2.85
2013	35,555	20,308	2.90
2000-2010 Absolute Change	+7,364	+4,236	+0.53
2000-2010 Percentage Change	+29.2%	+29.5%	+23.8%
2010–2013 Absolute Change	+2,967	+1,701	+0.14

[1] 2000 Census counts are April 1. Estimates are July 1.

Source: U.S. Census Bureau 2012a, 2014.

Table 3.10-3 Population Change within the Study Area, 2000 - 2013

County/Municipality	2000 (Census)	2013 Estimate	2000 – 2013 Net Change	2000 – 2013 CARC
Duchesne County	14,371	19,245	4,874	2.3%
Duchesne City	1,408	1,799	391	1.9%
Roosevelt City	4,299	6,750	2,451	3.5%
Balance of county	8,664	10,696	2,032	1.6%
Uintah County	25,224	34,540	9,316	2.4%
Vernal City	7,714	10,344	2,630	2.3%
Other municipalities	1,866	2,938	1,072	3.6%
Balance of county	15,644	21,258	5,614	2.4%

* CARC = Compounded Annual Rate of Change.

Source: U.S. Census Bureau 2000, 2014.

Other municipalities in the study area and their respective 2013 populations include: Altamont (population 248), Myton (population 604), and Tabiona (population 184) in Duchesne County and Ballard (population 906) and Naples (population 2,032) in Uintah County (U.S. Census Bureau 2014). The other communities in the study area are unincorporated.

The resident population in the study area is predominately white, but less so than that of the state as a whole. In 2010, American Indians were a larger share of the population in both counties as compared to the statewide average (**Table 3.10-4**). The proportions of Hispanic and/or Latino persons were considerably lower in both Duchesne County (7.1 percent) and in Uintah County (6.0 percent) when compared to Utah as a whole. Despite recent growth, the overall demographic composition in the two counties remains generally unchanged from 2000.

Table 3.10-4 Racial Demographics by Jurisdiction, 2010

Jurisdiction	White	Black / African American	American Indian[1]	Other and Two or More Races	Total Hispanic or Latino[2]
State of Utah	86.1%	1.1%	1.2%	8.8%	13.0%
Duchesne County	89.2%	0.2%	4.5%	5.5%	6.0%
Uintah County	86.6%	0.4%	7.7%	4.6%	7.1%

[1] American Indian includes other native races of North America.

[2] Persons identifying themselves as Hispanic or Latino may be of any race or combination of races.

Source: U.S. Census Bureau 2010.

Historically, natural increase (the net difference between local births and deaths) had been a major component of the population change dynamics in Duchesne and Uintah counties. In Duchesne and Uintah counties, natural increase between 2006 and 2013 is estimated at 2,168 and 3,548 persons, respectively (**Table 3.10-5**). Net migration, the difference between the number of residents who move into a county and those who leave, is the other component of population change. Both counties experienced substantial net in-migration in the 2006 to 2013 timeframe, with Uintah County gaining 3,551 residents, and Duchesne County gaining 2,358 residents thru migration; 724 in 2013 alone.

Table 3.10-5 Components of Population Change

Year	Uintah County			Duchesne County		
	Natural Increase	Net Migration	Net Change	Natural Increase	Net Migration	Net Change
2006	359	467	826	212	161	373
2007	428	745	1,163	232	512	744
2008	451	475	907	265	419	674
2009	468	1,217	1,702	302	717	1,022
2010	437	-1,023	-587	249	-207	41
2011	430	295	728	298	-51	248
2012	461	875	1,354	296	83	378
2013	514	500	1,015	314	724	1,063
Total 2006 – 2013	3,548	3,551	7,108	2,168	2,358	4,543

Source: U.S. Census Bureau 2012b,c, 2013a.

The original boundaries of the Uintah and Ouray Indian Reservation encompass approximately 4.5 million acres of land under varied ownership in Uintah, Duchesne, and five other counties. Tribal trust lands, including surface and mineral interests covers approximately 1.3 million acres in three counties, though the area is not all contiguous and the surface and mineral estates do not entirely overlap (Ute Indian Tribe 2014). In 2000, 19,182 residents lived within the outer perimeter of the Reservation, of which 3,147 persons identified themselves as American Indian, either solely or in combination with one or more other races (**Table 3.10-6**) (U.S. Census Bureau 2000). In 2010, 3,457 residents identified themselves as American Indians and the number of non-Indians had risen to 20,912. The large number of non-Indians residing within the Reservation's perimeter reflects the large area of private land located within its boundaries.

Table 3.10-6 Resident Population on the Uintah and Ouray Reservation

	2000 Census[1]	2010 Census[1]	Change 2000 – 2010
Total Resident Population, All Races	19,182	24,369	5,187
American Indian Population (persons of one race)	2,780	2,951	171
American Indian Population (persons of two or more races)	367	506	139
American Indian Population as Percent of Total Population	16.4%	14.2%	-1.8% (abs)

[1] 2000 Census data include population on off-reservation trust land.

Source: U.S. Census Bureau 2000, 2010.

The Ute Tribal headquarters is located in Fort Duchesne and the tribe reports membership of 3,022, more than half of which reside on the reservation. The Tribe is economically active, with enterprises including a supermarket, gas station/convenience stores, a bowling alley, a livestock feedlot, Uintah River Technologies (computer data capture and management), Ute Tribal Enterprises LLC (livestock management), Ute Water Systems (provides water and sewer for several reservation communities), and Ute Energy (development of State energy resources) (Ute Indian Tribe 2014).

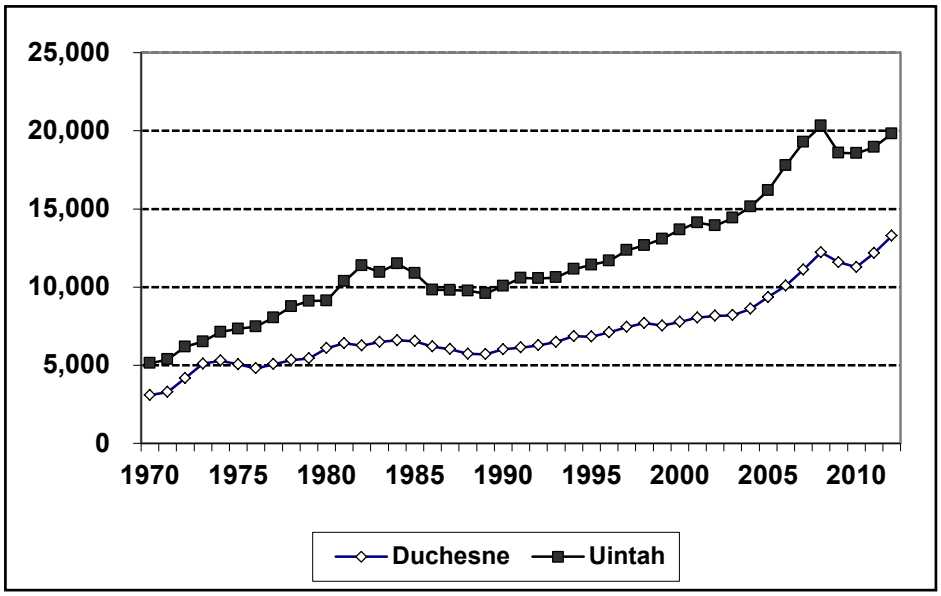
3.10.4 Local Economy and Labor Force

Total employment in Duchesne and Uintah counties more than tripled between 1970 and 2012 (**Figure 3.10-1**), with additional job growth realized in 2013. Energy resource development played a key role in local economic growth during the early 1980s, with a slowdown in such development triggering an economic contraction in the latter half of that decade. Total employment in Uintah County did not surpass the previous peak until 1995. Renewed energy and mineral resource development, beginning in 2002, triggered another economic expansion cycle in the region with more than 11,000 new jobs were added in the two-county region between 2002 and 2012.

The net long-term job growth through 2012 was consistent with the 3.2 percent compounded annual rate of change achieved statewide. Duchesne and Uintah counties have kept pace with the increase in post recessional job growth during the 2010 to 2012 timeframe.

As is common throughout the nation, non-farm wage and salary employment accounts for the majority of employment and most of the recent job growth in Duchesne and Uintah counties. Proprietors account for one of every four jobs in the study area (**Table 3.10-7**). However, many of the proprietorships are part-time or incidental/casual type businesses, rather than full time occupations. Much like the state farm employment trend, farm employment has steadily decreased from 2000 to 2012 in the affected counties (U.S. Bureau of Labor Statistics 2014b).

The distribution of jobs by major industrial sector in 2012 is detailed in **Table 3.10-8**. Mining (which includes the oil and gas industry) currently accounts for nearly 1-in-5 jobs in Uintah and Duchesne counties. Local government is the second largest share of employment in each county.



Source: USBEA 2014.

Figure 3.10-1 Total Full and Part-time Employment in Duchesne and Uintah Counties, 1970 to 2012

Table 3.10-7 Composition of Total Employment in the Study Area over Selected Years

	1990	2000	2010	2012	Change 2000 – 2012
Duchesne County					
Total full and part-time employment	6,016	7,766	11,281	13,275	5,509
Wage and salary employment	4,061	5,133	7,865	9,490	4,357
Proprietors	1,955	2,633	3,416	3,785	1,152
Farm employment	913	992	882	861	-131
Uintah County					
Total full and part-time employment	10,057	13,667	18,559	19,824	6,157
Wage and salary employment	7,410	9,999	14,085	15,715	5,716
Proprietors	2,647	3,668	4,474	4,109	441
Farm employment	811	1,000	974	950	-50
State of Utah (000s)s					
Total full and part-time employment	944.33	1,387.85	1,610,289	1,704,281	316,431
Wage and salary employment	778.16	1,134.76	1,236,422	1,305,665	170,905
Proprietors employment	166.17	253.09	373,867	398,616	145,526
Farm employment	19.15	20.38	19,066	18,365	-2,015

Source: USBEA 2014.

Table 3.10-8 Non-Farm Wage and Salary Employment by Major Industry, 2012 (Percent of Total)

Industry	Duchesne County (%)	Uintah County (%)	State of Utah (%)
Agricultural Services, Forestry, Fishing and Hunting	(D)	0.6	0.2
Mining	19.1	19.5	1.0
Utilities	0.3	0.8	0.2
Construction	9.0	7.6	5.6
Manufacturing	1.9	1.6	7.4
Wholesale and Retail Trade	11.2	15.4	13.9
Transportation and Warehousing	9.3	6.7	3.3
Information	1.7	0.9	2.2
Finance and Insurance	2.6	3.4	7.1
Real Estate and Rental and Leasing	4.1	4.8	5.4
Professional Scientific and Technical Services	2.1	3.6	6.8
Management of Companies and Enterprises	(D)	(D)	1.4
Admin., Support, Waste Mgmt, Remediation	(D)	(D)	5.7
Education Services (private)	(D)	0.6	3.1
Health Care and Social Assistance	(D)	6.3	8.5
Arts, Entertainment, and Recreation	0.8	0.6	2.2
Accommodation and Food Services	4.0	6.9	6.4
Other Services (except Public Admin.)	6.2	6.9	5.3
Federal Government, civilian	0.6	2.2	2.1
Military	0.7	0.9	1.0
State Government, including Public Education	1.0	0.8	4.2
Local Government, including Public Education	14.6	13.3	7.0
Total Non-Farm Employment, not including (D)	93.5	95.2	99.0

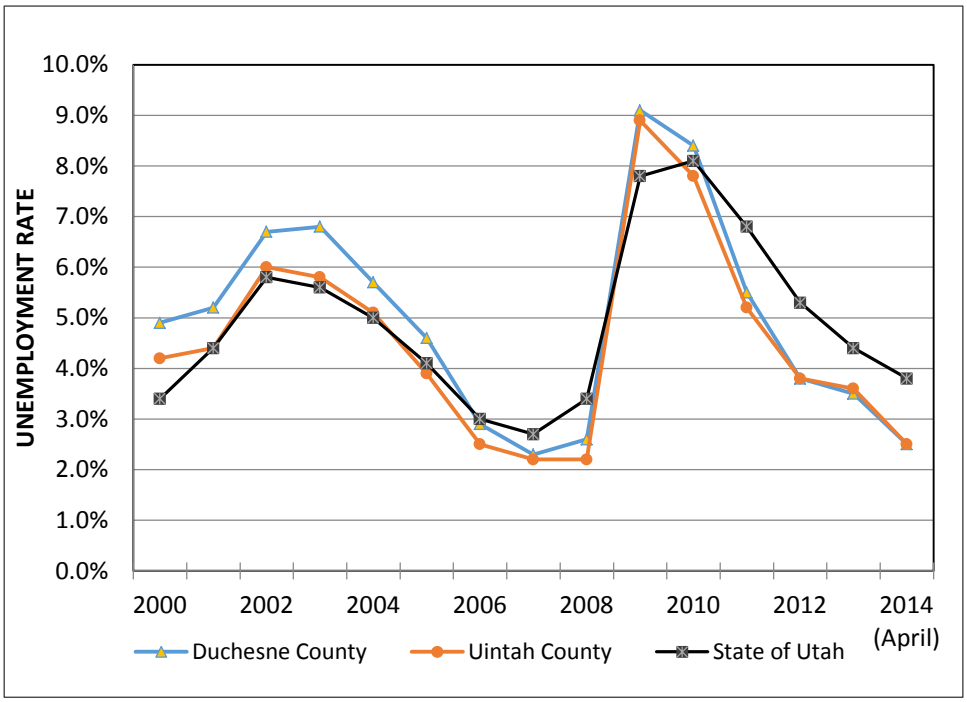
Note: (D) data not disclosed due to regulations regarding confidentiality.
Source: USBEA 2014.

The Uinta Basin economy has long been dependent on the oil and gas industry (included as part of mining in **Table 3.10-8**), and Uintah County's relative concentration in oil and gas production has increased since the early 1990s, climbing above 60 percent of the statewide total (UDOGM 2014e,f). Mining's lower employment values in Duchesne County reflects a smaller resource base, local government and services employment associated with the Uintah and Ouray Reservation along with relative gains in other sectors.

In the natural gas portion of the mining industry, modest increases in wellhead natural gas prices, have recently triggered an increase in new development activity and hiring of workers.

Energy resource development in the region, along with the economic stimulus associated with outdoor recreation and other activities created many new jobs and decreased unemployment rates in the socioeconomics study area between 2003 and 2008. As a result, local unemployment rates dropped below 3 percent. The economic recession and financial crisis that began in late 2007, combined with a sharp decline in natural gas prices, resulted in a sharp increase in unemployment in 2009/2010. More

than 3,000 jobs were lost locally and local unemployment increased more than four-fold between December 2008 and June 2009. Unemployment levels would likely have been even higher but for the combined effects of migration and falling labor force participation rates that resulted in shrinkage in the labor force. Unemployment has since decreased. In April of 2014 local unemployment rates were approximately 2.5 percent (**Figure 3.10-2**).



Source: U.S. Bureau of Labor Statistics 2014b.

Figure 3.10-2 Total Full and Part-time Employment in Duchesne and Uintah Counties, 1970 to 2014

Tourism is another important component of the regional economy. According to the Utah Office of Tourism (2008), tourism employment, including both direct travel and tourism employment and the ripple effects of that employment, constitutes some 7 percent of total employment in the Uinta Basin. However, a substantial portion of that employment is attributable to spending by oil and gas industry employees in local cafes, restaurants, motels and campgrounds that also cater to tourists. Recreation resources of the GCWPA are described in Section 3.15, Recreation.

Per capita income in Duchesne and Uintah counties had historically been below the statewide average. Recently, the gaps between the statewide average and that in the two counties has narrowed (**Table 3.10-9**), due in part to higher employment in the oil and gas industry and the effect of high labor demand pushing up wages for other jobs. In Duchesne County, the 2012 per capita income was 118 percent of the statewide average, up from 94 percent in 2005. In Uintah County, the 2012 per capita income was 94 percent of the state average, up from 83 percent in 2005. Real growth from 2005 to 2012, after adjusting for inflation, was a strong 27 percent in Duchesne County and 14 percent in Uintah County, compared to just over 1 percent statewide (U.S. Bureau of Economic Development 2014; U.S. Bureau of Labor Statistics 2016).

Table 3.10-9 Per Capita Personal Income, 2005, 2010, and 2012

	Per Capita Income				Per Capita Income as a Percent of Statewide Income		
	2005	2010	2012	Change 2005-2012	2005	2010	2012
Duchesne County	$27,684	$34,471	$41,832	51%	94	106	118
Uintah County	$24,514	$29,777	$33,170	35%	83	92	94
State of Utah	$29,436	$32,472	$35,430	20%	100	100	100

Source: USBEA 2014.

The mining industry is a key contributor to total and per capita income in Duchesne and Uintah counties. The mining industry recorded high average monthly wages in both counties in 2012, second only to the utilities industry in Uintah County (**Table 3.10-10**). "Arts, Entertainment, and Recreation" and "Accommodations and Food Services" industries are among the lowest-wage industries in these counties, reflecting both lower pay scales and the fact that many of the jobs are part-time.

Table 3.10-10 Private Non-Farm Average Monthly Wages, For Selected Industries, 2012

Industry	Duchesne County	Uintah County
Agriculture, Forestry, Fishing & Hunting	$1,033	$2,093
Mining, including oil and gas	$5,933	$6,314
Utilities	$3,746	$7,607
Construction	$4,400	$4,228
Wholesale Trade	$4,675	$5,390
Retail Trade	$2,017	$2,174
Transportation and Warehousing	$4,254	$4,470
Real Estate and Rental and Leasing	$3,942	$5,068
Professional, Scientific and Technical	$3,872	$3,897
Administrative Support and Waste Management	$2,733	$2,864
Education Services	$2,033	$2,671
Health Care and Social Assistance	$2,714	$2,754
Arts, Entertainment and Recreation	$1,220	$1,332
Accommodation and Food Services	$971	$1,077

Source: Utah Department of Workforce Services 2013.

Non-labor earnings is another dimension of regional personal income. Dividends, interest, rent, and personal transfer receipts, together account for approximately 27 percent of total income in the two counties, both lower than the 31 percent share statewide (**Table 3.10-11**). In Duchesne and Uintah counties, non-labor income is principally associated with income maintenance and public assistance medical care benefits rather than with public retirement benefits or property income.

Table 3.10-11 Composition of Total Personal Income, 2012

	Duchesne County		Uintah County	
	(000s)	% of Total	(000s)	% of Total
Total Earnings by Place of Work	$591,345	73.5	$972,207	84.9
Less: Contributions for Government social insurance	$61,343	7.6	$102,073	8.9
Plus: Net Residency Adjustment	$58,218	7.2	-$29,716	-2.6
Net Earnings by Place of Residence	$588,220	73.1	$840,418	73.4
Plus: Dividends, interest and rent	$112,072	13.9	$165,348	14.4
Plus: Personal Current Transfers	$104,732	13.0	$139,380	12.2
Equals: Total Personal Income	$805,024	100.0	$1,145,146	100.0

Sources: USBEA 2014.

People who reside in one county but commute to work in another county also have an impact on personal income. In-coming commuters take income away from the county where jobs are located, and out-going commuters bring income back to their home county. Detailed income data from 2012 show the net effect of commuting was to add more than $58 million to personal income in Duchesne County, likely indicative of many residents employed in the oil and gas industry firms with offices in Uintah County, as well as in well-paying jobs in locations west of Duchesne. The effect in Uintah County, based on a net-outflow of nearly $30 million paid to non-residents, was to subtract 2.6 percent from local personal income in 2012 (USBEA 2014).

3.10.5 Specific Economic Sectors

Discussions of specific economic sectors are included because they are the subject of expressed public interest as evidenced by comments received during the scoping process. This section addresses three specific topics: grazing, recreation, and the oil and gas industry. Discussion of the first two topics focuses on the economic impact of resources in these sectors that are in or near the GCWPA. The third topic discusses how local oil and gas resources fit into a regional and national context.

3.10.5.1 Grazing

Agriculture is an important segment of the regional economy, with nearly 2,300 farms, operated by more than 1,300 farmers and ranchers and employing more than 1,110 full-time, part-time and seasonal workers in 2012 (USDA 2014). Collectively, local farmers and ranchers had receipts of $67 million from sales of livestock and crops in 2007 (**Table 3.10-12**). In 2012 the comparable total was $85.3 million in receipts from sales of livestock and crops, 71 percent of which was derived from livestock sales (USBEA 2014). Like much of the west, the area has endured extended drought, one impact of which has been pressures on ranchers to trim their herds and flocks due to reduced availability and higher cost of feed.

As in other western states, the local ranching industry relies on grazing on public lands. The GCWPA includes portions of six federal grazing allotments. The federal allotments are primarily fall/winter use (November to April). Total active grazing use in the GCWPA is 3,527 animal unit month (AUMs), the majority of which supports sheep (**Table 3.10-13** and **Table 3.12-1**). Grazing levels in recent years has been affected by poor forage/range conditions associated with long-term drought. The grazing contributes to overall agricultural output in the region, as well as generating grazing fees for the BLM and the Uintah and Ouray Tribe. Current estimates of the economic value of that grazing are not available.

Table 3.10-12 Annual Farm and Ranch Receipts for Sales of Livestock and Crops

	Duchesne County		Uintah County		
	Livestock Sales	Crop Sales	Livestock Sales	Crop Sales	Total Receipts
2007	$26,091,000	$8,416,000	$22,167,000	$10,647,000	$67,321,000
2008	27,090,000	11,342,000	23,450,000	13,728,000	$75,610,000
2009	20,607,000	6,397,000	18,340,000	8,030,000	$53,374,000
2010	25,657,000	7,062,000	22,394,000	8,925,000	$64,038,000
2011	29,466,000	10,966,000	25,641,000	13,293,000	$79,366,000
2012	32,017,000	11,009,000	28,717,000	13,590,000	$85,333,000

Source: USBEA 2014; USDA 2014.

Table 3.10-13 Annual Livestock Production from Federal Grazing Leases in the GCWPA

AUMs[1]	Value in GCWPA
Active AUMs within the GCWPA	3,527
Projected AUMs (Cattle / Horse / Sheep)	80 / 223 / 3,224

[1] An AUM represents the quantity of forage required to sustain 1 cow-calf pair or 5 sheep for 1 month.

Sources: BLM 2008b; USDA 2007.

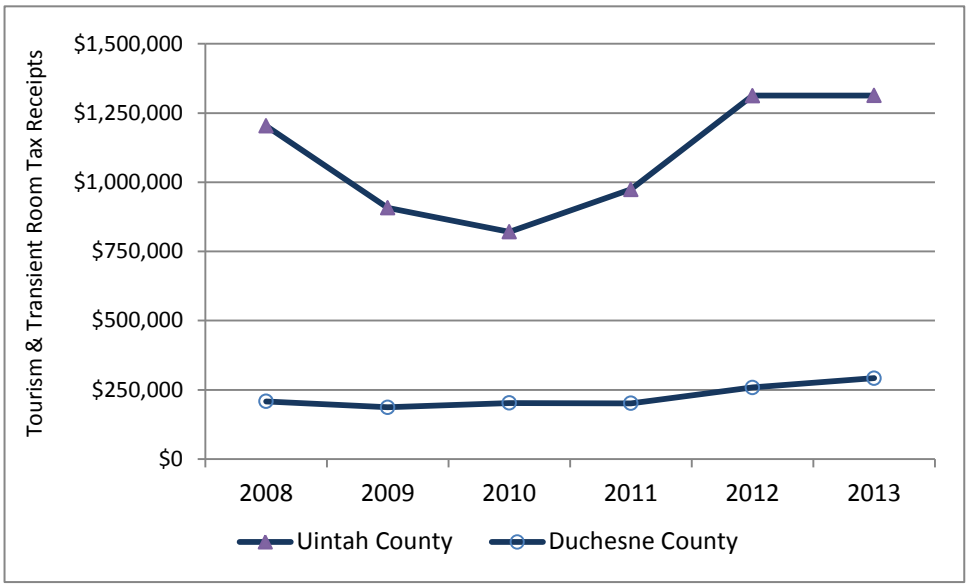
Circumstances affecting the value of production include weather, stocking rates, livestock prices, and forage availability. In addition, grazing on a particular allotment may be pivotal to permittee revenue production if restrictions in use occur and the permittee "depends" on the forage from that allotment and cannot find substitute forage at the same cost, in a feasible location, or in the proper seasonal sequence and consequently has to scale back the size of herd (Godfrey and Bagley 1994).

3.10.5.2 Outdoor Recreation

Beneficial economic impacts from visitor expenditures occur in the local economy where people stop and stay while visiting an attraction, pursing one of the myriad of recreation opportunities, spending the evening in local lodging accommodations, or purchasing equipment and supplies to support leisure activities. The benefits include revenues for local businesses, jobs supported in those businesses, and sales and transient room taxes for local governments.

Local outdoor recreation opportunities and attractions include the Pariette Wetlands, Fantasy Canyon, scenic byways, camping, hiking and rafting on portions of the White River south of the study area. Nearby recreation opportunities and attractions include Dinosaur National Monument, the Utah Field House of Natural History, several scenic byways and state parks, Flaming Gorge National Recreation Area and vast expanses of BLM and National Forest lands for outdoor recreation. The Utah Office of Tourism Office prepares estimates of annual non-resident traveler and tourism spending, by county. In 2012, the estimated spending and number of jobs supported by that spending were $29.6 million in spending and 515 jobs in Duchesne County, and $86.2 million and 1,497 jobs in Uintah County (Utah Office of Tourism 2013). County tourism and transient room taxes associated with that spending exceeded $290,000 in Duchesne County and $1.3 million in Uintah County. The estimates for Uintah and Duchesne counties include spending by non-resident oil and gas workers living in the area on a temporary basis. An indication of the substantial contributions of such spending in the local economies is demonstrated by pattern of tourism and transient tax receipts in Duchesne and Uintah counties over the 6-year period 2008 – 2013 (**Figure 3.10-3**). Between 2008 and 2010, a period characterized by a major contraction in the region's oil and gas industry, the combined collections declined by more than

28 percent, from $1.41 to $1.02 million. The corresponding total tax receipts in 2013 exceeded $1.6 million, in part due to a resurgence in oil and gas development activity.



Source: Utah Office of Tourism 2014.

Figure 3.10-3 Annual Tourism and Transient Room Tax Receipts in Duchesne and Uintah Counties, 2008 to 2013

Hunting and fishing, much of which is related to public lands, is another source of economic stimulus for the local economy, particularly for local motels, restaurants, sporting goods dealers and outfitters. According to the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 20 percent of all Utahans 16 years and older hunted and/or fished in 2011, and 35 percent participated in some form of wildlife watching. Average annual participation among Utah sportsmen was estimated at 16.0 days for fishing, 16.4 days for hunting, and 11.9 days for wildlife watching away from home and the estimated average annual expenditures associated with this activity were $1,132 for fishing, $2,297 for hunting, and $681 for wildlife watching (USFWS 2014c).

Many resources associated with public lands are not marketed but nonetheless provide satisfaction and have economic value even if no money changes hands. Economists use non-market valuation studies to estimate a monetary value equivalent that people associate with public lands and the benefits they provide in terms of their on-site use value and their off-site, or "passive," use value. Around the country, on-site use values have been calculated for public goods like recreation and water quality. Passive use values have been calculated for rare species and environments such as wilderness.

Valuation studies of recreation use are common nationally and many studies of this type are available for the intermountain area—including Utah (Rosenberger and Loomis 2001). **Table 3.10-14** presents average on-site use values for selected recreation activities that resemble public use near the GCWPA. These values represent the economic value received by users that is over and above what they received for their direct expenditures.

Table 3.10-14 Non-market Use Value of Recreation on Public Lands in the Intermountain Area[1]

Recreational Activity	Value Per Person Per Activity Day (2006 dollars)[2]
Biking	$69
Camping	$28
Float Boating	$47
General Recreation[3]	$16
Hiking	$35
Picnicking	$28
Sightseeing	$14
Wildlife Viewing	$38

[1] Intermountain Area is USDA Forest Service regions 1 through 4.

[2] Original data is in 1996 dollars. Adjusted to 2006 dollars using Gross Domestic Product Inflation Index.

[3] General recreation is a composite of recreation opportunities at a site with a measure for the site, not a specific activity.

Source: Rosenberger and Loomis 2001.

3.10.5.3 Regional and National Natural Gas Industry Trends

Along with areas in southwestern Wyoming and western Colorado, the Uinta Basin has garnered attention for the development of its resources and potential role in the national energy strategy. Major pipeline corridors connect Utah and other Rocky Mountain states to the West and Midwest regions, making it a net exporter of natural gas. In the West, the major natural gas markets are California, Arizona and Nevada (Energy Information Administration 2009). Interest in Utah's energy resources also is reflected in the leasing activity and interest in Utah since the later 1990s.

Data published by the Utah Department of Workforce Services (2014a) indicates a total of 366 oil and gas development and related businesses in the GCWPA (**Table 3.10-15**), an increase of 10 percent over the 4-year period 2010 through 2014. The largest net change was in the number of establishments providing support activities for oil and gas operations (North American Industry Classification System Industry 213112) (U.S. Census Bureau 2009). Uintah County hosts 234 of these establishments (64 percent of the total).

Table 3.10-15 Oil and Gas Development Related Businesses in the GCWPA, 2013

Business Sector (North American Industry Classification System Industry Code)	Duchesne County	Uintah County	Two County Total
Extraction of Crude Petroleum and Natural Gas (211111)	16	23	39
Extraction of Natural Gas Liquid (211112)	0	1	1
Drilling of Oil and Gas Wells (213111)	4	20	24
Support Activities for Oil and Gas Operations (213112)	101	162	263
Construction – Oil and Gas Pipelines and Related Facilities (237120)	6	9	15
Wholesale – Industrial Equipment (423830)[1]	5	15	20
Transportation – Gas Pipelines (486210)	0	4	4
Total	132	234	366

[1] The sector includes sales of pipeline equipment.

Source: Utah Department of Workforce Services 2014a.

3.10.6 Community Facilities and Services

Housing markets and public facilities and services are described in terms of their ability to accommodate future growth. These attributes influence the commuting and relocation choices of workers attracted by jobs created by the Proposed Action and alternatives.

3.10.6.1 Housing

Housing inventoried for the 2010 U.S. Census was predominantly detached single-family; 69 percent of housing in Duchesne County, and 70 percent of housing in Uintah County (**Table 3.10-16**). Mobile and manufactured housing is common and increasing in frequency of use by consumers. Housing units in multi-family structures are the least common housing types in both counties.

Table 3.10-16 County Housing Stock by Type, 2010

Housing Type	Duchesne County	Uintah County
Single Family	68.9%	70.4%
Duplex	1.0%	2.5%
All Other Multi-Family	7.0%	13.4%
Mobile and Manufactured	22.9%	13.5%

Source: U.S. Census Bureau 2012c.

The conventional housing stock in the region has generally kept pace with resident population growth in Duchesne County with the number of housing units increasing by 35.8 percent between 2000 and 2010 compared to population growth 29.5 percent during the same period. Expansion of the housing supply also has kept pace with population growth in Uintah County, as the housing supply grew 32.4 percent compared to population growth of 29.2 percent (**Table 3.10-2** and **Table 3.10-17**).

Table 3.10-17 Total Housing Units by County

Year	Duchesne County	Uintah County
2000	6,985	9,041
2010	9,493	11,972
2011	9,539	12,026
2012	9,591	12,248
2013	9,627	12,839
2000-13 Absolute Change	2,642	3,798
2000-13 Percent Change	38%	42%

Source: U.S. Census Bureau 2012d, 2013b, 2014.

Fifty-seven percent of all building permits for new residential construction issued in the two counties from 2000 to 2013 were for single family dwellings and 21 percent were for duplexes or multifamily housing (**Table 3.10-18**). The latter represents a considerably higher share than existed in the housing stock in 2000; an indication of the housing demands associated with the many younger households and temporary and unaccompanied workers in the oil and gas industry. Most of the new multifamily construction was located in Uintah County and mobile and manufactured units were 34 percent of new units in Duchesne County (University of Utah 2014). Several single-family residential subdivisions and multi-family projects were under development during the summer of 2014.

Table 3.10-18 Cumulative Building Permits for New Residential Development, 2000 to 2013

	Duchesne County	Uintah County	Combined Total
Number of Units	2,132	4,092	6,224
Average per Year	152	292	444
Distribution of Permits by Type (Percent)			
Single family	62%	54%	57%
Manufactured/Mobile homes	34%	15%	22%
Duplexes, Condominiums, Apartments & other	4%	32%	21%

Source: University of Utah 2014.

Historically, housing resources in Duchesne and Uintah counties were concentrated in Roosevelt and Vernal. More recent construction has been concentrated in unincorporated parts of the counties; more than 97 percent of the permits issued in Duchesne County in 2013 were for homes to be built in unincorporated areas. A similar pattern was evident in Uintah County.

Housing availability in Uintah and Duchesne counties is sensitive to changes in the pace of oil and gas development, tightening with increases in the pace of development and corresponding decreases in unemployment, which triggers in-migration of workers, but then easing during downturns in the pace of oil and gas development activity. A search of a nationwide listing service from the Utah Association of Realtors in 2014 found 42 residential properties listed for sale in the Roosevelt area and more than 215 units in the Vernal area. Single family homes in the Vernal area range in price from under $100,000 to over $1,000,000, with many new units listed at over $300,000 (Realtor.com 2014).

The demand for housing also is reflected in home sales activity, with the number of sales climbing from 427 in 2004 to 634 in 2006. Home sales continued strong into 2008 before abating during the recessionary years of 2009 and 2010. Sales prices increased markedly between 2011 and 2013, such that housing affordability is as much a concern as availability (**Table 3.10-19**).

Table 3.10-19 Homes Sales and Average Prices in the Uinta Basin

Year	Number of Sales	Average Sales Price of Homes Sold	Local Average Sales Price as Percent of State Average[1]
2004	427	$115,144	61.0
2005	544	$137,798	69.6
2006	634	$172,132	74.5
2007	555	$209,496	85.2
2008	625	$187,762	78.2
2009	366	$174,850	87.7
2010	493	$151,825	79.9
2011	652	$145,000	82.9
2012	668	$171,950	95.4
2013	642	$184,100	89.8

[1] Comparison to state average based on state average not including Park City.

Source: Utah Association of Realtors 2009, 2014.

Natural gas development in Uintah and Duchesne counties is supported by a resident workforce plus workers who live in the area on a temporary basis while maintaining their permanent residence elsewhere. Many of the latter reside in motels, field camps, and recreational vehicles (RVs) parked at commercial campgrounds. The inventory of temporary accommodations in the study area includes more than 900 motel rooms and 500 commercial RV spaces (some seasonal) in and near Vernal, Naples, Jensen, Ballard, Roosevelt, and Duchesne (Travelocity.com 2016; Utah Office of Tourism 2014). The inventory includes several recently completed local franchises of nationally branded motel chains, and several additional motels were under construction during the summer of 2014.

Local motels and campgrounds also support the tourism and recreation. Growing industry use sometimes limits availability and support higher nightly rates. Availability can particularly be an issue during the summer tourism and fall hunting seasons.

3.10.6.2 Public Safety

The major law enforcement agencies in the study area include the Utah Highway Patrol, the two county sheriff departments and municipal police departments in Vernal and Roosevelt. Section 5 of the Utah Highway Patrol, headquartered in Vernal, covers Daggett, Duchesne, and Uintah counties. The U.S. Bureau of Indian Affairs provides law enforcement on tribal lands within the Uintah and Ouray Reservation.

The Uintah County Public Safety Complex was completed in Vernal in 2010. The 190,000-square-foot facility consolidates all administrative, dispatch, detention and probation functions in a single location. The facility includes 192 cells, kitchen and medical facilities, new courtrooms, as well as office space for the County Attorneys, Justice Court, FBI and the Utah Highway Patrol (Babcock Design).

The Duchesne County Justice Center was completed in 1997. It houses the Sheriff's Office, District and Justice Courts, the County Attorney's Office, and a 160-bed jail. The old jail was renovated to house state inmates engaged in various work release programs or employed in the Utah Correctional Industries enterprise. Housing state inmates is an enterprise activity for Duchesne County, generating substantial revenues to help fund local government (Duchesne County 2014).

There are 7 fire departments in Duchesne County—4 municipal and 3 rural departments; all are volunteer departments staffed by a total of approximately 95 fire fighters. The county funds the city departments for coverage outside their boundaries and one full-time employee to coordinate fire service and emergency management (Duchesne County 2016).

Uintah County has five volunteer fire departments serving areas outside of the BLM, USFS, and Uintah and Ouray Reservation boundaries. The five departments, which have a combined roster of approximately 80 volunteer fire fighters, include Vernal/Uintah County, Naples, Jensen, Lapoint-Tridell, and Avalon (Uintah County Fire District 2016).

3.10.6.3 Health Care

There are two hospitals in the study area:

- Ashley Valley Medical Center in Vernal is accredited by the Joint Commission on Hospital Accreditation. The hospital is an acute care facility with 39 certified beds; however, beds are available for long-term care. The hospital has completed an extensive facility expansion and renovation process in recent years, including its emergency room facilities which now include 9 treatment rooms (Hospital-Data.com 2016). The medical center also serves as a local base for emergency helicopter air ambulance and patient transport service.
- Uinta Basin Healthcare operates the Uinta Basin Medical Center in Roosevelt (Duchesne County) is a non-accredited general hospital facility with 42 certified beds. The hospital is a

short-term facility but all beds are available for long-term care (Hospital-Data.com 2014). A major expansion and renovation of the facility's emergency room was undertaken in 2014. Uinta Basin Healthcare also operates clinics in Duchesne City, Altamont, Manila, and Tabiona in Duchesne County and one in Vernal (Uinta Basin Healthcare 2016).

Clinics of the TriCounty Health Department provide screening and preventive services from locations in the Vernal, Roosevelt and Duchesne. The TriCounty Health Department operates a new multi-service administrative, care delivery and treatment facility in Vernal (TriCounty Health 2014).

3.10.6.4 Water and Wastewater

The Ashley Valley Water Reclamation Facility (Uintah County) treats wastewater for an area that includes Ashley Valley, the City of Vernal and unincorporated community of Maeser. The facility opened in 2001. Recent and ongoing water and sewer system improvements are anticipated to serve long-term growth needs by the Ashley Valley Water and Sewer District and the City of Vernal, which jointly manage the wastewater plant with the Maeser Water and Improvement District (Natural Resources Impact Working Group 2006).

3.10.6.5 Schools

A single, countywide school district provides public education in each county. The two districts had a combined enrollment of 12,612 students in the fall of 2013. That total represents net enrollment gains of 32.3 percent and 3,080 students between 2005 and 2013 (**Table 3.10-20**). Enrollment gains occurred in both districts, particularly in the period from 2010 through 2013, with a net gain of more than 2,000 students in the Uintah County School District. Not reflected in the historical data are more recent declines in enrollment between 2014 and 2015 that followed in the wake of the reductions in drilling activity (Utah State Office of Education 2015).

The Duchesne County School District operates 12 schools and the Uintah County School District operates 10 schools. Both districts have been engaged in ongoing improvement, facility construction and maintenance programs, and staffing needs to accommodate growth and the changes in geographic and age distributions of students.

High school students and adults in the area have access to concurrent enrollment, advanced degrees and career and technical training at the Roosevelt and Vernal campuses of the Uinta Basin Applied Technology College, and the Utah State University. The Bingham Entrepreneurship and Energy Research Center, a modern research, teaching and center for entrepreneurship and innovation, jointly sponsored by the University, Uintah County, the oil and gas industry, and funded by a $15 million private gift from Marc and Debbie Bingham, was dedicated in Vernal in 2010 (Utah State University 2010).

3.10.7 Public Sector Fiscal Conditions

Government and quasi-governmental entities in the socioeconomic study area provide a wide array of services to residents, local businesses and visitors to the area. Changes in the levels of economic activity, including energy resource and mineral development, can result in changes in the demands for services, and also in changes in the revenues available to governments and service providers to fund service delivery. The remainder of this section summarizes recent budget information for the two counties, local municipalities, and two school districts in the study area. The state and federal treasury benefit from revenues generated by energy resource development. The major sources of such revenue also are discussed below.

Table 3.10-20 Duchesne and Uintah County School District Enrollment

	Duchesne County School District	Uintah County School District
Fall Enrollment		
2005	3,993	5,539
2006	3,982	5,772
2007	4,224	5,952
2008	4,355	6,408
2009	4,436	6,489
2010	4,448	6,683
2011	4,574	6,993
2012	4,829	7,291
2013	5,021	7,591
Change 2005-13	1,028	2,052
Number of Schools		
Elementary and Middle	8	9
Senior High	4	1
Total	12	10

Source: Utah State Office of Education 2013.

3.10.7.1 Local Government

Total budgeted expenditures and shares by major use of funds for Duchesne and Uintah counties for 2013 are shown in **Table 3.10-21**. In Duchesne County, total budgeted expenditures were $24.63 million, of which $21.67 million constitute general fund expenditures. The remaining outlays are associated with one-time grants, capital project outlays and operations of the landfill.

Total expenditures in Uintah County were $74.75 million in the same year. As in Duchesne County, the remaining expenditures are associated with one-time grant and capital outlays, including construction of the public safety complex, as well as the County's participation in the Tri-County Health District, Emergency 911 system, and other services funded through special revenue funds. General government and public safety accounted for the bulk of general fund expenditures in both counties.

Total revenues and the main revenue sources for the counties are presented in **Table 3.10-22**. For counties, the reported revenue includes just the governmental-type funds within the primary government, plus special service districts. Duchesne County's budgeted total current revenue was $45.70 million in fiscal year 2013. Uintah County had total budgeted revenues of $59.34 million for the same years. The key revenue sources for the counties include property and local sales taxes, road fund allotments from the state, federal payments in lieu of taxes, state grants, charges for services and miscellaneous fees, and interest earnings.

Table 3.10-21 Total County Expenditures, Budget Year 2013, by Use, in Millions

Expenditure	Duchesne County		Uintah County	
	2013 Dollars	% of Total	2013 Dollars	% of Total
General Government	$4.82	19.6	$15.29	20.5
Public Safety	$6.10	24.8	$5.84	7.8
Public Health	$0.22	0.9	$6.29	8.4
Highways and Public Improvements	$2.95	12.0	$6.34	8.5
Parks, Recreation and Public Property	$0.73	3.0	$5.95	8.0
Community and Economic Development	$0.34	1.4	$0.19	0.3
Other Current Outlays[1]	$9.47	38.4	$34.85	46.6
Total	$24.63	100[2]	$74.75	100[1]

[1] Includes Capital Outlays, Debt Service, Enterprise Funds, and Miscellaneous Expenditures. These outlays vary dramatically from year-to-year and may include funds carried over from prior years.

[2] Sum does not equal 100.0% due to rounding.

Sources: Utah State Auditor 2014a.

Table 3.10-22 Budgeted Revenue for County Government, 2013

Revenue Source	Duchesne County		Uintah County	
	2013 Dollars	% of Total	2013 Dollars	% of Total
Property Tax	$3,527,722	8	$10,789,466	18
Sales and Use Tax	$2,896,881	6	$6,822,504	12
Other Taxes, Licenses, Fees and Permits	$5,468,963	12	$6,130,509	10
State Road Fund Allotment	$2,111,035	5	$2,119,298	4
Other Government Grants, Aid and Payments	$7,964,261	17	$12,422,762	21
Charges, Interest and Miscellaneous	$23,726,859	52	$21,051,308	35
Total	**$45,695,721**	**100**	**$59,335,847**	**100**

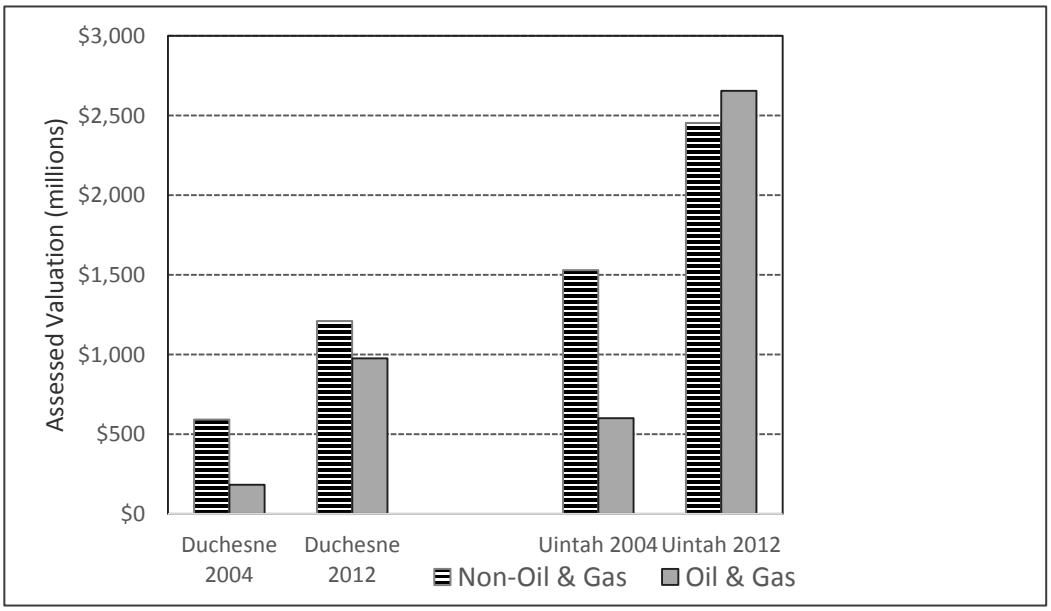
Sources: Utah State Auditor 2014a.

In 2012, the ad valorem tax base for property taxes levied by the counties and school districts exceeded $2.2 billion in Duchesne County and $5.1 billion in Uintah County (**Table 3.10-23**). Natural resources and related facilities are important components of the ad valorem/property tax base of the county governments in Duchesne and Uintah counties. Valuation on oil and gas had increased over time due to rising production and higher commodity values. In 2012, oil and gas production are 45 percent of total taxable value in Duchesne County and 52 percent in Uintah County (**Figure 3.10-4**). Some reductions may occur in the future unless there is an offsetting increase in production.

Table 3.10-23 Ad Valorem Tax Base of Local Governments, in Millions

	2009	2010	2011	2012	Change 2009-12
Duchesne County					
Total Assessed Valuation	$1,667.4	$1,673.2	$1,896.4	$2,186.9	$519.5
Oil and Gas Valuation	$548.0	$521.1	$724.7	$976.8	$428.8
Oil and Gas Share of Total	33%	31%	38%	45%	83%
Uintah County					
Total Assessed Valuation	$4,642.2	$4,547.5	$4,555.7	$5,106.6	$464.4
Oil and Gas Valuation	$2,091.4	$2,117.5	$2,278.7	$2,653.6	$562.2
Oil and Gas Share of Total	45%	47%	50%	52%	121%

Source: Utah State Tax Commission 2013a.



Source: Utah State Tax Commission 2013a.

Figure 3.10-4 Changes in Assessed Valuation from Oil and Gas and Other Sources, 2004 and 2012

The annual budgets of the local municipalities range from under $300,000 annually in Tabiona and Altamount to more than $17 million in Vernal (**Table 3.10-24**). The differences reflect the levels and type of services provided, size of community (demand for services), and the fiscal capacity of the communities. Sales taxes generally are the most significant recurring revenue source for municipalities because little taxable mineral development or production is located within municipal boundaries. Hence, Roosevelt and Vernal, the two largest trade centers in the area, capture the highest sales tax revenues. The City of Naples also realizes substantial sales tax revenue due to the location of several large oil and gas service firms in the community in recent years.

Table 3.10-24 Total Municipal Expenditures and Revenues, 2013

	Vernal	Roosevelt	Duchesne City	Naples	Ballard	Tabiona	Altamount
2013 Expenditures							
General Government	$3,146,250	$918,565	$154,747	$764,110	$223,350	$24,900	$96,600
Public Safety	$3,021,250	$1,962,079	$242,667	$914,443	$215,000	$1,400	$58,800
Transportation and Public Improvements	$3,133,450	$1,480,655	$263,751	$794,244	$60,000	$15,200	$4,000
Parks and Recreation	$336,750	$1,759,500	$376,835	$4,140	$2,000	$66,560	$24,500
Other Current Outlays[1]	$7,946,470	$4,128,166	$1,090,698	$876,214	$2,316,667	$55,445	$82,245
Total Current Expenditures	$17,584,170	$10,248,965	$2,128,698	$3,353,151	$2,817,017	$163,505	$266,145
2013 Revenue Sources							
Taxes	$8,019,950	$4,529,922	$604,500	$3,783,176	$536,000	$29,700	$155,500
Grants and Contributions	$746,050	$564,563	$364,000	$161,498	$592,000	$70,405	$13,500
Other Current Revenue[2]	$13,121,000	$7,723,679	$1,349,198	$1,027,171	$1,689,017	$65,115	$84,075
Total Current Revenues	$21,887,000	$12,818,164	$2,317,698	$4,971,845	$2,817,017	$165,220	$266,145

[1] Includes capital outlays, debt service, transfers out to service districts or other funds, and miscellaneous expenditures. These outlays can vary dramatically from year-to-year.

[2] Includes fines and forfeits, licenses and permits, investment earnings and other miscellaneous revenues. These revenues can vary from year-to-year.

Sources: Utah State Auditor 2014a.

Grants and contributions also play a significant role in local government finances, although the size, purpose, and source of grants vary significantly from year-to-year.

Expenditures for public safety and general government typically account for the majority of the recurrent general fund outlays. Outlays for transportation improvements also tend to be substantial, but vary more from year-to-year depending on the receipt of grants or unexpected availability of additional funds.

The recent economic expansion helped boost local government budgets. The increase in oil and gas exploration and development and new residential and commercial construction resulted in growing sales and use tax receipts, as well as development related licenses, fees and permit revenue. Expanded revenue in turn resulted in pressures to raise current operating and capital spending by local governments in the region.

3.10.7.2 Local School Districts

Public education is a major category of public expenditures. For school year 2012-2013, the Duchesne County School district had total expenditures of $39.86 million and the Uintah County School District had total expenditures of $58.69 million (**Table 3.10-25**). Outlays for student instruction amounted to more than $24.1 million in Duchesne County and $33.5 million in Uintah County. Both districts have made significant expenditures on facility improvements, expansions and new school construction in the recent years to accommodate growing enrollment. Uintah County School District had expenditures of nearly $25.4 million for such improvements in 2008, fully 36 percent of its total budget; however, for the 2012-2013 school year, these expenditures had decreased by a sizeable amount.

Table 3.10-25 Total Public School District Expenditures, 2012-2013, in Millions

2013 Expenditures	Duchesne County School District		Uintah County School District	
	Dollars	% of Total	Dollars	% of Total
Instruction	$24.14	60.6	$33.58	57.2
Support Services	$13.00	32.6	$18.89	32.2
School Lunch and Non-Instructional	$2.10	5.3	$3.11	5.3
Capital Facilities	$0.0	0.0	$1.79	3.0
Debt Service	$0.66	1.7	$1.32	2.3
Total Expenditures	$39.86[1]	100.0[1]	$58.69	100.0

[1] Sums do not equal sums of the entries due to rounding.

Sources: Utah State Auditor 2013.

Property taxes, levied on the ad valorem tax base within a district's boundaries, are the only taxes levied by school districts. Though educational support transfers from the State are by far the largest source of revenue for school districts, school districts do benefit from a larger tax base, as do local general purpose governments. Property taxes in Duchesne County exceeded $18.0 million in 2013 while such taxes yielded $34.7 million in Uintah County (**Table 3.10-26**). Taxes levied on oil and gas production accounts for a large share of those totals (**Table 3.10-23**).

Table 3.10-26 Total Revenues for Public School Districts, in Millions

2013 Revenue Sources	Duchesne County School District		Uintah County School District	
	Dollars	% of Total	Dollars	% of Total
Property Tax	$18.58	41.3	$34.77	51.6
Earnings on Investments	$0.12	0.3	$0.29	0.4
Miscellaneous	$1.34	3.0	$0.0	0.0
Federal and State Sources	$11.54	25.6	$12.99	19.3
Program Revenue	$13.43	29.8	$19.37	28.7
Total Revenue	$45.01	100.0	$67.39[1]	100.0

[1] Total includes a $34,819 loss on sale of assets.

Sources: Utah State Auditor 2013.

Schools in Utah have some protection from changing demands and revenues that is not available to other local governments. The education foundation program, the Utah Minimum School Program, supports districts that do not raise at least a minimum amount per "weighted pupil unit," currently about $2,899, from local sources. Weighted pupil units are a statistical measure of the average daily membership attending schools in grades 1 through 12 plus a fractional value of the number of students attending kindergarten. In addition, the State supports capital funding in districts with weak tax bases.

3.10.7.3 Public Revenues Related to Energy Development

The state and federal governments derive significant revenues from oil and gas development in the Uinta Basin. The major revenue sources associated with such development include severance taxes, mineral royalties and lease fees, and sales and use taxes.

Revenue from the Utah Severance Tax goes to the state's general fund. The tax on natural gas is assessed on the value of production, minus allowed deductions, at the rate of 3 percent on the first $1.50 per MCF of gas and 5 percent on the amount over that. Oil is taxed under a similar structure, with the 3 percent rate applied to the first $13 per barrel, and a 5 percent rate applied to all value in excess of $13 per barrel. In fiscal year 2013, the oil and gas severance tax netted $53.2 million to the state (Utah State Tax Commission 2013b).

The State of Utah collects a 0.2 percent oil and gas conservation fee on the value, at the wellhead, of oil, natural gas, and natural gas liquids produced. Proceeds from the fee, which totaled $5.9 million in fiscal year 2013, are used to pay for administration of the Board and Divisions of Oil, Gas and Mining, to fund the plugging and reclamation of abandoned oil and gas wells for which there is inadequate surety, and public educational programs designed to increase knowledge of mineral and petroleum resources and industries. In the event that surplus funds exceed $750,000 at the end of the fiscal year, funds in excess of the cap are transferred to the state's general fund (Utah State Tax Commission 2013b).

Public education in Utah realizes significant fiscal benefits from energy development due to royalties received from production on state lands managed by the SITLA. In fiscal year 2012, such royalties generated more than half of the agency's total $129.3 million in revenue.

Oil and gas development also generates a substantial sum of sales and use taxes, both directly from the purchases of taxable materials, equipment and supplies associated with the development process, and indirectly through the consumer purchases by its employees and those within the community whose jobs and incomes are supported by the spending by oil and gas industry employees. A portion of the sales and use taxes accrue to the state government; however, local governments also benefit from the taxes on purchases within their jurisdictions. Estimates of the sales and use tax specifically attributable to oil and gas development in Duchesne and Uintah counties in recent years are not readily available, but the available data suggest the sum is clearly in the millions of dollars.

State government directly benefits from lease royalties and taxes that are specific to minerals production, while local governments benefit indirectly. The federal minerals royalty revenue sharing program, through which approximately one-half of the federal mineral royalties from local production is returned to the state (a portion of which is in turn redistributed locally), is a source of current revenue and capital funding for local government. In Utah, the revenue sharing and capital funds provisions generally correlate with growth in areas hosting oil and gas development on public lands. Utah's federal mineral lease revenue, including rents and bonus bids on current lease sales, was $138.3 million in Fiscal Year 2013 (USDOI 2013). Thirty-seven percent is appropriated to the UDOT for redistribution to counties and, subsequently, to local special service districts. The state allocates 32.5 percent of the mineral royalties to the Permanent Community Impact Fund, which is used to provide loans and/or grants to state agencies and subdivisions of the state that are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands.

In Duchesne and Uintah counties, the county governments handle ongoing road maintenance and repair, and special service districts undertake capital construction projects. The latter are primarily financed by allocations of federal mineral lease revenues and funds appropriated through UDOT for local, state and federal aid transportation projects, and the Class B and C Road Funds (B and C refer to categories of local public roads) program. As shown in **Table 3.10-27**, distributions of mineral lease revenues to Duchesne and Uintah counties through UDOT have increased dramatically since 2003. Historically, these funds have been used for transportation and recreation projects but also have been used to fund other facilities and services authorized by statute. Duchesne County uses most of its funding for road work. Uintah County uses mineral lease grants and loans for special service districts whose missions include transportation, recreation, health, mental health and substance abuse, animal control, economic development and wildfire suppression.

Table 3.10-27 Mineral Lease Distributions to Duchesne and Uintah Counties from UDOT Appropriation, in Millions

Fiscal Year[1]	Duchesne County[2]	Uintah County[2]
2003	$0.68	$6.89
2004	$0.93	$11.77
2005	$1.90	$16.70
2006	$2.75	$27.50
2007	$3.15	$27.18
2008	$5.32	$25.60
2009	$6.70	$38.54
2010	$5.50	$26.86
2011	$6.55	$29.77
2012	$8.71	$31.27
2013	$7.53	$26.00
2014	$9.95	$33.92

[1] Data are for fiscal years ending June 30.

[2] Distributions by county are allocated in proportion to the amount of mineral lease money generated by each county. Within counties distributions are determined by the county legislative body. Revenues are derived from lease bonuses and production royalties of activities located in each county.

Source: UDOT 2014a.

Although Duchesne County is a high oil producing county, its federal mineral lease revenue allocation from the UDOT appropriation has historically been relatively low because much of the oil produced in the county was from private or tribal mineral rights. The share of production from federal minerals in Duchesne County has been increasing in recent years, contributing to an increase of more than $2.0 million in annual proceeds between 2010 and 2013, even as mineral lease distributions declined in Uintah County.

In addition to distributions of federal mineral lease revenues, local governments receive distributions of UDOT Class B and C Road funds, the revenues for which are derived from state highway users taxes and fees. These funds are to be used to improve and maintain county roads and city streets. In fiscal year 2013, local governments in the study area received a total of $6.13 million in such distributions (**Table 3.10-28**). The two counties received the largest distributions.

The Utah Permanent Community Impact Fund Board is a division of the Housing and Community Development Division of the Department of Workforce Services. The core mission of the Permanent Community Impact Fund Board is to aid in the mitigation of socioeconomic impacts associated with natural resource development on federal lands and mineral estate. The Permanent Community Impact Fund Board oversees four funds and programs to achieve its mission: the Permanent Community Impact Fund, the Uinta Basin Revitalization Fund, the Navajo Revitalization Fund, and support for the Regional Planning Program. The Regional Planning Program is a statewide planning effort wherein local counties belong to one of five multi-county associations of government. Duchesne and Uintah counties are part of the Uinta Basin Association of Governments. These efforts are funded via a combination of allocations of severance taxes, federal mineral lease bonus payments, and federal mineral lease payments. Fiscal year 2013 allocations from the Permanent Community Impact Fund to Duchesne and Uintah totaled $20.9 million and $38.8 million, respectively (**Table 3.10-29**). Under the Permanent Community Impact Fund's charter these funds are targeted to the planning, construction and maintenance of public facilities

and services in areas that may be socially or economically impacted by minerals development on federal lands.

Table 3.10-28 Utah Department of Transportation Class B and C Road Distributions, Fiscal Year 2013

Duchesne County		Uintah County	
Duchesne County	$2,119,789	Uintah County	$3,119,101
Altamont	$13,517	Ballard	$82,648
Duchesne	$89,091	Naples	$97,616
Myton	$41,797	Vernal	$320,574
Roosevelt	$236,953	**TOTAL**	**$3,619,939**
Tabiona	$9,607		
TOTAL	**$2,510,754**		

Source: UDOT 2014b.

Table 3.10-29 Utah Permanent Community Impact Fund Grant and Loan Funding, Fiscal Years 2010 to 2013

Fiscal Year	Duchesne County Allocation (Millions)	Uintah County Allocation (Millions)
2010	$13,221,734	$17,163,004
2011	$9,289,297	$13,622,478
2012	$18,340,820	$27,249,009
2013	$20,945,000	$38,793,710
2014	$42,221,225	$25,495,707

Source: Utah Department of Workforce Services 2013, 2014b.

The Ute Tribe receives royalties on oil and gas production from Tribal mineral interests.

Beyond the royalties and taxes derived from natural resource production and lease revenues, Duchesne and Uintah counties receive payments-in-lieu of taxes (PILT) from the federal government for public lands within the county. The federal PILT to counties offset, at least partially, foregone property tax revenues due to the tax-exempt status of the public lands, and aid local governments in covering the costs of services (e.g., law enforcement or emergency medical services) provided to the public on public lands. PILT payments are a function of the amount of eligible federal acres in a county, subject to certain population-related caps and the level of Congressional appropriations. PILT payments and are generally stable from year-to-year and insensitive to the level of energy or mineral related production or activity occurring on public lands. Following many years of partial funding, Congress reauthorized counties to receive their full PILT entitlements beginning in 2008. As a result, the PILT payments to Duchesne and Uintah counties increased sharply, to $1.35 million and $2.16 million, respectively (USDOI 2014). Payments have continued to rise, reaching $1.86 million in 2013 in Duchesne County and $2.88 million in Uintah County, as detailed in **Table 3.10-30**.

Table 3.10-30 Federal Payments In Lieu of Taxes

Year	Duchesne County	Uintah County
2007-2008	$1,345,138	$2,155,320
2008-2009	$1,383,884	$2,251,098
2009-2010	$1,595,192	$2,532,891
2010-2011	$1,678,548	$2,478,034
2011-2012	$1,778,530	$2,640,013
2012-2013	$1,737,658	$2,683,939
2013-2014	$1,861,656	$2,875,465

Source: USDOI 2014.

3.10.8 Long-term Population and Employment Projections

The Utah Governor's Office of Management and Budget prepares long-term population and employment projections for all counties in Utah under baseline conditions (i.e., continuation of general statewide and regional economic trends). Current long-term demographic projections for the period 2010 to 2050, shown in **Table 3.10-31**, anticipate population growth of over 8,400 residents in Duchesne County and more than 13,700 residents in Uintah County. Statewide growth is projected to remain strong, topping 3.0 million by 2020 and over 5.0 million by 2050. Population projections for the cities are not published by the State of Utah's long-term projections program.

Table 3.10-31 Population Projections to 2050

Projection Year	Duchesne County	Uintah County	Uinta Basin MCD[1]	State of Utah (Millions)
2010	18,643	32,588	52,292	2.774
2020	22,797	38,982	63,223	3.309
2030	24,836	41,099	67,312	3.914
2040	25,721	42,690	69,818	4.570
2050	27,123	46,291	74,933	5.257
2010-50 CAGR	0.9%	0.9%	0.9%	1.6%

[1] MCD = Multi-county district. Uinta Basin MCD = Daggett, Duchesne, and Uintah counties.

Source: Utah Governor's Office of Management and Budget 2012.

The projected population growth rates in Duchesne and Uintah counties are comparable, as are the projected employment growth rates (**Table 3.10-31** and **Table 3.10-32**).

Table 3.10-32 Employment Projections to 2050

Projection Year	Duchesne County	Uintah County	Uinta Basin MCD*	State of Utah (Millions)
2010	10,962	18,625	30,294	1.63
2020	12,527	21,039	34,431	1.99
2030	13,264	22,307	36,609	2.31
2040	13,819	23,329	38,387	2.62
2050	14,488	24,541	40,495	2.96
2010-50 CAGR	0.7%	0.7%	0.7%	1.5%

* MCD = Multi-county district.

Source: Utah Governor's Office of Management and Budget 2012.

3.10.9 Community Social Conditions

The first sub-section discusses the relationship of the nearby counties and communities to the GCWPA. The second sub-section discusses the affected groups.

3.10.9.1 Counties and Communities

In each community near the GCWPA, schools, churches, local government, and local institutions are touchstones of a social structure based on relationships among neighbors, acquaintances and members of community groups and institutions. Vernal and Roosevelt remain, as they have been historically, central places within large rural areas. These and the other communities in Duchesne and Uintah counties are separated from major Utah cities or nearby Grand Junction, Colorado, by 2 or more hours of highway travel. Private lands are adjoined by large tracts of public land that hold valuable and strategic natural resources. The public lands comprise 60 to 70 percent of the surface area in each county and are pivotal to the region's sense of place and plans for the future.

Community identity for most of the population in Uintah and Duchesne counties is tied to use of the land and natural resources, and to an economic dependency on public lands. The public in both counties is keenly aware of this and sensitive to the fact that public land management affects their economic well-being (BLM 2008b).

According to the Uintah County General Plan (Uintah County 2005), residents value the county's rural character, quiet lifestyle, natural landscapes, and open spaces. The plan states that maintaining these values is a priority of county residents. The plan states a belief that Uintah County depends on the use and development of natural resources for its economic well-being and defines county government's role as strongly supporting "the rights of Uintah County residents and businesses to responsibly use and develop natural resources" (Uintah County 2005). With respect to public lands management, the general plan states that county policy is to support "multiple-use," responsible resource use and development, and improved public and private access to and across public lands.

In Duchesne County, the County General Plan (Duchesne County 2013) identifies oil and gas and agriculture as significant to the county's economic well-being. The public's planning priorities, according to the document, are maintaining a rural character and lifestyle; local participation in public land management issues; natural resource development; economic development; private land use issues; and human services, particularly education.

According to the Duchesne County General Plan, oil and gas has become more important to the local economy since the 1980s, so it is "in the economic interest of the county citizens and government" to

promote access to public land to develop this resource (Duchesne County 2013). The general plan also states that recreation and tourism are part of the county's economy and should be encouraged for their stabilizing effect. The plan adds that public lands development should consider impacts to recreational activities and be sensitive to values like rural lifestyle, quality of life, and scenic environment. However, county officials also may assert that the economic benefits of resource development outweigh those of tourism (Hyde 2006).

In 2012, the Utah Legislature approved establishment of the Uintah Basin Energy Zone, which encompassed lands in Daggett, Duchesne, and Uintah counties. In establishing the Uintah Basin Energy Zone the state recognized the abundant energy and mineral resources in the area and established responsible management and development of existing energy and mineral resources to provide long-term domestic energy and supplies as the highest priority for lands within the zone. The statute also calls for cooperation and coordination between federal agencies who administer lands within the zone, the state and local governments, "…to development, amend, and implement land use and resource management plans and implement decisions that are consistent with the purposes, goals, and policies described in this section [63J-8-105.5] to the maximum extent allowed under federal law" (Utah Legislature 2014). The Duchesne County General Plan was amended to include the establishment of the Uintah Basin Energy Zone and to echo the management goals and objectives outlined in the state code (Duchesne County 2013).

Members of the Ute Tribe reside within and near the GCWPA. Over half of the Tribal membership chooses to live on the Uintah and Ouray Reservation (Ute Indian Tribe 2013), which occupies a large percentage of the land area in Uintah and Duchesne counties. Sovereignty over the land and resources of the reservation reinforces the Tribe's separate social and cultural identity. The Ute Tribe receives royalties on oil and gas production from Tribal mineral rights.

A survey conducted in 2004 (Duchesne County 2013), indicated that Tribal members see social benefits from residency on the reservation. The three aspects of life on the reservation that surveyed Tribal members liked the most were: 1) closeness to family, the sense of community, neighbors, and cultural/community/ecumenical activities; 2) natural resources, clean air and clean water, wildlife, scenery and mountains, lots of space; and 3) no taxes, tax exempt, lower cost of living. The issues for the Tribe that members ranked as most important were: 1) Tribal management, committee relations, and housing maintenance; 2) health services; and 3) resource development.

"Tribal/non-Tribal relations" were identified as an issue of moderate importance to members of the Ute Tribe in the 1994 survey (Duchesne County 2013). Counties also acknowledge the importance of cooperation and mutual sensitivity in relations with the Tribe. The Uintah County General Plan states that "cooperation between the Tribe and the County is necessary to ... address many Uinta Basin social and economic concerns and issues" (Uintah County 2005). The Duchesne County General Plan states that "resource use or development on private, public, or Tribal Lands should be sensitive to Tribal interests and the County's rural lifestyle, quality of life, and scenic environment" (Duchesne County 2013).

3.10.9.2 Affected Groups

Discussions of affected groups are included to structure the assessment of social impacts. Information from the BLM Vernal RMP (BLM 2008b) suggests that the attitudes and values regarding: 1) motorized access to public lands; 2) conservation of wildlife; 3) protection of areas with special designation; and 4) economic development, are likely to be salient in the public's perceptions of and reactions to a proposed action that involves natural gas development on public lands. Groups that share some or all of these values may be assumed to have similar attitudes and opinions toward development.

It should be noted that these following discussions may generalize the actual values of individual group members. In addition, the presentation format is not meant to imply that these groups are mutually exclusive, that members of each group do not share interests with other groups, or that individuals or

organizations might not affiliate themselves with multiple groups. Furthermore, people's attitudes and interests may change over time for a variety of reasons.

Individuals and Groups Who Give High Priority to Motorized Access to Public Lands

This group includes motorized recreationists (such as trail motorcycle, four-wheel-drive, and OHV enthusiasts); people with a business or professional need for motorized access; and businesses that supply vehicles and related goods and services. The group prefers to retain all motorized access and supports measures to promote safety, not access closure, wherever multiple-use might lead to traffic hazards. More recreation-oriented members of the group also want to protect visual quality and wildlife as part of their motorized trail use experience.

Individuals and Groups Who Give High Priority to Conservation of Wildlife

Members of this group and their supporters focus on the potential for impacts to wildlife and wildlife habitat, as well as other natural resource values associated with natural wildlife habitat. The comments emphasize the concern that these values should be studied for potential conflict with gas development and that mitigation be considered for the potential damage caused to the environment.

Individuals and Groups Who Give High Priority to Protection of Areas with Special Designation

These individuals and groups indicate that the status of lands in or near the GCWPA that have special BLM land use designation areas is important because they value their naturalness; their uniqueness or increasing rarity; their benefits for recreation; their place in the environment; or their value as a source of knowledge.

Groups with an interest in special designation areas indicated that their members may support these ideas because they want to protect personal, professional, lifestyle, or political values. In addition, many comments focused on an interest in preserving these areas for the benefit of future generations.

Individuals and Groups Who Give High Priority to Economic Use of Resources

Comments commonly offered during public scoping on energy development proposals in the region express concern that resources on public land be made available for use to contribute to economic development and strategic benefits at the local, regional and national level. Individuals and groups stating this concern did so because they live, work, or represent interests in communities that have benefited socioeconomically from development of natural resources on public lands. Some groups offered these concerns because they represent industry, or they represent businesses that sell to industry.

These groups indicate that gas development provides high paying jobs, stimulates the local economy, supports public facilities and services, and has historically been part of the local social and economic structure. Many comments show support for what they see as the need to encourage development to promote local social and economic stability.

Some comments stated the belief that development can occur without destroying other resources and values, especially if there is mitigation. Concerns of this kind came from local government concerned over impacts to roads and public safety service providers.

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3.11 Environmental Justice

Environmental justice is the principle defined by EO 12898 and implemented by agency directives (BLM 2005) that low-income, minority, and Tribal groups should not have to experience a disproportionate share of negative effects resulting from a plan or project. The principle is violated when a government action results in a disproportionate high and adverse environmental and or human health effects on low-income, minority, or Tribal populations.

Table 3.11-1 shows the proportions of low-income, minority, and Tribal populations in selected communities in Duchesne and Uintah counties that comprise the study area for this resource. The table includes the main communities in each county near the GCWPA plus three communities on the Uintah and Ouray Reservation. Data for the State of Utah are shown for comparison. The reservation communities are Fort Duchesne, Randlett, and Whiterocks. These communities are Census Designated Places (CDP) and they are the only boundary-defined places within the jurisdiction of the Uintah and Ouray Reservation that were enumerated by the U.S. Census Bureau in 2010. Fort Duchesne is the headquarters location of the Ute Tribe. Among the reservation communities, Randlett is the nearest to the GCWPA. Randlett is located approximately 25 miles to the northwest and is not situated along a major access road into the GCWPA.

Table 3.11-1 Poverty and Minority Population Characteristics of Selected Communities in Duchesne and Uintah Counties, 2008-2012

Population[1]	Total Population	Percent of Total Population in Poverty	Minority Race or Hispanic as Percent of Total Population[2]	Percent American Indian
Duchesne County	18,537	10.2	12.9	4.9
Duchesne City	2,256	14.6	3.5	0.0
Roosevelt	6,028	15.8	18.4	6.5
Uintah County	32,809	10.6	18.4	6.2
Vernal	9,218	14.4	23.3	4.0
Uintah and Ouray Reservation	23,496	11.1	18.0	10.7
Fort Duchesne CDP	633	40.0	100.0	91.0
Randlett CDP	231	48.9	73.6	73.6
Whiterocks CDP	206	10.2	88.8	88.8
State of Utah	2,766,233	12.1	21.4	1.1

[1] Unincorporated communities with boundaries defined for purposes of enumeration during the decennial census.

[2] The minority race or Hispanic population is the total minority population comprising all persons of a minority racial identity plus persons of Hispanic-origin identity not already included because of race.

Source: U.S. Census Bureau 2013c.

The BLM standard for identifying a low-income population is the poverty level used by the U.S. Census Bureau. The standard for identifying minority populations is either: 1) the minority population of the affected area exceeds 50 percent, or 2) the minority population percentage of the affected area is "meaningfully greater" than the minority population percentage in the general population or other appropriate unit of geographic analysis. For environmental justice compliance, the relevant minority population is the total minority population comprising all persons of a minority racial identity plus persons of Hispanic-origin identity (BLM 2005).

There are no resident populations with a poverty rate over 50 percent in the study area. Fort Duchesne and Randlett both recorded the study areas highest poverty rates at 40.0 percent and 48.9 percent, respectively. Elsewhere in Duchesne and Uintah counties, the poverty rate varies from 10.2 percent to 15.8 percent, compared to 12.1 percent in the state overall. Fort Duchesne, Randlett, and Whiterocks are minority communities. The population of these places is more than 70 percent minority and American Indian or other closely related racial identity. This is consistent with information provided by a 1994 survey of members of the Ute Tribe that indicated that 64 percent of members living in Utah reside in Whiterocks, 16 percent in Fort Duchesne, and 8 percent in Randlett, with the remainder in Lapoint, Ouray, and Indian Bench, the latter being communities not enumerated by the U.S. Census Bureau (Duchesne County 2013). Elsewhere in Duchesne and Uintah counties, the minority population percentage is not meaningfully higher than the state average (**Table 3.11-1**).

3.12 Livestock Grazing and Rangeland Health Standards

3.12.1 Rangeland Health Standards and Guidelines

In 1997, the Utah BLM developed standards for the desired conditions of the physical and biological characteristics of rangelands. These standards (Standards and Guidelines for Grazing Management) are included as **Appendix S** (BLM 1997). The standards and guidelines specify the conditions to be achieved on BLM lands and the management practices to be applied to achieve these conditions. According to these Standards, properly functioning public lands should exhibit the following four fundamental traits:

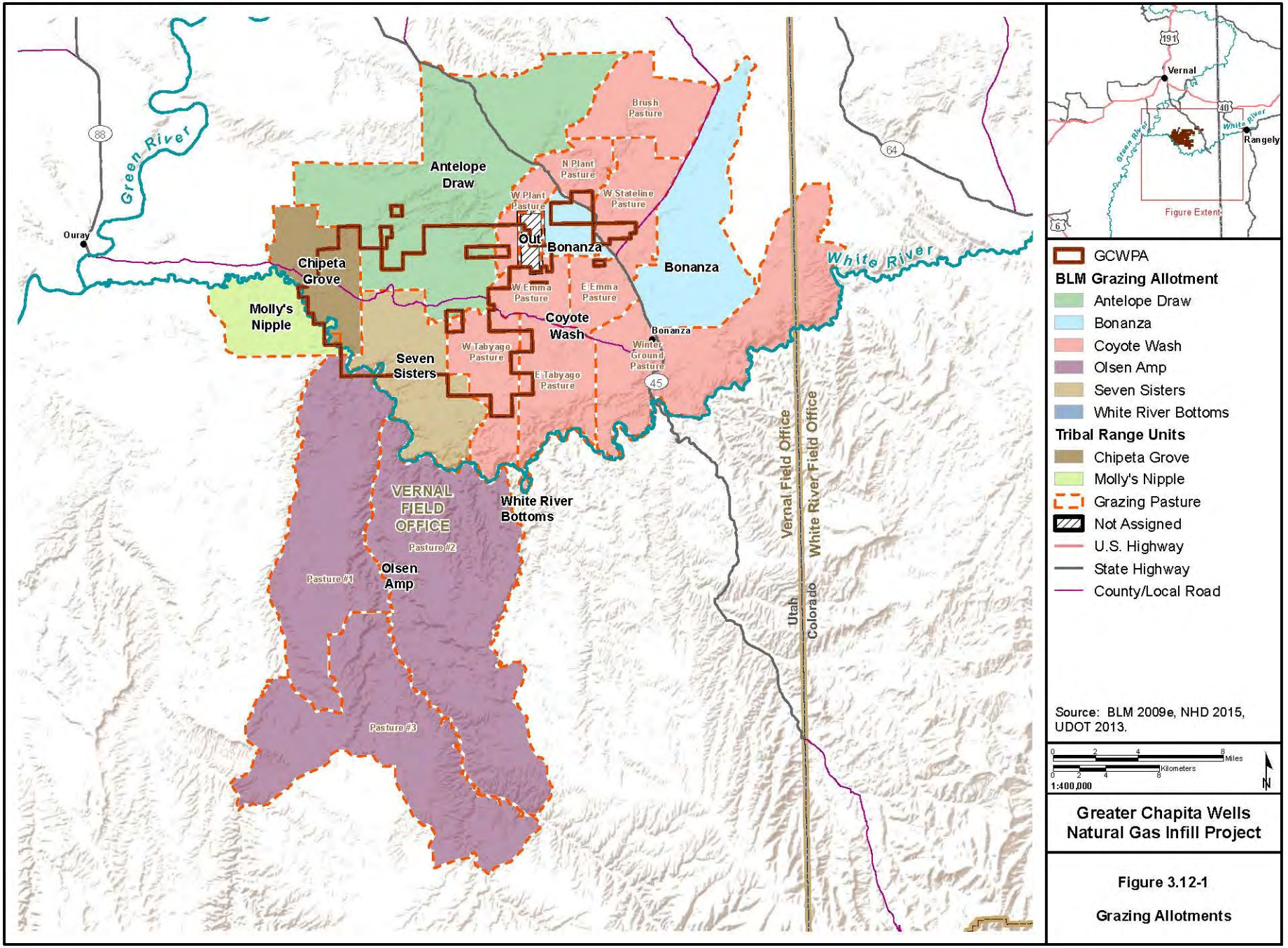
1. Watersheds are in, or making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; and soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate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

In conformance with the fundamental rangeland health traits, the VFO re-evaluated the management strategies for each of the grazing allotments under its supervision and has assigned to each allotment one of three management categories. The categories are based upon various parameters including current and future ecological conditions and succession, potential land use conflicts, land ownership status impacts on BLM management opportunities, and the potential for positive return on investment of public funds. The management categories are:

1. Maintain existing resource conditions;
2. Improve existing resource conditions; and
3. Custodial management.

3.12.2 Livestock Grazing

As illustrated in **Figure 3.12-1**, the GCWPA overlaps portions of six BLM and two BIA grazing allotments that comprise the study area for the livestock grazing assessment. The six allotments include public, state, and private lands. However, the portions within the GCWPA are limited to federal and state surface lands. Approximately 1,000 acres of private surface lands within the GCWPA have not been included. Except for a small portion of the White River Bottoms allotment, all of the BLM grazing allotments within the GCWPA are designated for sheep (BLM 2014c). The Coyote Wash allotment was formed in September 2008 by combining four smaller allotments (Horned Toad, Little Emma, Stateline, and West Tabyago), which comprise pastures in the new allotment. The BIA/Tribal allotments are designated for cattle and horses (Pingree 2014).



Greater Chapita Wells Natural Gas Infill Project

Figure 3.12-1

Grazing Allotments

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6/3/2016

Two sections of state lands are separately leased for grazing by SITLA (SITLA GIS data). BLM Range improvements within the GCWPA include approximately 17 small stock ponds. There is a livestock corral in the Seven Sisters Allotment, Section 30, T9S, R23E. There is a Friendship Fence between the Seven Sisters Allotment and Tribal land, located in T9S, R22E, and there are 12 guards along the Friendship Fence plus two additional in a fence extension to the south in Section 27, T9S, R22E. An exclosure has been constructed in Section 3, T10S, R22E (BLM GIS data) (**Figure 3.12-1**). Approximately 36 acres of open water/stockponds are present in the GCWPA (as described in Section 3.4.1.1).

The carrying capacity of rangeland is generally characterized by the AUM, the amount of forage required by one animal unit for one month. An AUM is commonly defined as that required by a mature (1,000-pound) cow, or the equivalent, based on an average daily consumption rate of 26 pounds of dried forage matter. Forage requirements for other species are extrapolated based on consumption rates. For range carrying capacity computations, five sheep are generally considered to be the equivalent of one cow. Computations of range carrying capacity using AUMs must be used with caution and the understanding that nutritional requirements may vary greatly seasonally (Ruyle and Ogden 1993).

All of the GCWPA BLM allotments have a fall/winter use period except for the White River Bottoms (cattle) allotment (summer/fall). Three of the allotments also have a spring use period. The BIA/Tribal allotments have winter and year-round use. The size, carrying capacities, use seasons, and current management direction for the GCWPA grazing allotments are summarized in **Table 3.12-1**. Rangeland carrying capacity of the GCWPA BLM allotments ranges from approximately 3.4 to 13.9 acres per AUM with an average of 11.1 acres per AUM, assuming uniform proration of the capacity of the entirety of each allotment to that portion within the GCWPA. BIA allotments are designated for year-round and winter-spring use.

Rangeland forage productivity in the vicinity has been mapped by the NRCS (Leishman et al. 2003) and is summarized in **Table 3.12-2**. Productivity can vary considerably, depending on moisture conditions. Approximately 85 percent of the non-tribal portion of the GCWPA has a dry forage productivity of 400 pounds per acre per year or less in normal moisture years. Along the major drainages, including the White River, approximately 5 percent of the area's forage productivity ranges from approximately 801 to 1,200 pounds per acre per year. Approximately 10 percent of the northeastern portion of the GCWPA has productivity of 401 to 800 pounds per acre per year.

The VFO has evaluated the problems and conflicts associated with BLM grazing allotments meeting the rangeland health standards. For the allotments overlapping the GCWPA, all but the Olsen Allotment Management Plan (AMP) were noted as having problems with invasive species. In addition, seasonal use conflicts occur with all the allotments except White River Bottoms. Vegetative diversity and water sufficiency are issues for the Bonanza and Coyote Wash allotments. Conflicts with recreational use have been identified for the Antelope Draw and White River Bottoms allotments (BLM 2008d). The Bonanza, Olsen AMP and Seven Sisters were reassessed in 2009 and 2010. Each was found to be experiencing departures from proper biotic and hydrologic function resulting from soil loss, erosion resistance, and invasive species, in particular cheatgrass. High levels of oil and gas development have affected the Seven Sisters allotment (BLM 2014d).

Table 3.12-1 Summary of GCWPA Grazing Allotments

Allotment Name and Number		Stock	Total Acres	Federal Allotment Acres	GCWPA Acres	Federal Active AUMs	GCWPA Prorated Active AUMs	Acres per Active AUM [1]	Mgmt. Category	Use Periods
BLM										
Antelope Draw	15854	Sheep	55,898	51,296	11,659	3,679	836	13.9	Improve	10/1-5-10
Bonanza	15842	Sheep	28,238	24,546	1,450	1,939	115	12.7	Improve	3/1-5/05, 12/5-2/28
Coyote Wash	02945	Sheep	108,706	82,760	11,176	7,762	1,048	10.7	Maintain	11/1-5/20
Olsen AMP	08816	Sheep	134,946	102,929	453	9,268	41	11.1	Maintain	3/1-6/15, 11/1-2/28
Seven Sisters	15845	Sheep	18,787	16,104	9,932	1,920	1,184	8.4	Maintain	3/1-4/15, 11/1-2/28
White River Bottoms	15850	Cattle	2,278	1,625	219	480	65	3.4	Improve	6/1-10/15
BIA/Tribal Range Units										
Chipeta Grove		Horses	11,330	11,330	6,802	372	223	30.5	NA	11/1-4/30
Molly's Nipple		Cattle	10,742	10,742	380	432	15	24.9	NA	11/1-3/31
Unassigned Acreage			1,000	NA	1,000	NA	NA	NA		
Total			**371,925**	**301,332**	**43,071**	**25,852**	**3,527**	**11.1**		

[1] More thorough and current data are available for BLM allotments and have been used to estimate average GCWPA-wide acres/AUM.

Sources: BLM 2012c, 2014a; Pingree 2014.

Table 3.12-2 Range Productivity

Dry Forage Productivity (pounds/acre/year)	Acres	%
1,201 - 1,600	34	0
801 - 1,200	1,816	5
401 - 800	3,495	10
0 - 400	30,448	85
Total Non-tribal	35,793	
Non-allotment	7,278	
Total	**43,071**	**100**

Source: Leishman et al. 2003.

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3.13 Access and Transportation

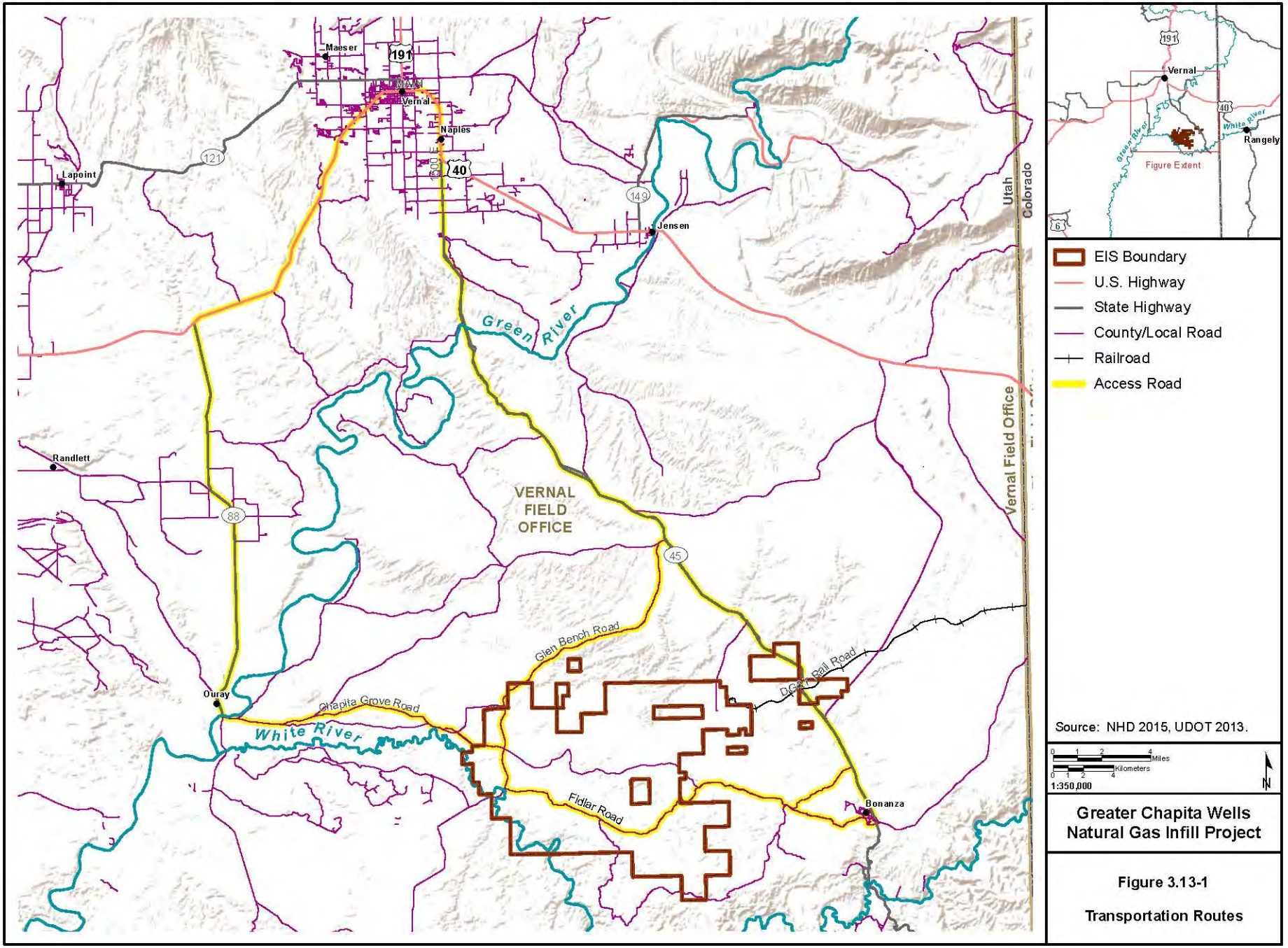
The GCWPA study area for the assessment of access and transportation that includes the GCWPA and primary access roads is located approximately 24 miles south of Vernal, Utah (**Figure 3.13-1**), and occupies principally federal, state, and Tribal lands supporting dispersed industrial development consisting principally of oil and gas related facilities and a coal-fired electrical generating plant, and livestock grazing permitted by the above surface management entities for their respective affected lands. Main paved access routes consist of Utah State Routes (SR) 88 and 45 (**Figure 3.13-1**). Both SR 88 and SR 45 are oriented from north to south and connect to the mostly east to west oriented U.S. Highway 40, which passes through Vernal, Utah. SR 88 provides access to the GCWPA from the west and the Ouray, Utah, area. SR 45 crosses a portion of the GCWPA in Sections 17, 20, and 28, T8S, R24E and provides access from the east and Bonanza, Utah, area. A majority of the traffic traveling to the GCWPA and its vicinity from the Vernal, Utah, area access the area via SR 45 as this route is the shortest when compared to accessing the area via SR 88 and U.S. Highway 40 from Vernal, Utah (Bedell 2009a).

Several rural (paved, graveled, and native surface) roads consisting of Class 1-B paved and graveled Uintah County roads, BLM roads, Class D Uintah County roads (non-maintained county roads) are present within the GCWPA (**Figure 3.13-2**). Additional graveled and native surface roads constructed in support of ongoing oil and gas development in the vicinity of the GCWPA, and not yet recorded by BLM or county mapping, and additional 4-wheel drive trails are likely to be present within the GCWPA. Most of the unpaved roads within the GCWPA are claimed by Uintah County as Class 1-B and D roads and are deemed by the county to be public roads. The remaining roads are mostly short (less than 0.5 mile), dead-end roads constructed by oil and gas development firms to access well pads and other facilities. The oil and gas industry maintains most of these roads and other Class D roads as conditions necessitate for access to facilities. The Class 1-B (gravel and native surface) and D roads plus other BLM-maintained roads also provide access to recreational OHV travel. OHV activity within the GCWPA is described in more detail in Section 3.15, Recreation.

The Class 1-B paved Glen Bench Road (CR 3260) provides access to the western part of GCWPA from the northeast and SR 45 (**Figure 3.13-2**). The Glen Bench Road extends west and south of the GCWPA and ultimately connects to the Seep Ridge Road, which extends south of SR 88's terminus just south of Ouray, Utah. A second paved road, Chapita Grove Road (3310), ties into the Glen Bench Road on Tribal lands in Section 5, T9S, R22E and its route extends west to connect at the terminus of SR 88.

The Glen Bench road intercepts a second major access road for the GCWPA (Fidlar Road) in Section 17, T9S, R22E. Fidlar Road (CR 3410) is a maintained gravel road that extends east from the western edge of the GCWPA to the east, through and beyond the GCWPA to an intercept with SR 45 in Bonanza, Utah (**Figure 3.13-2**). This road leaves the GCWPA as it crosses the northern section line of Section 22, T9S, R23E. Looping off and back onto Fidlar Road is a third key access route, the graveled Seven Sisters Road (CR 3420). This route leaves Fidlar Road in Section 24, T9S, R22E, heads south, then east, and then north to the connection with Fidlar Road in Section 20, T9S, R23E. This looping road crosses Section 3, T10S, R23E and the GCWPA after leaving the GCWPA at southern boundary of Section 30, T9S, R23E. After exiting Section 3, T10S, R23E and the GCWPA, the Seven Sisters Road heads east and north to its intercept with Fidlar Road in Section 20, T9S, R24E. Between the above Class 1-B roads and SR 45, the Class D roads provide additional access within the GCWPA (**Figure 3.13-2**).

Currently there are approximately 261.0 miles of roads within the GCWPA (**Table 3.13-1**).

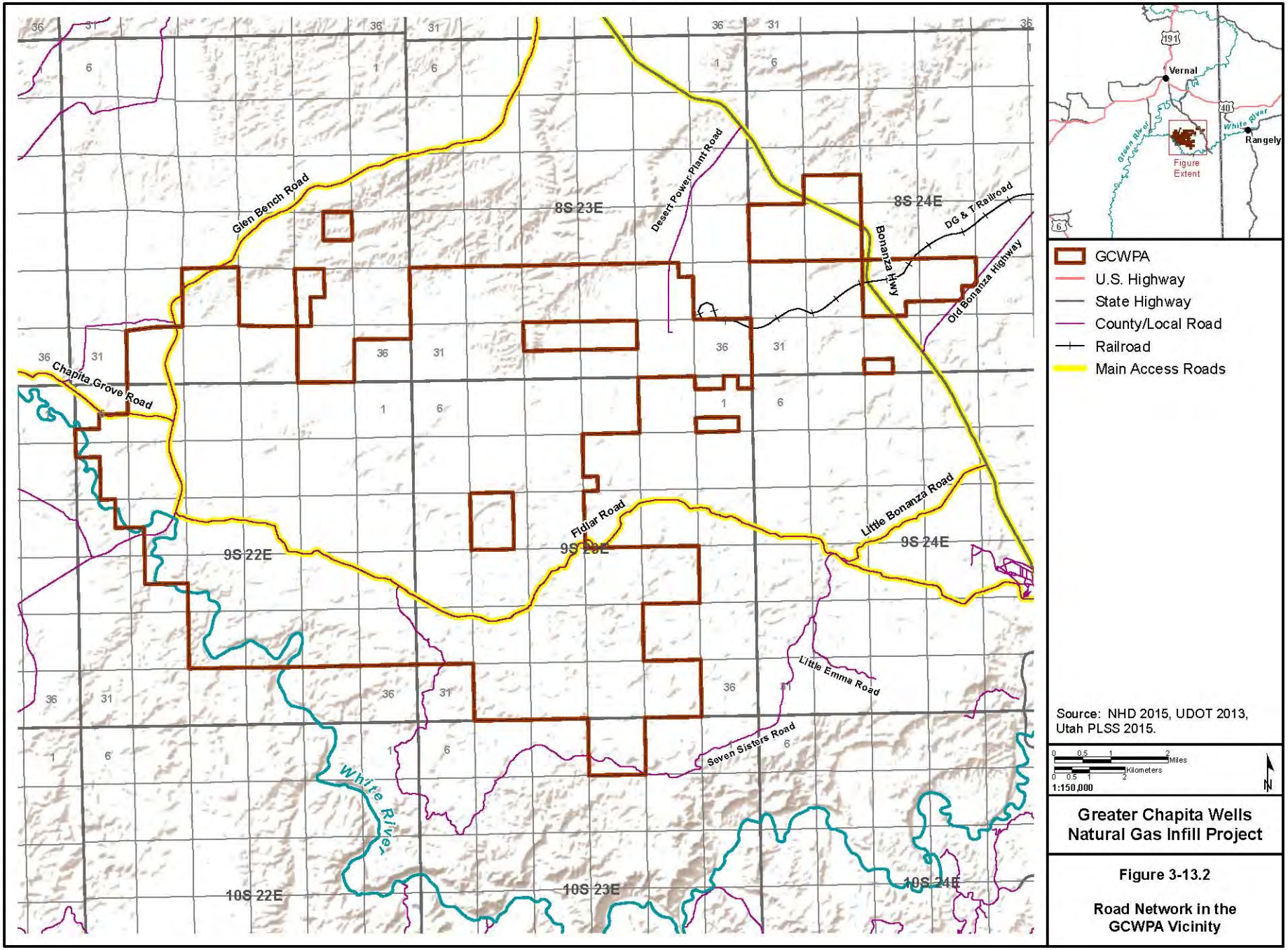


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Figure 3.13-1

Transportation Routes

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Figure 3-13.2

Road Network in the GCWPA Vicinity

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Table 3.13-1 Road Types within the GCWPA

Road Type	Miles
SR Paved	1.6
Class 1-B Paved	8.6
Class 1-B Graveled	10.6
Non-maintained Class D	71.7
BLM Maintained	0.9
Well Pad and Additional Roads	167.6
Total	**261.0**

Source: BLM 2013b; EOG 2008; Uintah County Roads 2012.

Of the total 261 miles of road within the GCWPA, 0.9 mile of road is maintained by the BLM. Uintah County or the oil and gas industry maintain the remainder of those roads that are maintained within the GCWPA. A railroad line that accesses the Deseret Generation and Transmission Cooperative's Power Plant in southeast corner of Section 26, T8S, R23E crosses portions of Section 36, T8S, R23E and Section 28, T8S, R24E.

Average Annual Daily Traffic (AADT) counts for use of key roads accessing and crossing portions of the GCWPA are presented in **Table 3.13-2**. Heavy duty truck traffic represents approximately 80 percent of the reported annual average daily traffic vehicle counts (Bedell 2009b; Ellis 2014). Current traffic counts in the vicinity of and within the GCWPA appear to be much reduced due to the drop in oil and gas activity since mid-2008 (Bedell 2009b; Ellis 2014).

Table 3.13-2 AADT Counts for Roads within and Accessing the GCWPA at Uintah County Count Locations Recorded in 2014

Road/Count Recording Location	AADT [1]
Glen Bench Road (3260) / south of Wonsits Road intersection	818
Glen Bench Road (3620) / north of Chapita Grove Road intersection	645
Glen Bench Road (3620) / north of Fidlar Road intersection	897
Chapita Grove Road (3310) / west of Glen Bench Road intersection	650
Chapita Grove Road (3310) / east of State Highway 88 intersection	672
Fidlar Road (3410) / east of Glen Bench Road intersection	556
Fidlar Road (3410) / west of Little Bonanza Road (3430) intersection	152
Seven Sisters Road (3420) / south of West Fidlar Road intersection	117
Seven Sisters Road (3420) / south of East Fidlar Road intersection	43

[1] AADT estimated from traffic counts recorded hourly over a 24-hour/7-day period between June and October 2014. Counts are the sum of traffic in both directions at a counting location.

Source: Uintah County Roads Department - Slaugh 2014a-e; Uintah County Roads Department 2012.

3.14 Visual Resources

Scenic quality is the measure of the visual appeal of a unit of land. Section 102 (a) of the FLPMA (1976), states that "...the public lands are to be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values." Section 103(c) identifies "scenic values" as one of the resources for which public land should be managed. Section 201(a) states that "the Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values (including scenic values)..." Section 505(a) requires that "each ROW shall contain terms and conditions which will...minimize damage to the scenic and esthetic values..."

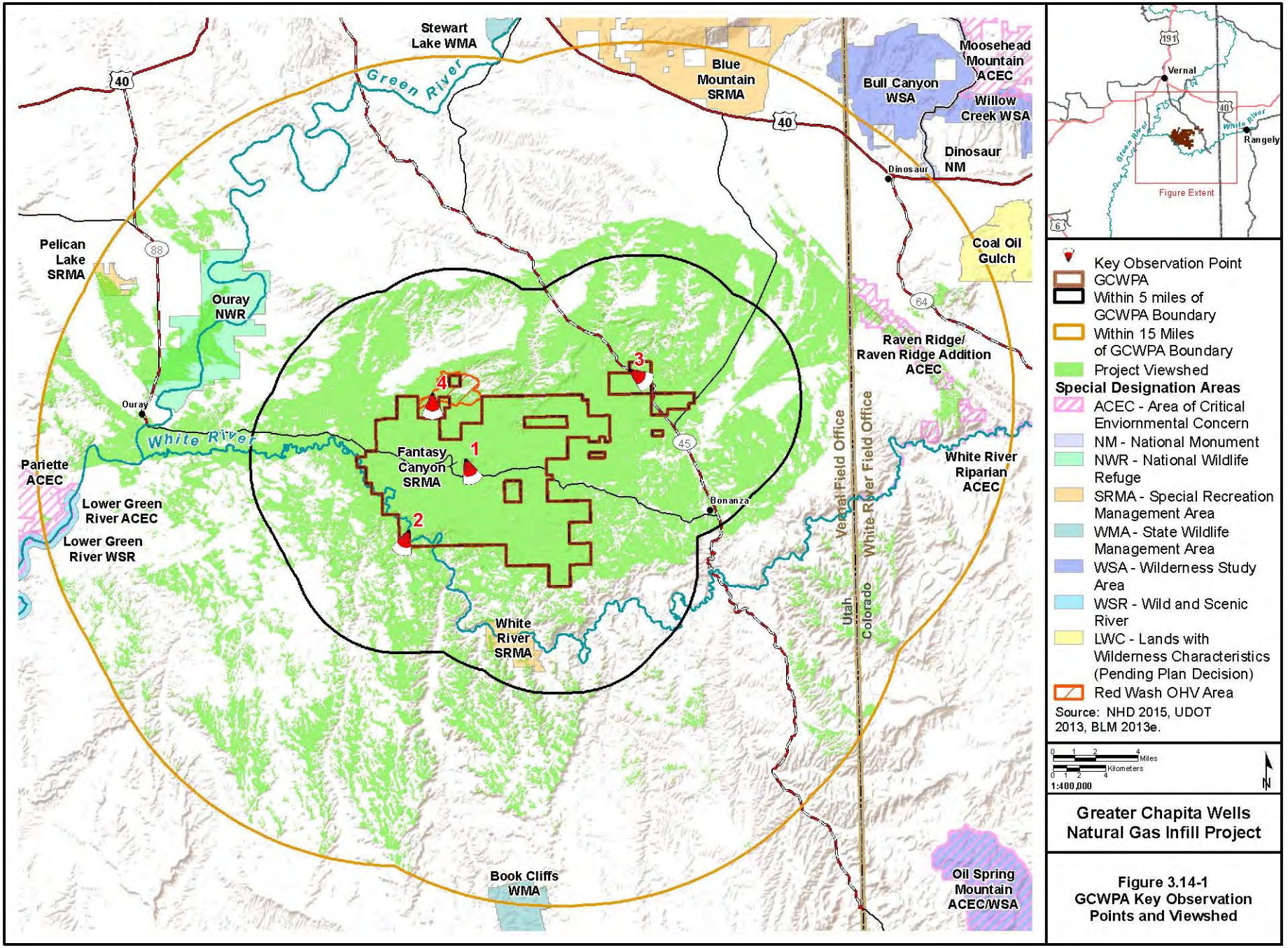
Section 101 (b) of the NEPA requires that measures be taken to ensure that aesthetically pleasing surroundings be retained for all Americans.

Under FLPMA, the BLM developed a standard visual assessment methodology, known as the VRM System, to inventory and manage scenic values on lands under its jurisdiction. Guidelines for applying the VRM system on BLM lands are described in BLM Manual 8400 et seq.

The GCWPA study area for the assessment of visual resources includes both of the 5-mile (BLM VRM foreground-middle ground distance zone) and the15-mile (BLM VRM background distance zone) BLM VRM standard areas of visibility (**Figure 3.14-1**). Fugitive dust due to vehicle traffic in the foreground-middleground distance zone limits expansive views. The characteristic landscape of the GCWPA is contained within a variety of landforms of the Uinta Basin – Colorado Plateau physiographic province (Fenneman 1931). Visual resources within the GCWPA are influenced by topographic, vegetative, geologic, hydrologic, and land use characteristics. The topography ranges from the flat White River valley floor, to finely dissected and scenic erosion patterns of Fantasy Canyon SRMA, to low rolling or flat-topped hills. Vegetation is comprised of grasses, greasewood, rabbitbrush, and sagebrush through the majority of the area to riparian cottonwoods and grasses along the White River. Vegetation patterns affect color, form, line, and contrast, which shape the basis for analysis of visual resources in the GCWPA. Land use in the area is predominantly oil and gas and grazing, with the Deseret Power Plant as the major viewshed feature. In addition, there are campsites at the Enron boat takeout area and a few recreational access roads. The main recreational access roads include Utah SR 45, the Bonanza Highway, Old Bonanza Highway, Little Bonanza Road, Glen Bench Road, Chapita Grove Road, and Seven Sisters Road. There is little surface water in the area with exception of intermittent streams, small ponds associated with oil and gas facilities and the Deseret Power Plant, and the White River. Recreational activities, including boating on the White River, camping at the Enron boat takeout area, and hiking, photography, and picnicking at Fantasy Canyon SRMA and Red Wash Open OHV Area/Devil's Playground depend on the settings and scenic views that VRM is required to manage.

A Visual Resource Inventory (VRI) was conducted to determine the visual values of the VFO area (BLM 2011e). The components of VRIs include: scenic quality evaluation, sensitivity level analysis, visibility, distances zones, and visual resource inventory classes.

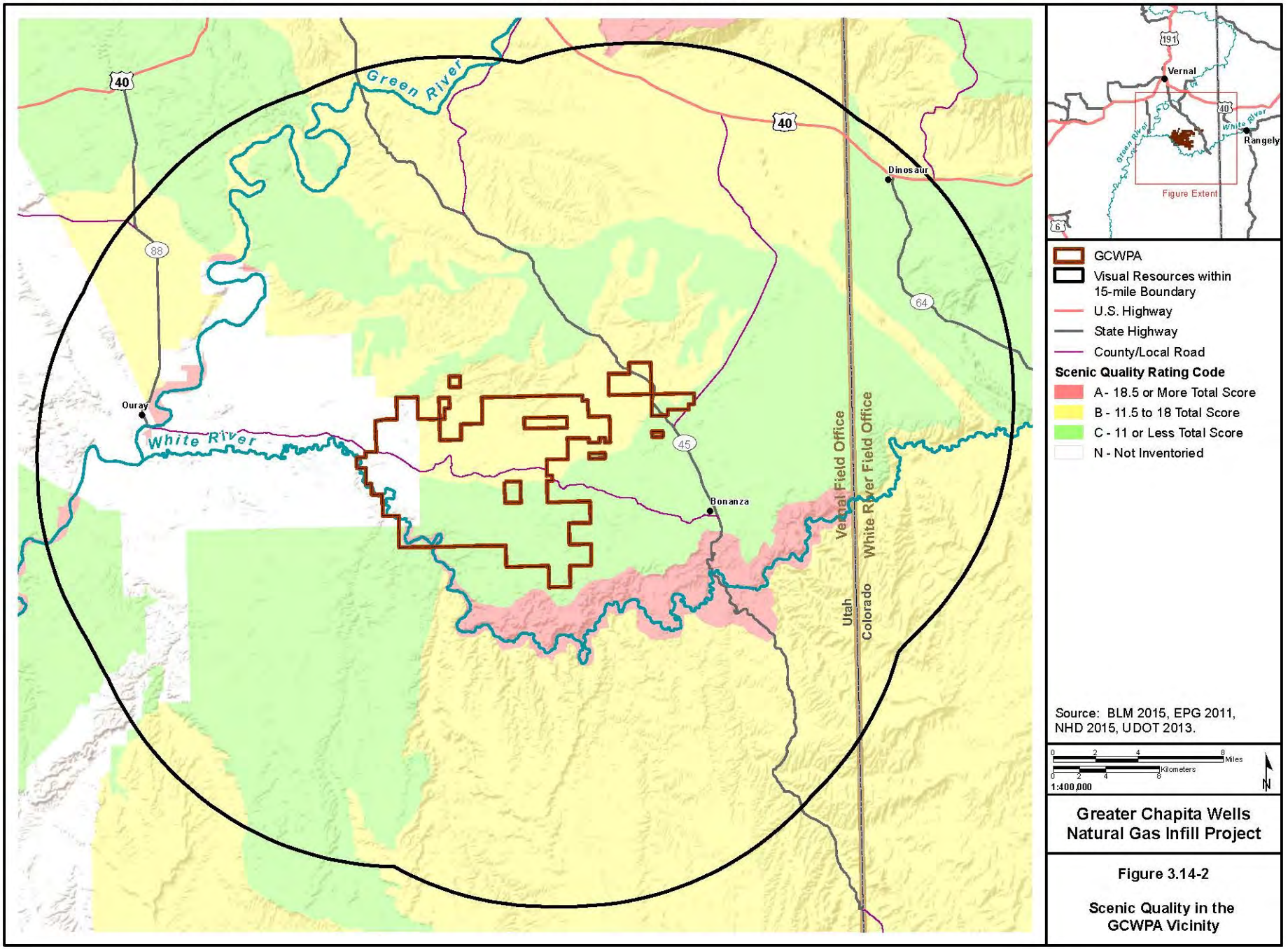
For the scenic quality evaluation, lands are rated as Class A (19 points or more), Class B (12 to 18 points), or Class C (11 points or less). Lands are rated using seven key factors: landforms, vegetation, water, color, influence of adjacent scenery, scarcity and cultural modifications. **Figure 3.14-2** illustrates the scenic quality classifications in the GCWPA.



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Figure 3.14-1
GCWPA Key Observation Points and Viewshed

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Figure 3.14-2

Scenic Quality in the GCWPA Vicinity

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The sensitivity level analysis measures public concern for visual resources. Lands are assigned high, medium, or low sensitivity levels based on consideration of the following factors: types of users, amount of use, public interest, adjacent land uses, special areas, and other factors. **Figure 3.14-3** illustrates the sensitivity levels for the sensitivity level rating units in the GCWPA study area.

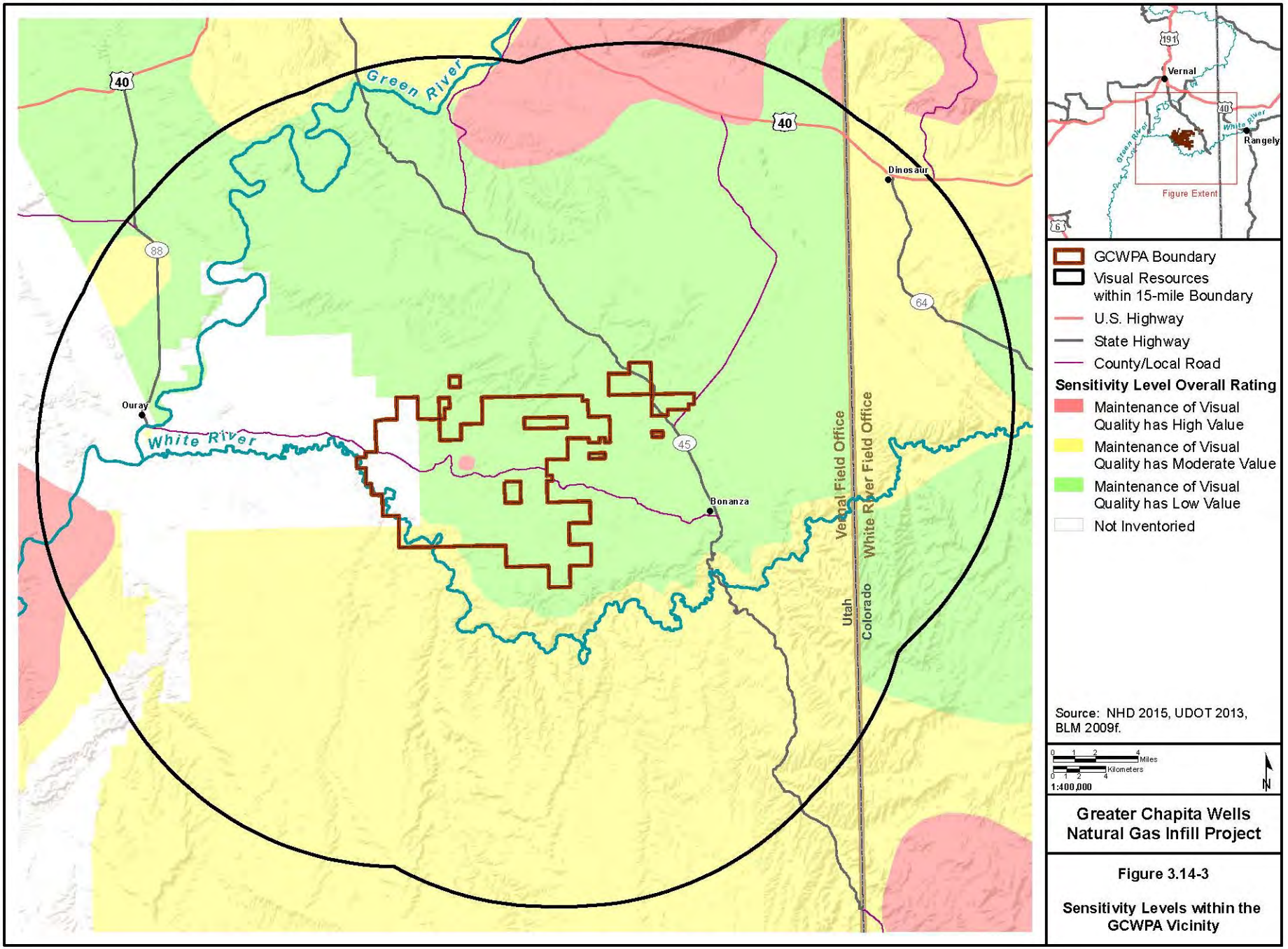
Distance zones are delineated to subdivide the landscape based on relative visibility from travel routes, use areas, or vantage points. The three distance zones (**Figure 3.14-4**) include:

- Foreground-Middleground Zone: This is an area that can be seen from a distance of 3 to 5 miles.
- Background Zone: This is the remaining area which can be seen from approximately 15 miles.
- Seldom Seen Zone: These are areas that are not visible within the foreground-middleground and background zones and areas beyond the background zones.

The scenic quality evaluation, sensitivity level analysis, and delineation of distance zones are combined to develop VRI Classes (**Figure 3.14-5**), which represent the relative value of the visual resources. Classes I and II are the most valued, Class III represents a moderate value, and Class IV represents the least valued landscape. VRI classes are informational in nature and provide the baseline data for considering visual values in the RMP process. VRI classes do not establish management direction and are not used as a basis for constraining or encouraging surface-disturbing activities. **Table 3.14-1** summarizes the acreages and percent of that portion of the study area categorized into each VRI component, the resulting VRI Classes, and the VRM Classes.

The assignment of VRM classes (**Figure 3.14-6**) is based on the management decisions made in the RMP process, which must take into consideration the value of visual resources and management priorities for land uses. During the RMP process, inventory class boundaries can be adjusted as necessary to reflect resource allocation decisions made in the RMP. Management objectives established for each VRM class (BLM Handbook H-8410-1 Visual Resource Inventory) are summarized in **Table 3.14-2**.

The visual resources study identified four key observation points (KOPs) (**Figure 3.14-1**) as the viewpoints for conducting the characteristic landscape, impacts, and VRM compliance analyses (**Appendix T**). KOP locations are as follows: KOP-1 is located at the entrance facility of Fantasy Canyon; KOP-2 is located at the Enron boat takeout facility; KOP-3 is located on the access road to the Chapita Wells GCWPA at a point near the entry; and KOP-4 is located within the Red Wash Open Ride Area (also known as the Devils Playground Open Ride Area). In addition, the visibility of the GCWPA from the White River is provided in **Figure 3.14-7**.

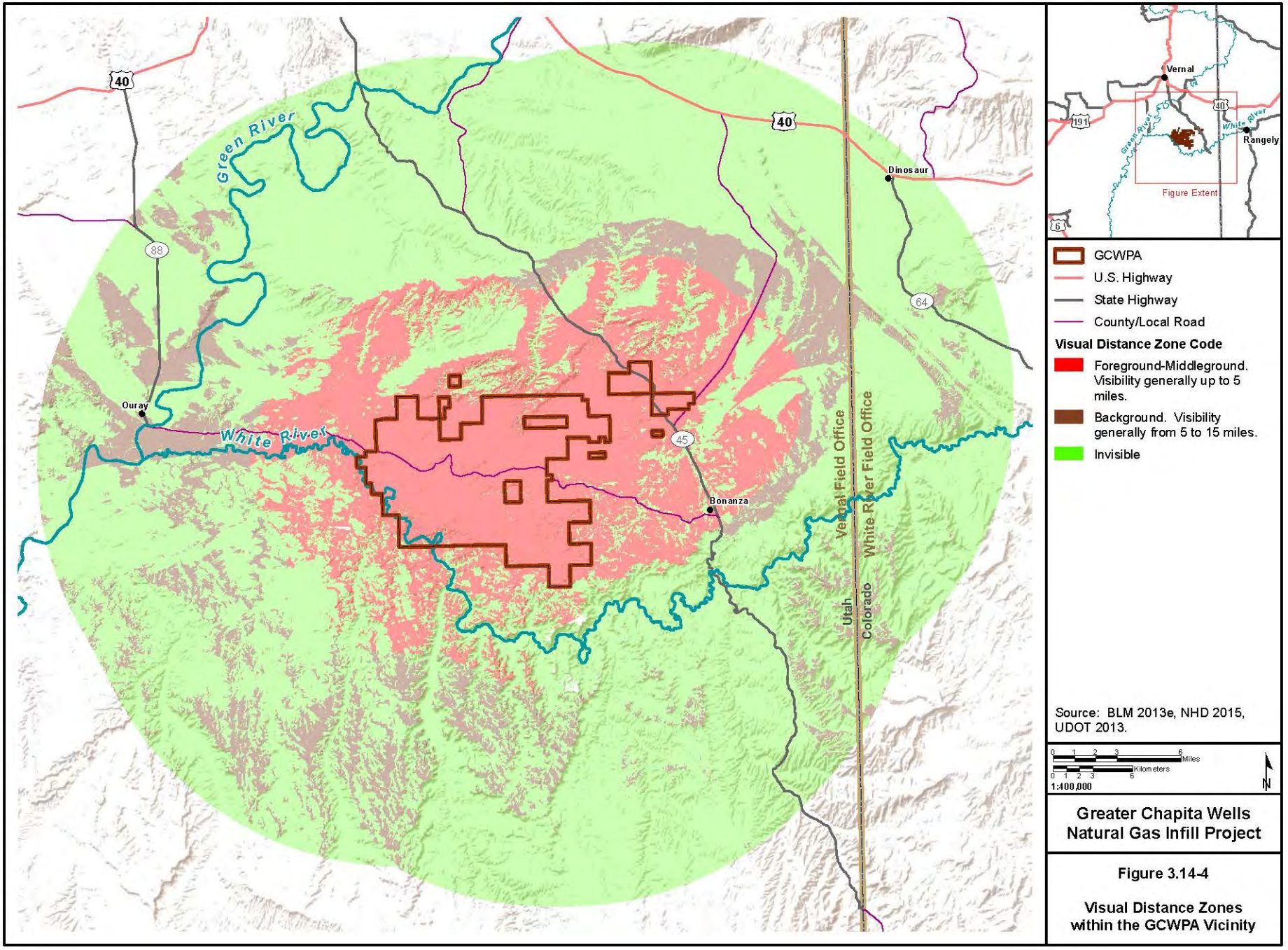


Greater Chapita Wells Natural Gas Infill Project

Figure 3.14-3

Sensitivity Levels within the GCWPA Vicinity

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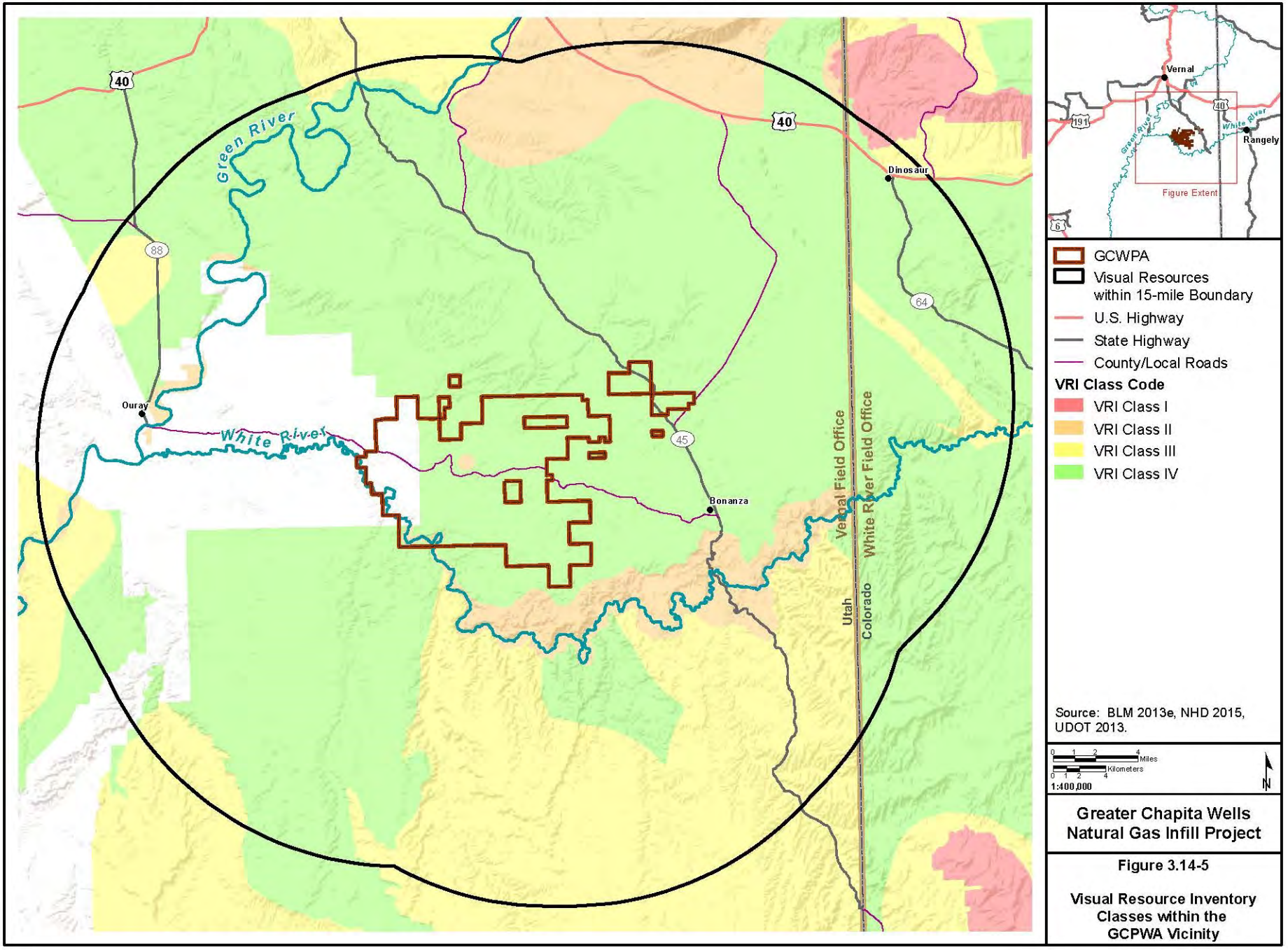


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Figure 3.14-4

Visual Distance Zones within the GCWPA Vicinity

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Figure 3.14-5

Visual Resource Inventory Classes within the GCPWA Vicinity

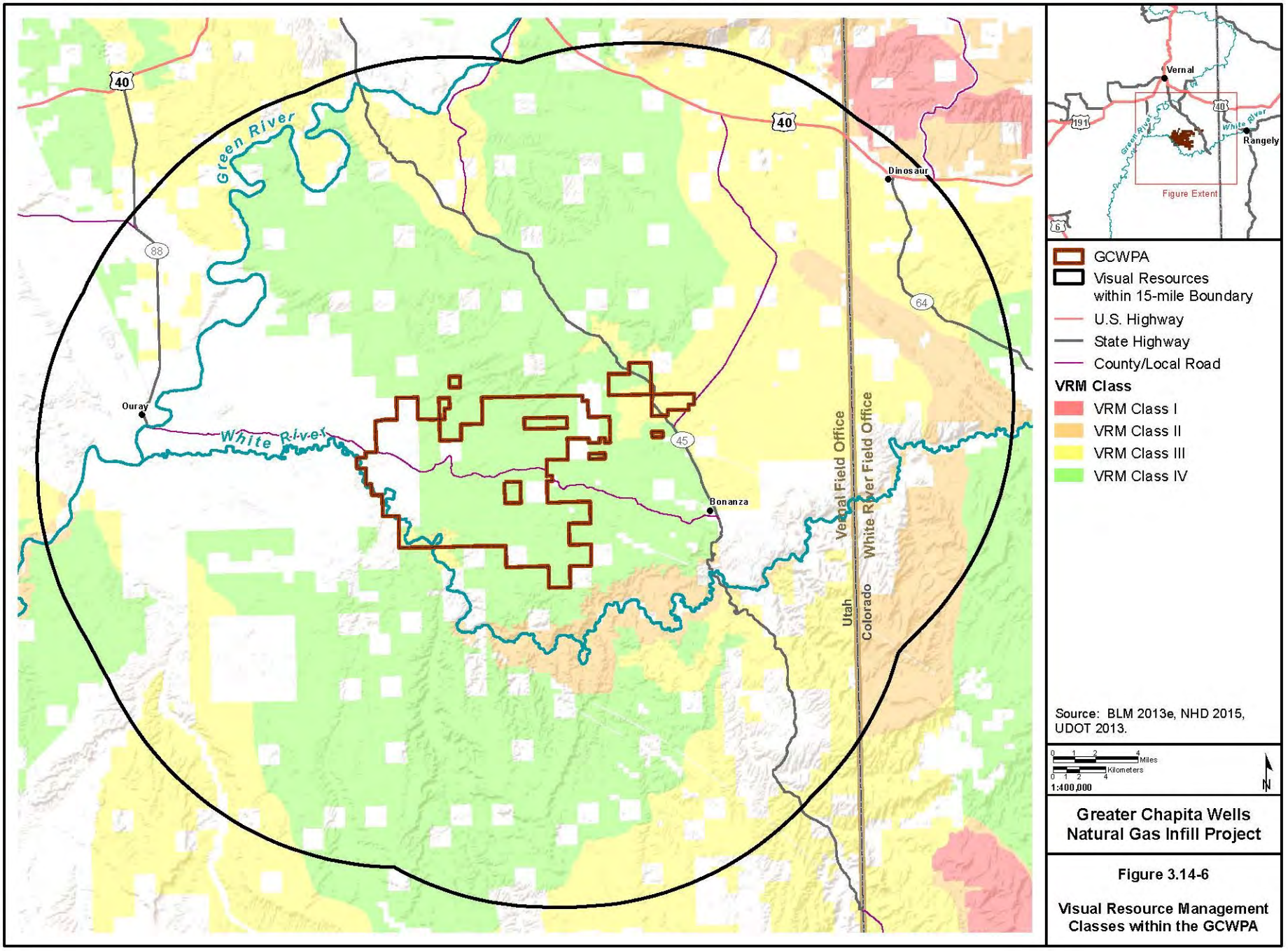
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Table 3.14-1 GCWPA Key Observation Points and Viewshed

	Class A		Class B		Class C		Total	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Scenic Quality Evaluation	14,742	8.4%	68,792	39.1%	92,401	52.5%	175,935	100.0%
	High		**Medium**		**Low**		**Total**	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Sensitivity Level Analysis	283	0.2%	35,856	20.4%	139,795	79.5%	175,935	100.0%
	Foreground-Middleground		**Background**		**Seldom Seen**		**Total**	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Distance Zones	167,814	95.4%	8,120	4.6%	0	0.0%	175,935	100.0%

	VRI Class I		VRI Class II		VRI Class III		VRI Class IV		Total	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
VRI Classes	0	0.0%	15,019	8.5%	6,304	3.6%	154,612	87.9%	175,935	100.0%
	VRM Class I		**VRM Class II**		**VRM Class III**		**VRM Class IV**		**Total**	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
VRM Classes	0	0.0%	15,801	9.0%	32,064	18.3%	127,521	72.7%	175,387	100.0%



Greater Chapita Wells Natural Gas Infill Project

Figure 3.14-6

Visual Resource Management Classes within the GCWPA

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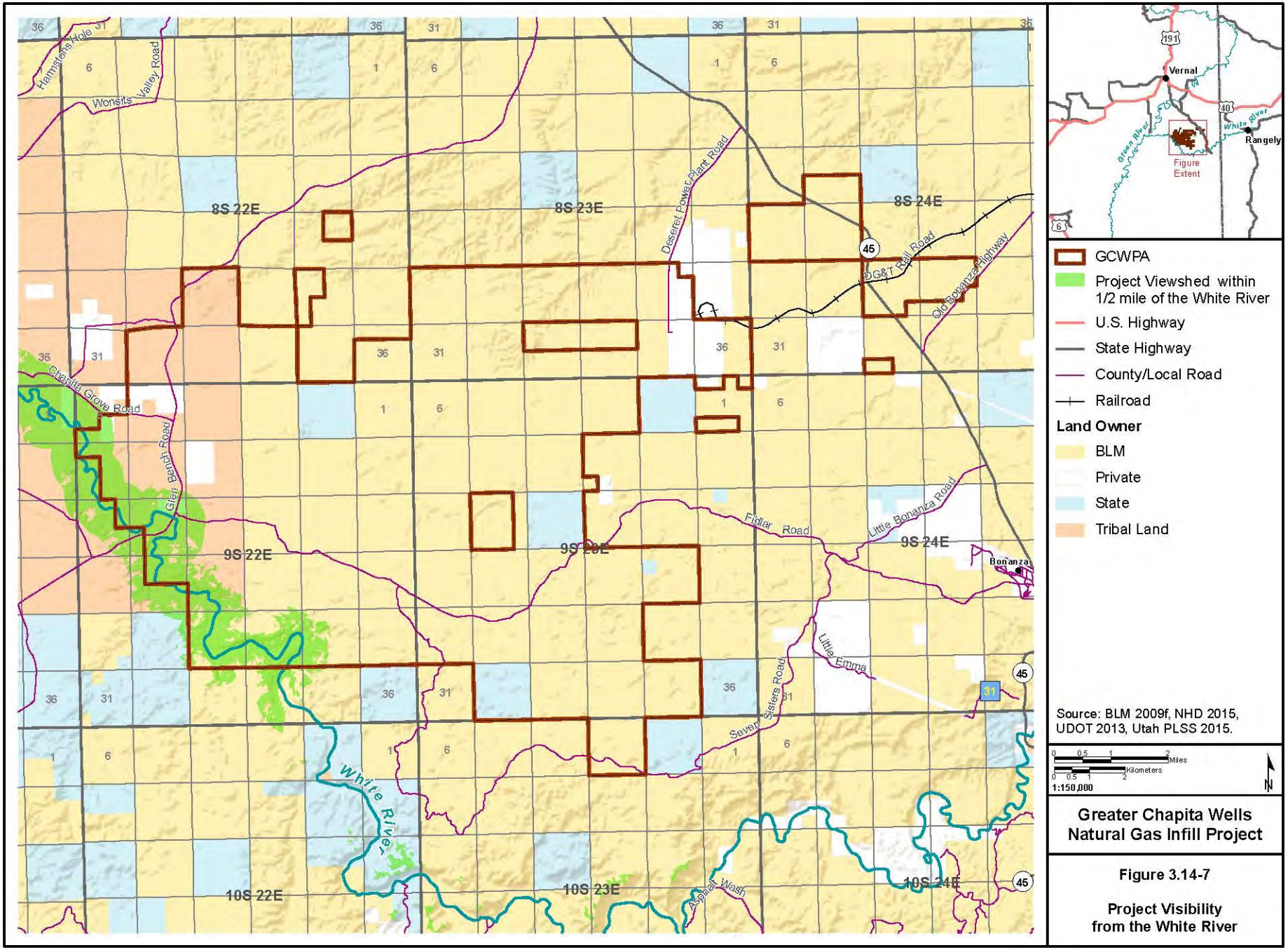
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Table 3.14-2 BLM Visual Resource Management Class Objectives

Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. 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 (design) elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective Class IV is to provide for management activities that require major modifications to the existing character of the landscape. The level of change to the landscape can be high. The management activities may dominate the view and may be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic visual elements of form, line, color, and texture.

Source: BLM 1986, 2008b.

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Figure 3.14-7

Project Visibility from the White River

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3.15 Recreation

The recreation study area includes a 2-mile buffer around the GCWPA. The area is used for primarily dispersed types of recreation consistent with those activities described in the Vernal Field Office Resource Management Plan (BLM 2008b). These activities may include OHV operation, backpacking, boating (rafting, canoeing, kayaking), fishing, camping, observing natural and cultural features, dirt biking, four-wheel driving, hiking, horseback riding, hunting, mountain biking, rock climbing, and scenic driving or sight-seeing, among others. Within the GCWPA, principal recreational uses are OHV operation, hunting, visitation of Fantasy Canyon SRMA, and boating and fishing activities associated with the White River. Based on past surveys, Utah State University's Institute of Outdoor Recreation and Tourism confirmed OHV use and rafting the White River as popular recreational activities within and near the GCWPA (Reiter 2009). Dispersed recreational activities on SITLA lands occur as described above for dispersed recreational activities on BLM-administered federal lands.

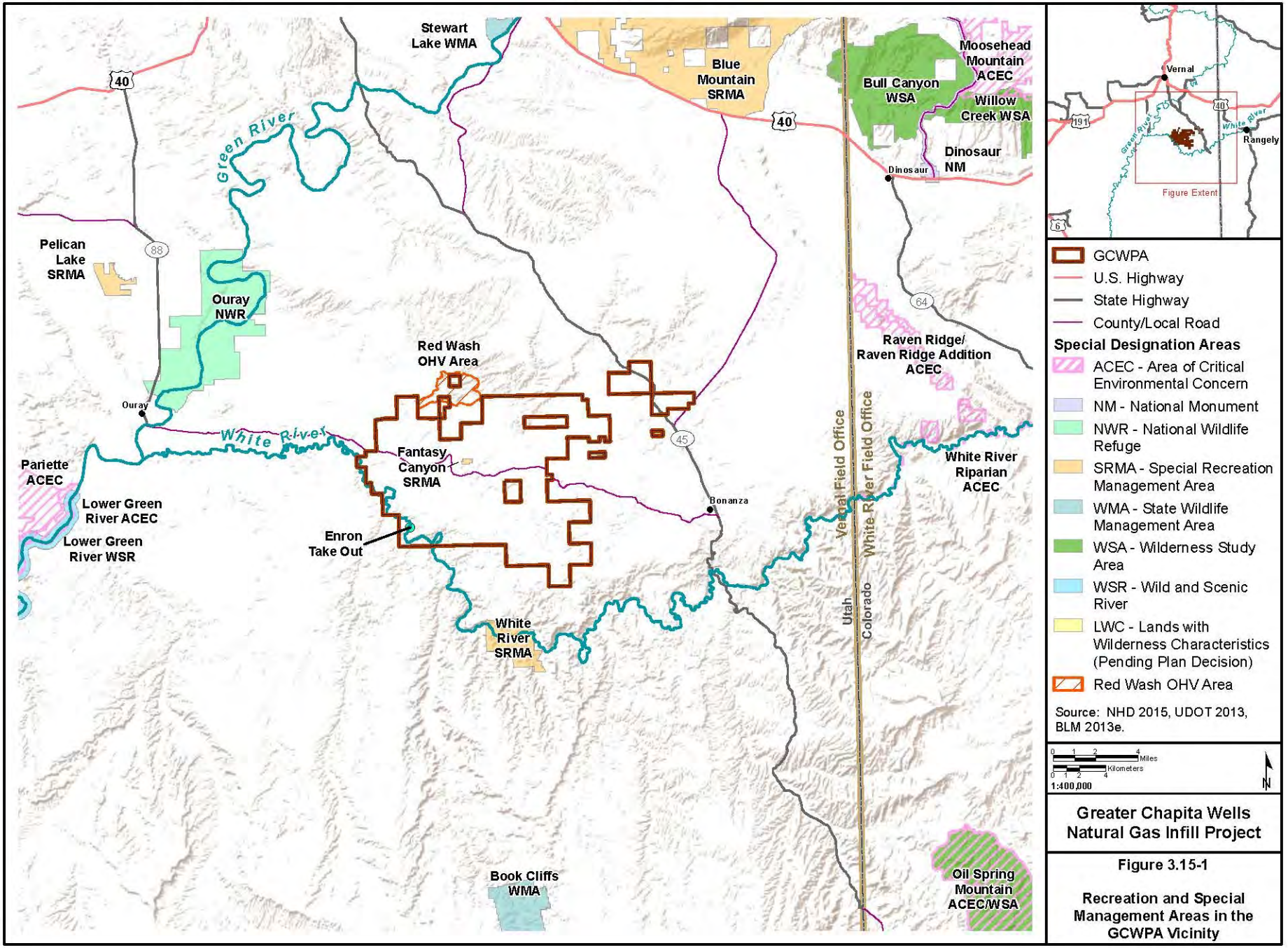
The Ute Tribe controls recreational activities on Tribal lands within the GCWPA through permitting and approval processes (Ute Indian Tribe Fish and Wildlife Department 2014a). Recreational activities on Tribal lands are likely similar to those occurring on adjacent federal and state lands. Permits for hunting, fishing, and camping on Tribal lands are issued by the Ute Indian Tribe Fish and Wildlife Department (Ute Indian Tribe Fish and Wildlife Department 2014b). Recreation on private lands within the GCWPA is controlled by the land owner and permission is typically needed to access private lands for activities such as hunting.

3.15.1 OHV Activity

On BLM-administered lands within the GCWPA, the BLM offers two designations for OHV use: Open and Limited (BLM 2008b) (**Figure 3.15-1**). Approximately 240 acres of lands within the GCWPA are open to OHV travel. The 240 acres are part of the Red Wash OHV Open Area (also known locally as Devil's Playground). The portions of the OHV Open Area within the GCWPA consist of the northern half of NW1/4 of Section 26, T8S, R22E and the NE1/4 of Section 23, T8S, R22E. The open area is characterized by a predominance of steep rugged terrain separated by nearly level drainage bottoms. The drainage bottoms support a number of oil and gas facilities including well pads, access roads, and adjacent surface pipelines. OHV-created casual trails crisscross the open area, including bottom lands, but mostly avoid crossing the existing oil and gas facilities. OHV travel within the GCWPA's remaining federal lands are controlled by the BLM and designated as Limited Areas for OHV use (BLM 2008b). The Limited Area designation restricts OHV travel to defined routes that comprise a network of BLM-approved transportation routes that tie into roads administered by the Ute Tribe, State of Utah, Uintah County, and private land owners. No counts or data are available for use of the Red Wash OHV Open Area or for general use in the vicinity of the GCWPA. However, use of the Red Wash area is considered high and use of the Limited Areas and approved routes is known to occur within the GCWPA.

3.15.2 Hunting

Hunting is a permitted activity throughout the BLM-administered federal and SITLA lands. Hunting also occurs on private and Tribal lands with permission. Ute Tribe members and authorized guests of the Tribe are issued hunting permits by the Ute Indian Tribe Fish and Wildlife Department. The UDWR provides permits for and has kept records of game species on lands inclusive of the GCWPA including big game species (mule deer, elk, pronghorn, moose, bison, and Rocky Mountain bighorn), black bear, and upland game species (game birds, cottontail rabbit, and snowshoe hare). As identified in Section 3.14, hunted species whose ranges include lands within the GCWPA are mostly limited to mule deer, pronghorn, sage grouse, wild turkey, mourning dove, chukar, California quail, and cottontail. Due to the existing level of oil and gas development, livestock grazing, and other activities, small game hunting is not a common activity within the GCWPA.



Greater Chapita Wells Natural Gas Infill Project

Figure 3.15-1

Recreation and Special Management Areas in the GCWPA Vicinity

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Big game hunting of the two more prevalent species, mule deer and pronghorn, is more common in the GCWPA, particularly for mule deer along the White River. The big game hunting season typically extends from mid-August through early November. **Table 3.15-1** and **Table 3.15-2** present the most recently published hunting statistics for mule deer and pronghorn. The statistics are presented for the two large game management units (GMUs) that include portions of the GCWPA. The South Slope GMU, Bonanza subunit includes approximately 42,371 acres (98 percent) of the 43,071-acre GCWPA to the north and east of the White River, which serves as the boundary between the South Slope GMU, Bonanza subunit and the Book Cliffs GMU. The Book Cliffs GMU includes approximately 700 acres (2 percent) of the GCWPA to the south and west of the White River boundary.

The mule deer harvest of 88 in 2012 for the South Slope GMU, Bonanza subunit (98 percent of the GCWPA) represents 6 percent of the harvest of 1,550 for the entire South Slope GMU. The pronghorn harvest of 24 in 2012 for the South Slope GMU, Bonanza and Diamond Mountain subunits (98 percent of the GCWPA) represents 86 percent of the harvest of 28 for the combined subunits of the South Slope GMU.

3.15.3 Fantasy Canyon

Within the GCWPA, the BLM has designated a recreational destination known as Fantasy Canyon as a SRMA in the VFO RMP (BLM 2008b) (**Figure 3.15-1**). The 69-acre area offers self-guided tours and hiking through an area of sandstone outcrops that have weathered and eroded into a number of geologic features unique in their form and setting. The BLM has constructed an interpretive kiosk, vaulted restroom, and informal parking area at the entrance. Volunteers have established and maintained a trail system to all of the named unique rock forms. An estimated 4,500 visitors visit the SRMA annually, primarily on weekends during the spring. The most direct access to the SRMA is a signed 5-mile gravel and native surface road off of the paved county Glen Bench Road that connects into SR 45 between Vernal/Naples and Bonanza, Utah.

3.15.4 White River Activity

A segment of the White River and its canyon crosses a portion of the GCWPA from southeast to northwest and roughly forms the southwestern boundary of the GCWPA (**Figure 1-1**). The BLM has not assigned this portion of the river that crosses federal lands a special designation in the Vernal Field Office Resource Management Plan (BLM 2008b) nor are permits required from the BLM for use of this portion of the White River. The White River SRMA is located on a segment of the river approximately two to three miles south of the GCWPA boundary. The Ute Tribe also has not assigned a special designation or protections for this segment of the river that crosses Tribal lands within the GCWPA with the exception that surface facilities cannot be located within 660 feet of the water's edge. Although specific designations for recreation related to the White River are absent within the GCWPA, the river and its adjacent floodplains and canyon bottom can provide recreational opportunities for visitors within the GCWPA. Principal uses are spring rafting and summer canoeing and associated camping; however, the White River in the GCWPA is not considered a popular destination for fishing. All recreational uses of the White River and adjacent lands where it crosses Tribal lands are limited to Tribal members and guests of the Tribe and those with approved permits (Ute Indian Tribe Fish and Wildlife Department 2014a,b).

In Section 28, T9S, R22E, a co-maintained BLM- and Uintah County-managed vaulted restroom facility is located at a water craft take out known as the Enron Take Out. This take-out and restroom facility is located on BLM-administered land. The take-out's location allows water craft to be removed for vehicle transport prior to the river entering Tribal lands with its crossing into Section 21, T9S, R22E (**Figure 3.15-1**). Water craft can be launched at this takeout for use on the river upstream and south of the Tribal boundary if visitors do not have Tribal approvals to cross into Tribal lands and waters. Primitive campsites are located in the vicinity of the take out and restroom facility.

Table 3.15-1 Mule Deer Hunting Statistics 2008 – 2012

GMU-subunit / Year	Total Mule Deer Harvested	Hunters Afield
South Slope - Bonanza		
2008	66	222
2009	55	207
2010	56	218
2011	43	158
2012	88	315
Book Cliffs*		
2003	467	540
2004	573	684
2005	555	623
2006	487	567
2007	458	559

* Specific data for the Bitter Creek subunit of the Book Cliffs GMU was not available.

Source: UDWR 2014b.

1

Table 3.15-2 Pronghorn Hunting Statistics 2008 – 2012

GMU-subunit / Year	Total Pronghorn Harvested	Hunters Afield
South Slope - Bonanza/Diamond Mountain		
2008	21	24
2009	22	25
2010	24	26
2011	22	23
2012	24	24
Book Cliffs - Bitter Creek		
2008	10	10
2009	12	12
2010	10	11
2011	8	9
2012	9	9

Source: UDWR 2014b.

2

4.0 Environmental Consequences

4.1 Introduction

This chapter discusses effects to those resources and values described in Chapter 3.0, which would result from implementation of Alternative A or other alternatives discussed in Chapter 2.0. As indicated in Chapter 2.0, site-specific actions associated with implementation of a liquids gathering system within the GCWPA analyzed in prior NEPA documents would be constructed even if an action alternative is selected for this EIS. A comparison of surface disturbance associated with each alternative is presented in **Table 2-9**. A comparison of effects associated with each alternative is presented in **Table 2-10**. Development of the Natural Buttes gas field, including the GCWPA, is ongoing. Thus, estimated surface disturbance and other effects from the analyzed action alternatives (Alternatives B, C, and D) would be additive to effects and disturbance from site-specific actions (LGS Phase 2 and electrical distribution system) summarized in Alternative A, as well as to the existing surface disturbance. In addition, NEPA requires consideration of the potential for proposed effects to add to effects from other foreseeable actions that will occur in the vicinity of the Alternative B or other alternative. These cumulative effects are analyzed in detail in Chapter 5.0.

Effects to environmental resources or values resulting from implementation of the Alternative B or alternative actions may be either beneficial (positive) or detrimental (negative) and may vary in duration from short-term (until completion of interim or final reclamation), typically 5 or more years in this portion of the Uinta Basin, to long-term, which would encompass project life and may be permanent in the absence of successful restoration or reclamation. Effects may be negligible (little or no effect to the resource), low (effects are difficult to detect and cause minimal change to the resource), moderate (effects are readily apparent but do not meet the criteria of significant effects), and significant.

The concept of “significance” is defined by NEPA regulations at CFR 40 Section 1508.27 and depends upon both the context and intensity of expected effects. Context varies with the areal extent of expected effects, such as local or regional influence, and would include both short-term and long-term effects. Intensity refers to the severity of the effects and includes considerations of influences on public health and safety, unique characteristics of the GCWPA, whether the action is highly controversial or would involve unique or unknown risks, and whether the action would establish a precedent for future actions with significant effects, among others.

Effects may be either direct, occurring at the same time and place as the Proposed Actions, or indirect, occurring at another time or location. Residual effects would be those remaining following completion of reclamation activities and application of all incorporated design features and added mitigations.

Implementation of any alternative may result in the irreversible and irretrievable commitment of resources. Examples would include the depletion of the oil or gas resource during field development, permanent loss of cultural resources, or permanent destruction of wetlands. These are effects which are permanent and cannot be reversed, precluding future options for the use of the resource. Effects also may be beneficial, as in economic returns from resource development projects.

Analysis of effects resulting from implementation of the Proposed Action or an alternative action assumes application of the incorporated ACEPMs and/or design features for each alternative that were discussed in detail in Chapter 2.0.

The analysis developed for this EIS is “programmatic” in nature, meaning that it is based upon the general, projected locations of proposed facilities. At the APD approval or ROW grant stage, additional site-specific NEPA compliance would be conducted by BLM and additional mitigations may be imposed in the form of COAs attached to drilling permits and ROW grants.

4.2 Geology, Minerals, and Energy Production

4.2.1 Direct and Indirect Effects

4.2.1.1 Alternative A—No Action

Oil and Gas Resources

Under this alternative, approximately 98 percent of the GCWPA oil and gas reservoirs (except the 700-acre area under the Bonanza Power Plant) would be available for oil and gas production. Implementation of Alternative A would result in oil and gas production from up to 462 new wells. Maximum daily gas production under Alternative A would be approximately 88,180 MCF plus 731 barrels of condensate. Existing daily field gas production, including Alternative A production, would increase to an estimated peak output of approximately 144,110 MCF plus 1,805 barrels of condensate. Project cumulative production from Alternative A would be approximately 524 BCF gas plus 4,900,000 barrels of condensate. These gas and condensate resources would be removed from the subsurface reservoir and would no longer be available for extraction. Individual wells are expected to produce for approximately 40 years.

A potential effect related to hydraulic fracturing or injection of oil development-associated wastewater is the production of induced earth tremors. The experience of the BLM VFO has been that the hydraulic fracturing process is confined to the target oil and gas reservoir zone. None of the wells drilled in the last 50 years which have used hydraulic fracture completions have been found to affect near surface waters used for beneficial purposes.

With respect to injection of produced fluids, there is extensive injection of produced water for disposal and also for enhanced recovery purposes in the Uinta Basin. Disposal of produced fluids in the vicinity of the GCWPA is typically into a vugular and fractured geologic horizon that has demonstrated the capacity to accept very large volumes of water. It is the experience of the VFO that there has been no known occurrence of earth tremors associated with injection of disposal or enhanced recovery fluids.

Other Mineral Resources

Effects to other mineral resources are assumed to be proportional to the levels of surface disturbance or, for subsurface deposits, the number of proposed wellbores penetrating the resource. Including existing and alternative-specific activities, approximately 6,660 acres (15.5 percent of the GCWPA) would undergo disturbance of the surface.

Gilsonite – While there is the potential for gilsonite-bearing veins to be located within the GCWPA, only one mapped vein crosses an extreme eastern portion of the GCWPA, and the known accumulations in the vicinity are located to the east and southwest. Oil and gas drilling in close proximity to a gilsonite mine could potentially lead to mine damage from drilling equipment-induced vibration and there is the potential for loss of drilling fluids into the mine. Adherence to proper casing techniques required under Onshore Oil and Gas Order #2 and review of drilling plans by BLM engineers would minimize the potential for these sorts of effects. Such precautions also would serve to protect well integrity in the event a well intersects an unknown gilsonite vein not expressed on the surface. Blasting, which is sometimes required during construction activities in certain parts of the GCWPA, could potentially lead to mine damage to any nearby gilsonite mines. Because there are no active or inactive gilsonite mines located within the GCWPA, and the potential for future mines is likely to be low, the possibility of conflict between oil and gas and gilsonite development is considered to be negligible.

Oil Shale – Almost all of the GCWPA overlying federal mineral estate has been identified as being within an area of potential oil shale development. State lands within the GCWPA have been leased for possible oil shale development. However, the depth to the primary oil shale zones, greater than 2,000 feet, and the number of existing well bores in the GCWPA, may make the GCWPA less attractive than areas

farther to the south where the primary oil shale zones occur at shallower depths. In the event of attempts at *in-situ* extraction of oil shale resources, the necessity of avoiding some distance around existing well bores would result in the inability to extract the resource, at least during the life of the oil and gas wells.

Tar Sands – Large tar sands deposits tend to occur around the marginal areas of the Uinta Basin, outside the GCWPA. Areas with the highest potential for tar sands development have been designated by BLM as Special Tar Sands Areas. There are no Special Tar Sands Areas within 6 miles of the GCWPA. Within the southern GCWPA, the smaller Chapita Wells deposit consists of disseminated deposits located over a two-township area. Economically, it seems likely that tar sands development in the Uinta Basin would be located in more concentrated deposits than in disseminated accumulations such as the Chapita Wells deposit. The potential for conflict between oil and gas and tar sands extraction is equally likely to be minimal.

Mineral Materials – Large areas of alluvial deposits associated with larger intermittent drainages within the GCWPA are open to extraction of sand and gravel. The areal extent of the deposits, compared to the more limited extent of oil and gas production facilities, indicates that access for sand and gravel extraction should not be substantially affected. Excavation of sand and gravel deposits in the vicinity of buried pipelines would require coordination between the extraction operator and EOG to avoid possible damage to pipelines.

4.2.1.2 Alternative B—Proposed Action

Oil and Gas Resources

Under this alternative, approximately 98 percent of the GCWPA oil and gas reservoirs (except the 700-acre area under the Bonanza Power Plant) would be available for oil and gas production. Implementation of Alternative B would result in oil and gas production from up to 2,808 new wells. Maximum daily gas production under Alternative B would be approximately 555,342 MCF plus 7,725 barrels of condensate. Existing daily field gas production would increase to an estimated peak output of approximately 603,288 MCF plus 8,648 barrels of condensate. Life of Project cumulative production from Alternative B would be approximately 4,174 BCF gas plus 60,454,000 barrels of condensate. These gas and condensate resources would be removed from the subsurface reservoir and would no longer be available for extraction.

Other Mineral Resources

Effects to other mineral resources would be as described under Alternative A. The scale of effects would be proportional to well counts and/or surface disturbance levels. Because the majority of Alternative B involves pad expansions, rather than new well pad and associated facilities development, disturbance under this alternative (1,875 acres) would actually be less than under Alternative A (2,685 acres). Including existing, LGS and electrical distribution system projects, and alternative-specific activities, approximately 6,884 acres (16.0 percent of the GCWPA) would undergo disturbance of the surface.

4.2.1.3 Alternative C—Resource Protection Action (BLM-Preferred)

Oil and Gas Resources

Under this alternative, design features primarily intended to enhance protection for sensitive plant populations would limit access to downhole locations in the northern part of the GCWPA and along the White River in the southwestern GCWPA. Restrictions on siting surface locations and limitations on the reach of current directional drilling technology mean that approximately 97 percent of the GCWPA would be available for Mesaverde wells and 89 percent would be available for Wasatch wells. Downhole areas accessible to drilling would allow for all 2,808 proposed wells, including up to 1,262 Wasatch wells. Areas not accessible under this alternative would accommodate an additional 93 Mesaverde and 237 Wasatch wells. Because location restrictions would apply only to BLM surface, all Tribal and state mineral estate would be accessible under this alternative (**Appendix G**).

Implementation of Alternative C would result in oil and gas production from up to 2,808 new wells. Because this alternative would result in a well count and, development schedule identical to Alternative B, effects to oil and gas resources would be the same as described for Alternative B.

Other Mineral Resources

Similar to the alternative-specific discussion under oil and gas resources, effects to other mineral resources under this alternative would be similar to those described for Alternative B. Including existing, LGS and electrical distribution system projects, and alternative-specific activities, approximately 6,523 acres (15.1 percent of the GCWPA) would undergo disturbance of the surface.

4.2.1.4 Alternative D—Other Protections Action

Oil and Gas Resources

Under this alternative, design features primarily intended to enhance protection for sensitive plant populations and visual resources along the White River would limit access to downhole locations in the northern part of the GCWPA and along the White River in the southwestern GCWPA. Restrictions on siting surface locations and limitations on the reach of current directional drilling technology mean that approximately 88 percent of the GCWPA would be available for Mesaverde wells and 81 percent would be available for Wasatch wells. Downhole areas accessible to drilling would allow for all 2,808 proposed wells, including up to 1,165 Wasatch wells. Areas not accessible under this alternative would accommodate an additional 587 Mesaverde and 410 Wasatch wells. Because location restrictions would apply only to BLM surface, all Tribal and state mineral estate would be accessible under this alternative (**Appendix G**).

Implementation of Alternative D would result in oil and gas production from up to 2,808 new wells. Because this alternative would result in a well count, and development schedule identical to the Alternative B, effects to oil and gas resources would be the same as described for Alternative B.

Other Mineral Resources

Similar to the alternative-specific discussion under oil and gas resources, effects to other mineral resources under this alternative would be similar to those described for the Alternative B. Including existing, LGS and electrical distribution system projects, and alternative-specific activities, approximately 6,511 acres (15.1 percent of the GCWPA) would undergo short-term disturbance of the surface.

4.2.2 Alternative-specific Design Features and Mitigations

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.2-1**.

4.2.3 Residual Effects

All Alternatives

Under all of the alternatives, residual effects would include the loss of a portion of the in-place oil and gas resource. Exploitation of this resource is the objective of the proposed project. Development of subsurface mineral resources, in particular the possibility of *in situ* recovery of oil shale kerogen, would likely be hindered or prohibited in areas proximal to oil and gas wells, at least during the lifetimes of the wells. Mitigations protective of kerogen and mineral materials extraction would minimize negative effects to exploitation of those resources.

Alternatives A and B

Under Alternatives A and B, no additional residual effects to geology, mineral resources, or energy development have been identified.

Table 4.2-1 Geology, Minerals, and Energy Production Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
If any vertical or directional well bore will be located within 300 feet of an active gilsonite mine, the mine operator must be notified by EOG at least 24 hours prior to commencement of drilling and prior to commencement of hydraulic fracturing operations to coordinate activities to protect mine worker safety.					m	m	m	m
If blasting operations are to occur within 2 miles of an active gilsonite mine, the mine operator must be notified by EOG at least 24 hours prior to blasting to coordinate activities to protect mine worker safety.					m	m	m	m
At the time of issuance of any site-specific permit for oil and gas within the GCWPA, BLM will review the proposal for potential conflicts with sand and gravel operations, and will coordinate with sand/gravel permit owner prior to issuance of the permit.					m	m	m	m
If drilling or construction activity reveal a previously unknown gilsonite vein, the location will be reported to BLM within 24 hours.					m	m	m	m

Alternatives C and D

Under Alternatives C and D, residual effects to oil and gas resource development would result from certain limitations placed on locating wells. Each of the action alternatives would theoretically permit the drilling of 2,808 wells, as specified in Alternative B; however, oil and gas resources in portions of the GCWPA would not be recoverable under Alternatives C and D. If the same restrictions, principally involving *Sclerocactus* protections, were subsequently applied to a full field development scenario, these resources would not be extractable using currently economic technology.

4.2.4 Irretrievable and Irreversible Commitment of Resources

Production of a portion of the oil and gas resource within the GCWPA, which is the purpose of all of the action alternatives, would result in an irreversible and irretrievable commitment of that resource. Produced oil and gas would be consumed and could not be recovered for subsequent beneficial use.

Production of oil shale within the GCWPA could be hindered during the life of the oil and gas field.

4.2.5 Relationship of Short-term Use to Long-term Productivity

Implementation of oil and gas development under any of the alternatives would result in varying levels of permanent removal of current technically recoverable hydrocarbon resources for short-term use. Conflicts between the short-term removal of oil and gas resources and operation of other extractive mineral resources are anticipated to be minimal.

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4.3 Air Quality and Climate

This section presents an assessment of the effects on air quality and air quality related values (AQRVs) due to the proposed project emissions in the Uinta Basin Region. To conduct the analyses an emissions inventory was developed and applied using two different models to predict potential effects on air quality (criteria pollutants, including ozone, and hazardous air pollutants), visibility, atmospheric deposition, and acid neutralizing capacity.

As discussed in Chapter 2.0, four project alternatives, Alternative A—No Action, Alternative B—Proposed Action, Alternative C—Resource Protection Action, and Alternative D—Other Protections Action are analyzed for this EIS. As a result of the identical well counts and applied mitigations for air quality, the future action alternatives are expected to yield similar air emissions. For the purpose of air quality modeling and to conservatively disclose Project effects, the alternative with potentially the highest air quality effects was modeled and analyzed. A near field model was used to evaluate effects on criteria and hazardous air pollutants in the near-field of the GCWPA while a regional model was used to evaluate regional effects on ozone and AQRVs. For the near field modeling, maximum short-term and annual emissions scenarios were selected for modeling from the Alternative B in order to disclose the potential maximum impacts anticipated in the vicinity of the planned development. For regional modeling, two annual scenarios from Alternative B were selected for modeling based on the peak NO_X emissions (project year 7) and the peak VOC emissions (project year 15). Since Alternatives A, C, and D consist of fewer new well pads, less total acres disturbed, and increased mitigation strategies, it is expected that air quality effects from these three alternatives would be equivalent or less than those shown in Alternative B.

Emissions Inventory

A project emissions inventory was compiled for well development activities, production activities, and ancillary facilities. The emissions inventory includes the following pollutants: NO_X, SO_2, CO, PM_{10}, $PM_{2.5}$, VOCs, and HAPs benzene, toluene, ethyl benzene, xylene, n-hexane and formaldehyde. Lead emissions are expected to be negligible and were not calculated in the inventory. In addition, CH_4, N_2O and CO_2 emissions were included for the purpose of quantifying GHG emissions. CO_2e for all three GHGs are reported. More detailed information on the Project emissions inventory is given in the Air Quality Technical Support Document (**Appendix J**) and the Greater Chapita Wells Project Emissions Inventory (**Appendix K**). The GCWPA emissions inventory was developed to include all emissions sources associated with the Proposed Action.

Greenhouse Gas

GHGs are produced and emitted by various sources during oil and gas exploration, well development, and production. The primary sources of GHGs associated with oil and gas exploration and production are CO_2, N_2O, and CH_4. Implementation of any of the alternatives will result in both direct and indirect GHG emissions within the GCWPA. The primary sources of GHG emissions include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities – vehicles driving to and from production sites, engines that drive drill rigs, etc. Such equipment produces
- CO_2 in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors;
- Fugitive CH_4 – CH_4 that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global CH_4 emissions. These emissions have been estimated for various aspects of the energy sector, and starting in 2011, producers are required under 40 CFR 98, to estimate and report annual CH_4 emissions to the USEPA; and

- Combustion of produced oil and gas – it is expected that future operations would produce marketable quantities of oil and/or gas. Combustion of the oil and/or gas would release CO_2 into the atmosphere. Fossil fuel combustion is the largest source of global CO_2.

The GHGs emissions for GCWPA are quantified in terms of CO_2e. Unifying emissions in terms of CO_2e allows for the comparison of different greenhouse gases based on their Global Warming Potential (GWP). GWP is a measure of how much energy a ton of gas will absorb over a given period of time, relative to one ton of CO_2. The CO_2e is derived by multiplying the emissions of the gas by its GWP. Methane is estimated to have a GWP of 28 to 36, while N_2O has a GWP of 265 to 298 times that of CO_2 for a 100-year timescale (USEPA 2016). For calculating the CO_2e for this project, methane's GWP was assumed to be 21, while N_2O's GWP was assumed to be 310. These values were used by the USEPA in their analysis of the recent U.S. GHG emissions and sinks (USEPA 2011b). Details of the greenhouse gas emissions calculations are provided in **Appendix J** and **Appendix K**.

Near Field Modeling

A near-field ambient air quality effect assessment was performed to quantify pollutant effects of both criteria air pollutants (excluding ozone) and hazardous air pollutants within and near the GCWPA that could potentially result from the Proposed Action. Near-field modeling ambient air quality effects were assessed for stations at 100 m out to 2,000 m from the project center, conducted in accordance with the USEPA's Guideline on Air Quality Models (Appendix W of 40 CFR Part 51; USEPA 2005). The near-field ambient air quality effect assessment was carried out using the latest version of AERMOD (version 14134) that was available at the time the modeling was conducted. AERMOD is a Gaussian plume model and is USEPA's guideline model for assessing local effects from industrial sources (USEPA 2005). AERMOD treats dispersion and transport of pollutants and is approved for assessing the maximum pollutant concentrations within the near field of an emissions source.

Five years of hourly meteorological data were used for the near-field analysis. All five years of surface observations were collected at the Vernal national weather station, and included 1 minute Automated Surface Observing System wind data to account for calm winds. Upper-air data were collected at Grand Junction, Colorado. The model-ready meteorological dataset for 2005-2009 was obtained from the Utah Division of Air Quality (UDAQ 2014).

Model results were processed to calculate effects in a manner consistent with the form of the AAQS (for criteria pollutants) or applicable significance threshold (for HAPs). A more detailed description of the AERMOD model and modeling effect analysis can be found in **Appendix J**.

Criteria Air Pollutants

Background concentrations of criteria pollutants were used to account for emissions from existing sources (such as oil and gas, mobile, residential, biogenic, other non-industrial emission sources), and transport into the region. Background concentrations were developed based on the representative monitors recommended by Utah DEQ. Monitoring data were processed to calculate concentrations in a manner consistent with the form of the AAQS. Background values were added to modeled near-field effects to calculate total criteria air pollutant effects for comparison to AAQS.

HAPs

Three different assessments were conducted to analyze exposure to potential HAP emissions. First, the modeled short-term (1-hour) HAP concentrations were compared to acute Reference Exposure Levels (RELs). RELs are defined as concentrations at or below which no adverse health effects are expected. No RELs are available for ethylbenzene and n-hexane; instead, the available Immediately Dangerous to Life or Health divided by 10 (IDLH/10) values were used. These IDLH values are determined by the National Institute for Occupational Safety and Health (NIOSH) and were obtained from USEPA's Air

Toxics Database (USEPA 2017b). These values are approximately comparable to mild effects levels for 1-hour exposures.

Second, for the assessment of long-term exposures to HAPs, modeled long-term concentrations were compared to Reference Concentrations for Chronic Inhalation (RfCs). An RfC is defined by USEPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both non-carcinogenic and carcinogenic effects on human health (USEPA 2017b).

Thirdly, long-term exposures to suspected carcinogens (benzene and formaldehyde) were evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime. The analysis presents the potential incremental risk from these pollutants, and does not represent a total risk analysis. The cancer risks were calculated using the maximum predicted annual concentrations and USEPA's chronic inhalation unit risk factors for carcinogenic constituents. Estimated cancer risks were evaluated based on the Superfund National Oil and Hazardous Substances Pollution Contingency Plan (USEPA 1993), where a cancer risk range of $1x10^{-6}$ to $1x10^{-4}$ is generally acceptable. Two estimates of cancer risk are presented: 1) a most likely exposure (MLE) scenario; and 2) a maximally exposed individual (MEI) scenario. The estimated cancer risks were adjusted to account for duration of exposure and time spent at home.

For estimation of long-term exposure, maximum annual modeled concentrations were multiplied by USEPA's unit risk factors (based on 70-year exposure) for those pollutants, and then the product was multiplied by an adjustment factor which represents the ratio of projected exposure time to 70 years. The MLE duration is assumed to be 9 years, which corresponds to the mean duration that a family remains at a residence (USEPA 1993). This duration corresponds to an adjustment factor of 9/70 = 0.13. The duration of exposure for the MEI is assumed to be 60 years (i.e., the LOP), corresponding to an adjustment factor of 60/70 = 0.86.

A second adjustment was made for time spent at home versus time spent elsewhere. For the MLE scenario, the at-home time fraction is 0.64 (USEPA 1993), and it was assumed that during the rest of the day, the individual would remain in an area where annual HAP concentrations would be one quarter as large as the maximum annual average concentration. Therefore, the MLE adjustment factor is (0.13) x [(0.64 x 1.0) + (0.36 x 0.25)] = 0.0949. The MEI scenario assumes that the individual is at home 100 percent of the time, for a final adjustment factor of (0.86 x 1.0) = 0.86.

Regional Modeling

Recent high levels of observed ozone in the Uinta Basin required evaluation of potential ozone effects due to the GCW Project emissions. Ozone is not emitted directly into the atmosphere, but is formed from photochemical reactions of precursor species (primarily NO_X and VOCs) in the presence of sunlight. A photochemical model was used to assess ozone effects as these types of models are able to simulate the formation, transport, and removal of ozone, its precursors, and other reactive pollutants in the atmosphere. In addition, photochemical models also can be used to estimate the concentrations of particulate matter. Therefore, the same photochemical model used to assess ozone effects also was used to assess AQRV effects to visibility and atmospheric deposition.

Photochemical models are different from near-field models in many ways, but most importantly photochemical models require all emissions sources to be explicitly included in the modeling analysis. As a result, photochemical modeling provides a cumulative assessment of effects which needs to be post-processed to estimate project-specific contributions.

Model Approach

The CMAQ modeling system was the photochemical model selected to assess the potential regional effects of the GCW Project. The CMAQ model (version 5.0, publicly released in February 2012) was selected for this project for consistency with the Air Resource Management Strategy (ARMS) Modeling

Project. One of the primary objectives of the ARMS Modeling Project was to develop a reusable modeling platform for NEPA analyses (AECOM 2014). The ARMS Modeling Project is a cumulative assessment of potential future air quality effects associated with potential future oil and gas activity in the Uinta Basin. The ARMS Modeling Project provides data, models, and estimates of future air quality effects to facilitate BLM's future NEPA and land use planning efforts. A technical advisory group consisting of the BLM and other federal and state agencies including the UDAQ, USEPA, Forest Service, National Park Service (NPS), and USFWS reviewed the ARMS Modeling Project study and resulting documents. Detailed information regarding the ARMS modeling platform is available on the ARMS Modeling Project Website (BLM 2015c).

In accordance with the design of the ARMS Modeling Project, the ARMS modeling platform was used to estimate project effects for GCW Proposed Action. Specifically, the ARMS base year modeling, which includes meteorological data (AECOM and Sonoma Technology, Inc. 2013), emissions data (AECOM 2013b), and a model performance evaluation (AECOM and Sonoma Technology, Inc. 2014) were used. While the ARMS base year modeling was not modified, modifications were made to the future year simulations to explicitly account for the GCW project emissions. The future year simulations summarized and reported in this chapter and in **Appendix J** are modifications of the ARMS Modeling Platform 2021 'On-the-Books' regional emissions scenario (AECOM 2013). The 2021 On- the Books regional emissions scenario incorporated reasonably foreseeable future oil and gas development, as well as estimates of future emissions based economic and development projections and federal and state regulations (often referred to as 'on-the-books' regulatory requirements). Specifically, results presented in this Chapter anticipate that 1,412 less wells will be developed in Uintah County than the ARMS Modeling Project assumed.

In order to assess the GCW Project effects, two modeling scenarios are presented:

1) A 2022 future year simulation of Alternative B with project emissions from year 7, the year with the maximum NO_X project emissions.
2) A 2022 future year simulation of Alternative B with project emissions from year 15, the year with the maximum VOC project emissions.

Since NO_X and VOC are ozone precursors, modeling the project year with both the maximum VOC and NO_X emissions provides an assessment of potential project ozone effects under varying VOC-to-NO_X project emissions ratios.

Air Quality Effects

To quantify the effect of the GCW Project on ambient air quality, the modeling results are compared with applicable standards and thresholds. Model-predicted concentrations of NO_2, CO, SO_2, ozone, $PM_{2.5}$, and PM_{10} are summarized and reported. The CMAQ results were post-processed to conduct the following analyses.

- Comparison of modeled cumulative air quality effects to the applicable AAQS. For ozone and $PM_{2.5}$, this analysis was conducted using two techniques:
  - model-predicted, absolute effects; and
  - model-adjustment method for both monitored and unmonitored areas.[1]

  These two techniques provide a range of potential effects, which helps to bound model uncertainty.

[1] More detailed information about these techniques is provided in the Air Quality Technical Support Document (**Appendix J**).

- Comparison of Project air quality effects to the applicable PSD increments. While the effects are numerically compared to PSD increments, there is no formal assessment of increment consuming sources.[2]
- Comparison of modeled light extinction changes to visibility effect thresholds for Class I and sensitive Class II areas.
- Comparison of modeled sulfur and nitrogen deposition to deposition thresholds for nitrogen critical loads and ANC for sensitive water bodies.

Each air quality parameter, the method used to process modeling results, and the threshold for comparison are presented in **Table 4.3-1**. Air quality and visibility effects are reported for the Uinta Basin Study Area, monitors in the Uinta Basin Study area, and Class I areas and sensitive Class II areas as stated in Section 3.3.2.5. Deposition and acidification are reported at the Sensitive Lakes listed in Section 3.3.2.5. A more detailed description of the CMAQ model, the model-adjustment method, and modeling effect analysis can be found in **Appendix J**.

Table 4.3-1 Metrics Analyzed for Air Quality and Air Quality-Related Values

Parameter	Averaging Period	Method or Statistic Used to Analyze Effects	Threshold for Comparison
NO_2	1-hour	98th Percentile Daily Maximum Absolute Concentration	AAQS
	Annual	Annual Average Absolute Concentration	AAQS and PSD Increment
CO	1-hour	Maximum Absolute Concentration	AAQS
	8-hour	Maximum Absolute Concentration	AAQS
SO_2	1-hour	99th Percentile Daily Maximum Absolute Concentration	AAQS
	3-hour	Maximum Absolute Concentration	AAQS and PSD Increment
	24-hour	Maximum Absolute Concentration	PSD Increment
	Annual	Annual Average Absolute Concentration	PSD Increment
Ozone	8-hour	4th high Absolute Concentration, Modeled Attainment Test Software (MATS) Monitored and Unmonitored Area Analyses	AAQS
$PM_{2.5}$	24-hour	98th Percentile Absolute Concentration, MATS Monitored and Unmonitored Area Analyses	AAQS and PSD Increment
	Annual	Annual Average Concentration, MATS Monitored and Unmonitored Area Analyses	AAQS and PSD Increment
PM_{10}	24-hour	98th Percentile Absolute Concentration	AAQS and PSD Increment
	Annual	Annual Average Concentration	PSD Increment

[2] These demonstrations are for informational purposes only and are not regulatory PSD Increment consumption analyses, which are completed as necessary during the permitting process.

Table 4.3-1 Metrics Analyzed for Air Quality and Air Quality-Related Values

Parameter	Averaging Period	Method or Statistic Used to Analyze Effects	Threshold for Comparison
Visibility	Annual	Absolute number of days maximum incremental change over both 0.5 delta deciview (Δdv) and 1.0 Δdv, 98th Percentile Incremental Change	Number of days that exceed 1.0 Δdv
Nitrogen Deposition	Annual	Total annual deposition flux over the assessment area	Nitrogen Critical Load, Deposition Analysis Threshold
Sulfur Deposition	Annual	Total annual deposition flux over the assessment area	Deposition Analysis Threshold
Acidification	Annual	Total annual acidification over the assessment area	NA
ANC	Annual	Absolute model-predicted change in ANC relative to measurements	10% for lakes with a background ANC >25 µeq/L 1 µeq/L for lakes with a background <25 µeq/L

Source: **Appendix J**.

Visibility

Under the Clean Air Act, visibility has been established as a critical resource for mandatory Class I areas. Particulate matter in the atmosphere contributes to visibility degradation by both scattering and absorption of visible light. The combined effect of scattered and absorbed light is called light extinction.

Visibility effects were calculated using the IMPROVE equation as documented in the FLAG Phase 1 Report – Revised (FLAG 2010) which calculates light extinction as a function of relative humidity for large particles, small particles and sea salt particles. Relative humidity adjustment factors are required because some particles (e.g., ammonium sulfate and ammonium nitrate) can absorb water, increasing their size and light scattering. Site specific monthly relative humidity factors and background concentration data are based on data in the FLAG guidance (2010).

Deposition

Atmospheric deposition has been established as an AQRV because of the ecological effects of increased nutrient loading and acidification resulting from airborne nitrogen and sulfur compounds deposited in sensitive areas. The effects of nitrogen and sulfur deposition on terrestrial and aquatic ecosystems are well-documented and have been shown to cause leaching of nutrients from soils; acidification of soils, groundwater, and surface waters; injury to high elevation vegetation; and changes in nutrient cycling and species composition. Related to acidification, ANC is a measure of the ability of a water body to neutralize atmospheric deposition; reduction in ANC can be detrimental to the chemistry of sensitive aquatic ecosystems.

For the deposition effect analysis, the potential nitrification and acidification effects to terrestrial and aquatic ecosystems are assessed as a result of model-predicted nitrogen and sulfur deposition. Nitrification and acidification effects to terrestrial and aquatic ecosystems are analyzed at Class I areas, sensitive Class II areas, and sensitive lakes for both model simulations.

Model Limitations

All models are simply tools that are developed to provide an estimate or prediction. As a consequence of using models to estimate real world phenomena, there are inherent uncertainties and biases that are helpful to understand when interpreting model results. In the case of photochemical models there are uncertainties in the model inputs, and model formulation (chemical reactions, transport, removal rates, etc.). For example, in many cases, model inputs, such as emissions, boundary conditions, or meteorology, are based on estimates or averages. For the emissions, the best available datasets available at the time of the development of the ARMS model regional emission inventory were used. This is the acceptable and standard approach for modeling assessments conducted for NEPA analyses. More recent emission inventory datasets may include more current information or new methods to estimate emissions from specific sources. In particular, more recent emissions data are available for the emissions of ammonia sources, oil and gas sources, Continuous Emission Monitoring at Electrical Generating Units point sources, and other point sources since the ARMS emission inventory was finalized. The emission inventory data is one component of the total overall model uncertainty. The model uncertainty further increases when modeling future conditions, which requires estimates of future emissions for all emission sources (e.g., industrial, electric generation, motor vehicle, biogenic, etc.). The assumptions used to estimate future emissions affect the modeled environment and can likewise affect the model's prediction of the project's effects.

In order to estimate the model bias, the model values are compared to monitored values. This type of analysis provides information regarding whether the model values are biased high or low relative to observations. Knowing the direction of the model biases can be helpful when interpreting the results. For example, the ARMS model under-predicts ozone concentrations in the Uinta Basin from January to May, and over-predicts concentrations from June to October, (AECOM and Sonoma Technology, Inc. 2014). The time series and statistical analyses conducted to compare modeled concentrations to observed ozone indicate the model generally was able to reproduce elevated ozone concentrations but not always the peak concentrations, particularly during winter months (AECOM and Sonoma Technology, Inc. 2014). The ability of the model to reproduce peak concentrations is important due to the use of peak 8-hour average values for comparison to AAQS. As a result of this low bias during winter, it is possible that the absolute model results for the GCW project could potentially under-predict maximum ozone concentrations. Indeed, when model results are adjusted for model bias the adjusted results predicts impacts are higher than the absolute (or unadjusted) impact. To minimize model bias and help bound model uncertainty, GCW project effects for ozone and $PM_{2.5}$ are presented for both model-predicted absolute concentrations and model-adjusted concentrations.

Model performance for gas-phase criteria pollutants other than ozone was analyzed; however, photochemical models are not formulated to assess effects of NO_2, CO, and SO_2.near project sources. The near-field modeling results are more appropriate to assess potential effects of these pollutants for comparison to applicable AAQS.

4.3.1 Direct and Indirect Effects

Summary of Impacts for Alternative A, C, and D

Although the emissions inventory for Alternative A was not analyzed directly, it is anticipated that the emissions and corresponding impacts would be lower than those for Alternative B. Relative to current operations, connecting existing wells to the LGS is estimated to reduce direct GHG emissions while indirect GHG emissions are expected to remain unchanged. Criteria pollutant and HAPS effects under Alternative A would be the same or less than the effects under Alternative B. It is possible that the model-predicted ozone exceedences predicted for Alternative B also would occur for Alternative A. Although visibility and deposition effects were not directly assessed for Alternative A, it is anticipated that the effects on visibility and deposition from Alternative A would be similar or less than those discussed for Alternative B. While not directly modeled, one can infer the improvement in visibility and deposition due to connecting the LGS to existing wells and central facilities, as discussed in Section 2.2.1, by an

assessment of NO_X, PM_{10}, $PM_{2.5}$, and SO_2 emissions reductions. For more detailed descriptions of impacts from Alternatives A, C, and D (see Sections 4.3.1.1, 4.3.1.3, 4.3.1.4, respectively).

Summary of Impacts for Alternative B

As part of Alternative B (EOG 2013), EOG is proposing to drill up to 2,808 new over 15 years infill natural gas wells to continue development of currently known productive formations underlying lands in the GCWPA. In order to estimate the effects of this project on air quality and climate several analyses were conducted.

First, an emissions inventory was developed to include all emission sources that would result from Alternative B in the GCWPA. The sources associated with the project consist of well site emissions, both from the well development phase (i.e., construction, drilling, and completion activities) and well production phase (i.e., emissions from active, producing wells), and centralized facilities. A detailed description of the development of the GCWPA Alternative B emission inventory including the benefit attributed to connecting the new project wells to the LGS is found in **Appendix J**. In recognition of elevated ozone levels in the Uinta Basin, EOG has developed a comprehensive strategy for minimizing the generation of additional ozone precursor emissions as indicated in **Appendix C**.

Second, total GHG emissions are estimates as a sum of direct emissions actually emitted as part of the project and indirect emissions emitted from combustion of the produced oil and gas. The total GHG emissions estimated for the duration of the project under Alternative B is 162 MMTCO2e. As it is not possible to assign a “significance” value or impact to these numbers, the emissions estimates themselves are presented as a proxy for potential climate effects.

Third, a near-field modeling assessment was performed to estimate maximum potential impacts on criteria pollutants (PM_{10}, $PM_{2.5}$, NO_X, SO_2, and CO) and hazardous air pollutants. Near-field modeling refers to the assessing the potential air impacts in the immediate vicinity of a single or closely-spaced group of well pads. Emissions from drilling and production phases of development were evaluated to determine which emissions activities are likely to produce the maximum criteria pollutant impacts. The highest modeled concentration for all pollutants and averaging times for Alternative B are summarized below and the details are presented in **Appendix J**. Analysis of the pollutant and averaging periods indicate high values of 1-hour NO_2, however violations of the 1-hour NO_2 NAAQS are not anticipated. Peak impacts for 1-hour NO_2 drilling are predicted to occur on the perimeter of the drilling pad. Near-field HAPs concentrations from production activities were assessed relative to short-term (acute) exposure and long-term chronic and carcinogenic risk. Model results indicate that HAP concentrations would be within the acceptable limits. Although the one-in-one million cancer risk for benzene is predicted to be exceeded, impacts are below one-in-ten thousand.

Fourth, the CMAQ photochemical model was used to estimate the regional impacts of criteria pollutants, visibility, and deposition. Ambient air quality effects from the Alternative B project years 7 and 15 were compared with applicable standards. The model predicts that ozone concentrations for Alternative B would exceed the AAQS in the Uinta Basin Study Area and the Uintah and Ouray Indian Reservation. Absolute model-predicted and model adjusted effects estimate that Alternative B would contribute 1.5 ppb to the total modeled 75 ppb ozone concentrations at the Ouray AQS site and up to 5.9 ppb at other locations throughout the Basin. All other criteria pollutant concentrations are predicted to be below applicable AAQS for Alternative B. Although not a formal increment consumption analysis, the model-predicted effects for the Alternative B are estimated to be less than PSD increment values for all pollutant and averaging times. Additional information regarding the model-predicted effects relative to all AAQS and PSD increments are presented in the Air Quality Technical Support Document (**Appendix J**).

Visibility effects to occur under Alternative B were modeled for the annual average natural conditions and for the best 20 percent natural conditions for both project year 7 and 15. Neither of these years are predicted to have days with visibility impacts greater than 0.5 ∆dv (the amount just able to be perceived by the human eye) at federally protected Class I areas. Three sensitive Class II areas were predicted to have visibility impacts greater than 0.5 ∆dv relative to the annual average natural conditions.

The regional model predicted nitrogen and sulfur deposition for Alternative B year 7 and 15. The cumulative nitrogen deposition critical load is exceeded at most areas analyzed during both years 7 and 15. Alternative B is predicted to contribute less than the Deposition Analysis Threshold for nitrogen deposition, except at Dinosaur National Monument and Uintah and Ouray Indian Reservation. The sulfur Deposition Analysis Threshold is not exceeded at any area analyzed. The project effects are predicted to be within the limit for acceptable change for all sensitive lakes. For more detailed descriptions of impacts from Alternative A (see Section 4.3.1.2).

4.3.1.1 Alternative A—No Action

Alternative A represents the continuation of current land management practices in the GCWPA. Air quality effects include oil and gas activities from previously approved projects and other reasonably foreseeable future actions, including the Chapita Wells Unit LGS and the Chapita Wells Electrification System.

The LGS has been designed to provide substantial near-term reductions in air emissions from 47 percent of existing wells within the GCWPA. Criteria and hazardous air pollutant emissions from existing wells that have been or will be connected to the LGS Phase 1 are anticipated to be reduced by between 62 percent and 96 percent, depending on the pollutant (BLM 2013a). The emissions reductions from existing wells that will be connected to the LGS Phase 2 are anticipated to be similar to Phase 1.

Alternative A Emissions Inventory Summary

Although the emissions inventory for Alternative A was not analyzed directly, it is anticipated that the emissions would be lower than those for Alternative B. The Alternative A emission inventory would consist of all existing regional emissions within the analysis area, but exclude project-specific emissions associated with any further development proposed under the Alternative B. The GCWPA Alternative A emissions includes the following sources:

- Existing well production phase (i.e., emissions from active, producing non-Project wells in the GCWPA);
- GCWPA midstream compressor engines (the Project does not include construction of any new midstream sources);
- Central facilities, pipelines, and an electrical distribution system (i.e., central facilities permitted under the current approved projects [BLM 2013g, 2012d]); and
- Drilling and completion of up to 462 wells approved in previous NEPA evaluations.

Effects to Climate

Relative to current operations, connecting existing wells to the LGS is estimated to reduce direct GHG emissions by 13.6 Million Metric Tons of CO_2 equivalent ($MMTCO_{2e}$). Indirect GHG emissions are expected to remain unchanged since installation of the LGS does not affect projected production. Therefore, Alternative A is expected to reduce total GHG emissions by 13.6 $MMTCO_{2e}$ relative to current operations.

Effects to Criteria Pollutants

Maximum potential criteria pollutant effects from emission sources under Alternative A only includes sources that would continue to operate under Alternative A. Criteria pollutant effects under Alternative A would be the same or less than the effects under Alternative B. It is possible that the model-predicted ozone exceedences predicted for Alternative B also would occur for Alternative A.

Effects to Toxics

H_2S is a flammable, colorless gas that can be toxic at extremely low concentrations and is a component of some natural gas from the GCWPA. EOG has developed a worker safety program for H_2S to limit its effects, as discussed in Section 2.6.4.1.

Although Alternative A HAPs concentrations were not modeled, the effect to HAPs would be equivalent to or less than the model estimates shown for the Proposed Action Alternative (Section 4.3.1.2), which for near-field HAPs concentrations were all below the acute and chronic inhalation levels, and showed the incremental cancer risk to be within acceptable limits.

Effects at Class I and II Areas – Visibility

Although visibility effects were not directly assessed for Alternative A, the effects analysis presented in Section 4.3.1.2 for Alternative B indicated that there would be no days with a contribution to visibility greater than a 10 percent increase in the light extinction coefficient (1.0 Δdv) at listed Class I. It is anticipated that the effects on visibility from Alternative A at both Class I and sensitive Class II areas would be similar or less than those discussed for Alternative B.

While not directly modeled, one can infer the improvement in visibility due to connecting the LGS to existing wells and central facilities, as discussed in Section 2.2.1, by an assessment of NO_X, PM_{10}, $PM_{2.5}$, and SO_2 emissions reductions. NO_X, PM_{10}, $PM_{2.5}$, and SO_2 contribute to visibility impairment either directly (in the case of PM_{10} and $PM_{2.5}$) or indirectly after chemical reactions in the atmosphere (in the case of NO_X and SO_2). The anticipated emission reductions for existing wells within the GCWPA and central facilities connected to the LGS are shown for each year of the project in **Table 4.3-2**.

Effects at Class I and II Areas – Deposition

Although atmospheric deposition effects were not modeled specifically for Alternative A, effects from project-related sources are anticipated to be similar or less than Alternative B.

While not directly modeled, one can infer the improvement in deposition when existing wells within the GCWPA and central facilities are connected to the LGS, as discussed in Section 2.2.1, by an assessment of NO_X and SO_2 emissions reductions. The emission reductions are shown in **Table 4.3-2**. NO_X and SO_2 contribute to deposition when these compounds are converted into other compounds that are readily removed from the atmosphere and deposited to soils, vegetation, and waterbodies.

Table 4.3-2 Emission Reductions Anticipated When Existing Wells and Central Facilities Are Connected to the LGS

Year	LGS Emissions Reductions Summary (tpy)			
	NO_X	PM_{10}	$PM_{2.5}$	SO_2
1	-23	-10	-4	-1
2	-33	-21	-6	-1
3	-42	-29	-9	-2
4	-49	-34	-10	-2
5	-47	-37	-11	-2
6	-45	-32	-10	-2
7	-44	-27	-9	-2
8	-43	-23	-8	-2
9	-42	-20	-7	-2
10	-41	-17	-7	-2
11	-41	-14	-6	-2
12	-40	-11	-5	-2
13	-40	-9	-5	-2
14	-40	-7	-5	-2
15	-40	-6	-4	-2
16	-40	-6	-4	-2
17	-40	-6	-4	-2
18	-40	-5	-4	-2
19	-40	-4	-4	-2
20	-40	-4	-4	-2
21	-23	-10	-4	-1

Source: **Appendix J**.

4.3.1.2 Alternative B—Proposed Action

As part of Alternative B (EOG 2013), EOG is proposing to drill up to 2,808 new infill natural gas wells to continue development of currently known productive formations underlying lands in the GCWPA. EOG plans to drill infill wells at an average rate of approximately 187 wells per year, with a maximum annual rate of 252 wells. Drilling all the proposed wells at the estimated rate would require approximately 15 years. The productive life of each well would be approximately 40 years. For the purpose of analysis, all wells are assumed to be productive. The ultimate recovery from each well would vary depending on individual reservoir conditions.

Emissions Inventory Summary

The GCWPA emission inventory was developed to include all emission sources that would result from Alternative B in the GCWPA. The sources associated with the project consist of well site emissions, both from the well development phase (i.e., construction, drilling, and completion activities) and well production phase (i.e., emissions from active, producing wells), and centralized facilities. A detailed description of the development of the GCWPA Alternative B emission inventory is found in **Appendix J**. In recognition of elevated ozone levels in the Uinta Basin, EOG has developed a comprehensive strategy for minimizing the generation of additional ozone precursor emissions as indicated in

Appendix C. This strategy and associated commitments were accounted for in the emissions inventory to the extent that the commitments result in quantifiable emissions.[3] Alternative B emissions estimate by pollutant and by project year are shown in **Table 4.3-3**. **Table 4.3-4** shows the anticipated emissions benefits by project year (already accounted for in Alternative B) attributed to connecting the new project wells to the LGS.

Table 4.3-3 Alternative B Emissions by Pollutant and by Project Year

Project Year	NO_X (tpy)	VOC (tpy)	CO (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	HAPS (tpy)	CO_2 ($MMTCO_2e$)[1]	CH_4 ($MMTCO_2e$)	N_2O ($MMTCO_2e$)
1	145.9	229.5	151.1	92.8	19.4	0.3	7.7	0.03	0.02	0.00
2	286.5	532.3	272.2	207.2	42.5	0.7	17.9	0.05	0.04	0.00
3	488.9	1,045.2	451.0	362.7	73.9	1.2	34.9	0.08	0.09	0.00
4	497.2	1,447.7	486.5	409.4	82.4	1.3	47.1	0.09	0.12	0.00
5	494.2	1,843.9	503.8	409.0	81.9	1.4	59.0	0.10	0.16	0.00
6	497.2	2,236.6	525.4	433.6	86.3	1.5	70.9	0.11	0.19	0.00
7	497.3	2,622.6	538.4	451.4	89.3	1.5	82.7	0.11	0.23	0.00
8	434.3	2,913.1	500.5	429.7	84.3	1.4	91.1	0.11	0.26	0.00
9	430.6	3,239.9	503.9	429.0	83.9	1.5	101.0	0.11	0.29	0.00
10	430.5	3,567.0	509.7	432.4	84.4	1.5	111.0	0.12	0.32	0.00
11	369.3	3,799.9	467.4	400.7	77.7	1.4	117.7	0.11	0.34	0.00
12	306.6	3,975.0	418.7	357.2	68.9	1.3	122.6	0.10	0.35	0.00
13	303.6	4,187.2	413.4	342.5	66.1	1.3	129.1	0.10	0.37	0.00
14	242.3	4,306.6	363.6	300.0	57.5	1.2	132.3	0.10	0.38	0.00
15	240.1	4,462.5	355.7	283.6	54.5	1.2	137.1	0.09	0.40	0.00
16	55.9	4,326.7	198.2	166.2	30.6	0.8	131.9	0.07	0.39	0.00
17	50.7	4,314.5	179.1	125.6	23.1	0.8	131.6	0.06	0.39	0.00
18	47.6	4,305.5	166.3	103.3	19.1	0.7	131.3	0.06	0.39	0.00
19	45.3	4,298.2	156.3	87.6	16.2	0.7	131.1	0.05	0.39	0.00
20	43.4	4,291.9	148.0	75.8	14.0	0.7	131.0	0.05	0.39	0.00
21	41.7	4,286.1	140.5	66.5	12.3	0.7	130.8	0.05	0.39	0.00

[1] $MMTCO_2e$: Million Metric Tons of CO_2 equivalent.

Source: **Appendix J**.

[3] One exception is that EOG has committed to connecting 47 percent of existing wells and a minimum of 51 percent of project wells to the LGS. The emissions inventory for assessing cumulative conditions is based on connecting 49 percent of existing wells and a 51 percent of project wells to the LGS. The difference between connecting 47 percent versus 49 percent of existing wells to the LGS is 31 wells may not ultimately be connected to the LGS that were assumed to be connected. As a result of overestimating the number of existing wells that may be connected to the LGS, the emissions inventory underestimates potential future emissions from those 31 existing wells. It is not anticipated that the differences attributed to these 31 wells would have a meaningful effect on modeling results. Over time the actual project impacts are likely to diverge from predicted impacts as assumptions required to estimate future activities diverge from actual activities. Note that the difference between 47 percent and 49 percent of existing wells does not affect the estimated Alternative B emissions which exclusively quantify emissions from project wells, not existing wells.

Table 4.3-4 Alternative B Emissions Benefits of Connecting Project Wells to the LGS by Project Year

Project Year	NO_X (tpy)	VOC (tpy)	CO (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	HAPS (tpy)	CO_2 ($MMTCO_2e$)[1]	CH_4 ($MMTCO_2e$)	N_2O ($MMTCO_2e$)
1	-11	-104	-44	-12	-2	-0.01	-3	-0.01	-0.01	-0.00
2	-17	-236	-55	-30	-6	-0.02	-7	-0.02	-0.02	-0.00
3	-29	-471	-82	-76	-15	-0.06	-14	-0.02	-0.03	-0.00
4	-46	-722	-127	-143	-27	-0.10	-22	-0.04	-0.05	-0.00
5	-59	-967	-164	-210	-40	-0.14	-30	-0.05	-0.07	-0.00
6	-62	-1,206	-186	-233	-44	-0.16	-37	-0.06	-0.09	-0.00
7	-63	-1,438	-200	-250	-47	-0.18	-44	-0.06	-0.11	-0.00
8	-62	-1,638	-210	-255	-48	-0.19	-50	-0.06	-0.12	-0.00
9	-59	-1,832	-213	-253	-47	-0.20	-56	-0.07	-0.14	-0.00
10	-59	-2,028	-219	-255	-48	-0.21	-62	-0.07	-0.15	-0.00
11	-57	-2,191	-223	-250	-47	-0.22	-68	-0.07	-0.17	-0.00
12	-54	-2,319	-220	-233	-44	-0.22	-71	-0.07	-0.18	-0.00
13	-51	-2,443	-215	-218	-41	-0.22	-75	-0.07	-0.19	-0.00
14	-49	-2,537	-211	-202	-38	-0.22	-78	-0.07	-0.20	-0.00
15	-47	-2,626	-203	-185	-35	-0.22	-81	-0.07	-0.20	-0.00
16	-41	-2,612	-182	-150	-28	-0.21	-81	-0.06	-0.20	-0.00
17	-36	-2,599	-162	-108	-20	-0.19	-80	-0.05	-0.20	-0.00
18	-33	-2,590	-149	-86	-16	-0.18	-80	-0.05	-0.20	-0.00
19	-30	-2,582	-139	-70	-13	-0.17	-80	-0.05	-0.20	-0.00
20	-28	-2,575	-131	-58	-11	-0.17	-80	-0.04	-0.20	-0.00
21	-27	-2,569	-124	-49	-9	-0.16	-80	-0.04	-0.20	-0.00

[1] $MMTCO_2e$: Million Metric Tons of CO_2 equivalent.

Source: **Appendix J**.

Effects to Climate

Climate change analyses are comprised of several factors including, but not limited to, GHG emissions, land use management practices, and the albedo effect. Climate change analysis for the purpose of this document focuses on accounting and disclosing of GHG emissions that may contribute to climate change (see Section 3.3.2.6 for information regarding climate science). In light of the difficulties in attributing specific climate impacts to individual projects, the projected GHG emissions are used as a proxy for assessing a Proposed Action's potential climate change impacts.

Direct greenhouse gas emissions are summarized in **Table 4.3-3**. Emission calculation includes direct emissions of carbon dioxide, methane, and nitrous oxide. Direct GHG emissions for Alternative B range from a maximum of 0.49 $MMTCO_2e$ at project year 15 to a minimum of 0.05 $MMTCO_2e$ at project year 1, which is approximately 175 tons of CO_2e per well at peak GHG emissions levels.

Indirect GHG emissions are estimated based on speculative annual oil, gas, and/or natural gas liquids production. For the GCWPA, indirect GHG emissions are calculated based on an assumed 100 percent combustion of the product which converts the fuel's carbon into CO_2. Estimated indirect GHG emissions

for Alternative B are shown in **Table 4.3-5**. As it is not possible to assign a "significance" value or impact to these numbers, the emissions estimates themselves are presented as a proxy for potential climate effects.

Table 4.3-5 Alternative B Indirect GHG Emissions by Project Year

Year	CO_2 ($MMTCO_2e$[1])		
	Condensate Production[2]	Gas Production[3]	Total
1	0.35	2.05	2.40
2	0.38	2.30	2.68
3	0.48	3.01	3.49
4	0.71	4.53	5.24
5	0.89	5.76	6.64
6	1.03	6.72	7.75
7	1.12	7.29	8.41
8	1.19	7.81	9.00
9	1.23	8.06	9.29
10	1.27	8.33	9.60
11	1.31	8.62	9.93
12	1.32	8.67	9.98
13	1.29	8.51	9.80
14	1.28	8.44	9.72
15	1.23	8.13	9.36
16	1.11	7.29	8.40
17	1.00	6.59	7.59
18	0.92	6.07	6.99
19	0.86	5.64	6.50
20	0.80	5.28	6.08
21	0.75	4.93	5.69

[1] $MMTCO_2e$: million metric tons of CO_2 equivalent.

[2] CO_2e emissions due to condensate production conservatively calculated using an oil indirect emission factor of 0.43 MT CO_2 per Barrel (USEPA 2016b).

[3] CO_2e emissions due to gas production conservatively calculated using a gas indirect emission factor of 0.054717 MT CO_2 per MCF (USEPA 2016b).

Source: Derived from **Appendix J**.

Although this EIS presents an estimate of potential GHG emissions associated with estimated production levels, there is substantial uncertainty in GHG emission estimates due to uncertainties with regard to eventual production volumes and variability in flaring, construction, and transportation. It is important to note that the BLM does not exercise control over the specific end use of the oil and gas produced from any EIS. The BLM has no authority to direct or regulate the end use of the produced oil, condensate, and/or gas. As a result, the BLM can only provide an estimate of potential GHG emissions using national approximations of where or how the end use may occur because oil, condensate, and natural gas could be used for combustion of transportation fuels, fuel oils for heating and electricity generation, as well as production of asphalt and road oil, and the feedstocks used to make chemicals, plastics, and synthetic materials.

The estimates shown in **Table 4.3-6** provide a comprehensive estimate of GHG emissions from the first step of inspecting the area for potential well site development through final site reclamation and also include indirect emissions emitted by combustion of the final product. A rough estimate of GHG emissions was possible using publicly available information and using estimates from future production.

Table 4.3-6 Alternative B Total Direct and Indirect GHG Emissions by Project Year

Year	CO_2 ($MMTCO_2e$[1])		
	Total Direct[2]	Total Indirect[3]	Total
1	0.05	2.40	2.45
2	0.09	2.68	2.77
3	0.17	3.49	3.66
4	0.21	5.24	5.45
5	0.26	6.64	6.90
6	0.3	7.75	8.05
7	0.34	8.41	8.75
8	0.37	9.00	9.37
9	0.4	9.29	9.69
10	0.44	9.60	10.04
11	0.45	9.93	10.38
12	0.45	9.98	10.43
13	0.47	9.80	10.27
14	0.48	9.72	10.20
15	0.49	9.36	9.85
16	0.46	8.40	8.86
17	0.45	7.59	8.04
18	0.45	6.99	7.44
19	0.44	6.50	6.94
20	0.44	6.08	6.52
21	0.44	5.69	6.13
Total	7.65	154.54	162.19

[1] $MMTCO_2e$: million metric tons of CO_2 equivalent.

[2] Source: **Appendix J**.

[3] Source: USEPA 2016b.

Also, there is uncertainty with regard to the net effects of GHG emissions on climate – that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. Inconsistencies in the results of scientific models designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science at the present time. As part of Alternative B, air quality control measures discussed in Section 2.2 would be applied to project emissions sources. Control measures designed to reduce VOC emissions are expected to also reduce direct GHG emissions via the control of CH_4, which is co-emitted with VOCs from natural gas sources.

Effects to Criteria Pollutants

In order to quantify the effects to criteria pollutants under Alternative B, two types of modeling assessments were completed. The near-field modeling assessed the project effects within and nearby the GCWPA, while the regional modeling assessed project effects across the region.

Near Field Modeling Results

A near-field criteria pollutant assessment was performed to estimate maximum potential effects of PM_{10}, $PM_{2.5}$, NO_X, SO_2, and CO from emissions sources that are likely to operate during the drilling and production phases of the GCW Project. Emissions from each phase of field development and production were evaluated to determine which emissions activities are likely to produce the maximum pollutant effects. Four modeling scenarios were developed and evaluated for each case. Both single well pad and section-scale multi-pad well drilling scenarios were evaluated to determine the effects of well development emissions and the combined effects of well development and existing well density on criteria pollutant concentrations. The single well model scenario consists of one multi-well pad with eight wells. The section, multi-pad well scenario consists of 15 existing well pads in a single section where the wells are unconnected to the LGS. In addition to the two drilling scenarios, effects of emissions from the production phase for both a single well pad and section multi-pad are analyzed through AERMOD. The modeling scenarios are:

- Single pad drilling;
- Section multi-pad drilling/production;
- Single pad production; and
- Section multi-pad production.

The different scenarios are designed to capture the maximum air quality effects from the GCW Project. The emissions totals modeled in each scenario are shown in **Table 4.3-7**. The emissions totals are calculated in accordance with averaging periods for existing ambient standards. Total emissions modeled for 1 year. All sources are assumed to emit 365 days per year.

Table 4.3-7 Total Emissions Modeled with AERMOD by Modeling Scenario

Scenario	Analysis Type	NO_X		SO_2			PM_{10}		$PM_{2.5}$		CO	
		1-hour (lbs)	Annual (lbs)	1-hour (lbs)	24-hour (lbs)	Annual (lbs)	24-our (lbs)	Annual (lbs)	24-hour (lbs)	Annual (lbs)	1-hour (lbs)	8-hour (lbs)
Drilling	Single	74.57	3.12	0.22	0.22	0.02	2.44	0.09	2.37	0.09	49.14	49.14
Drilling	Section	119.02	35.22	1.23	1.23	0.38	4.90	1.56	4.21	1.29	180.12	180.12
Production	Single	8.71	2.14	0.07	0.07	0.02	0.42	0.05	0.41	0.05	11.02	11.02
Production	Section	52.65	34.66	1.08	1.08	0.38	2.49	1.14	2.21	1.27	143.29	143.29

Source: **Appendix J**.

Tables 4.3-8 through **4.3-12** present the near field modeling results for the four modeling scenarios. Maximum air quality effects resulting from the GCW Project drilling and production activities within the GCWPA were added to representative background concentrations, and the resulting concentrations for Alternative B were below the levels AAQS for all pollutant and averaging times analyzed.

Table 4.3-8 Single Pad Drilling Scenario Criteria Pollutant Effects

Pollutant	Averaging Period	Background (µg m^3)	Modeled Concentration (µg/m^3)	Modeled Concentration and Background (µg/m^3)	NAAQS (µg/m^3)	Percent of NAAQS	Complies with NAAQS
CO	8-hour	1.7	184.2	185.9	10,000	1.9	Yes
CO	1-hour	4.4	824.7	829.1	40,000	2.1	Yes
PM_{10}	24-hour	104.0	3.2	107.2	150	71	Yes
$PM_{2.5}$	Annual	8.0	0.013	8.0	12	67	Yes
$PM_{2.5}$	24-hour	25.5	1.1	26.6	35	76	Yes
NO_2	Annual	13.2	0.38	13.5	100	14	Yes
NO_2	1-hour	*	186.3	186.6	188	99	Yes[1]
SO_2	1-hour	*	46.3	46.3	196	24	Yes
SO_2	3-hour	*	30.1	30.1	1,310	2.3	Yes

[1] Compliance with the NAAQS is based on the 98th percentile daily maximum 1-hour NO_2 concentration, which is consistent with the form of the NAAQS. Values in **Figure 4.3-1** show the maximum 1-hour NO_2 concentrations.

* Model used hourly and seasonal background values as recommended in USEPA modeling clarification memo (USEPA 2011c).

Source: **Appendix J**.

1

Table 4.3-9 Section Multi-pad Drilling/Production Scenario Criteria Pollutant Effects

Pollutant	Averaging Period	Background (µg/m^3)	Modeled Concentration (µg/m^3)	Modeled Concentration and Background (µg/m^3)	NAAQS (µg/m^3)	Percent of NAAQS	Complies with NAAQS
CO	8-hour	1.7	190	192	10,000	1.9	Yes
CO	1-hour	4.4	826	830	40,000	2.1	Yes
PM_{10}	24-hour	104.0	3.2	107	150	71	Yes
$PM_{2.5}$	Annual	8.0	0.4	8.4	12	70	Yes
$PM_{2.5}$	24-hour	25.5	1.1	26.6	35	76	Yes
NO_2	Annual	13.2	1.0	14.2	100	14	Yes
NO_2	1-hour	*	186.7	186.7	188	99	Yes[1]
SO_2	1-hour	*	46.3	46.3	196	24	Yes
SO_2	3-hour	*	30.1	30.1	1,310	2.3	Yes

[1] Compliance with the NAAQS is based on the 98th percentile daily maximum 1-hour NO_2 concentration, which is consistent with the form of the NAAQS. Values in **Figure 4.3-2** show the maximum 1-hour NO_2 concentrations.

* Model used hourly and seasonal background values as recommended in USEPA modeling clarification memo (USEPA 2011c).

Source: **Appendix J**.

2

Table 4.3-10 Single Pad Production Scenario Criteria Pollutant Effects

Pollutant	Averaging Period	Background ($\mu g/m^3$)	Modeled Concentration ($\mu g/m^3$)	Modeled Concentration and Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of NAAQS	Complies with NAAQS
CO	8-hour	1.7	58.2	59.9	10,000	0.6	Yes
CO	1-hour	4.4	207.3	211.6	40,000	0.5	Yes
PM_{10}	24-hour	104.0	0.69	104.7	150	69.8	Yes
$PM_{2.5}$	Annual	8.0	0.010	8.0	12	66.8	Yes
$PM_{2.5}$	24-hour	25.5	0.23	25.7	35	73.5	Yes
NO_2	Annual	13.2	0.29	13.4	100	13.4	Yes
NO_2	1-hour	*	87.9	87.9	188	46.8	Yes
SO_2	1-hour	*	46.1	46.1	196	23.5	Yes
SO_2	3-hour	*	29.8	29.8	1,310	2.3	Yes

* Model used hourly and seasonal background values as recommended in USEPA modeling clarification memo (USEPA 2011c).

Source: **Appendix J**.

1

Table 4.3-11 Section Multi-pad Production Scenario Criteria Pollutant Effects

Pollutant	Averaging Period	Background ($\mu g/m^3$)	Modeled Concentration ($\mu g/m^3$)	Modeled Concentration and Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of NAAQS	Complies with NAAQS
CO	8-hour	1.7	59.6	61.3	10,000	0.6	Yes
CO	1-hour	4.4	241.2	245.6	40,000	0.6	Yes
PM_{10}	24-hour	104.0	2.4	106.4	150	71.0	Yes
$PM_{2.5}$	Annual	8.0	0.42	8.4	12	70.2	Yes
$PM_{2.5}$	24-hour	25.5	0.27	25.8	35	73.6	Yes
NO_2	Annual	13.2	1.0	14.1	100	14.1	Yes
NO_2	1-hour	*	86.9	86.9	188	46.2	Yes
SO_2	1-hour	*	46.1	46.1	196	23.5	Yes
SO_2	3-hour	*	29.8	29.8	1,310	2.3	Yes

* Model used hourly and seasonal background values as recommended in USEPA modeling clarification memo (USEPA 2011c).

Source: **Appendix J**.

2

Table 4.3-12 Maximum Modeled Concentrations for 1-hour NO_2

Scenario	NAAQS (µg/m^3)	Background (µg/m^3)	Modeled Concentration (µg/m^3)	Modeled Concentration and Background (µg/m^3)	Exceed the NAAQS
Single Pad Drilling Scenario	188	*	**308.7**	**308.7**	Yes[1]
Multi-pad Drilling/Production Scenario	188	*	**309**	**309**	Yes[1]

[1] Compliance with the NAAQS is based on the 98th percentile daily maximum 1-hour NO^2 concentrations, which is consistent with the form of the NAAQS. Values in **Table 4.3-12** are the maximum concentrations and not directly comparable to the NAAQS.

* Model used hourly and seasonal background values as recommended in USEPA modeling clarification memo (USEPA 2011c).

Source: **Appendix J**.

While no violations of the NAAQS are predicted to occur (as shown in **Tables 4.3-8** through **4.3-11**), NAAQS may be exceeded without causing a violation. For example, modeled concentrations may exceed the value of the NAAQS (as is shown in **Table 4.3-12**), but this concentration may or may not ultimately contribute to a violation once a formal review is conducted by federal and state agencies. In the case of the 1-hour NO_2 NAAQS, ambient air concentrations of NO_2 can exceed the level of the NAAQS frequently provided that the three year average of the 98th percentile peak daily 1-hour NO_2 concentrations is below the NAAQS. If the three year average of the 98th percentile peak daily 1-hour NO_2 concentrations exceeds the NAAQS, it may be determined that there has been a violation. Often a violation is based on measured air quality conditions rather than model-predicted impacts.

The highest modeled concentration for all pollutants and averaging times are presented in **Appendix J**. The only pollutant and averaging period that exceed the NAAQS is 1-hour NO_2 for some scenarios, but violations of the 1-hour NO_2 NAAQS are not anticipated (as shown in **Tables 4.3-8** through **4.3-11**). **Table 4.3-12** shows the highest modeled concentration for 1-hour NO_2 for the single pad drilling and section multi-pad drilling/production scenarios, which is a combined scenario that includes both production and drilling emission sources. The section-scale multi-pad production scenario did not exceed NAAQS.

Figures 4.3-1 and **4.3-2** display the spatial extent of the 1-hour NO_2 exceedences for the single pad drilling and section multi-pad drilling/production scenarios, respectively. These are the only criteria pollutant plots presented because these are the only scenarios with maximum modeled concentrations that exceed NAAQS. For the section multi-pad drilling/production scenario, the impacts are dominated by the drilling emission sources. Therefore, the figure is shown for a drilling array scenario. The drilling array scenario includes drilling emission sources for multi-well pads within a square mile section. The bold contour shows the concentration of the NAAQS (188 µg/m^3) and the dark blue dots indicate receptors with concentrations that exceed the NAAQS. For the single pad drilling, the maximum modeled concentration within the modeling domain (308.7 µg/m^3) occurred at a receptor on the perimeter of the drilling pad (light blue dot). For the drilling array scenario, the maximum modeled concentration within the modeling domain (309.0 µg/m^3) occurred at a receptor on the perimeter of the drilling pad (light blue dot). A list of all modeled exceedences of the 1-hour NO_2 NAAQS for the single pad drilling and multi-pad drilling/production scenarios as well as their dates and times are shown in **Appendix J** along with a description of the meteorological conditions during each event.

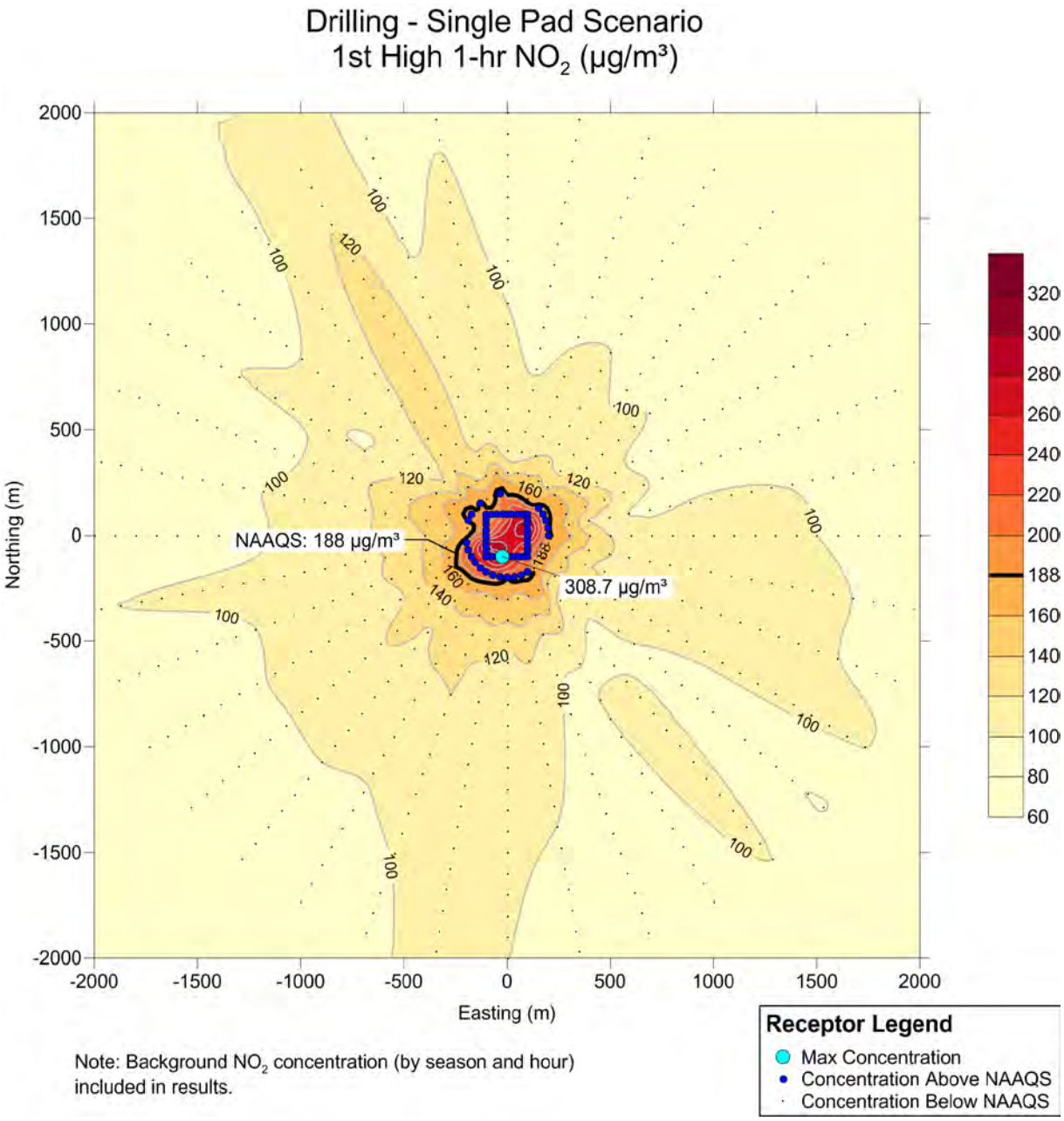


Figure 4.3-1 Spatial Extent of the Exceedences of the 1-hour NO_2 NAAQS for the Single Pad Drilling Scenario

1

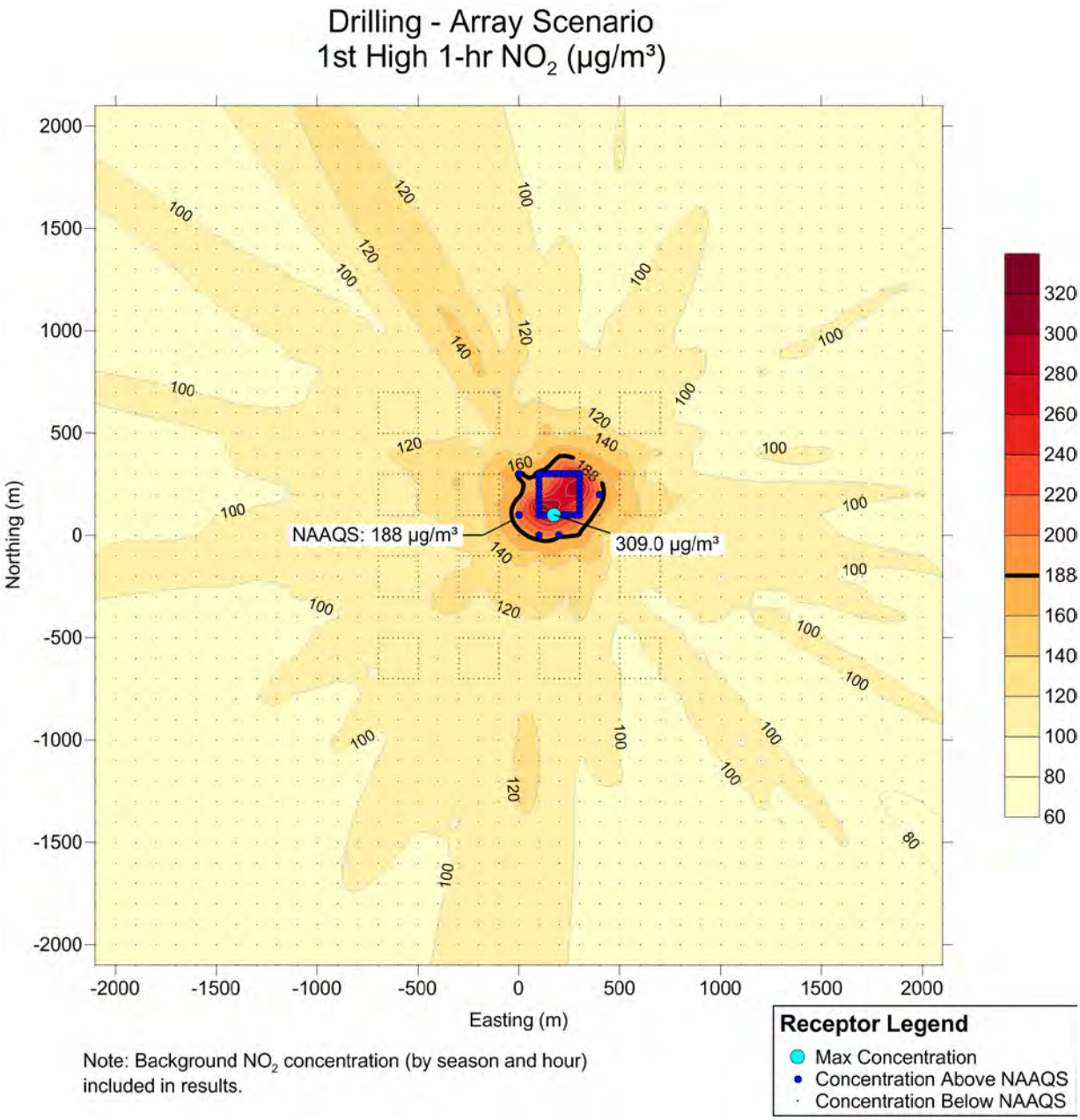


Figure 4.3-2 Spatial Extent of the Exceedences of the 1-hour NO_2 NAAQS for the Multi-pad Drilling/Production Scenario

Regional Modeling Results

The CMAQ photochemical model was used to estimate the regional effects on criteria pollutants, visibility, and atmospheric deposition within the cumulative effect study area as discussed in **Appendix J**. Ambient air quality effects from the Alternative B emissions inventory for project years 7 and 15 were compared with applicable AAQS. In addition, results were processed for comparison with Class I and sensitive Class II PSD Increment values. The assessment of effects relative to PSD

increments is provided for informational purposes only and does not represent a regulatory PSD increment consumption analysis.

As discussed previously, regional modeling results for ozone and $PM_{2.5}$ are provided for both model-predicted absolute effects as well as model-adjusted effects. The model-predicted absolute effects for ozone are shown in **Table 4.3-13**. The model-adjusted ozone effects using the MATS tool are presented in **Tables 4.3-14** and **4.3-15** for monitored and unmonitored locations, respectively. The MATS tool is an USEPA developed analysis tool used to analyze model predicted estimates of ozone, visibility and $PM_{2.5}$. The observed baseline monitor design values shown in **Table 4.3-14** represent the 2010 design values. These values are used when the MATS tool calculates the 2021 future design value with Y15 project emissions and 2021 future design value with Y7 project emissions. The impacts of Y15 and Y7 Project emissions are calculated using the 2021 Future design values and the future base modeling scenario discussed in **Appendix J**. The model predicts that ozone concentrations for Alternative B would exceed the AAQS in the Uinta Basin Study Area, which is comprised of portions of Uintah, Duchesne, Grand and Emery Counties, and the Uintah and Ouray Indian Reservation. Absolute model-predicted effects estimate that Alternative B would contribute 1.5 ppb to the total modeled 75 ppb ozone concentrations at the Ouray AQS site. Model adjusted results with the MATS tool show that the highest effect at an existing monitor would be 2.1 ppb of the total estimated 78.8 ppb concentrations at the Ouray AQS site. The unmonitored area analysis predicts that the highest project effects of 5.9 ppb would occur within the Uinta Basin Study Area when ozone concentrations could be 87.3 ppb for Alternative B.

All other criteria pollutants concentrations are predicted to be below applicable AAQS for Alternative B.

Table 4.3-13 Model-Predicted Ozone Effects (ppb) for Year 15 and Year 7

Receptor Site\Area	8-hr Average 4th high Absolute Concentration Daily Max.			
	Year15 Total	Year 15 Project Impact	Year 7 Total	Year 7 Project Impact
Uinta Basin Study Area				
Uinta Study Area	**84.8**	0.4	**85.1**	0.7
Dinosaur AQS Station	**72.0**	0.1	**72.0**	0.1
Ouray AQS Station	**75.3**	1.5	**74.3**	0.6
Rangely AQS Station	70.2	0.1	70.2	0.1
Redwash AQS Station	**71.0**	0.2	**71.0**	0.1
Class I Areas				
Arches NP	69.5	0	69.5	0
Bryce Canyon NP	70.2	0	70.2	0
Canyonlands NP	69.8	0	69.8	0
Capitol Reef NP	**71.1**	0	**71.1**	0
Mesa Verde NP	69.3	0	69.3	0

Table 4.3-13 Model-Predicted Ozone Effects (ppb) for Year 15 and Year 7

Receptor Site\Area	8-hr Average 4th high Absolute Concentration Daily Max.			
	Year15 Total	Year 15 Project Impact	Year 7 Total	Year 7 Project Impact
Sensitive Class II Areas				
Dinosaur NM	**72.0**	0.1	**72.0**	0.1
Flaming Gorge National Recreation Area	68.9	0	68.9	0
Goshute Indian Reservation	69.5	0	69.5	0
High Uintas Wilderness	70.0	0	70.0	0
Paiute Indian Reservation	70.6	0	70.6	0
Skull Valley Indian Reservation	69.4	0	69.4	0
Uintah and Ouray Indian Reservation	**81.5**	1.2	**81.3**	1

Source: **Appendix J**.

1

Table 4.3-14 MATS Estimated Ozone Effects (ppb) at Monitored Locations within the Study Area

Station Name	Observed Baseline Monitor Design Value	2021 Future Design Value with Y15 Project Emissions	Impact of Y15 Project Emissions	2021 Future Design Value with Y7 Project Emissions	Impact of Y7 Project Emissions
Uinta Basin Study Area					
Dinosaur NM, Uintah County, Utah	**71.7**	66.3	0.6	66.2	0.5
Ouray Site, Uintah County, Utah	**97.7**	**78.8**	2.1	**77.6**	0.9
Rangely Site, Rio Blanco County, Colorado	64	61.4	0.5	61.2	0.3
Red Wash Site, Uintah County, Utah	**86**	**71.9**	1.5	**71.2**	0.8
Utah Stations Outside of Uinta Basin Study Area					
Cottonwood Site, Salt Lake County, Utah	75	**82.8**	0	**82.8**	0
Hawthorne Site, Salt Lake County, Utah	75.3	**81.1**	0	**81.1**	0

Source: **Appendix J**.

2

Table 4.3-15 MATS Estimated Ozone Effects (ppb) at Unmonitored Locations within the Study Area

Area Name	MATS Unmonitored			
	Year 15 Total	Year 15 Project Impact	Year 7 Total	Year 7 Project Impact
Uinta Basin Study Area				
Uinta Study Area	**87.3**	5.9	**84.4**	3
Class I Areas				
Arches NP	65.2	0	65.2	0
Bryce Canyon NP	59.0	0	59.0	0
Canyonlands NP	66.1	0	66.2	0.1
Capitol Reef NP	61.3	0	61.3	0
Mesa Verde NP	62.7	0	62.7	0
Sensitive Class II Areas				
Dinosaur NM	70.3	0.5	70.2	0.4
Flaming Gorge National Recreation Area	57.4	0	57.4	0
Goshute Indian Reservation	62.6	0	62.6	0
High Uintas Wilderness	61.8	0	61.8	0
Paiute Indian Reservation	66.3	0	66.3	0
Skull Valley Indian Reservation	61.5	0	61.5	0
Uintah and Ouray Indian Reservation	**79.0**	1.6	**78.2**	0.8

Source: **Appendix J**.

Although not a formal increment consumption analysis the model-predicted effects for the Alternative B are estimated to be less than PSD increment values for all pollutant and averaging times, as shown in **Table 4.3-16**. Additional information regarding the model-predicted effects relative to all AAQS and PSD increments are presented in the Air Quality Technical Support Document (**Appendix J**).

Table 4.3-16 Model-Predicted PSD Increment Values

Receptor Site	NO_2 (ppb)	SO_2 (ppb)			$PM_{2.5}$ ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual	24-hour	Annual
PSD Increment								
Class I	**1.3**	**9.5**	**1.9**	**0.76**	**2**	**1**	**8**	**4**
Class II	**13.3**	**195.5**	**34.8**	**7.6**	**9**	**4**	**30**	**17**
Project Year 7								
Uinta Basin Study Area								
Uinta Basin Study Area	1.2	0.0	0.0	0.0	0.9	0.6	0.1	0.0
Dinosaur AQS Station	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0
Ouray AQS Station	0.2	0.0	0.0	0.0	0.7	0.2	0.7	0.2
Rangely AQS Station	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Redwash AQS Station	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0

Table 4.3-16 Model-Predicted PSD Increment Values

Receptor Site	NO_2 (ppb)	SO_2 (ppb)			$PM_{2.5}$ ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual	24-hour	Annual
PSD Increment								
Class I	**1.3**	**9.5**	**1.9**	**0.76**	**2**	**1**	**8**	**4**
Class II	**13.3**	**195.5**	**34.8**	**7.6**	**9**	**4**	**30**	**17**
Class I Areas								
Arches NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryce Canyon NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canyonlands NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capitol Reef NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesa Verde NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Class II Areas								
Dinosaur NM	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0
Flaming Gorge National Recreation Area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goshute Indian Reservation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High Uintas Wilderness	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paiute Indian Reservation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skull Valley Indian Reservation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uintah and Ouray Indian Reservation	1.2	0.0	0.0	0.0	0.9	0.6	0.9	0.6
Project Year 15								
Uinta Basin Study Area								
Uinta Basin Study Area	0.8	0.0	0.0	0.0	0.7	0.2	0.1	0.0
Dinosaur AQS Station	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Ouray AQS Station	0.1	0.0	0.0	0.0	0.8	0.0	0.8	0.1
Rangely AQS Station	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Redwash AQS Station	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Class I Areas								
Arches NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bryce Canyon NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canyonlands NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capitol Reef NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mesa Verde NP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Class II Areas								
Dinosaur NM	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Flaming Gorge National Recreation Area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4.3-16 Model-Predicted PSD Increment Values

Receptor Site	NO_2 (ppb)	SO_2 (ppb)			$PM_{2.5}$ ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual	24-hour	Annual
PSD Increment								
Class I	**1.3**	**9.5**	**1.9**	**0.76**	**2**	**1**	**8**	**4**
Class II	**13.3**	**195.5**	**34.8**	**7.6**	**9**	**4**	**30**	**17**
Goshute Indian Reservation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High Uintas Wilderness	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paiute Indian Reservation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skull Valley Indian Reservation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uintah and Ouray Indian Reservation	0.8	0.0	0.0	0.0	0.7	0.3	0.7	0.3

Source: **Appendix J**.

Effects to Toxics

Although project emissions of H_2S were not calculated for Alternative B, the worker safety program outlined in Section 2.6.4.1 will minimize worker exposure.

Near-field HAPs concentrations were calculated in order to assess effects both in the immediate vicinity of GCWPA for short-term (acute) exposure assessment and for calculation of long-term risk. HAPs emissions are expected from well site fugitives, well blowdown venting, pneumatic devices, and condensate tank losses, among other smaller sources, such as truck traffic. Because HAPs would be emitted predominantly during the production phase, only HAPs emissions from the production scenario were analyzed. The HAPs emissions modeled for this analysis are shown in **Table 4.3-17**. Emissions for a full list of HAPs were reviewed, but only those with the greatest emissions in relation to health effects were evaluated.

Table 4.3-17 Total HAPs Emissions Modeled with AERMOD

Analysis Type	Benzene		Toluene		Ethyl Benzene		Xylenes		n-Hexane		Formaldehyde	
	1-hr (lbs/year)	Annual (lbs/year)	1-hr (lbs/year)	Annual (lbs/year)	1-hr (lbs/year)	Annual (lbs/year)	1-hr (lbs/year)	Annual (lbs/year)	1-hr (lbs/year)	Annual (lbs/year)	1-hr (lbs)/year	Annual (lbs/year)
Single	0.57	0.45	1.18	1.05	0.05	0.04	0.62	0.57	2.65	0.99	0.16	0.12
Section	8.98	7.24	18.72	16.73	0.74	0.66	9.85	9.11	42.35	15.85	1.93	1.85

Source: **Appendix J**.

Short-term (1-hour) HAP concentrations were compared to acute Reference Exposure Levels (RELs) shown in **Table 4.3-18**. Model results indicate that HAP concentrations would be below the 1-hour RELs for Alternative B.

Table 4.3-18 Comparison of Model Results with Acute RELs for HAPs (1-hour Exposure)

HAP	1-hour REL (µg/m^3)	Maximum Modeled Concentration (µg/m^3)	Complies with REL
Benzene[1]	1,300	187.4	Yes
Toluene[2]	37,000	354.4	Yes
Ethylbenzene[2]	350,000	13.9	Yes
Xylene[1]	22,000	179.7	Yes
n-Hexane[2]	390,000	1,419.6	Yes
Formaldehyde[1]	55	1.1	Yes

[1] USEPA Dose-Response Assessment for Assessing Health Risks Associated With Exposure to Hazardous Air Pollutants -Table 2 (USEPA 2014).).

[2] No REL available for these HAPs. Values shown are from Immediately Dangerous to Life or Health (IDLH/10), USEPA Air Toxics Database, Table 2 (USEPA 2017b).

Source: **Appendix J**.

Annual modeled HAP concentrations for all HAPs emitted are compared directly to the non-carcinogenic RfCs shown in **Table 4.3-19**. Model results indicate that HAP concentrations would be below the 1-hour RfCs for Alternative B.

Table 4.3-19 Comparison of Model Results with Non Carcinogenic HAP RfCs (Annual Average)[1]

HAP	Non Carcinogenic RfC (µg/m^3)	Maximum Modeled Concentration (µg/m^3)	Complies with REL
Benzene	30	11.01	Yes
Toluene	5,000	25.66	Yes
Ethylbenzene	1,000	1.02	Yes
Xylene	100	14.00	Yes
n-Hexane	700	13.89	Yes
Formaldehyde	10	0.03	Yes

[1] USEPA Air Toxics Database, Table 1 (USEPA 2017b).

Source: **Appendix J**.

Thirdly, long-term exposures to emissions of suspected carcinogens were evaluated. The analysis presents the potential incremental risk, and does not characterize a complete risk analysis. USEPA unit risk factors and adjustment factors, as described in Section.4.3.1.2, are shown in **Table 4.3-20**. For each pollutant, the cancer risk was computed by multiplying the maximum predicted annual concentration by the appropriate risk factor and overall exposure adjustment factor from **Table 4.3-20**. The modeled exposure concentrations are within the acceptable limits ($1x10^{-6}$to $1x10^{-4}$) for all scenarios.

Table 4.3-20 Cancer Risk Assessment: Carcinogenic HAP RfCs, Exposure Adjustment Factors, and Adjusted Exposure Concentrations

Analysis[1]	HAP Constituent	Acceptable Limits ($\mu g/m^3$)	Carcinogenic RfC (Unit Risk Factor) [2,3] $1/(\mu g/m^3)$	Exposure Adjustment Factor	Adjusted Exposure Concentration ($\mu g/m^3$)	Within Limits
MLE	Benzene	$1x10^{-6}$to $1x10^{-4}$	7.80E-06	0.0949	8.15E-06	Yes
MLE	Formaldehyde	$1x10^{-6}$to $1x10^{-4}$)	5.50E-09	0.0949	1.51E-11	Yes
MEI	Benzene	$1x10^{-6}$to $1x10^{-4}$)	7.80E-06	0.86	7.38E-05	Yes
MEI	Formaldehyde	$1x10^{-6}$to $1x10^{-4}$)	5.50E-09	0.86	1.36E-10	Yes

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] USEPA Air Toxics Database, Table 1 (USEPA 2017b).

[3] Annual Average Concentration.

Source: **Appendix J**.

Figure 4.3-3 shows the cancer risk contours for the production scenario for the MLE case for benzene. The one-in-one million cancer risk extends approximately 2,000 m east of the center of the well array and largest impacts are predicted in the immediate vicinity of the wells. **Figure 4.3-4** shows cancer risk contours for the MEI case for benzene. As for the MLE case, the one-in-one million contour lies outside the well array. The one-in-one million risk extends up to 9,000 m east of the center of the well array. As shown in **Table 4.3-20**, the cancer risk for both the MLE and MEI cases is below the one-in-ten thousand threshold for all carcinogenic HAPs.

Effects at Class I and II Areas – Visibility

Visibility effects predicted to occur under Alternative B are presented for the annual average natural conditions (FLAG Table 6) in **Table 4.3-21** and for the best 20 percent natural conditions (FLAG Table 5) in **Table 4.3-22** for both project year 7 and 15. Neither of these years are predicted to have days with greater than 0.5 or 1.0 Δdv visibility effect at Class I areas relative to both the average and best 20 percent natural conditions. The peak 98th percentile Δdv, shown in **Table 4.3-21**, for the annual average natural conditions at a Class I area is 0.104 at Arches National Park during project year 7. As shown in **Table 4.3-22**, the peak 98th percentile Δdv for the 20 percent best natural conditions at a Class I area is 0.13 at Arches National Park during project year 7. At sensitive Class II areas, the peak 98th percentile Δdv for annual average natural conditions is greater than 0.5 Δdv at Dinosaur National Monument, Flaming Gorge National Recreation Area and the Uintah and Ouray Indian Reservation. Both model years 7 and 15 predict effects greater than 1.0 Δdv during average natural conditions at Uintah and Ouray Indian Reservation with the Dinosaur National Monument also having predicted effects greater than 1.0 Δdv during model year 7.

As discussed earlier in the emissions inventory summary and in **Appendix J**, project emissions are reduced when the project wells are connected to the LGS. By reviewing the reductions of NO_X, PM_{10}, $PM_{2.5}$, and SO_2 shown in **Table 4.3-4**, one can infer the improvement in visibility due to wells connected to the LGS. The reaction of these criteria pollutants will affect visibility conditions.

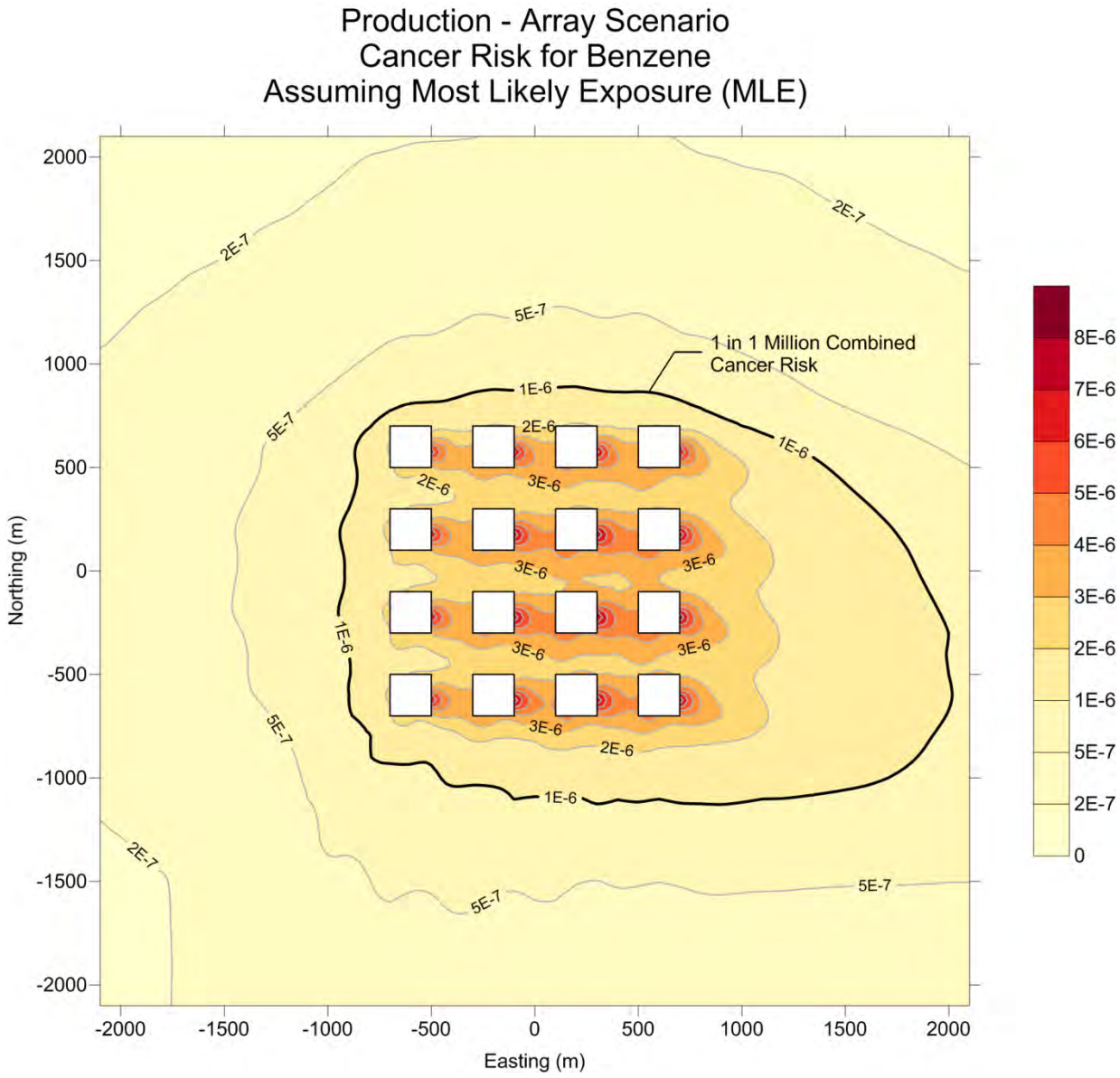


Figure 4.3-3 Benzene MLE Cancer Risk for the Production Array Scenario

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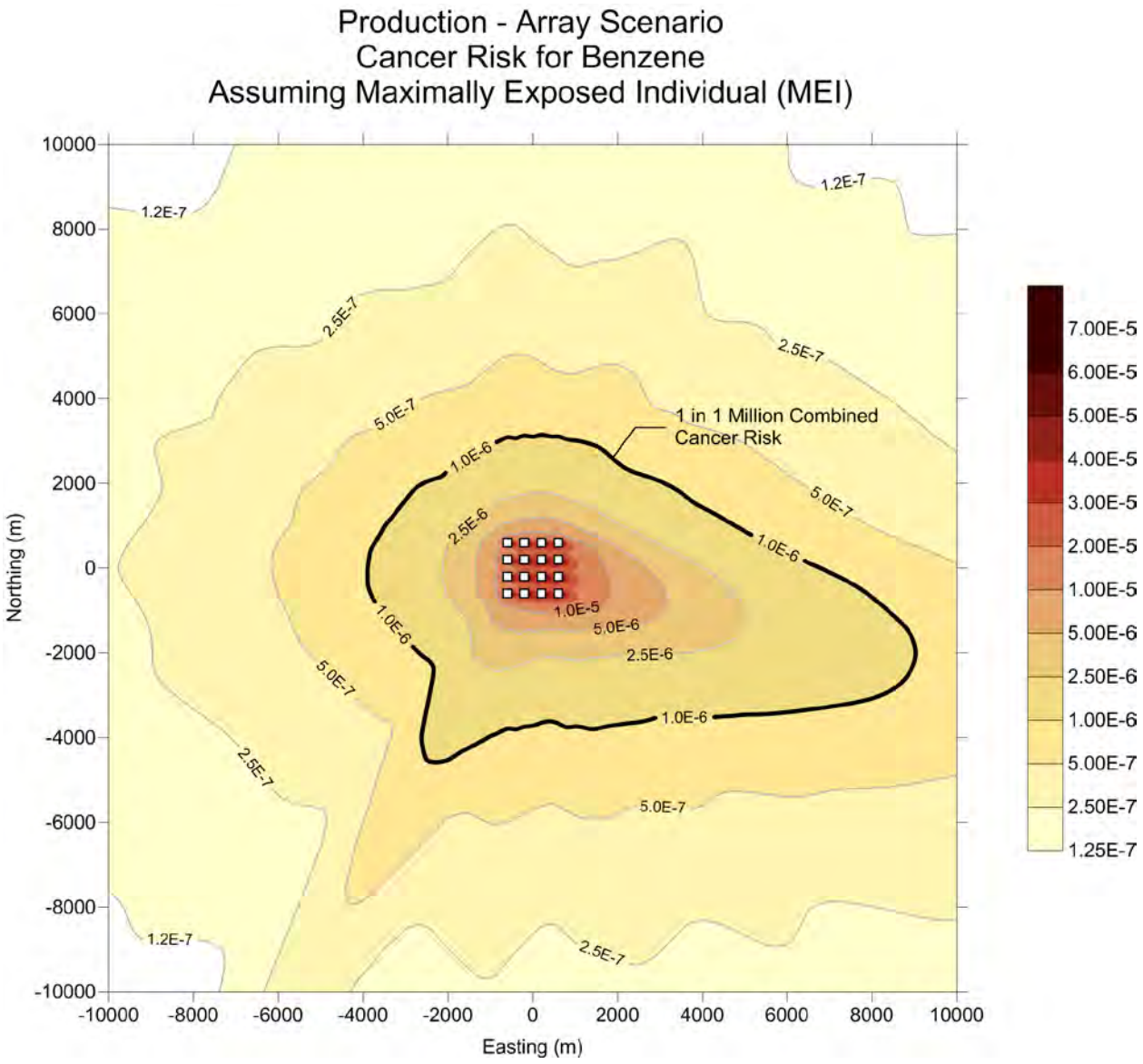


Figure 4.3-4 Benzene MEI Cancer Risk for the Production Array Scenario

Table 4.3-21 Number of days exceeding 0.5 and 1.0 Δdv and the 98th percentile and Maximum Δdv for Year 15 and Year 7 Compared with Annual Average Natural Visibility Conditions

Receptor Site	Year 15				Year 7			
	Days Δdv > 0.5	**Days Δdv > 1.0**	**98th Δdv**	**Max Δdv**	**Days Δdv > 0.5**	**Days Δdv > 1.0**	**98th Δdv**	**Max Δdv**
Class I Areas								
Arches NP	0	0	0.0586	0.1694	0	0	0.1045	0.2566
Bryce Canyon NP	0	0	0.0143	0.0534	0	0	0.0231	0.0585
Canyonlands NP	0	0	0.0598	0.2375	0	0	0.1013	0.2811
Capitol Reef NP	0	0	0.0470	0.1723	0	0	0.0845	0.1269
Mesa Verde NP	0	0	0.0582	0.2151	0	0	0.0824	0.1341
Sensitive Class II Areas								
Dinosaur NM	29	0	0.6859	0.8741	45	3	0.8914	1.3206
Flaming Gorge National Recreation Area	0	0	0.2589	0.3366	1	0	0.7690	0.5237
Goshute Indian Reservation	0	0	0.0149	0.0508	0	0	0.0140	0.0961
High Uintas Wilderness	0	0	0.0649	0.1616	0	0	0.1513	0.2697
Paiute Indian Reservation	0	0	0.0102	0.0762	0	0	0.0111	0.0487
Skull Valley Indian Reservation	0	0	0.0077	0.0762	0	0	0.0101	0.0562
Uintah and Ouray Indian Reservation	342	270	4.7320	6.2339	356	315	6.1548	7.2299

Source: **Appendix J**.

1

Table 4.3-22 Number of days exceeding 0.5 and 1.0 Δdv and the 98th percentile and Maximum Δdv for Year 15 and Year 7 Compared with 20 Percent Best Natural Visibility Conditions

Receptor Site	Year 15				Year 7			
	Days Δdv > 0.5	**Days Δdv > 1.0**	**98th Δdv**	**Max Δdv**	**Days Δdv > 0.5**	**Days Δdv > 1.0**	**98th Δdv**	**Max Δdv**
Class I Areas								
Arches NP	0	0	0.0754	0.2175	0	0	0.1340	0.3290
Bryce Canyon NP	0	0	0.0192	0.0723	0	0	0.0315	0.0784
Canyonlands NP	0	0	0.0771	0.3058	0	0	0.1295	0.3623
Capitol Reef NP	0	0	0.0595	0.2171	0	0	0.1071	0.1599
Mesa Verde NP	0	0	0.0767	0.2810	0	0	0.1079	0.1764

Table 4.3-22 Number of days exceeding 0.5 and 1.0 Δdv and the 98th percentile and Maximum Δdv for Year 15 and Year 7 Compared with 20 Percent Best Natural Visibility Conditions

Receptor Site	Year 15				Year 7			
	Days Δdv > 0.5	Days Δdv > 1.0	98th Δdv	Max Δdv	Days Δdv > 0.5	Days Δdv > 1.0	98th Δdv	Max Δdv
Class II Areas								
Dinosaur NM	49	4	0.9327	1.1857	63	16	1.2093	1.7781
Flaming Gorge National Recreation Area	0	0	0.3544	0.4606	10	0	0.5276	0.7150
Goshute Indian Reservation	0	0	0.0188	0.0638	0	0	0.0176	0.1210
High Uintas Wilderness	0	0	0.0859	0.2160	0	0	0.2024	0.3601
Paiute Indian Reservation	0	0	0.0129	0.1023	0	0	0.0140	0.0613
Skull Valley Indian Reservation	0	0	0.0097	0.0959	0	0	0.0127	0.0708
Uintah and Ouray Indian Reservation	354	303	5.7818	7.5125	360	337	7.4100	8.6266

Source: **Appendix J**.

Effects at Class I and II Areas - Deposition

Model-predicted nitrogen and sulfur deposition for Alternative B year 7 and 15 are presented in **Table 4.3-23**. The critical loads thresholds reported for each assessment area were selected based on appropriate ecosystem information for each Class I or II area, as described in the ARMS Modeling Project (AECOM 2014). For both model years analyzed, the cumulative nitrogen deposition critical load is exceeded at most areas. Alternative B is predicted to contribute less than 0.005 kg/ha/yr (the Nitrogen Deposition Analysis Threshold) to nitrogen deposition, except at Dinosaur National Monument, where Alternative B is predicted to contribute 0.006 kg/ha/yr in Year 15 and 0.008 kg/ha/yr in Year 7, and at the Uintah and Ouray Indian Reservation, where Alternative B is predicted to contribute 0.011 kg/ha/yr for both Project years. The sulfur Deposition Analysis Threshold is not exceeded at any area analyzed.

Model predicted total annual acidification is presented in **Table 4.3-24**. The peak project effects on acidification are estimated to occur during Year 7 at Dinosaur National Monument with a value of 0.6 equivalents per hectare per year (eq/ha/yr).

Model-predicted effect on ANC of sensitive lakes is presented in **Table 4.3-25**. The limit for acceptable change is 10 percent for all lakes assessed. The project effects are predicted to be lower than the limit for acceptable change. The peak effect is predicted to occur at Walk Up Lake in the Ashley National Forest with a value of 0.1 percent during Year 7.

Reduced emissions from wells connected to the LGS, as indicated in the Emissions Inventory summary and **Appendix J** would include reductions in NO_X and SO_2 emissions. Reducing the addition of NO_X and SO_2 would also reduce atmospheric chemical reactions generating nitric and sulfuric acid, among other compounds. Therefore, implementation of the LGS would reduce atmospheric deposition effects at Class I and Class II areas and at the sensitive mountain lakes indicated in Section 3.3.1.5 and **Tables 4.3-23** through **4.3-25**, below.

Table 4.3-23 Model-predicted Nitrogen and Sulfur Deposition for Year 15 and Year 7

Receptor Site	Total Annual Nitrogen Deposition (kg N//ha/yr)					Total Sulfur Deposition (kg S/ha/yr)			
	Critical Load	Year 15 Total	Year 15 Project Impact from Total	Year 7 Total	Year 7 Project Impact from Total	Year 15 Total	Year 15 Project Impact from Total	Year 7 Total	Year 7 Project Impact from Total
Class I Areas									
Arches NP	3	**5.49**	0.001	**5.49**	0.001	0.82	0	0.82	0
Bryce Canyon NP	2.5	**5**	0	**5**	0	0.74	0	0.74	0
Canyonlands NP	3	2.58	0	2.58	0	0.65	0	0.65	0
Capitol Reef NP	2.5	**3.12**	0	3.12	0	0.59	0	0.59	0
Mesa Verde NP	3	**3.56**	0	3.56	0	1.55	0	1.55	0
Sensitive Class II Areas									
Dinosaur NM	3	**3.36**	**0.006**	**3.36**	**0.008**	0.87	0	0.87	0
Flaming Gorge National Rec. Area	2.5	**3.38**	0.001	**3.38**	0.002	0.82	0	0.82	0
Goshute Indian Reservation	3	1.95	0	1.95	0	0.66	0	0.66	0
High Uintas Wilderness	2.5	**4.82**	0.001	**4.82**	0.001	1.14	0	1.14	0
Paiute Indian Reservation	2.5	**4.68**	0	**4.68**	0	0.92	0	0.92	0
Skull Valley Indian Reservation	3	2.95	0	2.95	0	0.76	0	0.76	0
Uintah and Ouray Indian Reservation	2.5	**5.01**	**0.011**	**5.01**	**0.011**	0.75	0	0.75	0
Sensitive Lakes									
Heart Lake, High Uintas WA	3	**5.03**	0.001	**5.03**	0.002	1.24	0	1.24	0
4D2-039, High Uintas WA	3	**6.41**	0.001	**6.42**	0.002	1.67	0	1.67	0
Dean Lake, High Uintas WA	3	**4.48**	0	**4.48**	0	1.03	0	1.03	0
Walk Up Lake, Ashley National Forest	3	**5.84**	0.001	**5.84**	0.003	1.31	0	1.31	0
4D1-044, High Uintas WA	3	**4.59**	0	**4.59**	0.001	1.17	0	1.17	0
Fish Lake, High Uintas WA	3	**6.15**	0.001	**6.15**	0.002	1.46	0	1.46	0

Source: **Appendix J**.

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Table 4.3-24 Model-predicted Total Annual Acidification for Year 15 and Year 7

Receptor Site	Total Annual Acidification (eq/ha/yr)			
	Year 15 Total	Year 15 Project Impact from Total	Year 7 Total	Year 7 Project Impact From Total
Class I Areas				
Arches NP	443.5	0	443.5	0.1
Bryce Canyon NP	403.8	0	403.8	0
Canyonlands NP	225.2	0	225.2	0
Capitol Reef NP	259.6	0	259.6	0
Mesa Verde NP	351.4	0	351.5	0
Sensitive Class II Areas				
Dinosaur NM	294.8	0	294.9	0.6
Flaming Gorge National Recreation Area	292.6	0	292.6	0.1
Goshute Indian Reservation	180.9	0	180.9	0
High Uintas Wilderness	415.6	0	415.6	0.1
Paiute Indian Reservation	392	0	392	0
Skull Valley Indian Reservation	258.4	0	258.4	0
Uintah and Ouray Indian Reservation	404.5	0	404.5	0.8
Sensitive Lakes				
Heart Lake, High Uintas WA	436.9	0	436.9	0.1
4D2-039, High Uintas WA	562.6	0	562.6	0.1
Dean Lake, High Uintas WA	384.3	0	384.3	0
Walk Up Lake, Ashley National Forest	499.2	0	499.3	0.2
4D1-044, High Uintas WA	400.9	0	401	0.1
Fish Lake, High Uintas WA	530.3	0	530.4	0.2

Source: **Appendix J**.

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Table 4.3-25 Model-predicted Effect on ANC of Sensitive Lakes for Year 15 and Year 7

Lake	Actual Watershed Area (hectares) [1]	Annual Precipitation (meters) [1]	Background ANC (ueq/L) [1]	N Deposition (kg/ha/yr)[2]	S Deposition (kg/ha/yr)[2]	ANC(o) (eq)[2]	Hdep (eq)[2]	ANC Change from Measurement (percent)[2]
Year 15								
Heart Lake, High Uintas WA	117	1.03	54.6	0.00	0.00	44085	8	0.0%
4D2-039, High Uintas WA	174	0.89	65.16	0.00	0.00	67608	9	0.0%
Dean Lake, High Uintas WA	122	1.1	51.4	0.00	0.00	46216	3	0.0%
Walk Up Lake, Ashley National Forest	175	0.88	61.43	0.00	0.00	63383	19	0.0%
4D1-044, High Uintas WA	59.6	1.01	64.98	0.00	0.00	26207	1	0.0%
Fish Lake, High Uintas WA	220	0.88	104.5	0.00	0.00	135549	20	0.0%
Year 7								
Heart Lake, High Uintas WA	117	1.03	54.6	0.00	0.00	44085	13	0.0%
4D2-039, High Uintas WA	174	0.89	65.16	0.00	0.00	67608	20	0.0%
Dean Lake, High Uintas WA	122	1.1	51.4	0.00	0.00	46216	4	0.0%
Walk Up Lake, Ashley National Forest	175	0.88	61.43	0.00	0.00	63383	36	0.1%
4D1-044, High Uintas WA	59.6	1.01	64.98	0.00	0.00	26207	4	0.0%
Fish Lake, High Uintas WA	220	0.88	104.5	0.00	0.00	135549	36	0.0%

[1] Values from ARMS Impact Report (AECOM 2014).

[2] Project Impact Values from **Appendix J**.

4.3.1.3 Alternative C—Resource Protection Action (BLM Preferred)

The Alternative C (BLM's preferred alternative) is similar to Alternative B, but would place more emphasis on protection of GCWPA resources. There would be restrictions on new wells and well pads within *Sclerocactus* protection areas identified by the USFWS. **Table 4.3-26** shows a comparison between Alternatives B and C.

Table 4.3-26 Comparison of GCW Alternatives B and C

	Alternative B - Proposed Action	Alternative C - Resource Protection (Preferred)
Well Count	2,808	2,808
Estimated Development Period (years)	15	15
Total Produced Gas (TCF)	4.387	4.387
Total Produced Condensate (bbls)	64,000,000	64,000,000
Maximum Expanded Well Pads	960	960
Maximum New Well Pads	233	151
Maximum New Surface Disturbance (acres)	1,875	1,448
Proposed Wells Connected to LGS	1,432	1,432
Air Quality Design Features	PDEIS Section 2.6.9	PDEIS Section 2.6.9

Source: **Appendix J**.

Emissions Inventory Summary

Although the emissions inventory for Alternative C was not analyzed directly, it is anticipated that the emissions would be lower than Alternative B due to fewer well pads and design features specifically focused on limiting NO_X and VOC emissions. The project development under Alternative C would occur at the same rate as the development for Alternative B.

Effects to Climate

It is anticipated that this alternative's effect on climate would be equivalent or less than those associated with Alternative B. Control measures designed to reduce fugitive VOC emissions are expected to also reduce GHG emissions via the control of CH_4, which is co-emitted with VOCs from natural gas sources.

Effects to Criteria Pollutants

Maximum criteria pollutant effects under Alternative C are likely to be the same or less than the effects under Alternative B. It is possible that the model-predicted ozone exceedences for Alternative B also would occur for Alternative C. Ozone formation is a non-linear complex process of the project VOC and NO_X (NO and NO_2) emissions reacting with each other and other gases in the local atmosphere to form ozone. While the increased air quality controls of NO_X and VOC could potentially reduce ozone effects, it also is possible that ozone effects from the project could be greater than Alternative B under Alternative C. It is possible that the decreased NO_X emissions in the alternative could reduce the local reaction of the fresh NO emissions with ambient ozone and increase the ozone concentrations in the vicinity of the project; however if NO_X emissions decreases lead to increase in ozone impacts, it is anticipated to be by a very small amount and would be offset by ozone decreases further downwind of the GCWPA.

Effects to Toxics

Although project emissions of H_2S were not calculated for Alternative C, the worker safety program outlined in Section 2.6.4.1 will reduce worker exposure.

Maximum potential HAPs effects from emission sources under Alternative C include sources similar to the Alternative B. HAPs effects under Alternative C would be the same or less than the effects under Alternative B. Control measures designed to reduce fugitive VOC emissions are expected to also reduce HAPs emissions, which are co-emitted with VOCs from natural gas sources.

Effects at Class I and II Areas – Visibility

Although visibility effects were not directly assessed for Alternative C, the effects analysis presented in Section 4.3.1.2 indicated that there would be no days with a contribution to visibility greater than a 10 percent increase in the light extinction coefficient (1.0 Δdv) at listed Class I areas under Alternative B. It is anticipated that the effects on visibility from Alternative C would be similar or less than those discussed for Alternative B.

Effects at Class I and II Areas – Deposition

Although atmospheric deposition effects were not modeled specifically for Alternative C, effects from project-related sources are anticipated to be similar or less than Alternative B.

4.3.1.4 Alternative D—Other Protections Action

Alternative D encompasses most features of Alternative C, but would place additional emphasis on mitigating Project effects on certain resources. Within portions of the GCWPA, new well pads would be restricted and additional design features would specifically focus on additional controls to minimize air quality effects. Some of the design features include: more stringent standards of NO_X on stationary internal combustion engines, use of Tier IV drill rig engines phased in by 2018, and controls on dehydrators and well site tanks to reduce VOC emissions. Restrictions on development within *Sclerocactus* core areas would be tightened, a visual buffer along the White River would be enforced, and all new pipelines would be buried. Development would be limited in portions of the northern part of the GCWPA and along the White River. A comparison of the alternatives B and D are summarized in **Table 4.3-27**.

Table 4.3-27 Comparison of GCW Alternative B and D

	Alternative B - Proposed Action	Alternative D - Other Protections
Well Count	2,808	2,808
Estimated Development Period (years)	15	15
Total Produced Gas (TCF)	4.387	4.387
Total Produced Condensate (bbls)	64,000,000	64,000,000
Maximum Expanded Well Pads	960	822
Maximum New Well Pads	233	146
Maximum New Surface Disturbance (acres)	1,875	1,507
Proposed Wells Connected to LGS	1,432	1,432
Air Quality Design Features	PDEIS Section 2.6.9	Additional controls

Source: **Appendix J**.

Emissions Inventory Summary

Although the Alternative D emissions inventory was not analyzed directly, it is anticipated that the emissions would be lower than Alternative B due to fewer well pads and air quality design features. While the emissions reductions between Alternative D and Alternative B were not explicitly quantified for all air quality design features, the emissions reductions associated with phasing in the use of Tier IV drill rig engines by 2018 are shown in **Table 4.3-28**. BLM-proposed air quality environmental protective measures are in addition to Alternative C - the Resource Protection Alternative. The Project development under the Increased Mitigations Action would occur at the same rate as that indicated for the Alternative B.

Table 4.3-28 Emissions Reductions Associated with Phasing in Tier IV Drill Rig Engines by 2018

Project Year	NO_X (tpy)	VOC (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
1	-55.8	-2.1	-2.5	-2.5
2	-111.7	-4.3	-5.1	-4.9
3	-195.4	-7.5	-8.9	-8.6
4	-195.4	-7.5	-8.9	-8.6
5	-195.4	-7.5	-8.9	-8.6
6	-195.4	-7.5	-8.9	-8.6
7	-195.4	-7.5	-8.9	-8.6
8	-167.5	-6.4	-7.6	-7.4
9	-167.5	-6.4	-7.6	-7.4
10	-167.5	-6.4	-7.6	-7.4
11	-139.6	-5.3	-6.4	-6.2
12	-111.7	-4.3	-5.1	-4.9
13	-111.7	-4.3	-5.1	-4.9
14	-83.8	-3.2	-3.8	-3.7
15	-83.8	-3.2	-3.8	-3.7
16	-	-	-	-
17	-	-	-	-
18	-	-	-	-
19	-	-	-	-
20	-	-	-	-
21	-	-	-	-

Source: **Appendix J**.

Effects to Climate

Given the air design features for Alternative D, it is anticipated that the alternatives effect to climate would equivalent or less than those associated with Alternative B. Control measures designed to reduce fugitive VOC emissions are expected to also reduce GHG emissions via the control of CH_4, which is co-emitted with VOCs from natural gas sources.

Effects to Criteria Pollutants

Maximum criteria pollutant effects under Alternative D are likely to be the same or less than the effects under Alternative B. It is possible that the model-predicted ozone exceedence for Alternative B also would occur for Alternative D. Ozone formation is a non-linear complex process of the project VOC and NO_X (NO and NO_2) emissions reacting each other and with other gases in the local atmosphere to form ozone. While the increased air quality controls of NO_X and VOC could potentially reduce ozone effects, it also is possible that ozone effects from the project could be greater than Alternative B under Alternative D. It is possible that the decreased NO_X emissions in the alternative could reduce the local reaction of the fresh NO emissions with ambient ozone and increase the ozone concentrations in the vicinity of the project; however if NO_X emissions decreases lead to increase in ozone impacts, it is anticipated to be by a very small amount and would be offset by ozone decreases further downwind of the GCWPA.

Effects to Toxics

Although project emissions of H_2S were not calculated for Alternative B, the worker safety program outlined in Section 2.6.4.1 would minimize worker exposure.

Maximum potential HAPs effects from emission sources under the Other Protections Action include sources similar to Alternative B. HAPS effects under the Other Protections Action would be the same as or less than the effects under Alternative B. Control measures designed to reduce fugitive VOC emissions are expected to also reduce HAPs emissions, which are co-emitted with VOCs from natural gas sources.

Effects at Class I and II Areas – Visibility

Although visibility effects were not directly assessed for Alternative D, the effects analysis presented in Section 4.3.1.2 indicated that there would be no days with a contribution to visibility greater than a 10 percent increase in the light extinction coefficient (1.0 Δdv) at listed Class I areas under Alternative B. It is anticipated that the effects on visibility from Alternative D would be similar or less than those discussed for Alternative B.

Effects at Class I and II Areas- Deposition

Although atmospheric deposition effects were not modeled specifically for Alternative D, effects from project-related sources are anticipated to be similar or less than Alternative B.

4.3.2 Alternative-specific Design Features and Mitigations

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.3-29**.

4.3.3 Residual Effects

Following application of mitigation measures, exceedence of the AAQS for ozone may continue to occur under all alternatives; however, maximum concentrations of all other criteria pollutants are anticipated to be well below applicable state and federal criteria. Based on a dispersion modeling assessment predicting potential near-field air quality effects, localized, short-term increases in CO, NO_2, and PM_{10} concentrations would occur, but mitigation measures would minimize NO_2 and PM_{10} effects. Similarly, GHG emissions and predicted HAP concentrations also would be reduced via application of mitigation measures. To the extent that mitigation measures reduce PM concentrations, visibility effects also would be minimized. To the extent that mitigation measures reduce NO_X and SO_2 concentrations, atmospheric deposition and ANC effects also would be minimized. Air pollutants in the vicinity of the GCWPA would return to background levels at the end of operations.

4.3.4 Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable air quality effects are anticipated. As wells are plugged and abandoned, production equipment and their associated emissions would cease. Following reclamation and revegetation, soil would be stabilized and particulate levels should return to what is typical for an arid environment. Once the emissions sources cease to operate and wind erodible surfaces are reclaimed, air quality would revert to its original state.

Development and combustion of the natural gas and oil resources also would lead to additional GHGs being emitted to the atmosphere. As indicated in previous sections, there is substantial scientific evidence that increased atmospheric concentrations of GHGs and land use changes are contributing to an increase in average global temperature (IPCC 2013). While it is generally agreed upon that human activities are changing the composition of Earth's atmosphere, questions remain about how much warming will occur, how fast it will occur, and how it will affect the rest of the climate system. No alternative is expected to produce detectable effects to global climate resources. However it is impossible to quantify any affect (positive or negative) of the project's GHG emissions on climate with any degree of certainty.

4.3.5 Relationship of Short-term Use to Long-term Productivity

Increased development activities within the GCWPA would lead to increases in ozone, fugitive dust and other air pollutants associated with oil and gas drilling and production equipment. These activities would affect the local and regional air quality over the duration of the project (estimated to be approximately 60 years) although effects are anticipated to be highest within and near the GCWPA. Ozone effects in excess of the AAQS may contribute to localized effects to human health and the environment. However, once the wells are plugged and abandoned and the area is revegetated no long-term air quality effects are anticipated.

Table 4.3-29 Air Quality Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
EOG reduced the size of the proposed project by approximately 60% (from 7,000 to 2,800 wells) in response to identified air pollution problems in the Uinta Basin, particularly winter ground-level ozone.		d	d	d				
EOG will use water and/or water with commercial suppressants for dust abatement on access roads, if needed.		d	d	d	m			
The use of carpooling will be encouraged to minimize vehicle traffic and related emissions. EOG will also commit to minimize idling when safety is not a risk.		d	d	d	m			
Operator will meet a stationary internal combustion engine standard of 2g NOX/bhp-hr for engines <300 HP and 1g NOX/bhp-hr for engines >300 HP.		d	d	d	m			
EOG will reclaim and reseed 9 evaporation ponds within the GCWPA.		d	d	d	m			
Tier II or better drilling rig engines will be required.		d	d	d	m			
EOG will recover gas that will otherwise be vented or flared during testing operations for new or recompleted wells. These completions may use portable flow-back equipment and/or permanent production equipment, depending on site-specific conditions. Use of this equipment will allow the transport of gas and oil to sales and prevent waste.		d	d	d	m			
Retrofit all existing pneumatic controllers to meet the standards established for pneumatic controller affected facilities that are constructed, modified or reconstructed on or after October 15, 2013, as specified in 40 CFR 60, Subpart OOOO Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution (as is required by Utah DAQ R307-502-4).		d	d	d	m			
Pneumatic devices on separator/dehydration units on existing and new units will be low/no bleed pneumatic devices. All existing dehydration units will be equipped with a Kimray Model 2015 glycol circulation pump which has lower circulation rates and therefore results in lower emissions from the dehydration units. Pneumatic pumps on all wells connected to the centralized facilities will be eliminated.		d	d	d	m			
Bottom filling of tanker trucks to control fugitive emissions will be required		d	d	d	m			

Table 4.3-29 Air Quality Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
EOG is in the process of constructing a liquids gathering system covering approximately 52% of the most heavily developed portions of the GCWPA. The purpose of the gathering system is to reduce emissions of ozone-precursor pollutants in response to the identified winter ozone problem in the Uinta Basin. Approximately 47% of all existing wells and a minimum of 51% of project wells would be connected to the system. The system will also reduce water and condensate haul truck traffic and associated emissions.	d	d	d	d				
EOG will construct an electrical distribution system to provide power for their liquids gathering system.	d	d	d	d				
Truck traffic will be reduced for wells connected to the LGS.		d	d	d	m			
Truck traffic will be reduced through the use of water offloading facilities.		d	d	d	m			
Use of tanks for wells connected to EOG's LGS will be eliminated except for one tank on most well pads, which may be used for emergencies or blowdowns.		d	d	d	m			
All production equipment at well sites and at the centralized facilities will be fitted with low-bleed pneumatic or electric valves.		d	d	d	m			
Dehydrators and fired separators will be removed from wells and well pads connected to the LGS. Non-fired separators may continue to be used for fluids measurement purposes. Truck loading and transport of liquids will be eliminated from LGS-connected wells.		d	d	d	m			
Where technically feasible, wells that utilize plunger lift systems (or otherwise automated systems) shall be operated so as to minimize fugitive emission from well pressure fluctuation and liquid accumulation within the well.		d	d	d	m			
EOG will implement a telemetry monitoring system on wells not connected to the LGS for the effective management of production and reduction in the number of vehicle trips and miles traveled.		d	d	d	m			
EOG will conduct Audio-Visual-Olfactory (AVO) leak inspections on all existing and new facilities within the GCWPA on an annual basis and repair observed leaks. EOG will utilize IR Camera observations in place of AVO inspections for at least 10% of facility inspections. If future regulations are implemented to address leak detection and repair requirements, the regulatory program will replace the voluntary inspection program.		d	d	d	m			
EOG will comply with the leak inspections for all new, reconstructed, or modified facilities as required by 40 CFR Part 60, subpart OOOOa.		d	d	d	m			

Table 4.3-29 Air Quality Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
EOG will provide an annual report listing the facilities where leaks were observed, the date the leak was observed, the cause of the leak, and the date corrective actions were completed at such facilities.		d	d	d	m			
EOG will manage the Project such that new stationary sources authorized by the ROD will not result in net increases of volatile organic compounds (VOC) emissions within the GCWPA from a 2012 baseline year. This will be accomplished by achieving reductions of VOC emissions from existing stationary sources within the GCWPA prior to operating new sources, balanced on a calendar year annual basis.		d	d	d	m			
EOG will incorporate in its current employee training program ozone awareness and specific actions for reducing ozone precursor emissions.		d	d	d	m			
EOG will develop an Ozone Action Management Plan which includes an operator training component as well as a list of Project activities that could be delayed or minimized during ozone episodes. The Ozone Action Management Plan will be submitted to BLM prior to signing of the Record of Decision.		d	d	d	m			
The use of Tier IV drill rig engines will be phased in by 2018.				d				
Well site dehydrator VOC emissions will be controlled to +95 percent efficiency.				d				
Well site tank VOC emissions will be controlled to +95 percent efficiency.				d				
Blowdown emissions at LGS-connected well sites will be reduced approximately 83 percent.				d				
Well site pneumatic devices will achieve a control efficiency of approximately 75 percent.				d				
Central facility tank emissions will be controlled to +95 percent efficiency.				d				
Require existing and new three-way oil/water/gas separators to be controlled via combustor or otherwise reroute vapors to sales lines.				d				
No intentional non-emergency venting will occur.				d				
Flaring will be allowed on a site specific basis and must be consistent with air quality modeling assumptions.				d				

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4.4 Water Resources

Effects on water resources (i.e., water quality and quantity) would occur during implementation of alternatives defined in Chapter 2.0. These effects may occur to surface water resources from surface disturbing activities, encroachment on floodplains, and by disturbance in waters of the U.S. Effects to wetlands are disclosed in Section 4.6, Vegetation. The water needed to complete proposed well drilling and development would increase water use during project construction. Hydraulic fracturing during well development may affect groundwater quality and quantity. Potential leaks or spills of produced water, petroleum products, or other hazardous materials used during construction and operation pose a risk to both surface water and groundwater quality.

4.4.1 Surface Water

4.4.1.1 Direct and Indirect Effects

Direct and indirect effects to surface water resources would likely occur during construction (short-term) and to a much lesser extent during the operational phase of project implementation (long-term). Effects generally would be expected from surface disturbance during construction of access roads, pipelines, and well pads. This surface disturbance would create unprotected soil surfaces, thus increasing potentials for accelerated soil erosion and sedimentation while elevating suspended sediments and salinity in runoff. Direct effects would be most likely to occur during construction of drainage crossings for access roads and/or pipelines, and at well pad locations near drainages during periods of precipitation, runoff, and streamflow. Indirect effects from disturbance would occur at all locations that are not near drainages.

Installation of culverts or other stream crossing methods across intermittent streams with streamflow at or shortly after the time of construction would likely result in direct effects of increases in sediment available for entrainment and transport by the channelized flow. These crossings would be installed in accordance with the “Gold Book” (USDOI and USDA 2007). Such installations could temporarily result in elevated levels of TSS and increases in turbidity at and downstream from the stream crossing; however, TSS and turbidity levels would be expected to begin to decrease within several days after the completion of in-stream construction activities, or with the end of runoff-inducing precipitation events. Upon reclamation, revegetation, and finalized bank stabilization, these effects would be expected to return to near pre-construction levels. Lease stipulations may restrict disturbance or occupancy on BLM-administered lands within floodplains, within or near riparian areas and wetlands, and at public water reserves. On BLM-administered lands, in accordance with the Utah BLM Riparian Policy, no new surface disturbing activities would occur within 100 meters of riparian areas unless it can be shown that: a) there are no practical alternatives, b) all long-term effects can be fully mitigated, or c) the activity will benefit and enhance the riparian area.

Surface water quality could be directly affected by leaks or spills of petroleum products or other hazardous materials from construction or operation equipment into streams or waterbodies, or indirectly by leaks or spills onto upland surfaces where contaminants could migrate to streams or waterbodies; however, protective measures to minimize the risk of contamination from accidental releases would be implemented according to the applicable SPCC Plan. A typical SPCC plan is included as **Appendix E**.

Areas of disturbance not successfully reclaimed adjacent to and directly upslope of streams also might contribute to effects on surface water through increased levels of stream sedimentation from accelerated rates of soil erosion during precipitation-driven runoff events. The BLM VFO implements intensive management and construction measures to reduce sediment and salinity production on important watersheds, and to reduce water quality degradation of the Green River, White River, and their tributaries within the Vernal planning area (BLM 2008b). Site-specific storm water runoff control BMPs (Section 2.6.9) would be applied during construction and reclamation to minimize these effects. During review of APDs, other reasonable measures to minimize effects could be specified by the BLM in

accordance with the CFR, Title 43, Subpart 3101.1-2. For example, relocation of proposed facilities by up to 200 meters would be deemed consistent with lease rights. Specific areas of potential upland and stream-bank or channel erosion would be identified during the detailed design phase.

The analysis of surface water quality effects is based on the assumption that surface disturbance within a given watershed serves as an indicator of the potential for increased sediment and salt runoff. Marston and Dolan (1988) conducted research to investigate the major criteria that control upland erosion in an environment similar to the GCWPA. This research showed that slope and vegetative cover exert the most influence on upland erosion rates. Erosion was found to be inversely correlated with vegetation density (i.e., as vegetation density decreases, upland erosion increases). The surface disturbance associated with the proposed project would initially remove vegetative cover, which will increase erosion. With the application of reclamation measures consistent with the BLM's Green River District Reclamation Guidelines (**Appendix B**), vegetative cover would be reestablished, thereby reducing rates of soil erosion. As the re-establishing vegetative cover approaches desired density levels, the erosion rate also would approach pre construction levels. **Table 4.4-1** presents the calculated disturbance by sub-watershed across the GCWPA from conceptual project development footprints by alternative.

Table 4.4-1 Existing and Initial Project Disturbance in Project Boundary by Sub-Watershed

	Existing Disturbance	Project Disturbance							
		Alt. A		Alt. B		Alt. C		Alt. D	
Sub-watershed	acres	acres	percent[1]	acres	percent[1]	acres	percent[1]	acres	percent[1]
Saddle Tree Draw-White River	37	21	0.1	15	0.0	11	0.0	14	0.0
Sand Ridge	0	71	0.5	50	0.4	40	0.3	50	0.4
Upper Coyote Wash	0	0	0.0	0	0.0	0	0.0	0	0.0
Kennedy Wash	514	125	0.4	87	0.3	69	0.2	84	0.3
Middle Coyote Wash	101	88	0.6	61	0.4	49	0.3	61	0.4
Red Wash	420	346	1.9	241	1.3	193	1.1	193	1.1
Lower Coyote Wash	1,441	1,168	4.9	815	3.4	652	2.7	684	2.9
Lower Sand Wash	0	0	0.0	0	0.0	0	0.0	0	0.0
Inlet Sand Wash-White River	1,061	612	2.7	427	1.9	334	1.4	333	1.5
Glen Bench	362	204	2.1	142	1.5	138	1.4	147	1.5
Antelope Draw	5	5	0.0	3	0.0	3	0.0	3	0.0
Outlet White River	29	47	0.2	33	0.1	24	0.1	26	0.1
Total	**3,970**	**2,685**	1.0	**1,875**	0.7	**1,514**	0.6	**1,595**	0.6

[1] Percent Disturbance Increase within Entire Sub-watershed from Project.

Water would be needed for use during construction and operation of the project. In a region where water resources are limited, there is a concern that industrial activities such as gas well drilling would put additional pressure on existing water supplies. Water for well drilling and completion, road compaction and dust abatement, and other construction uses for the action alternatives would come from fresh or recycled fresh (previously used) water from the Bonanza power plant under Water Right 49-225. No additional water supplies are proposed for use.

Water use estimates are based on the assumptions provided in Section 2.6.3.3, and include an annual need for dust suppression water of 0.01 acre-feet (92 barrels) per mile of access road, and 2.17 acre-feet (16,580 barrels) per well for well drilling and completion. Dust suppression water would be

fresh, where the well drilling and completion water would be approximately 12 percent fresh and 88 percent recycled fresh. **Table 2-3** summarizes water use by specific process.

Alternative A—No Action

Under Alternative A, the proposed project would increase surface disturbance in the GCWPA study area by approximately 1.0 percent. The disturbed area within the GCWPA would increase from the existing condition by approximately 2,685 acres. Effects on surface water resources would be as described above in Section 4.4.1.1 and as reflected in the disturbance indicator listed in **Table 4.4-1**. Assuming the currently permitted wells are completed in a ten-year timeframe (averaging 46 wells completed per year), and assuming the same water need as Alternative B, approximately 16 acre-feet of fresh water would be needed annually for well drilling and dust abatement.

Average annual water consumption would total 101 acre-feet, where 13 acre-feet are fresh water and 88 acre-feet are recycled fresh water. To reduce the overall water consumption, EOG would make reasonable efforts to recycle well drilling and completion fluids where practicable. Recycling would depend on suitability and compatibility of fluids and other factors that would prevent advantageous reuse. By comparison, the annual water consumption of the Bonanza power plant is approximately 7,700 acre-feet per year (Department of Energy - National Energy Technology Laboratory 2009). Water consumption after full build out should drop to 0.5 acre-feet per year for dust suppression only. Due to use of existing water rights, water recycling, and the relatively small amount of water needed annually (fresh water need would be approximately 0.2 percent of the Bonanza power plant annual consumption), water consumption for Alternative A would not be expected to impact water supplies.

Alternative B—Proposed Action

Under Alternative B, the Project would increase surface disturbance in the GCWPA study area by approximately 0.7 percent. The disturbed area within the GCWPA would increase from the existing condition by approximately 1,875 acres. Effects to surface water resources would occur as described above in Section 4.4.1.1 and as reflected in the disturbance indicator listed in **Table 4.4-1**. The application of protective design features where necessary, would limit effects of new surface disturbance within active floodplains or within 100 meters of riparian areas are described in Section 2.6.9. These features, coupled with site-specific reclamation for all disturbances, would lessen direct effects on surface water flows and water quality by stabilizing soil surfaces through use of stabilized diversions and runoff control features. Soil and channel stabilization also would reduce indirect effects on associated wildlife habitat.

Under Alternative B, water consumption over the life of the project would be estimated as 6,099 acre-feet (annual average of 407 acre-feet for 15 years). As in Alternative A, EOG would make reasonable efforts to recycle well drilling and completion fluids where practicable to reduce water use. Approximately 88 percent of the needed water would come from recycled fresh water from the Bonanza power plant as previously described. This equates to 50 acre-feet of fresh water and 357 acre-feet of recycled fresh water on an average annual basis.

The maximum annual well development scenario during project implementation (252 wells in 1 year, requiring 548 acre-feet total) would be greater than the average annual rate. Under this scenario, approximately 67 acre-feet of fresh water and 481 acre-feet of recycled fresh water would be needed during that year for well drilling, cementing, and dust suppression. At the maximum annual well development, the requirement for fresh water would be approximately one percent of the Bonanza power plant's annual water consumption. Due to use of existing water rights, water recycling, and the relatively small amount of water needed annually, water consumption for Alternative B would not be expected to impact water supplies.

Alternative C—Resource Protection Action (BLM-Preferred)

Under Alternative C, the Project would increase surface disturbance in the study area by approximately 0.6 percent. The disturbed area within the GCWPA would increase from the existing condition by approximately 1,514 acres. Effects on surface water resources would occur as described above in Section 4.4.1.1. The application protective design features and reclamation measures would limit effects of new surface disturbance within active floodplains or within 100 meters of riparian areas and are described in Section 2.6.9. In addition, the preclusion of surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100–meter buffer of these water features and use of spill controls and preventers (Section 2.8.3) would further protect water quality and associated habitat. Supplemental mitigations for Alternative C also requires the development and implementation of a water monitoring plan (**Appendix I**) because of the potential for water quality effects and limited water resources data in or near the GCWPA. Through monitoring of water flows and quality, adverse effects on surface water resources that may result from the proposed project development would be detected, and adaptive management would then be applied to implement additional appropriate mitigation measures that would minimize the detected adverse effects.

Under Alternative C, water use would be the same as Alternative B.

Alternative D—Other Protections Action

Under Alternative D, the Project would increase surface disturbance in the study area by approximately 0.6 percent. The disturbed area within the GCWPA would increase from the existing condition by approximately 1,595 acres. Effects on surface water resources would occur as described above in Section 4.4.1.1. Necessary protective design features, reclamation measures, no-disturbance buffers around water features, including a buffer that would exclude new well pads within 0.5 mile of the White River and implementation of a water monitoring program (**Appendix I**) would be applied under Alternative D. These measures would provide additional protection of surface water resources similar to those described for Alternative C, and would be more protective of the White River and its floodplain.

Under Alternative D, water use would be the same as Alternative B.

4.4.1.2 Alternative-specific Design Features and Mitigations

During the APD and ROW Grant approval processes, surface water considerations would be identified for further mitigation and monitoring of surface water resources. This would include the listing of nearby streams, springs, seeps, and riparian areas and their characteristics that could be adversely affected by the proposed drilling location or associated facilities. Recommended protective measures for such resources would be specified from the Gold Book, the BLM VFO RMP, or other guidelines (Sections 2.6.9, 2.7.3, 2.8.3, and 2.9.3).

Under Alternatives B, C, or D, EOG has committed to many environmental protection measures as listed in Section 2.6.9 and listed in **Table 4.4-2**. Included in those are several that would avoid, reduce, and minimize impacts to water resources such as performing interim reclamation, locating gathering lines adjacent to access roads where possible, re-using drilling mud as much as possible, using closed-loop drilling systems, incorporating site-specific storm water controls, and ceasing project construction and maintenance activities if roads become saturated.

In addition, the Long-term Monitoring Plan for Water Resources (**Appendix I**) would be implemented under Alternatives C or D. For the overall GCWPA, the operator would prepare and submit an annual summary describing periodic monitoring results. The contents and format of the GCWPA summary report would be determined by the agencies. The document would be submitted annually for approval by the BLM, UDOGM, and UDEQ.

Table 4.4-2 Water Resources Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Surface Water and Groundwater								
EOG would develop and maintain a SPCC Plan for each well in the GCWPA. A typical SPCC Plan from the field has been included as **Appendix E**. To satisfy SPCC Plan requirements, any necessary storage facilities or tanks would be constructed in accordance with applicable containment regulations.		d	d	d	m			
EOG will re-use drilling mud for new wells to the maximum possible extent.		d	d	d	m			
EOG will use closed-loop drilling systems.		d	d	d	m			
EOG will incorporate site-specific BMPs in a Storm Water Pollution Prevention Plan to control the amount and quality of runoff, including appropriate measures to prevent or address sedimentation and spills.		d	d	d	m			
All construction and maintenance activities will cease if soils or road surfaces become saturated to the extent that construction equipment is unable to stay within the ROW, and before activities cause irreparable harm to roads, soils, or excessive siltation of nearby lakes, reservoirs, or live flowing streams.		d	d	d	m			
A long-term water resources monitoring plan will be developed during analysis for the EIS and will be included as an appendix (**Appendix I**) to the EIS.			d	d	m	m		
Back flow preventers, automatic shut off valves, and\or pressure block valves on liquids pipelines that cross 100-year floodplains will be required.			d	d	m	m		
Compliance with BLM memorandum UT IM 10-055 on groundwater protection will be required.			d	d	m	m		
Active Floodplains and Riparian Areas								
EOG will utilize BLM Hydraulic Considerations for Pipeline Crossings of Stream Channels (prepared by the Utah State Office BLM, Salt Lake City, Utah) where possible.		d	d	d	m			
If project operations will create new surface disturbance within active floodplains or within 100 meters of riparian areas, and assuming there are no practical alternatives, EOG will work with the AO to evaluate site-specific design features to maintain and protect wildlife habitat, water quality, and appropriate land uses. The decision to implement site-specific design features within an active floodplain or within 100 meters of a riparian area will be determined on a well-by-well basis during the APD approval process.		d	d	d	m			

Table 4.4-2 Water Resources Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
No surface disturbance will be allowed in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas.			d	d	m	m		
No surface disturbance will be allowed in the 100-year floodplain of the White River.			d	d	m	m		
To protect the White River visual environment, no new wells or well pads would be permitted within 0.5 mile of the river, unless such wells would not be visible from the river because of intervening topography.				d				
Storage and parking locations for hazardous materials, lubricants, fuel tanks or trucks, and refueling activities will be a minimum distance of 100 meters from wetlands, riparian areas, and channels with defined beds and banks. Such materials storage or refueling activities will be outside the mapped 100-year floodplains.					m	m	m	m
Flow monitors will be installed on produced water pipelines to detect possible leaks.					m	m	m	m
Perennial and ephemeral/intermittent drainages will be avoided where possible; otherwise the disturbance will be minimized.					m	m	m	m
Siting well pads within active drainages will be avoided. Well pads sited adjacent to drainages will be bermed to prevent runoff from entering the drainage.					m	m	m	m
Roads will be designed and constructed to divert stormwater runoff around the pad and reduce erosion by proper design and installation of erosion control structures, such as water bars, diversion channels, and silt fences.					m	m	m	m
Roads will have appropriate energy dissipaters (e.g., water bars and silt fences) where water leaves the road and is routed toward an adjacent drainage.					m	m	m	m
Road crossings of drainages will be built to accommodate the 100-year flood. Crossings will be designed so they will not cause siltation or accumulation of debris, nor will the roadbed block the drainage.					m	m	m	m

1

4.4.1.3 Residual Effects

All Alternatives

Mitigation measures are designed to identify and reduce effects on water resources but do not fully eliminate those effects. Under all the alternatives, the project would result in the potential for site-specific increases of upland soil erosion during construction, thereby increasing sedimentation to streams. This effect would decrease with improving soil stabilization resulting from applied reclamation measures; however, some continued elevated levels of sedimentation would be expected during operations in areas with poor or low reclamation potentials due to the continued use of constructed roads. The increased risk of accidental releases of hazardous materials also would continue despite minimizing the potential during construction and operation.

4.4.1.4 Irretrievable and Irreversible Commitment of Resources

The application of environmental stabilization and reclamation measures would mitigate long-term effects from surface disturbance on water quantity and quality over time. Temporary reductions in water quality from erosion and sedimentation would be irretrievable. Accidental releases of hazardous materials are difficult to remediate, and often would cause an irretrievable effect to water resources.

Water consumptively used during the project would be irretrievable. However, consumptive use would not be irreversible because the water uses would end after construction, drilling, and completion phases of the project.

4.4.1.5 Relationship of Short-term Use and Long-term Productivity

Increases in erosion and decreases in streamside bank vegetation during construction could potentially affect channel stability beyond the construction phase of the project. If reclamation is effectively implemented, this would not affect the long-term productivity of the streams.

4.4.2 Groundwater

4.4.2.1 Direct and Indirect Effects

Contamination

Sources of potential groundwater contamination include leaks and spills of material (such as fuels) from storage containers, transportation accidents, leaks from impoundments, and well integrity breaches. Likely groundwater sources to be affected would be the near-surface alluvial aquifers because they are shallow, unconfined, and composed of materials that transmit fluids more easily than solid rock. There are concerns that deeper aquifers may be potentially at risk from effects from hydraulic fracturing or loss of well integrity.

In order to minimize the risk of contaminating shallow aquifers due to leaks and spills, the transportation, storage and disposal of potentially deleterious materials would be done in accordance with regulatory requirements of applicable federal and state programs as listed on **Table 1-2**. In addition, EOG would maintain and implement SPCC plans (see **Appendix E**) for the potential release of petroleum and non-petroleum materials (various ingredients of fracturing fluids and well treatment chemicals).

Since EOG has proposed to use closed-loop drilling fluid systems at all of its well locations, potential effects on groundwater resources associated with pits are eliminated. By using closed-loop drilling fluid systems, drilling fluids would not be disposed on location, but rather would be recycled or sent to an offsite disposal facility, thereby further lowering the potential risk of contamination of groundwater.

Surface casing and cementing procedures, as described below, would also be used to avoid impacts to shallow aquifers. As described in Affected Environment Sections 3.2 and 3.4, such zones occur in

unconsolidated Quaternary deposits (colluvium, alluvium) and shallow bedrock in the Uinta Formation and the Brennan Basin Member of the Duchesne Formation. No Sole Source Aquifers occur anywhere near the project area (USEPA 2010), and the only drinking water protection zone is at Bonanza, more than 5 miles from the project area (see Section 3.4.2.5). According to **Table 3.4-6**, four stock or domestic wells occur within two miles of the project area. Of these, recorded well depths range from 26 to 500 feet. The shallower wells are all drilled in alluvial settings, where blasting for project development would not be needed.

Contamination of shallow groundwater zones would be avoided by the implementation of BLM UT IM 2010-055 procedures during the BLM APD process, when site-specific well locations are proposed. The potential for physical or chemical effects on shallow water-bearing zones from pad development or pipeline burial would be avoided by implementing the IM procedures, surface casing and cementing, the SPCC and storm water plans, closed-loop drilling, and by the nature of excavation practices. Well pads, roads, and pipeline alignments would be developed by earthmoving in unconsolidated deposits, ripping soft bedrock, or blasting as described in Chapter 2.0, Sections 2.6.2.2 and 2.6.2.3. Given the existing weathered and naturally fractured nature of near-surface bedrock, the anticipated amount and depth of any blasting would be limited. Where needed, blasting depths would likely be 5 to 10 feet or less, in comparatively soft fractured rock. This would reduce the charges needed and the extent of effects. On steep side-slopes requiring contouring for pads, it is likely that shallow zones are already naturally drained along the topography or by incised drainages. Because of these factors, and with few wells in the area, impacts to shallow groundwater sources would be avoided.

Fracturing chemicals would be disclosed to FracFocus© (2015) as required by UDGOM rules (and potential BLM hydraulic fracturing rules). FracFocus© (2015) contains a national registry through which oil and gas operators can list by well the ingredients used in fracturing fluids, subject to proprietary ingredients exceptions. The potential effects from fracturing chemicals are primarily from surface spills which can be reduced or minimized through adherence to existing rules and regulations. When flow back of fracturing fluids begins, often materials have changed character (spent acids) or have been absorbed into the reservoir rock and do not return to the surface. Flow back generally nets not much more than 50 percent of fluids injected before production begins. Then the fluids would be recovered with the produced water from the formation and would be disposed with the produced water in permitted disposal wells. Additionally, fracturing chemicals that remain downhole would likely not migrate and would reside in the hydrocarbon producing formation. Fracturing make-up fluids and fracturing flow-back fluids would be held in portable tanks and flow-back fluids would be disposed off-site at a commercial disposal facility. No pits would be used to hold flow-back fluids, thereby greatly reducing the risk of contamination.

In order to protect shallow aquifers and deeper potential USDW, adequate surface casing to protect aquifers would be installed. A USDW is defined by the USEPA as “an aquifer or portion of an aquifer that:

- Supplies any public water system or contains a quantity of groundwater sufficient to supply a public water system; and
- Currently supplies drinking water for human consumption; or
- Contains fewer than 10,000 mg/L TDS and is not an “exempted aquifer” (USEPA 2002b).

There are no exempt aquifers in the GCWPA (Vanden Berg et al. 2013).

The depth at which surface casing is set would be based on hydrogeological factors and site conditions as determined by compliance with BLM IM 2010-055 (BLM 2010b). Under the IM, submission of an APD triggers hydrogeologic and engineering reviews of the application by BLM and would consist of the following:

- Determine the depths or presence of water-bearing zones that meet the definition of a USDW.
- Review of the operator's casing and cementing program to determine if the proposed program is adequate to protect usable water, oil, gas, or other minerals.
- Determine whether a closed-loop drilling fluid system is warranted because of shallow groundwater.

After operations have commenced, the BLM would monitor casing and cementing activities to ensure that groundwater resources are adequately protected.

In addition to surface spills and releases, a concern regarding hydraulic fracturing is the risk that vertical fractures would migrate into USDWs and cause fracturing chemicals to be injected into a usable aquifer. Fracture monitoring data from hydraulically fractured wells in adjacent Natural Buttes Field indicated that the vertical extent of fractures averaged 30 feet above the hydrocarbon zone perforations, 90 percent of the data indicated fractures extended no more than 55 feet, and the maximum was 158 feet (BLM 2012c). In addition, published data also from Natural Buttes indicated a range of horizontal fracture lengths from 700 to 1,250 feet (Mohammad and Miskimins 2010). As indicated in Section 3.4.2.4, moderately saline water (less than 10,000 mg/L TDS) ranges from 1,000 to 3,000 feet below the surface at GCWPA (Anderson et al. 2012). Based on the fracture monitoring data cited above, it is very unlikely that vertical fractures would migrate to the moderately saline level. Accordingly, there appears to be very little risk of affecting USDWs from hydraulic fracturing. However, since the transition from moderately saline to very saline is not uniform, it is possible for USDWs to occur below the transition defined by Anderson et al. (2012). Compliance with IM 2010-055 (BLM 2010b) would provide additional protection to USDWs. It also is very unlikely that fractures would migrate in an up-dip direction in the producing zone and potentially reach better quality water.

It is not likely that zones of natural fracturing and faulting would allow the migration of fracturing fluids from the reservoir. As production progresses and reservoir energy is expended, fluid gradients would preclude the movement of fluids along natural fracture or fault planes. Migration of gas or other formation fluids would most likely occur due to the breakdown of well integrity barriers (e.g., casing, cement, packers) rather than the migration of these fluids via fractures or faults intercepted by the well bore or artificially created fractures.

Produced Water and Fracturing Flow-back Water Disposal

All of the flow-back fluid and produced water would be disposed by SWDs. Disposal of produced water by deep injection reduces the risk of effects on groundwater posed by the use of evaporation pits. Similar to lined reserve pits, liners may lose integrity causing leakage into shallow aquifers. SWDs are regulated by the USEPA under the underground injection control (UIC) program of the CWA and are designated Class II injection wells. Class II wells are used for oil and gas production and include wells used for injection disposal and wells used for secondary hydrocarbon recovery. Although the UIC program for Class II wells has been delegated to the State of Utah, in the GCWPA the UIC program is regulated by the USEPA because of the presence of tribal land in the area.

Deep injection disposal is not without risk and there is a concern that injected fluids could leave the injected zone and migrate into USDWs. However, the Bird's Nest aquifer, the preferred injection zone in the area, has several attributes that would prevent the migration of fluids from the zone (BLM 2012c).

- Adequate disposal capacity based on modeling conducted on SWDs in the Natural Buttes unit.
- Well documented water salinities greater than 10,000 mg/L TDS where injection is occurring (**Figure 3.4-4**).
- High permeability.
- The presence of persistent confining layers above and below the zone.

- A fluid pressure gradient of 0.33 pounds per square inch per foot that would preclude the migration of potential contaminants from the Bird's Nest.

The fluid pressure gradient is one of the most important attributes for ensuring confinement of injected fluids. In the vicinity of the GCWPA, the fluid gradient to 6,000 feet deep is generally 0.5 pounds per square inch per foot (Nelson 2003). The lower gradient of the Bird's Nest facilitates the movement of fluid into the aquifer and would substantially reduce the likelihood of movement of fluid from the zone.

Water Use

Groundwater would not be used as a supply for project development. Water from surface water right 49-225 would be used as described in Section 4.4.1.1.

Alternative A—No Action

Although measures would be in place to minimize the risk of leaks and spills, shallow aquifers would remain susceptible to contamination from accidental releases of hazardous materials.

The potential for waste water disposal through SWDs to contaminate USDWs is minimized because the lower gradient of the Bird's Nest formation facilitates the movement of fluid into the aquifer, and the existence of approximately 500 feet of confining layers between the disposal zone and the aquifers above the BMSG, substantially reducing the likelihood of movement of fluid from the zone.

Alternative B—Proposed Action

Issues and effects concerning contamination, hydraulic fracturing and waste water disposal would be the same as the Alternative A, but the increased number of wells would likely pose a risk of greater impacts.

The additional production wells may necessitate the installation of three additional SWDs. However, because of the unique properties of the Bird's Nest aquifer, the zone should have the capacity to absorb the additional injection disposal capacity (see **Table 2-6** for produced water volumes) without increasing the risk that disposed fluids would migrate out of the zone.

Alternative C—Resource Protection Action (BLM-Preferred)

Issues and effects concerning contamination, hydraulic fracturing and waste water disposal would be the same as Alternative A.

Alternative D—Other Protections Action

Issues and effects concerning contamination, hydraulic fracturing and waste water disposal would be the same as Alternative A.

4.4.2.2 Alternative-specific Design Features and Mitigations

No alternative specific mitigations are recommended because many of the risks and concerns are dealt with under existing statutory and regulatory programs. The mitigations listed in **Table 4.4-2** also may be protective of groundwater from indirect effects such as spilled material that would migrate through the vadose zone and impact shallow groundwater.

4.4.2.3 Residual Effects

All Alternatives

The risk to shallow aquifers after mitigation of accidental releases of hazardous materials would be a potential residual effect. The potential for migration of gas or other formation fluids due to the breakdown of well integrity barriers (e.g., casing, cement, packers) also would be a potential residual effect.

4.4.2.4 Irretrievable and Irreversible Commitment of Resources

Produced formation water is not practically available or usable before it is withdrawn from the ground with oil and gas and would be injected in a disposal well.

4.4.2.5 Relationship of Short-term Use to Long-term Productivity

Little or no long-term effects to the current or future beneficial uses of groundwater are anticipated.

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4.5 Soils

4.5.1 Direct and Indirect Effects

Potential effects on GCWPA soils from access road, well pad, pipeline, and ancillary facilities construction and operations would result from the exposure and disturbance of in-place soils and both short-term and long-term loss of soil productivity characterized principally by the loss of protective vegetative cover. Soil exposure to the elements from loss of vegetative cover and disturbance is anticipated based on construction and operational requirements to blade/level, to excavate/move, to loosen and/or compact, to disturb existing steep slopes, and to create steep slopes of soil materials:

- Blading and/or leveling of the land surface and surface soils would result in the removal and clearing of protective vegetation and biological soil crusts, where present, from construction zones; and in the exposure of disturbed surface soil materials to erosive forces of raindrop impact, runoff (water erosion), and wind erosion.
- Excavation and transport of soil materials as part of anticipated cut-and-fill and trenching operations would result in the loosening of soil materials, the potential mixing of soil horizons, and the reduction in quality as plant growth media. These actions also would contribute to increased potentials for accelerated erosion and soil loss.
- Compaction of affected soil materials could reduce soil productivity by limiting infiltration of moisture and oxygen needed to support the successful reestablishment of desired vegetation. Compaction also can lead to accelerated soil erosion due to the subsequent lack of protective vegetative cover, breakdown of soil aggregates, and increased runoff of water.
  - Intentional compaction of soil materials as part of facilities construction and continued operations would mostly preclude the re-establishment of vegetation in these areas for the duration of the facilities' use; and
  - Unintentional or unnecessary compaction and/or rutting of lands beyond the facilities boundaries by wheeled or tracked vehicles including off road vehicles could result in the following effects:
    - Mixing of topsoil and subsoil;
    - Disrupt surface flow conditions by diverting and possibly channelizing surface runoff; and
    - Damage to plant roots and again, reduction of soil aeration and water infiltration limiting plant growth.
- Disturbance of existing steep slopes and the creation of steeper slopes (cut-and-fills) as part of facilities construction would further exacerbate potentials for accelerated soil erosion by increasing rates for runoff across exposed soil materials.

Such adverse effects, individually or in combination, could limit the potential for successful reestablishment of vegetative cover for any post-construction interim or final reclamation of affected soils due to surface instability (soil movement by erosion), to loss of soil materials (erosion and sedimentation), and to reduction of suitability of growth media represented by replaced, mixed, or disturbed-in-place soil materials. However, these effects, when coupled with additional inherent limitations to successful reclamation that characterize nearly all soils that are present within the GCWPA, would pose even greater challenges to successful reclamation. Because soil types with constraining characteristics for reclamation are distributed throughout the GCWPA, total avoidance by proposed facilities of these areas is not feasible (**Appendix L**). Soils characterized by high constraints occupy an estimated 87 percent (37,472) of the 43,071-acre GCWPA. Soils exhibiting moderate constraints (11 percent/4,738 acres) and low constraints (2 percent/861 acres) of the GCWPA comprise the remaining 16 percent of the GCWPA. High constraint soils present a variety of limitations that would

require flexibility within both interim and final reclamation planning to account for the individual and combination of limitations that characterize these soils when disturbed by project development activities (**Appendix L**).

For the purposes of this analysis, successful interim and final reclamation, including soil stabilization, preparation, and revegetation, refers to the return of disturbed areas to a stabilized condition that is resistant to erosion and supports vegetative productivity and use comparable to current principal uses of oil and gas development, livestock grazing, and wildlife habitat described in the BLM Green River District Reclamation Guidelines (**Appendix B**). Reclamation objectives are for the establishment of a self-perpetuating diverse plant community. The objective is to attain 75 percent basal cover based on similar undisturbed adjacent native vegetative community, and comprised of desired species and/or seeded species within 5 years of initial reclamation action. Species diversity should approximate the surrounding undisturbed area. However if after three growing seasons there is less than 30 percent of the basal cover based on similar undisturbed native vegetative community, then the AO may require additional reclamation efforts.

The long-term performance standard is reestablishment of a self-sustaining native plant community. To date, the BLM VFO has yet to observe such levels of successful reclamation. The recent multi-year drought conditions in the Uinta Basin area are believed to be the principal limitation to success for both interim and final reclamation efforts.

Implementation of any of the four alternatives would result in soils disturbance of high, moderate, and low constraint soils. The estimated area of disturbance by alternative for each of the three constraint levels is provided in **Table 4.5-1**. Acres of effect for the alternatives are new disturbance and are in addition to existing disturbance within the GCWPA, which is estimated to total approximately 3,975 acres. Construction and field development effects are quantified as acres disturbed from construction of well pads, roads, pipelines, and related facilities. Post interim reclamation or residual effects are quantified as acres of disturbance that remain after interim reclamation of pipelines (final) and those portions of roads, well pads, and other related facilities that would not be used during operations. Locations of roads, wells, pipelines, and other facilities have not yet been identified; therefore, site-specific effects on soils are not assessed in this analysis. The poor quality and limited quantity of topsoil and the high erodibility and high potential for accelerated erosion of the materials comprising the high and moderate constraint soils pose the greatest challenges to successful soil stabilization, reclamation, and restoration of protective and productive vegetative cover following construction for both interim and final reclamation efforts (**Appendix L**). Drought conditions are believed to have exacerbated and will continue to exacerbate those conditions limiting successful soil stabilization and revegetation in the vicinity of the GCWPA.

In addition to natural limiting factors inherent to the sensitive soil types, additional limitations on post-construction and reclamation success may result from accidental releases of contaminants including hydrocarbons, salts, and other hazardous chemicals that may limit revegetation establishment and success and may indirectly contribute to surface water contamination via runoff from contaminated soil surfaces. Implementation of any of the four alternatives could result in increased potential for contamination from accidental releases in the form of spills or leaks of hydrocarbons and also waste water from well pad facilities, pipelines, storage tanks, and transport tankers. This increase in potential would result from the corresponding increase in activity of all four alternatives over existing conditions.

Table 4.5-1 Anticipated Disturbance Acreages by Alternative for High, Moderate, and Low Constraint Soils within the GCWPA

Disturbance Type	High Constraint Soils[1]	Moderate Constraint Soils	Low Constraint Soils	Total
Alternative A				
Construction	2,245	275	165	2,685
Interim Reclamation[2]	1,110	136	26	1,272
Alternative B				
Construction	1,637	201	37	1,875
Interim Reclamation[2]	358	44	8	410
Alternative C				
Construction	1,332	152	30	1,514
Interim Reclamation[2]	293	33	7	333
Alternative D				
Construction	1,404	159	32	1,595
Interim Reclamation[2]	383	43	9	435

[1] Includes areas of badlands and rock outcrop where soil material is mostly absent.

[2] Surface disturbance interim reclaimable acreage.

Source: Project disturbance overlaid on SSURGO soils GIS data, with projection into Tribal lands.

BSCs also would be affected by implementation of any of the four alternatives. The presumption is that BSC would occupy or comprise soil cover of at least one percent over all soil map units within the GCWPA. BSCs are expected to occur on soils throughout the GCWPA; however, their specific locations relative to approved or proposed disturbance is not known due the absence of mapping of this community of various organisms. All four alternatives would result in the proportional loss or damage of affected BSCs present in areas to be disturbed by construction of facilities.

4.5.1.1 Alternative A—No Action

Current Management Actions

Soils would be managed to restore and maintain soil quality and long-term productivity through the implementation of applicable BMPs, guidelines for rangeland health, and other soil protection measures presented in the BLM Vernal RMP (BLM 2008b). To meet these goals and objectives, the RMP's Soil and Water Resources Management Decisions stipulate the following:

- Severe and critical erosion are to be restored and protected by restricting or mitigating surface disturbances.
- Activities are to comply with standards identified in the "Surface Operating Standards for Oil and Gas Exploration and Development" (Gold Book) unless otherwise specified in the RMP.
- The Gold Book is to be used as a guide for the surface-disturbing proposals on steep slopes/hillsides:
  - Steep slopes/hillsides would be avoided in the construction of routes, pipelines, and flowlines.

  - If surface disturbing activities cannot be avoided on slopes of 21 to 40 percent, an approved plan comprised of an erosion control strategy, GIS modeling, and proper survey and design by a certified engineer would be required.
  - For affected slopes greater than 40 percent, no surface disturbance will be allowed unless it is determined that it would cause undue or unnecessary degradation to pursue other placement alternatives.
- Effects on biological soil crusts are to be considered and measures are to be taken to identify and avoid bacterial soil crust areas when possible.

Effects on Soils

Implementation of Alternative A would result in no additional oil and gas development activities beyond those activities previously approved in the GCWPA. Previously approved actions would involve the new disturbance of 2,685 acres (6.2 percent) of the 43,071-acre GCWPA due to access road construction, drilling and completion, production facilities construction, and linear pipeline and power line facilities construction over about a 10-year period. Including existing disturbance of 3,975 acres (**Table 2-1**), approximately 6,660 acres (15.5 percent of the GCWPA) of soils affected, including soil stability and productivity, would be disturbed under Alternative A (**Table 2-2**). Reclaimable new disturbance under interim reclamation goals to meet BLM BMP and reclamation objectives would total approximately 1,272 acres (3.0 percent) of the GCWPA. Of the anticipated 2,685 acres of total new disturbance in the GCWPA, approximately:

- 2,245 acres (87 percent) of the new disturbance from approved oil and gas development would occur in high constraint soils that pose mostly multiple limitations to successful implementation of reclamation measures and long-term maintenance of protective and productive vegetative cover (**Tables L-1** and **L-2**, **Appendix L**);
- 275 acres (11 percent) of new disturbance from approved oil and gas development would occur in moderate constraint soils that pose again mostly multiple, but less severe limitations to successful reclamation and long-term maintenance of vegetative cover (**Tables L-1** and **L-2**, **Appendix L**); and
- 165 acres (2 percent) of new disturbance from approved oil and gas development would occur in low constraint soils that pose mostly single and minor limitations to successful reclamation and revegetation (**Tables L-1** and **L-2**, **Appendix L**).

Regardless of whether or not soils in the GCWPA are characterized by constraining quantity, erosion hazard, or elevated salinity and/or sodicity levels, all but two soil mapping units of limited acreage within the GCWPA are rated at best poor topsoil material (**Appendix L**).

Effective mitigation of an implemented Alternative A would likely be challenged by the following constraint factors:

- Steep slopes (greater than 25 percent slopes), regardless of a soils inherent erodibility (K-factor), could exacerbate runoff and accelerate erosion by further exposing soil materials to water erosion forces through removal of protective vegetation and soil loosening and/or compaction. Soil loss from accelerated erosion could in turn result in less successful revegetation due to loss of growth media and exposure of less suitable media, subsoil and geologic materials.
- Sloping to moderately steep slopes (8 to 25 percent slopes) combined with a higher erodibility of soil also could exacerbate runoff and accelerate erosion by further exposing soil materials to water erosion forces through removal of protective vegetation and soil loosening and/or compaction. Again, soil loss from accelerated erosion and reduction in growth media would likely result in less successful revegetation.

- Shallow/rocky/droughty soils, when disturbed by vegetation removal and excavation, could pose challenges to timely reclamation due to a limited moisture and nutrient holding capacity and availability, especially under arid, drought conditions.
- Saline and/or sodic soils, when disturbed by vegetation removal and excavation, also could pose challenges to timely reclamation due to:
    1. Presence of soluble calcium, magnesium, and sodium salts in elevated soil conductivity levels in excess of 4 deci-siemens per meter, which may exacerbate droughty conditions by the salts absorbing available soil moisture or otherwise making soil moisture unavailable to plants;
    2. Presence of elevated adsorbed sodium levels in comparison to calcium and magnesium levels measured as a level equal to or in excess of a sodium adsorption ratio of 12, which can cause soil aggregates to breakdown and soil particles to disperse resulting in reduced infiltration and permeability, resulting in a droughty growth medium with limited air exchange; and
    3. A combination of both saline and sodic conditions which together would further limit successful revegetation and reclamation.
- Wind erodible soils, when disturbed, are more susceptible to entrainment by wind and loss from the disturbed location which would result in loss of growth medium for reestablishment of protective plant cover. This loss of soil material exacerbates the inherent constraining factors of these mostly sandy, droughty, and low nutrient soils in supporting revegetation.

The amount and duration of anticipated effects would depend on the soil conditions and locations of proposed facilities, and the application of mitigation measures agreed to by the BLM and operators in the previous NEPA compliance analyses and site-specific measures developed at future on-sites for each well/facility as part of the APD permitting process and ROW grant approval process, where applicable.

Effects on Biological Soil Crusts

Given the likely presence of BSCs in soils throughout the GCWPA, damage to or loss of BSCs would correlate to the projected disturbance of soils that would result from implementation of previously approved actions under Alternative A. Soil disturbance and associated presumed disturbance of BSCs from approved oil and gas development would total up to 2,568 acres. In addition to direct disturbances from construction of oil and gas facilities, BSCs also are vulnerable to other activities such as off-road vehicle traffic, livestock grazing, and off-road horse and pedestrian traffic. The fibers that comprise the tensile strength of BSCs are weak in comparison to the compressional and/or cutting strength of construction equipment, foraging livestock, and horse (horseback activities) traffic. The effect to a given soil surface supporting BSC by disturbance depends on the severity, frequency, timing, and type of disturbance, as well as weather conditions during and following the disturbance (Belnap 2001). Even pedestrian traffic by workers or recreationists off road can damage BSCs with the extent of damage increasing with repeated foot falls.

The damage and loss of BSCs from development of approved oil and gas locations would be considered a long-term effect (Belnap et al. 2001). Natural recovery of BSCs in areas where crusts have been severely damaged or lost due to disturbance can take tens of years to hundreds of years. The predominantly cyanobacteria crusts of the GCWPA are expected to recover within about 10 years, assuming mostly favorable conditions. Favorable conditions would be supported by the implementation of interim and final reclamation measures that are consistent with measures mandated by BLM reclamation requirements (**Appendix B**); however, interim reclaimed areas may again be disturbed thus damaging or destroying any recovering BSC and therefore resulting in the restart of BSC recovery for those recontoured and topsoil-replaced areas undergoing final reclamation.

4.5.1.2 Alternative B—Proposed Action

Effects on Soils

Implementation of Alternative B would result in additional oil and gas development activities beyond those activities previously approved in the GCWPA. The Proposed Action would involve the new disturbance of 1,875 acres (4.4 percent) of the 43,071-acre GCWPA due to access road construction, drilling and completion, production facilities construction, and linear pipeline facilities construction. Including existing, LGS and electrical distribution system, and Proposed Action disturbance, approximately 6,879 acres (16.0 percent of the GCWPA) of soils would be disturbed. Interim reclamation measures would be applied immediately following construction to approximately 85 percent of the site-specific No Action. Reclaimable new Proposed Action disturbance under interim reclamation goals to meet BLM BMP and reclamation objectives (**Appendix B**) would total approximately 410 acres (1.0 percent) of the GCWPA. Of the anticipated 1,875 acres of total new disturbance in the GCWPA, approximately:

- 1,636 acres (87 percent) of the new disturbance from approved oil and gas development would occur in high constraint soils that pose mostly multiple limitations to successful implementation of reclamation measures and long-term maintenance of protective and productive vegetative cover (**Tables L-1** and **L-2**, **Appendix L**);
- 201 acres (11 percent) of new disturbance from approved oil and gas development would occur in moderate constraint soils that pose again mostly multiple, but less severe limitations to successful reclamation and long-term maintenance of vegetative cover (**Tables L-1** and **L-2**, **Appendix L**); and
- 37 acres (2 percent) of new disturbance from approved oil and gas development would occur in low constraint soils that pose mostly single and minor limitations to successful reclamation and revegetation (**Tables L-1** and **L-2**, **Appendix L**).

The affected soil constraint types and factors are as described for Alternative A.

The duration of well development-related effects from the Proposed Action would increase to a projected 15 years from about 10 years projected for approved development under Alternative A. The duration of production and project decommissioning, reclamation, and abandonment would add on approximately 45 years to the two alternatives' development periods to account for the staggered abandonment of the remaining well locations and associated facilities.

To minimize effects to soils, EOG has committed to specific design features (Section 2.6.9) that comply with soils-related BMPs (BLM IM No. 2007-021):

- To conduct interim reclamation of well locations as soon as feasible as agreed upon by the AO.
- To design and construct all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use.
- To conduct final reclamation recontouring of all disturbed areas, including access roads, to original contour or a contour that blends with the surrounding topography.

The effect of implementing these design features, BMPs, and appropriate reclamation measures would be to minimize the extent, magnitude, and duration of new disturbance from construction; to effectively stabilize disturbed soil materials and control accelerated erosion from disturbed areas, including both interim-reclaimed and final-reclaimed areas; and to initiate restoration of protective and productive vegetative cover under both interim and final reclamation actions. Final reclamation requirements would be determined as part of the site-specific APD approval process, and the effectiveness of implemented reclamation measures would be monitored over time for effectiveness, revised, and re-implemented as

needed. Compliance with USEPA-required SPCC plans (40 CFR Part 112) and proposed storm water control measures would reduce potentials for releases of contaminants and their off-site transport. The application of such measures also would promote timely remediation of any spill or release and of storm water off-site flows to limit both direct effects on soil conditions and indirect effects on vegetation and overland and channelized water flows and subsequent sedimentation.

As previously noted, reclaimed disturbed soils could be expected to return to conditions supportive of natural soil development processes that would foster protective and productive vegetative cover over time; in some areas within the GCWPA this could occur within a few years, assuming adequate precipitation. Should precipitation be limiting, soil recovery and vegetation reestablishment would likely occur over an extended period of time. The predominant presence of high constraint soils with characteristics that present challenges to timely reclamation and revegetation success equating to at least 75 percent or greater vegetative cover in comparison to cover of adjacent natural conditions may greatly extend the time required for successful reclamation. Further evaluation of these areas where specific development would occur in the future would be necessary to identify appropriate site-specific adaptive, remedial measures.

Again, the amount and duration of anticipated effects would depend on the locations of proposed facilities. As previously described, total avoidance of constraining soil types in siting facilities would likely not be achievable. Facility locations on slopes greater than 40 percent, badlands, active floodplains, or within 100 meters of a riparian area would be determined on a site-specific basis using site-specific design features approved by the AO should there be no practical alternative location (BLM 2008b, Appendix K).

Effects on Biological Soil Crusts

Consistent with effects described for approved oil and gas development under Alternative A, implementation of the Alternative B would involve the new disturbance of approximately 1,875 acres of BSC–supporting area within the GCWPA. Again, the presumption is that BSC would occupy or comprise soil cover of at least one percent over all soil map units within the GCWPA (Bryce et al. 2012). Disturbance effects, although less by 693 acres than for the approved Alternative A development, would again be considered long-term in terms of acres disturbed for potential BSC cover. However, the early successional cyanobacteria could possibly contribute to the restoration of protective soil cover in about 10 years after final reclamation, assuming favorable conditions.

4.5.1.3 Alternative C—Resource Protection Action (BLM-preferred)

Effects on Soils

Implementation of Alternative C would result in additional oil and gas development activities beyond those activities previously approved in the GCWPA. Alternative C would involve the new disturbance of 1,514 acres (3.5 percent) of the 43,071-acre GCWPA due to access road construction, drilling and completion, production facilities construction, and linear pipeline facilities construction. Including existing, LGS and electrical distribution system, and Alternative C disturbance, approximately 6,523 acres (15.0 percent of the GCWPA) of soils would be disturbed. Interim reclamation measures would be applied immediately following construction to approximately 85 percent of the site-specific No Action. Reclaimable new disturbance under interim reclamation goals to meet Gold Book, BLM BMP, and reclamation objectives (**Appendix B**) would again total approximately 333 acres (1.0 percent) of the GCWPA. Of the anticipated 1,514 acres of total new disturbance in the GCWPA, approximately:

- 1,332 acres (88 percent) of the new disturbance from approved oil and gas development would occur in high constraint soils that pose mostly multiple limitations to successful implementation of reclamation measures and long-term maintenance of protective and productive vegetative cover (**Tables L-1** and **L-2**, **Appendix L**);

- 152 acres (10 percent) of new disturbance from approved oil and gas development would occur in moderate constraint soils that pose again mostly multiple, but less severe limitations to successful reclamation and long-term maintenance of vegetative cover (**Tables L-1** and **L-2**, **Appendix L**); and
- 30 acres (2 percent) of new disturbance from approved oil and gas development would occur in low constraint soils that pose mostly single and minor limitations to successful reclamation and revegetation (**Tables L-1** and **L-2**, **Appendix L**).

The affected soil constraint types are as described for Alternative A and as referenced and expanded upon under Alternative B. The amount of initial disturbance of 1,875 acres for the Proposed Action would be reduced by 361 acres to 1,514 acres for this alternative. Correspondingly, reclaimable acreage for this alternative would comparatively decrease to 333 acres from 410 acres for the Proposed Action. The nature of challenges to successful interim and final reclamation would remain much the same as described for both the Alternatives A and B. Again, the evaluation of areas where specific development would occur in the future would be necessary to identify appropriate site-specific adaptive, remedial measures.

However, additional design features would be applied under this alternative:

- Pipeline construction widths and associated disturbance of vegetative cover and soils will be minimized to the extent possible through the use of brush-hogging, rather than clearing vegetation from the entire ROW width.
- Mats will be used for drilling pads or access roads where feasible to reduce surface disturbance and improve reclamation success.
- Soils BMPs (silt fences, erosion devices, secondary containment, rip rap, etc.) will be utilized as site-specific conditions warrant and in accordance with the Gold Book guidance.
- No surface disturbance will be allowed in the 100-year floodplain of the White River.

These first two measures would effectively reduce the actual disturbance acreages for facility construction and operations. The areas where vegetation and soils are not bladed off locations would reduce the damage or loss of vegetative cover and soil productivity characteristics thus fostering both interim and final reclamation measures to be more timely and effective in restoring stabile and productive soil conditions. The third commitment would further add to those measures to be implemented as part of interim and final reclamation to stabilize disturbed soils primarily during construction and prior to revegetation and the stabilizing effects that vegetation would have on disturbed soils. The preclusion of disturbance within the 100-year floodplain of the White River would again foster soil stability and productivity within this portion of the GCWPA which provides important habitat for biological resources and opportunities for recreation.

Effects on Biological Soil Crusts

Consistent with effects described for approved oil and gas development under Alternative A and as referenced for Alternative B, implementation of Alternative B would involve the new disturbance of approximately 1,448 acres of BSC–supporting area within the GCWPA. Again, the presumption is that BSC would occupy or comprise soil cover of at least one percent over all soil map units within the GCWPA (Bryce et al. 2012). Disturbance effects, although less by 427 acres than for Alternative B development, would again be considered long-term in terms of acres disturbed for potential BSC cover. For pipeline installation, the clearing of vegetative cover using a brush-hog, although resulting in damage to BSC from passage of wheeled tractor, would leave portions of the affected ROW undisturbed with the potential that portions of the pipeline construction ROW would remain undisturbed after pipeline installation. Use of mats placed over undisturbed surface or brush-hogged areas for portions of well pads and access roads would cover, but leave BSC communities and topsoil media in place where recovery of

BSC after mat removal may be enhanced in terms of a shorter period of recovery for BSC over damaged or lost BSC communities that would be anticipated during vegetative clearing and soil salvage ahead of pad and access road construction.

4.5.1.4 Alternative D—Other Protections Action

Implementation of Alternative D would result in additional oil and gas development activities beyond those activities previously approved in the GCWPA. Alternative D would involve the new disturbance of 1,595 acres (3.7 percent) of the 43,071-acre GCWPA due to access road construction, drilling and completion, production facilities construction, and linear pipeline facilities construction. Including existing, LGS and electrical distribution system, and Alternative D disturbance, approximately 6,604 acres (15.3 percent of the GCWPA) of soils would be disturbed. Interim reclamation measures would be applied immediately following construction to approximately 85 percent of the site-specific No Action. Reclaimable new disturbance under interim reclamation goals to meet BLM BMP and reclamation objectives (**Appendix B**) would total approximately 386 acres (0.9 percent) of the GCWPA. Of the anticipated 1,595 acres of total disturbance in the GCWPA, approximately:

- 1,404 acres (88 percent) of the new disturbance from approved oil and gas development would occur in high constraint soils that pose mostly multiple limitations to successful implementation of reclamation measures and long-term maintenance of protective and productive vegetative cover (**Tables L-1** and **L-2**, **Appendix L**);
- 159 acres (10 percent) of new disturbance from approved oil and gas development would occur in moderate constraint soils that pose again mostly multiple, but less severe limitations to successful reclamation and long-term maintenance of vegetative cover (**Tables L-1** and **L-2**, **Appendix L**); and
- 32 acres (2 percent) of new disturbance from approved oil and gas development would occur in low constraint soils that pose mostly single and minor limitations to successful reclamation and revegetation (**Tables L-1** and **L-2**, **Appendix L**).

The affected soil constraint types are as described for Alternative A and as referenced and expanded upon by Alternative B. The amount of initial disturbance of 1,875 acres for the Proposed Action would be reduced by 280 acres to 1,595 acres for this alternative. Correspondingly, reclaimable acreage for this alternative would comparatively increases to 435 acres from 410 acres for Alternative B. The nature of challenges and proposed means to achieve successful interim and final reclamation would remain much the same as described for both Alternatives A and B, and would include the additional required mitigation measures presented for Alternative C (Section 2.8.3) and Alternative D (Section 2.9.3.1).

An added soils-related mitigation measure for this alternative would be that specific reclamation actions would be applied to address reclamation standards to be presented in final USFWS recovery plans for the *Sclerocactus* species (Section 2.9.3.1). In the interim, proposed successful reclamation standards for this project (Alternative D) would be approved by USFWS.

Again, the evaluation of areas where specific development would occur in the future would be necessary to identify appropriate site-specific adaptive, remedial measures.

Effects on Biological Soil Crusts

Consistent with effects described for approved oil and gas development under Alternative A and as referenced for Alternatives B and C, implementation of Alternative D would involve the new disturbance of approximately 1,595 acres of BSC–supporting area within the GCWPA. Again, the presumption is that BSC would occupy or comprise soil cover of at least one percent over all soil map units within the GCWPA (Bryce et al. 2012). Disturbance for Alternative D, although less by 280 acres than for Alternative B development, would increase the disturbance acreage by 81 acres over Alternative C. Again, the damage or loss of the BSC cover would be considered long-term in terms of acres disturbed

for potential BSC cover. The effects of applying brush-hogging techniques and the use of mats to avoid or minimize effects to BSC would be as described for Alternative C.

4.5.2 Alternative-specific Design Features and Mitigations

Table 4.5-2 presents a summary of alternative-specific design features and mitigations by type of mitigation that would reduce effects on soils.

4.5.3 Residual Effects

Residual effects under all of the alternatives would include the added, proportional disturbance of in-place, developing soils; the loss of soil productivity from damage or removal of protective vegetative cover; the accelerated erosion and loss of exposed and loosened soil materials from exposure to water and wind erosion; and the loss or damage of protective BSCs inhabiting affected soil materials. However, the extent, magnitude, and duration of these effects would be mitigated by those measures listed by alternative (**Table 4.5-2**).

Alternatives A and B

For both alternatives, mitigation measures that would proportionally limit disturbance; prevent, control, remediate accidental soil contamination, runoff, and soil loss and sedimentation would be applied (**Table 4.5-2**). Steep slopes, in particular those steeper than 21 percent would be avoided where possible, and if unavoidable, appropriate engineering would be applied to develop plans to stabilize and control erosion of affected soils and geologic materials. These measures would effectively reduce, but not eliminate the effects on soils entirely. Some disturbance and associated soil instability would remain for the life-of-project and/or until reclamation, including BSC reestablishment, occurs and is determined to be successful. For the life of project, the implementation of spill, contaminant release, and erosion controls would limit the adverse effects, but would again not entirely eliminate the potential for soil contamination, soil loss, and sedimentation due to an accident or act of nature.

Alternatives C and D

For both alternatives, those mitigation measures identified in **Table 4.5-2** for both Alternatives A and B would again be applied and again they would proportionally limit disturbance; prevent, control, remediate accidental soil contamination, runoff, and soil loss and sedimentation. Both additional brush-hogging techniques and use of mats would be applied where appropriate to further reduce adverse effects on soils and their productivity in terms of both higher plants and BSCs, but would again not entirely eliminate the potential for soil contamination, loss of soil productivity, soil loss, and sedimentation due to an accident or act of nature.

4.5.4 Irretrievable and Irreversible Commitment of Resources

The loss of productivity including BSCs and soil development would occur for the life of disturbance where oil and gas facilities are maintained for the life-of-project. Loss of productivity also could persist during and possibly beyond the life-of-project, in areas of soils where hydrocarbons or saline waste waters are accidentally released. High levels of soil productivity-limiting hydrocarbon or salinity could remain in affected soils until such time treatment, removal, or the limited natural precipitation results in the leaching of salts below surface soil horizons and restoration of more favorable conditions supportive of the reestablishment of native vegetation. However, favorable conditions for affected soil materials would be reestablished and the soils treated to allow active reclamation measures and natural restoration of protective vegetative cover and associated productivity, including BSCs, to begin again. Irreversible commitment would be limited to the period of time during life-of-project where the operation of constructed facilities would maintain a state of soil disturbance, loss of vegetative productivity, and off-site sedimentation, including the period of time where soils are affected by accidental spills or releases of hydrocarbons and/or high salinity waste water.

4.5.5 Relationship of Short-term Use to Long-term Productivity

Recovery of hydrocarbon resources within the GCWPA with implementation of any of the four alternatives would likely result in limited losses of soil from localized locations during the construction of project facilities; however, application of monitored reclamation measures would restore and possibly enhance the post-project, long-term stability and productivity of affected soils. Assuming regular monitoring for effectiveness of applied reclamation measures and the application of appropriate responses to maintain progress toward successful reclamation, the restoration of long-term productivity would likely be achieved and off-site effects of sedimentation would be reduced to approximate natural levels. The soil productivity of those areas overlain by project operational facilities would be lost for the duration of life-of-project, but the application of final reclamation measures with monitoring would restore the long-term productivity of those soils for both higher plants and BSCs upon project termination.

Table 4.5-2 Soils Design Features and Mitigation

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
EOG would develop and maintain a SPCC Plan for each well in the GCWPA. A typical SPCC Plan from the field has been included as **Appendix E**. To satisfy SPCC Plan requirements, any necessary storage facilities or tanks would be constructed in accordance with applicable containment regulations.		d	d	d	m			
EOG will perform interim reclamation of well locations and access roads soon after the initial phase of development on a well pad is completed or after all the wells on a pad are put into production as agreed up by the AO. The BLM determined this design feature to be an environmental BMP to be Considered in nearly all circumstances. Timing for interim reclamation on multi-well pads will be coordinated with the AO.		d	d	d	m			
EOG will modify procedures and strategies as needed and will evaluate reclamation performance on an ongoing basis in terms of successful site stabilization.		d	d	d	m			
EOG will design and construct all new roads to a safe and appropriate standard “no higher than necessary” to accommodate their intended use. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances.		d	d	d	m			
EOG will utilize shared well pads to the extent possible, in consideration of technical, environmental, and economic viability, to minimize the amount of total surface disturbance in the GCWPA.		d	d	d	m			
EOG will locate gathering lines adjacent to access roads where possible.		d	d	d	m			
EOG will use closed-loop drilling systems.		d	d	d	m			
EOG will incorporate site-specific BMPs to control storm water runoff, including appropriate measures to prevent sedimentation.		d	d	d	m			
All construction and maintenance activities will cease if soils or road surfaces become saturated to the extent that construction equipment is unable to stay within the ROW, and before activities cause irreparable harm to roads, soils, or excessive siltation of nearby lakes, reservoirs, or live flowing streams.		d	d	d	m			
All new pipeline construction activities will conform to requirements of the VFO RMP.		d	d	d	m			

Table 4.5-2 Soils Design Features and Mitigation

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Should additional pipeline capacity be required, a new, larger diameter line will be used in place of the original. Duplication of pipelines will be prohibited, unless necessitated by site-specific circumstances.			d	d				
All pipelines greater than 12-inch-diameter will be buried.			d	d				
Pipeline construction widths and associated disturbance of vegetative cover and soils will be minimized to the extent possible through the use of brush-hogging, rather than clearing vegetation from the entire ROW width.			d	d				
Mats will be used for drilling pads or access roads where feasible to reduce surface disturbance and improve reclamation success.			d	d				
Soils BMPs (silt fences, erosion devices, secondary containment, rip rap, etc.) will be utilized as site-specific conditions warrant and in accordance with the Gold Book guidance.			d	d	m	m		
Steep slopes and rugged topography will be avoided where possible; otherwise the disturbance will be minimized.					m	m	m	m
If surface-disturbing activities cannot be avoided on slopes for 21 percent to 41 percent, a plan including the following will be required: 1) an erosion control strategy, 2) GIS modeling, and 3) proper survey and design by a certified engineer. The plan will be approved by the BLM prior to construction and maintenance.					m	m	m	m
Surface disturbance on slopes between 40 percent and 60 percent will be avoided. If it is not feasible to avoid these slopes, then the applicant will provide the AO with an erosion control plan, a maintenance plan, GIS modeling, and an engineered drawing of the proposed disturbance.					m	m	m	m
Cut side slopes will be immediately stabilized.					m	m	m	m
As determined necessary upon site-specific review, wells will not be developed on saline facies or highly erodible soils (k factor greater than 0.37).					m	m	m	m
Areas disturbed by project-related activities (including roads, well pads, etc.) with soils susceptible to wind erosion will be surfaced (covering of piles where appropriate, graveling or surfactants applied to roads, etc.) on a site-specific basis, as directed by the AO.					m	m	m	m
Biologically active top-soil will be used in reclamation where possible.					m	m	m	m
Where topsoil removal is necessary for pipelines or other linear ROWs, it will be windrowed (i.e., stockpiled/accumulated along the edge of the ROW and in a low row/pile parallel with the ROW)					m	m	m	m

Table 4.5-2 Soils Design Features and Mitigation

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
and respreads over the disturbed area after construction and backfilling are complete. Vegetation removed from the ROW also will be respreads to provide protection, nutrient recycling, and a seed source.								
Mulching, hydromulching, soil amendments, supplemental mycorrhizal applications, erosion fencing, use of erosion fabric, spray-on fiber matrices, tackifiers, and other state-of-the-art techniques will be used as determined necessary or as directed by the AO on a site-specific basis to assure the highest possible revegetation success, to stabilize any disturbed areas, and ensure the long-term re-establishment of long-term perennial vegetation.					m	m	m	m

4.6 Vegetation

4.6.1 Direct and Indirect Effects

The primary issues associated with vegetation resources include direct and/or indirect effects to vegetation communities, special status plant species, riparian/wetland habitats, and effects associated with the introduction and/or spread of noxious weeds and invasive species. The direct effects study area for effects to vegetation resources is the GCWPA.

As detailed in **Table 4.6-1**, the GCWP is approximately 43,071 acres in size (SWReGAP 2004b). However, the amount of potential disturbance to vegetation resources differs for each alternative due to exclusion areas designated for each alternative. **Table 4.6-1** identifies the composition and distribution of vegetation community types in the GCWPA by alternative.

4.6.1.1 Alternative A—No Action

Vegetation Community

As permitted under existing authorizations, approximately 2,685 acres of vegetation would be disturbed by new activity under Alternative A. Estimated acreage of surface-related disturbance associated with new activity under Alternative A within the GCWPA is identified by vegetation community type in **Table 4.6-2**. Because exact locations of new surface disturbance-related activities are unknown for Alternative A, the effects to vegetation in the GCWPA were quantified by initially multiplying the percent of the GCWPA impacted by new surface disturbance-related activities by the acreage of each vegetation type within the GCWPA. Site-specific project components, mitigation measures, and design features were then accounted for and applied to the programmatic disturbance values presented below. The majority of the disturbance would occur within the salt-desert shrubland, badlands, and sagebrush shrubland community types.

Construction Effects

Construction-related surface-disturbing activities would occur within the GCWPA under Alternative A, should it be selected. Surface-disturbing activities would consist of vegetation clearing for new well pad and expanded well pad construction, installation of pipelines and overhead electrical lines, and new road construction. Additional direct surface disturbing effects to vegetation would include the trampling/crushing of vegetation, the removal of vegetation, soil compaction, disturbance to soil structure/composition due to mixing of soil horizons, and BSCs (Section 4.5.1) that could affect the health and successful restoration of native vegetative communities, and potential hazardous spills from vehicles and equipment.

Indirect effects to vegetation would include increased erosion, sedimentation, fugitive dust generation, the potential spread and establishment of noxious and invasive weed species, herbicide drift, changes in the quantity and arrangement of surface fuels, and habitat fragmentation. In areas where there are already extensive infestations of noxious weeds, noxious weed control during construction, operation, and maintenance activities could be difficult due to the large local seed source.

Fugitive dust that settles on vegetation can affect photosynthesis, respiration, transpiration, water use efficiency, and allow the penetration of phytotoxic pollutants. Dust also may exacerbate secondary stressors like drought and insects (Farmer 1993). The amount of vegetation impacted by indirect effects as a result of project implementation would vary depending on the type of indirect disturbance. Typically, indirect effects occur 100 to 300 feet away from the construction disturbance but could affect vegetation communities farther away such as through increased fugitive dust generation and sedimentation into drainages, affecting communities downstream (USFWS 2013c).

Table 4.6-1 Vegetation Community Types by Alternative within the GCWPA

Vegetation Community/ Type	Alternative A		Alternative B		Alternative C		Alternative D	
	Acres	Percent of GCWPA	Acres	Percent of GCWPA	Acres	Percent of GCWPA	Acres	Percent of GCWPA
Badlands	10,381	24.3	10,381	24.3	10,222	25.3	8,115	24.0
Cliff/Canyon	2,527	6.0	2,527	6.0	2,343	5.8	1,697	5.0
Developed/Disturbed	2,899	6.9	2,899	6.9	2,846	7.1	2,488	7.4
Grassland	1,884	4.5	1,884	4.5	1,785	4.4	1,301	3.8
Sagebrush	6,906	16.4	6,906	16.4	6,763	16.8	6,370	18.8
Salt Desert Shrub	16,927	40.2	16,927	40.2	16,284	40.3	13,844	40.9
Wetland/Riparian	548	1.3	548	1.3	117	0.3	-	-
Exclusion[1]	*998*	-	*998*	-	*2,713*	-	*9,256*	-
Potential Disturbance	**42,073**		**42,073**		**40,359**		**33,815**	
Total	**43,071**	100	**43,071**	100	**43,071**	100	**43,071**	100

[1] Alternative A Exclusion includes: Bonanza Power Plant.

Alternative B Exclusion includes: Bonanza Power Plant.

Alternative C Exclusion includes: Bonanza Power Plant, NWI 100-meter buffer, White River 100-year flood plain.

Alternative D Exclusion includes: Bonanza Power Plant, NWI 100-meter buffer, White River 100-year flood plain, Hookless Cactus Core 1, White River viewshed/ 0.5 mile, MesaVerde Reservoir.

Source: SWReGAP 2014b.

Table 4.6-2 Disturbance to Vegetation Community Types Under Alternative A

Vegetation Community Types	Acres Impacted[1]
Badlands	657
Cliff/Canyon[2]	160
Developed/Disturbed	179
Grassland	119
Sagebrush	451
Salt Desert Shrub	1,119
Wetland/Riparian	0
Total	**2,685**

[1] This quantitative assessment is calculated by taking the total acreage impacted by new programmatic surface disturbance associated with Alternative A, multiplied by the percentage for each vegetation type within the GCWPA based on the information reported in **Table 4.6-1** above. Site-specific LGS and electrical distribution system components were then directly measured against affected vegetation types and added to the applicable programmatic disturbance values. Additionally, disturbance in wetland/riparian vegetation types is prohibited by design feature or mitigation. Therefore, the amount of wetland/riparian acres potentially disturbed by the Alternative were then multiplied by each vegetation type percentage and added to the applicable programmatic disturbance values.

[2] The cliff/canyon vegetation type is protected by slope restrictions.

Construction activities may increase erosion and sedimentation and may modify the floodplain surface as well as channel beds and banks. These effects may create indirect effects on any nearby riparian vegetation, may directly affect habitat for wildlife, and may adversely affect wildlife and plant species further downstream. Following surface disturbance activities, noxious weeds and invasive species may readily colonize areas that have minimal vegetation cover. It is anticipated that populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas for extended periods of time. Within the GCWPA, noxious and invasive weed species are often present in the seedbank, and once an area is disturbed, these species can quickly establish. The disturbed areas can act as sources of propagules for further spread of noxious and invasive species to spread into undisturbed native vegetative communities and special status species habitat. Noxious and invasive weed species compete with native plants, and are a particular threat to species with low population numbers and diversity (i.e., special status species). Noxious and invasive weed species can degrade and modify native communities, and reduce resources for native and special status species (e.g., moisture, soil nutrients, and light). In addition, the competition from noxious and invasive species can reduce special status species population size. The spread of noxious and invasive plant species could lead to changes in species composition within the native vegetative communities. Changes in species composition potentially would lead to greater grazing pressure from sheep and/or cattle on grasses and shrubs that act as “nurse” plants for immature cacti. Nurse plants create an environment that is more favorable for successful establishment of immature cacti by providing shade, moisture, and protection from trampling. In addition, noxious and invasive weed species could outcompete the immature cacti as the invading species modify the habitat and species composition, and use resources required by the immature cacti. Habitat fragmentation and the introduction and spread of noxious and invasive weed species could impact the plant pollinators, which would negatively impact the reproductive success of the plant species within the GCWPA.

Direct surface disturbance effects from access road construction would include vegetation trampling/crushing, vegetation removal, grading, and compaction. Indirect effects from access road

construction would include increased erosion, sedimentation, fugitive dust generation, the potential establishment of noxious and invasive weed species, habitat fragmentation, and the potential increase in special status species collection.

Landscape fragmentation would result from the development of the access road network and facilities. Landscape fragmentation is defined as the division of large, contiguous vegetated areas into smaller, more isolated remnants, thus resulting in habitat loss. Landscape fragmentation breaks up native habitats into smaller units separated by areas of disturbance or different habitat types. Landscape fragmentation can result in loss of plant habitats, increased edge effects, effects on sensitive plant species populations and native pollinators (Winder 2012), and increased competition from noxious and invasive weed species.

Operation and Maintenance Effects

Operation and maintenance effects include the permanent loss of vegetation due to facility, structure, and access road footprints, maintenance activities, introduction of noxious and invasive weed species, and increased use of access roads. The estimated acres of operation-related surface effects are listed below under each alternative.

Decommissioning Effects

Decommissioning activities would include the removal of facilities and the reclamation of access roads. Effects would be similar to those discussed for construction activities, except that removal of vegetation would not be required as part of decommissioning. The same BMPs, design features, and mitigation measures would be applied to reduce effects during decommissioning activities. Reclamation will follow the guidelines set forth in the BLM Green River District Reclamation Guidelines (**Appendix B**) and include temporary, interim, and final reclamation.

Due to multi-year droughts in the area, the high percentage of soils with characteristics that limit restoration (Section 4.5, Soils), and noxious and invasive weed species present in the area, successful reclamation is difficult in the Uinta Basin (BLM 2012c). Successful reclamation is defined as re-establishment of a sustainable vegetation community with similar species diversity and vegetative cover compared to similar undisturbed native vegetative communities (BLM 2009g). In areas with high reclamation constraints (limited moisture availability, limiting soils, etc.), almost no revegetation success or natural recolonization (except by invasive plant species such as halogeton) has been observed during reconnaissance conducted on currently permitted wellsites and associated infrastructure in the region within the last 50 years.

The goal of final reclamation as defined in the BLM Green River District Reclamation Guidelines (**Appendix B**) would be to return the disturbed areas to approximately pre-construction condition, and maintain a stable and productive condition compatible with previous land uses. According to the BLM Green River District Reclamation Guidelines (**Appendix B**), successful reclamation (defined as having basal cover of 75 percent as compared to surrounding undisturbed areas) should occur within 5 years of initial reclamation action. However, the desert shrub, perennial grasslands/sagebrush communities, and pinyon-juniper are three vegetative communities that have lower potential for successful reclamation (BLM 2012c). In this region, herbaceous-dominated plant communities typically require a minimum of 5 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species and grazing operations (**Appendix B**). Woody-dominated plant communities would require at least 25 to 50 years for shrubs to recolonize the area, while re-establishment of mature pinyon-juniper woodlands would require at least 75 to 100 years. The desert shrub type is associated with shallow and highly saline soils, and has limited moisture availability. The perennial grasslands/sagebrush and pinyon-juniper communities are both highly susceptible to noxious weed invasions. Based on the assumptions for reclamation success, all effects associated with previously approved projects would be considered long-term.

Noxious Weeds and Invasive Species

Surface disturbance-related activities associated with the Alternative A would result in the introduction and/or spread of noxious weeds and invasive species into areas that recently have been disturbed or areas that typically lack or have minimal vegetation cover. Within sensitive native plant communities, noxious or invasive species potentially would displace less aggressive plant species and colonize habitat suitable for special status plant species. This is especially an issue for species with low population numbers and diversity (i.e., threatened and endangered species). In addition to degrading and modifying native communities, noxious and invasive weed species can reduce resources for native and special status species (e.g., moisture, soil nutrients, and light), and impact species pollinators. The competition from noxious and invasive species can reduce special status species population size, and lead to potential extirpation for highly threatened species. Due to the greater distance of disturbance from the White River corridor, under Alternative A fewer noxious weeds and invasive species would have the potential to be introduced to this sensitive area.

To mitigate the effects from the spread and establishment of noxious and invasive species, the ACEPMs, described in Chapter 2.0 would continue to be implemented. The implementation of project-specific weed management plans and the washing of vehicles would minimize the spread and establishment of noxious and invasive species into recently disturbed areas or areas of minimal vegetation cover.

Wetlands and Riparian Areas

Under Alternative A, mitigation measures described under Section 4.4, Water Resources, would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, as identified in **Table 4.6-2**, direct impacts to wetlands and riparian areas would not occur under Alternative A. There potential for indirect impacts to these areas would include those described above under Construction, Operation and Maintenance, and Decommissioning Effects.

Special Status Plant Species

The following impact assessments focus on special status plant species that potentially occur within the GCWPA. This includes species listed as federally threatened, endangered, proposed, and/or candidate; BLM sensitive species; and State of Utah species of concern. These species are identified in Section 3.6.3, Special Status Plant Species.

Uinta Basin Hookless Cactus

Effects to the Uinta Basin hookless cactus would be similar to those described above for all vegetation resources. In addition, construction and maintenance traffic could cause extra dust and particulate deposition on plants, potentially effecting growth and pollination. Habitat loss and fragmentation associated with energy development is a major threat to this species across its known range (USFWS 2012b). The Uinta Basin hookless cactus is distributed throughout the GCWPA and many of the populations are quite large. Based on the habitat modeling for the Uinta Basin hookless cactus, a total of approximately 19,859 acres of potential habitat is located in areas of potential disturbance under Alternative A. This includes 2,498 acres of Level 1 CCAs and 5,646 acres of Level 2 CCAs. Based on the distribution and large number of individuals, a qualitative assessment of the amount of Uinta Basin hookless cactus habitat that would be impacted by Alternative A is estimated by multiplying the percentage of potential disturbance acreage (56 percent for potential habitat, 6 percent for Level 1 CCAs, and 13 percent for Level 2 CCAs) by the amount of acreage that would be impacted by new surface disturbance associated with Alternative A (2,685 acres). Additionally, site-specific components were directly measured against affected vegetation types and added to the applicable programmatic disturbance values. Therefore, approximately 1,854 acres of potential habitat (less than 1 percent of potential habitat across its entire range) would be impacted by new activity under Alternative A. This includes 111 acres of Level 1 CCAs (4 percent of Level 1 CCAs found within the GCWPA and 1 percent of the total Level 1 CCAs within both the White River and Bonanza CCAs) and 304 acres of Level 2

CCAs (5 percent of Level 2 CCAs found within the GCWPA and 1 percent of the total Level 2 CCAs within both the White River and Bonanza CCAs).

Based on the impact analysis of previous NEPA decision documents, direct effects to the Uinta Basin hookless cactus under the Alternative A would be avoided and indirect effects would be minimized through the implementation of the Uinta Basin hookless cactus ACEPMs identified in Section 2.6.9 and the design features and mitigations in **Table 4.6-6** that include the protection of threatened, endangered, candidate, or sensitive species; the control and management of noxious and invasive weed species; the minimization of surface disturbance; and the use of dust abatement measures. Direct effects to individuals and populations from the placement of existing and approved wells and facilities would be avoided through site-specific project design and the implementation of the BLM VFO RMP (BLM 2008b), USFWS (2014d), and Tribal Uinta Basin hookless cactus conservation measures depending on surface and subsurface ownership. These conservation measures include:

- Pre-project habitat assessments;
- Site inventories within potential habitat;
- Minimization of surface effects through project design;
- Adherence where possible to agency and Tribal required and recommended buffers between the edge of the surface disturbance and identified plants and populations. For previously approved projects, the minimum buffer will be 100 feet. For projects that are not yet approved through the APD process, a 300-foot buffer is required in the VFO RMP [BLM 2008b] on BLM lands. The USFWS recommends both survey and avoidance buffer distances of 50 to 300 feet depending on the type of ground disturbance or project component (USFWS 2014d). Finally, the Tribal Cactus Management Plan (Ute Indian Tribe 2015) requires adherence to a 100-foot survey and avoidance buffer on Tribal surface and subsurface owned lands;
- Additional mitigation within Level 1 and Level 2 CCAs as described by the USFWS (USFWS 2014d) to avoid or minimize effects to the species may be developed and implemented in consultation with the USFWS to ensure compliance with the ESA;
- Flagging of avoidance areas before and during construction; and
- Avoid concentrating water flows or sediments into occupied habitat.

Additional mitigation for this species under this alternative (Section 4.6.6) has been identified to avoid surface disturbance to identified plants by 50 to 300 feet, where possible. Identified plants on Tribal surface will be avoided by a minimum of 100 feet. However, based on the potential for surface disturbance within potential habitat and the possibility of surface disturbance within 50 to 300 feet of individuals or populations of Uinta Basin hookless cactus, Alternative A **may affect, and is likely to adversely affect** Uinta Basin hookless cactus.

Ute Ladies'-tresses Orchid

Effects to the Ute ladies'-tresses orchid would be similar to those described above for all vegetation resources. Urbanization resulting in the loss of habitat is the greatest threat to this species (USFWS 1995). Based on the vegetation community type in **Table 3.6-1,** a total of approximately 551 acres of potential habitat for this species is located in the GCWPA. However, additional mitigation measures described under Section 4.4, Water Resources, would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, as identified in **Table 4.6-2**, potential habitat would not be impacted under Alternative A resulting in minimal to no direct effects to this species. However, due to potential indirect effects such as fugitive dust generation, the potential spread and establishment of noxious and invasive weed species, and herbicide drift, Alternative A may affect, but is not likely to adversely affect the Ute ladies'-tresses orchid.

Horseshoe milkvetch and sterile yucca

Effects to the horseshoe milkvetch and sterile yucca and their associated habitat would be similar to those described above for all vegetation resources. Residual effects due to the loss of sagebrush habitat are discussed in Section 4.7, Wildlife and Fisheries Resources.

Based on the vegetation community type in **Table 3.6-2,** a total of approximately 23,824 acres of suitable habitat for these species is located in the GCWPA. A qualitative assessment of the amount of suitable habitat that would be impacted by Alternative A is calculated by multiplying the percentage of the GCWPA impacted by new surface disturbance associated with Alternative A by the acreage of suitable habitat in the GCWPA. As estimated on **Table 4.6-2**, approximately 6 percent of the GCWPA would be impacted by new surface disturbances associated with Alternative A. Therefore, approximately 1,550 acres of suitable habitat would be impacted by new activity under Alternative A.

Based on the large amount of suitable habitat within the GCWPA, there is potential for effects to these species. Effects would be reduced based on the ACEPMs identified for *Threatened, Endangered, Candidate, or Sensitive Species* (Section 2.6.9), the design features and mitigations described in Section 4.6.2, and the BLM Green River District Reclamation Guidelines (**Appendix B**) that would minimize effects from noxious weeds and invasive species as well as effects on special status plant species populations and suitable habitat. Therefore, Alternative B is not likely to result in a trend towards federal listing for the horseshoe milkvetch and sterile yucca.

4.6.1.2 Alternative B—Proposed Action

Under Alternative B, 2,808 wells would be constructed and operated at a rate of 187 to 252 wells per year over a 15-year timeframe, including associated infrastructures (e.g., compressor stations, gathering pipelines, access roads). EOG would implement oil and gas development using the ACEPMs identified in Section 2.6.9, the design features and mitigations described in Section 4.6.2, and the BLM Green River District Reclamation Guidelines (**Appendix B**).

Vegetation Community

Project-related activities and effects on vegetation would be similar to those described above under Alternative A. Under Alternative B, the project would directly remove or impact a total of approximately 1,875 acres of vegetation. **Table 4.6-3** identifies estimated acreage of project-related disturbance by vegetation community type within Alternative B. Precise surface disturbance locations have not been determined for Alternative B. Because exact locations of new surface disturbance-related activities are unknown for Alternative B, the effects to vegetation in the GCWPA were quantified by multiplying the percent of the GCWPA impacted by new surface disturbance-related activities by the acreage of each vegetation type within the GCWPA. Mitigation measures and design features described in Section 4.6.2 were then accounted for and applied to the programmatic disturbance values presented below. Additionally, there is a potential for effects to additional acres of vegetation community types based on project-related activities. For example, vegetation along existing access roads would be affected (e.g., reduction in growth rate) as a result of dust deposition.

Table 4.6-3 Disturbance to Vegetation Community Types Under Alternative B

Vegetation Community Types	Impacted Acres[1]
Badlands	468
Cliff/Canyon	114
Developed/Disturbed	131
Grassland	85
Sagebrush	312
Salt Desert Shrub	765
Wetland/Riparian	0
Total	**1,875**

[1] This quantitative assessment is calculated by taking the total acreage impacted by new programmatic surface disturbance associated with Alternative B, multiplied by the percentage for each vegetation type within the GCWPA based on the information reported in **Table 4.6-1**. Additionally, disturbance in wetland/riparian vegetation types is prohibited by design feature or mitigation. Therefore, the amount of wetland/riparian acres potentially disturbed by the Alternative were then multiplied by each vegetation type percentage and added to the applicable programmatic disturbance values.

To stabilize the growth media, reduce soil erosion, and minimize the potential for the establishment of noxious weeds and invasive species, EOG would implement interim and final reclamation techniques as defined in the ACEPMs (Section 2.6.9), the design features and mitigations described in Section 4.6.2, and the BLM Green River District Reclamation Guidelines (**Appendix B**). Reclamation would occur in three steps (short-term, interim, and final) depending on the project phase. Short-term reclamation of disturbed areas would take place as soon as construction starts, interim reclamation would start once construction is completed and production activities commence, and final reclamation would commence after production and operation of the project ends. During construction, short-term reclamation of disturbed areas would seek to stabilize areas that have been disturbed and protect areas adjacent to the disturbed areas from further degradation. Interim reclamation would occur on areas not needed for production activities including access road ROWs, portions of well pads, and linear features. The focus of interim reclamation would be to stabilize and revegetate disturbed areas to create sustainable vegetative communities. Interim and final reclamation techniques to be implemented include the control and monitoring of noxious weeds after surface disturbance; erosion techniques to control storm water runoff and wind erosion; and adherence to all applicable federal, state, county, and BLM regulations.

The majority of the disturbance would occur within the salt-desert shrubland, badlands, and sagebrush shrubland community types. Sagebrush habitat covers approximately 17 percent of the GCWPA (**Table 3.6-1**). This habitat type is in decline throughout the region (BLM 2008b) due to lack of periodic fire and the invasion of cheatgrass (BLM 2007c). The lack of periodic fire allows the pinyon-juniper to encroach into the sagebrush habitat. Alternative B would impact 305 acres, less than 1 percent of the available sagebrush habitat.

Noxious Weeds and Invasive Species

Under the Alternative B, a total of approximately 1,875 acres of vegetation would be removed or disturbed (**Table 4.6-3**). As described under the Alternative A, following surface disturbance activities, noxious weeds and invasive species may readily colonize areas that typically lack or have minimal vegetation cover. It is anticipated that populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas for extended periods of time.

EOG would implement weed control methods as described in the ACEPMs (Section 2.6.9), design features and mitigations described in Section 4.6.2, and the BLM Green River District Reclamation Guidelines (**Appendix B**) to reduce the establishment and/or spread of noxious weeds. Herbicide

spraying would be conducted following all applicable state and federal laws regarding chemical use, adverse weather, chemical storage, and chemical drift. Further guidelines and protocols for herbicide spraying on BLM land is provided in the Final BLM Vegetation Treatment Using Herbicides Programmatic EIS (BLM 2007d). Standard operating procedures for herbicide spraying include buffers for sensitive areas such as waterways, riparian and wetland areas, and threatened and endangered species habitat, timing restrictions, chemical composition, and safety protocols.

Because chemical weed treatments can have unintended effects on the threatened and endangered species through direct spray, herbicide drift, surface runoff from upslope treatment sites, accidental spills, and the loss of pollinators (BLM 2007d), the biggest threat to threatened and endangered species in the GCWPA is from herbicide drift. The risk is low, and protective measures described above would be taken to reduce risk of drift in threatened and endangered species habitat areas. In the BLM Vegetation EIS, standard operating procedures for herbicide spraying include:

- Surveying for special status plant species before treating an area;
- Considering effects to special status species when designing herbicide treatment programs;
- Using drift reduction agents to reduce the risk of drift hazard; and
- Using a selective herbicide and a wick or backpack sprayer to minimize risks to special plants.

For those areas where the appropriate special status species surveys have been conducted, or would be conducted as part of the APD process, additional surveys would not be required. In addition, the BLM Vegetation EIS recommends herbicide-specific buffer distances for weed treatments to minimize risk to special status species (BLM 2007d). These are larger buffer distances than the previous recommendations from the Vernal BLM and the distances specified in the BLM Green River District Reclamation Guidelines (**Appendix B**) would be implemented.

In the Biological Assessment associated with the BLM Vegetation EIS (BLM 2007d), the USFWS requires buffers of up to 0.5 mile for some herbicides around threatened and endangered species to have no effect on these species. This is a larger distance than either the BLM Vegetation EIS recommended buffer distances or the previous recommended buffer distances from the BLM VFO. The USFWS buffer distances are for all threatened and endangered species, while the herbicide buffers recommended by the BLM Vegetation EIS are herbicide-specific. The herbicide buffer distances used by the BLM VFO were specific to individual species. The BLM and USFWS are in the process of determining which buffer distances would be required. Appropriate survey buffer distances would be determined by the BLM during the pesticide use proposal approval process.

Wetlands and Riparian Areas

Under Alternative B, mitigation measures described under Section 4.4, Water Resources, would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, impacts to wetlands and riparian areas would be the same as those discussed under Alternative A.

Special Status Plant Species

Implementation of Alternative B would result in approximately 1,875 acres of surface disturbance and would increase the potential for direct and indirect effects to special status plant species as detailed under Alternative A (Section 4.6.1.2). Under Alternative B, potential effects to special status plant species would be similar to those listed for Alternative A. Effects would be reduced by the implementation of the ACEPMs (Section 2.6.9), the design features and mitigations described in Section 4.6.2, and the BLM Green River District Reclamation Guidelines (**Appendix B**).

For populations of other threatened, endangered, or BLM sensitive plants that are identified in the future, avoidance and mitigation measures would be addressed at the site-specific level during the APD process and through consultation with the USFWS, as necessary.

Uinta Basin Hookless Cactus

The Uinta Basin hookless cactus is distributed throughout the GCWPA and many of the populations are quite large. Based on the habitat modeling for the Uinta Basin hookless, a total of approximately 19,859 acres of potential habitat for this species is located in areas of potential disturbance under Alternative B. This includes 2,498 acres of Level 1 CCAs and 5,646 acres of Level 2 CCAs. Based on the distribution and large number of individuals, a qualitative assessment of the amount of Uinta Basin hookless cactus habitat that would be impacted by Alternative B is estimated by multiplying the percentage of potential disturbance acreage (56 percent for potential habitat, 6 percent for Level 1 CCAs, and 13 percent for Level 2 CCAs) by the amount of acreage that would be impacted by new surface disturbance associated with Alternative B (2,909 acres). As a result, approximately 2,005 acres of potential cactus habitat (less than 1 percent of potential habitat across its entire range) would be impacted under this alternative. This includes 124 acres of Level 1 CCAs (5 percent of Level 1 CCAs found within the GCWPA and 1 percent of the total Level 1 CCAs within both the White River and Bonanza CCAs) and 336 acres of Level 2 CCAs (6 percent of Level 2 CCAs found within the GCWPA and 1 percent of the total Level 2 CCAs within both the White River and Bonanza CCAs).

Based on the impact analysis of previous NEPA decision documents, direct effects to the Uinta Basin hookless cactus under the Alternative B would be avoided and indirect effects would be minimized through the implementation of the Uinta Basin hookless cactus conservation measures incorporated into the design features and mitigations described in Section 4.6.2, and ACEPMs identified in Section 2.6.9 that include the protection of threatened, endangered, candidate, or sensitive species; the control and management of noxious and invasive weed species; the minimization of surface disturbance; and the use of dust abatement measures. Direct effects to individuals and populations from the placement of existing and approved wells and facilities would be avoided through site-specific project design and the implementation of the BLM VFO RMP (BLM 2008b), USFWS (2014d), and Tribal Uinta Basin hookless cactus conservation measures depending on surface and subsurface ownership. These conservation measures include:

- Pre-project habitat assessments;
- Site inventories within potential habitat;
- Minimization of surface effects through project design;
- Adherence to agency and Tribal required and recommended buffers between the edge of the surface disturbance and identified plants and populations. For previously approved projects, the minimum buffer will be 100 feet. For projects that are not yet approved through the APD process, a 300-foot buffer is required in the VFO RMP (BLM 2008b) on BLM lands. The USFWS recommends buffer distances of 50 to 300 feet depending on the type of ground disturbance or project component (USFWS 2014d). Finally, the Tribal Cactus Management Plan (Ute Indian Tribe 2015) requires adherence to a 100-foot survey and avoidance buffer on Tribal surface and subsurface owned lands;
- Additional mitigation within Level 1 and Level 2 CCAs as described by the USFWS (USFWS 2014d) to avoid or minimize effects to the species may be developed and implemented in consultation with the USFWS to ensure compliance with the ESA;
- Flagging of avoidance areas before and during construction; and
- Avoid concentrating water flows or sediments into occupied habitat.

Additional mitigation for this species under this alternative (Section 4.6.6) has been identified to avoid surface disturbance to identified plants by 50 to 300 feet, where possible. Identified plants on Tribal surface will be avoided by a minimum of 100 feet. However, based on the potential for surface disturbance within potential habitat and the possibility of surface disturbance within 50 to 300 feet of individuals or populations of Uinta Basin hookless cactus, Alternative B **may affect, and is likely to adversely affect** Uinta Basin hookless cactus.

Ute Ladies'-tresses Orchid

Based on the vegetation community type in **Table 3.6-1**, potential habitat for the Ute ladies'-tresses orchid in the GCWPA would be approximately 551 acres. However, additional mitigation measures described under Section 4.4, Water Resources, would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, impacts would be the same as those described under Alternative A and Alternative B may affect, but is not likely to adversely affect the Ute ladies'-tresses orchid.

Horseshoe Milkvetch and Sterile Yucca

Based on the vegetation community type in **Table 3.6-1,** a total of approximately 23,824 acres of suitable habitat for these species is located in the GCWPA. A qualitative assessment of the amount of suitable habitat that would be impacted by Alternative B is calculated by multiplying the percentage of the GCWPA impacted by new surface disturbance associated with Alternative B by the acreage of suitable habitat in the GCWPA. As estimated on **Table 4.6-3**, approximately 4 percent of the GCWPA would be impacted by new surface disturbances associated with Alternative B. Therefore, approximately 1,062 acres of suitable habitat would be impacted by new activity under Alternative B.

Implementation of the ACEPMs (Section 2.6.9) for *Threatened, Endangered, Candidate, or Sensitive Species*, the design features and mitigations in **Table 4.6-6**, and the BLM Green River District Reclamation Guidelines (**Appendix B**) would minimize residual effects from noxious weeds and invasive species as well as effects on special status plant species populations and suitable habitat. Therefore, Alternative B is not likely to result in a trend towards federal listing for the horseshoe milkvetch and sterile yucca.

4.6.1.3 Alternative C—Resource Protection (BLM-Preferred)

Implementation of Alternative C would result in the drilling of up to 2,808 new infill natural gas wells to continue development of currently known productive formations underlying lands in the GCWPA (**Figure 2-8**). Alternative C resource protection restrictions would allow a maximum of 162 new well pads, or 71 fewer new pads than under Alternative B. The number of available existing expandable pads would remain at 960, the same as under Alternative B, for a total of 1,111 new and existing well pads available for drilling new directional wells to bottom hole locations not situated vertically beneath the well pads. Maximum project surface disturbance would be up to 1,514 acres, or 3.4 percent of the GCWPA. Up to 333 acres of the 1,448 acres would be reclaimable in the short term.

Vegetation Community

Project-related activities and effects on vegetation under Alternative C would be similar to those described above under Alternative A. Under Alternative C, direct and/or indirect effects to vegetation related to new surface disturbance would be approximately 1,514 acres; 361 acres less than Alternative B. Alternative C would place more emphasis on protection of GCWPA resources. **Table 4.6-4** provides the estimated acres of impact for each vegetation type under this alternative. Similar to Alternative B, precise surface disturbance locations have not been determined for Alternative C and the method used to quantify acres of vegetation community types impacted by surface disturbance was the same as Alternative B. Overall, the ACEPMs described for Alternative C include more stringent measures than Alternative B to protect vegetation resources.

Table 4.6-4 Disturbance to Vegetation Community Types Under Alternative C

Vegetation Community Types	Impacted Acres[1]
Badlands	385
Cliff/Canyon	88
Developed/Disturbed	107
Grassland	67
Sagebrush	255
Salt Desert Shrub	612
Wetland/Riparian	0
Total	1,514

[1] This quantitative assessment is calculated by taking the total acreage impacted by new programmatic surface disturbance associated with Alternative C, multiplied by the percentage for each vegetation type within the GCWPA based on the information reported in **Table 4.6-1**. Additionally, disturbance in wetland/riparian vegetation types is prohibited by design feature or mitigation. Therefore, the amount of wetland/riparian acres potentially disturbed by the Alternative were then multiplied by each vegetation type percentage and added to the applicable programmatic disturbance values.

Noxious Weeds and Invasive Species

Under Alternative C, direct and/or indirect surface disturbance-related effects to noxious weeds and invasive species would be approximately 1,514 acres. Anticipated effects and recovery timeframes would be the same as described under Alternative A.

Wetlands and Riparian Areas

As described under Section 4.4, Water Resources, design features implemented under Alternative C would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, impacts to wetland and riparian areas would be the same as those described under Alternative A.

Special Status Plant Species

Direct and indirect effects to special status plant species under Alternative C would be the same as those detailed under Alternative A (Section 4.6.1.2). Approximately 1,514 acres of surface disturbance would occur as a result of this alternative.

Uinta Basin Hookless Cactus

Based on the habitat modeling for the Uinta Basin hookless, a total of approximately 19,010 acres of potential habitat for this species is located in areas of potential disturbance under Alternative C, approximately 850 acres less than Alternatives A and B. This includes 2,173 acres of Level 1 CCAs and 5,295 acres of Level 2 CCAs. To calculate effects to this species under Alternative C, the same quantitative calculation described under Alternative B was utilized. The amount of Uinta Basin hookless cactus habitat that would be impacted by Alternative C is estimated by multiplying the percentage of potential disturbance acreage (57 percent for potential habitat, 5 percent for Level 1 CCAs, and 13 percent for Level 2 CCAs) by the amount of acreage that would be impacted by new surface disturbance associated with Alternative C (2,548 acres). As a result, approximately 1,762 acres of potential cactus habitat (less than 1 percent of potential habitat across its entire range) would be impacted under this alternative. This includes 103 acres of Level 1 CCAs (4 percent of Level 1 CCAs found within the GCWPA and 1 percent of the total Level 1 CCAs within both the White River and Bonanza CCAs) and 287 acres of Level 2 CCAs (5 percent of Level 2 CCAs found within the GCWPA and 1 percent of the total Level 2 CCAs within both the White River and Bonanza CCAs).

Direct effects to the Uinta Basin hookless cactus under the Alternative C would be avoided and indirect effects would be minimized through the implementation of the USFWS Uinta Basin hookless cactus conservation measures (USFWS 2014d) incorporated into the design features and mitigations in **Table 4.6-6** and ACEPMs identified in Section 2.8.2 that include surveys within potential habitat, adherence to USFWS, BLM, and Tribal surface disturbance buffers where possible, restrictions within conservation core areas, the control and management of noxious and invasive weed species, and the use of dust abatement measures. However, based on the potential for surface disturbance within potential habitat and the possibility of surface disturbance within 50 to 300 feet of individuals or populations of Uinta Basin hookless cactus, Alternative C **may affect, and is likely to adversely affect** Uinta Basin hookless cactus.

Ute Ladies'-tresses Orchid

Based on the vegetation community type in **Table 3.6-1**, potential habitat for the Ute ladies'-tresses orchid in the GCWPA would be approximately 551 acres. However, additional design features described under Section 4.4, Water Resources, would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, impacts would be the same as those described under Alternative A and Alternative C may affect, but is not likely to adversely affect the Ute ladies'-tresses orchid.

Horseshoe Milkvetch and Sterile Yucca

Based on the vegetation community type in **Table 3.6-1,** a total of approximately 23,046 acres of potential habitat for these species is located in the GCWPA. A qualitative assessment of the amount of suitable habitat that would be impacted by Alternative C is calculated by multiplying the percentage of the GCWPA impacted by new surface disturbance associated with Alternative C by the acreage of suitable habitat in the GCWPA. As estimated on **Table 4.6-2**, approximately 4 percent of the GCWPA would be impacted by new surface disturbances associated with Alternative C. Therefore, approximately 827 acres of suitable habitat would be impacted by new activity under Alternative C.

Effects would be reduced based on the reduction of surface disturbance under Alternative C and associated alternative–specific design features and mitigations (**Table 4.6-6**) identified for BLM sensitive plant species. Therefore, Alternative C is not likely to result in a trend towards federal listing for the horseshoe milkvetch and sterile yucca.

4.6.1.4 Alternative D—Other Protections Action

Project-related activities and effects on vegetation under Alternative D would be similar to those described above under Alternative A. Under Alternative D, 146 new well pads would be constructed or 87 fewer than Alternative B. The number of available existing expandable well pads would be reduced to 880, 138 fewer than Alternative B.

Vegetation Community

Under Alternative D, direct and/or indirect surface disturbance-related effects to vegetation resources would be approximately 1,595 acres (**Table 4.6-5**); 280 acres less than under Alternative B. Alternative D would affect up to 241 acres of sagebrush habitat. ACEPMs described for Alternative D are listed in Section 2.9.3 and include more stringent measures than Alternative B and Alternative C to protect vegetation resources.

Table 4.6-5 Disturbance to Affected Vegetation Community Types Under Alternative D

Vegetation Community Types	Impacted Acres[1]
Badlands	383
Cliff/Canyon	80
Developed/Disturbed	117
Grassland	61
Sagebrush	300
Salt Desert Shrub	653
Wetland/Riparian	0
Total	**1,595**

[1] This quantitative assessment is calculated by taking the total acreage impacted by new surface disturbance associated with Alternative D, multiplied by the percentage for each vegetation type within the GCWPA based on the information reported in **Table 4.6-1**.

Noxious Weeds and Invasive Species

Under Alternative D, direct and/or indirect surface disturbance-related effects to noxious weeds and invasive species would be approximately 1,595 acres. Anticipated effects would remain consistent with Alternative B; however, as surface disturbance acreage increases, the potential for the introduction and/or spread of noxious weeds and invasive species increases. In addition, with increased surface disturbance, successful reclamation would be even more challenging. Additionally, under Alternative D, no new wells or well pads would be permitted within 0.5 mile of the White River (unless such wells would not be visible from the river because of intervening topography) likely resulting in a lower potential for the introduction of noxious weeds and invasive species into this sensitive area.

Wetlands and Riparian Areas

As described under Section 4.4, Water Resources, design features implemented under Alternative D would prohibit surface disturbance in wetlands, riparian areas, seeps or springs, or within a 100-meter buffer around these areas. Therefore, impacts to wetland and riparian areas would be the same as those described under Alternative A.

Special Status Plant Species

Direct and indirect effects to all special status plant species under Alternative D would be the same in nature as those described under Alternative A (Section 4.6.1.2). Approximately 1,595 acres of surface disturbance would occur as a result of this alternative.

Uinta Basin Hookless Cactus

Based on the habitat modeling for the Uinta Basin hookless, a total of approximately 18,366 acres of potential habitat for this species is located in areas of potential disturbance under Alternative D, approximately 1,500 acres less than Alternatives A and B and over 600 acres less than Alternative C. Under Alternative D, disturbance to Level 1 CCAs would be limited to pad expansion and where no plant populations are affected, and potential disturbance to 1,552 acres of Level 2 CCAs. To calculate effects to this species under Alternative D, the same quantitative calculation described under Alternative B was utilized. The amount of Uinta Basin hookless cactus habitat that would be impacted by Alternative D is estimated by multiplying the percentage of potential disturbance acreage (66 percent for potential habitat and 5 percent for Level 2 CCAs) by the amount of acreage that would be impacted by new surface disturbance associated with Alternative D (2,629 acres). As a result, approximately 1,817 acres of potential cactus habitat (less than 1 percent of potential habitat across its entire range) would be

impacted under this alternative. This includes 298 acres of Level 2 CCAs (5 percent of Level 2 CCAs found within the GCWPA and less than 1 percent of the total Level 2 CCAs within both the White River and Bonanza CCAs).

The potential for effects to occur would be reduced proportionately due to the reduction in surface disturbance compared to Alternative B and this alternative would result in the smallest percentile of potential Uinta Basin hookless cactus habitat affected by the GCWP.

The design features and mitigations in **Table 4.6-6** and ACEPMs identified in Section 2.6.9 and Section 2.9.3 for the Uinta Basin hookless cactus would further reduce effects on this species. These design features and mitigation measures incorporate the USFWS (2014d) conservation measures that include:

- The prohibition of new well pads in Level 1 CCAs;
- Restrictions for surface disturbance within Level 1 and Level 2 CCAs;
- Surveys within potential habitat;
- Adherence to surface disturbance buffers based on surface and subsurface ownership, where possible;
- Control and management of noxious and invasive weed species; and
- The use of dust abatement measures.

However, based on the potential for surface disturbance within potential habitat and the possibility of surface disturbance within 50 to 300 feet of individuals or populations of Uinta Basin hookless cactus, Alternative D may affect, and is likely to adversely affect Uinta Basin hookless cactus.

Ute Ladies'-tresses Orchid

As detailed in **Table 3.6-1**, potential habitat for the Ute ladies'-tresses orchid in the GCWPA would not be impacted under Alternative D. Therefore, Alternative D would have no effect on the Ute ladies'-tresses orchid.

Horseshoe Milkvetch and Sterile Yucca

Based on the vegetation community type in **Table 3.6-1,** a total of approximately 20,214 acres of suitable habitat for these species is located in the GCWPA under Alternative D. A qualitative assessment of the amount of suitable habitat that would be impacted by Alternative D is calculated by multiplying the percentage of the GCWPA impacted by new surface disturbance associated with the Alternative D by the acreage of suitable habitat in the GCWPA. As estimated on **Table 4.6-2**, approximately 4 percent of the GCWPA would be impacted by new surface disturbances associated with Alternative C. Therefore, approximately 901 acres of suitable habitat would be impacted by new activity under Alternative D.

Effects would be reduced compared to Alternative B, but slightly increased compared to Alternative C. Based on the presence of suitable habitat and the conservation measures identified for BLM sensitive plant species (Section 2.9.3), Alternative D is not likely to result in a trend towards federal listing for the horseshoe milkvetch and sterile yucca.

4.6.2 Alternative-specific Design Features and Mitigations

During the APD and ROW Grant approval processes, vegetation considerations would be identified for further mitigation and monitoring of vegetation resources. **Table 4.6-6** includes a summary of alternative-specific design features and mitigations, and the types of mitigations included, that would reduce effects to vegetation resources, including special status species and wetland/riparian areas.

4.6.3 Residual Effects

For all alternatives, residual effects to vegetation resources including general vegetation and special status plant species, would occur and include the long-term loss of herbaceous and woody communities and the potential for the spread of noxious and invasive weeds.

4.6.4 Irretrievable and Irreversible Commitment of Resources

Disturbance to vegetation communities within the GCWPA would occur as a result of all of the alternatives. If interim reclamation is successful, no irretrievable commitments are anticipated for native vegetation communities. If interim reclamation is not successful, there would be an irretrievable loss of native vegetation communities due to construction and production activities. Assuming successful reclamation at project completion, these effects would be reversible. If final reclamation is successful, no irreversible commitments would be anticipated.

If successful reclamation is not achieved, disturbed areas would no longer support native vegetation communities and potentially would be dominated by noxious and invasive weed species, especially halogeton and cheatgrass species. This would represent an irreversible and irretrievable commitment of this resource.

This incremental loss of special status plant species habitat during construction and operation activities would represent an irretrievable commitment of this resource. If interim and final reclamation are successful, this habitat may be reclaimed at the completion of the project.

4.6.5 Relationship of Local Short-term Use to Long-term Productivity

Due to very slow revegetation rates and low revegetation success, the proposed project would result in effects to vegetation communities that would extend beyond construction, operation, and maintenance activities, affecting long-term ecological and anthropogenic uses of vegetation areas.

For all alternatives, long-term effects that may affect long-term productivity include the disturbance of herbaceous and shrub-dominated vegetation community types that would require 10 to 50 years to fully recover, the disturbance of pinyon-juniper woodlands that would require at least 75 to 100 years to recover, and the potential that populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas for extended periods of time. Under Alternative B, the disturbance of approximately 1,170 acres of herbaceous and shrub-dominated vegetation community types that include the presence of pinyon-juniper woodlands would occur. Under Alternative C, the disturbance of approximately 895 acres of herbaceous and shrub-dominated vegetation community types that include the presence of pinyon-juniper woodland would occur. Under Alternative D, the disturbance of approximately 958 acres of herbaceous and shrub-dominated vegetation community types that include the presence of pinyon-juniper woodland would occur. The decrease in the acreages of these vegetation communities either through direct effects (i.e., removal of vegetation) or indirect effects (i.e., the spread of noxious and invasive species) could impact ecological function, livestock and wildlife grazing, and recreation activities in the GCWPA.

Table 4.6-6 Vegetation Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Vegetation and Noxious/Invasive Species								
EOG will control invasive and noxious weeds along access roads, pipeline routes, well sites, or other facilities as specified by BLM, state, and county regulations. A list of noxious weeds will be obtained from the BLM or the appropriate County Extension Office. On BLM-administered land, a Pesticide Use Proposal will be approved prior to the application of herbicides or pesticides.		d	d	d	m			
If directed by the AO, prior to any surface disturbance, well pad sites and access roads will be examined by a botanist to determine if any listed threatened, endangered, candidate, or sensitive species of plants or their habitat are present. If present and prior to initiating any surface disturbance activities, appropriate avoidance or mitigation measures shall be implemented. Site-specific clearances will be performed at the time of the onsite inspection.		d	d	d	m			
Project implementation will incorporate the VFO Weed Policy.			d	d	m	m		
EOG will obtain and comply with a Pesticide Use Permit prior to herbicide use. The Pesticide Use Permit will specify buffer distances between herbicide treatment and special status plants based on the BLM herbicide use programmatic EIS (BLM 2007d), and with then-current VFO policy.			d	d	m	m		
Additional weed control and prevention measures include the washing of vehicles and equipment coming into the GCWPA from areas outside of the Uinta Basin, annual monitoring, and herbicide spraying.					m	m	m	m
Any seed, straw, mulch, and matting used for restoration will be certified weed-free.					m	m	m	m
The presence of biological soil crusts will be assessed on a site-specific basis during well-pad and road development and siting. Areas with crusts will be avoided as feasible, and any unavoidable disturbance will be mitigated as necessary.					m	m	m	m
Uinta Basin Hookless Cactus *(Sclerocactus wetlandicus)*								
This project includes areas important to the recovery of Uinta Basin hookless cactus. The USFWS has identified core habitat areas that may require additional conservation measures. On Tribal lands, a Tribal Cactus Management Plan will be approved by both the Tribe and USFWS. Surveys will be required in potential habitat prior to surface disturbing activities in accordance with USFWS and Tribal survey protocols. Surface disturbance will avoid identified plants by 50 to 300 feet, where possible and depending on the type of ground			d	d	m	m		

Table 4.6-6 Vegetation Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
disturbance or project component (USFWS 2014d). Identified plants on Tribal surface will be avoided by a minimum of 100 feet.								
Within Core 1 areas, the following restrictions will apply: • No new well pads will be constructed. Expansion of existing well pads to accommodate additional wells will be allowed, where such expansion does not disturb existing cactus plant populations. Installation of new pipelines to accommodate increased production will be permitted, where necessary, and such pipelines will be installed aboveground. • Where populations or individuals of Uinta Basin hookless cactus are located within 300 feet of the proposed edge of the expansion pad, pipeline ROW, or access road ROW, the following actions will be taken to minimize the impacts: – Pad expansion construction or pipeline installation work will occur outside the flowering period (April 1 to June 30). – All disturbed areas will be revegetated with native species comprised of species indigenous to the area and non-native species that are not likely to invade other areas. – Silt fencing will be used to protect cacti that are within 300 feet and down slope or downwind of surface disturbance. Fencing is intended to prevent sedimentation or dust deposition and will be evaluated for effectiveness by a qualified botanist. – A qualified botanist will be on site to monitor surface-disturbing activities when cacti are within 300 feet of any surface disturbance. – Dust abatement will occur during construction where plants are closer than 300 feet from surface disturbing activities. Abatement will be designed to minimize potential for dust plume generation and will use water only. – Cacti within 300 feet of a proposed surface disturbance will be flagged immediately prior to surface-disturbing activities and flags will be removed immediately after surface-disturbing activities are completed. Leaving cacti flagged for as short a time as possible will minimize drawing attention to the cacti and reduce the potential for theft. – New pipelines will be sited to maximize the distance from adjacent Uinta Basin hookless cactus. – Project personnel associated with construction activities will be instructed to drive at a speed limit of 15 miles per hour on unpaved roads and to remain on the existing roads and ROWs at all times.			d		m	m		

Table 4.6-6 Vegetation Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Within Core 2 areas, the following restrictions will apply: • New well pads will be allowed, however the density of new and existing well pads will not exceed 4 pads per section (160-acre spacing) in most of the GCWPA. In Sections 27 and 28, T8S, R23E, where current drilling density is low, new well pads will be allowed at a density of 1 new pad per 160-acre tract, if that tract does not contain an existing well pad. Well pad expansions to accommodate additional wells, and surface pipeline installation, where necessary to accommodate additional production, will be permitted.			d		m	m		
Construction of new well pads, expansion of existing pads to accommodate additional wells, and creation of other facilities would be prohibited within Core 1 areas.				d	m	m	m	
New well pads and expansion of existing well pads would be allowed within Core 2 areas. However, new and existing well pads must not exceed a density of four pads per section (or 160-acre spacing). New well pads and expansion of existing well pads would be prohibited where GCWPA surface disturbance exceeds five percent of the area of the affected cactus population (Bonanza or White River).				d	m	m	m	
If the 5 percent disturbance cap is already exceeded, no additional surface disturbance will occur until disturbed areas are successfully reclaimed. Reclamation standards will be developed in the final USFWS recovery plan for each *Sclerocactus* species. In the interim, proposed successful reclamation standards for this project would be approved by USFWS.				d	m	m	m	
All activities in potential habitat will conform to the latest conservation measures for this species (see **Appendix H,** *Sclerocactus* Management and Survey Guidelines).					m	m	m	m
Ute Ladies'-tresses *(Spiranthes diluvialis)*								
Surveys will be required in suitable habitat prior to surface disturbing activities in accordance with protocol and surface disturbance will avoid identified populations by at least 300 feet.			d	d	m	m		
All activities in potential habitat will conform to the latest conservation measures for this species.					m	m	m	m
BLM Sensitive Plant Species								
Pre-construction surveys for *Yucca sterilis*, and *Astragalus equisolensis* will be required. Identified populations will be avoided by at least 150 feet. Future protective measures will comply with then-current VFO policy.			d	d	m	m		

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4.7 Wildlife and Fisheries

4.7.1 Direct and Indirect Effects

4.7.1.1 Alternative A—No Action

Implementation of Alternative A would result in the drilling of up to 462 new wells from up to 425 new well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 2,685 acres, or 6.2 percent of the GCWPA. Including existing disturbance, approximately 6,655 acres (15.5 percent of the GCWPA) would undergo disturbance of the surface.

General Wildlife

Common Non-game Wildlife

Under Alternative A, the proposed GCWP project would not be approved and current land management practices would continue. Under this alternative, wells and associated facilities already approved under previously conducted NEPA analyses would occur. Implementation of Alternative A would result in an estimated 2,685 acres of disturbance in the GCWPA (**Table 4.6-2**).

Under this alternative, potential effects to wildlife include various direct and indirect effects, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The degree to which these effects affect wildlife species depends on a variety of factors including the species, time of year, duration of effect, and intensity of effect.

Direct effects on common wildlife species under Alternative A include injury and mortality, disturbance, and displacement. Injury or mortality to wildlife species may occur during the construction and operation phases of the project. During the construction phase, the use of heavy equipment and various vehicles could lead to wildlife collisions, crushing or entrapment of wildlife. Vehicle use and traffic during production operations also could lead to similar injury or mortality. Wildlife species and individuals most susceptible to direct injury or mortality are those that are unable to avoid disturbance based on their size, age, form of mobility, or life stage. Another source of potential wildlife injury or mortality is the potential for wildlife harassment and poaching. Increased human activity in the GCWPA, associated with project implementation, may lead to an increase in poaching frequency and intensity.

Common wildlife also may be disturbed or displaced during implementation of Alternative A. Wildlife disturbance can be caused by human presence, activity, and noise. These effects can alter an individual animal's behavior resulting in reductions in overall fitness and health, reproductive success, and survivorship. Project activities that would occur during metabolically stressful periods (reproduction, winter, drought) could reduce fitness and health of an individual, and if effects occurred with sufficient duration and intensity these could lead to death. Potentially disruptive project activities (for example, habitat removal, long periods of human presence and activity, or sustained noise from construction activities or drilling) that occur during an animal's courtship, reproduction, or maturation stages could reduce reproductive success and fecundity. Human presence and activity in suitable and occupied habitats could cause animals to avoid affected habitats, as wells as other habitats that are immediately surrounding the disturbance that are not necessarily directly affected by project-related activities. The degree to which displacement affects individual animals varies based on the species, time of year, and the availability of otherwise unaffected and suitable habitats.

Displacement effects can have measurable and detrimental effects on locally occurring common wildlife species if habitats are at maximum carrying capacity. For most common wildlife species, including small- and medium-sized mammals, reptiles, and passerines, habitats within the GCWPA are not presumed to be at maximum carrying capacity. As such, other non-affected habitats are presumed to be available, suitable, and capable of supporting displaced individuals. Common wildlife can experience short-term

and long-term displacement effects. Short-term displacement effects may be realized in the form of flushing an individual from cover or altering an individual's daily hunting or foraging behavior. Long-term displacement effects could occur in instances when suitable and occupied habitats are removed or altered, thereby precluding occupation by common wildlife species. In the case of habitat disturbance, individuals would be expected to find other non-affected, suitable, and available habitats. Potential displacement effects on common wildlife species are not expected to have measurable effects on species populations or protective status.

Potential indirect effects associated with implementation of Alternative A include habitat alteration and loss and effects associated with habitat fragmentation. It is estimated that implementation of Alternative A would result in the direct loss of 2,685 acres in the GCWPA. Under Alternative A, habitat alteration and loss would occur in a variety of vegetation community types (**Table 4.6-2**). Habitat alteration and loss would have the most profound effect on common wildlife, including small mammals, reptiles and amphibians that have relatively small home ranges or limited mobility. For most common wildlife species, their habitat requirements are general or broad. Their occurrence and distribution in the GCWPA is in response to the availability and suitability of common habitat conditions.

Habitat fragmentation is an ecological principle that relates to the modification of habitat homogeneity, connectivity, and effectiveness at the landscape level. Habitat fragmentation implies a loss of habitat effectiveness, reduced patch size and an increasing distance between patches of similar habitat, but also an increase of new habitat (Andren 1994). Habitat fragmentation and the evaluation and interpretation of its potential effects on wildlife species, including positive and negative effects, depends on a myriad of variables and conditions, including species-specific responses to habitat changes; the type, condition and availability of habitats; and the scale at which biological and environmental factors are relevant to species and for which effects are measured.

Evaluations of habitat fragmentation, including habitat availability and suitability, cannot be evaluated or analyzed at the community or ecosystem level, which are collections of species. Instead effects associated with habitat fragmentation are species-specific (Franklin et al. 2002). It is expected that most common wildlife species are less sensitive to effects associated with habitat fragmentation and more sensitive to habitat alteration or loss. Other species, including some big game species, are affected by habitat fragmentation and associated impacts, including human presence and activity, habitat alteration and loss, and changes in predator access and population numbers.

Design features and additional mitigations protective of general wildlife are summarized in Section 4.7.2.

Big Game

Mule Deer

Under Alternative A, mule deer may be injured or killed by a variety of circumstances including: collision with moving vehicles and equipment while constructing new pads, roads and other facilities and during production operations for the life-of-projects in the GCWPA that have been previously approved under other completed NEPA analyses. Mule deer also may be injured or killed as the result of poaching.

Mule deer may be disturbed or displaced during the implementation of Alternative A. Human activity and presence can disturb individual deer. While disturbance is not expected to have a critical effect on individual health or survivorship for most deer, disturbance that occurs during periods of high stress, including parturition and winter survival, could negatively affect already weakened individuals. Human presence and activity, as well as habitat alteration and loss may displace deer from otherwise suitable habitats. Displaced deer could face increased pressure to maintain individual health and fitness if other unaffected habitats are not available and if displacement occurs during periods of high stress.

Implementation of Alternative A could affect deer through habitat alteration and loss, and effects associated with habitat fragmentation. As identified in Section 3.7.1.2, Big Game, construction of proposed facilities would result in the loss or alternation of mule deer crucial yearlong/fawning range in the GCWPA. **Table 4-7.1** summarizes the acres of disturbance by alternative on yearlong crucial/fawning mule deer ranges in the GCWPA.

Table 4.7-1 Disturbance to Mule Deer Range in the GCWPA by Alternative

Mule Deer Range	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Crucial Yearlong/fawning	143	105	77	40

Implementation of Alternative A could lead to the introduction and spread of noxious weeds in the GCWPA. While noxious weeds are expected to currently occur in the GCWPA, increased surface disturbance could increase noxious weed occurrence, distribution, and varieties in the GCWPA. Noxious weed occurrence can cause a shift in vegetation communities, potentially making them less suitable for mule deer and other big game species; and can change local wildfire frequency, intensity, and patterns. These effects associated with noxious weeds can lead to indirect alteration and loss of habitats otherwise suitable to the mule deer.

Implementation of Alternative A has the potential to add to existing effects associated with habitat fragmentation. As previously described, the GCWPA is currently an active oil and gas development area, and as such, habitats have already been altered, removed, and fragmented. Effects associated with habitat fragmentation under Alternative A are expected to be less discernible and potentially less important on big game species, including the mule deer, because habitats within the GCWPA have already experienced some degree of alteration, loss, and fragmentation. Big game ranges that are no longer in their natural condition, specifically large uninterrupted tracts of suitable and unfragmented habitats, are less susceptible to effects associated with habitat fragmentation than those habitats that are not disturbed. Although implementation of Alternative A may affect individual mule deer, implementation would not be expected to negatively affect local populations or UDWR population objectives for the South Slope Vernal /Diamond Mountain Herd Unit.

Mule deer crucial yearlong range and fawning habitats are coincident in the GCWPA and associated with riparian habitats of the White River (**Figure 3.7-1**). Existing well pads in this portion of the GCWPA could be expanded. Under Alternatives A, B, and C there are 35 existing well pads that may be expanded; seven of which are on BLM lands, 26 are on Tribal lands, and two are on privately owned surface. Under Alternative A there are 28 existing pads that could be expanded, of which one is on BLM surface, 25 on Tribal surface, and two on privately-owned surface. For action proposed on lands administered by the BLM and privately owned lands that have federal mineral rights, the implementation of a timing limitation in mule deer fawning habitats from May 15 – June 30 (BLM 2008b, Appendix K) would avoid, reduce, and minimize a variety of potential impacts to individual mule deer and the local population (Section 4.7.2). This mule deer fawning timing stipulation may not be applied to Tribal surface thereby exposing mule deer at these limited well locations to unmitigated impacts.

Pronghorn

Effects to pronghorn would be similar to mule deer. Construction of proposed facilities would result in the loss or alternation of yearlong crucial range/fawning pronghorn habitat in the GCWPA. **Table 4.7-2** summarizes the acres of disturbance by alternative to pronghorn ranges in the GCWPA.

Table 4.7-2 Disturbance to Pronghorn Range in the GCWPA by Alternative

Pronghorn Range	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Yearlong Crucial/Fawning	2,382	1,739	1,417	1,547

Although implementation of Alternative A would impact pronghorn, implementation would not be expected to greatly impact the species or UDWR population objectives for the South Slope Vernal/Diamond Mountain Herd Unit.

Rocky Mountain Bighorn Sheep

Implementation of Alternative A would not likely affect individual Rocky Mountain bighorn sheep (bighorn sheep) because of the low likelihood of occurrence in the GCWPA and the limited availability and use of suitable habitats in the GCWPA. Human presence and activity could disturb or displace individual sheep, in the unlikely event sheep occurred in or near areas proposed for development. Implementation of Alternative A would affect an estimated 184 acres of bighorn sheep range in the GCWPA (**Table 4.7-3**). Estimates of disturbance to bighorn sheep range in the GCWPA may be overestimated, as these habitats are highly isolated and limited to the rugged breaks and canyons associated with the White River that may preclude or limit development activities. Implementation of Alternative A would not be expected to have measurable effects on individual Rocky Mountain bighorn sheep, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Table 4.7-3 Disturbance to Bighorn Sheep Range in the GCWPA by Alternative

Bighorn Sheep Range	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Yearlong Crucial	184	134	101	57

Bison

Implementation of Alternative A would not likely affect individual bison because of the low likelihood of occurrence in the GCWPA. The White River acts as a natural barrier for bison, limiting their movement northward from several HMUs where this species was introduced. Human presence and activity could disturb or displace individual bison, in the unlikely event bison occurred in or near areas where development was taking place. Implementation of this alternative would affect an estimated 58 acres of bison yearlong crucial range that is mapped within the GCWPA (**Table 4.7-4**). Implementation of Alternative A would not be expected to have measurable effects on individual bison, local populations, or UDWR's population objectives for the Book Cliffs HMU.

Table 4.7-4 Disturbance to Bison Range in the GCWPA by Alternative

Bison Range	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Yearlong Crucial	58	42	19	2

Small Game, Furbearers, and Upland Game Birds

Under this alternative, potential effects to small game, furbearers, and upland game birds include various direct and indirect effects, including injury and morality, disturbance, displacement, habitat alteration and loss, and habitat fragmentation similar to those described for common non-game species above. The degree to which these impacts affect these species depends on a variety of factors including the species, time of year, duration of effect, and intensity of effect.

Direct effects including injury and mortality may occur during the construction and operation phases of the project. Surface disturbing activities associated with the construction of new well pads, roads, and other facilities, and vehicle use on local and project-specific roads in the GCWPA may result in injury or mortality to small game, furbearers, and upland game birds. Individuals unable to avoid harm, including eggs, young, nestlings, and tending adults would be at greatest risk for injury and mortality. Individuals may be injured or killed by entrapment, physical collision or crushing by construction equipment, and collision with vehicle and truck traffic on project-related and public roads. Another source of wildlife injury or mortality is the potential for wildlife harassment and poaching. Increased human activity in the GCWPA, associated with project implementation, may lead to an increase in the frequency of poaching and harassment and may increase hunter access and success. Implementation of various practices, measures, and mitigation, combined with the scheduling of surface disturbing activities outside the avian nesting season, when practicable, would further reduce the potential and magnitude of injury and mortality to upland game birds.

Increased human presence and activity associated with implementation of Alternative A that occurs during the nesting period has the potential to cause a decrease in nesting attempts, increase in frequency of nest abandonment, and ultimately a reduction in reproductive success for upland game birds.

Habitat alteration and loss are indirect effects associated with implementation of Alternative A. Implementation of Alternative A would affect an estimated 2,685 acres that may support small game, furbearers, and upland game bird species. Oil and gas development and production activities currently occur throughout much of the GCWPA. These activities and others have altered the natural condition and connectivity, and patch size of habitats in the GCWPA. Effects associated with habitat fragmentation are not likely to be important for small game, furbearers, and upland game bird species because of the current disturbance within the GCWPA and because these species are not typically considered highly sensitive or negatively responsive to changes in habitat connectivity, patch size, or diversity of habitats.

The introduction and spread of non-native plants and invasive weeds, under Alternative A, has the potential to lead toward a shift in habitat suitability, thereby limiting habitat availability for small game, furbearers, and upland game birds. The degree to which non-native plants and invasive weeds impact these species depends on species-specific habitat requirements, current availability and suitability of these habitats, species-specific sensitivity to habitat alterations, and the variety and extent of the introduction and spread of non-native plants and invasive weeds.

Migratory Birds

Non-Raptors

Under Alternative A, potential effects to migratory bird species are similar to those described for other terrestrial wildlife species and include injury and mortality; disturbance, displacement, habitat alteration and loss, and possibly effects associated with habitat fragmentation. These potential effects are applicable to all species of migratory birds that occur within the GCWPA. However, the degree to which these impact different migratory bird species is associated with the amount of disturbance in habitats that support each species and species-specific sensitivities. While all migratory bird species that may occur in the GCWPA have the potential to experience effects from implementation of Alternative A, those migratory bird species that have been identified by the USFWS as BCC are expected to be most

sensitive based on their population declines, limited distribution, and habitat requirements. Refer to **Appendix L** for the list of BCC migratory bird species that may occur in the GCWPA and for which this analysis applies. The following sections pertain to all migratory bird species that may occur in the GCWPA. Each species uses and relies on habitats in different combinations and conditions. For a summary of the effects to dominant vegetation cover types that may be used by migratory bird species refer to **Table 4.6-2**.

Under Alternative A, injury and mortality may occur during the construction and operation phases of the project. Surface disturbing activities associated with the construction of new well pads, roads, and other facilities, and vehicle use on local and project-specific roads in the GCWPA may result in injury and mortality to migratory birds. Individuals unable to avoid harm, including eggs, nestlings, and tending adults would be at greatest risk for injury and mortality. Birds may be injured or killed by entrapment, physical collision or crushing by construction equipment, and collision with vehicle and truck traffic on project-related and public roads. Additionally, birds may be exposed to a variety of chemicals, fuels, and substances that may be hazardous to their health and body condition. Another source of potential injury and mortality is wildlife harassment and poaching. Increased human activity in the GCWPA, associated with project implementation, may lead to an increase in the frequency of poaching and harassment. Bird species are most susceptible to these direct effects during the nesting season, when individuals may be too small or physically unable to avoid effects or are energetically stressed or compromised. Implementation of various practices, measures, and mitigation, combined with the scheduling of surface disturbing activities outside the avian nesting season, when practicable, would further reduce the potential and magnitude of injury and mortality to migratory birds.

Increased human presence and activity associated with implementation of Alternative A that occurs during the nesting period has the potential to cause a decrease in nesting attempts, increase in frequency of nest abandonment, and ultimately a reduction in reproductive success for migratory birds.

Habitat alteration and loss are indirect effects associated with implementation of Alternative A. Implementation of Alternative A would affect an estimated 2,685 acres that may support migratory bird species. Oil and gas development and production activities currently occur throughout much of the GCWPA. These activities and others have altered the natural condition and connectivity, and patch size of habitats in the GCWPA. Effects associated with habitat fragmentation are not likely to be important for most migratory species because of the current disturbance and conditions within the GCWPA and because some species are not typically considered highly sensitive or negatively responsive to effects associated with habitat fragmentation.

The introduction and spread of non-native plants and invasive weeds, under Alternative A, has the potential to lead toward a shift in habitat types, thereby limiting habitat availability for migratory bird species. The degree to which non-native plants and invasive weeds impact these species depends on species-specific habitat requirements, current availability and suitability of these habitats, species-specific sensitivity to habitat alterations, and the variety and extent of the introduction and spread of non-native plants and invasive weeds.

Implementation of this alternative includes several measures, design features and mitigation measures that would avoid, reduce, or minimize impacts to migratory bird species. All alternative-specific wildlife design features and mitigation measures related to migratory birds are presented in Section 4.7.2. While implementation of Alternative A may affect individuals of various migratory bird species, effective application of the measures included under this alternative, and described in Section 4.7.2, would avoid or reduce the occurrence, intensity, and duration of potential effects to migratory bird species.

Raptors

Implementation of Alternative A and disturbance of 2,685 acres of potential nesting, wintering, and foraging habitat (**Table 4.6-2**) could result in a variety of direct and indirect effects to raptors, including

injury and mortality, disturbance, displacement, and habitat alteration and loss within the GCWPA similar to impacts described for non-raptor migratory birds. Implementation of Alternative A could cause disturbance to individual raptors. Disturbance during critical periods can have effects on local nesting success. Human presence and activity can lead to the disruption of a variety of important raptor reproductive behaviors including, territory formation, pair bonding, territory defense, nest building, copulation, egg laying and incubation, and feeding of nestlings. Toward avoiding, reducing, and minimizing disturbance of raptors during the nesting period, the VFO has timing and surface use stipulations that preclude surface disturbing activities within established buffers around known active raptor nests.

Displacement of individual raptors is another potential effect associated with implementation of Alternative A. The effects to individuals from displacement are influenced by a variety of factors, including species and individual sensitivity to human presence and activity, the duration and intensity of the disturbance, the timing of disturbance, and the availability and suitability of unaffected habitats to support displaced individuals. It is expected, that project-related incidents of displacement would be short-term in nature and would not have lasting effects on local reproductive status of nesting raptor species. Implementation of VFO timing and surface use stipulations would reduce the potential for displacement of raptors during implementation of this alternative.

For raptor species that may occur in the GCWPA, habitat alteration and loss associated with implementation of Alternative A would most likely be important as it pertains to habitat availability and suitability for prey species, particularly small and medium sized mammals. Prey species diversity and populations would not be expected to vary substantially as the result of implementation of Alternative A. While implementation of Alternative A has the potential to alter or remove some suitable nesting habitats, in the form of scattered pinyon juniper or large decadent shrub/scrub, the majority of high quality nesting habitats are likely to be avoided, including large mature trees, cliff faces, and active prairie dog colonies.

Implementation of this alternative includes alternative-specific design features and mitigation measures that are intended to avoid, reduce or minimize impacts to raptor species. All wildlife design features and mitigation measures related to raptors are summarized in Section 4.7.2. Under Alternative A, EOG will adhere to seasonal and spatial buffers applicable to occupied raptor nests in the GCWPA in consideration of applicable guidelines (BLM 2008b). In addition, the bald and golden eagles are protected under the Bald and Golden Protection Act (BGEPA). Under the BGEPA, it is unlawful to “take” bald and golden eagles. Under the BGEPA, “take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb.” The measures previously described are intended to avoid “take” and also avoid, reduce, and minimize other impacts to eagles.

Implementation of Alternative A has the potential to result in direct and indirect impacts on raptor species in the GCWPA. However, the effective implementation of alternative-specific measures (Section 4.7.2) would avoid, reduce, or minimize these impacts.

Fisheries

Implementation of Alternative A could result in a variety of effects to local fish, including injury and mortality, displacement, and habitat alteration and loss. The potential for direct injury or mortality of fish is considered low based on the limited occurrence of suitable and occupied aquatic habitats in the GCWPA and the expectation that the majority of these habitats would be avoided during the construction and operational phases of the proposed project. While displacement of individual fish from occupied habitats is a possibility under Alternative A, this also is considered unlikely based on the limited occurrence of occupied aquatic habitats in the GCWPA and the expectation that these habitats would be avoided in most cases.

Implementation of Alternative A could result in the alteration and loss of aquatic habitats by direct disturbance, and indirectly by increases in local erosion and sedimentation, and uncontrolled releases of

various industrial fluids, oils, and chemicals. As described previously, direct disturbance to occupied aquatic habitats could occur under Alternative A, but is considered unlikely based on the limited occurrence of suitable aquatic habitats in the GCWPA and the expectation that the majority of these habitats would be avoided.

Indirect disturbances have the highest potential for altering aquatic habitats that may support common fish species. Increases in local soil erosion could lead to increases in sedimentation of local fish habitats. Increases in sedimentation of local fish habitats can affect the health of individual fish, spawning, fish rearing, and behavior (USEPA 2003b).

The uncontrolled release of various fluids and, oils can lead to contamination of local aquatic environments if these releases are of sufficient size, proximity to aquatic habitats or associated drainages, and are not appropriately contained and remediated. Under Alternative A, a SPCC Plan would be prepared for each well. This plan would include all of the practices, responses, and measures necessary to effectively avoid, limit, and respond to uncontrolled releases. Such a plan would reduce the likelihood of an uncontrolled release and would reduce the potential effects of such a release.

Implementation of Alternative A would require water for various phases of the project. As described in Chapter 2.0, recycled and fresh water would be obtained from the Deseret Generation and Transmission Cooperative's Bonanza power plant. Water for the Bonanza power plant is obtained from the Green River under Water Right 49-225. Water consumption and depletion of the White River as part of the operation of the Bonanza power plant have undergone evaluation and consultation with the USFWS, including agreements and mitigation associated with water use.

Implementation of Alternative A could affect individual fish, but is not expected to adversely affect fish species populations or their current protective status.

Special Status Species

Terrestrial Species

Black-footed Ferret

Implementation of Alternative A would affect an estimated 165 acres of black-footed ferret PMZ that is mapped in the GCWPA. For a summary of potential habitat disturbance in the black-footed ferret PMZ in the GCWPA by alternative, refer to **Table 4.7-5**.

Table 4.7-5 Disturbance to Black-footed Ferret PMZ in the GCWPA by Alternative

Black-footed Ferret	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
PMZ	165	121	96	120

Implementation of Alternative A could result in a variety of direct and indirect effects on the black-footed ferret including injury and mortality, disturbance, displacement, habitat loss of approximately 165 acres (**Table 4.7-5**), and the associated fragmentation of existing and occupied white-tailed prairie dog colonies. The likelihood of implementation resulting in injury and mortality to individual black-footed ferrets is low for a variety of reasons. Project related activities would most often occur during daylight hours, while black-footed ferret activity most often occurs during the night. Increases in human presence and activity in the GCWPA could displace individual ferrets when activities are of sufficient duration and intensity. Proposed activities would avoid, when practicable, or limit disturbance in active prairie dog colonies. Black-footed ferrets numbers are relatively low and widely distributed throughout the black-footed ferret PMZ, further reducing the likelihood of injury or mortality. However, while unlikely, there is

potential for injury or mortality by collision with moving vehicles and equipment, and crushing of individuals in burrows during soil disturbing activities. Additionally, project-related use and public use of existing and new access roads in the GCWPA, could lead to an increase in vehicle-ferret collisions.

Implementation of Alternative A could alter or remove an estimated 165 acres of the black-footed ferret PMZ. While project activities would avoid active prairie dog colonies, where practicable, it is possible that soil disturbing activities could take place in active prairie dog colonies that support black-footed ferrets. Black-footed ferrets are highly dependent upon prairie dogs as a prey species and on their burrows for denning and security. Effects to active prairie dog colonies could result in indirect effects to black-footed ferrets. Disturbance that occurs in active prairie dog colonies could result in effects related to fragmentation, potentially altering the suitability of fragmented colonies to support the black-footed ferret.

Section 4.7.2 includes alternative-specific measures that pertain to the black-footed ferret. As part of Section 7 ESA consultation, non-essential, experimental populations, as is the black-footed ferret in Utah, are addressed in the same manner as proposed species. Implementation of Alternative A **is not likely to jeopardize** the black-footed ferret. This determination is based on effective implementation of the black-footed ferret mitigation measures identified under this alternative and the low likelihood that project-related activities would harm individual ferrets.

White-tailed Prairie Dog

Implementation of Alternative A could cause a variety of direct and indirect effects to the white-tailed prairie dog, including injury and mortality; disturbance, displacement, and habitat loss. Individual prairie dogs could be injured or killed under implementation of this alternative by vehicle and equipment use in occupied habitats. Soil disturbing activities conducted in occupied habitats could crush individual prairie dogs on the surface and could bury and trap individual prairie dogs within their burrows. Increased human presence and activity in the GCWPA also could lead to an increased frequency and intensity of animal harassment and poaching.

Prairie dogs may be disturbed under implementation of Alternative A. Disturbance could be caused by short-term and long-term human presence and activity near colonies where similar activities do not currently occur. This potential disturbance could result in little to no effects to individual and colonies or it could result in an expenditure of energy that results in decreased fitness and health of individuals, particularly those already experiencing stresses from drought, reproduction, or plague. Disturbance also may cause individual prairie dogs to be distracted and less vigilant, resulting in potential increases in predation rates.

Individual prairie dogs and colonies are not likely to experience direct displacement from their established colonies as the result of implementing Alternative A. However, soil disturbing activities and the alteration of habitats adjacent to and within active colonies, could limit the expansion and growth of some colonies.

Evaluation of preliminary development scenarios indicates implementation of Alternative A could affect up to 121 acres of mapped white-tailed prairie dog colonies in the GCWPA (**Table 4.7-6**). As described previously, habitat alteration or loss outside active colonies can limit dispersal and expansion of prairie dog colonies. Implementation of this alternative could lead to the introduction and spread of noxious weeds in the GCWPA. The presence of noxious weeds could lead to a shift in the dominant plant community in some areas, thereby reducing the suitability of some habitats to support the white-tailed prairie dog and to an increase in wildfire frequency and intensity that could affect active prairie dog colonies.

Table 4.7-6 Disturbance to Mapped Prairie Dog Colonies in the GCWPA by Alternative

Prairie Dog Colony	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Coyote Basin	16	12	10	12
Glen Bench	52	38	31	26
Kennedy Wash	53	39	31	38
Total	121	89	71	76

Measures, including alternative-specific design features and mitigation measures, are summarized in Section 4.7.2. Alternative A includes measures to avoid active prairie dog colonies, whenever possible. Implementation of these measures will avoid or reduce impacts to existing active prairie dog colonies.

Implementation of Alternative A could affect individual white-tailed prairie dogs, but **is not likely to result in a trend towards federal listing** for the species. This determination is based on effective implementation of the applicable white-tailed prairie dog mitigation measures, summarized in Section 4.7.2.

Townsend's Big-eared Bat, Spotted Bat, Fringed Myotis, Big Free-tailed Bat

Implementation of Alternative A has the potential to cause a variety of direct and indirect effects to the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat, including injury and mortality, disturbance, displacement, and habitat loss and alteration. Caves and abandoned mines, and possibly cliff and rock crevices, are typical roosting habitats for these species. Project-related activities that occur in roosting habitats would have the potential to injure or kill individual bats. Project-related activities would likely avoid roosting habitats for these species, thereby making the likelihood of injuring or killing roosting bats low. Foraging bats may be injured or killed by impacting new structures, guy wires, or moving vehicles. Under Alternative A, project-related increases in human presence and activity in areas that support roosting bats would have the potential to disturb individual bats. Disturbing roosting bats could affect individual health, reproduction, and survivorship. Long-term displacement of individuals or populations would be unlikely under implementation of Alternative A, as it is expected that known roosting sites, particularly in caves and abandoned mines, would be avoided by project-related activities. Project-related activities that occur in suitable foraging habitats, such as the salt desert shrub vegetation type, would not be expected to have important or measurable effects on individual bats because project-related activities would almost always take place during daylight hours, while bat foraging occurs at night; and potentially suitable foraging habitats are expected to be common throughout the GCWPA and surrounding areas.

Implementation of Alternative A would result in 1,119 acres of salt desert shrub habitat disturbance in, the GCWPA (**Table 4.6-2**). Surface disturbing activities under Alternative A are not expected to affect caves and mines, which are primary roosting habitats for these species.

Alternative-specific design features and mitigation measures relating to bats are presented in Section 4.7.2.

Implementation of Alternative A is **not likely to result in a trend towards federal listing** for the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat. This determination is based on the low likelihood for direct injury or mortality of individuals; the expected avoidance of caves and abandoned mines; the availability and suitability of foraging habitats in the GCWPA, and the implementation of the alternative-specific mitigation measure that would require pre-disturbance

assessment of sites for the occurrence of listed threatened, endangered, candidate or sensitive wildlife species.

Western Yellow-billed Cuckoo

Impacts to the western yellow-billed cuckoo as a result of implementation of Alternative A would be the same as those described above for other migratory birds.

Implementation of Alternative A would avoid disturbance to potentially suitable wetland/riparian habitats in the GCWPA. For a summary of proposed disturbance to vegetation cover types by Alternative A that may be used by this species refer to **Table 4.6-2**. Dense and mature woodland riparian habitats are uncommon in the GCWPA and mostly limited to areas associated with the White River. In addition to being uncommon in the GCWPA, such riparian habitats and associated floodplains would be avoided, thus likely avoiding direct impacts, including injury or death and alternation of suitable habitat for Western yellow-billed cuckoo. There are no known plans to add or create designated critical habitat within the analysis area, and therefore there would be no impacts to designated-critical habitat under this alternative. Proposed activities that occur near suitable and occupied habitat have the potential to disturb or possibly displace individuals.

Alternative-specific measures (design features and mitigation measures) that would avoid, reduce, and minimize impacts to this species are presented in Section 4.7.2.

Implementation of Alternative A **may affect** the Western yellow-billed cuckoo. This determination is based on the current lack of site-specific information regarding suitable habitat and cuckoo occurrence at sites proposed for disturbance. If site-specific surveys determine the presence of the Western yellow-billed cuckoo at sites proposed for disturbance, additional alternative-specific measures, previously described, would avoid, minimize, and reduce effects on the Western yellow-billed cuckoo. Therefore, only after site-specific information is available, the determination for implementation of Alternative A would likely be **may affect, but is not likely to adversely affect** the Western yellow-billed cuckoo.

Greater Sage-grouse

Impacts to greater sage-grouse as a result of implementation of Alternative A would be the same as those identified for upland game birds. In addition, individual grouse also may be at risk of injury or death as the result of aerial collisions with structures and guy wires. Grouse have relatively small wings relative to their body size, which limits their aerial maneuverability and speed. As such, grouse may be at risk for collision with structures and guy wires, and above-ground power lines, if present.

Oil and gas development can disturb and displace grouse through a variety of mechanisms. Infrastructure can provide raptors with new and widespread perching sites. Grouse have been shown to abandon leks if raptors repeatedly perch nearby (Ellis 1984). Increased vehicle frequency and traffic volumes also have been shown to alter grouse behavior resulting in avoidance of otherwise suitable habitats and historical leks (Lyon and Anderson 2003). Human presence and activity also has been shown to disturb and displace grouse from otherwise suitable habitats, particularly during the breeding and nesting seasons (Braun et al. 2002; Holloran 2005). Anthropogenic noise associated with human presence and activity has been shown to alter lek attendance where leks were experimentally exposed to noise from natural gas drilling and roads (Blickley et al. 2012). Disturbance and displacement effects can result in effects to individual health and survivorship. These effects can have more serious effects on the local population number and status if other unaffected and suitable habitats are absent or limited.

Implementation of Alternative A would result in 88 acres of disturbance to greater sage-grouse general habitat management area (GHMA; occupied/brood rearing/winter habitat) in the GCWPA (**Table 4.7-7**). Implementation of Alternative A would result in disturbance to GHMAs (nesting, brooding, and wintering habitats) in the GCWPA.

Table 4.7-7 Disturbance to Mapped Greater Sage-Grouse Habitat in the GCWPA by Alternative

Greater Sage-grouse	Alternative A (acres; % GHMA)[1]	Alternative B (acres; % GHMA)	Alternative C (acres; % GHMA)	Alternative D (acres; % GHMA)
General Habitat Management Area	88/7	64/5	52/4	64/5

[1] % GHMA refers to alternative percentage of total GHMA acreage in GCWPA.

Implementation of Alternative A and the expansion of well pads, installation of new facilities and infrastructure, and the use and building of new roads may initially appear to fragment habitat in the GCWPA. However, when considering potential effects on the grouse, these aspects of implementation are more related to habitat alteration and loss and not to habitat fragmentation. Grouse have been shown to avoid habitats and abandon leks that are proximal to these areas of development and disturbance. Also noteworthy, is that potentially suitable grouse habitats in the GCWPA and the vicinity have been exposed to energy development for years and are not, for the most part, considered undisturbed or unfragmented.

Implementation of Alternative A includes several mitigation measures. A comparison of alternative-specific wildlife design features and mitigations relating to greater sage-grouse is presented in Section 4.7.2.

Implementation of Alternative A is **not likely to result in a trend toward federal listing** for the greater sage-grouse. This determination is based on the low likelihood for implementation to affect individual grouse, the lack of known active leks in the GCWPA, and for the effective application of alternative-specific mitigation measures to avoid, reduce, and minimize effects that may impact individuals and the local population.

Bald Eagle

Implementation of Alternative A could result in a variety of effects to migrating and wintering bald eagles, including injury and mortality, disturbance, displacement, and habitat alteration and loss. Effects are not expected on nesting or resident bald eagles because no bald eagle nests are known to exist within the GCWPA. While no wintering roosting sites are known to occur in the GCWPA, with the inclusion of a small part of the White River within the GCWPA and near the project boundary, there is the potential for migrating and wintering bald eagles to use these riverine habitats. Migrating and wintering bald eagles often forage on carrion, including animals killed by vehicles on roadways. Bald eagles eating carrion on public and project-related roads would be at risk for collision with vehicles. Implementation of this alternative and the associated increases in human presence and activity in the GCWPA could disturb migrating and wintering bald eagles that are roosting, resting, or hunting in the GCWPA. If bald eagles are roosting in the GCWPA and project-related activities occur with sufficient intensity and proximity to a roost, eagles may abandon the roost. Suitable roosting habitats are expected to be limited within the GCWPA and vicinity. Displacement from a roost could result in effects to individual health and survivorship.

Surface disturbing activities would be expected to avoid habitats that may support migrating or wintering bald eagles. However, these same activities are likely to occur in habitats that support species that can be terrestrial prey for the bald eagle, including rabbits/hares, ground squirrels, and prairie dogs. Such effects are not expected to have measurable or detectable effects on the bald eagle, as small and medium-sized terrestrial prey species and their habitats are common and widely distributed throughout the GCWPA.

Implementation of Alternative A includes several measures (design features and mitigation measures) relating to general wildlife and raptors that would avoid, reduce, and minimize impacts to this species. These measures are summarized in Section 4.7.2.

The bald eagle is protected under the MBTA and the BGEPA. Under the BGEPA, it is unlawful to "take" bald and golden eagles. Under the BGEPA, "take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb." The measures previously described are intended to avoid "take" and also avoid, reduce, and minimize other impacts to the bald eagle.

Implementation of Alternative A is **not likely to result in a trend towards federal listing** or "take" for the bald eagle. This determination is based on the lack of known bald eagle nesting and roosting sites in the GCWPA, the expected limited and infrequent occurrence of bald eagles in the GCWPA, the availability and distribution of suitable terrestrial habitats for small and medium-sized prey species, and the effective implementation of alternative-specific design features and mitigation measures.

Ferruginous Hawk

Impacts to the ferruginous hawk as a result of the implementation of Alternative A would be the same as those described above for all other raptor species. BLM seasonal and spatial restrictions included as an alternative-specific mitigation measure, Section 4.7.2, would effectively avoid and reduce potential effects on individual hawks and their nesting habitats. Implementation of this measure would be effective at avoiding and reducing effects to hawks while nesting, when they are particularly sensitive to human presence and activity. Other measures associated with habitat reclamation, speed limits on project-related roads toward reducing vehicle-hawk collisions would further limit possible direct and indirect effects to this species. Surface disturbing activities associated with this alternative would result in indirect effects to this species by directly (injury or death) and indirectly (habitat disturbance and removal) affecting terrestrial prey species.

Implementation of Alternative A includes measures (design features and mitigation measures) that would avoid, reduce, and minimize impacts to this species. These measures are summarized in Section 4.7.2 and are the same as those indicated for bald eagles.

Implementation of Alternative A is **not likely to result in a trend towards federal listing** for the ferruginous hawk. This determination is based on the effective implementation of alternative specific design features and mitigation measures that would avoid and reduce the frequency and intensity of potential direct and indirect effects.

Burrowing Owl

Implementation of Alternative A could result in a variety of effects to the burrowing owl, including direct injury and mortality, disturbance, displacement, and habitat alteration and loss. Burrowing owls are burrow nesters that will use natural burrows created by prairie dogs and other mammals, as well as man-made features including culverts and other disturbed habitats. Burrowing owls may be injured or killed if surface disturbing activities destroy or collapse occupied nesting sites. Owls also may be injured or killed by colliding with moving vehicles or equipment.

Implementation of Alternative A could result in disturbance of burrowing owls. Human presence and activity could disrupt establishment of nesting territories, pair forming, nest building, and egg incubation. If project-related activities are of sufficient duration and intensity and occur during sensitive periods, including territory establishment and nesting, nest success and fecundity may be affected. Human presence and activity could displace owls from nesting territories and hunting habitats. If other suitable and unoccupied territories are not available, this type of displacement could affect local reproduction rates and populations.

In the GCWPA, burrowing owls rely on active white-tailed prairie dog colonies as nesting habitat. Under Alternative A, an estimated 121 acres of mapped white-tailed prairie dog colonies could be disturbed (**Table 4.7-6**). Alteration and loss of white-tailed prairie dog colonies would reduce the availability and suitability of burrowing owl nesting and foraging habitats within the GCWPA. Under this alternative, active white-tailed prairie dog colonies would be avoided to the extent practicable.

Implementation of Alternative A includes measures (design features and mitigation measures) that would avoid, reduce, and minimize impacts to this species. These measures are summarized in Section 4.7.2 and are the same as those indicated for other analyzed raptor species. Additionally, the mitigation measure for white-tailed prairie dogs that includes establishing a 660-foot buffer around active colonies (BLM 2008b, Appendix K), also would avoid, reduce, and minimize possible impacts to the burrowing owl, as these species often nest and forage in active prairie dog colonies.

Therefore, implementation of Alternative A, including the alternative-specific design features and mitigation measures, is **not likely to result in a trend toward federal listing** for the burrowing owl.

Grasshopper Sparrow

Impacts to the grasshopper sparrow as a result of the implementation of Alternative A would be the same as those described above for all other migratory birds described above. Implementation of Alternative A would result in 119 acres of disturbance to potentially suitable grasslands habitat in the GCWPA (**Table 4.6-2**). Implementation of this alternative also could affect individual grasshopper sparrows; however, because of a lack of documented occurrences and the absence of highly suitable habitat, impacts are expected to be unrealized or minor for this species.

Prairie Falcon

Impacts to the prairie falcon as a result of the implementation of Alternative A would be the same as those described above for all other raptors. Implementation of this alternative includes design features and mitigation measures that would avoid, reduce, and minimize impacts to this species. These measures are summarized in Section 4.7.2 and are the same as those for bald eagles and other raptors previously discussed.

Implementation of the BLM Raptor BMPs combined with the alternative-specific mitigation measures would effectively avoid and reduce potential effects to individual falcons, active nests, and nesting habitats.

Under this Alternative, direct disturbance to nests and preferred nesting habitats (cliff faces) is not expected. Implementation could alter or remove habitats that support preferred prey species. However, prey species and their habitats are common and widely dispersed throughout the GCWPA and therefore, effects to habitats that support prey species are not expected to cause measurable changes in prey species diversity or abundance.

Brewer's Sparrow

Impacts to the Brewer's sparrow as a result of the implementation of Alternative A would be the same as those described above for all other migratory birds described above. Implementation of Alternative A would result in 451 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-2**).

Application of alternative-specific measures related to migratory birds, summarized in Section 4.7.2, would avoid or reduce impacts to this species. Implementation of this alternative could affect individual Brewer's sparrows, but is not expected to impact population health or survivorship or the protective status of this species.

Sage Sparrow

Impacts to the sage sparrow as a result of the implementation of Alternative A would be the same as those described above for all other migratory birds described above. Implementation of Alternative A would result in 451 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-2**).

This alternative includes design features and mitigation measures that would avoid, reduce, and minimize impacts to this species (Section 4.7.2) and other migratory birds as discussed above for Brewer's sparrow. Implementation of this alternative could affect individual sage sparrows, but is not expected to affect population health or survivorship or the protective status of this species.

Sage Thrasher

Impacts to the sage thrasher as a result of the implementation of Alternative A would be the same as those described above for all other migratory birds. Implementation of Alternative A would result in 451 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-2**).

This alternative includes design features and mitigation measures that would avoid, reduce, and minimize impacts to this species (Section 4.7.2) and are the same as those described for other migratory bird species above. Implementation of this alternative could affect individual sage thrashers, but is not expected to affect population health or survivorship or the protective status of this species.

Aquatic Species

Federally Listed Fish Species: Bonytail, Colorado Pikeminnow, Humpback Chub, and Razorback Sucker

Under implementation of Alternative A, there would be no direct impacts to Colorado River endangered fish species based on the mitigation measure that would prohibit surface disturbance within the 100-year floodplain of the White River (**Table 4.7-8**). Impacts to water quality are presented as possible impacts to these species because of the potential for surface-disturbing activities to have negative impacts on local ephemeral drainages and for the unlikely case of subsequently causing measurable changes in water quality of the White River.

On January 22, 1988, a Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) was initiated to address depletion effects to the Colorado River fish. Any water depletions from tributary waters within the Colorado River drainage are considered to “jeopardize the continued existence” of these fish under this Recovery Program. A Section 7 agreement was implemented on October 15, 1993, by Recovery Program participants to further define and clarify objectives of the recovery process, as stated in the Recovery Program. Incorporated into this agreement was the Recovery Implementation Program Recovery Action Plan (RIPRAP). The RIPRAP identified actions currently believed to be required to recover the Colorado River fish most expeditiously. Included in the RIPRAP was the requirement that a one-time depletion fee would be paid to help support the Recovery Program for all non-historical water depletions from the Upper Colorado River Basin. These depletion fees were intended to be a Reasonable and Prudent Alternative to avoid jeopardy to the endangered Colorado River fish by depletions to the Upper Colorado River Basin.

As described in Chapter 2.0, water use would include fresh water and recycled water, with recycled water representing the most significant proportion. Water use during the estimated 15-year drilling phase would be an estimated 405 acre-feet/year. Water, including recycled water and fresh water would be obtained from the Deseret Generation and Transmission Cooperative’s Bonanza Power Plant, which has already consulted for the original depletion. Because no project specific depletion is proposed under this alternative, Colorado River endangered fish species would not be indirectly affected by project-related

water depletion. As previously discussed in the Fisheries section, implementation of this alternative could affect Colorado River endangered fishes by increasing soil erosion and subsequently increasing sediment loads in the White River. Increased sedimentation of GCWPA ephemeral and perennial streams that flow into the White River could bury fish eggs and suffocate fish larvae. In addition increased sedimentation could reduce visibility affecting fish feeding and predator avoidance behaviors, and it also could affect the health and condition of individual fish.

The uncontrolled release of oils, fluids, and chemicals into local ephemeral and perennial watercourses that flow into the White River could affect individual fish and their habitats. Under Alternative A, a SPCC Plan would be prepared for each well. This plan would include all of the practices, responses, and measures necessary to effectively avoid, limit, and respond to uncontrolled releases.

Implementation of Alternative A **may affect, but is not likely to adversely affect** the Colorado River endangered fishes, including the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker, and their designated critical habitats. This determination is based on insignificant effects, because any potential impacts to the White River would not be expected to be measurable or detectable and would not lead to take.

BLM Sensitive Fish – Flannelmouth Sucker, Bluehead Sucker and Roundtail Chub

Implementation of Alternative A could result in a variety of direct and indirect effects on the flannelmouth sucker, bluehead sucker and roundtail chub. These potential effects are similar to those described in the Fisheries section (Section 4.7.1.4). Implementation of Alternative A, including design features and mitigation measures related to the endangered Colorado River fish species (Section 4.7.2.), **is not likely to result in a trend towards federal listing** for these three species. This determination is based on the possibility but low likelihood of affecting individuals and local aquatic habitats and on the effective implementation of alternative-specific measures that would avoid and reduce potential effects from erosion, sedimentation and other perturbations to aquatic habitats that may support these species.

4.7.1.2 Alternative B—Proposed Action

Implementation of Alternative B would result in the drilling of up to 2,808 new wells from up to 233 new, and an undetermined number of expansion, well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,875 acres, or 4.4 percent of the GCWPA. Including existing, site-specific Alternative A and Alternative B disturbance, approximately 6,879 acres (16.0 percent of the GCWPA) would undergo disturbance of the surface, and associated forage capacity. Approximately 85 percent of the site-specific Alternative B disturbance would undergo interim reclamation immediately following construction.

General Wildlife

Common Non-game Wildlife

Implementation of Alternative B would result in 1,875 acres of disturbance in the GCWPA (**Table 4.6-3**). As described under Alternative A, there are several potential direct and indirect effects to common non-game wildlife species that could occur under Alternative B, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The type, magnitude, and duration of these effects on common wildlife species under Alternative B would be nearly identical to those described under Alternative A. Design features and additional mitigations protective of general wildlife are summarized in Section 4.7.2.

Big Game

Mule Deer

Implementation of Alternative B would have similar effects on mule deer as described under Alternative A. Implementation of Alternative B would result in 105 acres of disturbance to mule deer yearlong crucial/fawning range in the GCWPA (**Table 4.7-1**).

Alternative B includes a mule deer fawning mitigation measure. Under this measure, exploration, drilling and other development activity will not be allowed in mapped mule deer fawning habitat from May 15 to June 30 (BLM 2008b, Appendix K). This measure, and its associated exception, is presented in Section 4.7.2.

Mule deer crucial yearlong range and fawning habitats are coincident in the GCWPA and associated with riparian habitats of the White River. Existing well pads in this portion of the GCWPA could be expanded. Under Alternatives A, B, and C there are 35 existing well pads that may be expanded; 7 of which are on BLM lands, 26 are on Tribal lands, and 2 are on privately owned surface. Under Alternative B there are 28 existing pads that could be expanded, of which 1 is on BLM surface, 25 on Tribal surface, and 2 on privately owned surface. For action proposed on lands administered by the BLM and privately owned lands that have federal mineral rights below, the implementation of a timing limitation in mule deer fawning habitats from May 15 – June 30 would avoid, reduce, and minimize a variety of potential impacts to individual mule deer and the local population. This mule deer fawning timing stipulation may not be applied to Tribal surface and thereby exposing mule deer at these limited well locations that may be expanded to unmitigated impacts.

Although implementation of Alternative B may affect individual mule deer, implementation would not be expected to negatively affect local populations or UDWR population objectives for the South Slope Vernal /Diamond Mountain Herd Unit.

Pronghorn

Implementation of Proposed Action would have similar effects on pronghorn as described under Alternative A. Implementation of Alternative B would result in 1,739 acres of disturbance pronghorn yearlong crucial range the GCWPA (**Table 4.7-2**). Although implementation of Alternative B would impact pronghorn, implementation would not be expected to significantly impact the species or UDWR population objectives for the South Slope Bonanza /Diamond Mountain Herd Unit.

Rocky Mountain Bighorn Sheep

Implementation of Alternative B would have similar effects on Rocky Mountain bighorn sheep as described under Alternative A. Implementation of this alternative could affect 134 acres of bighorn sheep yearlong crucial range in the GCWPA (**Table 4.7-3**). Implementation of Alternative B would not be expected to have measurable effects on individual Rocky Mountain bighorn sheep, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Bison

Implementation of Alternative B would have similar effects on bison as those described under the Alternative A. Implementation of this alternative would affect an estimated 42 acres of bison yearlong crucial range in the GCWPA (**Table 4.7-4**). Implementation of Alternative B would not be expected to have measurable effects on individual bison, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Small Game, Furbearers, and Upland Game Birds

Implementation of Alternative B would result in 1,875 acres of vegetation-based habitat disturbance in the GCWPA (**Table 4.6-3**). Implementation of Proposed Action would have similar effects on small game, furbearers, and upland game birds as described under Alternative A.

Migratory Birds

Non-Raptors

Implementation of Alternative B would result in 1,875 acres of potential habitat disturbance in the GCWPA (**Table 4.6-3**). Implementation of Proposed Action would have similar effects on migratory birds as described under Alternative A.

Implementation of this alternative includes several measures, design features and mitigation measures that would avoid, reduce, or minimize impacts to migratory bird species, similar to those described under Alternative A. All alternative-specific wildlife design features and mitigation measures are presented in Section 4.7.2.

Although implementation of Alternative B may affect individuals of various migratory bird species, including raptor species, it would not be expected to adversely affect species populations or their protective status.

Raptors

Implementation of Alternative B would result in 1,875 acres of disturbance to habitat that may directly or indirectly support raptors (**Table 4.6-3**). Implementation of Alternative B would result in impacts that are similar in nature, intensity, and distribution as those described under Alternative A.

Implementation of this alternative includes alternative-specific measures, design features and mitigation measures that would avoid, reduce, or minimize impacts to raptors. All alternative-specific wildlife design features and mitigation measures are presented in Section 4.7.2.

Implementation of Alternative B could impact individual raptors, but with effective implementation of the associated measures, these impacts are not expected to result in measurable or important changes to the local populations or to protective status.

Fisheries

Implementation of Alternative B would have effects on fish similar to those described under Alternative A. Potential effects would be similar in type, magnitude, duration, and intensity. Implementation of Alternative B could affect individual fish, but is not expected to adversely affect fish species populations or their current protective status.

Special Status Species

Terrestrial Species

Black-footed Ferret

Implementation of Alternative B would result in an estimated 121 acres of disturbance in the Black-footed Ferret PMZ in the GCWPA (**Table 4.7-5**). The type, magnitude, and duration of these effects on the black-footed ferret under Alternative B would be nearly identical to those described under Alternative A. Section 4.7.2 includes alternative-specific measures that pertain to the black-footed ferret.

Implementation of Alternative B **is not likely to jeopardize** the black-footed ferret. This determination is based on effective implementation of the alternative-specific black-footed ferret measures summarized in Section 4.7.2 and the low likelihood that project-related activities would harm individual ferrets.

White-tailed Prairie Dog

The evaluation of preliminary development scenarios indicates implementation of Alternative B could affect up to 89 acres of mapped white-tailed prairie dog colonies (**Table 4.7-6**). Effects to the white-tailed prairie dog are the same as those described under Alternative A. Measures, including alternative-specific design features and mitigation measures, are summarized in Section 4.7.2. Implementation of Alternative B measures would avoid or reduce impacts to existing active prairie dog colonies.

Implementation of Alternative B could affect individual white-tailed prairie dogs, but **is not likely to result in a trend towards federal listing** for the white-tailed prairie dog. This determination is based on effective implementation of the alternative-specific measures summarized in Section 4.7.2.

Townsend's Big-eared Bat, Spotted Bat, Fringed Myotis, Big Free-tailed Bat

Implementation of Alternative B would result in 765 acres of salt desert shrub habitat disturbance in the GCWPA (**Table 4.6-3**). Surface disturbing activities under Alternative B are not expected to affect caves and abandoned mines, which are primary roosting habitats for these species. Section 4.7.2 includes alternative-specific measures that would avoid, reduce or minimize impacts to special status species, including these four bat species.

Under Alternative B, effects on the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat would be nearly identical to those described under Alternative A. Implementation of Alternative B is **not likely to result in a trend towards federal listing** for the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat. This determination is based on the low likelihood for direct injury or mortality of individuals; the expected avoidance of caves and abandoned mines; the availability and suitability of foraging habitats in the GCWPA, and the effective implementation of alternative-specific measures summarized in Section 4.7.2.

Western Yellow-billed Cuckoo

Implementation of Alternative B would not impact potentially suitable riparian habitats that exist in the GCWPA. Under Alternative B, effects on the Western yellow-billed cuckoo would be nearly identical to those described under Alternative A. Section 4.7.2 includes a summary of wildlife-related measures, including design features and mitigation measures that would avoid, reduce, or minimize impacts to the Western yellow-billed cuckoo.

Implementation of Alternative B **may affect** the Western yellow-billed cuckoo. This determination is based on the current lack of site-specific information regarding suitable habitat and cuckoo occurrence at sites proposed for disturbance. If site-specific surveys determine the presence of the Western yellow-billed cuckoo at sites proposed for disturbance, additional alternative-specific measures, previously described, would avoid, minimize, and reduce effects on the Western yellow-billed cuckoo. Therefore, only after site-specific information is available, the determination for implementation of Alternative B would likely be **may affect, but is not likely to adversely affect** the Western yellow-billed cuckoo.

Greater Sage-grouse

Implementation of Alternative B would result in 64 acres of disturbance to greater sage-grouse GHMA (occupied/brood-rearing/winter habitat) in the GCWPA (**Table 4.7-7**). Implementation of Alternative B could result in disturbance to nesting, brooding, and wintering habitats in the GCWPA. Under

implementation of Alternative B, effects on the greater sage-grouse would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply specifically to the greater sage-grouse. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative B is **not likely to result in a trend toward federal listing** for the greater sage-grouse. This determination is based on the low likelihood for implementation to affect individual grouse, the lack of known active leks in the GCWPA, and for the effective application of alternative-specific design features and mitigation measures to avoid and reduce effects to individuals and the local population.

Bald Eagle

Implementation of Alternative B would result in 1,875 acres of disturbance in the GCWPA (**Table 4.6-3**). Under Alternative B effects on the bald eagle would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

The bald eagle is protected under the MBTA and the BGEPA. Under the BGEPA, it is unlawful to “take” bald and golden eagles. Under the BGEPA, “take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb.” The measures previously described are intended to avoid “take” and also avoid, reduce, and minimize other impacts to the bald eagle.

Implementation of Alternative B is **not likely to result in a trend towards federal listing** for the bald eagle. This determination is based on the lack of known bald eagle nesting and roosting sites in the GCWPA, the expected limited and infrequent occurrence of bald eagles in the GCWPA, the availability and distribution of suitable terrestrial habitats for small and medium-sized prey species, and the effective implementation of alternative-specific design features and mitigation measures.

Ferruginous Hawk

Implementation of Alternative B would result in 1,875 acres of vegetation-based habitat type disturbance in the GCWPA (**Table 4.6-3**). Under Alternative B, effects on the ferruginous hawk would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative B is **not likely to result in a trend towards federal listing** for the ferruginous hawk. This determination is based on the effective implementation alternative-specific measures that would avoid and reduce the frequency and intensity of potential direct and indirect effects.

Burrowing Owl

Implementation of Alternative B could affect up to 89 acres of mapped white-tailed prairie dog colonies (**Table 4.7-6**), which are highly suitable nesting and foraging habitats for the burrowing owl. Under Alternative B, effects on the burrowing owl would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative B may affect individual owls but **is not likely to result in a trend towards federal listing** for the burrowing owl. This determination is based on the effective application of alternative-specific measures that would reduce potential effects on this species.

Grasshopper Sparrow

Implementation of Alternative B would result in 85 acres of disturbance to potentially suitable grasslands habitat in the GCWPA (**Table 4.6-3**). Under Alternative B, effects on the grasshopper sparrow would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative also could affect individual grasshopper sparrows; however, because of a lack of documented occurrences and the absence of highly suitable habitat, impacts are expected to be unrealized or minor for this species.

Prairie Falcon

As described under Alternative A, there are several potential direct and indirect effects that also could occur under Alternative B, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the prairie falcon under Alternative B would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative could impact individual prairie falcons, but with the implementation of alternative-specific measures, summarized in Section 4.7.2, it is not expected to affect population status for this species.

Brewer's Sparrow

Implementation of Alternative B would result in 312 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-3**). Under Alternative B, effects on the Brewer's sparrow would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative could affect individual Brewer's sparrows, but with the implementation of alternative-specific measures, s, is not expected to affect population health or the protective status of this species.

Sage Sparrow

Implementation of Alternative B would result in 312 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-3**). Under Alternative B, effects on the sage sparrow would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative B could affect individual sage sparrows, but, with the implementation of alternative-specific measures, is not expected to affect population health or the protective status of this species.

Sage Thrasher

Implementation of Alternative B would result in 312 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-3**). Under Alternative B, effects on the sage thrasher would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative B could affect individual sage thrashers, but, with the implementation of alternative-specific measures, is not expected to affect population health or the protective status of this species.

Aquatic Species

Federally Listed Fish Species: Bonytail, Colorado Pikeminnow, Humpback Chub, and Razorback Sucker

Based on the mitigation measure implemented for Alternative B that would prohibit surface disturbance within the 100-year floodplain of the White River, effects on Colorado River endangered fish species would be similar in type and magnitude to those described for Alternative A and in the Fisheries section (Section 4.7.1.1). Implementation of Alternative B **may affect, but is not likely to adversely affect** the Colorado River endangered fishes, including the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker, and their designated critical habitats. This determination is based on the insignificant effects associated with implementation of the proposed project. Potential impacts described previously would be unlikely to reach the scale where take occurs, and therefore are characterized as insignificant.

BLM Sensitive Fish – Flannelmouth Sucker, Bluehead Sucker and Roundtail Chub

Implementation of Alternative B would have effects on the flannelmouth sucker, bluehead sucker and roundtail chub similar to those described under Alternative A. Potential effects would be similar in type, magnitude, duration, and intensity. Implementation of Alternative B **is not likely to result in a trend towards federal listing** for these three species. This determination is based on the possibility but low likelihood of affecting individuals and local aquatic habitats and on the effective implementation of alternative-specific measures that would avoid and reduce potential effects from erosion, sedimentation and other perturbations to aquatic habitats that may support these species.

4.7.1.3 Alternative C—Resource Protection Action (BLM-Preferred)

Implementation of Alternative C would result in the drilling of up to 2,808 new wells from up to 162 new, and an undetermined number of expansion, well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,514 acres (3.5 percent of the GCWPA), 361 acres less than Alternative B. Including existing, site-specific No Action, and alternative-specific disturbance, approximately 6,518 acres (15.0 percent of the GCWPA) would undergo disturbance of the surface, and associated forage capacity. Approximately 85 percent of the site-specific No Action disturbance would undergo interim reclamation immediately following construction.

General Wildlife

Common Non-Game Wildlife

Implementation of Alternative C would result in 1,514 acres of disturbance in the GCWPA (**Table 4.6-4**). Under Alternative C, effects on common wildlife would be nearly identical to those described under Alternative A. Design features and additional mitigations protective of general wildlife are summarized in Section 4.7.2.

Big Game

Mule Deer

Implementation of Alternative C would result in effects to 77 acres of yearlong-crucial range, approximately half the amount of acres disturbed for Alternative B. Under implementation of Alternative C, effects on mule deer would be nearly identical to those described under Alternative A.

Alternative C includes a mule deer fawning mitigation measure. Under this measure, exploration, drilling and other development activity will not be allowed in mapped mule deer fawning habitat from May 15 to June 30 (BLM 2008b, Appendix K). This measure, and its associated exception, is presented in Section 4.7.2.

Mule deer crucial yearlong range and fawning habitats are coincident in the GCWPA and associated with riparian habitats of the White River. Existing well pads in this portion of the GCWPA could be expanded. Under Alternatives A, B, and C there are 35 existing well pads that may be expanded; 7 of which are on BLM lands, 26 are on Tribal lands, and 2 are on privately owned surface. Under Alternative C there are 28 existing pads that could be expanded, of which 1 is on BLM surface, 25 on Tribal surface, and 2 on privately owned surface. For action proposed on lands administered by the BLM and privately owned lands that have federal mineral rights below, the implementation of a timing limitation in mule deer fawning habitats from May 15 – June 30 would avoid, reduce, and minimize a variety of potential impacts to individual mule deer and the local population. This mule deer fawning timing stipulation may not be applied to Tribal surface and thereby exposing mule deer at these limited well locations that may be expanded to unmitigated impacts.

Although implementation of Alternative C may affect individual mule deer, implementation would not be expected to negatively affect local populations or UDWR population objectives for the South Slope Vernal/Diamond Mountain Herd Unit.

Pronghorn

Implementation of Alternative C would result in 1,417 acres of disturbance to yearlong-crucial range in the GCWPA (**Table 4.7-2**), a reduction of approximately 370 acres. Under Alternative C, effects on pronghorn would be nearly identical to those described under Alternative A. Although implementation of Alternative C would impact individual pronghorn, implementation would not be expected to significantly

impact the species negatively affect local populations or UDWR population objectives for the South Slope Bonanza/Diamond Mountain Herd Unit.

Rocky Mountain Bighorn Sheep

Implementation of Alternative C would have similar effects on Rocky Mountain bighorn sheep as described under Alternative A. Implementation of this alternative could affect 101 acres of bighorn sheep yearlong crucial range in the GCWPA (**Table 4.7-3**). Implementation of Alternative C would not be expected to have measurable effects on individual Rocky Mountain bighorn sheep, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Bison

Implementation of Alternative C would have similar effects on bison as those described under Alternative A. Implementation of this alternative would affect an estimated 19 acres of bison yearlong crucial range in the GCWPA (**Table 4.7-4**), approximately half the amount of acres disturbed for Alternative B. Implementation of Alternative C would not be expected to have measurable effects on individual bison, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Small Game, Furbearers, and Upland Game Birds

Implementation of Alternative C would result in 1,514 acres of disturbance in the GCWPA (**Table 4.6-4**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The type, magnitude, and duration of these effects on small game, furbearer, and upland game bird species under Alternative C would be nearly identical to those described under Alternative A. Implementation of Alternative C may affect small game, furbearer, and upland game bird individuals, but would not be expected to adversely affect species populations or UDWR population objectives for these species.

Migratory Birds

Non-Raptors

Implementation of Alternative C would result in 1,514 acres of potential habitat disturbance in the GCWPA (**Table 4.6-4**), effects on migratory bird species would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Although implementation of Alternative C may affect individuals of various migratory bird species, it would not be expected to adversely affect species populations or protective status.

Raptors

Implementation of Alternative C would result in 1,514 acres of disturbance in the GCWPA (**Table 4.6-4**). Potential direct and indirect effects on raptors associated with implementation of Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Although implementation of Alternative C may affect individuals of various raptor species, it would not be expected to adversely affect species populations or their protective status.

Fisheries

Implementation of Alternative C would have effects on fish similar to those described under Alternative A. Potential effects would be similar in type, magnitude, duration, and intensity. Implementation of Alternative C could affect individual fish, but is not expected to adversely affect fish species populations or their current protective status.

Special Status Species

Terrestrial Species

Black-footed Ferret

Implementation of Alternative C would result an estimated 96 acres of black-footed ferret PMZ disturbance in the GCWPA (**Table 4.7-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the black-footed ferret under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to the black-footed ferret. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C **is not likely to jeopardize** the black-footed ferret. This determination is based on effective application of alternative-specific measures, summarized in Section 4.7.2 and the low likelihood project-related activities would harm individual ferrets.

White-tailed Prairie Dog

Evaluation of preliminary development scenarios indicates implementation of Alternative C could affect up to 71 acres of mapped white-tailed prairie dog colonies (**Table 4.7-6**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the white-tailed prairie dog under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to the white-tailed prairie dog. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C could affect individual white-tailed prairie dogs, but **is not likely to result in a trend towards federal listing** for the white-tailed prairie dog. This determination is based on effective application of alternative-specific measures, summarized in Section 4.7.2.

Townsend's Big-eared Bat, Spotted Bat, Fringed Myotis, and Big Free-tailed Bat

Implementation of Alternative C would result in 612 acres of salt desert shrub habitat disturbance in the GCWPA (**Table 4.6-4**). Surface disturbing activities under Alternative C are not expected to affect caves and abandoned mines, which are primary roosting habitats for these species.

As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on these bat species under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to special status bat species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C is **not likely to result in a trend towards federal listing** for the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat. This determination is based on the low likelihood for direct injury or mortality of individuals; the expected avoidance of caves and abandoned mines; the availability and suitability of foraging habitats in the GCWPA, and the effective implementation of alternative-specific measures, summarized in Section 4.7.2, that would avoid and reduce potential effects on these species.

Western Yellow-billed Cuckoo

Implementation of Alternative C would not directly impact riparian habitats that may support this species. As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, and displacement. The type, magnitude, and duration of these effects on the Western yellow-billed cuckoo under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species and special status species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C **may affect** the Western yellow-billed cuckoo. This determination is based on the current lack of site-specific information regarding suitable habitat and cuckoo occurrence at sites proposed for disturbance. If site-specific surveys determine the presence of the Western yellow-billed cuckoo at sites proposed for disturbance, additional alternative-specific measures, previously described, would avoid, minimize, and reduce effects on the Western yellow-billed cuckoo. Therefore, only after site-specific information is available, the determination for implementation of Alternative C would likely be **may affect, but is not likely to adversely affect** the Western yellow-billed cuckoo.

Greater Sage-grouse

Implementation of Alternative C would result in 52 acres of disturbance to greater sage-grouse GHMA (occupied/brood-rearing/winter habitat) in the GCWPA (**Table 4.7-7**). Implementation of Alternative C could result in disturbance to nesting, brooding, and wintering habitats in the GCWPA. As described under Alternative A, there are several potential direct and indirect effects that could occur under implementation of Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the greater sage-grouse under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to the greater sage-grouse. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C is **not likely to result in a trend toward federal listing** for the greater sage-grouse. This determination is based on the low likelihood for implementation to affect individual grouse, the lack of known active leks in the GCWPA, and for the effective application of additional

greater sage-grouse design features and mitigation measures (Section 4.7.2) to avoid and reduce impacts to individuals and the local population.

Bald Eagle

Implementation of Alternative C would result in 1,514 acres of vegetation-based habitat type disturbance in the GCWPA (**Table 4.6-4**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the bald eagle under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

The bald eagle is protected under the MBTA and the BGEPA. Under the BGEPA, it is unlawful to "take" bald and golden eagles. Under the BGEPA, "take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb." The measures previously described are intended to avoid "take" and also avoid, reduce, and minimize other impacts to the bald eagle.

Implementation of Alternative C is **not likely to result in a trend towards federal listing** for the bald eagle. This determination is based on the lack of known bald eagle nesting and roosting sites in the GCWPA, the expected limited and infrequent occurrence of bald eagles in the GCWPA, the availability and distribution of suitable terrestrial habitats for small and medium-sized prey species, and the effective implementation of alternative-specific design features and mitigation measures.

Ferruginous Hawk

Implementation of Alternative C would result in 1,514 acres of vegetation-based habitat type disturbance in the GCWPA (**Table 4.6-4**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the ferruginous hawk under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C is **not likely to result in a trend towards federal listing** for the ferruginous hawk. This determination is based on the effective implementation of alternative-specific measures, summarized in Section 4.7.2, that would avoid and reduce the frequency and intensity of potential direct and indirect effects.

Burrowing Owl

Implementation of Alternative C could affect up to 71 acres of mapped white-tailed prairie dog colonies (**Table 4.7-6**), which are highly suitable nesting and foraging habitats for the burrowing owl. As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the burrowing owl under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C may affect individual owls but **is not likely to result in a trend towards federal listing** for the burrowing owl. This determination is based on the effective application of alternative-specific measures that would reduce potential effects on this species.

Grasshopper Sparrow

Implementation of Alternative C would result in 67 acres of disturbance to potentially suitable grasslands habitat in the GCWPA (**Table 4.6-4**). Under Alternative C, effects on the grasshopper sparrow would be nearly identical to those described under Alternative A. Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative also could affect individual grasshopper sparrows; however, because of a lack of documented occurrences and the absence of highly suitable habitat, impacts are expected to be unrealized or minor for this species.

Prairie Falcon

As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the prairie falcon under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative could impact individual prairie falcons, but with the implementation of alternative-specific measures, summarized in Section 4.7.2, it is not expected to affect population status for this species.

Brewer's Sparrow

Implementation of Alternative C would result in 255 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-4**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the Brewer's sparrow under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C could affect individual Brewer's sparrows, but, with the implementation of alternative-specific measures, is not expected to affect population health or the protective status of this species.

Sage Sparrow

Implementation of Alternative C would result in 255 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-4**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the sage sparrow under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C could affect individual sage sparrows, but, with the implementation of alternative-specific measures, is not expected to affect population health or the protective status of this species.

Sage Thrasher

Implementation of Alternative C would result in 255 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-4**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative C, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the sage thrasher under Alternative C would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative C could affect individual sage thrashers, but, with the implementation of alternative-specific measures, is not expected to affect population health or survivorship or the protective status of this species.

Aquatic Species

Federally Listed Fish Species: Bonytail, Colorado Pikeminnow, Humpback Chub, and Razorback Sucker

Based on the design feature included under Alternative C that would prohibit surface disturbance within the 100-year floodplain of the White River, effects on Colorado River endangered fishes would be similar in type and magnitude to those described for Alternative A and in the Section 4.7.1.1. Implementation of Alternative C **may affect, but is not likely to adversely affect** the Colorado River endangered fishes, including the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker, and their designated critical habitats. This determination is based on the insignificant effects associated with the implementation of the proposed project. Potential impacts, previously described, would be unlikely to reach the scale where take occurs, and therefore are characterized as insignificant.

BLM Sensitive Fish – Flannelmouth Sucker, Bluehead Sucker and Roundtail Chub

Implementation of Alternative C would have effects on the flannelmouth sucker, bluehead sucker and roundtail chub similar to those described under Alternative A. Potential effects would be similar in type, magnitude, duration, and intensity. Implementation of Alternative C **is not likely to result in a trend towards federal listing** for these three species. This determination is based on the possibility but low likelihood of affecting individuals and local aquatic habitats and on the effective implementation of alternative-specific measures, summarized in Section 4.7.2, that would avoid and reduce potential

effects from erosion, sedimentation and other perturbations to aquatic habitats that may support these species.

4.7.1.4 Alternative D—Other Protections Action

Implementation of Alternative D would result in the drilling of up to 2,808 new wells from up to 157 new, and an undetermined number of expansion, well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,595 acres, or 3.7 percent of the GCWPA. Including existing, site-specific No Action, and alternative-specific disturbance, approximately 6,599 acres (15.1 percent of the GCWPA) would undergo disturbance of the surface, and associated forage capacity. Approximately 85 percent of the LGS and electrical distribution system disturbance would undergo interim reclamation immediately following construction.

General Wildlife

Common Non-game Wildlife

Implementation of Alternative D would result in 1,595 acres of disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The type, magnitude, and duration of these effects on common wildlife species under Alternative D would be nearly identical to those described under Alternative A. Design features and additional mitigations protective of general wildlife are summarized in Section 4.7.2.

Big Game

Mule Deer

Implementation of Alternative D would result in 34 acres of mule deer range disturbance in the GCWPA (**Table 4.7-1**). As described under Alternative A, there are several potential direct and indirect effects that could occur under implementation of Alternative D, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The type, magnitude, and duration of these effects on mule deer under Alternative D would be nearly identical to those described under Alternative A.

Alternative D includes a mule deer fawning mitigation measure. Under this measure, exploration, drilling and other development activity will not be allowed in mapped mule deer fawning habitat from May 15 to June 30 (BLM 2008b, Appendix K). This measure, and its associated exception, is presented in Section 4.7.2.

Mule deer crucial yearlong range and fawning habitats are coincident in the GCWPA and associated with riparian habitats of the White River. Existing well pads in this portion of the GCWPA could be expanded. Under Alternatives A, B, and C there are 35 existing well pads that may be expanded; 7 of which are on BLM lands, 26 are on Tribal lands, and 2 are on privately owned surface. Under Alternative D there are 28 existing pads that could be expanded, of which 1 is on BLM surface, 25 on Tribal surface, and 2 on privately owned surface. For action proposed on lands administered by the BLM and privately owned lands that have federal mineral rights below, the implementation of a timing limitation in mule deer fawning habitats from May 15 – June 30 would avoid, reduce, and minimize a variety of potential impacts to individual mule deer and the local population. This mule deer fawning timing stipulation may not be applied to Tribal surface and thereby exposing mule deer at these limited well locations that may be expanded to unmitigated impacts.

Although implementation of Alternative D may affect individual mule deer, implementation would not be expected to negatively affect local populations or UDWR population objectives for the South Slope Vernal/ Diamond Mountain Herd Unit.

Pronghorn

Implementation of Alternative D would result in 1,538 acres of pronghorn range disturbance in the GCWPA (**Table 4.7-2**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The type, magnitude, and duration of these effects on pronghorn under Alternative D would be nearly identical to those described under Alternative A. Although implementation of Alternative D may affect individual pronghorn, implementation would not be expected to greatly impact the species or UDWR population objectives for the South Slope Vernal /Diamond Mountain Herd Unit.

Rocky Mountain Bighorn Sheep

Implementation of Alternative D would have similar effects on Rocky Mountain bighorn sheep as described under Alternative A. Implementation of this alternative could affect 52 acres of bighorn sheep yearlong crucial range in the GCWPA (**Table 4.7-3**). Implementation of Alternative D would not be expected to have measurable effects on individual Rocky Mountain bighorn sheep, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Bison

Implementation of Alternative D would have similar effects on bison as those described under Alternative A. Implementation of this alternative would not affect bison yearlong crucial range in the GCWPA (**Table 4.7-4**). Implementation of Alternative D would not be expected to have measurable effects on individual bison, local populations, or UDWRs population objectives for the Book Cliffs HMU.

Small Game, Furbearers, and Upland Game Birds

Implementation of Alternative D would result in 1,595 acres of disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, habitat alteration and loss, and effects associated with habitat fragmentation. The type, magnitude, and duration of these effects on small game and furbearer species under Alternative D would be nearly identical to those described under Alternative A. Implementation of Alternative D may impact individuals, but impacts are not expected to adversely affect species populations or UDWR population objectives for these species.

Migratory Birds

Non-Raptors

Implementation of Alternative D would result in 1,595 acres of potential habitat disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on migratory bird species under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Although implementation of Alternative D may affect individuals of various migratory bird species, it would not be expected to adversely affect species populations or protective status.

Raptors

Implementation of Alternative D would result in 1,595 acres of disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, potential direct and indirect effects associated with implementation of Alternative D may include injury and mortality, disturbance, displacement, and habitat loss. The type, magnitude, and duration of these effects on raptors under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Although implementation of Alternative D may affect individuals of various raptor species, it would not be expected to adversely affect species populations or their protective status.

Fisheries

Implementation of Alternative D would have effects on fish similar to those described under Alternative A. Potential effects would be similar in type, magnitude, duration, and intensity. Implementation of Alternative D could affect individual fish, but is not expected to adversely affect fish species populations or their current protective status.

Special Status Species

Terrestrial Species

Black-footed Ferret

Implementation of Alternative D would result in an estimated 120 acres of black-footed ferret PMZ disturbance in the GCWPA (**Table 4.7-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the black-footed ferret under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to the black-footed ferret. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D **is not likely to jeopardize** the black-footed ferret. This determination is based on effective implementation of alternative-specific measures, summarized in Section 4.7.2, and the low likelihood project-related activities would harm individual ferrets.

White-tailed Prairie Dog

Evaluation of preliminary development scenarios indicates implementation of Alternative D could affect up to 76 acres of mapped white-tailed prairie dog colonies (**Table 4.7-6**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the white-tailed prairie dog under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to the white-tailed prairie dog. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D could affect individual white-tailed prairie dogs, but **is not likely to result in a trend towards federal listing** for the white-tailed prairie dog. This determination is based on the effective application of alternative-specific measures, summarized in Section 4.7.2.

Townsend's Big-eared Bat, Spotted Bat, Fringed Myotis, Big Free-tailed Bat

Implementation of Alternative D would result in 653 acres of salt desert shrub habitat disturbance in the GCWPA (**Table 4.6-5**). Surface disturbing activities under Alternative C are not expected to affect caves and abandoned mines, which are primary roosting habitats for these species. As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on these species under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to special status bat species. Effective implementation of these measures would avoid, reduce, or minimize impacts to these species.

Implementation of Alternative D is **not likely to result in a trend towards federal listing** for the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat. This determination is based on the low likelihood for direct injury or mortality of individuals; the expected avoidance of caves and abandoned mines, and the effective application of alternative-specific measures, which are summarized in Section 4.7.2.

Western Yellow-billed Cuckoo

Implementation of Alternative D would not result in wetland/riparian habitat disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, and displacement. The type, magnitude, and duration of these effects on the Western yellow-billed cuckoo under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory birds and special status species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D **may affect** the Western yellow-billed cuckoo. This determination is based on the current lack of site-specific information regarding suitable habitat and cuckoo occurrence at sites proposed for disturbance. If site-specific surveys determine the presence of the Western yellow-billed cuckoo at sites proposed for disturbance, additional alternative-specific measures, previously described, would avoid, minimize, and reduce effects on the Western yellow-billed cuckoo. Therefore, only after site-specific information is available, the determination for implementation of Alternative D would likely be **may affect, but is not likely to adversely affect** the Western yellow-billed cuckoo.

Greater Sage-grouse

Implementation of Alternative D would result in 64 acres of disturbance to greater sage-grouse GHMA (occupied/brood-rearing/winter habitat) in the GCWPA (**Table 4.7-7**). Implementation of Alternative D could result in disturbance to nesting, brooding, and wintering habitats in the GCWPA. As described under Alternative A, there are several potential direct and indirect effects that could occur under

implementation of Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the greater sage-grouse under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to the greater sage-grouse. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D is **not likely to result in a trend toward federal listing** for the greater sage-grouse. This determination is based on the low likelihood for implementation to affect individual grouse, the lack of known active leks in the GCWPA, and for the effective application of alternative-specific measures, summarized in Section 4.7.2, to avoid and reduce impacts to individuals and the local population.

Bald Eagle

Implementation of Alternative D would result in 1,595 acres of vegetation-based habitat type disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the bald eagle under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

The bald eagle is protected under the MBTA and the BGEPA. Under the BGEPA, it is unlawful to “take” bald and golden eagles. Under the BGEPA, “take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb.” The measures previously described are intended to avoid “take” and also avoid, reduce, and minimize other impacts to the bald eagle.

Implementation of Alternative D is **not likely to result in a trend towards federal listing** for the bald eagle. This determination is based on the lack of known bald eagle nesting and roosting sites in the GCWPA, the expected limited and infrequent occurrence of bald eagles in the GCWPA, the availability and distribution of suitable terrestrial habitats for small and medium-sized prey species and the effective implementation of alternative-specific design features and mitigation measures.

Ferruginous Hawk

Implementation of Alternative D would result in 1,595 acres of vegetation-based habitat type disturbance in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the ferruginous hawk under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D is **not likely to result in a trend towards federal listing** for the ferruginous hawk. This determination is based on the effective implementation of alternative-specific measures, summarized in Section 4.7.2, that would avoid and reduce the frequency and intensity of potential direct and indirect effects.

Burrowing Owl

Implementation of Alternative D could affect up to 76 acres of mapped white-tailed prairie dog colonies (**Table 4.7-6**), which are highly suitable nesting and foraging habitats for the burrowing owl. As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the burrowing owl under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D may affect individual owls but **is not likely to result in a trend towards federal listing** for the burrowing owl. This determination is based on the effective application of alternative-specific measures that would avoid and reduce potential impacts on this species.

Grasshopper Sparrow

Implementation of Alternative D would result in 61 acres of disturbance to potentially suitable grasslands habitat in the GCWPA (**Table 4.6-5**). Under Alternative D, effects on the grasshopper sparrow would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory bird species. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative also could affect individual grasshopper sparrows; however, because of a lack of documented occurrences and the absence of highly suitable habitat, impacts are expected to be unrealized or minor for this species.

Prairie Falcon

As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the prairie falcon under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to raptors. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of this alternative could impact individual prairie falcons, but with the implementation of alternative-specific measures, summarized in Section 4.7.2, it is not expected to affect population status for this species.

Brewer's Sparrow

Implementation of Alternative D would result in 300 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the Brewer's sparrow under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory birds. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D could affect individual Brewer's sparrows, but, with the implementation of alternative-specific measures, is not expected to affect population health or survivorship or the protective status of this species.

Sage Sparrow

Implementation of Alternative D would result in 300 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the sage sparrow under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory birds. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D could affect individual sage sparrows, but, with the implementation of alternative-specific measures, summarized in Section 4.7.2, is not expected to affect population health or survivorship or the protective status of this species.

Sage Thrasher

Implementation of Alternative D would result in 300 acres of disturbance to potentially suitable sagebrush habitats in the GCWPA (**Table 4.6-5**). As described under Alternative A, there are several potential direct and indirect effects that could occur under Alternative D, including injury and mortality, disturbance, displacement, and habitat alteration and loss. The type, magnitude, and duration of these effects on the sage thrasher under Alternative D would be nearly identical to those described under Alternative A.

Section 4.7.2 presents a summary of all wildlife-related measures, design features and mitigation measures, including those that apply to migratory birds. Effective implementation of these measures would avoid, reduce, or minimize impacts to this species.

Implementation of Alternative D could affect individual sage thrashers, but, with the implementation of alternative-specific measures is not expected to affect population health or survivorship or the protective status of this species.

Aquatic Species

Federally Listed Fish Species: Bonytail, Colorado Pikeminnow, Humpback Chub, and Razorback Sucker

Based on the design feature included under Alternative D that would prohibit surface disturbance within the 100-year floodplain of the White River, effects on Colorado River endangered fishes would be similar in type and magnitude to those described for Alternative A and in the Section 4.7.1.1. Implementation of Alternative D **may affect, but is not likely to adversely affect** the Colorado River endangered fishes, including the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker, and their designated critical habitats. This determination is based on the insignificant effects associated with implementation of the proposed project. Potential impacts, previously described, would be unlikely to reach the scale where take occurs, and thereby, are appropriately described as insignificant.

BLM Sensitive Fish – Flannelmouth Sucker, Bluehead Sucker and Roundtail Chub

Implementation of Alternative D would have effects on the flannelmouth sucker, bluehead sucker and roundtail chub similar to those described under Alternative A. Potential effects would be similar in type, magnitude, duration, and intensity. Implementation of Alternative D **is not likely to result in a trend towards federal listing** for these three species. This determination is based on the possibility but low likelihood of affecting individuals and local aquatic habitats and on the effective implementation of alternative-specific measures that would avoid and reduce potential effects from erosion, sedimentation and other perturbations to aquatic habitats that may support these species.

4.7.2 Alternative-specific Design Features and Mitigations

A summary of alternative-specific wildlife design features and mitigations to minimize effects to wildlife is provided in **Table 4.7-8**.

4.7.3 Residual Effects

All Alternatives

Associated with each alternative, are residual effects on wildlife that could not be fully mitigated, including:

- Long-term loss of habitats; and
- Fragmentation and effects associated with habitat fragmentation resulting from construction of well pads, pipelines, roads, and other related facilities.

Residual effects on wildlife are likely most strongly associated with the amount of surface disturbance proposed under each Alternative. Implementation of Alternative A would have the most residual effects, followed by Alternative B, Alternative D, and Alternative C.

4.7.4 Irretrievable and Irreversible Commitment of Resources

Effects on and removal of previously undisturbed habitats would be an irretrievable effect under each of the alternatives. Fragmentation of previously unfragmented habitats also would be an irretrievable effect under each of the alternatives. Contamination or deterioration of habitats as the result of an uncontrolled release of chemicals, fuels, and oils would be an irretrievable effect. Project-related wildlife mortality would be an irreversible effect. The introduction and spread of noxious weeds in the GCWPA, as the result of implementation, is considered an irreversible effect based on the unlikelihood of eradicating noxious weeds from the GCWPA. Effects on the Colorado River endangered fishes associated with water depletion and possible increases in sedimentation of the White River would be an irreversible effect.

4.7.5 Relationship of Short-term Use to Long-term Productivity

Short-term use of constructed roads, well pads, pipelines, and other facilities would result in long-term alteration, loss, and fragmentation of habitats that may support a variety of wildlife, fishes, and special status species. The potential for the introduction and spread of noxious weeds in the GCWPA would be a long-term effect associated with implementation, construction, and operation of project-related facilities. Noxious weeds could affect long-term habitat diversity, composition, and suitability for common wildlife species and special status species.

Table 4.7-8 Wildlife Design Features and Mitigations

Measure	Design Feature (d)				Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Wildlife								
If directed by the AO, prior to any surface disturbance, well pad sites and access roads will be examined by a wildlife biologist to determine if any listed threatened, endangered, candidate, or sensitive species of animals or their habitat are present. If present and prior to initiating any surface disturbance activities, appropriate avoidance or mitigation measures shall be implemented. Site-specific clearances will be performed at the time of the onsite inspection.	d	d	d	d				
Proposed wells and roads located within pinyon-juniper woodland-dominated habitat would be sited, whenever possible, to reduce the amount of disturbance to mule deer foraging habitat.	d					m	m	m
All open exhaust stacks would be capped with screen cones to exclude their use by birds and bats.	d					m	m	m
All open pits or tanks containing liquids would be covered or netted to exclude their use by birds, bats, and other wildlife.					m	m	m	m
Mule deer – Exploration, drilling, and other development activity will not be allowed mapped mule deer fawning habitat from May 15 to June 30. Exception: This restriction will not apply to maintenance and operation of existing facilities. This measure may be excepted if either the resource values change or the lessee/operator demonstrates to BLM's satisfaction that adverse impact can be mitigated.					m	m	m	m
Raptors								
EOG will adhere to seasonal and spatial buffers applicable to occupied raptor nests in the GCWPA in consideration of applicable guidelines (BLM 2008b).		d	d	d	m			
Project implementation will incorporate the BLM Raptor BMPs (VFO RMP/ROD Appendix A [BLM 2008b]), in particular for bald eagle, ferruginous hawk, burrowing owl, short-eared owl, golden eagle, red-tailed hawk, and prairie falcon.			d	d	m	m		

Table 4.7-8 Wildlife Design Features and Mitigations

Measure	Design Feature (d)				Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Migratory Birds								
EOG will install bird-excluding devices that prevent the perching and entry of migratory birds on or into its new fired vessel exhaust stacks in nesting habitat of high-priority bird species. In addition, EOG will retrofit existing exhaust stacks in these areas. Devices will include flat or conical screens.	d	d	d	d				
This alternative will comply with the MOU between the BLM and the USFWS to Promote the Conservation of Migratory Birds (2010) and the BLM Strategic Plan for Migratory Bird Conservation (April 2013). Future mitigation and best management practices to be developed through this MOU and Strategic Plan will be incorporated as appropriate on a site-specific basis.			d	d	m	m		
To the extent feasible, surface disturbing activities shall be performed before migratory birds begin nesting or after all young have fledged, in order to avoid take under the MBTA. If activities must be scheduled to occur during the migratory bird breeding season, appropriate steps to prevent migratory birds from establishing nests in the potential impact area will be taken. These steps could include covering equipment and structures and use of various excluders (e.g., noise). Prior to nesting, birds can be harassed to prevent them from nesting on the site. If activities must be scheduled during the migratory bird breeding season, a site specific survey for nesting birds will be performed no more than 7 to 10 days before ground-breaking activities or vegetation treatments. Established nests with eggs or young cannot be moved, and the birds cannot be harassed until all young have fledged and are capable of leaving the nest site. Project- related activities within the buffer areas will be postponed until the birds have fledged. Confirmation that all young have fledged will be made by a qualified biologist.					m	m	m	m
Active nests identified within the areas to be disturbed shall be appropriately marked and a disturbance-free buffer of 100 feet, centered on the nest, shall be established and maintained until the young have fledged.					m	m	m	m
Black-footed Ferret and White-tailed Prairie Dogs								
Black-footed Ferret and Greater Sage-grouse Restrictions: Within those portions of the GCWPA containing UDWR-identified greater sage-grouse winter or brood habitat, or within the black-footed ferret PMZ, construction of new well pads would be limited to a spacing of one new pad per 80-acre tract. New well pads could only be constructed where there is			d	d				

Table 4.7-8 Wildlife Design Features and Mitigations

Measure	Design Feature (d)				Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
currently no existing well pad within the 80-acre tract. The 80-acre new pad restriction would apply to approximately 3,275 acres (7.6 percent) of the GCWPA.								
Inside and outside the black-footed ferret PMZ – Construction activities will be conducted with the objective of avoiding white-tailed prairie dog colonies whenever possible. Otherwise, activities will be designed to impact the smallest area possible and/or those areas with the lowest prairie dog densities. Surface disturbing activities proposed from May 1 through July 15 shall be surveyed for the presence of black-footed ferrets. All surveys will be completed by a BLM biologist or BLM-approved biologist. Previously existing or permitted operations that may occur within these boundaries will continue normal operations.			d	d	m	m		
Inside the black-footed ferret PMZ – The development or construction of temporary or permanent facilities and associated surface disturbance will be prohibited within 1/8-mile (660 feet) of known home ranges of female ferrets during the “critical” period from May 1 through July 15. No new surface disturbances will be initiated at these sites during the “critical” period.			d	d	m	m		
Outside the black-footed ferret PMZ – If a black-footed ferret is found in the GCWPA, BLM or UDWR shall live-trap and remove the ferret prior to the beginning of construction.			d	d	m	m		
No new surface disturbance will be allowed in known home ranges of female ferrets from March 1 to July 15 (known as the “critical period”).					m	m	m	m
Proponent will provide a notification of surface disturbing activities to the BLM 10 days prior to initiation. This will allow BLM/UDWR the opportunity to trap and relocate individual ferrets from the areas to be impacted.					m	m	m	m
Do not allow surface-disturbing activities within 660 feet of prairie dog colonies identified within prairie dog habitat. No permanent above-ground facilities are allowed with the 660-foot buffer. Exception: An exception may be granted if the applicant submits a plan that indicates that impacts of the proposed action can be adequately mitigated or, if due to the size of the town, there is no reasonable location to develop a lease and avoid colonies the Field Manager will allow for a loss of prairie dog colonies and/or habitat to satisfy terms and conditions of the lease.					m	m	m	m

Table 4.7-8 Wildlife Design Features and Mitigations

Measure	Design Feature (d)				Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Modification: The Field Manager may modify the boundaries of the stipulation area if portions of the area do not include prairie dog habitat or active colonies are found outside the currently defined areas, as determined by the BLM. Waiver: May be granted if, in the leasehold, it is determined that habitat no longer exists or has been destroyed.								
Greater Sage-grouse								
Black-footed ferret restrictions and greater sage-grouse: Within those portions of the GCWPA Greater Sage-grouse GHMA, or within the black-footed ferret PMZ, construction of new well pads would be limited to a spacing of one new pad per 80-acre tract. New well pads could only be constructed where there is currently no existing well pad within the 80-acre tract. The 80-acre new pad restriction would apply to approximately 3,275 acres (7.6 percent) of the GCWPA.			d	d				
Within greater sage-grouse GHMA, existing roads and facilities will be utilized to the extent possible.			d	d	m	m		
Road maintenance activities during the greater sage-grouse breeding season (between February 15 and June 15) will be minimized.			d	d	m	m		
Within greater sage-grouse GHMA, off-site tanks or central tank batteries will be considered where technically and administratively feasible.			d	d	m	m		
Within greater sage-grouse GHMA, interim reclamation seed mixes will be designed to provide habitat for greater sage-grouse.			d	d	m	m		
This alternative will fully comply with required design features applicable to greater sage-grouse general habitat management areas as indicated within Appendix C of the Utah Greater Sage-grouse Land Use Plan Amendment, including mitigation.			d	d	m	m		
Within GHMA, new surface disturbance will be mitigated at a 2:1 acreage ratio.			d	d	m	m		
Western Yellow-billed Cuckoo								
USFWS guidelines (2015) will be followed for identification of suitable breeding, nesting, and foraging habitat for WYBC.			d	d	m	m		

Table 4.7-8 Wildlife Design Features and Mitigations

Measure	Design Feature (d)				Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
"If construction activities are sited within occupied habitat, the following will be implemented: • Machinery will be equipped with mufflers to minimize increases in baseline noise levels. • Insecticides and herbicides will not be used to preclude loss of cuckoo prey. • Control measures will be implemented to prevent project-related sediment from moving downstream."			d	d	m	m		
Vegetation management, including removal, mowing, drive-and-crush, and application of herbicides or insecticides will not occur within 300 feet of suitable habitat.			d	d	m	m		
Temporary disturbance within suitable habitat shall be reclaimed to preclude invasion of noxious plants such as tamarisk and Russian olive.			d	d	m	m		
Permanent impacts to suitable habitat shall be offset at a 3:1 acreage ratio. Restoration may include treatment of noxious weeds, planting of native cottonwoods and willows, and other measures beneficial to WYBC.			d	d	m	m		
No surface disturbing activities shall occur within suitable habitat between June 1 and August 31.			d	d	m	m		
Special Status Fish								
No surface disturbance will be allowed in the 100-year floodplain of the White River.			d	d	m	m		
Buried natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried below the predicted scour depth, or a minimum of five feet below channel bottom,. The construction requirements for each type of crossing would be determined on a site-specific basis and would consider the technical guidance of the document entitled, "Hydraulic Considerations for Pipeline Crossings of Stream Crossings", which is found in Appendix B of the Vernal RMP (BLM 2008).					m	m	m	m
Roads and well pads shall be set back a minimum of 300 feet from perennial, intermittent, or ephemeral stream channels, where practical.					m	m	m	m

4.8 Paleontology Resources

4.8.1 Direct and Indirect Effects

4.8.1.1 Alternative A—No Action

Implementation of Alternative A would result in the drilling of up to 462 new wells from up to 425 new well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 2,685 acres, or 6.2 percent of the GCWPA. Including existing disturbance, approximately 6,660 acres (15.5 percent of the GCWPA) would undergo disturbance of the surface. Within the GCWPA, approximately 76 percent of the surface is underlain by Eocene rocks of high biostratigraphic importance which are known to produce scientifically valuable vertebrate and other fossils. These formations bear a PFYC rating of 4 or 5.

Under this alternative, there is a high potential for direct effects to paleontologic resources from excavation of fossil-bearing rock during construction of well pads, buried pipelines, or related facilities. Indirect effects include potential loss of scientifically important fossils from vandalism or illegal collecting by personnel brought into the GCWPA during implementation of the alternative. These effects would typically be restricted to the 76 percent of the GCWPA where the Eocene formations form the shallow subsurface. Certain assumptions were used to estimate the amounts of potential disturbance to Eocene rocks in the GCWPA. Where the approximate locations of proposed facilities were known, the associated disturbance was calculated for those facilities located on Eocene-age rocks. Where approximate facility locations were not known, the disturbance was estimated based on the proportion of Eocene to Quaternary surface in the GCWPA. Using these assumptions, construction disturbance to areas underlain by Eocene rocks in the GCWPA under Alternative A would be approximately 1,897 acres.

Because pre-construction paleontologic field surveys are required on federal, state, or Tribal surface (BLM 2007b, Utah Code Title 79 Chapter 3 Part 5 Section 510) and are incorporated here as design features, effects on paleontologic resources would be minimized in these areas. Based on the pre-construction field survey of proposed site-specific facility locations, mitigative measures of avoidance by monitoring during facilities construction and possible fossil recovery and curation would likely be applied based on the lead agency's decisions for each previously approved project. On the 1,117 acres of private surface and mineral estate, surveys are not required. BLM may request survey access; however, the surface owner is not required to comply. Where surveys are missing, potential paleontologic effects are estimated based on local formation and PFYC formation ranking. Fossil information may be lost, but the potential for loss will be estimated and disclosed in site-specific NEPA prior to permit approvals. However, only approximately 260 acres of the private surface (0.6 percent of the GCWPA) are underlain by the Eocene formations of primary concern.

4.8.1.2 Alternative B—Proposed Action

Implementation of Alternative B would result in the drilling of up to 2,808 new wells from up to 233 new and up to 960 expansion well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,875 acres, or 4.4 percent of the GCWPA. Including existing, site-specific Alternative A, and alternative-specific activities, approximately 6,884 acres (16.0 percent of the GCWPA) would undergo disturbance of the surface.

Direct and indirect effects would be similar to those discussed under Alternative A, but proportional to the levels of activity and alternative-specific surface disturbance. Using the assumptions described above, under Alternative B, up to approximately 1,312 acres of surface underlain by Eocene-age rocks would be disturbed. Implementation incorporated design features would reduce, but not necessarily eliminate the possibility for loss of scientifically important fossils.

4.8.1.3 Alternative C—Resource Protection Action (BLM-preferred)

Implementation of Alternative C would result in the drilling of up to 2,808 new wells from up to 162 new and up to 960 expansion well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,514 acres, or 3.4 percent of the GCWPA. Including existing, site-specific Alternative A, and alternative-specific activities, approximately 6,523 (15.1 percent of the GCWPA) would undergo disturbance of the surface.

Direct and indirect effects would be similar to those discussed under Alternative A, but proportional to the levels of activity and alternative-specific surface disturbance. Using the assumptions described above, under Alternative C, up to approximately 1,148 acres of surface underlain by Eocene-age rocks would be disturbed. Implementation incorporated design features would reduce, but not necessarily eliminate the possibility for loss of scientifically important fossils

4.8.1.4 Alternative D—Other Protections Action

Implementation of Alternative D would result in the drilling of up to 2,808 new wells from up to 157 new and up to 880 expansion well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,595 acres, or 3.5 percent of the GCWPA. Including existing, site-specific Alternative A, and alternative-specific activities, approximately 6,604 acres (15.3 percent of the GCWPA) would undergo disturbance of the surface.

Direct and indirect effects would be similar to those discussed under Alternative A, but proportional to the levels of activity and alternative-specific surface disturbance. Using the assumptions described above, under Alternative D, up to approximately 1,254 acres of surface underlain by Eocene-age rocks would be disturbed. Implementation incorporated design features would reduce, but not necessarily eliminate the possibility for loss of scientifically important fossils

Under this alternative, restrictions on locating new wells on BLM surface would mean that there would not be effects to approximately 4,600 acres of Eocene rocks in these areas. Restriction areas are principally in the northern portions of the GCWPA where the Eocene bedrock is comprised of the Brennan Basin Member of the Duchesne River and the Myton Member of the Uinta Formation, and along the White River, where the Eocene bedrock is comprised of the Wagonhound Member of the Uinta Formation. All of these Eocene rocks are PFYC 4 or 5 level units.

4.8.2 Alternative-specific Design Features and Mitigation

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.8-1**.

4.8.3 Residual Effects

Under all of the alternatives, residual effects to paleontologic resources would be minimized as a result of the application of project design features requiring pre-disturbance surveys over high sensitivity areas, and monitoring of surface disturbance in areas of particular concern on federal and state surface. Survey and monitoring requirements would apply to almost all of the GCWPA underlain by the Eocene formations of high paleontologic importance. Additional mitigations to encourage relocation of disturbance in identified deposits of high scientific interest would further reduce the potential for loss of paleontologic information Residual effects, which would be reduced but could not necessarily be eliminated, would include the potential destruction of unidentified fossil occurrences and permanent loss of scientific information in those cases.

4.8.4 Irretrievable and Irreversible Commitment of Resources

Destruction of scientifically important fossil remains that may be overlooked during field surveys and monitoring activities would result in an irreversible and irretrievable commitment of paleontologic resources and loss of scientific information.

4.8.5 Relationship of Short-term Use to Long-term Productivity

Implementation of oil and gas development under any of the alternatives would result in varying levels of disturbance to bedrock formations identified as being highly productive of fossils of scientific importance. Destruction of unidentified and scientifically important fossils would represent a permanent loss of information. Current and recommended mitigations would likely greatly reduce, but not completely eliminate, such information loss.

Table 4.8-1 Paleontological Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
EOG will conduct a paleontological survey in sensitive fossil areas (PFYC Classes 4 or 5) where bedrock is exposed or located sufficiently close to the surface to be disturbed by excavation activities. All EOG personnel will refrain from collecting fossils and from disturbing any scientifically important fossil in the GCWPA. If fossils were to be uncovered during construction, EOG will immediately stop surface disturbing activities that might further disturb such materials and contact the AO.		d	d	d	m			
Monitoring of all bedrock excavations will be performed by a qualified paleontologist when required by the AO.		d	d	d	m			
Where proposed disturbance would affect identified deposits of scientifically important fossils, the disturbance should be re-located, if feasible, at the direction of the AO.					m	m	m	m
Where surface disturbing activities cannot avoid rocks bearing, or potentially bearing, fossils of scientific importance, monitoring of construction and excavation by a permitted paleontologist will be required at the direction of the AO. Depending on the results of the monitoring, fossil materials may be recovered and curated at the operator's expense.					m	m	m	m

4.9 Cultural Resources and Traditional Cultural Values

None of the proposed alternatives eliminate adverse effects to archaeological sites, historic properties, or potential TCPs in the APE. Oil and gas exploration and production poses increased potential for both direct and indirect effects. Potential direct effects include the unintentional damage or destruction caused during construction related activities, disturbance of subsurface remains, and indirect effects such as erosion, vandalism, and increased visitation. Under each alternative, however, provisions are made to comply with Section 106 of the NHPA and applicant-committed measures such as archaeological monitoring in culturally sensitive areas. Section 106 of the NRHP is a process that involves the identification of cultural resources in advance of ground disturbing activities occurring on federal lands or with federal funds. The level of resource identification varies, but applicant-committed measures include conducting Class III cultural resource inventories (field surveys) in any area where new ground disturbance will occur that has not been inventoried within the last 10 years. Typical survey buffers are 100 feet either side of centerline for linear facilities and 10-acre blocks for well pads. Much of the GCWPA has been block surveyed by section. Any cultural resources identified are then evaluated for inclusion to the NRHP.

4.9.1 Direct and Indirect Effects

Cultural resources are nonrenewable resources that represent the collective evidence of past human activities. Once destroyed or damaged, that resource is lost along with an integral part of our communal past. Many cultural resources, such as the archeological sites regularly encountered in the GCWPA, have surface vestiges that are apparent to archaeologists and others with keen eyes. Unknown to even the archaeologist, given the lack of scientific excavation in the area, is how many more sites lie buried under shallow dune and alluvial deposits, which may have no manifestation upon the surface.

Cultural resources, regardless of whether they reside on the surface or below it, are subject to both direct and indirect effects associated with oil and gas development. Direct effects result from various construction activities, such as grubbing and clearing vegetation, well pad or other facilities construction, pipeline trenching, and road construction. Indirect effects may include an increase in oil and gas related vehicle and pedestrian traffic, surface pipeline movement, and contamination and cleanup related to spills and leaks. Indirect effects also can include increased visitation, OHV traffic, increased erosion, dust accumulation, vandalism, looting, and visual and auditory effects. Direct and indirect effects can result in the destruction or damage to sites, the loss of scientific information, inaccessibility of TCPs, the loss of recreation and interpretation opportunities, and a loss of site setting, feeling, and context. Every impact to cultural resources would be considered long-term because the resource could not be recovered.

4.9.1.1 Alternative A—No Action

Alternative A would have the largest surface disturbance of the four alternatives. Based on the average and maximum site densities observed in the GCWPA, an additional 19 to 48 archaeological sites could be located in new proposed disturbance areas.

The programmatic nature of the development makes it difficult at this time to determine if there are deferential effects that will occur in the predefined areas of medium and low site potential within the GCWP. However, regardless of where the wells pads, access corridors, pipelines, and ancillary facilities are constructed, certain direct and indirect effects would be anticipated. Known eligible sites, either those previously identified or those found during the course of new Class III inventories, would be avoided during most undertakings given adequate planning time. Inadvertent direct effects may occur to buried archeological sites that lack any surface indications during construction or trenching activities. Indirect effects could include exposure, damage, or loss cultural materials from temporary accelerated soil erosion of areas adjacent proposed facilities, and adverse visual and auditory effects from increased development activity including vehicle traffic.

4.9.1.2 Alternative B—Proposed Action

Based on the conceptual design for Alternative B, the majority of the disturbance, approximately 1,610 acres, would likely occur in the medium site probability zone. About 265 acres of the proposed disturbance would be located in the low probability zone with a negligible potential for disturbance in the high probability zone.

The overall site densities in each zone are similar. Based on the average and maximum site densities observed in the GCWPA, an estimated 14 to 35 archaeological sites occur in the proposed disturbance area. The high density of prehistoric sites in the medium probability zone, where most of the proposed disturbance would likely occur, increases the chance that prehistoric sites may be adversely affected by either direct or indirect effects. It also increases the risk of encountering buried cultural resources, particularly where site clusters occur or dunes are present. Indirect effects related to visitation, OHV use, erosion, etc., would be similar to those described for Alternative A.

4.9.1.3 Alternative C—Resource Protection Action (BLM-preferred)

Approximately 1,514 acres of disturbance are anticipated under this alternative. In addition to limiting the disturbance in sensitive ecological areas, the decrease of disturbance also decreases the potential for some effects to archaeological site clusters in the same vicinities. Decreases in the number of disturbance acres also decreases in the low probability zone. It is estimated that of the anticipated disturbance under Alternative C, 190 acres occurs in the low site probability area and 1,351 acres occurs in the medium site probability area.

The site densities in each zone are similar. Based on the average and maximum site densities observed in the GCWPA, an estimated 11 to 27 archaeological sites occur in the proposed disturbance area. The lower number of disturbed acres in Alternative C, as compared with Alternative B, would slightly reduce the risk of damaging or destroying cultural resources in select areas of the GCWPA such as the sensitive White River corridor. Indirect effects related to visitation, OHV use, erosion, etc., would be similar to those described for Alternatives A and B.

4.9.1.4 Alternative D—Other Protections Action

Under Alternative D, a total of 1,595 acres of disturbance are anticipated under this alternative. Approximately 1,410 acres are in areas with moderate site probability and 185 acres overlap with the areas of low site potential. By keeping development out of the White River corridor, the most culturally sensitive sites in the GCWPA are entirely avoided by at least 0.25 mile.

Based on the average and maximum site densities observed in the GCWPA, an estimated 11 to 28 archaeological sites occur in the proposed disturbance area. The lower number of disturbed acres in Alternative D, as compared with Alternative B, would eliminate the risk of damaging or destroying very sensitive cultural resources in the White River corridor; cultural resources in other select areas of the GCWPA would be reduced as well. Indirect effects related to visitation, OHV use, erosion, etc., would be similar to those described for the other alternatives.

4.9.2 Alternative-specific Design Features and Mitigation

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.9-1**.

4.9.3 Residual Effects

For all alternatives considered, there is a potential for adverse residual effects to cultural resources, particularly for buried sites. Adherence to the Section 106 process would allow for the mitigation or such effects should disturbance of eligible sites not be avoidable.

4.9.4 Irretrievable and Irreversible Commitment of Resources

Effects to the context or the destruction of cultural resources eligible to the NRHP, or those yet unevaluated would constitute an irreversible or irretrievable commitment of that resource. Adverse effects would not only be site-specific, but result in a loss of cumulative data on landscape and regional scales.

4.9.5 Relationship of Short-term Use to Long-term Productivity

The short-term use of oil and gas resources could result in effects to cultural resources within the APE. Cultural resources effected during production and related activities could result in the loss of important information. Data recovery resulting from mitigating adverse effects would represent short-term use of cultural resources at the expense of future, research-oriented opportunities of undisturbed sites. Hence, long-term productivity, the continued presence of undisturbed cultural resources, would be lost in such cases.

Table 4.9-1 Cultural Resources Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
A Class III archaeological survey will be conducted on all federal lands in the GCWPA when new surface disturbance is proposed. If historic or archaeological materials were to be uncovered during construction, EOG will immediately stop surface disturbing activities that might further disturb such materials and contact the AO.		d	d	d	m			
All EOG personnel will refrain from collecting artifacts and from disturbing any NRHP eligible cultural resources in the area. EOG will be responsible for informing all persons in the area who are associated with this project that they may be subject to prosecution for knowingly disturbing historic or archaeological sites or for collecting artifacts. All vehicular traffic, personnel movement, construction, and restoration activities will be confined to the areas approved for surface disturbance.		d	d	d	m			

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4.10 Socioeconomics

The socioeconomic assessment focuses on potential impacts to regional employment, population, income; housing, public facilities and services; and local government fiscal conditions. Each alternative also has the potential to affect social conditions in the GCW socioeconomic influence area. The socioeconomic assessment considers the effects of Alternative B and alternatives to cultural resources (Section 4.9), rangeland (Section 4.12), and recreation (Section 4.15).

Key Project Development Drivers for the Socioeconomic Assessment

The major factors of the GCW Oil and Gas project that would drive socioeconomic effects are:

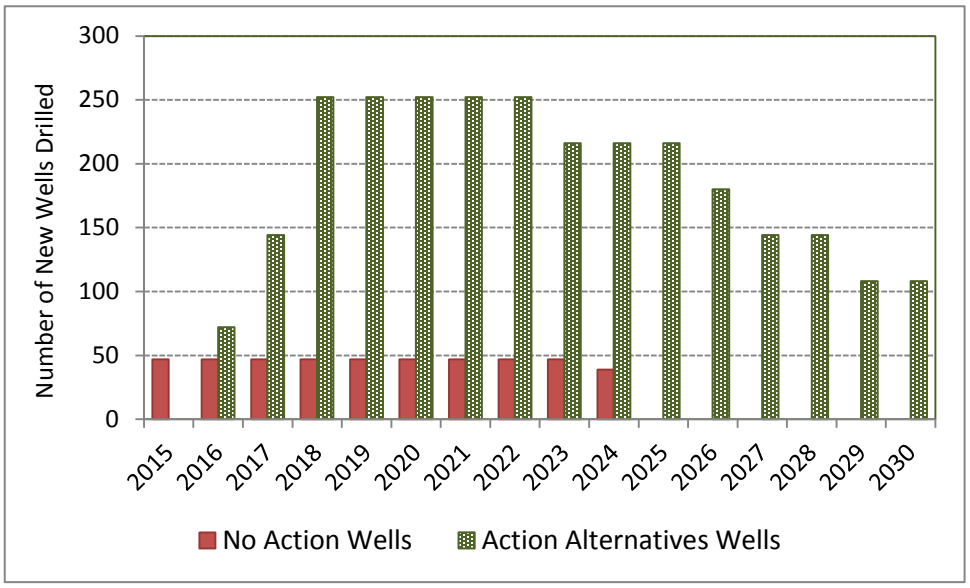
- The number of well and pace of drilling and completion;
- The employment associated with development, completion and production;
- The level and rate of production over time from completed wells; and
- The investment to develop and operate the field.

The alternatives differ primarily in the anticipated level of development, up to 462 new wells under Alternative A, as compared to an additional 2,808 wells under Alternative B. In effect, the action alternatives reflect 2,440 additional wells beyond the total number that would be drilled under Alternative A.[1] The differences in the number of new wells to be completed would, in turn, translate into differences in short-term employment during development, projected gas and oil production, associated public revenues, population growth, housing demand, and other socioeconomic effects over time. Chapter 2.0 describes the level of current development and projected level and pace of development for each alternative. **Figure 4.10-1** shows EOG's proposed development schedule (i.e., number of wells for which drilling commences in a given year).

Although actual production varies among individual wells, production information from existing wells in the Uinta Basin suggests an average economic recovery of 1.56 BCF of natural gas and 22,900 barrels of oil over the anticipated productive life of a well. Per-well production profiles were combined with the assumed future development schedules to generate an aggregate production schedule for the field as a whole. The production phase for each alternative would extend approximately 50 years beyond completion of the last well. **Table 4.10-1** summarizes the production assumptions for the project alternatives.

Figure 4.10-2 shows the projected natural gas production over the life of the project under the assumptions outlined above. Future production of recoverable condensates and water would follow similar patterns, increasing over time as the drilling program is implemented, but then declining following completion of the drilling program. Future production from existing wells in the GCWPA is anticipated to total 0.61 TCF of natural gas and 11.63 million barrels of oil condensates. Total projected resource recovery over the life of the project is 0.52 TCF of natural gas and 4.90 million barrels of oil condensates under Alternative A and 4.39 TCF and 64.26 million barrels of oil condensates under Alternative B and other action alternatives.

[1] It is assumed that 94 of the No Action wells would be completed before a ROD on Alternative B.



Note: No Action wells shown being drilled from 2017 through 2024 would be subsumed within the action alternative well count total if a ROD approves an action alternative.

Figure 4.10-1 Projected New Well Development under Alternative A and Alternative B

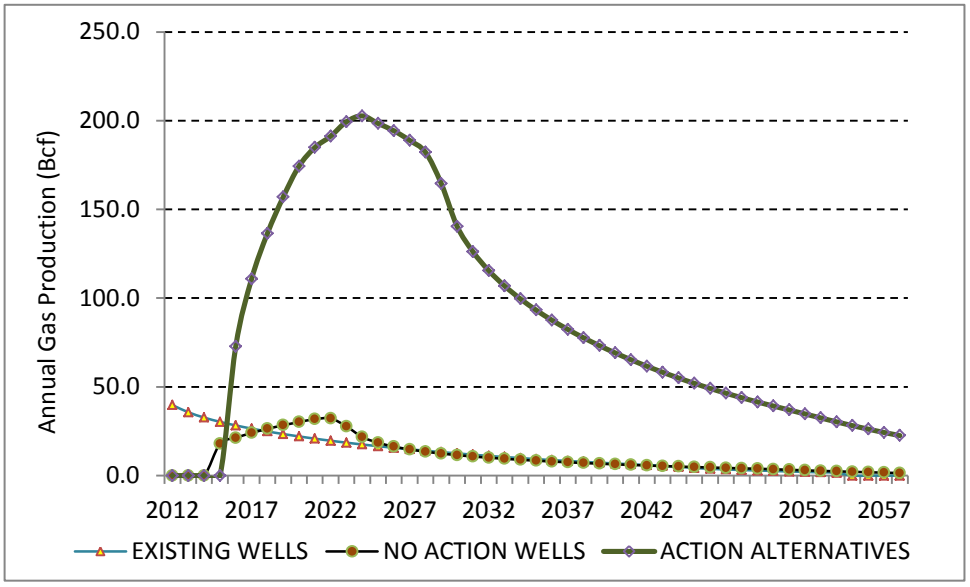


Figure 4.10-2 Projected Natural Gas Production for the Alternatives

Table 4.10-1 Projected New Wells and Total Projected Natural Gas and Oil Production

	Alternative A	Alternative B	Alternative C	Alternative D
Number of New Wells	462	2,808	2,808	2,808
Number of Rigs Deployed	1 or 2	2 to 9	2 to 9	2 to 9
Life of Project Natural Gas Recovery (TCF)	0.52	4.39	4.39	4.39
Life of Project Oil Produced (million barrels)	4.90	64.26	64.26	64.26

The value of future natural gas and liquids produced from the GCWPA would be substantial. Based on assumed prices of $3.85 per MCF and $84.00 per barrel of liquids, peak annual sales values would exceed $130 million under Alternative A and $929 million under Alternative B and alternatives. Production from existing wells is declining over time, with the projected value of annual production declining below $100 million in 2019. **Figure 4.10-3** shows the annual production values through 2070 for existing wells and those that would be drilled under Alternative A and the action alternatives.

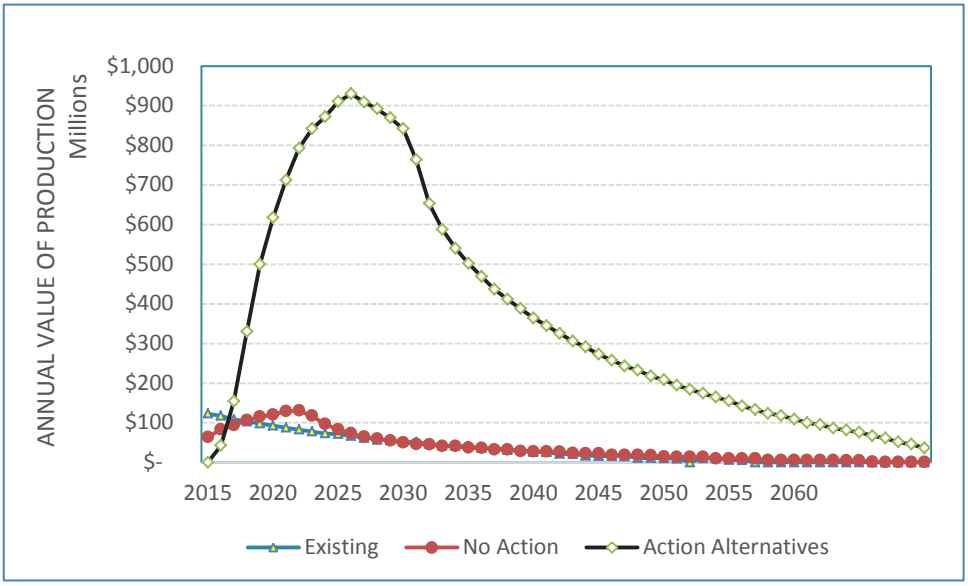


Figure 4.10-3 Projected Value of Annual Production for the Alternatives

The cumulative values of future production associated with those three categories of wells would be $1.9 billion from existing wells, $2.2 billion from Alternative A wells, and $20.2 billion for Alternative B and action alternatives.

EOG provided the estimated development and operating costs on a per well basis (**Table 4.10-2**). Initial development cost are estimated at $1.9 to $2.2 million per well. Ongoing annual operations costs are projected at $42,000 per well, with a $10,000 annual allowance for well workovers.

Table 4.10-2 Well Development Cost Assumptions, All Alternatives

	Cost (2014 $)
Drilling, Completion and Gathering – per well	
Materials	$300,000 to $400,000
Labor and Services	$1,600,000 to $1,800,000
Field Production and Operations – average/producing well/year	
Average Annual Operating Expense	$42,000
Allowance for Well Workovers (average work-over interval = 3 years)	$10,000

The upper end of the well development cost range would be associated with a single well on a pad, the lower costs being associated with multiple wells on a pad where the location construction, rig mobilization, electrical and gathering systems and reclamation costs, though higher in total, are lower on a per well basis. On average, approximately 75 percent of the total well development costs are associated with drilling and completion (**Figure 4.10-4**). EOG estimates more than 6.0 percent of its total well costs would be directed to interim and final reclamation and plugging and abandoning a well at the end of its productive life.

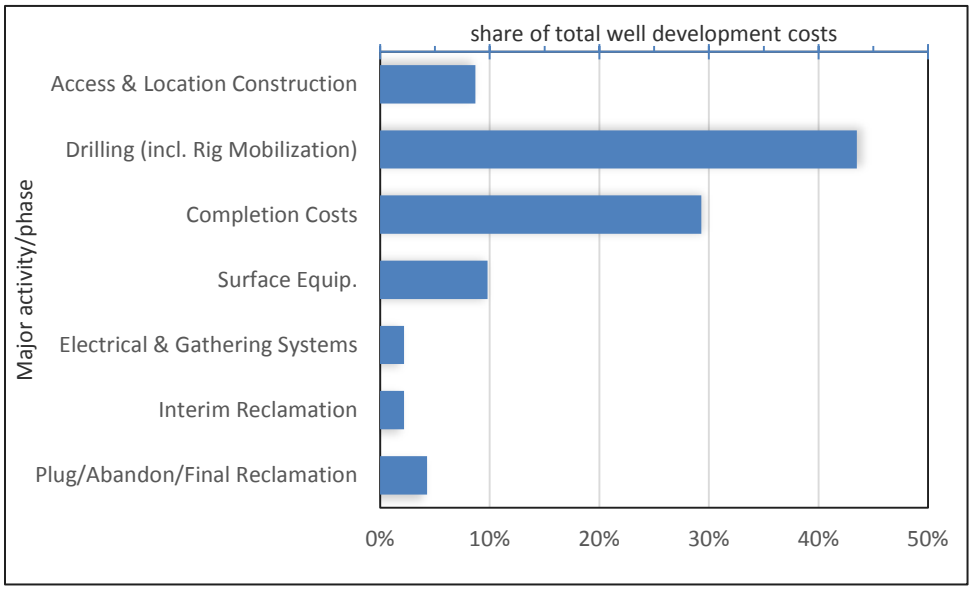


Figure 4.10-4 Typical Well Development Costs, by Major Activity – Percent of the Total

Under Alternative A, EOG anticipates one or two drilling rigs being active in the GCWPA. Alternative B would see the number of rigs increase; two to three additional rigs during the first full year, five additional rigs during the second year of drilling, and as many as eight additional rigs during the third year to drill 250 additional new wells. The pace of drilling would remain at that level for 4 more years, after which the pace of drilling and number of rigs deployed would decrease. EOG anticipates 4 rigs would be deployed to complete approximately 110 wells per year during the final 2 years of the project.

Applied to the GCW alternatives, those costs yield estimated development and operating costs of approximately $1.8 billion over the life of the field under Alternative A, and $11.3 billion for Alternative B. Future investments in the proposed reinjection wells, the LGS (under Alternative A), and field compression would be in addition to those costs. Those investments would give rise to the need for labor as well as providing the production and recovery capacity that would drive the social, economic and fiscal effects associated with the project.

Development of a single vertical well on its own pad in the GCWPA would typically span from 12 to 28 days from location staking through installation of surface production facilities. Following construction of the access road and well pad, a drilling rig would be transported to, erected on the well pad, and the well drilled. On multi-well pads, development of all wells on a specific pad would typically occur sequentially; EOG would drill the first well, then skid the rig to drill the next well, until all wells on a pad are drilled. The drilling rig would then be dismantled and demobilized (transported) from the location after which a completion rig would be transported to and erected on the pad. Completion operations consist of perforating the production casing, stimulating the formation(s) using hydraulic fracturing techniques, flowing back the fracturing fluids to the surface for disposal, flow testing to determine productivity, and installing production equipment. EOG plans to complete all new wells on any given pad sequentially. Interim reclamation would be undertaken after all planned wells on a pad have been completed. Interim reclamation typically requires 2 to 5 days.

On-site employment at an individual well varies over time with a peak of approximately 42 employees and averaging 18 employees over a 24-day period, assuming the various development activities run consecutively. **Figure 4.10-5** illustrates the direct on-site employment (including site development, drilling, and well completion) required for a typical vertical well. EOG staff, other than project engineers, state and federal regulatory and resource management staff, and others may visit an individual well site, but the number and frequency of such visits is unknown. Furthermore, while some workers are on-site during their entire shift, others are on-site for relatively brief periods (e.g., drivers making water deliveries to support drilling and hydraulic fracturing).

Development of a multi-well pad in the GCWPA could span 60 to 70 days from access road and pad construction through installation of surface production facilities and gathering lines. Interim reclamation typically requires another 3 to 5 days. Estimated peak and average on-site employment at an individual multi-well pad would be 47 and 20 employees, respectively, with the peak employment occurring during completion activities. **Figure 4.10-6** illustrates the number of direct on-site workers (including site development, drilling, and well completion) over a 70-day time schedule, assuming that all wells are batch-completed at one time. Project engineers, EOG management, state and federal regulatory and resource management staff, and others may occasionally visit an individual well site.

Extending those profiles over time and aggregating the employment over multiple wells yields an estimate of the project's projected incremental effects on regional employment for the alternatives (**Figure 4.10-7**). The peak and average employment estimates over the first 10 years of the Alternative A are 109 and 95 jobs, respectively. The corresponding values for Alternative B would be 345 and 279 jobs, respectively.

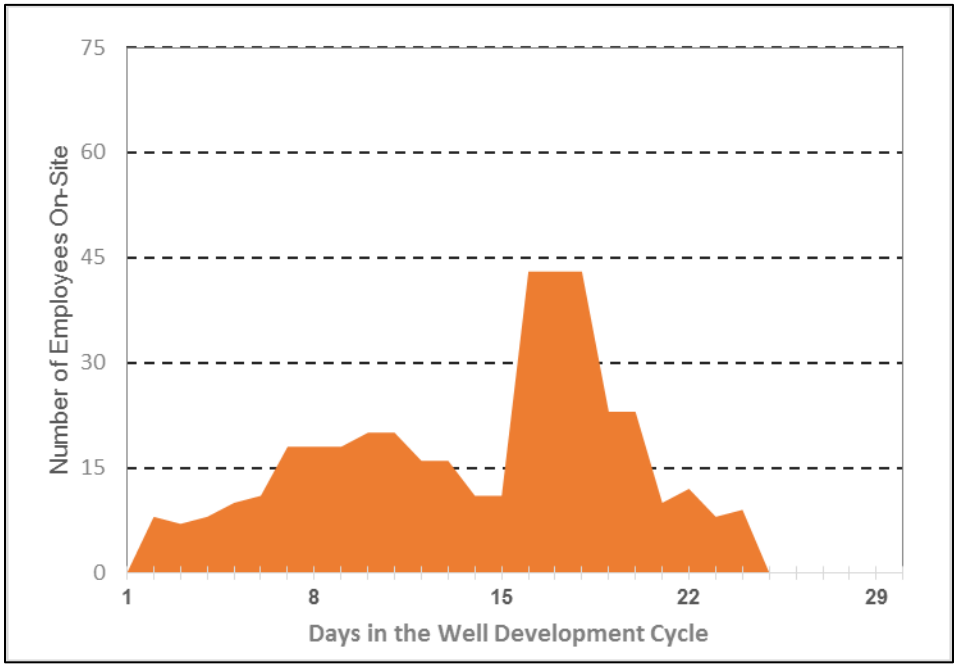


Figure 4.10-5 Direct On-site Employment to Develop a Typical Vertical Well

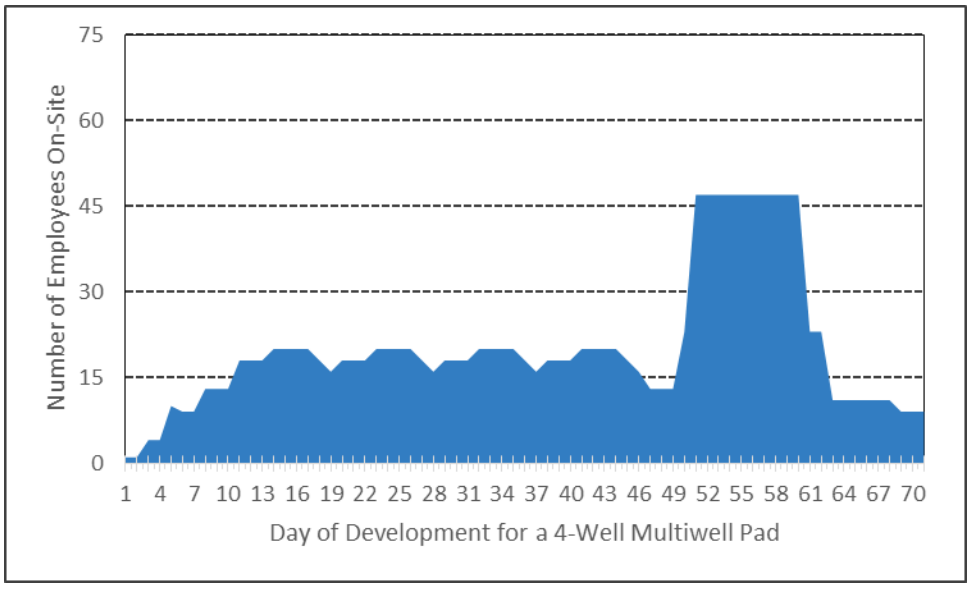


Figure 4.10-6 Direct On-site Employment to Develop a Multi-well Pad with 4 Wells

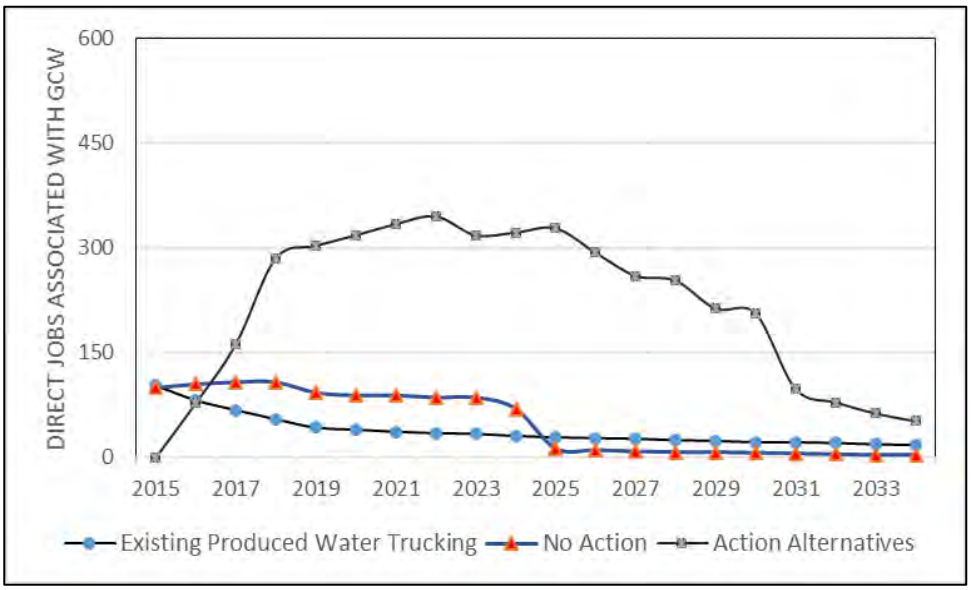


Figure 4.10-7 Direct Employment Associated with Energy Development in the GCWPA

Other Factors Underlying the Socioeconomic Assessment

In addition to the project specific factors, the assessment of socioeconomic impacts considers several other important factors as discussed below.

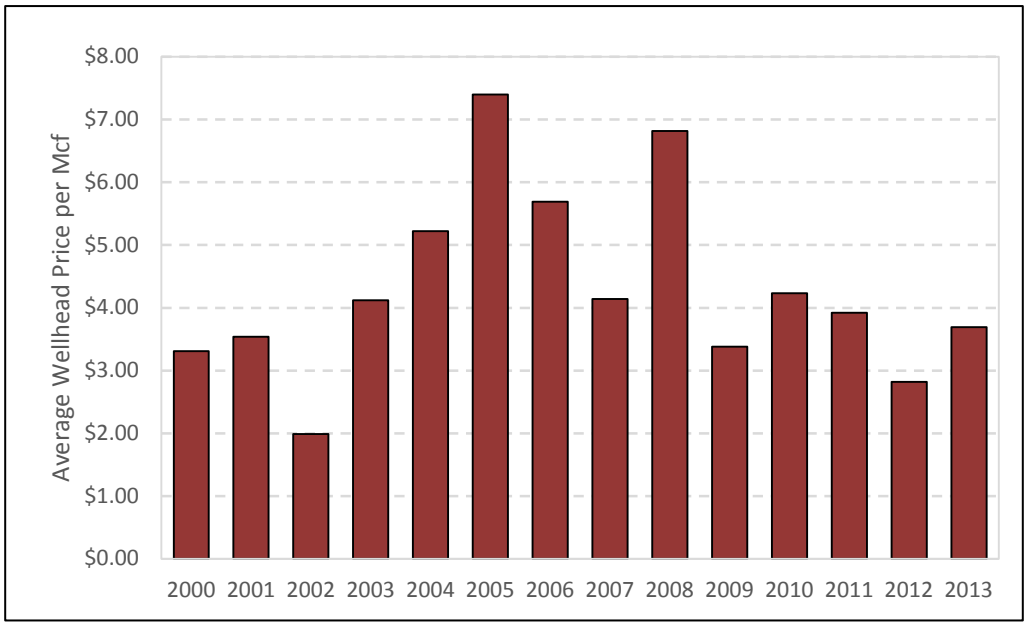
A History of Oil and Gas Development in the Uinta Basin

Oil and gas drilling, field development, and production activities have occurred in Uintah County for more than 65 years, with a dramatic increase in the level of activity in recent years. According to data reported by UDOGM there were a total of 9,936 producing oil and gas wells in Uintah and Duchesne counties in September 2014, with another 437 wells in some stage of drilling and APDs approved for a further 3,208 wells. UDOGM also reports an average of 944 new wells per year drilled in the GCWPA during the four year period 2010 to 2013 and rig count data for Duchesne and Uintah county for the 12 months ending September 2014 reported an average of 23 rigs active in the region, four fewer than the previous year. Thus, while Alternative B assumes annual drilling of an average of approximately 188 wells, the socioeconomic assessment acknowledges that the industrial and community infrastructure to address many effects associated with historic levels of activity is in place and local communities have expanded capacity to address many of the socioeconomic effects associated with that pace of development. Although the recent economic recession triggered a slowdown in the pace of development that in turn resulted in an outmigration of some non-resident oil and gas workers from the region, the industrial and community infrastructure remains in place, and in some instances expanded during the recession.

Uncertainty

The socioeconomic assessment is based on EOG's proposed level of new well development over time. However, the actual pace of natural gas drilling will likely depart from those assumptions because development decisions are dependent on a variety of factors including natural gas pricing, regulatory approvals, environmental constraints, rig and manpower availability, improvements in technology, and the company's overall investment and development strategies given various opportunities. For example, during the historic assessment period for this EIS, natural gas demand and prices rose to historic levels and then declined precipitously (**Figure 4.10-8** shows average price trends since 2001). The recent price

declines were accompanied by tightening in the availability of development capital, which hampered operations for some Operators and service companies. Although less affected than many other areas of the country, Duchesne and Uintah counties experienced economic slowdowns during the national economic recession that began in the latter part of 2007.



Source: Utah Geological Survey 2016.

Figure 4.10-8 Historical Wellhead Prices for Natural Gas in Utah

Regional Context

Long-term cumulative effects of actions are addressed in a separate section of this document. In the case of socioeconomics, responses to changing economic conditions by energy resource development companies can rapidly affect labor market, housing and other socioeconomic parameters across a broad region, resulting in effects that vary from those anticipated at the time of the assessment. The natural gas and petroleum reserves in the GCWPA are but a part of the larger regional resource base that extends into three states. Consequently, changes in prices and market conditions that may affect EOG's investment decisions in the GCWPA would generally occur in the context of regional energy development activities elsewhere in the Uinta Basin and the broader Rocky Mountain west. This means that periods of elevated demand associated high gas sales prices would generate increased activity in the GCWPA as well as in natural gas fields in nearby areas of Wyoming and Colorado, and vice versa. The implication for socioeconomics is that changes in market conditions for natural gas that would stimulate or delay development of the GCW project would likely affect other projects in the region similarly, potentially triggering rapid changes in local socioeconomic conditions. The timing, magnitude and types of changes could in turn affect the anticipated project-related effects.

Effects of Enhanced Resource Protection Measures, Surface Disturbance Caps, and Directional Drilling Requirements—For the GCWPA, basic resource protections on federal surface would be applied across all alternatives. In contrast, proposed enhanced environmental protections and mitigation measures may affect the pace of drilling for any given project. Well pad density limits, surface disturbance caps and other environmental parameters can add to the overall cost of drilling and field development. Additional costs factor into Operator development decisions, and may slow the pace of development and limit the extent of development in a particular area.

As noted above, commodity prices play a major role in the pace and extent of drilling in a particular play. Operators are able to absorb higher development costs during periods of higher commodity prices. Conversely, as commodity prices decrease, the ability to absorb higher costs diminishes, and would affect the economics of further development. The extent to which EOG obtains leases or opportunities in other, lower-cost areas, this might reduce the pace and extent of drilling in the GCWPA under the alternatives as compared to the pace and extent of development under Alternative B.

Continued evolution of drilling and completion methods and technology also might influence the pace and extent of oil and gas development. Recent advances in directional and horizontal drilling technologies are contemporary examples of such improvements. Improvements in methods and technology are likely within the development period assumed for this assessment. Future improvements may reduce drilling/completion times and surface disturbance, as well as dampen the economic and logistical effects of compliance with the environmental protections associated with the alternatives.

Because of the difficulty in assessing the effects of any additional environmental compliance costs on the pace and ultimate extent of development, the assessment assumes the same number of wells (2,808) would be drilled at the same pace under each alternative. However, the costs associated with environmental compliance could affect the pace and extent of development under Alternatives B, C, and D, particularly in a low commodity price environment. The implications of a slower pace of development or reduced extent of development resulting from the compliance with environmental protections and mitigation measures are that drilling could extend beyond the proposed time horizon, or that some locations would not be drilled. Under such a scenario, some socioeconomic effects of development and production (i.e., employment and federal royalty revenues) could be lower than those identified, or could be similar in total, but accrue over a longer period of time. If the costs of compliance with environmental protections and mitigation measures reduced the overall extent of development under the action alternatives, total public-sector tax and royalty revenues would be correspondingly decreased.

To the extent that additional design features under Alternatives B, C, and D were successful in reducing impacts on environmental resources such as air quality, water quality, vegetation, wildlife habitat, and wildlife, the value of those resources would be partially or wholly preserved.

4.10.1 Direct and Indirect Effects

4.10.1.1 Effects Common to All Alternatives

Natural gas development can give rise to variety of social and economic effects, both beneficial and adverse, and can include:

Employment—effects on direct employment in the natural gas exploration and production industry, indirect employment in businesses supporting that industry, and induced effects on other sectors of the economy, including those affected by industry and employee spending and those that may be directly affected by development including outdoor recreation and ranching. Natural gas development also can affect community and regional economic diversity.

Income—effects on income of businesses and their employees; on tourism, agriculture and other economic sectors; and on landowners, mineral owners, and other royalty interests.

Population—effects on resident and temporary populations in nearby communities.

Housing—demand for temporary and long-term housing.

Infrastructure and services—demand for governmental, quasi-public and private facilities and services.

Fiscal conditions—changes in local, state and federal taxes and mineral royalty revenues and government expenditures.

Social conditions—effects on community stability and cohesion, quality of life, crime, attitudes, and lifestyles.

Environmental Justice—beneficial or disproportionately high and adverse effects on minority and low-income populations.

Each alternative considered in this EIS, including Alternative A, has the potential to affect the social and economic conditions previously described in Section 3.10. All action alternatives would result in increased employment and income in certain sectors of the local economy and population growth with resultant increased demand for housing and community infrastructure and services. After all authorized wells are drilled, decreased employment and income for certain sectors of the economy would occur under all alternatives, and likely result in employee and household migration. Each of the alternatives has the potential to affect other sectors of the economy, such as ranching and outdoor recreation, that are closely linked to land use and access in the GCWPA. Beneficial and adverse effects on community infrastructure, local government services and fiscal conditions, and community social conditions also would likely occur under all alternatives.

Economic Effects

Each action alternative would support direct employment and income in the natural gas industry, indirect employment and income in businesses that support the natural gas industry, and induced effects on other sectors of the economy affected by changes in industry and employee spending. That support could manifest itself as new jobs, or continued support for existing jobs in the region that might otherwise be lost as other development is completed. Each alternative also could affect other activities including outdoor recreation and ranching and could potentially affect regional economic diversity.

Under Alternative A, drilling and field-development is assumed to continue on private and state minerals and on a case-by-case basis on tribal and federal minerals, resulting in some support for existing employment in the study area. Production-related employment would continue beyond the decade-long development period, but at lower levels as compared to Alternative B, decreasing as production from new and existing wells decline and production ceases as wells become uneconomical.

Induced and indirect employment associated with drilling, field-development, and production activities would parallel the advances and declines in direct employment for each alternative.

Federal, state, local, and Tribal governments would receive additional tax and royalty revenues under all alternatives. Such revenues, particularly federal mineral royalties, would be substantially higher under the action alternatives when contrasted to the revenues associated with Alternative A.

The assessment projects important revenue streams for the federal government, the State of Utah and local taxing jurisdictions that would be directly impacted by the alternatives: the state severance tax, state royalties on lands managed by Utah SITLA, and federal mineral royalty (FMR) revenue. The latter is revenue from federal royalties on gas production from the alternatives, a portion of which is returned to the State. The federal government also administers mineral royalty management for Tribal minerals, dispersing royalties to the Tribe based on production from Tribal wells.

Oil and natural gas production is the primary business activity on the Uintah & Ouray Reservation. The Ute Indian Tribe requires payment of fees to the Tribe resulting from operations on the Reservation as part of negotiated Surface Use Agreements, as well as mineral lease royalties, and severance tax. In 2000, approximately 80 percent of Tribal income was derived from oil and gas royalties (BIA 2004)."

Projected value of future production and the derivative calculation of related tax revenues are in 2014 dollars, assuming that 97 percent of the production is sold at $3.65/MCF for natural gas and $84/barrel for crude oil and oil condensates. The commodity price assumptions reflect wellhead prices for production in Utah as reported by the UDOGM prior to the dramatic price declines since

September 2014, and thus implicitly assume average prices over the productive life of the field more in keeping with average prices from 2010 through 2014.

At the same time, short-term price fluctuations would be expected to occur such that actual prices received for production would be higher than the long-term average at times and lower than the long term average at other times. Variances between the actual and the assumed price would result in corresponding differences between projected and actual royalties, severance taxes, and property taxes. Given the uncertainties associated with pricing and production, assuming a constant price across all alternatives was considered reasonable for assessment purposes.

Cyclical Economic Expansion and Contraction

The economic expansion associated with each action alternative would likely be followed by a period of economic contraction.[2] For all alternatives, the current level of natural gas development would extend drilling within the GCWPA for 10 to 15 years. The contraction phase would follow as drilling and field-development employment ceases and production employment begins to decrease.

For all action alternatives, the expansion phase would be characterized by increases in direct employment and income in the natural gas industry and increases in indirect and induced employment and income. The drilling and field-development phase would be accompanied by increases in both temporary and long-term population as well as temporary and long-term housing demand, and demand for community infrastructure and local government services.

The economic contraction phase would likely result in reductions in employment, and possibly out-migration of workers and families, and reductions in demand for housing, community infrastructure, and local government services. The contraction phase also would be characterized by reductions in federal, state, and local government tax and royalty revenues. The severity of these effects would depend on other economic activities occurring at the time and the success of economic development initiatives.

The foregoing discussion assumes the pace of development outlined for Alternative B and Alternative C. Historically, natural gas development and expansion cycles have been more frequent and shorter in duration than the 15-year cycle assumed for all alternatives in this EIS.

Effects on Other Uses in the GCWPA (Recreation and Ranching/Grazing)

All action alternatives have the potential to displace some other use that occurs on federal lands in the GCWPA, temporarily in some instances and for extended periods for others. The existing level of development and ongoing drilling and field-development activity may have already resulted in past displacement of some recreation use, both directly and indirectly as a result of altering the recreational setting and recreation access in the GCWPA. Limited hunting occurs in active gas-producing portions of the GCWPA. Intensification of development would further alter the recreation setting. Over time, as development and production activities cease and reclamation occurs, recreation users may return to the GCWPA. Shifts in the geographic distribution of hunting and other recreation activity could have corresponding economic implications as well.

Grazing patterns and practices in the GCWPA have been affected by past natural gas development activity. Past development activity, the associated disturbance, and resultant reductions in available forage have resulted in reductions in use of certain allotments, and likely requiring grazing permittees to more actively monitor and move livestock, resulting in increased costs, reductions in livestock weight gain. These and other effects, such as the effects of drought on forage availability and weight gain, affect the profitability for grazing permittees.

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[2] This characterization of effects is a function of the assumption of the steady pace of new well development. In fact some variability would be expected. Such variability would likely temper both the expansions and contractions described here.

Under Alternative A, the potential adverse effects on grazing permittees associated with drilling and field-development activity and traffic on federal lands would be less than under all action alternatives. Under all of the action alternatives, the levels of drilling and field-development and associated traffic could potentially double over recent levels and the amount of temporary and long-term disturbance would increase, likely resulting in displacement of grazing operators from portions of allotments. Adverse effects on portions of grazing allotments, coupled with the aforementioned other factors could have detrimental effects on the economic viability of some affected ranches.

Effects on Environmental Amenity Values

Environmental amenities including air and water quality, wildlife and wildlife habitat, scenic vistas, and cultural and historical features in the Uinta Basin and surrounding region are valued by local residents and visitors alike. These amenities add to the quality of life for residents, promote tourism and recreation, and are factors that can attract new residents and businesses to an area. Many people value these amenities for their very existence and desire their continued availability for future generations.

Much of the GCWPA has already been affected by development, adversely affecting some outdoor amenities including scenic vistas, wildlife and wildlife habitat, and outdoor recreation. All alternatives would continue to affect these amenities, although Alternative A would result in fewer effects on federal lands. The action alternatives would intensify development in many currently developed areas of the GCWPA and perhaps result in development in relatively undeveloped areas.

In addition to the effects of development, disturbance, and activity on environmental amenities, the increases in traffic and proliferation of litter along roads adversely affect scenic and wildlife amenities. These effects would continue under all alternatives but would likely intensify under the action alternatives given the increase in activity and extended duration of the drilling and field-development phase.

Economic Diversity

Energy development in the region has expanded the inventory of housing, tourism and recreation infrastructure (motels and restaurants), other commercial infrastructure, and increased the resident work force in communities in the study area, all of which would be resources for economic development as natural gas development subsides. Energy development has the potential to enhance economic diversity in rural communities by expanding commercial and community infrastructure and providing funding that can support economic development, community revitalization, and tourism promotion efforts. Energy development also has the potential to limit economic diversity in rural communities by raising housing costs and limiting housing availability, contributing to work force shortages, and adversely affecting environmental amenities. Potential dampening effects on economic diversity would intensify under all action alternatives as the pace and duration of increased drilling, along with housing demand and labor competition. Potential dampening effects of natural gas development in the GCWPA would diminish sooner under the Alternative A as labor competition and high housing costs decline and long-term reclamation proceeds. The potential effects on economic diversity should be viewed in the context of the cumulative development within the study area as high levels of drilling in the GCWPA would likely be accompanied by active development elsewhere in the region. Potential economic diversity-enhancing effects could ultimately be associated with all action alternatives as well as with cumulative development.

4.10.1.2 Alternative A—No Action

In 2007, EOG deployed 8 active rigs in the GCWPA. As of March 2014, 1,247 wells were active in the GCWPA. EOG presently has 105 employees in the study area in conjunction with its operations, the majority of whom live in Uintah County.

Without federal approval for additional development in the GCWPA, EOG would limit its activity to drilling and completing wells on state, Tribal, and fee lands and wells that have been previously approved on BLM-managed lands under existing NEPA documents. Alternative A assumes 462 additional wells over

10 years of development activity through the year 2024. That development program would be achieved through the continued deployment of two drilling rigs. Additional LGD, compression, treating, processing capacity also would be developed under Alternative A. Production would continue to approximately the year 2063 (the actual life of field would be determined on future gas prices, the economics of well operations, and other factors that are uncertain and beyond the scope of this analysis). Final reclamation and field abandonment activities would occur in the latter stages of field life and following the end of production. The past presence of drilling rigs, current location of EOG's field office in Vernal, and existing wells means that the local socioeconomic environment has already internalized some or substantial portions of the effects described in the following analysis.

Alternative A would result in estimated direct project spending of more than $1.8 billion (2014 dollars) by EOG for well development and operation.[3] The pattern of spending is illustrated in **Figure 4.10-9**. Of the total expenditures, approximately $0.99 billion would occur during the first 10 years of Alternative A development, 2015 to 2024. EOG anticipates making approximately 75 percent of its future development and operations expenditures with contractors, other service firms, and equipment and materials suppliers having a local presence in the Uinta Basin. The target represents $1.3 billion in spending under Alternative A.

Total future production under Alternative A, excluding production from existing wells, is estimated at 0.52 TCF of gas and 4.10 million barrels of oil and condensates. As depicted in **Figure 4.10-10**, peak annual production would occur 5 to 6 years into the project (2021/22) at a time when gains in production from new wells no longer offset the declining production from wells drilled previously. Production would decline rapidly thereafter, to less than half the peak level within 5 years (2025) and to approximately 10 percent of the peak in 2051. The estimated value of gas and oil sold into the marketplace (assumed to be 98 percent of the gross production) would be $2.20 billion in 2014 dollars.

Employment, Population, and Housing

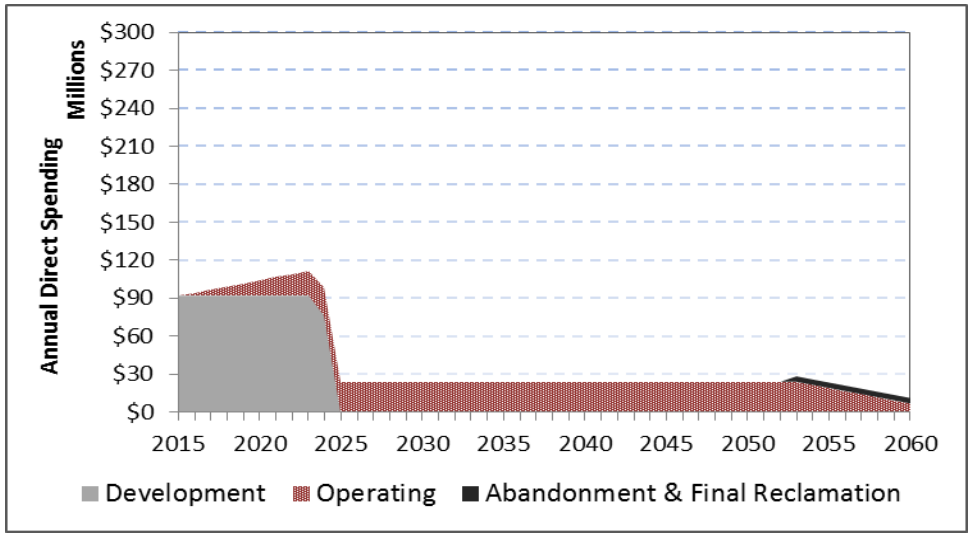
Alternative A would provide support for an estimated 188 workers during the midst of the development phase; 102 workers employed directly in development and production, the remaining 86 jobs would be supported indirectly by the activity and consumer expenditures by workers and households. **Table 4.10-3** and **Figure 4.10-11** summarize the average direct and secondary employment during the 5-year period of stabilized drilling activity, 2016 thru 2020, and post-development after drilling activity had been completed.

Table 4.10-3 Project–related Employment, Alternative A

	Development 5-year Average (2016-2020) [1]	Development Average (2015-2024)	Post Development (2025)
Direct (average annual)	102	92	16
Secondary (average annual)	86	84	12
Total	**188**	**176**	**28**

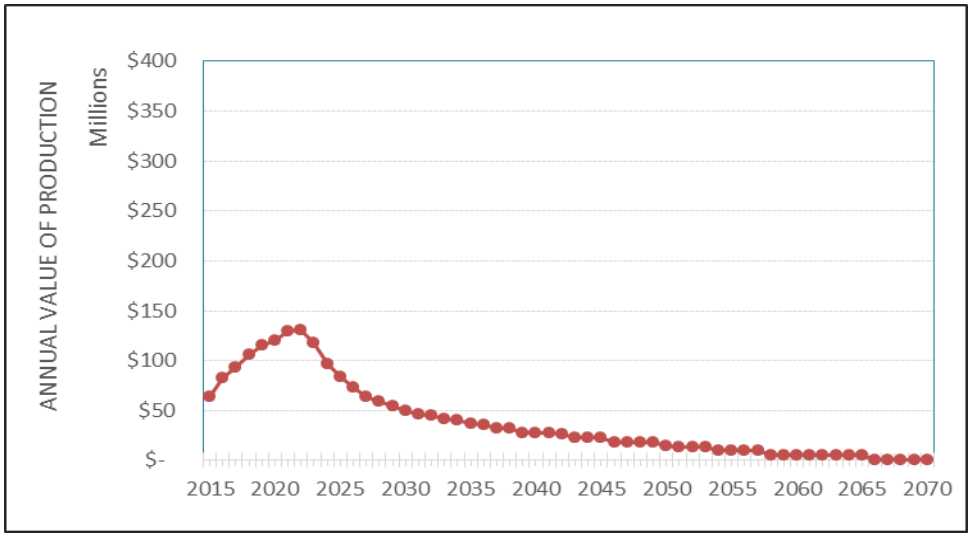
[1] Assumes operation of two drilling rigs.

[3] The total includes direct project spending only. EOG's prior outlays for leases, development of existing wells and infrastructure, project planning, permitting, internal management and salaries for current production staff in the Vernal office, as well as corporate support provided from other offices and future expenditures for some centralized infrastructure, royalties, taxes, and other payments to governments and mineral estate owners are not included.



1

2 **Figure 4.10-9 Direct Project Spending Under Alternative A**



3

4 **Figure 4.10-10 Projected Market Value of Product Sold, Alternative A**

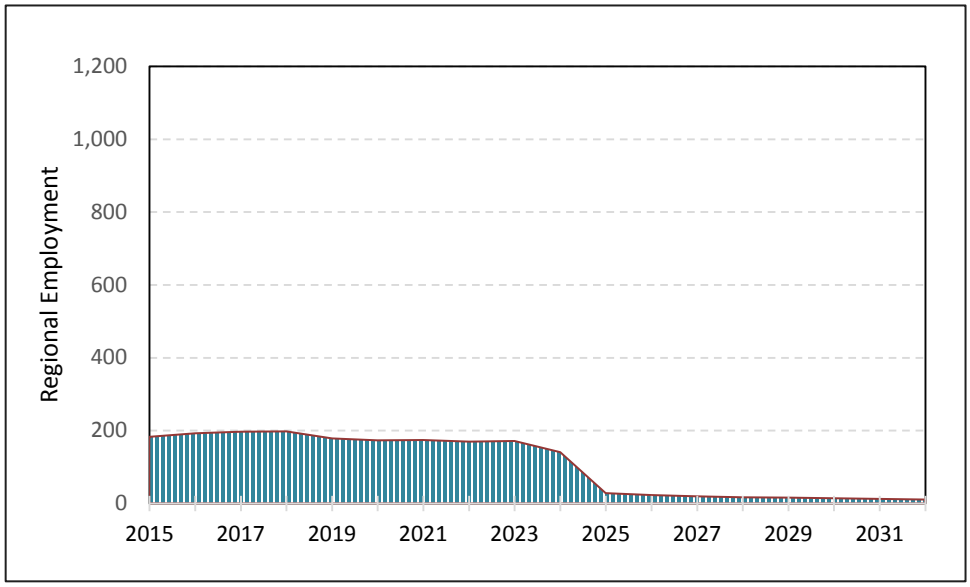


Figure 4.10-11 Total Direct and Secondary Employment, Alternative A

Not shown below would be a temporary rise in employment associated with construction of the LGS (Phase II), field compression and other infield infrastructure. The scheduling and the labor force requirements associated with that construction are not presently known. Also not shown are the additional truck haul employees that would have been required assuming the LGS was not built. The applicant estimates that the LGS would effectively reduce produced water truck haul by approximately one-half.

Direct employment would decline sharply following the completion of development, with attendant declines in secondary employment. Total production-related employment is estimated at 28 jobs in the first year following the completion of drilling, declining further as production falls. The relatively few production-related jobs reflect the anticipated effectiveness of the LGS in reducing future trucking employment associated with water hauling.

Current unemployment in the region is low even though the level of oil and gas development activity is lower than in past years. Consequently, local labor availability is relatively low, limiting the number of current residents of the region who would be available to fill the jobs supported by Alternative A. At the same time, some sectors of the local economy have available capacity to serve additional demand following the cutbacks in regional oil and gas activity over the past several years. For this analysis, current residents or temporary workers already employed in positions contingent upon sustained or rising activity are assumed to fill only 20 percent of the available jobs. Individuals who temporarily relocate to the area or those who relocate for the long-term are assumed to fill the remaining 80 percent of the jobs.

Local labor income, reported on a place of work basis, would generally increase and decline in step with project-related employment. Much of the labor income would leave the local economies as a result of jobs held by non-residents, especially during the development phase. However, in the area, these workers would account for substantial contributions to the local economy via their spending for lodging, food, beverages, fuel, clothing, and other goods and services.

Based on the underlying relationships between employment, population, and housing, the employment effects associated with Alternative A correspond to an incremental population of 313 temporary and long-term residents and housing demand of 128 dwelling units over a 5-year period during the development phase (**Table 4.10-4**). A considerable portion of the population and the housing demand would be associated with single-status temporary workers who are not accompanied by family members and who live in rig camps, motels, RVs, or other temporary living quarters.

Table 4.10-4 Employment, Population, and Housing Demand Impacts, Alternative A

	Development 5-year Average (2016-2020)	Development Average (2015-2024)	Production (2025)
Project Related Jobs			
Filled Locally	38	34	5
Temporary/Long-term Relocations	150	142	23
Incremental Population			
Non-local Temporary Workers	76	70	6
New Long-term Residents	237	231	48
Total	313	301	54
Incremental Housing Demand			
Temporary (Rig camp/RV/Motels)	68	64	2
Conventional (Apts/Mobile Homes/Houses)	65	63	20

Short-term peak population and housing demands would occur during periods when infrastructure construction and two rigs operate simultaneously. The magnitude and duration of those peaks is uncertain. The short-term nature of the construction related demand would correspondingly increase demands on temporary housing and lodging accommodations. Temporary population and housing demand would decrease as wells are connected with LGS facilities and produced water trucking decreases.

Long-term population effects and housing demand during the extended production period would be noticeably lower than during the development phase. Immediately following the completion of development, production related population is estimated at 35, declining over time as production decreases. The attendant housing demand is 22 units, most of which would be for conventional housing. There would be limited additional pressure on local housing markets during production because the long-term production-related demand would be substantially lower than during development.

Grazing

Alternative A would have limited impacts on grazing in the GCWPA, resulting in a maximum of 2,685 acres of disturbance, including existing disturbance, and a potential short-term loss of up to 225 AUMs per year of available forage in 6 federal and 2 BIA grazing allotments (see Section 4.12 for additional information). The long-term loss would depend on the productive life of the wells (assumed to be 40 years) and the future success of reclamation. The increase in fragmentation that accompanies development can adversely affect the area's suitability for grazing sheep, requiring more management and reducing productivity. The reduction in grazing AUMs would translate into reductions in future cash receipts from livestock production for the grazing permittees. Although the reductions in receipts and income would be small in the context of the region's overall ranching community, such reductions would be in addition to past effects associated with energy development, reductions associated with extended drought in the region and changes in management in response to other factors. The net effects of such

impacts may diminish the economic value of grazing to certain operators, potentially to the point of rendering some grazing permits uneconomical. In such instances, the economic loss to the individual operator would be greater than the incremental loss in AUMs described above. The net loss in agricultural income could then accrue to the overall economy unless another operator subsequently applies for and receives the grazing privileges or changes in management (e.g., combining several affected allotments) are implemented to sustain the economic viability of grazing in that area.

Recreational Use and Tourism

Limited adverse effects on the levels of dispersed recreation, including OHV use, hunting, and nearby river use and fishing in the GCWPA may result under Alternative A. Such effects may result from the response of recreation users to the increased level of industrial activity on the landscape, traffic along access roads, or restrictions associated with activity in proximity to facilities. The effects on recreation users could affect residents, as well as the parts of the economy that benefit from recreation and cultural tourism.

Community Facilities and Services

Population growth, housing demand, and associated demands on public facilities and services under Alternative A would contribute to ongoing service provision, facility capacity and staffing needs. These include expansions of water and wastewater systems to accommodate further residential development and increased staffing for law enforcement, county road and bridge departments, social services, and other county services. Although adding to existing demand, the scale of the population gains and housing demand would be small relative to the regional resident population, overall housing inventory, and seasonal tourism demands.

Local road and bridges are impacted by industrial traffic and traffic related to general population growth. Local governments face challenges in recruiting and retaining staff due to the high wages and salaries offered in the energy resource industries, high housing costs, and overall demand for labor. Local municipal agencies are often constrained to respond to demand in a timely fashion due to their reliance on community-based sources of revenue (e.g., sales and property taxes that lag the pace of energy development). Administrative facilities in the GCW study area generally are adequate to meet current demands.

Local fire protection and emergency medical services were taxed by past growth, particularly in the area of staffing as most of these services are volunteer-based. A common, indirect effect of intense energy or mineral resource development is difficulty in recruiting volunteers, in part because the individual job sites are often outside of the core community(ies) and also because of the level of transiency/mobility in the work force. Local services also are impacted by an increasing share of new development occurring in unincorporated areas of the county.

The existing Ashley Valley Medical Center in Vernal and Uinta Basin Medical Center in Roosevelt, plus the outlying clinics and private health care practices provide health care to residents of the area. Recent growth, including that associated with EOG activities, has increased patient loads and benefitted operations of the hospitals. Both facilities have recently completed or are undergoing facility improvement programs, including expanding their respective emergency medicine facilities and staffing. Alternative A would contribute to, but not dramatically increase demands for local health care facilities and services over approximately a 10-year period.

Both school districts have responded to accommodate rising enrollments, changes in terms of geographic distribution and the needs to update/modernize facilities by completing several new schools and renovating others. Some modular classrooms also are in use to address capacity needs at some elementary schools. Alternative A would contribute to future enrollment needs, but the incremental demands would be expected to be relatively limited given the project-related long-term population gains and the fact that many of the non-local development work force would not be accompanied by families.

The Uintah School District would experience an increase in local revenue generating potential in conjunction with the increased mineral production associated with Alternative A. The revenue generating potential would mirror the projected production (**Figure 4.10-10**), rising for 5 to 6 years, then declining.

Public Expenditures and Revenues

Public Expenditures

County governments, local municipalities, and special service districts in the region budget their staff and budgetary resources to provide services to residents, businesses, and visitors. EOG's presence in the community and its activities under Alternative A would contribute to the needs facing these providers. As detailed above, limited additional temporary and long-term population growth is anticipated as a result of Alternative A. That growth, in and of itself, would be unlikely to trigger needs for staffing increases or expansion of capital facilities, although as a group, local cities and counties may budget for some increases in operating expenditures. Order of magnitude estimates of public expenditures of local, general-purpose government are presented in **Table 4.10-5**, based on the average project-related population effects shown in **Table 4.10-4**, and average annual expenditures of local county and municipal governments over the past 5 years. The amounts shown are the average annual and cumulative expenditures during the 10-year development phase. The annual expenditure requirements would be substantially lower during the production phase.

Table 4.10-5 Local Government General Purpose Expenditures during the 10-Year Development Phase (2014 $), Alternative A

Jurisdiction Type	Average Population Increment (2015 – 2024)	Annual Average Expenditures per Resident[1]	Cumulative Expenditures (2015 – 2024)
Counties (**Table 4.10-4**)	231	$942	$2,176,020
Municipalities[2]	81 (35% of total) [(3)]	$1,045	$846,450

[1] Average per capita general fund and road expenditures by Duchesne and Uintah counties for the period 2010 to 2014, adjusted to $2014 using BLS CPI-U inflation estimates.

[2] Based on combined average annual expenditures per resident in Duchesne City, Roosevelt cities, Vernal, Naples, and Ballard during the period 2010 to 2014, adjusted to $2014 using BLS CPI-U inflation estimates.

[3] Assumption based on share of growth between 2000 and 2010 and overall distribution of population in 2010.

Note: Cost estimates based on average per capita costs that likely overstate the incremental costs to serve population growth.

Sources: Derived using U.S. Census Bureau 2014; U.S. Bureau of Labor Statistics 2014b; Utah State Auditor 2014b.

As a group, the two county and five municipal governments could anticipate expenditures on the order of $302,000 per year, or $3.0 million over the 10 years of development in conjunction with the Alternative A, assuming a continuation of recent expenditure patterns and residential settlement patterns. That total compares to total annual general purpose and road expenditures of approximately $80 million per year currently; an aggregate increase of less than 0.5 percent.

Public Revenues

The four primary units of affected local government, along with the two school districts, would realize additional revenues in conjunction with Alternative A, either directly or indirectly. The state and local governments would realize substantial sales and use tax revenues (not estimated here) levied on many purchases by EOG, as well as consumer expenditures by its employees and those supported indirectly by the project. Uintah County and countywide special service districts are better positioned from a fiscal perspective because of past growth in its property tax base due to energy production. The municipalities, particularly Roosevelt, rely more heavily on sales taxes and are therefore more likely to be adversely affected. Local governments also would realize additional revenues from fees and charges for services.

Despite these revenues, local governments may face fiscal challenges due to jurisdictional mismatches between tax accrual and the timing of needed expenditures, lags in some revenue flows, and competing demands associated with overall growth.

The cumulative value of marketed production over the life-of-field under Alternative A is estimated at $2.20 billion. Estimated property taxes accruing to Uintah County and the Uintah School District would average about $465,200 annually, approximately 32 percent of which would accrue to the County and the remainder to the school district. [4] Cumulative property tax revenues to the two entities would approach $28.0 million over the life of the field (**Table 4.10-6**). The state and local governments also would realize substantial sales and use tax revenues (not estimated here) levied on many purchases by EOG, as well as consumer expenditures by its employees and those supported indirectly by the project.

Table 4.10-6 Selected Major Public Revenues Over the Life of Field, Alternative A

	Annual Average	Cumulative
Value of Marketed Production over the life of the field	$36,743,534	$2,204,248,637
Projected Ad Valorem Tax (Uintah County and School District)	$465,230	$27,909,193
Utah Severance Taxes	$1,346,928	$80,815,700
Total Federal and Tribal Mineral Royalties		
Federal and Tribal allocation of the total	$1,940,918	$116,455,110
State allocation of the total	$1,794,949	$107,696,968
Royalties to the State Permanent Public School Fund	$251,351	$15,081,088
Total Revenue[1]	$5,799,377	$347,958,059

[1] Includes ad valorem and severance taxes, federal and tribal mineral royalties, and royalties to the State Permanent Public School Fund. Sales and use taxes on EOG material and equipment purchases and on local consumer purchases by project-related workers would be substantial during the development phase but have not been estimated.

Severance tax revenues accruing to the State would average about $1.35 million annually, approaching $81 million cumulatively.[5] The state severance tax on oil, except for those taxes collected on certain Indian lands, is credited to the General Fund, where it is subject to legislative appropriation.

FMR revenues, based on a 12.5 percent royalty rate, would be derived on production from federal and tribal mineral estate that, including Tribal Lands held in trust for the Ute Tribe, underlies about 92 percent of the GCWPA. The federal government withholds 2 percent as an administrative and processing fee, then splits the remainder of the revenues with the state in which the production occurred. Royalties on production from Tribal mineral interests are not subject to revenue sharing. Alternative A would yield average annual FMR of about $3.7 million and $224 million cumulatively over the life of the field. Of the

[4] The Utah Property Tax Division values producing gas properties and the taxable value is apportioned to local jurisdictions based on well location. Because projected taxable valuations are not available for this assessment, an “effective tax yield” of 1.4 percent of the value of production, based on analysis of data for past years, was assumed.

[5] The Utah severance tax is based on the value of production. The rate for natural gas is 3 percent of value for the first $1.50 per MCF and 5 percent of value in excess of $1.50. Given the assumed price of $3.65 price per MCF, the effective severance tax rate on EOG gas production is estimated at 4.2 percent. The severance tax rate on oil condensates is 4.0 percent.

cumulative sum, the federal government and Ute Tribe would receive a combined total of about $116 million and $108 million would be disbursed to the state.[6]

The State of Utah allocates 32.5 percent of its share of FMR to the Utah Permanent Community Impact Fund, which provides funds to state agencies and/or local sub-divisions of the state to help address social and economic impacts from mineral development on federal lands. Forty percent of the State mineral lease revenue funds are allocated to the UDOT, which in turn disburses funds to special services districts with preference to counties with significant mining activity on federal lands. The remaining funds are earmarked to other state agencies and programs, and to funding a state PILT program.

Under Alternative A, a total of approximately $384 million would be generated in the form of projected ad valorem taxes, Utah severance taxes, federal and tribal mineral royalties, and royalties to the state Permanent Public School Fund; an average of $5.8 million annually. Future public sector revenues could rise or decline in response to future changes in energy prices. In addition to the contribution of produced energy to meet domestic demands, and the jobs supported in the regional economy, these revenues represent additional benefits of Alternative A.

Non-producing federal oil and gas leases are subject to annual lease fees of $1.50 to $2.00 per acre. These fees are waived for producing leases, replaced by receipts of Federal mineral royalties. There are a number of previously completed producing wells on the leases within the GCWPA. Consequently, no additional annual lease fees would accrue under Alternative A.

As outlined in the formation of the Uinta Basin Energy Zone, the State of Utah, along with Daggett, Duchesne, and Uintah counties promote the full and efficient development of energy and mineral resources in the Uinta Basin and encourage federal land management agencies to implement land and resource management plans and implement management decisions that are consistent with the purposes, goals, and policies to the maximum extent allowed under federal law and to allow continued maintenance and increased development of roads, power lines, pipeline infrastructure, and other utilities necessary to facilitate such development. Among the goals for creating the zone are maximizing taxes, royalties and fees generated by development to support education and other governmental services and programs. Because Alternative A does not promote maximum development of the energy resources, the State and counties would likely view the alternative unfavorably.

Community Social Conditions

Employment and population in most communities of the local study area would experience little change under Alternative A and correspondingly are unlikely to substantially alter community social conditions. The population effects of Alternative A would represent less than one percent of the region's current population.

Some residents of the area may support Alternative A because it would result in less future development than the action alternatives. Other residents and some local officials would be dissatisfied by selection of Alternative A as it fails to more fully develop the resources in keeping with the goals and objectives outlined in the state's establishment of the Uinta Basin Energy Zone. Those same goals and objectives were subsequently incorporated into the Uintah County General Plan (Uintah County 2012).

Activities associated with this alternative have the potential to impact traditional Tribal life-ways, and religious and cultural sites. In such Tribal-sensitive areas, construction, operation, and associated sights and sounds of wells and ancillary facilities could affect the natural character of previously undisturbed

[6] A "temporary" change in the distribution of FMR, to 51 percent to the federal government and 49 percent to the state was approved by Congress. The forecasts in this analysis assume the "temporary" change remains in place for the life of field.

areas and alter the landscape to a more industrialized setting and diminish opportunities for hunting, gathering of plants, and other materials. Specific sites or conflicts have not been identified.

4.10.1.3 Alternative B—Proposed Action

With approval of Alternative B, the Project Applicant would anticipate ramping up its drilling program from one or two rigs under Alternative A to as many as nine rigs to achieve its development target. The expanded level of drilling and development activity would result in additional economic and population growth in the region and also extend the development phase from 10 years to 13 years. This analysis evaluates a total of 2,808 wells for Alternative B, in addition to the more than 1,300 existing wells. Long-term production levels would be higher and the production phase would be extended.

Effects on Socioeconomics and Environmental Justice

Alternative B would result in total direct project spending of more than $11.7 billion (2014 $) by EOG for well development and future operation.[7] The pattern of spending is illustrated in **Figure 4.10-12**. Approximately $7.0 billion of the total expenditures would occur during the 13-year project development phase, $6.0 billion more than under Alternative A. Total anticipated local spending over the life-of-project would be approximately $8.8 billion.

Total production under Alternative B, excluding production from existing wells, is estimated at 6.07 TCF of gas and 86.5 million barrels of oil. Peak annual production would occur 10 years into the project (2025). Production would drop off rapidly thereafter, to less than half the peak level within 8 years (2028) and to approximately 25 percent of the peak in 2038 (**Figure 4.10-13**). Under the assumed well production profile, production would continue to 2058/59. The total value of gas and oil sold into the marketplace would be $20.2 billion in 2014 dollars, with peak annual sales of $929 million.

Employment, Income, and Population

The employment impact of Alternative B is measured by the combined direct and secondary employment. Direct employment includes EOG payroll jobs but consists primarily of jobs with EOG contractors in the drilling and field services industries and, much less so, employees of material and equipment suppliers for the project. Secondary employment includes jobs supported by purchases of goods and services by EOG contractors and suppliers (indirect employment) and the spending of all households that receive project-related income (induced employment) through the multiplier effect. **Figure 4.10-14** shows the projected level of regional employment change associated with the GCW Alternative B.

Employment effects for Alternative B are summarized in **Table 4.10-7**. Total development-related employment would average 591 during the 5 years of highest drilling activity (2018 to 2022) in the study area; 317 direct and 274 secondary. The total would be equivalent to 1.8 percent of the total regional employment in 2012 and would include those jobs that would be in place as part of Alternative A, extending the employment opportunities for most of the workers. Extending those jobs and the associated economic contributions made into the regional economic represents an important economic benefit of Alternative B. The direct employment includes production workers associated with as many as 1,450 new wells brought into production under Alternative B through 2022.

[7] The total includes direct project spending only. EOG spending for leases, development of existing wells and infrastructure, project planning and permitting, and internal management and corporate support provided from other offices, as well as royalties, taxes, and other payments to governments and mineral estate owners are not included. The total does not include future compression and transmission costs.

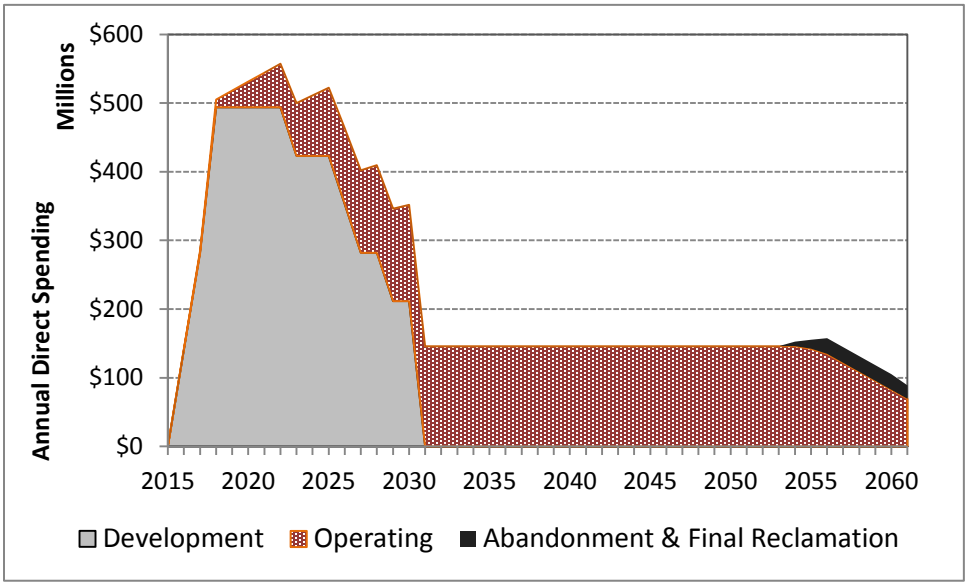


Figure 4.10-12 Projected Direct Investment, Alternative B

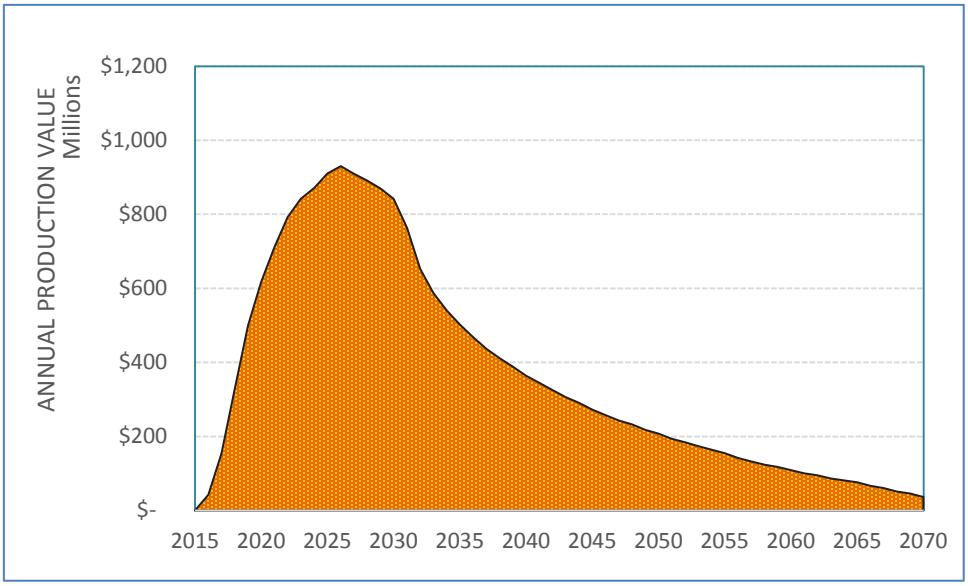


Figure 4.10-13 Annual Value of Production, Alternative B

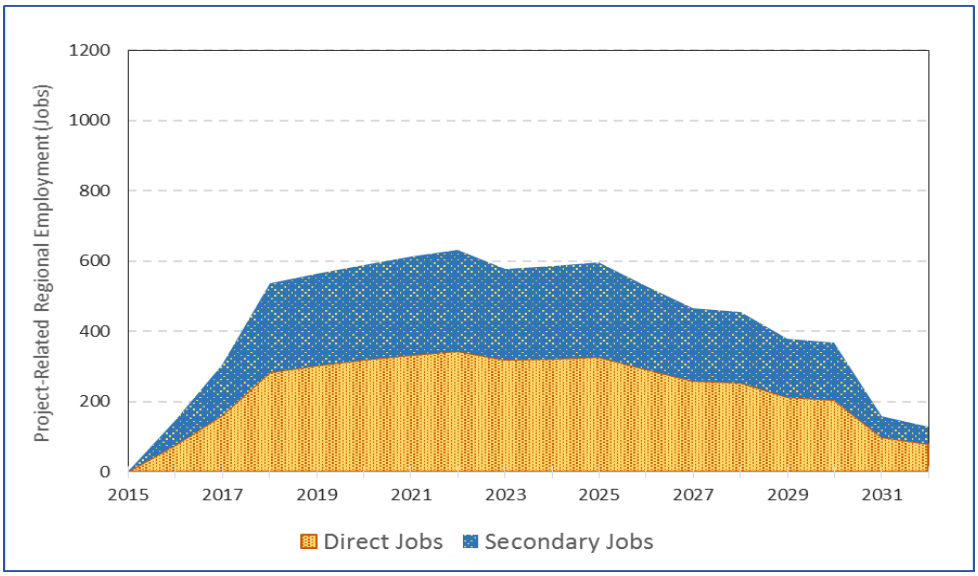


Figure 4.10-14 GCW Project-related Jobs, Alternative B

Table 4.10-7 Development Phase Employment Impacts, Alternative B

Jobs	Development 5-year Average (2018 – 2022) *	Development Average (2016 – 2030)	Post Development (2031)
Direct (average annual)	317	268	98
Secondary (average annual)	274	222	62
Total	**591**	**490**	**160**

[1] Assumes 10 drilling rigs operating during this period.

Total project-related employment would average 490 over the 15-year development phase. The completion of the LGS and other facilities under Alternative A would reduce the level of produced water trucking compared to what it would have otherwise been. Short-term construction employment also would be lower.

Long-term employment associated with ongoing production is estimated at 160 jobs immediately following the completion of development. That employment would then decline over time as production falls. Project-related demand for labor would contribute to an increase in hiring of qualified available workers from the local labor market, and potentially trigger temporary and long-term migration of labor into the region.

Field operations and maintenance to support continued production following the completion of development would initially support an estimated 160 jobs across the region, 98 direct and 62 indirect and induced. That number would decline gradually over time as production and the number of producing wells declines. A small amount of temporary employment would be created in the future to complete abandonment and final reclamation efforts. The timing and magnitude of those jobs is unknown at this time.

The wage and salary income of workers and business owners, whose jobs and business activities are directly and indirectly supported by Alternative B, would increase under Alternative B. Gains in personal income would be substantially higher during the development than during the long-term production phase. The wages and salaries of individual workers would be higher for workers in the energy industry, but the distribution of incomes would correspond to the range incomes presently located in the region and the overall increase in personal income would be comparable to the relative increase in employment. Although many local businesses would realize additional revenues from sales to non-local workers who relocate to take advantage of the job opportunities associated with Alternative B, a substantial portion of their labor income would flow to their permanent place of residence.

Employment gains associated with Alternative B, when combined with the tight labor market, would trigger moderate population growth and demand for both conventional and temporary housing in the region. Most of the growth inducing effects of Alternative B would occur over a 3- to 4-year period, creating another expansionary period in the local economy as the pace of development increases and the number of active rigs increases from 2 under Alternative A to as many as 10.

The estimated project-related incremental population during development would average 911, the equivalent of 1.6 percent of the region's current population. That level of growth would spawn demand for more than 220 additional conventional housing units (**Table 4.10-8**), along with demand for 378 temporary accommodations. Temporary accommodations would include spaces for worker-owned RVs, rooms in rig or other temporary worker camps, and motel rooms. The conventional housing demand represents about one-third of the average yearly construction of new homes in the region in recent years. The existing inventory of more than 1,400 rooms and RV spaces and new facilities under construction provide capacity that would meet some or most of the demand for temporary accommodations, depending on the overall level of development activity in the region, and demand from tourism and travel markets.

Table 4.10-8 Employment, Population, and Housing Demand Impacts, Alternative B

	Development 5-year Average (2018 – 2022)	Development Average (2016 – 2030)	Production (2031)
Project Related Jobs			
Filled Locally	59	47	13
Temporary/Long-term Relocations	528	442	70
Incremental Population			
Non-local Temporary Workers	368	199	66
New Long-term Residents	730	712	222
Total	**1,068**	**911**	**288**
Incremental Housing Demand			
Temporary (Rig camp/RV/Motels)	276	235	49
Conventional (Apts/Mobile homes/Houses	202	173	64
Total	**478**	**408**	**113**

The higher level of development under Alternative B would be sustained for approximately 5 years, augmented by the employment effects attributable to rising production. Development related effects would subsequently decline over a period of years as the number of active rigs and new wells drilled decline. Production related employment would continue climbing for several years, and also then

decline. As a result, the total project-related employment, population, and housing demand would be expected to decline beyond 2025.

The period of initial expansion in years 3 and 4 of the development program would likely be characterized by inflows of temporary residents instead of permanent immigration. Whether because of the industry's occupational requirements (rotational and transient crews), housing availability (scarcity of appropriate type or price), lifestyle preference (invested elsewhere, "footloose" by choice), or economic expectations (job permanence, job mobility), a percentage of those employed in development activity under Alternative B would not reside permanently in the region. Over time, a sustained level of activity and rising production-related labor needs would promote more permanent residency.

Grazing

Development under Alternative B would result in an estimated short-term annual reduction of up to 145 AUMs of available forage, 70 AUMs fewer than under Alternative A. Those reductions would be in addition to reductions tied to existing disturbance and that associated with site-specific Alternative A development such that the maximum overall loss under Alternative B is estimated at 720 AUMs of range carrying capacity (see Section 4.12). Long-term reductions in forage availability and carrying capacity over the life of the field, including allowances for the re-establishment of adequate forage following interim and final reclamation, is not estimated due to uncertainties regarding the timing for successful reclamation. Reductions in grazing levels, along with the potential effects on livestock mortality and reduction in productivity due to fragmentation, would likely translate to reductions in revenue for operators. The reductions would materialize over time. Although relatively limited in the context of the region's overall economic output, the effects to the economic well-being of one or more individual operators could be non-trivial.

In addition to any direct effects on grazing associated with the loss of forage, the simultaneous occurrence of energy development and grazing may impact ranching operations in other ways (e.g., requiring additional herd management and fence maintenance). The net effect of such impacts could diminish the economic value of grazing to an operator, potentially to a point that renders the entire grazing permit uneconomical. In such instances, the net economic loss to the individual operator would be greater than the incremental loss in AUMs described above. The net loss in agricultural income could then accrue to the overall economy unless another operator subsequently applies for and receives the grazing privileges or changes in grazing management (e.g., combining the affected allotment with another allotment) are implemented to sustain the economic viability of grazing.

Recreational Use and Tourism

The effects on the levels of dispersed recreation, including rafting, OHV use, and hunting and fishing in the GCWPA would be greater under Alternative B than under Alternative A. The levels of disturbance, traffic, awareness of industrial activity, and restrictions related to proximity to energy facilities would all be higher at any given time. The impacts could affect the quality of life of area residents as well as that of non-residents used to recreating on public lands in the area. The level of impact is indeterminate but thought to be minor given the lesser extent, type, and quality of recreation resources within the GCWPA compared to others in the region and the relatively light general recreation use of public lands in the area. Decreases in the allowable level of upland hunting, which is managed by the UDWR, and changes in the level of rafting on the White River could result in less tourism and recreation spending in the regional economy. The adverse effects on recreation users could affect parts of the economy that benefit from recreation and cultural tourism. The level of impact is indeterminate but thought to be limited given the type and quality of recreation access and resources in the GCWPA as compared to other locations in the region.

As noted in Section 3.8.5.1, Housing, the GCWPA region has approximately 900 motel rooms and 500 commercial RV spaces (some year-round and some seasonal), and several new motels were under

construction in the fall of 2014 (the base period for the affected environment). The local lodging industry has been adversely affected by the slowdown in drilling activity.

Local recreation and tourism economies can be affected indirectly by oil and gas industry development if lodging is absorbed by workers and recreation and tourism visitors are displaced. As noted in Section 3.8.5.1, Housing, the GCWPA region has approximately 900 motel rooms and 500 commercial RV spaces (some year-round and some seasonal) and several new motels were under construction in the fall of 2014 (the base period for the affected environment). The local lodging industry has been adversely affected by the slowdown in drilling activity.

Community Facilities and Services

Health Care

Faced with demands associated with past population growth and industrial demands associated with the energy and mineral resource industries, the two hospitals in the region recently completed or are currently involved in capital facility improvement projects to meet the current and future health care needs of the region's residents and temporary labor force, including growth such as that associated with Alternative B. Emergency rooms would see increases in the number of clients, as would emergency medical providers, including local air ambulance/medivac services. At the same time, the hospitals face challenges in recruiting physicians, nurses, other health care staff and administrative staff due to the rising housing costs and competition for labor. They also may face increased turnover if adequate staffing levels are not maintained. Private medical and dental providers also would experience increases in demand for service, which depending on their ability to recruit and retain staff could be a benefit or a negative impact.

Water and Wastewater

Project-related growth, in particular the demand for residential development, would increase the demand for water and wastewater services in the region. Development in some rural areas can be served by individual wells and septic systems, but the development in subdivisions would affect several local municipal and special district providers. Capital improvement planning and expansion projects in the region are moving forward in order to provide capacity to meet the anticipated needs. Tap fees and future service fees associated with new development would help fund the improvements and ongoing service provision.

Public Safety

Given past local experience with energy related development, county and municipal law enforcement agencies are familiar with the impacts of rapid growth. Although past experience may help them anticipate these effects, local law enforcement agencies may need to increase staffing, particularly the number of uniformed officers, as well as expand their motor vehicle fleets. From a fiscal perspective, Uintah County is better positioned than Duchesne County or local municipalities due to its more-extensive tax base and revenues from current and ongoing energy resource development. Uintah County has taken advantage of its growing tax base to complete a new law enforcement/judicial center providing administrative, communications and detention facilities to meet demands for the foreseeable future.

Population growth, additional residential development in unincorporated areas, increases in the level of industrial development, and increases in the number of motor vehicle accidents and other emergency medical calls would all contribute to additional pressures on local fire protection and emergency medical providers in the region. These pressures, coupled with the difficulty in recruiting and retaining volunteers, could factor into deliberations by some providers to add paid staff or become paid professional departments.

Schools

Alternative B would result in more students enrolling in public schools. Enrollment gains linked to the development phase would be relatively low as many of the workers would be single status, that is, unaccompanied by families. Production-related workers are more likely to be resident households with children. As a result, although there would be fewer production workers, the number of school age children could be comparable or even higher than the number associated with development workers. Over time the number of project-related school children enrolled in local schools could rise to the 75 to 125 range, with the total distributed across the two districts and across the grade spectrum. The upper-end of the range corresponds to approximately 1 percent of the current combined enrollments of the two districts.

The local school districts engage in ongoing facility, staffing, and curriculum planning. Both districts have undertaken construction and facility remodeling programs to accommodate growth. Furthermore, both have seen expansion in their local ad valorem tax base as a result of past energy resource development. Alternative B would help sustain that base in the face of future production declines from existing wells across the region. At the same time, past experience suggests that considerable uncertainty accompanies rapid growth in terms of the number and grade distribution of school age children, which can result in dramatic year-to-year shifts in enrollments. A higher degree of transiency among students and staff also creates additional challenges for public education.

Public Expenditures

Order of magnitude estimates of public expenditures of local, general-purpose government are presented in **Table 4.10-9**. The estimates are based on the average project-related population effects shown in **Table 4.10-10**, and the average inflation adjusted annual per resident expenditures of the county and municipal governments over the past 5 years. The incremental population growth under Alternative B is 712 residents. In and of itself, that growth, although triple that under Alternative A, would be unlikely to trigger needs for staffing increases or expansion of capital facilities by local governments, although as a group the local cities and counties may budget for some increases in operating expenditures.

Table 4.10-9 Local Government General Purpose Expenditures during the 15-year Development Phase (2014 $), Alternative B

Jurisdiction Category	Average Population Increment (2016 – 2030)	Annual Average Expenditures per Resident[1]	Cumulative Expenditures (2016 – 2030)
Counties (**Table 4.10-8**)	712	$952	$10,060,560
Municipalities[2]	249	$1,045	$3,903,075

[1] Average per capita general fund and road expenditures by Duchesne and Uintah counties for the period 2010 to 2014, adjusted to $2014 using BLS CPI-U inflation estimates.

[2] Based on combined average annual expenditures per resident in Duchesne City, Roosevelt cities, Vernal, Naples, and Ballard during the period 2010 to 2014, adjusted to $2014 using BLS CPI-U inflation estimates.

Note: Cost estimates based on average per capita costs that likely overstate the incremental costs to serve population growth.

Sources: U.S. Census Bureau 2014; U.S. Bureau of Labor Statistics 2014a; Utah State Auditor 2014b.

Table 4.10-10 Selected Major Public Revenues over the Life of Field, Alternative B

	Annual Average	Cumulative
Value of Production over the life of the field (undiscounted)	$355,783,359	$20,223,258,045
Projected Ad Valorem Tax (Uintah County and School District)	$4,504,767	$256,057,692
Utah Severance Taxes	$13,151,630	$749,642,900
Total Federal and Tribal Mineral Royalties		
Federal and Tribal allocation of the total	$19,001,569	$1,084,468,851
State allocation of the total	$17,572,533	$1,002,910,083
Royalties to the State Permanent Public School Fund	$2,463,862	$140,440,121
Total Revenue[1]	**$56,694,361**	**$3,233,519,647**

[1] Includes ad valorem and severance taxes, federal and tribal mineral royalties, and royalties to the State Permanent Public School Fund. Sales and use taxes on EOG material and equipment purchases and on local consumer purchases by project-related workers would be substantial during the development phase but have not been estimated.

Note: The revenues shown would include those associated with undrilled wells from Alternative A that are subsumed into Alternative B assuming approval of Alternative B.

Current general purpose expenditures by the two counties, including road and bridge maintenance, average about $952 per resident. Average expenditures across the five incorporated municipalities average about $1,045 per resident. Assuming continuation of those expenditures, a reasonable assumption given the projected population gain of less than 1.5 percent associated with Alternative B, the average annual expenditures across the 7 local governments would average $931,000 per year, the equivalent of 1.1 percent of the combined annual total base expenditures of approximately $80 million per year. Over the 15-year development phase, the incremental general purpose expenditures would total $13.96 million. The annual expenditure requirements would be substantially lower during the production phase.

Considering the location of the GCWPA, highway accessibility, temporary and conventional housing inventories, retail and consumer oriented services, size of community, and other factors, suggests that Uintah County and the City of Vernal would experience the largest shares of the expenditure effects. For the county, the largest shares of the expenditure impact would be expenditures to fund general government, public safety, public health and roads and bridges. In Vernal the spending impacts would mostly represent the costs of general government, public safety, streets, and recreation.

Public Revenues

Property taxes, severance taxes, and FMR revenues are three important sources of local and state public revenue that would respond directly to development under Alternative B because they are based on the value of production. The state and local governments also would realize sales and use taxes levied on the company's material and equipment purchases, as well as on consumer expenditures by workers whose jobs are directly and indirectly supported by Alternative B.

The projected value of marketed production under Alternative B would average approximately $356 million per year and $20.2 billion cumulatively over the life of the field. The projection was derived by multiplying annual field production estimates by $3.85 per MCF of natural gas and $84 per barrel of oil (2014 dollars). All of the wells would be located in Uintah County. **Table 4.10-10** summarizes the selected revenue streams over time.

Future production under Alternative B would provide substantial contributions to the ad valorem tax base of Uintah County and the Uintah School District. The expansion of the tax base would be more than a nine-fold multiple of that under Alternative A. Based on Fiscal Year 2013 tax rates, anticipated tax

payments to Uintah County and the Uintah School District under Alternative B would average $4.5 million annually; 32 percent of the total accruing to the county, the remainder to the school district. Duchesne County, the city of Vernal, and other local jurisdictions would realize gains in their respective tax bases from new residential and commercial development.

Severance tax revenues accruing to the State from Alternative B would average $13.1 million annually and approach $750 million cumulatively over the life of the field. That revenue would be in addition to the revenues associated with the existing wells and those drilled and completed under Alternative A. These revenues would accrue to the state's general fund, supporting statewide government and services.

Approval and implementation of Alternative B would yield more than $2.0 billion in cumulative FMR over the life of the field, averaging approximately $36.6 million annually; based on the projected production and assumed prices. Nearly $1.1 billion would accrue to the federal treasury and Ute Tribe and $1.0 billion would be disbursed to the state. Approximately $325 million of the state's allocation would accrue to the Permanent Community Impact Fund, more than $400 million to the UDOT, with the remaining funds earmarked to other state agencies and programs, and to funding a state PILT program.

Public education in Utah also would realize significant fiscal benefits under Alternative B due to royalties received from production on state lands that would accrue to the SITLA. Based on the approximate state ownership interests in the GCWPA, more than $140 million in such royalties would result during the life of the field.

Under Alternative B, a total of $3.2 billion would be generated in the form of projected ad valorem taxes, Utah severance taxes, federal and tribal mineral royalties, and royalties to the state Permanent Public School Fund; an average of $56.7 million annually (**Figure 4.10-15**). This sum is more than nine times the sum under Alternative A.

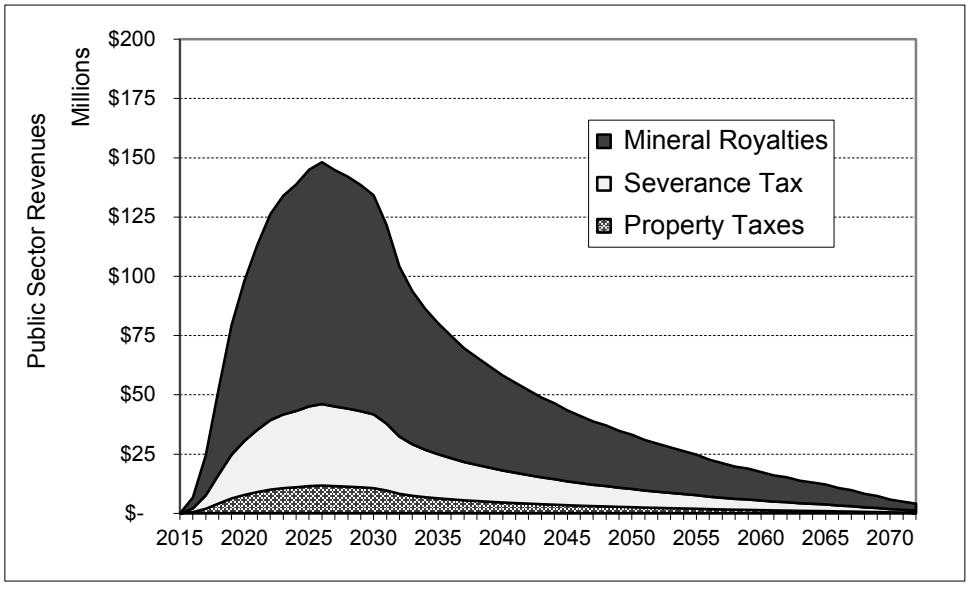


Figure 4.10-15 Major Public Sector Revenues, By Year, Alternative B

The BLM's annual lease revenues in the Uinta Basin would be unaffected by Alternative B. Such fees are due on non-producing leases, but are waived for producing leases when Federal mineral royalties are received. The leases comprising the GCWPA are considered producing due to existing wells within the GCWPA, as well as those to be completed under Alternative A.

Future changes in energy prices would flow through to public sector revenues; higher prices resulting in higher revenues, lower prices yielding lower revenues. The effects of price changes on revenues would be relatively proportional in the short term. The net effect of prices changes over the long term would reflect a combination of pricing and the quantity of natural gas and condensates sold at any given price. In addition to the contribution of produced energy to meet domestic demands, these revenues represent additional benefits of Alternative B that would accrue over an extended period.

Sales and use taxes on purchases of taxable goods in the region by EOG, plus retail purchases of contractors and employees, also would be collected by jurisdictions in Duchesne and Uintah counties. All county and municipal jurisdictions in the local study area for socioeconomics assess the local option sales tax of 1 percent. The state sales tax is 4.75 percent.

Community Social Conditions

Some aspects of community social well-being can be disrupted during periods of rapid growth or decline, though not all dimensions of well-being are affected by such rapid change. Also, if social well-being is adversely affected by boom growth, studies in natural-resource driven communities, including in Utah, have found that disruptive effects may not last once stability is re-established (Smith et al. 2001).

Under Alternative B, growth pressures would mount in the local study area, especially during years 3 through 5 of the development phase. The pace of growth would then moderate over the ensuing decade as the pace of development declines and the number of jobs supported declines.

Potential adverse effect to existing residents of the region could include declines in personal feelings of satisfaction with affected communities as places to live during the most rapid periods of growth. The disruptive consequences of boom growth that "occur in some places, during some growth periods, and for only some segments of the local population" (Smith et al. 2001), are related to perceptions of the friendliness, neighborliness, and trustworthiness of other residents; security, safety and risk of victimization by crime; and how satisfying community life is in general, all of which can be adversely impacted for existing residents by the growth and change brought on by a relatively large wave of development (Smith et al. 2001).

A period of renewed social disruption would occur at the end of the development phase, but community social well-being likely would rebound during the extended production period. A factor that could moderate some of the adverse effect on social well-being is the fact that the local community has experienced these changes in the context of oil and gas development over the past 20 years. The past experience has resulted in a relatively high level of social integration of newcomers related to the oil and gas industry, which has resulted in a resident population relatively adaptable to the social effects of natural resource development. This is reinforced by the general understanding that commitment to "public lands resource extraction ... [is] the mainstay of our employment and tax base" (Uintah County 2005).

Activities associated with this alternative have the potential to impact traditional Tribal ways of life, and religious and cultural sites. In areas that are important to affected Tribes, construction, operation, and associated sights and sounds of wells and ancillary facilities could affect the natural character of previously undisturbed areas, alter the landscape to a more industrialized setting and diminish traditional opportunities for hunting, gathering of plants, and other materials. Specific sites or conflicts have not been identified; however, the potential for conflict would be higher due to the increased density of development than under Alternative A.

4.10.1.4 Alternative C—Resource Protection (BLM-Preferred)

Under the Resource Protection Alternative, the total number of additional wells and assumed pace of development would both be the same as under Alternative B. Consequently, the number of new wells drilled, completed and put into production each year, a critical driver for the socioeconomic assessment, also would be the same as under Alternative B. Some differences in costs, labor utilization, and other dimensions of well drilling and completion are anticipated as a result of fewer but larger multi-well pads employing directional drilling.

The net magnitude and extent of the differences is uncertain due to potential trade-offs in different activities, for example, more labor associated with drilling but less effort involved in rig moves and mobilization. Consequently, there is no substantive basis to differentiate between the socioeconomic impacts of Alternative C from those for Alternative B in terms of the intensity of development pressure in the region, population growth, and attendant implications for housing demand, public school enrollment, and demands on public services and facilities. Production related public sector revenues also would be comparable, both on an average annual basis and cumulatively, because the differences in well pad density are not anticipated to affect overall resource recovery. The surface occupancy limitations associated with Alternative C would limit accessibility to some locations on federal surface along the White River. In some instances resource recovery could be achieved from nearby locations. Consequently the ultimate effects on the timing and extent of actual reductions in development of these resources is unknown.

Estimated short-term loss of up to 113 AUMs of forage for grazing would occur under this alternative. Including reductions due to existing disturbance, increased allotment fragmentation, and site-specific Alternative A development, total net loss of up to 688 AUMs in carrying capacity could occur (see Section 4.12). Long-term loss also would be less than under Alternative B. The resulting effects on ranch income would be of limited magnitude and limited significance within the context of the regional agricultural economy, although the effects on an individual operator or operators could be more severe, particularly if an operator has experienced additional losses due to existing development or that under Alternative A.

4.10.1.5 Alternative D—Other Protections Alternative

Under the Other Protections Alternative, the total number of additional wells and assumed pace of development would both be the same as under Alternative B. Consequently, the number of new wells drilled, completed and put into production each year, a critical driver for the socioeconomic assessment, also would be the same as under Alternative B. Some differences in costs, labor utilization, and other dimensions of well drilling completion are anticipated as a result of fewer but larger multi-well pads employing directional drilling.

The net magnitude and extent of the differences is uncertain due to potential trade-offs in different activities, for example, more labor associated with drilling but less effort involved in rig moves and mobilization. Consequently, there is no substantive basis to differentiate between the socioeconomic impacts of the Other Protections Alternative from those for Alternative B in terms of the intensity of development pressure in the region, population growth, and attendant implications for housing demand, public school enrollment, and demands on public services and facilities. Production related public sector revenues also would be comparable, both on an average annual basis and cumulatively. Based on current technology and understanding of the geology in the area, the surface occupancy limitations associated with Alternative D could limit accessibility to some federal surface and potential reduce the number of bottomhole locations to federal minerals. Any such reductions would result in corresponding reductions in federal mineral development royalties and state and local taxes associated with development and production. The timing and extent of actual reductions in development of these resources is unknown.

Estimated short-term annual loss of up to 119 AUMs of forage for grazing would occur under Alternative. Total short-term loss of range carrying capacity, including that from existing and site-specific Alternative A development, could reach 694 AUMs (see Section 4.12). Long-term loss also would be less than under Alternative B. The resulting effects on ranch income would be of limited magnitude and limited significance within the context of the regional agricultural economy.

4.10.2 Alternative-specific Design Features and Mitigation

No additional mitigation measures for economic and social values have been identified; therefore, no review of mitigation effectiveness has been made.

4.10.3 Residual Effects

No additional mitigation measures have been identified for economic and social values; therefore the residual effects include all of the impacts described above.

4.10.4 Irretrievable and Irreversible Commitment of Resources

Development and production of the energy resources located in the GCWPA would require the investment of human, natural, and monetary resources. Most of those investments would be irretrievable and also may preclude or foreclose opportunities associated with other alternatives. Meeting the demands for goods and services directly and indirectly associated with the project, for example, the commitment of natural and other resources to housing or gravel and asphalt to build and maintain highways, also would be irreversible.

4.10.5 Relationship of Short-term Use to Long-term Productivity

Development and production of the energy resources located in the GCWPA would provide economic support for local households. Communities would benefit from additional investments and public entities, including the federal, state, Ute Tribe, and local governments, would derive revenues from the economic activities. Development of these resources also would benefit residential, commercial, and industrial consumers outside the region. Some of the infrastructure put in place to serve this project also may support future production and distribution of energy resources from other deposits in the region or nearby.

Higher development and production rates in the short term, however, carry with them potential trade-offs in social and economic conditions when compared to those that would exist assuming lower, more sustained development and production levels over a longer time horizon. Furthermore, the consumption of the energy resources in the short term precludes use at a future time. Which of these futures is preferable is largely a matter of individual preference, particularly as the alternatives affect different groups of individuals over time.

4.11 Environmental Justice

4.11.1 Direct and Indirect Effects

4.11.1.1 Alternative A—No Action

Continuing production and some additional development activity is foreseen within the GCWPA under Alternative A. The GCWPA encompasses a vast, largely unpopulated and undeveloped area in south-central Uintah County, characterized by substantial existing oil and gas development. The latter includes many producing wells, gathering lines, resource roads, and field compression and water disposal facilities. A few residents live on scattered farms and ranches in the general vicinity of the GCWPA, on the Ouray National Wildlife Refuge, and a small cluster of residences are located in Ouray, site of the former Reservation agency. Randlett CDP, with a population of 224 in 2000, is the nearest community of any substantial size to the GCWPA, located approximately 10 linear miles to the northwest. The Fort Duchesne and Whiterocks CDPs, the two other identified communities warranting consideration under the environmental justice criteria, are even more distant from the GCWPA.

The spatial separation between these communities and the GCWPA, combined with other factors, supports a determination of no environmental justice effects under Alternative A. The other factors include no adverse environmental impacts of concern extending outside the GCWPA and avoidance of these communities by the primary highway access routes from the oil and gas industry's major service centers and staging areas in Vernal and Naples.

Given the nature and depths of the shallow and deep aquifers described in Section 3.4, and the regulatory conditions applied to well drilling, completion, and produced water disposal as described above, no impacts to shallow water supply aquifers in the Bonanza or Ouray areas would be anticipated. According to the Utah Division of Water Rights database, no registered water wells in the Ouray vicinity are used for drinking water. Therefore, the likelihood of impacts to surrounding communities is not anticipated and there would be no disproportionate impact to minority or low-income communities.

Results of near-field air quality modeling are described in Section 4.3. Those results indicate that concentrations of pollutants would be below the NAAQS within the GCWPA boundary. Therefore, adverse environmental effects of concern for environmental justice extending beyond the GCWPA are not anticipated. The BLM notes that ozone exceedances have been observed at monitoring stations in the Uinta Basin near Ouray and Redwash. These impacts are regional in scale and would not disproportionately impact communities with low-income or minority populations.

Finally, the Ute Tribe would receive royalty revenues on current and future oil and gas production from Tribal minerals under Alternative A that may be used to further the Tribe's economic development and diversification goals. Future development under Alternative A may support employment for some members of the Tribe under the Ute Tribal Employment Rights policy and the Tribe's mineral interests in the GCWPA.

4.11.1.2 Alternative B—Proposed Action

Although Alternative B would increase levels of future natural gas development and production activities within the GCWPA, the fact that it is an infill development means that the project would not alter the fundamental spatial, economic, and demographic relationships used to assess potential economic justice effects with respect to the three minority and low-income communities; the Whiterocks, Fort Duchesne, and Randlett CDPs. Although additional well pads would be developed in the GCWPA, Alternative B would not reduce the distances or alter the intervening land uses that effectively buffer those three communities from existing and future gas development in the GCWPA. The volume of truck traffic accessing the GCWPA would increase under Alternative B and residents living along the travel corridors would experience increases in traffic and traffic-related effects. However, the bulk of the truck traffic would occur on existing public highway access routes that avoid the three identified communities. Similar

to that discussed under Alternative A, near-field modeling does not predict air quality impacts from Alternative B beyond the GCWPA boundary; therefore, adverse impacts for environmental justice are not anticipated.

Potential growth-related social and economic impacts associated with Alternative B would be higher and continue over a longer duration than under Alternative A. Such impacts would have both beneficial and adverse dimensions, most of which would be focused in the Vernal and Naples area. Disproportionately high and adverse effects would not be anticipated in the three potentially affected minority and low-income communities.

The Ute Tribe would realize higher royalties on oil and gas production from Tribal mineral interests under Alternative B than under Alternative A. Future development under Alternative B may support employment for some members of the Tribe under the Ute Tribal Employment Rights policy and the Tribe's mineral interests in the GCWPA.

The spatial separation between these minority and low-income communities and the GCWPA, and the absence of adverse environmental effects, supports a determination of no environmental justice effects for Alternative B. Even were such environmental effects identified, prevailing wind patterns, the reliance on existing highway routes for project access, geographic distribution of the population, and Tribal participation in oil and gas development activity together support a negative determination of disproportionately high effects to potentially affected minority and low-income populations given their places of residency relative to the GCWPA.

4.11.1.3 Alternative C—Resource Protection Action (BLM-preferred)

The environmental effects under Alternative C, when considered in conjunction with the project location, geographic distribution of population, prevailing wind patterns, the reliance on existing high routes for project access, and Tribal participation in oil and gas development activity together support a negative determination regarding disproportionately high effects to potentially affected minority and low-income populations in the region. Tribal royalty revenues from production from Tribal mineral interests would be comparable to those under Alternative B; both of which would be substantially higher than under Alternative A. Employment opportunities for members of the Tribe also would be comparable to those under Alternative B.

4.11.1.4 Alternative D—Other Protections Action

No disproportionately high and adverse environmental effects to minority and low-income population would be anticipated under Alternative D. Tribal royalty revenues from production from Tribal mineral interests would be comparable to those under Alternative B; both of which would be substantially higher than under Alternative A. Employment opportunities for members of the Tribe also would be comparable to those under Alternative B and Alternative C.

4.11.2 Alternative-specific Design Features and Mitigation

No additional mitigation measures for environmental justice values have been identified; therefore, no review of mitigation effectiveness has been made.

4.11.3 Residual Effects

No additional mitigation measures have been identified for environmental justice values; therefore the residual effects include all of the impacts described above.

4.11.4 Irreversible/Irretrievable Commitment of Resources

Development and production of the energy resources located in the GCWPA would require the investment of human, natural, and monetary resources. Most of those investments would be irretrievable and also may preclude or foreclose opportunities associated with other alternatives. Meeting the demands for goods and services directly and indirectly associated with the project, for example, the commitment of natural and other resources to housing or gravel and asphalt to build and maintain highways, also would be irreversible.

4.11.5 Relationship of Short-term Use to Long-term Productivity

Development and production of the energy resources located in the GCWPA would provide economic support for local households. Communities would benefit from additional investments and public entities, including the Ute Tribe, would derive revenues from the economic activities. Some of the infrastructure put in place to serve this project also may support future production and distribution of energy resources from other Tribal deposits.

Higher development and production rates in the short term, carry with them potential trade-offs in social and economic conditions for the Tribes and their members when compared to those that would exist assuming lower, more sustained development and production levels over a longer time horizon. Furthermore, the consumption of the energy resources in the short term precludes use at a future time. Which of these futures is preferable is largely a matter of individual preference, particularly as the alternatives affect different groups of individuals over time.

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4.12 Livestock Grazing and Rangeland Health Standards

4.12.1 Direct and Indirect Effects

Grazing Allotments

The GCWPA overlies portions of six BLM and two BIA/Tribal grazing allotments. Principal direct effects to livestock and grazing involve the temporary loss of forage and reduction in grazing land carrying capacity (loss of AUMs) until completion of successful interim reclamation. Re-establishment of forage cover of density and species diversity similar to that prior to disturbance is difficult in the Uinta Basin due to drought conditions, infestations of invasive species, and generally poor soils. Successful reclamation can take at least 5 years or more. Long-term forage loss would apply for facilities, such as well pads and access roads that remain for the life of project, which may be more than 40 years.

Other effects may include temporary damage to range improvements (damage to fences, cattle guards, and stock ponds, etc.), increased fragmentation of forage habitat, and potential stock loss from such causes as vehicle collisions. Indirect effects would include possible downstream transport of sediment in intermittent streams used for stock watering purposes and dust transport onto forage plants. Surface disturbing activities also increase the potential for introduction of invasive species which can replace the previous forage cover. Particular concerns would be the spread of *Halogeton*, which can be poisonous to sheep and cattle, and cheatgrass. These effects to specific grazing allotments are expected, in general, to be proportional to the levels of disturbance and to the acreage of each allotment within the GCWPA.

The temporal nature of activities is important in determining the magnitude of effects. All of the allotments, with the exception of White River Bottoms, have seasonal use periods that overlap sheep and cattle birthing cycles. Noise, intrusion, and other effects from construction and drilling activities could result in the disturbance of, particularly, lamb and ewe pairs and increased lamb mortality.

Because the final locations of most facilities is not currently known, most individual allotment effects have been analyzed assuming a proration of surface disturbance by the proportion of the allotment acreage within the GCWPA. For the action alternatives, the general locations of new well pads and related facilities are known and effects from these developments have been assigned to the appropriate allotment. For Alternatives C and D, development restrictions in some areas have been incorporated in determining the surface disturbance for an individual allotment.

A summary of estimated acres of forage loss and reduction in range carrying capacity is included in **Table 4.12-1**.

Rangeland Health

As indicated in Section 3.12, the VFO has identified a number of problems associated with meeting the rangeland health standards (**Appendix S**). The most common issues include invasive species and conflicts with seasonal use, principally due to the existing heavy levels of oil and gas development, particularly within the Seven Sisters Allotment. Dry forage productivity over 85 percent of the non-Tribal surface in the GCWPA is very poor, with 400 pounds per acre per year, or less (**Table 4.12-1**). A projection of range productivity mapping onto Tribal lands using soils and vegetative cover mapping suggests that the bulk of the BIA Chipeta Grove allotment within the GCWPA also is likely to have very poor forage productivity. Additional surface disturbance to already heavily industrialized and challenged rangeland will increase the difficulties associated with meeting the rangeland health standards.

Table 4.12-1 Range Estimated Short-term Forage and Carrying Capacity Loss by Alternative and Allotment

Allotment Name	Acres per Active AUM [1]	Stock	Prorated Lost Forage (acres)	Lost AUMs	Prorated Lost Forage (acres)	Lost AUMs	Prorated Lost Forage (acres)	Lost AUMs	Prorated Lost Forage (acres)	Lost AUMs	Prorated Lost Forage (acres)	Lost AUMs
			Existing [2]		Alternative A [3]		Alternative B [4]		Alternative C [5]		Alternative D [6]	
BLM												
Antelope Draw	13.9	Sheep	930	67	728	52	565	41	408	29	390	28
Bonanza	12.7	Sheep	11	1	88	7	204	16	113	9	131	10
Coyote Wash	10.7	Sheep	935	88	725	68	571	54	444	42	484	45
Olsen AMP	11.1	Sheep	8	1	27	2	7	1	7	1	0	0
Seven Sisters	8.4	Sheep	1,486	177	668	80	203	24	207	25	234	28
White River Bottoms	3.4	Cattle	0	0	13	4	3	1	3	1	0	0
BIA/Tribal												
Chipeta Grove	36.4	Horses	567	16	413	11	316	9	325	9	357	9
Molly's Nipple	26.9	Cattle	33	1	23	1	6	0	6	0	0	0
Unassigned Acreage			0	0	0	0	0	0	0	0	0	0
TOTALS	**~ 11,7**		**3,970**	**350**	**2,685**	**225**	**1,875**	**145**	**1,514**	**115**	**1,595**	**121**

[1] More thorough and current data are available for BLM allotments and have been used to estimate average GCWPA-wide acres/AUM.

[2] Existing effects were prorated by existing well pad count.

[3] Effects for Alternative A were prorated by allotment acreage among all allotments.

[4] Effects for Alternative B accounted for potential new well pad locations. Other effects were prorated by allotment acreage.

[5] Effects for Alternative C accounted for potential new well pad locations.

[6] Effects for Alternative D accounted for potential new well pad locations and alternative-specific restrictions.

Sources: BLM 2014a; Pingree 2014.

Maintenance and recovery of rangeland health within the GCWPA can be advanced by careful adherence to the standards and monitoring deviations from the standards. Successful reclamation is the key indicator for recovery of proper range function and compliance with the VFO reclamation guidelines is a critical component of a successful management plan for maintaining and improving function in the GCWPA. However, because of the reclamation difficulty within the Uinta Basin, even with approved reclamation techniques, extended reduction in range carrying capacity (5 or more years for interim reclaimed areas and 40 or more years for life of project facilities) is very likely.

4.12.1.1 Alternative A—No Action

Implementation of Alternative A would result in the drilling of up to 462 new wells from up to 425 new well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 2,685 acres, or 6.2 percent of the GCWPA. This alternative would result in a short-term loss of forage of approximately 225 AUMs. Including existing disturbance, approximately 6,660 acres (15.5 percent of the GCWPA) would undergo disturbance of the surface, a loss of approximately 575 AUMs of range carrying capacity.

As discussed in Section 3.12, there are a number of BLM range improvements within the GCWPA. All but three of these improvements are located within the Seven Sisters and Coyote Wash allotments, the remainder in the Antelope Draw allotment. Surface disturbing activities in these allotments would have a disproportionate chance of affecting existing range improvements. However, any effects to range improvements would, under EOG standard field procedures and BLM requirements, be temporary. As soon as possible following damage to any range improvement, repairs would be instituted or, if absolutely necessary, the range improvement may be relocated, if feasible. Effects other than very temporary disruptions are not anticipated. Most of the GCWPA grazing allotments are assigned for sheep. Infrastructure development may lead to increased herding difficulties and potential fragmentation of lambing areas.

About 78 percent of prorated disturbance under this alternative is estimated to occur in the BLM Antelope Draw, Coyote Wash, or Seven Sisters allotments. Each of these has been identified as experiencing issues with invasive species and use conflicts (BLM 2008b). The Seven Sisters allotment also has been identified as departing from proper functioning due to high levels of existing oil and gas development (BLM 2014d). About 16 percent of disturbance is likely to occur within the BIA Chipeta Grove allotment.

4.12.1.2 Alternative B—Proposed Action

Implementation of Alternative B Alternative would result in the drilling of up to 2,808 new wells from up to 233 new, and up to 960 expansion, well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,875 acres, or 4.4 percent of the GCWPA. This alternative would result in a short-term loss of forage of approximately 145 AUMs. Including existing, site-specific Alternative A, and Alternative B disturbance, approximately 6,884 acres (16.0 percent of the GCWPA) would undergo disturbance of the surface, a loss of approximately 582 AUMs of range carrying capacity.

Effects to range improvements would be as discussed for Alternative A, but proportional to the level of surface disturbance. Effects on range improvements are anticipated to be very temporary. Effects to sheep herding and lambing would be similar to those indicated for Alternative A in proportion to the total disturbance levels.

About 81 percent of disturbance under this alternative is estimated to occur in the BLM Antelope Draw, Bonanza, Coyote Wash, or Seven Sisters allotments. Each of these has been identified as experiencing issues with invasive species and use conflicts (BLM 2008b). The Seven Sisters allotment also has been

identified as departing from proper functioning due to high levels of existing oil and gas development (BLM 2014d). About 16 percent of disturbance is likely to occur within the BIA Chipeta Grove allotment.

4.12.1.3 Alternative C—Resource Protection Action (BLM-Preferred)

Implementation of Alternative C would result in the drilling of up to 2,808 new wells from up to 162 new, and up to 960 expansion, well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,514 acres, or 3.4 percent of the GCWPA. This alternative would result in a short-term loss of forage of approximately 115 AUMs. Including existing, site-specific Alternative A, and alternative-specific disturbance, approximately 6,523 acres (15.1 percent of the GCWPA) would undergo disturbance of the surface, a loss of approximately 550 AUMs of range carrying capacity.

Effects to range improvements would be as discussed for Alternative A, but proportional to the level of surface disturbance. Under this alternative, in response to public scoping concerns and subject to lease terms as indicated in 43 CFR 3101.1, existing range improvements would be avoided by 200 meters by well locations and associated infrastructure. If this is not possible, the Range Improvement Project's would be relocated and/or reconstructed. Effects on range improvements are anticipated to be negligible and very temporary. Effects to sheep herding and lambing would be similar to those indicated for Alternative A in proportion to the total disturbance levels.

Approximately 81 percent of disturbance under this alternative is estimated to occur in the BLM Antelope Draw, Bonanza, Coyote Wash, or Seven Sisters allotments. Each of these has been identified as experiencing issues with invasive species and use conflicts (BLM 2008e). The Seven Sisters allotment also has been identified as departing from proper functioning due to high levels of existing oil and gas development (BLM 2014d). About 16 percent of disturbance is likely to occur within the BIA Chipeta Grove allotment.

4.12.1.4 Alternative D—Other Protections Action

Implementation of Alternative D would result in the drilling of up to 2,808 new wells from up to 157 new, and up to 880 expansion, well pads, as well as construction of access roads, pipelines, and other ancillary facilities. Estimated surface disturbance associated with this alternative would be up to 1,595 acres, or 3.5 percent of the GCWPA. This alternative would result in a short-term loss of forage of approximately 121 AUMs. Including existing, site-specific Alternative A, and alternative-specific disturbance, approximately 6,604 acres (15.3 percent of the GCWPA) would undergo disturbance of the surface, a loss of approximately 556 AUMs of range carrying capacity.

Effects to range improvements would be as discussed for Alternative A, but proportional to the level of surface disturbance. Under this alternative, existing range improvements would be avoided by 200 meters by well locations and associated infrastructure. If this is not possible, the Range Improvement Project's would be relocated and/or reconstructed. Effects on range improvements are anticipated to be negligible and very temporary. Effects to sheep herding and lambing would be similar to those indicated for Alternative A in proportion to the total disturbance levels.

Approximately 86 percent of disturbance under this alternative is estimated to occur in the BLM Antelope Draw, Bonanza, Coyote Wash, or Seven Sisters allotments. Each of these has been identified as experiencing issues with invasive species and use conflicts (BLM 2008e). The Seven Sisters allotment also has been identified as departing from proper functioning due to high levels of existing oil and gas development (BLM 2014d). About 14 percent of disturbance is likely to occur within the BIA Chipeta Grove allotment.

4.12.2 Alternative-specific Design Features and Mitigation

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.12-2**.

4.12.3 Residual Effects

All Alternatives

Residual effects would include alternative-specific levels of forage loss and range carrying capacity until completion of interim reclamation (estimated at 5 or more years) or final reclamation (up to 40 or more years). Associated effects, such as increased habitat fragmentation and interference with stock reproductive cycles would likely continue for the life of project. Effects to range improvement facilities are anticipated to be avoided or temporary.

Alternative A

Effects would be greatest during the construction and drilling phase, expected to last approximately 10 years for Alternative A.

Alternatives B, C, and D

Effects would be greatest during the construction and drilling phase, expected to last approximately 15 years for the three action alternatives

4.12.4 Irretrievable and Irreversible Commitment of Resources

The loss of range forage and carrying capacity would represent an irreversible commitment of resources during the life of the project until the completion of successful reclamation efforts to restore grazing capacity to pre-project levels. Contamination of proper forage species diversity by introduced invasive species would be an irreversible commitment until successful control of such infestations.

Particularly in an area of numerous challenges to proper rangeland function, it is possible that portions of grazing allotments could lose their capacity to support local stock. Such a long-term incapacity would represent an irretrievable commitment or loss of resources for an extended duration.

4.12.5 Relationship of Short-term Use to Long-term Productivity

Implementation of oil and gas development under any of the alternatives would result in immediate and lasting effects to range resources. Magnitude of effects would generally be proportional to the levels of surface disturbance and loss of range carrying capacity. Livestock grazing capacity would be reduced within the GCWPA under all of the alternatives, particularly during the construction and drilling phase, expected to last up to about 15 years. Recovery of range health and carrying capacity is likely to be a long-term process, with effects lasting at least 5 years in areas of interim reclamation, and more than 40 years for life-of-project facilities.

Failure to control the spread of invasive species, which has been identified as a key rangeland health issue over most of the GCWPA, could hinder and slow recovery of range carrying capacity beyond estimates based on typical successful reclamation rates. Should all or part of an allotment become non-functional, this could represent an essentially permanent effect.

Table 4.12-2 Livestock Grazing and Range Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Existing Range Improvement Project's should be avoided by 200 meters by well locations and associated infrastructure. If this is not possible, the Range Improvement Project's should be relocated and/or reconstructed.			d	d	m	m		
Existing range improvement facilities would be avoided to the extent possible during construction and drilling activities. Where damage to or removal of a facility is required, it will be repaired as soon as possible following completion of the activity which resulted in the damage. Where long-term disruption makes repair unfeasible, the affected facility will be relocated so as to achieve the continued function of the facility. Relocation should occur prior to the effects to the original facility.					m	m	m	m
An annual meeting should be held among EOG, potentially affected grazing permittees, and BLM to identify upcoming activities and potential conflicts with grazing operations. The meeting schedule should be determined by the AO, following consultation with the permittees, to maximize the potential for identifying potential conflicts with grazing operations and coordinating responses to minimize such conflicts.					m	m	m	m
Any damage to range facilities or injury or mortality of grazing stock is to be reported as soon as possible to the AO and to the affected permittee.					m	m	m	m
Speed limits on GCWPA roads are to be enforced by EOG and, where applicable, temporary reduced speed limits and signage will be installed within 0.5 mile of identified lambing areas during the lambing season, typically April 1 to June 1.					m	m	m	m
Where construction occurs in the vicinity of constructed ponds, surface flow to the ponds is not to be disrupted.					m	m	m	m

4.13 Access and Transportation

4.13.1 Direct and Indirect Effects

The effects of oil and gas development on access within and both in and out of the GCWPA and on the area's network of existing and new roads would be the increased daily vehicle use by workers/vehicle operators within and out of the GCWPA during the different development phases of the proposed project. The additional vehicle trips measured as traffic counts by Uintah County are expected to be greatest during peak periods of activity associated with facilities construction, well drilling, and well completion. With the addition of wells and continued production of existing, approved, and proposed wells, a higher level of traffic by water trucks during the overall well producing period for the GCWPA is expected to continue for the 40-year life of project production. Under all alternatives, additional transportation routes will be developed as new locations are identified and approved by appropriate agencies. Although traffic levels are expected to increase over existing levels with implementation of Alternative A, B, C, or D, the effects on the use of lands within the GCWPA is not expected to change. Oil and gas development and production along with livestock grazing and limited recreational uses are expected to continue with minimal effects. Under all alternatives, holders of existing ROW for roads, pipelines, and powerlines would be notified to avoid, minimize, or resolve any conflicts between proposed facilities/ROW and existing ROW. Regardless of alternative, existing and future resource roads to well sites would be reclaimed subject to surface owner approval.

4.13.1.1 Alternative A—No Action

Under Alternative A, approximately 462 wells on 425 well pads would be drilled and completed within the GCWPA over a period of up to 10 years starting in 2015, which would be in addition to the existing 1,247 wells on 960 well pads. Approximately 92.6 miles of new access road in addition to the 261 miles of existing road within the GCWPA would be constructed to reach the approved well pads and approved, central-facility locations. The approved, new roads, when constructed, would provide the additional access needed to facilitate worker, equipment, and materials access to facilitate construction, drilling and completion, production, and ultimately decommissioning and reclamation of the approved facilities. It is anticipated that use of the additional 92.6 miles of access road would not be limited; therefore, additional access to the public would be provided in the construction of these approved, access roads.

Construction, Drilling, and Completions

The approximately 6-week period of construction of a location's approved new access road, pipeline, and well pad and the drilling and completion of a single well would increase round trip traffic in and out of the GCWPA, based on recent 2014 traffic counts for the main county roads in and out of GCWPA as recorded by the Uintah County Roads Department (**Table 3.13-2**). Assuming an average of 10 days required to complete construction of an access road, surface pipeline, and new well pad (estimate 7 days for the expansion of an existing pad), projected vehicle roundtrips (to and from the GCWPA) would total approximately 58 for the 10-day period or about 6 vehicle roundtrips per day. Construction of buried pipeline for the LGS would require approximately 97 days per year over a 4-year period of LGS installation. During this roughly 3-month period of construction, an estimated 18 daily roundtrips of vehicles to and from the GWPA would occur in support of buried pipeline construction. Based on an estimated average of 11 days required to drill a well, projected vehicle roundtrips would total approximately 93 for the for 10-day period or about 9-vehicle roundtrips per day. Assuming an average of 7 days to complete a drilled well, projected roundtrips would total approximately 106 roundtrips or about 15 roundtrips per day.

A drill rig would require about 11 days to drill and four additional days for standup and take down for a total of 15 days per well. Based on these projections, a single drill rig would be able to drill about 24 wells per year. Based on this rate, it would require two drill rigs operating over the 10-year development period to drill the projected 462 wells. Two rigs operating continuously over this period would potentially double the traffic during full development activity to 90 daily roundtrips assuming parallel schedules for not only

the two drill rigs, but also for construction and completion activities. Approximately 54 (60 percent) of the vehicles would be heavy trucks with the remaining 36 (40 percent) consisting of lighter vehicles such as pickups.

Interim Reclamation

Vehicle use and the associated traffic on roads within and in and out of the GCWPA associated with interim reclamation of well pads and access as well as the application of final reclamation measures for buried LGS pipelines would begin within the first of 10 years of approved drilling under Alternative A. With the addition of some towed implements, interim reclamation measures would involve similar types and numbers of vehicles and motorized equipment as was used in constructing the access roads and well pads. The duration of activity would likely approximate the time required to construct, or about five days per well pad and access road. Assuming an average of 5 days required to complete interim reclamation contours, surface stabilization, and seeding of an access road and new well, projected vehicle roundtrips (to and from the GCWPA) would total approximately 30 for the 5-day period or about 6-vehicle roundtrips in and out of the GCWPA per day (**Table 4.13-1**). Assuming concurrent interim reclamation activity resulting from seven operating drill rigs, this level of activity would result in reclamation-related vehicle traffic at the 6 roundtrips per day level for approximately 58 percent of the time for the 10-year span of well development.

Production

For the 40- to 50-year life of production for the approved 462 wells, vehicles ranging from light pickups to heavy semi-tractor trailer rigs pulling larger tank trailers would travel into, within, and out of the GCWPA on a daily basis. The lighter traffic consisting principally of a well service (pumper) vehicle would access approximately 40 wells per day. On an annual basis approximately 9.1 vehicle trips to each well would be conducted annually. With the capability of a single pumper to reach about 40 wells per day, a single pumper vehicle would travel to, within, and from the GCWPA using the existing and approved road network approximately 105 days per year or roughly about every third or fourth day. On a daily basis, this would equate to a negligible 0.3 round trips per day.

Heavy vehicle activity over the 40- to 50-year life of production would result principally from the transport of produced water from producing wells, not connected to the LGS, to disposal sites within the GCWPA and from transport of condensate from all non-connected wells and central facilities to sales locations near Vernal, Utah. These heavy vehicles would travel daily to the GCWPA from the Vernal/U.S. Highway 40 corridor area, load and transport multiple loads of either condensate or produced water to off load points or disposal points, respectively, and then return to the Vernal/U.S. Highway 40 corridor. Given that currently 26 heavy trucks serve current transport needs for transport within and out of the GCWPA, implementation of Alternative A with the addition of 462 wells to the total well count and assuming none would be connected to the LGS would require approximately 10 more heavy tanker trucks or 60 more roundtrips per day that would be added incrementally over the 10-year drilling period to handle transport for the duration of peak production, not including or adjusting for eventual declines in production of both condensate and produced water over the 40- to 50-year life-of-well/life-of-project. The estimated maximum 60 additional roundtrips would proportionally increase EOG heavy truck production traffic within the GCWPA by approximately 38 percent and also would increase traffic on the three principal routes in and out of the GCWPA. The projected increase from 26 trucks to an estimated 36 trucks and their additional trips into and out of the GCWPA on a daily basis over the 10-year drilling period would increase vehicle use over current measured counts by Uintah County (**Table 4.13-1**).

Table 4.13-1 No Action Projected Maximum AADT Traffic Counts for Key Roads and Routes Accessing the GCWPA

Road / Count Recording Location	Current AADT [1]	Alternative A AADT[2]	Total AADT[3]
Glen Bench Road (3260) / south of Wonsits Road intersection	818	85	903
Chapita Grove Road (3310) / west of Glen Bench Road intersection	650	68	718
Fidlar Road (3410) / west of Little Bonanza Road (3430) intersection	152	16	169

[1] AADT estimated from traffic counts recorded hourly over a 7-day period during 2014. Counts are the sum of traffic in both directions at each counting location.

[2] Projected maximum AADT counts for approved No Action Alternative project scenarios at three Uintah County Roads Department traffic count locations.

[3] Projected maximum total AADT at three Uintah County Roads Department traffic count locations with implementation of Alternative A added to current AADT traffic counts.

Source: Uintah County Roads Department 2014.

Assuming travel to the GCWPA and return travel from the GCWPA to the Vernal area and U.S. Highway 40 corridor to the north, the daily traffic would likely access the GCWPA primarily by three primary routes:

1. SH 45, Wonsits Road, and the Glen Bench Road (50 percent of roundtrips);
2. SH 45, Little Bonanza Road, and Fidlar Road (10 percent); and
3. SH 88 and the Chapita Grove Road (40 percent).

Based on recorded counts by Uintah County, implementation of Alternative A would increase maximum traffic counts at key locations on three primary routes into and out of the GCWPA (**Table 4.13-1**).

The increased counts reported in **Table 4.13-1** represent a maximum level of traffic associated with the transportation requirements for development and production activities, which would overlap for a period of time as development continues until wells are completed and as production increases until development ceases and an overlap of transportation activity no longer exists.

Given the increase in traffic within the GCWPA and connecting transportation network likely to occur from development of additional approved wells beyond the existing traffic numbers, the potential for spills resulting from the increased vehicular access to the approved wells would increase proportionally. Information provided by EOG for 2013 indicates there were three spills that occurred in conjunction with servicing approximately 1,247 existing wells. The resulting accident probability rate resulting in a spill is 0.2 percent per well per year. Based on use of this annual rate and the addition of 462 wells under Alternative A, the rate of accidents resulting in spills under Alternative A would approximate 0.9 or less than one spill annually after all the wells have been drilled and are in operation.

Decommissioning and Final Reclamation

Final reclamation of the buried LGS-related pipelines would follow their installation during the 5-year build out of the LGS and traffic counts would be contained in the estimates for pipeline construction as final pipeline reclamation is an integral part of the overall pipeline construction and installation process. Traffic counts are included above for approved development activities.

Types and numbers of vehicles and duration of time required for facilities decommissioning and final reclamation of well pads and access roads would be similar to that required for interim reclamation; however, these activities associated with the approved 462 wells and 425 well pads and associated

roads would occur following 40 to 55 years of initiating the proposed project. Such activity would occur long after the cessation of the initial development activities associated with construction, drilling, completions, and interim reclamation; therefore associated traffic levels would be much reduced to levels associated with remaining production requirements associated with the remaining producing wells. Decommissioning and final reclamation would begin for those wells whose production will have been terminated due to lack of economic return while more recently drilled wells may continue to produce and drive continuing haul traffic until those wells are no longer economically productive.

4.13.1.2 Alternative B—Proposed Action

With implementation of Alternative B, approximately 233 new well pads would be constructed within the GCWPA, and from these new well pads and from approximately 960 existing well pads, 2,808 new wells would be drilled over a period of approximately 15 years. Approximately 44.1 miles of new access roads in addition to the 261 miles of existing road within the GCWPA would be constructed to reach the proposed new well pads. The new roads, when constructed, would again provide the additional access needed to facilitate worker, equipment, and materials access to facilitate construction, drilling and completion, production, and ultimately decommissioning and reclamation of the approved well locations. It is anticipated that use of these additional roads would again not be limited; therefore, additional access to the public would be provided.

Construction, Drilling, and Completions

As previously described for the approved actions under Alternative A, the approximately 6-week period of construction of new access road and well pad and the drilling and completion of a single well would increase round trip traffic in and out of the GCWPA, assuming no significant changes to the current 2014 traffic counts for the main roads in and out of GCWPA as recorded by Uintah County Roads Department (**Table 3.13-2**). Again applying the same projections to estimate roundtrips to and from the GCWPA for construction, drilling, and completions on a new well pad as described for Alternative A, construction would require approximately 6 roundtrips (to and from the GCWPA) per day; drilling would require approximately 9 roundtrips per day, and completions would require approximately 15 roundtrips per day. Construction of well pad expansions to accommodate a new well on an existing pad would require approximately 4 roundtrips per day, versus 10 roundtrips per day for a full new well pad along with access road and surface pipeline. No buried pipeline construction is proposed for this alternative.

Based on these estimates for vehicle roundtrips for the construction of 233 new access roads, surface pipelines, and well pads; the expansion of up to 960 existing well pads; and the drilling and completion of up to 2,808 wells; a single drill rig would be able to drill about 24 wells per year. Over the proposed 15-year drill period, EOG would use up to seven drill rigs to drill the proposed 2,808 wells. Use of seven drill rigs would therefore potentially increase the traffic at any one point in time approximately to seven-fold above a single rig operation assuming parallel schedules for not only the seven drill rigs, but also for construction and completion activities. Daily roundtrips for the 15-year development period and for the development phases of construction, drilling, and completion under Alternative B could approximate up to 378 roundtrips per day. Approximately 226 or 60 percent would be heavy trucks with the remaining 152 or 40 percent consisting of lighter vehicles such as pickups and smaller flatbeds.

Interim Reclamation

As described for Alternative A, vehicle use and the associated traffic on roads within and in and out of the GCWPA associated with interim reclamation of well pads and access would occur during the 15-year development period of Alternative B. With the addition of some towed implements, interim reclamation measures would involve similar types and numbers of vehicles and motorized equipment as was used in constructing the access roads and well pads. The activities and duration of activity would again likely approximate those required to construct the facilities. Given proposed construction of 233 well pads and associated access roads over the 15-year development period, approximately 42 vehicle roundtrips per

day would be required for interim reclamation assuming as many as seven interim reclamation actions could be occurring at any time during the 15-year development period.

Production

For the 40- to 55-year life of production for the proposed 2,808-well project, vehicles ranging from light pickups to heavy semi-tractor trailer rigs pulling larger tanker trailers would travel into, within, and out of the GCWPA on a daily basis. Again, the lighter traffic would consist of principally of well service (pumper) vehicles, each accessing approximately 40 wells per day. Based on approximately 9.1 vehicle trips to each well per year, approximately 25,553 pumper visits would be conducted annually during the operations phase for the proposed 2,808 wells. With the capability of a single pumper to reach about 40 wells per day, pumper activity would approximate the use of 1.6 pumpers for the life of production of the 2,808 wells or roughly two roundtrips in and out of the GCWPA per day.

Heavy vehicle activity over the 40- to 55-year life of production within the GCWPA from implementation of the Proposed Action would again result principally from the transport of produced water from producing wells, not connected to the LGS, to disposal sites within the GCWPA and from transport of condensate from all non-connected wells and central facilities to sales locations. These heavy vehicles would travel daily to the GCWPA from the Vernal/U.S. Highway 40 corridor area. Condensate transports would travel within the GCWPA to fill their tanks and would then return to the Vernal area and U.S. Highway 40 corridor to off-load the product at a receiving sales station. After one or more roundtrips between Vernal/U.S. Highway 40 corridor and the GCWPA, a final return trip to Vernal would conclude a day's activity. Produced water transports also would travel within the GCWPA to fill their tanks and would then transport the water to disposal sites within the GCWPP. At the end of approximately 6 roundtrips between loading points at well pads (not connected to the LGS) and disposal sites, the produced water transports would return to the Vernal/U.S. Highway 40 corridor to conclude the day's activity.

Daily roundtrips for the heavy truck transporters of condensate and produced water would increase for current levels of activity by approximately 6 and 21 roundtrips by 6 and 4 trucks per day, respectively, in the first year of project implementation with a projected well count of 35 non-LGS connected wells. With additional completed wells coming into production, the additional condensate and produced water is projected to increase to a maximum in roughly year 10 of the implementation of the Proposed Action. Daily roundtrips for heavy truck transports of condensate and produced water would increase to approximately 22 and 170 (192 total) roundtrips by 22 and 29 trucks per day, respectively. After year 10, the combined condensate and produced water volumes would begin to decrease and would continue to incrementally decrease until the end of a projected 55-year life-of-project, the life-of-wells as a whole, and an economics-based tipping point of project/well decommissioning and abandonment.

Given that currently 26 heavy trucks serve current transport needs within the GCWPA, implementation of Alternative B with the addition of 1,376 wells (not connected to the LGS) would require approximately 51 more heavy tanker trucks operating daily for the duration of maximum production under the Proposed Action, not adjusting for eventual declines in production of both condensate and produced water over time. The 51 additional heavy vehicles would proportionally increase EOG heavy truck production traffic within the GCWPA by approximately 196 percent and also would increase traffic on the three principal routes in and out of the GCWPA. The projected increase from 26 trucks to an estimated 87 trucks and their additional trips into and out of the GCWPA on a daily basis over the 15-year drilling period, and particularly in year 10 of the proposed project's implementation, would increase vehicle use over current measured counts by Uintah County (**Table 3.13-2**).

Based on current 2014 recorded counts by Uintah County, implementation of both the site-specific No Action Alternative and Alternative B would increase maximum traffic counts at the three key count locations on the three primary routes into and out of the GCWPA (**Table 4.13-2**). The increased counts reported in **Table 4.13-2** represent a maximum level of traffic associated with the transportation requirements for both alternative's development and production activities which in turn would overlap

under both alternatives for a period of time as development would continue until wells are completed and as production increases until development ceases and an overlap of transportation activity for development and production phases no longer exists for either alternative.

Given the presence of other roads that divert from the three principal routes discussed above into the GCWPA, counts at the three count locations reported in **Table 4.13-2** are likely conservative. Some traffic may enter and leave the GCWPA by way of roads such as the road to the Deseret Power Plant off SH 45 from which oil and gas field roads continue into the GCWPA from the power plant and such as the roads to Fantasy Canyon SRMA off of Glen Bench Road that lead south into the GCWPA.

Table 4.13-2 Proposed, Resource Protection, and Other Protections Action Alternatives Projected Maximum AADT Traffic Counts for Key Roads and Routes Accessing the GCWPA

Road / Count Recording Location	Current AADT [1]	Action Alternatives AADT[2]	Total AADT[3]
Glen Bench Road (3260) / south of Wonsits Road intersection	818	223	1,041
Chapita Grove Road (3310) / west of Glen Bench Road intersection	650	178	828
Fidlar Road (3410) / west of Little Bonanza Road (3430) intersection	152	45	197

[1] AADT estimated from traffic counts at three key route locations that were recorded hourly over 7-day periods during 2014. Counts are the sum of traffic in both directions at the counting location.

[2] Projected maximum AADT counts for Alternative B as well as Alternative C and Alternative D. As the number of wells dictates the transportation and traffic requirements for oil and gas development and production, the 2,808 well count for each action alternative indicates the traffic levels will be essentially the same among the three action alternatives.

[3] Projected maximum total AADT at three Uintah County Roads Department traffic count locations with implementation of an Action Alternative added to current AADT traffic counts.

Source: Uintah County Roads Department – Slaugh 2014a-e.

As described for Alternative A, the potential for spills resulting from increased traffic accessing the proposed 2,808 wells would increase proportionally above the reported three, 2013 accidents that occurred servicing the existing 1,247 wells in the GCWPA. Applying the 0.2 percent per well per annum rate to Alternative B would result in the projected occurrence of approximately 5.6 accidents per year that could result in a spill.

Decommissioning and Final Reclamation

Vehicle use and the associated traffic on roads within and in and out of the GCWPA associated with interim reclamation of well pads and access as well as the application of final reclamation measures for buried LGS pipelines would likely begin within the first year of a total of 15 years of approved drilling under Alternative B. Interim reclamation measures would involve similar types and numbers of vehicles and motorized equipment as was used in constructing the access roads and well pads. However, the duration of activity would likely approximate one half of the time required to construct, or about five days per well pad and access road. Assuming an average of 5 days required to complete interim reclamation contours, surface stabilization, and seeding of an access road and new well, projected vehicle roundtrips (to and from the GCWPA) would total approximately 30 for the 5-day period or about 6 vehicle roundtrips in and out of the GCWPA per day. This level of activity would result in reclamation-related vehicle traffic at the 6 roundtrips per day level for approximately 58 percent of the time for the 15 years of well development prior to production.

4.13.1.3 Alternative C—Resource Protection Action (BLM-preferred)

Implementation of Alternative C would result in effects on road use and vehicle counts entering and departing the GCWPA on a daily basis that are mostly similar to those described for the Propose Action Alternative due to number of proposed wells to be drilled under this alternative remaining 2,808 as proposed in Alternative B. However, the number of new well pads and associated access roads and adjacent surface pipelines to be constructed would be reduced from 233 well pads and 44.1 miles of access road (36.4 miles of surface pipeline) for Alternative B to 151 well pads (35 percent reduction) and 28.6 miles of access road (37 percent reduction) for Alternative C, respectively. Although the durations of construction activity associated with all 2,808 wells would be shortened due to the fewer numbers of new well pads to be constructed and the increase in pad expansions for existing wells pads, the actual numbers of vehicles would remain the same. Therefore, peak traffic numbers to and from the GCWPA would remain the same described for Alternative B during the periods of time of overlapping activity, particularly during the later years of the 15-year drilling window as drilling continues and condensate and produced water transport traffic increases. Peak traffic numbers and uses of the three main access routes into and out of the GCWPA would be consistent with the numbers and uses described for Alternative B (**Table 4.13-2**). Traffic accidents potentially resulting in a spill would again be approximately 5.6 accidents per annum based on the same 2,808 proposed new wells for this Alternative C.

4.13.1.4 Alternative D—Other Protections Action

Implementation of Alternative C would result in effects on road use and vehicle counts entering and departing the GCWPA on a daily basis that are again mostly similar to those described for the Propose Action Alternative due to number of proposed wells to be drilled under this alternative remaining 2,808 as proposed in Alternative B. In addition, this alternative would result in road use and traffic numbers comparable to those described for Alternative C as this alternative also would reduce the number of new well pads and miles of new access road. Similar to Alternative C, the number of new well pads and associated access roads and adjacent surface pipelines to be constructed would be reduced from 233 well pads and 44.1 miles of access road (36.4 miles of surface pipeline) for Alternative B to 146 well pads (35 percent reduction) and 27.7 miles of access road (37 percent reduction) for Alternative C, respectively. Although again the durations of construction activity associated with all 2,808 wells would be shortened due to the fewer numbers of new well pads to be constructed and the increase in pad expansions for existing wells pads, the actual numbers of vehicles would remain the same.

Unique to this alternative, approximately 17.4 miles of buried pipeline would be installed in place of surface installation described in Alternative B and Alternative C. This buried pipeline construction could add some additional traffic-related activities in addition to well pad and access road construction; however, traffic levels should not exceed those maximum projected counts presented in **Table 4.13-2** for the Proposed Action. The lack of exceedances would likely be due to this alternative's reduction in new well pad construction and the re-apportionment of wells to well pad expansions which would require less than one half the time as compared to new well pad construction and therefore would not appreciably add vehicle daily roundtrips to the projected maximum traffic counts.

Therefore, peak travel to and from the GCWPA would remain about the same as described for both Alternative B and for Alternative C during the periods of time of overlapping activity, particularly around the 10th year of project initiation as drilling would continue and condensate and produced water transport traffic peaks. Peak traffic numbers and uses of the three main access routes into and out of the GCWPA would be consistent with the numbers and uses described for Alternative B and as referenced for Alternative C. Traffic accidents potentially resulting in a spill would again be approximately 5.6 accidents per annum based on the same 2,808 proposed new wells for this Alternative D.

4.13.2 Alternative-specific Design Features and Mitigation

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.13-3**.

Table 4.13-3 Access and Transportation Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
Future transportation routes will be developed incrementally as new locations are developed and additional information becomes available. EOG will coordinate with government agencies having jurisdiction over transportation routes to accomplish transportation goals.		d	d	d	m			
Existing and future resource roads accessing individual well sites will be reclaimed and returned to the natural conditions similar to those existing prior to natural gas development activities.		d	d	d	m			
EOG anticipates that Uintah County roads will be retained in an upgraded status as will improvements to surface management agency designated roads. From the County roads, EOG uses various existing collector, local, and resource roads to travel to individual locations.		d	d	d	m			
Appropriate permits will be obtained from the County prior to placing temporary or permanent pipelines in a County Road ROW.			d	d	m	m		
EOG employees and contractors would comply with posted speed limits while driving roads within the GCWPA and would adhere to posted speed limits.					m	m	m	m
Additional permanent and temporary signage would be placed along roadsides to alert all motorists of heavy equipment and truck traffic and upcoming construction activities to reduce potentials for accidents.					m	m	m	m
EOG would coordinate with the appropriate federal, state, and county authorities throughout the life-of-project when constructing, maintaining, or reclaiming roads.					m	m	m	m
Whenever practicable, heavy and/or slow-moving equipment would be moved at night or during non-peak driving times to minimize delays to other users. Flaggers and/or flag cars would be used to alert non-project traffic to upcoming project equipment.					m	m	m	m
Surface Gas and water pipelines would be buried at road crossings. EOG would bury all pipelines crossing County roads to a minimum depth of 5 feet to ensure the safety of road maintenance workers and activities.					m	m	m	m
Passing areas would be constructed as directed by the AO to minimize traffic hazards for all traffic.					m	m	m	m

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4.13.3 Residual Effects

Residual effects under all of the alternatives would include an increase in daily traffic over the life-of-project including increased rates of use of government-maintained and both existing and future private roads and a corresponding increased potential for accidents, both a direct hazard for vehicle operators and an indirect hazard of spills of potentially hazardous materials or liquids. The additional traffic would likely increase the frequency of road improvement and maintenance actions in order to maintain acceptable road use conditions for both the efficient transport of materials and people and the minimization of accidents. However, the extent, magnitude, and duration of these effects would be mitigated by those measures listed in **Table 4.13-3**.

For all alternatives, the added list of mitigations would address the enhancement of safety measures to be employed during project development. Measures would include compliance with posted speed limits, and use of signage to warn motorists of construction activities and heavy truck and equipment. Heavy truck and equipment road use would be limited to night-time or other non-peak traffic periods, and when such use is to occur, flaggers or flag-cars would be used to warn other users of an impending encounter with heavy traffic. To further reduce risks of vehicular accidents, passing areas would be added to road segments where needed, and pipelines would be buried at all road crossings. All such accident-reduction measures along with all other road-related issues would be coordinated with the appropriate agency for the life-of-project. The application of these measures would reduce potentials for accidents and associated effects on human health and safety and resources from spills, but these measures would not eliminate the potential for their occurrence, nor would their implementation reduce the need for new construction, maintenance, or reclamation of such roads over the life-of-project.

4.13.4 Irretrievable and Irreversible Commitment of Resources

Project-related traffic levels would continue for the life-of-project for all alternatives, but would be potentially reversible and would potentially cease at project closure. Project-related effects due to development of new roads would be reversible should the new roads be closed and reclaimed at project closure. There would be no irretrievable effects associated with any of the alternatives.

4.13.5 Relationship of Short-term Use to Long-term Productivity

The increased mileages of road networks and use of these roads for all alternatives would lead to increased access and traffic volumes for the life-of-project. Maximum traffic volumes for all alternatives would be reached in the 10- to 15-year timeframe after project initiation with both development and production related traffic activity occurring concurrently. With the cessation of field development activities, elevated but reduced traffic volumes would be maintained although dropping over time for the life-of-project (50 to 55 years) to a point in time where all project-related traffic would cease.

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4.14 Visual Resources

4.14.1 Direct and Indirect Effects

This section discusses project related effects to visual resources resulting from Alternatives A, B, C, and D. Primary issues related to visual resources include direct and indirect effects associated with the degradation of views from KOPs and other sensitive views in the vicinity of the Project.

Potential visual effects associated with the proposed project were analyzed using the procedures outlined in the BLM Visual Contrast Rating Handbook H-8431-1 (BLM 1986). Effects to landscape scenery and effects to viewers were determined by comparing the characteristics and extents of the landforms, vegetation, and structures of the proposed project facilities with the visual resource inventory components of scenic quality, sensitivity levels, and distance zones. Compliance with agency management objectives were determined by comparing visual contrast ratings for the proposed project facilities with the VRM class objectives (**Tables 3.14-1** and **3.14-2**) for the project vicinity, VRM Class III and VRM Class IV. The process involves comparing the degree of visual contrast from the proposed facilities and project-related activities with the existing landscape character both during active production and after reclamation is completed. The contrast rating process used four KOPs (**Figure 3.14-1**) as the viewpoints for conducting the effects and RMP compliance analysis.

The expansion and development of the proposed project would increase the amount of visual contrast that currently exists between existing/authorized facilities and the natural character of the landscape. The primary change in visual effects from the currently approved levels would be the addition of oil and gas production facilities, storage tanks, pipelines, roads, and earthwork. The proposed project also would extend visual effects through the increased use of the area.

As noted in Section 3.14, Affected Environment, prior to completion of reclamation, the existing facilities exhibit strong form and color contrast, especially under bright, clear light conditions. Moderate to strong line and landform contrasts are generated to a large extent by the shapes of the existing structures and road embankments. Moderate texture contrasts are generated between the bare surfaces of the well pads and the vegetation textures and patterns in the natural landscape. The proposed project would expand the visual effects in the vicinity of the existing facilities and adjacent undeveloped areas. The visual contrast effects to landforms and vegetation gradually would become less noticeable with reclamation.

The proposed facilities would have visual characteristics during active production that would be similar to existing facilities, notably geometric structure forms and exposed earth surfaces. As a result, the proposed project would have similar, but expanded, visual effects to those already occurring from the existing facilities, including moderate to strong form and color contrasts, weak to moderate line contrast, and weak to moderate texture contrast. The key considerations, therefore, are the degree of expansion of the visual effects, and the amount of allowable contrast under the VRM Class III and VRM Class IV objectives. The objective for Class III states, "…the level of change to the characteristic landscape should be moderate." The objective for Class IV states, "…the level of change to the characteristic landscape can be high."

Night sky/night lighting of the operations (production areas, machinery, vehicles, light towers, and roadway intersections) would cause effects to the characteristic night landscape. There would be an increase in the existing conditions in sky glow in the view from all locations in the viewshed, including the four KOPs. Greater sky glow effects would be apparent during non-moonlit nights, from reflections on clouds, and during the clearest and darkest nights. Areas of night-time activity, such as star gazing, camping, hiking, dispersed recreation, and driving would receive higher noticeable changes to the characteristic night sky. Structures, landforms, and vegetation nearest the light sources would be reflected by operations lighting and would have increased visibility to viewers in the surrounding landscape out to and beyond the background distance zone.

4.14.1.1 Alternative A—No Action

Under Alternative A, effects on viewers and visual resources would result from construction of 425 well pads (plus 37 pad expansions), and 128 miles of access road, pipelines, and other facilities. This construction would result in approximately 2,685 acres of new disturbance and associated short-term effects. With the application of interim reclamation and final reclamation measures in the case of pipelines, residual long-term disturbance potentially affecting recreation would be reduced to approximately 1,413 acres. The decommissioning and final reclamation of these facilities and associated long-term disturbance would occur under the authority and COAs of existing NEPA decisions as well as applicable state and county requirements.

4.14.1.2 Alternative B—Proposed Action

Of particular importance to users of the GCWPA's visual resource is the White River. The overall viewshed of the proposed project is shown in **Figure 3.14-1** and the White River viewshed is shown in **Figure 3.14-7**. These viewshed analyses indicate the locations from where a viewer would see a 20-foot-tall storage tank, the tallest permanent features of the project. Although, the proposed project would be expected to conform to VRM Class IV objectives, the immediate foreground viewshed is a visually sensitive area. Users of the White River would notice moderate to high contrasts to landform, vegetation, and color in the characteristic landscape. These contrasts would be lessened by the presence of any existing facilities and remnant landscapes from past road development.

The Alternative B would result in the construction of 233 well pads (plus up to 960 pad expansions), 92 miles of access road, pipelines, and other facilities would result in approximately 1,875 acres of new disturbance and associated short-term effects on viewers and visual resources. The application of interim reclamation and final reclamation measures for pipelines, residual long-term disturbance potentially affecting viewers and visual resources would be reduced to approximately 1,465 acres. Alternative B and site-specific Alternative A would cause short-term and long-term effects resulting from 2,685 acres and 1,413 acres of disturbance, respectively (**Table 2-9**).

Visual contrasts from the proposed project would be greatest in the vicinities of KOP-1, KOP-2, KOP-3, and KOP-4 due to their viewer sensitivity and close proximities to substantial changes in the characteristic landscapes (**Figure 3.14-1**). The KOP-1, KOP-2, and KOP-4 viewsheds are located in the VRM Class IV management area. The KOP-3 viewshed is within both VRM Class III and VRM Class IV areas, with VRM Class IV in the immediate foreground and VRM Class III in the middleground and background. Lighting used to facilitate around-the-clock operations would increase visual contrasts at night in the view from all four KOPs. The drilling and production facilities would be visible on the skyline in the view from KOP-1. Due to the relative scale of the facilities, and change in color, line, form, and texture (moderate to strong contrasts) in the immediate foreground from KOP-1, KOP-2, KOP-3, and KOP-4, it is expected that the proposed facilities would reach the allowable "high" level of landscape change in the short term – during active production – for VRM Class IV areas. It would be expected that the visual contrasts from facilities would be reduced after reclamation. However, the long-term visual effects (as seen from KOP-3) would not be expected to achieve the VRM Class III objective unless the overall planar form of each drill pad and roadway is reshaped to repeat the surrounding angular landforms in the middleground.

The production activities and facilities in view in VRM Class IV areas are in compliance with VRM objectives, where high levels of changes are permitted in the characteristic landscape, and activities may dominate the view and may be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic visual elements of form, line, color, and texture.

The assessment of visual contrasts is documented in the visual contrast rating sheets for KOP-1, KOP-2, KOP-3, and KOP-4 and presented in **Appendix T**.

Design features and applicant-committed environmental protection measures are summarized in Section 2.6.8, Project Mitigation Strategy, and Section 2.6.9, Applicant-committed Environmental Protective Measures. Design features and applicant-committed environmental protection measures specific to visual effects focus on colors of structures and reclamation. Successful reclamation standards would include the recontouring of all disturbed areas to blend with the natural topography, stabilization of erosion, and the establishment of an acceptable vegetative cover. Reclamation goals and criteria, concurrent and proposed reclamation timelines, and post-reclamation monitoring standards are described in Section 2.6.7, Reclamation and Abandonment.

4.14.1.3 Alternative C—Resource Protection Action (BLM-Preferred)

Under Alternative C, the effects on viewers at KOP-1, KOP-2, KOP-3, and KOP-4 would be reduced as compared to Alternative B. Alternative C would result in similar but reduced effects in comparison to Alternative B. This alternative would result in 361 fewer acres of new short-term disturbance (1,514 acres total), versus 1,875 acres for Alternative B. There would be 30.7 miles of new access road versus 44.1 miles for Alternative B. Residual long-term disturbance would be reduced to approximately 1,118 acres. When combined with the approved development under Alternative A, short-term and long-term effects would result from 1,272 acres and 1,118 acres of disturbance, respectively. This is due to the additional emphasis on protection of GCWPA resources. Within portions of the GCWPA, new well pads would be restricted to a spacing of not more than 1 pad per 80 acres of surface. All other visual effects of Alternative C would be similar to the effects of Alternative B.

4.14.1.4 Alternative D—Other Protections Action

Alternative D would result in similar but reduced effects in comparison to Alternative B, but increased effects as compared to Alternative C. This alternative would result in 280 fewer acres of new disturbance (1,595 acres total), versus the 1,875 acres for Alternative B. Implementation also would result in 81 more acres of new disturbance (1,595 acres total), versus the 1,514 acres for Alternative C. Comparatively, 29.7 miles of new access road versus 44.1 miles for Alternative B and 30.7 miles for Alternative C would be constructed. Under Alternative D, the effects on viewers at KOP-1 would be reduced substantially, as compared to Alternative B and Alternative C. Effects at KOP-2, KOP-3, and KOP-4 would be reduced as compared to Alternative B and similar to Alternative C. This is due to the additional emphasis on protection of GCWPA resources, 80-acre spacing restrictions, and avoidance of the White River foreground viewshed. All other visual effects of Alternative D would be similar to the effects of Alternative B.

4.14.2 Alternative-specific Design Features and Mitigation

Mitigation measures are recommended for surfaces of structures based on selection of colors from the BLM Standard Environmental Color Chart. The color, Carlsbad Canyon, is recommended for storage tanks within the GCWPA to be consistent with disturbed soil and overall landscape. Additional mitigation measures and alternative-specific design features are described in (**Table 4.14-1**).

4.14.3 Residual Effects

For all alternatives, although successful reclamation would minimize visual effects to the extent possible, the forms and lines of the proposed facilities would likely remain visible for the life of the proposed project. These changes would result in residual adverse effects to visual resources.

4.14.4 Irretrievable and Irreversible Commitment of Resources

Effects to the visual environment would constitute an irreversible or irretrievable commitment of the present characteristic landscape. Adverse effects would be site-specific and also would occur throughout the project viewshed.

4.14.5 Relationship of Short-term Use to Long-term Productivity

The short-term use of oil and gas resources could result in adverse effects to visual resources within the APE. Visual resources affected during production and related activities would result in the loss of local, landscape, and regional natural identities. The highest likelihood of conflicts with viewing activities would occur during the latter stages of construction, drilling, and well completions coupled with production activities and associated vehicle traffic on road networks. Conflicts would decrease over the production life of wells and facilities until facilities decommissioning and reclamation when lands would be reclaimed to more natural conditions. Effective reclamation would improve the quality of visual resources over the long term.

Table 4.14-1 Visual Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
All constructed or installed structures that would remain on a location 6 months or longer would be painted a flat, non-reflective, earth-tone color as specified by the AO to reduce visual contrast with the landscape, where such painting does not conflict with safety requirements. All facilities requiring painting would be painted within 6 months of facilities installation for the last well on a pad.			d	d	m	m		
EOG will perform final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances.		d	d	d	m			
EOG will consolidate production facilities on shared well pads. EOG will minimize the amount of production equipment utilized on shared well pads to the extent allowable by varying ownership interests and production volumes, primarily liquid flow rates.		d	d	d	m			
EOG will paint all new facilities a color which best allows the facility to blend with the background, as specified by the AO. The BLM determined this design feature to be an environmental BMP to be considered in nearly all circumstances.		d	d	d	m			
Unpainted steel pipe will be used for surface gathering pipelines, which, after rusting, will blend with the existing landscape.		d	d	d	m			
All new or replacement pipelines would be buried.				d				
To protect the White River visual environment, no new wells or well pads would be permitted within 0.5 mile of the river, unless such wells would not be visible from the river because of intervening topography.				d	m	m	m	

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4.15 Recreation

4.15.1 Direct and Indirect Effects

The evaluation of effects on recreational opportunities from the construction and operation of oil and gas development that is consistent among the four alternatives is based on an assessment of loss of opportunities versus the accrual or enhancement of opportunities. Direct adverse effects would be if project development would replace current recreational space with oil and gas facilities, especially those to be maintained for life-of-project and that would present a constant contrast to a more natural environment and experience for the recreationist. A direct positive effect would be the additional road network itself for motorized to pedestrian activities. A more expansive indirect effect would be the expanded road network's increased access to lands not previously accessible to most recreationists. In between, there would be trade-offs between enhanced access to lands for recreational purposes and the expansion of industrial facilities and activities accompanied by dust and noise in addition to the facilities visual contrasts that may diminish recreational experiences for some.

4.15.1.1 Alternative A—No Action

Under Alternative A and within the GCWPA, construction of 425 well pads (plus 37 pad expansions); 255 miles of access road, pipelines, and power lines; and other facilities would result in approximately 2,685 acres of new disturbance and associated short-term effects on recreational opportunities and conditions. Including existing and site-specific No Action disturbance, approximately 6,660 acres (15.5 percent of the GCWPA) of lands will have been disturbed by approved projects under Alternative A. With the application of interim reclamation and final reclamation measures in the case of pipelines, residual long-term disturbance potentially affecting recreation would be reduced to approximately 5,388 acres. The decommissioning and final reclamation of these facilities and associated long-term disturbance would occur under the authority and COAs of existing NEPA decisions as well as applicable state and county requirements.

Access for recreationists for both highway vehicles and OHVs would increase with the construction of the additional approved 82.5 miles (424 acres) of access road. Surface and buried pipelines would undergo reclamation following installation and would not affect conditions for recreation.

New roads would enhance OHV opportunities as well as provide improved access to areas within the GCWPA for site-seeing, hiking, mountain bikes, and dirt bikes that were previously less accessible due to the absence of gravel and native-material roads. However, these enhanced recreational opportunities could be tempered in the eyes of recreationists by increased oil and gas-related traffic on the road network including large heavy trucks which may lessen the user's experience due to safety concerns and detracting general high activity, traffic-generated dust, noise, and impaired visual aesthetics. In turn, the enhanced road access could result in reduced recreational opportunities for those seeking activities away from roads and away from higher levels of human/vehicle activity such as hunting, hiking, and camping. The addition of 425 additional well pads and other surface facilities would further result in increased levels of industrial-based contrast with the residual natural landscape. Given the already industrialized nature of the GCWPA from past and ongoing oil and gas development, naturalness and solitude values in the area have already been reduced; therefore, additional development is not likely to alter the basic existing conditions for recreation. The construction of surface pipelines into approved well pads within the Red Wash Open Ride Area would add to the potential for conflict and danger for OHV users caused by the pipelines presenting at least partial obstacle or barrier to OHV passage, especially in areas where surface pipelines are at least partially if not wholly concealed or not readily observed even at close distances. However, open ride use of the designated area has not resulted in notable interference with either OHV use or oil and gas development. Riders mostly focus their use in the more rugged terrain above ephemeral drainage bottoms and associated lowlands where most of the oil and gas facilities have been and would be located. OHV-trails crisscross the more rugged terrain and generally avoid crossings of oil and gas facility locations including surface pipelines.

Although the GCWPA is not highly regarded for its hunting opportunities due to existing levels of human activity and recent drought conditions, the effects on hunting of either increased or reduced success would be anticipated to be minimal. An expanded road network and associated use of the roads, allowing greater access to game and hunt success; however success could be offset by habitat fragmentation from increased human activity and use of additional roads resulting in the additional displacement of game animals away from the roaded areas. The conversion of areas of habitat to locations of industrial facilities, essentially occupied pads and roads, could reduce forage acreages; however, the application of interim and final reclamation measures shortly after the completion of construction activities would potentially, with successful establishment of vegetation over time, increase and improve the availability and quality of forage that would compensate for the short-term loss in natural acreage due to disturbance.

In addition to effects of development on game animal habitat, hunter activity and well-being, particularly for those accessing their hunt areas within the GCWPA using OHVs, could be adversely affected by presence of surface pipelines. Although OHV use is restricted to existing roads on BLM-administered lands within the GCWPA, outside the Red Wash Open Ride Area, any OHV travel off road or even just off a road's running surface could result in either intentional or unintentional impact with a surface natural gas gathering pipeline. Gathering surface pipelines are frequently laid in parallel with access roads and within the road's construction ROW close to the running surface. An impact with the pipeline could result in harm to the OHV-mounted hunter and the vehicle itself. Given the established restrictions on OHV use off road in most of the GCWPA, both OHV recreationists and hunters using OHV for transportation would likely avoid leaving the road network thereby minimizing the risk of hitting a surface pipeline. Hunters in general would likely make less use of the Red Wash Open Ride Area due to high levels of human activity and the likely displacement and avoidance of the area by big game.

Recreational activities associated with the White River, including rafting and fishing, could be affected by noise and visual detractions of contrast created by presence of oil and gas development structures and activities during construction, drilling/completions, and production, principally vehicle traffic along roads near the river and the presence of tanks and towers within view of the river.

Although uses of the 69-acre Fantasy Canyon SRMA would emphasize protection of the unique geological formations, health and human safety, and visitation, oil and gas development activity could occur within the Fantasy Canyon SRMA boundaries. Such activity would likely damage or destroy those rock features within and adjacent to the footprint of construction disturbance resulting in the loss of unique features that contribute to the recreational opportunity presented by the SRMA. At a minimum, oil and gas development and production would create periods of visual and noise contrast for the duration of oil and gas development that may detract from the recreational experience. Use of blasting hard rock during construction inside and within 800 feet of the SRMA would be a source of visual and noise contrasts plus ground motion created by blasting could be sufficient to topple one or more pedastaled rock features, again a key aspect of the SRMA's appeal for visitors. Ease of access to the SRMA via the approximately five mile gravel/native material road into the SRMA could be affected during periods of high oil and gas vehicle use and traffic volume for any locations being accessed by some portion of the SRMA's access route. Periods of high oil and gas traffic levels would likely peak during the 10th year of approved development should Alternative A be selected.

Provisions for recreational opportunities and their protection within the GCWPA would be provided to the extent outlined in mitigations identified in those previous NEPA documents and decisions and lease stipulations.

4.15.1.2 Alternative B—Proposed Action

Implementation of Alternative B within the GCWPA would result in the construction of 233 well pads (plus 960 pad expansions), 80.5 miles of access road, pipelines, and other facilities would result in approximately 1,875 acres of new disturbance and associated short-term effects on recreational

opportunities and conditions compared to existing conditions. Including existing, site-specific No Action, and Proposed Action disturbance, approximately 6,884 acres (16.0 percent of the GCWPA) of lands would be disturbed. Interim reclamation measures would be applied immediately following construction to approximately 85 percent of the site-specific No Action disturbed area. Again with the application of interim reclamation and final reclamation measures under Alternative B in the case of pipelines, residual long-term disturbance potentially affecting recreation would be reduced to approximately 6,474 acres. Again, surface and buried pipelines would undergo reclamation following installation and would not affect conditions for recreation.

The addition of new roads would again enhance OHV opportunities and other recreational uses oriented toward use of roads while also detracting from other dispersed uses as described for Alternative A. Placement of surface pipelines to a single new location within the Red Wash Open Ride Area under Alternative A could increase the conflict and associated hazard to OHV users of the open ride area over current conditions as previously described for Alternative A; however, the anticipation is that OHV users would continue to mostly avoid existing and any new oil and gas facilities including surface pipelines. The effects on hunting would be similar to those described for Alternative A, but also proportionally less due to reduced acreage of disturbance and fewer miles of new access road. The effects of surface pipelines on hunting would be similar to those described for Alternative A. The effects on both Fantasy Canyon SRMA and the recreational uses of the White River would be as described for Alternative A with the exceptions that: 1) blasting as part of construction would not be permitted inside or within 800 feet of the SRMA boundary (ENSR 1999) and 2) adequate site distances along roads accessing Fantasy Canyon and the White River would be maintained for the life-of-project. Access and safety as part of traveling to Fantasy Canyon SRMA and to the White River would be improved by establishing and maintaining adequate sight distances along road routes and by timely posting of warning signs for heavy truck use of these access routes prior and during periods of such heavy traffic use.

4.15.1.3 Alternative C—Resource Protection Action (BLM-Preferred)

Alternative C would result in similar but reduced effects in comparison to the Proposed Action. Including existing, site-specific No Action, and Alternative C disturbance, approximately 6,523 acres (15 percent of the GCWPA) of lands would be disturbed. Interim reclamation measures would be applied immediately following construction to approximately 85 percent of the site-specific No Action disturbed area.

Implementation of this alternative would result in 361 fewer acres of new short-term disturbance and loss of habitat and natural lands, 1,514 acres, versus the 1,875 acres for the Proposed Action. Approximately 30.7 miles of new access road versus 44.1 miles for the Proposed Action would be constructed for this alternative. Residual long-term disturbance would be reduced to approximately 6,190 acres. Again, surface and buried pipelines would undergo reclamation following installation and would not affect conditions for recreation.

The effects on OHV activities, both positive and negative, short-term and long-term, would again be increased by this alternative over existing conditions, but less so than described for the Proposed Action and also for the combination of this alternative added to the LGS and electrical supply system due to reduction in overall disturbance and length of new access road. The potential conflicts and hazards to OHV users of the Red Wash Open Ride Area would remain as described for Alternative B under this alternative. The effects on hunting and risks to hunters using OHVs to access hunt areas within GCWPA would be similar to those described for Alternatives A and B. Within portions of the GCWPA where *Sclerocactus* core areas are present, there would be a reduction in locations for new well pads that would lessen adverse effects to both hunting and other dispersed reclamation activities. Similar results also would occur with the reduction in new well pad spacing from 40 acres to 80 acres in portions of the GCWPA where greater sage-grouse and black-footed ferret habitat is present. The effects on both Fantasy Canyon SRMA and the recreational uses of the White River including access would be as described for Alternative B.

4.15.1.4 Alternative D—Other Protections Action

Alternative D would result in similar but reduced effects in comparison to the Proposed Action, but slightly greater, respective positive and negative effects than Alternative C. Including existing, site-specific No Action, and Alternative D disturbance, approximately 6,604 acres (15.1 percent of the GCWPA) of lands would be disturbed. Interim reclamation measures would be applied immediately following construction to approximately 85 percent of the site-specific No Action disturbed area.

Implementation of this alternative would result in 280 fewer acres of new disturbance and loss of habitat and natural lands, 1,595 acres, versus the 1,875 acres for the Proposed Action. Implementation also would result in 81 more acres of new disturbance and loss of habitat and natural lands, 1,595 acres, versus the 1,514 acres for Alternative C. Approximately 29.7 miles of new access road versus 44.1 miles for the Proposed Action and 28.6 miles for the Alternative C would be constructed for this alternative. Again, surface and buried pipelines would undergo reclamation following installation and would not affect conditions for recreation.

The effects on OHV activities, both positive and negative, short-term and long-term, would again be increased by this alternative over existing conditions, but less so than described for the Proposed Action and also for the combination of this alternative added to the LGS and electrical supply system due to reduction in overall disturbance and length of new access road. The potential conflicts and hazards to OHV users of the Red Wash Open Ride Area would remain under this alternative with the exception that new surface pipelines would not be installed within this open ride area. New pipelines would be buried within the Red Wash Open Ride Area, thus further reducing the effects on both OHV users and oil and gas facilities in the open ride area. The effects also would be slightly greater for this alternative than for Alternative C due to the slight increase in initial short-term and residual long-term disturbance.

The effects on hunting and other dispersed recreation would generally be similar to those described for the Alternative B, and also proportionally reduced in effects due to the reduced disturbance acreages and miles of access road, but altered by further reducing development and associated disturbance for those lands within *Sclerocactus* core areas and by precluding new well pads and wells within a 0.5-mile buffer of the White River or within the buffer but not visible from the river due to intervening topography. The burial of new pipelines would reduce conflicts between OHV-mounted recreationists and hunters and oil and gas facilities. The reduced spacing of surface disturbance including roads within both buffered areas would reduce available road-oriented recreational activities, but in turn would improve recreational conditions for other dispersed activities such as hunting, camping, hiking, and sightseeing. The effects on the Fantasy Canyon SRMA and uses of the White River would be as described for the Alternative A, Alternative B, and Alternative C.

4.15.2 Alternative-specific Design Features and Mitigation

A summary of alternative-specific design features and mitigations, and the types of mitigations included, is indicated in **Table 4.15-1**.

4.15.3 Residual Effects

Residual negative effects on recreational opportunities within the GCWPA under all alternatives would include the proportional long-term reduction to loss of conditions supportive of dispersed recreation activities such as hunting, hiking, and camping correlated to the respective disturbance acreages for the alternatives. Positive effects would include the proportional expanded road system under each of the alternatives that would improve road-based recreational opportunities for the life-of-project and beyond as determined by the extent that the road network is maintained into the future.

Table 4.15-1 Recreation Design Features and Mitigations

Measure	Alternative Design Feature (d)				Alternative Mitigation Measure (m)			
	A	B	C	D	A	B	C	D
EOG will maintain adequate sight distances along routes accessing Fantasy Canyon and the White River to avoid traffic conflicts by implementing construction measures developed in conjunction with the AO. Such measures will include taking out high points on rises and by laying back cut slopes near blind turns. EOG will post signs along routes accessing Fantasy Canyon and the White River warning motorists of heavy truck traffic.		d	d	d	m			
Blasting will not be used for construction within 800 feet of Fantasy Canyon.		d	d	d	m			
No surface disturbance will occur within the Fantasy Canyon SRMA.					m	m	m	m
No surface pipelines will be laid within the Red Wash open ride area, including placement along existing roads (all new pipelines within the Red Wash open ride area will be buried).				d	m	m	m	
Placement of new well pads within the Red Wash open ride area will be avoided to the extent possible.					m	m	m	m

For all alternatives, the added list of mitigations would provide additional and direct protection of Fantasy Canyon SRMA by precluding any surface disturbance within the SRMA's boundary (**Table 4.15-1**), The application of this protective measure coupled with the blasting buffer of 800 feet should prevent any oil and gas development activity from damaging the surficial geologic features of the SRMA; however, as the features are products of erosion and are subject to continuous natural erosional forces, the SRMA's geologic features will be subject to change as time passes.

For Alternatives A, B, and C, the added protective safety measure of precluding the installation and operation of any surface pipelines within the Red Wash OHV Open Ride Area would likely reduce the risk of OHV recreationists accidentally hitting a surface pipeline in such a manner that the OHV might be damaged and the rider injured. Alternative D already includes this restriction on surface pipelines within this open ride area. For all alternatives, placement of new well pads within the open ride area would be avoided to the extent possible. Although the hazard of new surface pipelines being installed and operated for the life-of-project would be avoided by the application of mitigation measures (**Table 4.15-1**), a residual hazard posed by existing surface pipelines to OHV recreationists within the SRMA and to hunters throughout the GCWPA would continue into the future.

4.15.4 Irretrievable and Irreversible Commitment of Resources

The loss of dispersed recreational opportunities including hunting and camping would be irretrievable for the life-of-project, but reversible in response to decommissioning and final reclamation. Additionally, loss and/or incremental reduction of visual aesthetics, the detraction of views, from the White River also would be irretrievable.

4.15.5 Relationship of Short-term Use to Long-term Productivity

Access and opportunities for recreational use of expanded road networks would occur under all alternatives for the life-of-project; however, this same expansion of recreational opportunity would likely reduce opportunities for other dispersed recreational activities such as hunting, camping, and hiking. Greatest potentials for conflicts with recreational activities would occur during the late stages of construction, drilling, and well completions coupled with production activities and associated vehicle traffic on expanded road networks. Conflicts would decrease over the production life of wells and facilities until facilities decommissioning and reclamation when lands would be reclaimed to more natural conditions, which may reduce the road network, but will improve naturalness and visual aesthetics and conditions for dispersed recreational activities.

5.0 Cumulative Effects

5.1 Introduction

Cumulative effects are defined in the Council on Environmental Quality regulations (40 CFR 1508.7) as "*...the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions*." For this analysis, foreseeable actions are considered to be limited to those for which some formal notice or permit application has been made and does not include potential developments which are speculative. Because differentiating between past and present (ongoing) effects can be problematic, they have been considered together as existing effects in this analysis. Because reclamation efforts in the Uinta Basin are difficult and typically require 5 years or more to complete, past surface disturbing activities which ended within the past 5 years are considered to represent existing disturbance.

The time frame for analysis of cumulative effects extends to the completion of reclamation for all proposed project facilities. The time frame to achieve a functioning vegetative cover following project termination, the analysis time frame likely exceeds 50 years. Even then, recovery of sagebrush and salt desert shrub communities, as well as biological soil crusts, to a vegetative mix approximating the pre-disturbance cover would require additional decades of time and may never be achieved.

5.1.1 Cumulative Effects Analysis Areas

The geographic scope used for analysis varies for each resource. Resources which are more mobile in nature, such as air quality, tend to have larger analysis areas assigned to capture the extent of cumulative effects. A listing of the selected analysis areas is indicated in **Table 5-1** along with the rationale for selecting the analysis area extent shown on **Figures 5-1a, 5-1b,** and **5-1c**.

5.1.2 Analyzed Actions

Activities in the vicinity of the proposed project which have had the greatest effect on the surrounding environment are assumed to be those most likely to also be important in the future. Some activities, such as low-level saleable minerals extraction, occur at "background" levels that do not vary greatly over time, while others, such as oil and gas development, can display highly variable activity levels.

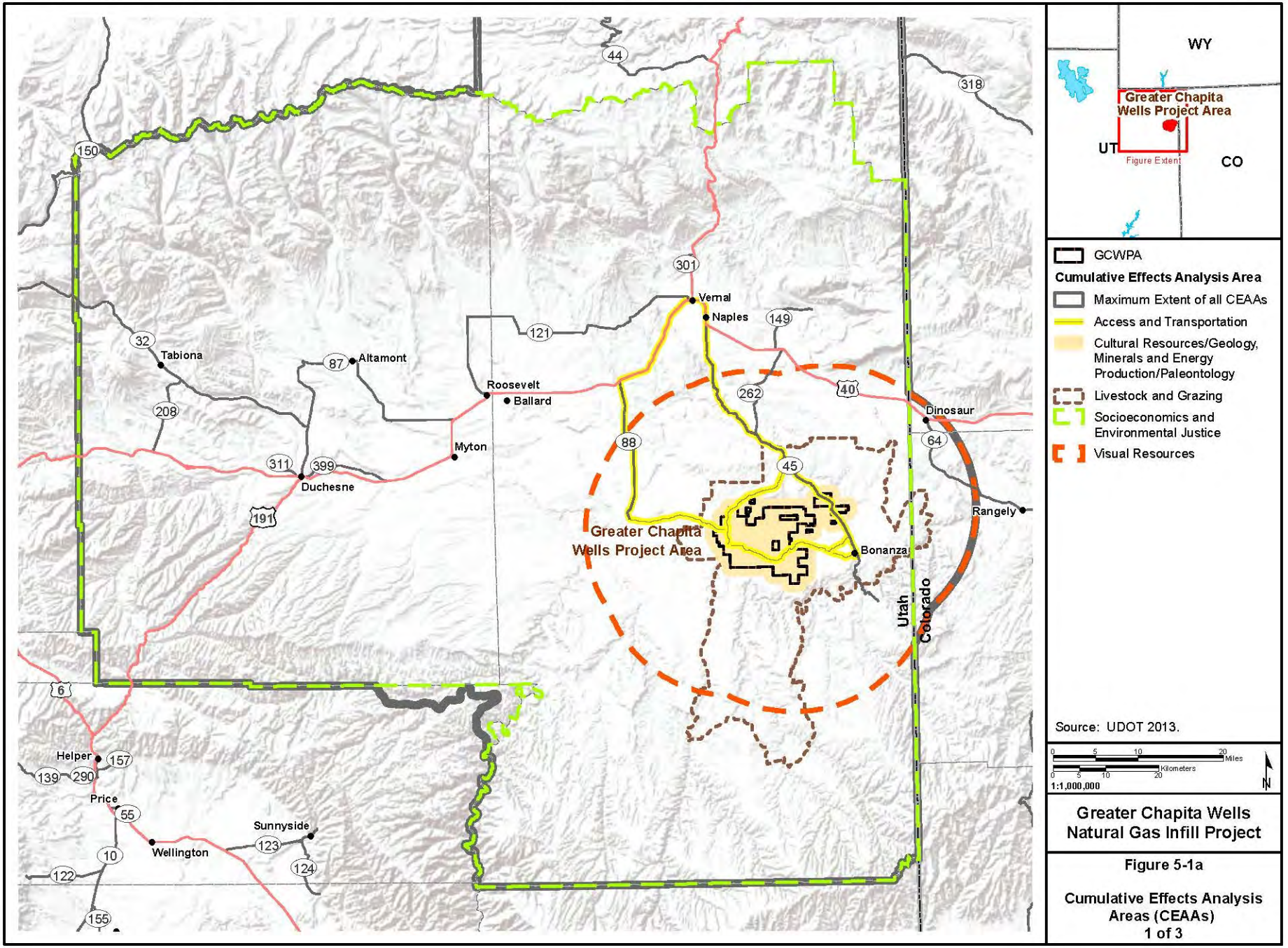
Activities in the vicinity of the GCWPA which have had substantial effects on the human environment, and for which reasonably available data sources exist, include minerals extraction, roads construction, and livestock grazing. For this document, those sources of past, present, and reasonably foreseeable effects which have been considered for the analysis, and the data sources used for the analysis, are indicated in **Table 5-2** and depicted in **Figure 5-2**.

Table 5-1 Cumulative Effects Analysis Areas

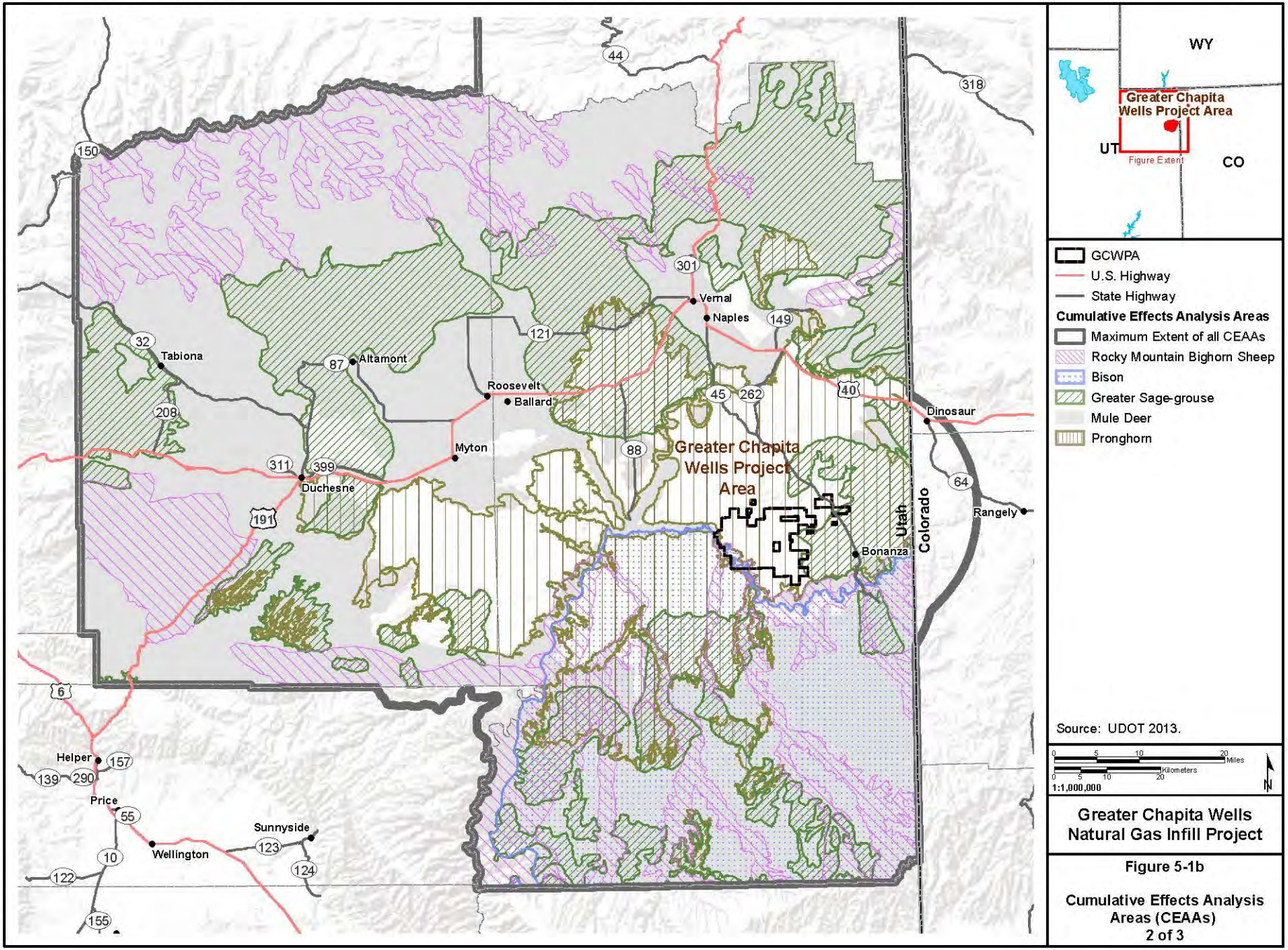
Resource	Cumulative Effects Analysis Area (CEAA)	CEAA (acres)	Rationale
Geology, Minerals, and Energy Production	GCWPA.	43,071	Oil and gas development represents the only reasonably foreseeable minerals development within the GCWPA. Oil and gas drainage is essentially limited to the area of the GCWPA.
Air Quality	Entire Uinta Basin + nearby Class I and Sensitive Class II areas, as indicated in the ARMS modeling protocol.	4,479,548	The CEAA includes areas analyzed by the near-field and far-field air quality modeling.
Water Resources	Surface water - twelve 6th order watersheds that intersect the GCWPA.	262,795	Surface water effects from all alternatives would largely be confined within local watersheds.
	Groundwater - GCWPA + 2-mile buffer.	124,718	Groundwater is less mobile compared to surface water and most effects should be largely confined to the groundwater in close proximity to the GCWPA.
Soils	Twelve 6th order watersheds that intersect the GCWPA.	262,795	Transport of soil materials can move beyond project boundary through overland and channelized flow, most commonly in the upper reaches of directly affected watersheds. Deposition of transported soil commonly occurs in the lower reaches of the same watersheds.
Vegetation	Twelve 6th order watersheds that intersect the GCWPA.	262,795	Disruption of vegetative cover contributes substantially to soil loss to local watersheds. Sediment and noxious weed seed transport are largely confined within the local watersheds. The watersheds encompass largely similar vegetative communities.
Special Status Plants	For *Sclerocactus*, the 2013 FWS potential habitat polygon. For other sensitives, the twelve 6th order watersheds.	537,566 262,795	The CEAA encompasses all of the potential *Sclerocactus* habitat and apportions disturbance to core1 and core 2 populations. The 6th order watersheds include local populations of other special status plants as well as areas along the White and Green rivers potentially used by Ute Ladies'-tresses.
Wildlife and Fisheries	UDWR ranges for pronghorn, mule deer, Rocky Mt. bighorn, and greater sage-grouse in Uintah and Duchesne counties.	1,148,043 3,862,142 1,047,147 1,501,962	Big game and greater sage-grouse species-specific range-based CEAAs would capture likely effects of overlapping projects and encompass ranges of less mobile species.

Table 5-1 Cumulative Effects Analysis Areas

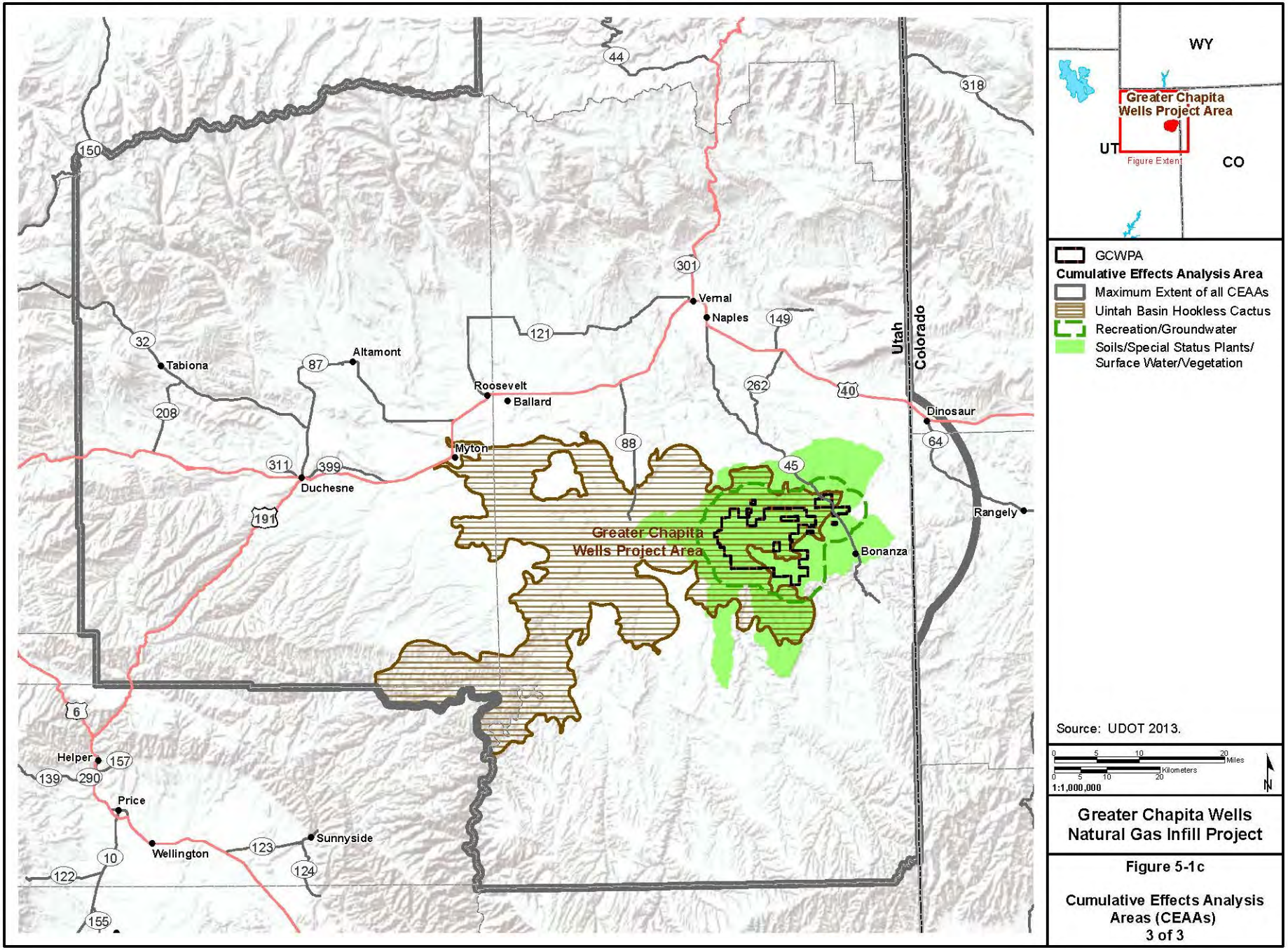
Resource	Cumulative Effects Analysis Area (CEAA)	CEAA (acres)	Rationale
Special Status Animals	For land species: Combined UDWR ranges for pronghorn, mule deer, Rocky Mt. bighorn, and greater sage-grouse in Uintah and Duchesne counties. For endangered fish: 4th order watersheds within the Vernal Field Office.	4,867,970 5,421,310	The CEAAs for big game and greater sage-grouse also encompass the potential range of smaller species. The 4th order watersheds within the VFO encompass a large portion of the range of the endangered fish as well as the site of the majority of effects to the fish.
Paleontology	GCWPA.	43,071	Fossils are non-mobile resources and effects would be confined within the GCWPA.
Cultural Resources	GCWPA plus a 1-mile buffer.	88,666	Cultural artifacts are non-mobile resources and effects, including any potential visual effects for sites eligible under Criterion C would be confined within the GCWPA plus the one mile buffer.
Socioeconomics, and Environmental Justice	Uintah and Duchesne counties.	4,961,230	The CEAA covers the reasonable area of anticipated socioeconomic effects resulting from the project.
Livestock and Grazing	Entirety of each grazing allotment within the GCWPA.	339,649	Project effects to livestock and grazing would be contained within the overlapped portions of the affected allotments.
Access and Transportation	GCWPA + primary access roads.	Not Applicable	Includes anticipated effects to the local transportation network.
Visual Resources	GCWPA viewshed out to 15 miles.	926,733	The CEAA encompasses the BLM background visual distance range.
Recreation	GCWPA + 2-mile buffer.	124,718	The CEAA encompasses most recreational opportunities likely to overlap the GCWPA.



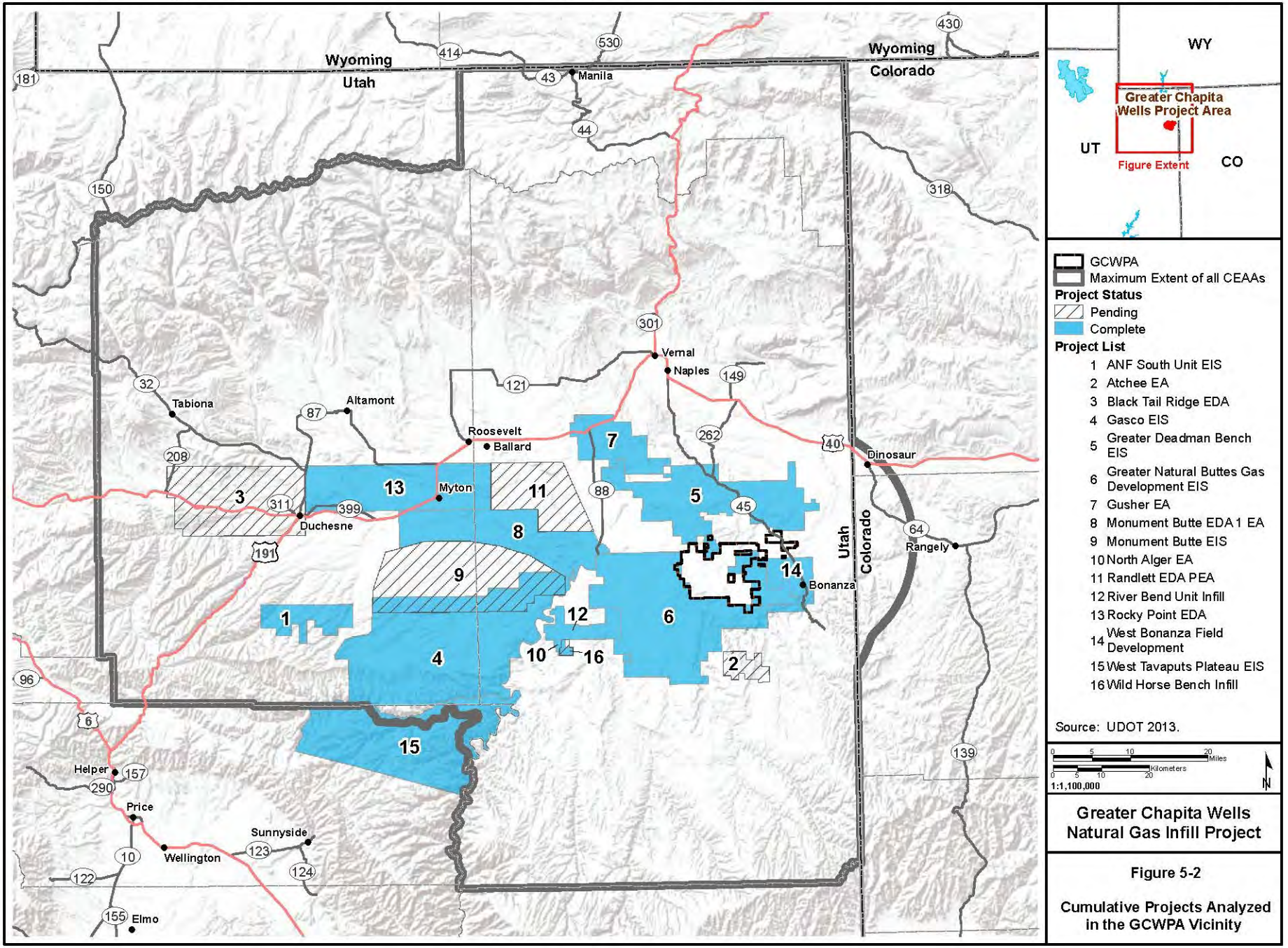
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Greater Chapita Wells Natural Gas Infill Project

Figure 5-2

Cumulative Projects Analyzed in the GCWPA Vicinity

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4/5/2016

Table 5-2 Types of Actions Included in Cumulative Analysis

Analyzed Actions	Data Sources
Minerals Industry	
Oil and Gas Wells and Related Facilities	Public data are available from UDOGM and NEPA documents (federal wells) for analysis of existing and foreseeable disturbance.
Gas Plants and Facilities	Public data are available from the Utah AGRC, EPA, Utah DEQ, and NEPA documents for existing and many foreseeable actions.
Recent Existing Pipelines	Data for larger, recent buried pipelines may be obtainable from BLM and FERC websites. Because of the length of time to reclaim disturbance in the Uinta Basin, buried pipelines completed within the last 5 years are considered existing disturbance. Pipeline disturbance over 5 years old is assumed to be fully reclaimed.
Reasonably Foreseeable Pipelines	Public data are available from NEPA documents and FERC filings for larger pipelines.
Mining	Public data are available from Utah Geological Survey, BLM, and NEPA documents for existing and some foreseeable mine projects.
Roads	
Federal and State Highways	Public data are available from county roads and/or GIS departments and/or federal land management agencies for existing roads. Data regarding some foreseeable roads is available from NEPA documents.
County Main Roads	
Minor Roads	
D-Class Roads	

Livestock grazing represents a long-term and historical use of the land. The levels of acceptable grazing loads have been determined based on prior usage and have typically not varied greatly over time. In most cases, these levels are expected to be continued into the future with only minor variations.

5.2 Past and Present (Existing) Actions

5.2.1 Oil and Gas Wells and Related Facilities

Facilities related to oil and gas well development include well pads and well pad access roads, gas gathering pipeline systems (typically small diameter and often laid on the surface in the Uinta Basin), and compressor stations or similar production support facilities. The primary source for information on existing wells in the GCWPA and vicinity is the UDOGM Well Data GIS file. For this analysis, existing wells as of March 31, 2014 have been considered. All existing and then-currently drilling wells have been included. Because of reclamation difficulties within the Uinta Basin, wells plugged within the past 5 years also have been included in the analysis.

Disturbance values associated with existing wells have been determined from summary information provided by BLM (BLM 2012e) covering the entire VFO. These 2012 data have not been updated, but, because of the number of existing wells compared to post-2012 wells, these values are considered very representative of average disturbance figures for the Uinta Basin. For this analysis, a long-term (life of project) existing disturbance (including associated facilities) is estimated at 2.16 acres/well (23,493 acres, based on 10,865 existing wells within the VFO as of 2012).

5.2.2 Gas Plants and Facilities

Data were obtained from BLM (BLM 2012) for these facilities. As of 2012, for 34 gas plants and larger compressor stations, an average existing surface disturbance was estimated at 9.4 acres per facility.

5.2.3 Pipelines

For larger diameter pipelines, data have been obtained from BLM NEPA tracking websites, the FERC pre-filing website, BLM summary data (BLM 2012e), and the EOG liquids gathering system. Large pipelines which have been completed within the last 5 years in the vicinity of the GCWPA were considered to represent existing disturbance because of the difficulty of reclamation in the Uinta Basin.

Existing disturbance from large pipelines is indicated in **Table 5-3**.

Table 5-3 Existing Pipeline Disturbance

Project	Applicant	Length (miles)	Size (inches)	Construction Disturbance (acres)	Year
Larger Pipelines					
Mainline 103	Questar	8.3	20	101	2012
Mainline 104	Questar	23.5	24	336	2012
LCU	XTO	7.0	16	64	2012
Willow Creek-Morgan CS	Anadarko	2.5	16	23	2012
Lateral 47 Loop	Questar	14.7	16	197	2013
Liquids Gathering Systems					
Chapita Wells Phase 1	EOG	76.4	Variable	728	2013
TOTALS		132.4		1,449	

Sources: BLM 2014f, 2012; FERC 2014.

5.2.4 Mining

Locations of existing mines were taken from mapping by the Utah Geological Survey (Bon and Heuscher 2008; Bon and Wakefield 2008). Disturbance estimates were made by GIS review of aerial imagery. Data have not been updated since 2008.

5.2.5 Roads

Roads data were estimated using GIS data for Uintah County roads from the Uintah County GIS Department. For portions of Duchesne County, road density was approximated from the Uintah County data.

5.3 Reasonably Foreseeable Future Actions

5.3.1 Oil and Gas Wells and Related Facilities

For federal wells, NEPA documents are the primary source of information, and typically include substantial information about associated facilities. For this analysis, a short-term disturbance of 2.85 acres/well and long-term (life of project) disturbance of 1.44 acres/well have been used (including associated facilities) based on current NEPA document data. The smaller value for long-term disturbance compared to that for existing wells (2.16 acres/well) reflects the recent and future trend of drilling multiple wells from a single well pad, compared to prior development which was generally one well per pad.

NEPA analyses of oil and gas development typically forecast effects for 10 to 15 or more years into the future. Many of the wells proposed for completed NEPA documents have not been drilled, and the UDOGM well data do not present a convenient method for determining which federal wells have been

drilled subsequent to a NEPA decision document. For this analysis, the proposed well counts indicated in completed documents were compared against a GIS review of existing wells within the respective project areas. From these reviews, an estimate was made of the percentage of NEPA approved wells remaining to be drilled. The proportional approved but undrilled wells have been counted as foreseeable for completed NEPA projects which overlap the combined CEAAs.

For non-federal wells, the UDOGM data for state and fee wells were used. There are no large planning documents available for non-federal drilling similar to the NEPA analyses available for federal wells from NEPA. Non-federal wells were considered reasonably foreseeable if an APD had been issued, but drilling had not commenced, for well locations within the combined CEAAs.

Because of the length of time required to prepare a NEPA analysis for large federal projects, a cutoff date must be selected, after which changes in existing conditions in the vicinity of the GCWPA are not generally included in the analysis. For the GSW Natural Gas Infill Project, the cutoff date is March 2014. Foreseeable federal developments which were initiated after that date have not been included in the cumulative effects analysis. An example of such a project is the Crescent Point Energy Utah Federal-Tribal Well Development Project, which is located northwest of the GCWPA. Effects resulting from this and other post-2014 projects are qualitatively the same or similar to the other enumerated projects indicated in **Table 5-4**, which have been analyzed for this project.

Disturbance associated with foreseeable oil and gas development is indicated in **Table 5-4**.

5.3.2 Other Actions

Reviews of the BLM NEPA ePlanning website and the FERC pre-filing website did not indicate currently foreseeable pipelines (beyond gathering systems likely included within larger NEPA analyses), gas plants or large compressor stations, or mines. One foreseeable road is indicated, a 12.3-mile bypass for oil and gas-related traffic around Vernal City. Surface disturbance associated with this project is estimated at 104 acres.

5.4 Cumulative Effects

For each CEAA, the number of existing facilities within the CEAA were identified and the amount of long-term surface disturbance was calculated. For foreseeable non-federal wells, the same procedure was followed. In the case of foreseeable federal wells, the proposed and remaining approved wells from the NEPA projects indicated in **Table 5-4** were used. Because most previously approved NEPA projects have remaining undrilled wells, the numbers of these undrilled wells (and their resulting surface disturbance) were estimated using GIS techniques. The area of each NEPA project overlying individual CEAAs was then used to pro-rate the estimated future disturbance within each CEAA. The amount of each NEPA project overlying the CEAA was used to pro-rate the estimated future disturbance. For each CEAA, a summary table was developed showing the cumulative effects and the additional disturbance added by each of the Greater Chapita Wells Natural Gas Infill Drilling Project EIS alternatives. These tables are located in the cumulative effects discussion of the applicable resource.

5.4.1 Geology, Minerals, and Energy Production

The CEAA for geology, minerals, and energy production encompasses the entirety of the GCWPA, an area of 43,071 acres (**Figure 5-1a**). The CEAA is overlapped by the Greater Natural Buttes Project Area and cumulative effects within the GCWPA would be limited to that development. Cumulative effects from geology, minerals, and energy production would include surface disturbance from development activities and the extraction of the oil and gas resource. Total past, present, and foreseeable surface disturbance within the CEAA would vary from 6,661 acres to 7,022 acres, depending on the alternative, as indicated in **Table 5-5**. Total cumulative surface disturbance would represent up to approximately 16 percent of the CEAA.

Table 5-4 Reasonably Foreseeable Oil and Gas Development Overlapping Project CEAAs

Project Name	GCWPA Acres	Applicant	Year Complete	NEPA New Pads	NEPA New Wells	Prorated New Wells	Prorated NEPA Construction Disturbance	Prorated NEPA LOP Disturbance
Federal Oil and Gas Drilling								
West Bonanza Field Development EA	27,993	Enduring Resources	2006	113	131	79	399	203
Love EA	12,229	Westport Resources	2007	123	123	25	141	72
Bonanza Field Development EA	12,149	Westport Resources	2007	95	95	19	72	37
Wilkin Ridge EA	12,085	Gasco	2007	52	52	26	135	69
Gusher EA	38,138	Newfield Exploration	2008	75	73	7	38	19
Greater Deadman Bench EIS	98,538	Questar Exploration and Production	2008	891	1,368	1,300	4,333	2,210
West Tavaputs Plateau EIS	137,932	Bill Barrett Corporation	2010	63	626	344	463	198
Greater Natural Buttes EIS	162,855	Anadarko Petroleum	2012	1,484	3,675	2,315	3,892	2,437
Gasco EIS	206,829	Gasco	2012	575	1,298	1,298	2,927	2,486
ANF South Unit EIS	25,608	Berry Petroleum	2012	162	356	267	619	347
River Bend Unit infill EA	17,183	Dominion	2013	70	250	250	1,103	376
North Alger EA	2,314	Koch Exploration	2013	19	124	124	192	79
Rocky Point EDA EA	92,098	Ute Energy/Newfield	2013	66	66	13	78	27
Monument Butte EDA 1 EA	77,647	Newfield	2014	448	500	500	3,445	2,028
Monument Butte EIS	119,805	Newfield	Pending	5,750	5,750	5,750	15,612	7,152
Randlett EDA EA	53,380	Ute Energy	Pending	500	500	500	2,945	1,023
Black Tail Ridge EDA EA	98,807	Bill Barrett Corporation	Pending	200	230	230	1,178	409
Atchee EA	11,388	Rosewood Resources	Pending	30	151	151	266	152
Wild Horse Bench Infill EA	1,757	Koch Exploration	Pending	0	135	135	151	63
Non-Federal Drilling		Various	Pending	NA	NA	401	1,143	577
TOTALS				10,716	15,503	13,734	39,131	19,964
Greater Chapita Wells EIS	43,071	EOG Resources	Pending	233	2,808	233	2,808	2,499
GRAND TOTALS				10,949	18,311	13,967	41,939	22,463

Table 5-5 Geology, Minerals, and Energy Production Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
GCWPA	**43,071**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		1,267	2.16	2,737	100	2.81	281
Gas Plants and Facilities		4	9.4	38	0	9.4	0
Pipelines		77.9	Variable	747	0	70	0
Mining		0	Variable	0	0	Variable	0
Roads							
Federal and State Highways		2	70	19	0	70	0
County B-Class Roads		19	40	94	0	40	0
County Other Roads		65	25	198	0	25	0
Totals				3,832			281
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							6,798
Cumulative Alternative B							7,022
Cumulative Alternative C							6,661
Cumulative Alternative D							6,742

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

As discussed in Section 4.2.1, oil and gas extraction represents the only past, present, and reasonably foreseeable substantial minerals development activity within the CEAA. Extraction of saleable minerals from disseminated surface deposits exists at low levels within the GCWPA and is likely to continue at similar levels into the future.

5.4.2 Air Quality and Climate

The cumulative air quality impacts are assessed using two different models: a near-field dispersion model and a far-field regional photochemical model. The near-field modeling results are used to assess criteria and HAP impacts within and near the GCWPA. The regional modeling was used to assess the cumulative impacts of criteria pollutants, ozone, visibility and deposition. Details of the near-field modeling are discussed in Section 4.3 and the Air Quality Technical Support Document (**Appendix J**) and the cumulative regional impacts are from the ARMS Modeling Project (AECOM 2014).

One of the primary objectives of the ARMS Modeling Project was to develop a reusable modeling platform for NEPA analyses (AECOM 2014). The ARMS Modeling Project is a cumulative assessment of

potential future air quality impacts in the Uinta Basin. Findings and reports were reviewed by a technical advisory group (consisting of the BLM and other federal and state agencies including the UDAQ, USEPA, USFS, NPS, and USFWS). Detailed information regarding the ARMS modeling platform is available on the ARMS Modeling Project Website (BLM 2015c). For consistency with the ARMS Modeling Project, the Air Quality Cumulative Effects Analysis Area is defined to be the Uinta Basin Study Area (AECOM 2014) plus nearby Class I and sensitive Class II areas.

5.4.2.1 Cumulative Air Emissions

Cumulative Criteria Emissions

The predominant industry in the Uinta Basin is oil and gas extraction and production; although there are also mining sites, a power plant, and other small stationary and mobile sources that emit criteria pollutants. To estimate the potential future cumulative air quality impacts, total regional emissions were estimated and included in the ARMS Modeling Project (AECOM 2013). **Table 5-6** contains a summary of the total oil and gas emissions modeled in the Uinta Basin for the ARMS project. The total oil and gas emissions were estimated using oil and gas development information available at the time of modeling and are generally consistent with the Past and Present Actions and Reasonably Foreseeable Future Actions presented in Section 5.2 and 5.3, respectively, with the exception of the Chapita Wells Liquid Gathering System Phases 1 and 2 and associated infrastructure.

Table 5-6 2021 Cumulative Oil and Gas Emissions in the Uinta Basin as Modeled in the ARMS Modeling Project

NO_X (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	$PM_{2.5}$ (tpy)	PM_{10} (tpy)
26,167	138,775	80,060	63	1,998	1,998

Source: AECOM 2014.

Table 5-6 values are from the ARMS Modeling Project and reflect the emissions of all current and foreseen oil and gas development in the Basin (the 2021 On-the-books Control Scenario) and are based on the basin development anticipated when the ARMS model was conducted. The ARMS modeling anticipated that 1,412 additional wells will be developed in Uintah County than was analyzed when modeling the GCW Project. The emissions differences between the GCW Project and the cumulative ARMS modeling affect the modeled environment and likewise affect predicted project impacts; however, accounting for known model errors, biases, and limitations described in Section 4.3, model results are anticipated to be representative of the area. Specifically, the modeled emissions inventory was developed in a manner that is consistent with other EIS analyses and other similar oil and gas modeling studies. Furthermore, the emissions are within the expected range. The meteorological model used to drive the air quality model performed within all established benchmarks for areas with complex terrain. The largest known contributor to the overall model error is related to the on-going scientific research of winter ozone formation. Altogether, both the potential future cumulative conditions and the model-predicted project contribution have known and unknown sources of uncertainty.

All air-specific mitigation measures focused on reduction of project VOC emissions are intended to reduce potential project impacts. Importantly, mitigation measures were not developed by solely considering modeling results. Other factors were considered including measured ozone concentrations in the Basin, mitigation measures for similar projects, and available control technologies, as well as other similar factors.

Cumulative GHG Emissions

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts, is an ongoing scientific process. It is not known with certainty the net impacts that oil and gas extraction and production could have on climate – that is, while BLM actions may contribute to the

climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. The BLM does not have the ability to directly associate a BLM action's contribution to climate change with effects in any particular area. Inconsistencies in the results of scientific models designed to predict climate change on regional or local scales limit the ability to completely quantify potential future effects of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science. When further information on the effect to climate change is known, such information would be incorporated in the BLM's planning and NEPA documents as appropriate.

The ARMS project did not analyze GHG emissions, so there is not an available estimate of total cumulative GHG emissions for the Uinta Basin. It is anticipated that Alternative B direct and indirect GHG emissions will increase as shown in **Table 5-7**. Alternative C and D may have similar or lower emissions, while Alternative A is anticipated to have a net reduction of 13.6 $MMTCO_2e$ emissions. GHG emissions may influence climate change within the region and result in some cumulative effects when combined with other past, present, and future actions in the area. For instance, as previously acknowledged in this EIS, it is possible that there could be additional oil and gas development on private surface and private minerals in the future. These activities could result in additional air emissions. Reclamation and other stipulations and best management practices, as described earlier in this EIS, would help to minimize the potential for significant adverse cumulative effects.

Table 5-7 Life of Project Direct and Indirect Greenhouse Gas Emissions – Alternative B

Emission Type	CO_2 ($MMTCO_2e$)	CH_4 ($MMTCO_2e$)	N_2O ($MMTCO_2e$)	Total ($MMTCO_2e$)
Direct[1]	1.75	5.9	0.00	7.65
Indirect [2]	154.54	0.0	0.00	154.54
Total	**156.29**	**5.9**	**0.00**	**162.19**

[1] Source: **Appendix J**.

[2] Source: USEPA 2016d.

5.4.2.2 Cumulative Impacts to Criteria Pollutants

Near-field Impacts

Near-field modeling was used to assess the cumulative impact within and nearby the GCWPA resulting from Project-related development and production emissions. While near-field modeling analyses do not explicitly model other projects, it is anticipated that the addition of existing background concentrations, used to characterize total cumulative impacts, is representative of potential future development. Maximum air quality impacts resulting from the GCW Project drilling and production activities within the GCWPA were added to representative background concentrations, and the resulting total cumulative concentrations were found to be below the levels of the NAAQS for all pollutant and averaging times, except for ozone which is not able to be analyzed with a near-field model.

Regional Impacts

Cumulative impacts to air quality from proposed oil and gas development within the Uinta Basin were analyzed using the ARMS project. Cumulative impacts include other past, present, and foreseeable future oil and gas projects in the Uinta Basin. Surface disturbance, drilling, completion, and operational activities resulting in effects to air quality in the GCWPA would contribute incrementally to those cumulative impacts analyzed for the region.

Table 5-8 compares the cumulative impacts predicted by the ARMS Modeling Project to the NAAQS. The impacts presented in the table represent a summary of the highest modeled impacts independent of location of those impacts. Cumulative impacts for criteria pollutants are predicted to be below the NAAQS at all Class I areas and sensitive Class II areas. However, ozone exceedances are predicted to occur within the Uinta Basin Study Area, Ouray Monitor station, Dinosaur Monitor Station, Dinosaur National Monument, Arches NP, Canyonlands NP, Rocky Mountain NP, and at Uintah and Ouray Indian Reservation. Also shown in **Table 5-8** is the GCW Alternative B project impact that would occur in the same location as the maximum cumulative impacts.

Table 5-8 Cumulative Air Quality Impacts

Pollutant	Averaging Time	Units	Alternative B Maximum Impact[1]	ARMS-predicted Cumulative Impact [2]	Alternative B as Percent of Cumulative	NAAQS	Receptor Site
NO_2	1-hour	ppb	0.9	46	2	100	Ouray Monitor Station
	Annual	ppb	0.3	11	3	53	Ouray Monitor Station
CO	1-hour	ppm	0	3	0	35	Uintah and Ouray Indian Reservation
	8-hour	ppm	0	2	0	9	Uintah and Ouray Indian Reservation and Uinta Basin Study Area
SO_2	1-hour	ppb	0	7	0	75	Wind River
	3-hour	ppm	0	0	0	0.5	All
O_3	8-hour	ppm	0.007	**0.117**	6	0.070	Uinta Basin Study Area
$PM_{2.5}$	24-hour	µg/m^3	0.8	28	3	35	Ouray AQS Monitor Station
	Annual	µg/m^3	0.6	**21.9**	3	12	Uintah and Ouray Indian Reservation and Uinta Basin Study Area
PM_{10}	24-hour	µg/m^3	0.9	50	2	150	Uintah and Ouray Indian Reservation

Bold values indicate projected NAAQS exceedences.

[1] The GCW Alternative B project impacts represent the maximum impact of from either model year 7 or 15. Source **Appendix J**.

[2] Source: AECOM 2015.

5.4.2.3 Cumulative Impacts to HAPs

Near-field HAP concentrations were calculated in order to assess impacts both in the immediate vicinity of GCWPA emission sources for short-term (acute) exposure assessment and for calculation of long-term risk. Near-field HAP concentrations were all below the acute REL and non-carcinogenic HAP RfCs and showed cancer risks within acceptable limits.

5.4.2.4 Cumulative Impacts to Visibility

The cumulative visibility at a Class I predicted by the ARMS Modeling Project ranged from 0.43 deciviews (dv) in the West Elk Wilderness Area to 11.3 dv in Rocky Mountain National Park. The maximum visibility impact for any of the areas analyzed is predicted to be 11.4 dv in the Uintah and Ouray Indian Reservation. The GCW Project analysis predicts that Alternative B would not lead to changes in visibility greater than 0.5 Δdv at any of the Class I areas analyzed. The GCW Project impacts were predicted using the ARMS Modeling Project cumulative emissions inventory with the ARMS estimated GCW emissions replaced with the GCW EIS estimated project emissions. Since the cumulative emissions estimates can affect the predicted project impacts, it is likely the project impacts would be different if modeled using a different approach to prepare cumulative emissions inventory.

5.4.2.5 Cumulative Impacts to Deposition

Table 5-9 shows the cumulative deposition predicted by the ARMS Modeling Project. For nitrogen deposition the values are compared with critical load thresholds. The maximum predicted impacts shown in the table represents a summary of the highest modeled impacts independent of location. Cumulative deposition values are generally predicted to exceed the nitrogen critical loads for most areas analyzed; however, no exceedances of the sulfur critical load are predicted for any area analyzed. GCW Alternative B is predicted to contribute less than 1 percent to the cumulative deposition. The GCW Project impacts were predicted using the ARMS Modeling Project cumulative emissions inventory with the ARMS estimated GCW emissions replaced with the GCW EIS estimated project emissions. Since the cumulative emissions estimates can affect the predicted project impacts, it is likely the project impacts would be different if modeled using a different approach to prepare cumulative emissions inventory.

Table 5-9 Cumulative Impacts Nitrogen and Sulfur Deposition

Pollutant	Units	Alternative B Maximum Impact[1]	Cumulative Impact of ARMS[2]	Alternative B as Percent of Cumulative	Critical Load	Receptor Site
Class I and Class II Areas						
Nitrogen	kg N/ ha/ yr	0.001	5.52	0.2	2.5	Arches NP
Sulfur	kg S/ ha/ yr	NA	1.85	0	--	Bridger WA
Sensitive Lakes						
Nitrogen	kg N/ ha/ yr	0.001	6.48	0.02	3.0	4D2-039, High Uintas WA
Sulfur	kg S/ ha/ yr	0	1.67	0	--	4D2-039, High Uintas WA

[1] **Appendix J**.

[2] AECOM 2015.

5.4.3 Water Resources

5.4.3.1 Surface Water

The surface water resources CEAA is comprised of the same 12 subwatersheds described in the affected environment and depicted in **Figure 3.4-1** and **Figure 5-1c**). Cumulative effects on water resources would occur from past, present, and reasonably foreseeable oil and gas development, vehicle traffic, mining, other industrial activities, and livestock grazing in the CEAA.

Cumulative effects on surface water would increase erosion and sedimentation rates, and increased salinity (salts and ion transport) in waterways. The disturbance actions from past, present, and reasonably foreseeable oil and gas development, roadways, mining, and other industrial activities would contribute incrementally to these effects. There also would be an increased potential for spilled materials such as vehicle and heavy machinery fluids or oil and gas production fluids to reach waterways. Livestock grazing also would contribute to the disturbance footprints; however, if current grazing BMPs are followed the effect contribution to water resources from grazing would be minimal. Increased water demand and consumptive use from the cumulative projects would reduce the water available for other users; however, the processes established through Utah Title 73 provide the framework to manage the State's water use and protect current water users accordingly.

Within the CEAA for water resources, past and present disturbance has occurred from oil and gas development, gas plants and facilities, pipelines, mining, and road development (**Table 5-10**). The total current disturbance within the CEAA is estimated to be 12,918 acres (5 percent of the total CEAA). It is reasonably foreseeable to expect an additional 5,904 acres (2 percent of the total CEAA) of disturbance from oil and gas development in the CEAA. This project would contribute an additional amount of disturbance, ranging from 1,514 to 2,685 (7 to 21 percent of the cumulative disturbance in the CEAA, respectively; approximately 1 percent of the total CEAA) depending on the alternative selected. Total cumulative surface disturbance would represent approximately 8 percent of the CEAA.

Although the incremental increases of the proposed project and reasonably foreseeable development are relatively large compared to the past and present (existing) disturbance, the overall percentage of disturbance within the CEAA would only increase by less than 3 percent. Furthermore, given the high variability of the water quality in the CEAA, the increase in disturbance will likely not create additional effects that could be directly attributed to the activities. Assuming other foreseeable projects adhere to similar project BMPs, and are subject to monitoring plans, the cumulative effects to surface water resources would be minimized.

5.4.3.2 Groundwater

The CEEA for groundwater is the GCWPA boundary plus a 2-mile buffer. Since the source water for the Greater Chapita Wells project is surface water that is either recycled or previously appropriated for the Deseret Power Plant, there would be no cumulative effects on groundwater supply sources. If there are opportunities for recycling of hydraulic fracturing water and produced water, the reduction in overall water requirements would have no effect for potential cumulative effects on groundwater resources.

Under all the alternatives, spent hydraulic fracturing fluids and produced water would be disposed into the Bird's Nest aquifer by injection disposal wells, which are permitted by USEPA as the authorizing regulatory agency for the UIC program on lands in the GCWPA. Disposal of produced water under the UIC program is a highly regulated activity that provides for the protection of USDWs. Assuming compliance with UIC program regulatory requirements, cumulative injection of produced water within the CEAA is not anticipated to affect USDWs.

Table 5-10 Surface Water Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Local 6th Order Watersheds	**262,795**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		4,412	2.16	9,530	2,101	2.81	5,904
Gas Plants and Facilities		6	9.4	56	0	9.4	0
Pipelines		82.0	Variable	800	0	70	0
Mining		2	Variable	59	0	Variable	0
Roads							
Federal and State Highways		16	70	134	0	70	0
County B-Class Roads		142	40	691	0	40	0
County Other Roads		544	25	1,648	0	25	0
Totals				12,918			5,904
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							21,507
Cumulative Alternative B							21,731
Cumulative Alternative C							21,370
Cumulative Alternative D							21,451

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

5.4.4 Soils

The CEAA for soil resources encompasses the local sixth order watersheds that contain the entirety of the GCWPA, an area of 262,795 acres (**Figure 5-1c**). The CEAA is overlapped by portions of five of the reasonably foreseeable federal actions illustrated in **Figure 5-2**; however, effects within the GCWPA would be limited to wells drilled as part of the Greater Natural Buttes oil and gas development. Total past, present, and foreseeable surface disturbance within the CEAA not inclusive of the disturbance projected for the four alternatives would total approximately 18,822 acres (**Table 5-11**). The cumulative soil disturbance total with the addition of the projected alternatives' disturbance acreages would vary from 21,370 acres to 21,731 acres, depending on the alternative, as indicated in **Table 5-11**.

Table 5-11 Soils Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Local 6th Order Watersheds	**262,795**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		4,412	2.16	9,530	2,101	2.81	5,904
Gas Plants and Facilities		6	9.4	56	0	9.4	0
Pipelines		82.0	Variable	800	0	70	0
Mining		2	Variable	59	0	Variable	0
Roads							
Federal and State Highways		16	70	134	0	70	0
County B-Class Roads		142	40	691	0	40	0
County Other Roads		544	25	1,648	0	25	0
Totals				12,918			5,904
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							21,507
Cumulative Alternative B							21,731
Cumulative Alternative C							21,370
Cumulative Alternative D							21,451

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

This increased cumulative soil disturbance acreage would likely reduce soils productivity within the CEAA for the life of oil and gas operations until post-decommissioning reclamation is determined to be successful in terms of soil stability and productivity. Cumulative effects to disturbed soils could include accelerated erosion and soil loss and reduced soil productivity as measured by amounts and types of vegetative cover and forage as well as BSC cover. In addition to direct cumulative effects related to soil disturbance, spills, accidental releases of hydrocarbons and waste water could cumulatively contaminate soils, reduce soil productivity, and indirectly contaminate surface water runoff from affected locations.

Selection of Alternative A No Action, approved development beyond existing conditions, would result in approximately 2,685 acres of new soil disturbance and cumulatively, approximately 21,507 acres of soil disturbance, or approximately 8.2 percent of the 262,795-acre CEAA. Under Alternative B Proposed Action, proposed new disturbance of 1,875 acres would yield a cumulative total of 21,731 acres, or approximately 8.3 percent of the CEAA. Selection of Alternatives C or D would result in approximately 1,448 or 1,507 acres of new soil disturbance, and cumulatively 21,304 or 21,363acres of disturbance,

respectively. Both cumulative totals would represent approximately 8.1 percent of the CEAA. Differences in cumulative effects to soils among the alternatives are minor (within 0.2 percent of the CEAA) with the Proposed Action potentially producing the greatest effects in the form of soil disturbance and with Alternative C Resource Protection Action Alternative producing the least effects (**Table 5-11**). Cumulative surface disturbance would represent approximately 8 percent of the CEAA.

With the application of site-specific measures to foster successful stabilization and re-establishment of protective higher vegetative and BSC cover as part of implementation of any of the alternatives, and with the continued efforts to improve the recovery of affected landscapes in the GCWPA, the potential for and the rate to achieve success should improve (Section 2.6.7 and **Appendix B**). Soil stability and isolation of soil effects to disturbed sites also would be addressed by various and site-specific BMPs consistent with USDI and USDA Gold Book guidance for projects throughout the CEAA. Reclamation measures would include those intended to optimize surface/slope stability, soil conditions (both physical and chemical/nutrient), seed mix composition and timely germination, BSC inoculation, and maintenance to resolve any soil conditions or revegetation issues prior to substantial effects to either soil stability or higher plant and BSC cover re-establishment.

Cumulative effects to soil resources would be expected to be limited for implementation of an alternative and associated potential spills or releases of contaminants. All spills or releases would be contained and an approved clean-up process would be applied in accordance with required SPCC plans. Effective remediation of hydrocarbon releases would be anticipated; however, releases of waste water, particularly saline waters may be difficult to remediate. Site-specific measures would be implemented to reduce soil salinity levels and any effects on existing or reestablishing vegetation productivity, and potentials for offsite transport of high salinity runoff.

5.4.5 Vegetation

The past and present actions and RFFAs identified include all known and foreseeable surface-disturbing activities that affect the type and extent of vegetation. The vegetation and special status plant resources CEAA is comprised of 12 subwatersheds described in Section 3.4, Surface Water, and depicted in **Figures 5-1c**. Cumulative effects to vegetation and special status plant resources would occur from past, present, and reasonably foreseeable oil and gas development, vehicle traffic, mining, other industrial activities, and livestock grazing in the CEAA. Most of this surface disturbance can be categorized as long-term disturbance. **Table 5-12** summarizes the acreage of past and present actions and RFFAs within the CEAA that affect vegetation resources.

Within the CEAA for vegetation and special status plant resources, past and present disturbance has occurred from oil and gas development, gas plants and facilities, pipelines, mining, and road development (**Table 5-12**). The total current disturbance within the CEAA is estimated to be 12,918 acres (5 percent of the total CEAA). It is reasonably foreseeable to expect an additional 5,904 acres (2 percent of the total CEAA) of disturbance from oil and gas development in the CEAA. This project would contribute an additional amount of disturbance, ranging from 1,448 to 2,685 (an additional 11 to 21 percent, respectively, of the cumulative disturbance in the CEAA; approximately 1 percent of the total CEAA) depending on the alternative selected. Total cumulative surface disturbance would represent approximately 8 percent of the CEAA.

Table 5-12 Vegetation Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Local 6th Order Watersheds	**262,795**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		4,412	2.16	9,530	2,101	2.81	5,904
Gas Plants and Facilities		6	9.4	56	0	9.4	0
Pipelines		82.0	Variable	800	0	70	0
Mining		2	Variable	59	0	Variable	0
Roads							
Federal and State Highways		16	70	134	0	70	0
County B-Class Roads		142	40	691	0	40	0
County Other Roads		544	25	1,648	0	25	0
Totals				12,918			5,904
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							21,507
Cumulative Alternative B							21,731
Cumulative Alternative C							21,370
Cumulative Alternative D							21,451

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

The effects of future surface-disturbing actions would result in direct and indirect effects to vegetation and special status plants, similar to the effects described for oil and gas related activities. Disturbance actions from past, present, and reasonably foreseeable oil and gas development, roadways, mining, and other industrial activities would contribute incrementally to these effects. The effects from all of these surface-disturbing activities would combine to alter the vegetative cover by removal or changing the long-term plant communities through reclamation. Livestock grazing also would contribute to the disturbance footprints; however, if current grazing BMPs are followed the effect contribution to vegetation resources from grazing would be minimal. Past, present, and reasonably foreseeable future actions (RFFAs) would cumulatively and incrementally reduce available vegetation cover types until such time that reclamation is deemed successful. Cumulative losses for vegetation resources potentially would include the reduction of numerous habitat functions including soil stability, erosion control, species biodiversity, wildlife forage and habitat, and available forage for livestock grazing operations.

Successful reclamation is defined as re-establishing a sustainable vegetation community that has similar species diversity and vegetative cover compared to similar undisturbed native vegetative communities. Successful reclamation is difficult in the Uinta Basin due to sustained drought conditions in the area, high percentage of soils with characteristics that limit restoration, and the presence of noxious and invasive weed species. It is estimated that successful reclamation would take at a minimum 5 years, and would be potentially problematic in the desert shrub, and perennial grasslands/sagebrush communities (**Appendix B**; BLM 2008d). The desert shrub type is associated with shallow and highly saline soils, and has limited moisture availability. When oil and gas activities are combined with other surface disturbances such as grazing and chaining and burning activities, the perennial grasslands/sagebrush and pinyon-juniper communities are both highly susceptible to noxious weed invasions.

Drought conditions in the Uinta Basin area are believed to be the principal limitation to success for reclamation efforts. Based on the difficulties in reclamation success, the incremental additional effects to vegetation as a result of the proposed project would be considered long-term in nature for the majority of the project disturbance area. It is estimated that herbaceous-dominated plant communities would require a minimum of 5 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species and grazing operations (BLM 2008d). Woody-dominated plant communities would require at least 25 to 50 years for shrubs of similar stature to recolonize the area (BLM 2008d). Re-establishment of mature pinyon-juniper woodlands would require 75 to 100 years (BLM 2008d).

Although the incremental increases of the proposed project and reasonably foreseeable development are relatively large compared to the past and present (existing) disturbance, the overall percentage of disturbance within the CEAA would only increase by less than 3 percent. Assuming other foreseeable projects adhere to similar project BMPs, and are subject to monitoring plans, the cumulative effects to vegetation resources would be minimized.

5.4.5.1 Uinta Basin Hookless Cactus

The CEAA for the Uinta Basin Hookless Cactus includes the extent of potential habitat as documented by the USFWS (2013). Cumulative effects to the Uinta Basin hookless cactus would be similar to those described above for vegetation and special status plant resources. The CEAA is comprised of designated Level 1 and 2 CCAs, as well as USFWS potential habitat (**Figure 5-1c**).The cumulative long-term surface disturbance of Uinta Basin hookless cactus habitat within the CEAA is shown in **Table-5-13.**

The total current disturbance within the CEAA for Uinta Basin hookless cactus is estimated to be 18,419 acres (4 percent of the total CEAA). It is reasonably foreseeable to expect an additional 15,300 acres (4 percent of the total CEAA) of disturbance from oil and gas development in the CEAA; this nearly doubles the amount of disturbance above what currently exists. This project would contribute an additional amount of disturbance, ranging from 1,151 to 2,003 acres (an additional 3 to 6 percent additional cumulative disturbance, respectively; less than 1 percent of the total CEAA) depending on the alternative selected. Total cumulative surface disturbance would represent approximately 7 percent of the CEAA.

CCAs comprise 30 percent of the total *Sclerocactus* CEAA. Level 1 CCAs on federal lands are not expected to be disturbed at all due to USFWS restrictions. Disturbance to plant populations within Level 2 CCAs would be limited and restricted to individual plants.

Although the incremental increases of the proposed project and reasonably foreseeable development are relatively large, nearly double the amount of disturbance compared to the past and present (existing) disturbance, the overall percentage of disturbance within the CEAA would increase by less than 4 percent. Assuming other foreseeable projects adhere to USFWS conservation measures, similar project BMPs, and are subject to monitoring plans, the cumulative effects to Uinta Basin hookless cactus would be minimized.

Table 5-13 Uinta Basin Hookless Cactus Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
***Sclerocactus* Potential Habitat**	**413,662**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		6,211	2.16	13,416	5,445	2.81	15,300
Gas Plants and Facilities		12	9.4	113	0	9.4	0
Pipelines		107.8	Variable	1,131	0	70	0
Mining		0	Variable	0	0	Variable	0
Roads							
Federal and State Highways		8	70	64	0	70	0
County B-Class Roads		234	40	1,135	0	40	0
County Other Roads		845	25	2,560	0	25	0
Totals				18,419			15,300
Proposed Project Effects							
Alternative A							2,003
Alternative B							1,418
Alternative C							1,151
Alternative D							1,173
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							35,722
Cumulative Alternative B							36,171
Cumulative Alternative C							35,904
Cumulative Alternative D							35,926

For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

5.4.6 Wildlife

Cumulative effects associated with the proposed project would be similar to the direct and indirect effects described previously, including injury and mortality; disturbance and displacement of animals; and habitat loss and alteration, including effects associated with habitat fragmentation. The CEAA for general wildlife are the twelve 6th order watersheds within the VFO (**Figure 5-1b**).

Past, present, and RFFAs, including oil and gas development, mining, and road development are considered in this cumulative effects analysis. Other permitted activities, including livestock grazing and recreational activities, have occurred or likely to occur in the CEAA. For the purposes of this analysis, it is assumed that the majority of quantifiable disturbance will be associated with oil and gas activities, including construction and use of well pads, facilities, roads, pipelines, and compressor stations. Future actions within the CEAA, including grazing, recreation, development of permanent recreation facilities, and growth and development of urban centers, also will likely alter or remove habitats that may support wildlife species.

Surface disturbance associated with each alternative and past, present, and RFFAs is used as a reliable and quantifiable indicator of potential cumulative effects on wildlife. As described in Section 4.7, other types of effects including injury and death, disturbance, and displacement are typically less quantifiable, but are most likely strongly associated with the amount, concentration, and distribution of project related surface disturbance.

5.4.6.1 General Wildlife

Surface disturbance associated with each of the alternatives would cumulatively affect wildlife when combined with all past, present, and reasonably foreseeable future development in the CEAA. An estimated 18,822 acres (7 percent) has been or will be disturbed in the CEAA. **Table 5-14**, presents the disturbance summaries for past, present, and RFFAs in the CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Implementation of any one of the alternatives would result in additional disturbance to 1 percent or less of the general wildlife CEAA. Disturbance associated with implementation of each of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to 8 percent of the general wildlife CEAA.

Table 5-14 General Wildlife Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Local 6th Order Watersheds	**262,795**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		4,412	2.16	9,530	2,101	2.81	5,904
Gas Plants and Facilities		6	9.4	56	0	9.4	0
Pipelines		82.0	Variable	800	0	70	0
Mining		2	Variable	59	0	Variable	0
Roads							
Federal and State Highways		16	70	134	0	70	0
County B-Class Roads		142	40	691	0	40	0
County Other Roads		544	25	1,648	0	25	0
Totals				12,918			5,904
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							21,507
Cumulative Alternative B							21,731
Cumulative Alternative C							21,370
Cumulative Alternative D							21,451

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

Wildlife species that are most susceptible to cumulative effects associated with the proposed project are those that have specific habitat or range requirements that are increasingly exposed to disturbance or loss. Big game species, including mule deer, pronghorn, Rocky Mountain bighorn sheep, and bison, have yearlong crucial range in the GCWPA. Cumulative habitat loss, human activity/presence, and disturbance/displacement effects on these species could occur with sufficient intensity and duration to alter the carrying capacity of yearlong crucial ranges in the GCWPA. The magnitude and effect of cumulative effects on these big game species is influenced by the availability and quality of range in the GCWPA, seasonal variation in population health, and weather.

For the pronghorn, the CEAA is defined as mapped/designated pronghorn range in Uintah and Duchesne counties (1,148,043 acres, **Figure 5-1b**). **Table 5-15** presents the disturbance summaries for past, present, and RFFAs in the CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Based on available data, past, present, and reasonably foreseeable projects would disturb an estimated 64,159 acres (6 percent) in the pronghorn CEAA. Implementation of any one of the alternatives would result in additional disturbance to less than 1 percent of the pronghorn CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to approximately 6 percent of the pronghorn CEAA.

Table 5-15 Pronghorn Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Uintah-Duchesne Cos. Pronghorn Range	**1,148,043**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		10,122	2.16	21,864	10,542	2.81	29,623
Gas Plants and Facilities		17	9.4	160	0	9.4	0
Pipelines		121.1	Variable	1,302	0	70	0
Mining		6	Variable	101	0	Variable	0
Roads							
Federal and State Highways		90	70	765	0	70	0
County B-Class Roads		580	40	2,813	0	40	0
County Other Roads		2,485	25	7,531	0	25	0
Totals				34,536			29,623
Proposed Project Effects							
Alternative A							2,499
Alternative B							1,739
Alternative C							1,417
Alternative D							1,538
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							66,658
Cumulative Alternative B							66,932
Cumulative Alternative C							66,610
Cumulative Alternative D							66,731

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

For the mule deer, the CEAA is defined as mapped/designated mule deer range in Uintah and Duchesne counties (3,862,142 acres, **Figure 5-1b**). **Table 5-16** presents the disturbance summaries for past, present, and RFFAs in the CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Based on available data, past, present and reasonably foreseeable projects would disturb an estimated 43,760 acres (1 percent) of mule deer range in the mule deer CEAA. Implementation of any one of the alternatives would result in additional disturbance to less than 1 percent of the mule deer CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to approximately 1 percent of the mule deer CEAA.

Table 5-16 Mule Deer Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Uintah-Duchesne Cos. Mule Deer Range	**3,862,142**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		3,167	2.16	6,841	2,606	2.81	7,323
Gas Plants and Facilities		16	9.4	150	0	9.4	0
Pipelines		86.1	Variable	853	0	70	0
Mining		10	Variable	579	0	Variable	0
Roads							
Federal and State Highways		329	70	2,794	12	70	104
County B-Class Roads		2,045	40	9,916	0	40	0
County Other Roads		5,016	25	15,200	0	25	0
Totals				36,333			7,427
Proposed Project Effects							
Alternative A							143
Alternative B							105
Alternative C							77
Alternative D							34
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							43,904
Cumulative Alternative B							44,900
Cumulative Alternative C							44,872
Cumulative Alternative D							44,829

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

For the Rocky Mountain bighorn sheep (bighorn sheep), the CEAA is defined as the mapped/designated bighorn sheep range in Uintah and Duchesne counties (1,070,147 acres, **Figure 5-1b**). **Table 5-17** presents the disturbance summaries for past, present, and RFFAs in the CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Based on available data, past, present, and reasonably foreseeable projects would disturb an estimated 10,827 acres (1 percent) of bighorn

sheep range in the bighorn sheep CEAA. Implementation of one of the alternatives would result in additional disturbance to less than 1 percent of the Rocky Mountain bighorn sheep CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to approximately 1 percent of the Rocky Mountain bighorn sheep CEAA.

Table 5-17 Rocky Mountain Bighorn Sheep Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Uintah-Duchesne Cos. Rocky Mt. Bighorn Range	**1,070,147**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		1,180	2.16	2,549	1,046	2.81	2,939
Gas Plants and Facilities		4	9.4	38	0	9.4	0
Pipelines		88.2	Variable	880	0	70	0
Mining		3	Variable	438	0	Variable	0
Roads							
Federal and State Highways		22	70	184	0	70	0
County B-Class Roads		268	40	1,300	0	40	0
County Other Roads		825	25	2,501	0	25	0
Totals				7,888			2,939
Proposed Project Effects							
Alternative A							184
Alternative B							134
Alternative C							101
Alternative D							52
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							11,011
Cumulative Alternative B							11,995
Cumulative Alternative C							11,962
Cumulative Alternative D							11,913

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

Cumulative effects on bison are not provided because while a very small amount of yearlong crucial bison range is mapped within the GCWPA, this range is presumed unoccupied (**Figure 5-1b**). As part of the bison re-introduction program, the White River was identified as the northern boundary of the Book Cliffs, Bitter Creek, and Little Creek HMUs, where re-introduction efforts have taken place.

Direct and indirect impacts associated with cumulative disturbance are likely to include direct injury and death to individuals, disturbance, displacement, changes in habitat suitability and availability, including effects associated with habitat fragmentation. Cumulative disturbance may also lead to

increases in the establishment and spread of noxious plants, and increases in predation rates by opportunistic avian and mammalian predators.

The cumulative loss and alteration of wildlife habitats in the GCWPA can affect other wildlife species, particularly those that rely on limited or rare habitats; those that are sensitive to changes to occupied habitats, and those that are susceptible to displacement or disturbance from human presence and activity. Locally occurring populations of raptors, migratory birds, upland game, and other non-sensitive wildlife species could respond negatively to the cumulative effects associated habitat disturbance, loss, and human presence and activity in the GCWPA, eventually leading to declines in population numbers and/or occurrence status. Species-specific responses to cumulative effects would vary according to species requirements, sensitivities, and availability of suitable habitats in the GCWPA. Based on the expected increase of direct and indirect cumulative effects on wildlife during the life of the GCW project under Alternative A, B, C, or D, wildlife habitats in the general wildlife CEAA could decrease in their suitability and availability to support species that rely on them. Implementation of a GCW Alternative would result in an estimated total cumulative disturbance of 8 percent in the general wildlife CEAA.

5.4.6.2 Fisheries

Potential cumulative effects to fisheries, including the Colorado River Endangered Fishes (bonytail, Colorado pikeminnow, humpback chub, and razorback sucker), BLM sensitive fish species (flannelmouth sucker, bluehead sucker, and roundtail chub), and other non-status fish species are similar to those described in Chapter 4.0 and include soil erosion and subsequent sedimentation caused by surface disturbing activities, water depletion of the Green River, and the potential for leaks or spills of industrial fluids, fuels, or other liquids that could contaminate occupied habitats in the White River. While it is difficult to characterize or estimate the effects of past, present, and future projects on fisheries, the comparison of surface disturbance associated with these activities along with proposed surface disturbance associated with each of the GCW project alternatives, can be used to provide a reasonable comparison and evaluation of potential effects to fisheries. Using this approach, the CEAA for fisheries is defined as the 4th order watersheds within the Vernal Field Office, which includes an estimated 5,421,310 acres. **Table 5-18**, Cumulative Effects Summary for Fisheries, presents the disturbance summaries for past, present, and RFFAs in the CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Based on available data, past, present, and RFFAs would disturb an estimated 109,466 acres, or approximately 2 percent of the fisheries CEAA. Implementation of any one of the alternatives would result in additional disturbance to less than 1 percent of the fisheries CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to 2 percent of the fisheries CEAA.

5.4.6.3 Special Status Wildlife Species

Implementation of the GCW project would be expected to result in cumulative effects on special status wildlife species that are similar to those described in Chapter 4.0. Potential cumulative effects would include direct injury or mortality to individuals, displacement, disturbance, and effects related to habitat alteration and loss. Evaluations of potential cumulative effects are presented below for species for which sufficient habitat and disturbance data were available. For those species not specifically analyzed, the comparison of surface disturbance associated with past, present, and reasonably foreseeable projects with proposed surface disturbance associated with each of the GCW Alternatives can provide reasonable insight into potential effects on special status species, in lieu of species-specific information. Refer to **Table 5-14**, Cumulative Effects Summary for General Wildlife, for this comparison.

Table 5-18 Fisheries Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Uinta 4th order Watersheds	**5,421,310**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		13,250	2.16	28,620	13,437	2.81	37,758
Gas Plants and Facilities		32	9.4	301	0	9.4	0
Pipelines		132.5	Variable	1,449	0	70	0
Mining		14	Variable	766	0	Variable	0
Roads							
Federal and State Highways		529	70	4,485	12	70	104
County B-Class Roads		2,569	40	12,455	0	40	0
County Other Roads		7,764	25	23,528	0	25	0
Totals				71,604			37,862
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							112,151
Cumulative Alternative B							112,375
Cumulative Alternative C							112,014
Cumulative Alternative D							112,095

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

Greater Sage-grouse

Cumulative effects most likely to affect the greater sage-grouse would include habitat alteration and loss and disturbance/displacement effects associated with increased human presence and activity in the GCWPA. The CEAA for the greater sage-grouse is defined as greater sage-grouse range/habitats mapped in the Uintah and Duchesne counties (1,501,962 acres). **Table 5-19** presents the disturbance summaries for past, present, and RFFAs in the greater sage-grouse CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Based on available data, past, present, and reasonably foreseeable projects would disturb an estimated 22,525 acres (1.5 percent) of the greater sage-grouse CEAA. Implementation of any of the GCW alternatives would result in additional disturbance to less than 1 percent of the greater sage-grouse CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to 2 percent of the greater sage-grouse CEAA.

Table 5-19 Greater Sage-grouse Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Uintah-Duchesne Cos. Greater Sage-grouse Range	**1,501,962**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		1,315	2.16	2,840	1,465	2.81	4,117
Gas Plants and Facilities		7	9.4	66	0	9.4	0
Pipelines		80.7	Variable	783	0	70	0
Mining		10	Variable	595	0	Variable	0
Roads							
Federal and State Highways		120	70	1,022	0	70	0
County B-Class Roads		897	40	4,349	0	40	0
County Other Roads		2,888	25	8,753	0	25	0
Totals				18,408			4,117
Proposed Project Effects							
Alternative A							90
Alternative B							64
Alternative C							52
Alternative D							64
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							22,615
Cumulative Alternative B							23,623
Cumulative Alternative C							23,611
Cumulative Alternative D							23,623

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

For other special status land wildlife species, surface disturbance within the CEAA is indicated in **Table 5-20**. The CEAA is overlapped by 19 foreseeable NEPA projects.

Table 5-20 Special Status Land Wildlife Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
Uintah-Duchesne Cos. Combined Big Game Ranges	**4,867,970**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		12,996	2.16	28,071	12,929	2.81	36,330
Gas Plants and Facilities		30	9.4	282	0	9.4	0
Pipelines		132.5	Variable	1,449	0	70	0
Mining		13	Variable	606	0	Variable	0
Roads							
Federal and State Highways		398	70	3,376	12	70	104
County B-Class Roads		2,480	40	12,022	0	40	0
County Other Roads		7,086	25	21,473	0	25	0
Totals				67,280			36,435
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							106,400
Cumulative Alternative B							106,624
Cumulative Alternative C							106,263
Cumulative Alternative D							106,344

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

Black-footed Ferret

Cumulative effects to the black-footed ferret that are associated with past, present, and reasonably foreseeable projects are expected to be similar to those associated with the proposed project and described in Chapter 4.0. These possible effects include direct injury or death to individuals, disturbance, displacement, alteration and loss of white-tailed prairie dog colonies of suitable size and populations to support black-footed ferrets, and other effects associated with habitat alteration and loss including habitat fragmentation, introduction and spread of noxious plants, and increased predation resulting from increased access and disturbance to occupied habitats. Surface disturbance under any of the alternatives would account for approximately 0.1 percent of the cumulative disturbance within the CEAA.

Western Yellow-billed Cuckoo

Cumulative effects to the Western yellow-billed cuckoo associated with past, present, and reasonably foreseeable projects are expected to be similar to those associated with the proposed project and described in Chapter 4.0. Such effects likely include the possibility of injury or death, disturbance, displacement, and effects associated with habitat alteration and loss including habitat fragmentation effects and establishment and spread of noxious plants, Impacts associated with dispersed land uses that can impact this species, including livestock grazing and recreation, are unquantified and unknown within the CEAA. However, surface disturbance to cuckoo habitat would account for a tiny fraction of 1 percent of the cumulative surface disturbance within the CEAA.

White-tailed Prairie Dog

Cumulative effects to the white-tailed prairie dog associated with past, present, and reasonably foreseeable projects are expected to be similar to those associated with the proposed project and described in Chapter 4.0. These effects include the possibility for injury and death to individuals, direct disturbance and displacement of individuals, alteration and loss of occupied and other suitable habitats, effects associated with habitat fragmentation, deleterious changes to habitat suitability associated with introduction and spread of noxious weeds, and the possibility of increased predation from avian and mammalian predators facilitated by disturbance and new access. The amount of disturbance from these projects to mapped white-tailed prairie dog colonies is unknown. However, surface disturbance to prairie dog habitat from this project under any of the alternatives would represent a tiny fraction 1 percent of the cumulative disturbance within the CEAA.

Townsend's Big-eared Bat, Spotted Bat, Fringed Myotis, Big Free-tailed Bat

Cumulative effects to the Townsend's big-eared bat, spotted bat, fringed myotis, and big free-tailed bat associated with past, present, and reasonably foreseeable projects are expected to be similar to those associated with the proposed project and analyzed in Chapter 4.0. Such effects likely include injury and mortality to individuals, potential disturbance and displacement to roosting bats, and alteration and loss of suitable foraging habitats. Depending on the alternative, disturbance to habitats supportive of these species would represent less than 1 percent of the cumulative disturbance within the CEAA.

Colorado River Endangered Fishes

Potential cumulative effects to the Colorado River Endangered fishes (Colorado pikeminnow, razorback sucker, humpback chub, and bonytail) are similar to those described in Chapter 4 and include erosion sedimentation caused by surface disturbing activities, water depletion of the Green River, and the potential for leaks or spills of industrial fluids, fuels, or other liquids that could contaminate occupied habitats in the White River. While it is difficult to characterize or estimate the effects of past, present, and future projects to the Colorado River endangered fishes, the comparison of surface disturbance associated with past, present, and other reasonably foreseeable projects with the GCW project can be an effective alternative to evaluating potential cumulative effects to the Colorado River Endangered Fishes.

The CEAA for endangered fish species includes the 4th order watersheds within the Vernal Field Office (5,421,310 acres). **Table 5-21** presents the disturbance summaries for past, present, and RFFAs in the Colorado River endangered fishes CEAA, as well as the estimated cumulative effects disturbance associated with each alternative. Based on available data, past, present, and reasonably foreseeable projects would disturb an estimated 116,519 acres (2 percent) of the Colorado River endangered fishes CEAA. Implementation of any one of the alternatives would result in additional disturbance to less than 1 percent of the Colorado River endangered fishes CEAA. Disturbance associated with implementation of any one of the alternatives combined with the estimated disturbance associated with past, present, and RFFAs would result in cumulative disturbance to 2 percent of the Colorado River endangered fishes CEAA. The proposed project would not result in new or unaccounted depletions from the White River, as all water would be obtained from the Bonanza Power Plant and under their current water depletion agreement with the USFWS.

Additionally, most major projects, particularly those that include water depletions from the Green and White rivers would be subject to consultation with the USFWS and would likely include payment into the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin (Recovery Program). Such payments are used toward habitat protection, improvement and management with the purpose of avoiding, reducing, and mitigating effects on these fishes and thus avoiding "jeopardy" determinations as part of the consultation process. As such, mitigation would have been addressed for potential cumulative effects for all past, present, and reasonably foreseeable federal actions.

Table 5-21 Colorado River Endangered Fishes Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
VFI 4th order Watersheds	**5,421,310**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		13,250	2.16	28,620	13,437	2.81	37,758
Gas Plants and Facilities		32	9.4	301	0	9.4	0
Pipelines		132.5	Variable	1,449	0	70	0
Mining		14	Variable	766	0	Variable	0
Roads							
Federal and State Highways		529	70	4,485	12	70	104
County B-Class Roads		2,569	40	12,455	0	40	0
County Other Roads		7,764	25	23,528	0	25	0
Totals				71,604			37,862
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							112,151
Cumulative Alternative B							112,375
Cumulative Alternative C							112,014
Cumulative Alternative D							112,095

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

5.4.7 Paleontology

The CEAA for paleontological resources encompasses the entirety of the GCWPA, an area of 43,071 acres (**Figure 5-1a**). The CEAA is overlapped by four of the reasonably foreseeable federal actions illustrated in **Figure 5-2**, Cumulative Project, however effects within the GCWPA would be limited to wells drilled as part of the Greater Natural Buttes oil and gas development. Cumulative effects to paleontological resources would include potential destruction to scientifically important fossils through

surface disturbance and vandalism or illegal collecting from increased human presence, both of which would result from additional oil and gas development. Total past, present, and foreseeable surface disturbance within the CEAA would vary from 6,661 acres to 7,022 acres, depending on the alternative, as indicated in **Table 5-22**, Paleontological Resources Cumulative Effects Surface Disturbance. Total cumulative surface disturbance would affect up to approximately 16 percent of the CEAA.

Table 5-22 Paleontological Resources Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
GCWPA	**43,071**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		1,267	2.16	2,737	100	2.81	281
Gas Plants and Facilities		4	9.4	38	0	9.4	0
Pipelines		77.9	Variable	747	0	70	0
Mining		0	Variable	0	0	Variable	0
Roads							
Federal and State Highways		2	70	19	0	70	0
County B-Class Roads		19	40	94	0	40	0
County Other Roads		65	25	198	0	25	0
Totals				3,832			281
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							6,798
Cumulative Alternative B							7,022
Cumulative Alternative C							6,661
Cumulative Alternative D							6,742

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

As discussed in Section 3.8.1, approximately 76 percent of the GCWPA is underlain by rocks of Middle Eocene age, the Duchesne River and Uinta formations, which have been shown to contain fossil remains of scientific importance. BLM has evaluated the potential for production of additional fossils of importance and assigned both units a PFYC ranking of 4 or 5, indicating a high probability of future discoveries. Irretrievable and irreversible loss of paleontologic information typically results from destruction during bedrock excavation during normal surface-disturbing activities associated with oil and gas development. Requirements to conduct pre-construction surveys and monitoring of surface disturbing activities, in some cases, would likely mitigate the potential for loss of paleontologic

information. Fossils recovered during these activities would add to our general understanding of Middle Eocene conditions in the area.

5.4.8 Cultural Resources

For cultural resources, the GCWPA plus a one-mile buffer serves as the boundary of the CEAA; this is approximately 88,666 acres (**Figure 5-1a**). Cumulative effects are those effects resulting from the damage or destruction of cultural resources caused from the incremental effect of the action when considered in regards to previous effects, and those resulting from the action in the present and in the foreseeable future (40 CFR 1508.7). The scale of cumulative effects on cultural resources depends partly on the density of cultural resource in the GCWPA, the significance of those resources, and intensity and scope of the foreseeable future actions. Cumulative effects to cultural resources are scale dependent. While direct and secondary effects typically affect only a single site resulting in the loss of a small bit of information in an isolated locality, cumulative effects occurring over a sufficient period of time diminish future analyses at the landscape and regional scales.

Present and future effects to cultural resources within the CEAA would result from actions associated with surface and subsurface disturbances related to the development and removal of natural resources (primarily hydrocarbons in one form or another). Other actions pertaining to transportation corridors, recreation, and grazing also may contribute to cumulative effects to the archaeological record in the foreseeable future. Effects to cultural resources also may result from management decisions that result in atmospheric, visual, or auditory effects that may affect the integrity of eligible historic properties or traditional places.

As detailed in **Table 5-23**, between 9,970 and 10,397 acres of land within the GCWPA has been or will be disturbed by past, present, and foreseeable future actions. Depending on which alternative is selected, disturbance acreage will increase an additional 1,514 to 2,685 acres as a result of the proposed development. Total cumulative surface disturbance would affect up to approximately 11 percent of the CEAA.

Currently, there are 331 documented archaeological sites in the GCWPA including 183 prehistoric sites, 133 historic sites, and 14 multicomponent sites. Probable effects from foreseeable actions can only be anticipated for the known cultural resources. Effects to unknown cultural resources and archaeological sites cannot be addressed until uninventoried areas are surveyed by archaeologists, or scientific modeling of site distribution and densities in the GCWPA occurs. Future actions will be required to follow the similar identification and evaluation processes as that of the current action (e.g., Section 106), though the standards may differ slightly. Regardless, the potential for effects to cultural resources will increase with increased disturbance. However, direct and indirect effects can be mitigated if appropriately identified and planned for in advance.

Although sites located within disturbance areas will be avoided or mitigated, inadvertent and accidental effects to eligible sites may occur. Sites located outside of and adjacent to disturbance areas are vulnerable to indirect effects such as vandalism, illegal collection, dust, and erosion. Increases in ground disturbing activities will increase the probability of these types of effects.

Under all the proposed alternatives, cultural resources would be protected by site-specific mitigation measures for each undertaking with the potential to disturb a given site or property. The primary mechanism for this is through the Section 106 process as incorporated into the ACEPMs.

Table 5-23 Cultural Resources Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
GCWPA + 1-mile Buffer	**88,666**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		2,154	2.16	4,653	496	2.81	1,394
Gas Plants and Facilities		4	9.4	38	0	9.4	0
Pipelines		79.0	Variable	761	0	70	0
Mining		0	Variable	0	0	Variable	0
Roads							
Federal and State Highways		6	70	49	0	70	0
County B-Class Roads		40	40	193	0	40	0
County Other Roads		132	25	401	0	25	0
Totals				6,095			1,394
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							10,173
Cumulative Alternative B							10,397
Cumulative Alternative C							10,036
Cumulative Alternative D							10,117

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

5.4.9 Socioeconomics

This section addresses the foreseeable socioeconomic effects of the project alternatives when added to the past, present, and reasonably foreseeable future energy resource development and other economic activities in the Uintah-Duchesne two-county CEAA (**Figure 5-1a**). Although cumulative development would likely generate substantial net long-term economic and fiscal beneficial effects, the potential for adverse cumulative socioeconomic effects within the CEAA would arise primarily during periods of concurrent construction and development of the Proposed Action and other oil and gas projects. The potential cumulative development of more than 16,000 additional new wells is projected for the CEAA, the wells associated with this project representing approximately 18 percent of that total. Unlike place and project-specific projects such as power plants, wind farms, and transmission lines that have relatively short and well defined construction periods, the Proposed Action and other oil and gas projects would involve multi-year development plans during which the level of development would vary and be located across a wide geographic area. For larger plays, such as the Uinta Basin, that characteristic increases the likelihood of cumulative effects, the timing, duration and magnitude of which would depend on the overall levels of concurrent activity.

As discussed in Section 4.10, the cumulative level of development activity during any period would tend to be directly correlated to energy prices; higher prices stimulating development, declining prices slowing the pace of development. Consequently, the potential the project to contribute to cumulative effects in the future would increase when natural gas prices rise, which in turn would accelerate the pace of development of one or more of the projects listed in **Table 5-4**. Such acceleration increases the potential for effects characteristic of rapid growth or "boom" conditions and also for the subsequent contraction or "bust" effects when development slows. The incremental contributions of the project would depend on the level of project related development to the overall pace of development.

Oil and gas development and production is the largest variable element of the RFFAs and consequently, changes in the level of drilling activity, production and other mining would have substantial social and economic implications for the regional economy. Energy development and production generate substantial public revenues that fund local public facilities and services and also are key drivers affecting local population, demographic, and migration trends. Other historically and economically important segments of the regional economic base include agriculture, recreation, and tourism.

Oil and gas, mining, and other industrial development in and near the GCWPA, and recreation and tourism has in the past supported construction and operation of substantial residential, commercial and public infrastructure in communities in the CEAA. Such development and related activities, events, and people associated with it, coupled with the underlying agricultural base, have resulted in the current socioeconomic context in which other energy development, including the Proposed Action and alternatives, would occur. The cumulative effects of past and ongoing development in the region are evident in existing settlement patterns, physical development, fiscal structures, and social settings and networks in the region. The collective cumulative activity also underlies important economic and social conditions and trends in the area. These trends include labor markets characterized by unemployment that is commonly below statewide levels, transient elements of the work force, competition for and shortage of qualified labor, relatively high labor compensation, and population growth. Absent the area's energy resource endowments and the production thereof, the region would likely be less developed and populated than it is today.

Cumulative social effects associated with past energy resource development include some conflicts with recreation, tourism, and grazing on public lands. Cumulative effects to recreation arise from fragmentation of contiguous areas available for outdoor recreation, changes in access, and development related traffic, dust and other factors that affect the quality of recreational experiences.

Prior to the onset of the economic recession of 2007/2010, more than 25 oil and gas drilling rigs were active in Uintah and Duchesne counties (UDOGM 2016). More than 500 wells were spud in Duchesne County in 2006 and 2007 and more than 1,350 additional wells spud in Uintah County during the same period. Past declines in commodity prices contributed to sharp slowdowns in the rate of exploration and development, as a total of only 480 new wells were spudded in 2009. The level of development picked up to about 1,000 new wells in 2012 and 2013, but declined to 843 wells in 2014 before falling sharply to 142 wells in 2015 (UDOGM 2016). In the intervening years communities have seen new public and private investment expand the conventional and temporary housing inventory, add to the retail and consumer service base, and completion of several high priority public facility projects. The resultant labor force and industrial, commercial, and public infrastructure is capable of supporting ongoing natural resource and industrial development activity and serves as a base to support future development.

Future development by EOG in the GCWPA would interact with other future activity, all introducing similar influences on local social and economic conditions, but the contributions to cumulative effects differing in scale, timing, and the degree of effect on the affected communities based on location and access. The reasonably foreseeable natural gas projects, both those currently approved and those, for which future approval might be anticipated, would contribute to cumulative socioeconomic effects over longer time periods and would affect socioeconomic conditions in the CEAA. Although assumed timing

and levels of development are defined for each of the natural gas projects identified in **Table 5-4**, as noted in Section 4.10, the actual pace of natural gas development in the Uinta Basin is variable and unpredictable because development plans would respond to various factors including energy demand, pricing, regulatory approvals, rig and manpower availability, transmission pipeline capacity, weather, and the investment and development strategies of individual energy companies. Consequently, the potential for beneficial and adverse cumulative socioeconomic effects, including population growth and migration, change in housing market conditions, demand for public services, and fiscal effects, and the project's contribution to those effect would be higher during extended periods of elevated commodity prices and natural gas demand, and diminish during periods of lower prices.

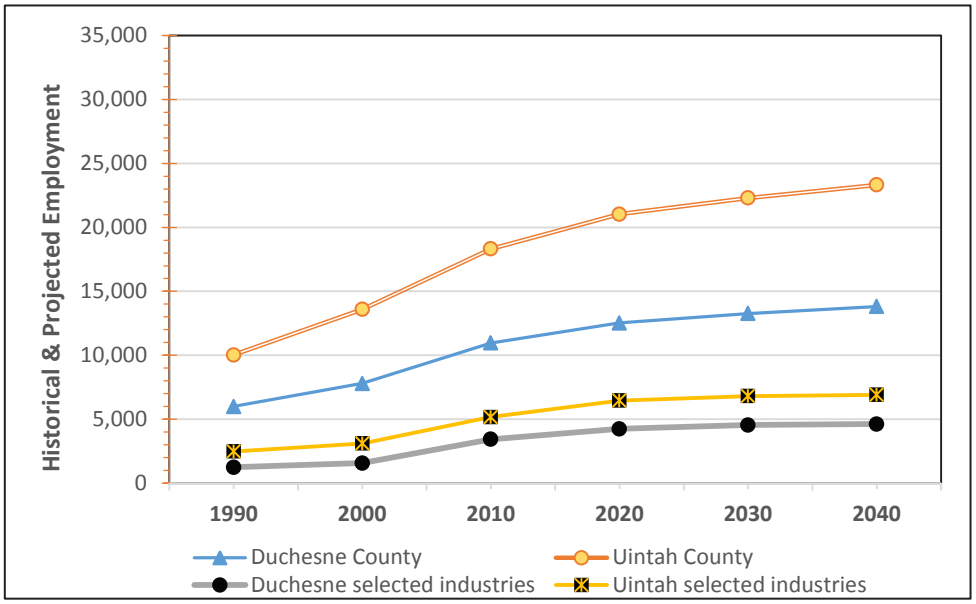
Economic and demographic forecasts periodically prepared by the Utah Governor's Office of Management and Budget, which consider future energy development activity, provide a perspective on cumulative growth in the region. The current projections, released in 2012, were predicated on long-term continuation of natural resource development through at least 2040, although the level of mining and related construction and transportation employment is foreseen to peak around 2030 and then decline slowly over time (**Figure 5-3**), presumably due to declining levels of new development. Such a scenario would be reasonably consistent with the completion of the development programs outlined in **Table 5-3** above.

Despite the projected stabilization in energy and mining employment the Utah Governor's Office of Management and Budget projections call for total employment in Duchesne and Uintah counties to continue to increase through 2040; the combined total exceeding 37,000 jobs in 2040. That total represents a gain of more than 7,800 jobs, or 27 percent, as compared to the 2010 employment.

Under the current forecasts, the two counties are projected to reach a combined population in excess of 68,000 residents by 2040, an increase of more than 33 percent over the population in 2010 (**Figure 5-4**). It should be noted that, although the Utah Governor's Office of Management and Budget long-term projections portray a pattern of steady growth, future growth would likely be characterized by periods of more rapid growth and decline reflecting the scale and timing of cumulative actions.

Employment supported by the No Action Alternative, an average of 188 jobs, would contribute to that growth, primarily between 2015 and 2024, after which its influence would wane. The Proposed Action, projected to directly and indirectly support an average of 591 jobs during the development phase (2016 to 2030), would be a major, though not the only source of economic activity, population growth, and income in the region. Proposed Action-related population growth, averaging about 900 permanent and temporary residents during development, would be unlikely to trigger expansions of public service or infrastructure capacities, although the development could accelerate the capital facility improvement plans of the two local school districts and may necessitate additional staffing by some local governmental departments and service providers.

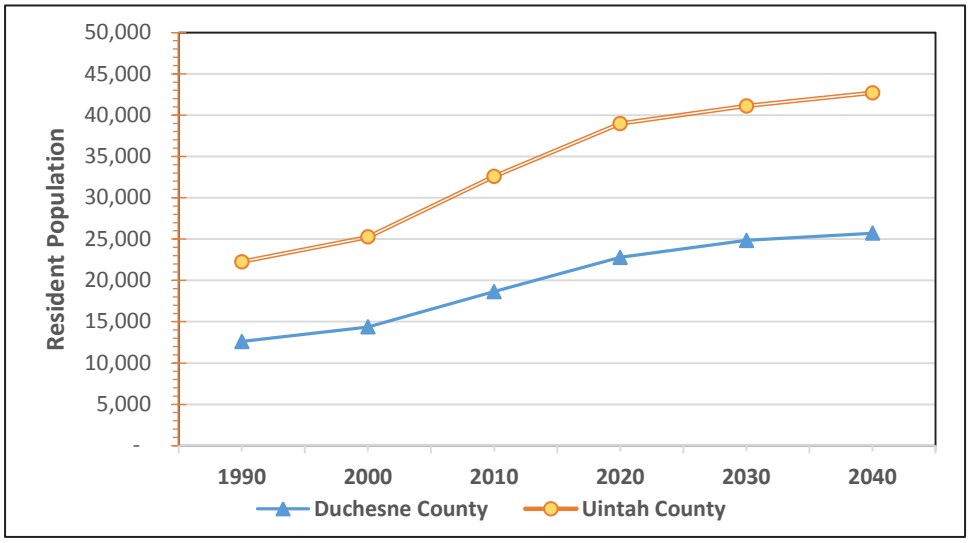
Development and employment associated with the Proposed Action would be a contributor to regional growth over the next 10 to 15 years. That growth may require residential and commercial development and expansion of some public infrastructure. Public sector expenditures likely would increase to fund infrastructure expansion and increases in staffing and services required to meet higher demands. After the development phase of the Proposed Action is completed, the incremental contribution attributable from the project would decline markedly in terms of employment, population, housing demand, and demands on public services, as other activities would increasingly be responsible for future growth.



Source: UGOMB 2012.

Note: selected industries include mining, construction, and transportation and warehousing.

Figure 5-3 Projected Total Employment in Uintah and Duchesne Counties to 2040



Source: UGOMB 2012.

Figure 5-4 Projected Resident Population of Uintah and Duchesne Counties to 2040

Cumulative actions, including the Proposed Action, would continue to generate public sector revenues over the long term, although the magnitudes of such revenues would fluctuate over time in response to changes in commodity prices and production levels. Due to the vast federal and state lands in the area, energy resource development would generate substantial revenues in the form of mineral lease royalties and severance taxes. Federal mineral lease royalties would accrue to the federal and state government, and also would benefit the Tribe due to the Tribal mineral interests in the area. Severance taxes and royalties on production from state lands would accrue to the state's coffers. Substantial ad valorem (property taxes) levied on the value of production as well as production, processing, and transportation equipment and facilities would accrue to local entities, principally the counties and school districts.

Project-related public sector revenues generated on future production, projected to exceed $3 billion over the life of the field, would continue for decades following the initial effects on population growth, housing, and demands on public facilities and services. More than 60 percent of these revenues would accrue to the state treasury and local governmental entities, benefitting the state's General Fund, Permanent Community Impact Fund, Permanent Public School Fund, UDOT, Uintah County and the Uintah School District, and several other state and local agencies. Revenues from the project would be in addition to those from other projects. Based on the cumulative number of wells proposed, the cumulative revenues could exceed $17 billion, assuming similar development costs, resource recovery, and pricing and tax assumptions. The cumulative revenues represent substantial public fiscal benefits from oil and gas development.

Potentially adverse effects would include: demand for temporary and long-term housing resources that exceed existing inventories, supporting continued new residential construction and housing price escalation; demand for local government services that require additional staff; higher public expenditures to provide such services, and, changes in local social conditions that could include social disruption in some communities. The recent pace of residential construction in the CEAA would need to be sustained for some time to accommodate cumulative demand for conventional housing units, were the development phases of several of the projects overlap. Shortfalls in temporary housing availability could be mitigated by development of temporary housing facilities, such as rig camps. It is becoming increasingly common for natural gas operators and drilling companies to develop temporary housing; several such camps were operational in the region in the fall of 2014. Demands on housing and local government services associated could have a seasonal dimension, presenting staffing challenges for counties and communities that also would face seasonal tourism and recreation demand.

Increased employment opportunities in relatively high-paying construction and energy-development jobs would result in competition for workers to the detriment of existing businesses and government agencies that could lose existing employees and experience difficulty recruiting new employees. On the other hand, workers would benefit from the increased wages that would result from this competition, while simultaneously potentially facing higher costs of living.

Excess capacity exists in many public-utility infrastructure systems (e.g., water and wastewater systems) in the communities that would likely host the bulk of the construction and natural gas development workforce. Recent experience in the CEAA has been that relatively few families and school-age children have accompanied construction and natural gas workers to the area; consequently, local school districts could likely accommodate some additional enrollment in the near term. In the longer term the districts would likely need to implement their capital facility plans.

Community services, such as law enforcement, emergency response, social services, and road and bridge departments, could initially face constraints recruiting and training additional staff to respond to increased demand.

Cumulative adverse economic effects would potentially occur in the areas of grazing and recreation. Effects on grazing would occur as the combined effects of past and future energy resource development affect portions of one or more grazing allotments within the GCWPA, resulting in reductions in forage.

Effects on recreation would occur as the cumulative levels of development adversely affect the quality of the recreation experience and potentially the level of recreation activity. These effects could have slight incremental effects on the local tourism and outdoor recreation related industries; however, the timing, magnitude, and intensity of these effects are uncertain.

Cumulative development in the CEAA also holds potential to affect local attitudes, opinions, and lifestyles and these effects are likely to be mixed. Development of multiple projects listed in **Table 5-4**, potentially coupled with currently unforeseen development of transmission lines, pipeline, or other projects, could result in economic growth and increased employment opportunities for residents. These changes would further the prospect for improved financial status of many residents, which would correspondingly increase support for cumulative development activities. On the other hand, dissatisfaction may occur among those residents whose economic activities and/or recreation activities rely on use of the same geographical areas as the Proposed Action and projects listed in **Table 5-4**, including grazing permittees, hunters, and other recreationists. Moreover, if area residents perceive that wildlife habitat, scenic vistas, and other resources are being degraded unacceptably; levels of dissatisfaction could become greater and more widespread.

Given the cyclical nature of natural gas development and the potential for other energy development to occur, it is difficult to predict development and associated population levels with any certainty. Following population gains in response to cumulative development construction activities, population in the CEAA would likely decline as construction is completed, perhaps dramatically in the event of multiple concurrent construction schedules. If employment and population were to fall dramatically, businesses that expanded or opened to accommodate the temporary population influx would need to transition to accommodate the decreased demand. Some business closures would be likely. Adverse effects on area housing conditions could range from moderate to severe, depending on whether the construction and natural gas development demands were accommodated in temporary housing or if housing to accommodate the temporary workforce was developed with a post-boom use in mind. In those cases, communities in the CEAA could reduce the amount of unoccupied temporary housing after construction is completed or if a slowdown in natural gas development were to occur. Similarly, the fact that most community infrastructure including water and sewer systems is already in place should help communities avoid substantial debt that would be difficult to service when population levels decrease.

Section 4.10 cited findings in Smith et al. (2001) that community well-being is often disrupted during resource development booms by the effect of waves of transient workers; landscape change; intrusion of industrial activity into recreational open space; and stress to local facilities, services, and institutions. While the pace of drilling is subject to short-term variability, causing cycles of expansion and contraction in communities, an expanding inventory of producing wells and field facilities can support workforces for a generation or longer. By enlarging the well base, development under the RFFA would potentially contribute stability for the region's resident labor force and population for some time. Though typically an order of magnitude smaller than the level of transient jobs accompanying drilling phases, ongoing operations and production workers typically reside in communities near their worksites, have household characteristics similar to other residents, and quickly integrate into the community social fabric. Given the historic level of oil and gas development in the CEAA, few barriers to community integration for relocating operations workers would be anticipated.

In summary, cumulative socioeconomic effects would be anticipated in the Uinta Basin under any alternative due to anticipated concurrent oil and gas development in other locations that also would be based and serviced from field exploration, production offices, and oil field service companies in the Vernal, Naples and Roosevelt area. The potential effects would be of longer duration and higher magnitude under the Proposed Action and other action alternatives than under the No Action alternative. The potential for adverse socioeconomic effects would increase if natural gas commodity prices rise, as this would trigger higher rates of new well development and associated activities across the various projects, stimulating migration, particularly by drilling and field development workers, and correspondingly increasing demand for temporary housing and community services. The Proposed Action would be a major contributor to

such cumulative effects, particularly over the next decade, accounting for a decreasing share of future growth as development is completed. The state and local governments, school districts and other local service providers would benefit from the cumulative revenues that would accrue, not only from the Proposed Action and other future projects, but from residual revenues from past development as well. Moreover, while mindful of the potential cumulative socioeconomic effects, the state and Duchesne and Uintah counties have all endorsed the goals outlined for the Uintah Basin Energy Zone, which specifically encourages the full development of the region's energy and mineral resources.

5.4.10 Environmental Justice

No environmental impacts warranting detailed consideration under environmental justice guidelines for disproportionately high and adverse effects on minority and low-income populations were identified in conjunction with the Proposed Action or alternatives. Consequently, the GCW project would be unlikely to contribute to any cumulative adverse environmental justice effects under any alternative.

5.4.11 Livestock Grazing and Rangeland Health Standards

The CEAA for livestock grazing encompasses the entirety of each BLM or BIA grazing allotment overlapping the GCWPA, an area of 367,886 acres (**Figure 5-1a**). The CEAA is overlapped by six of the reasonably foreseeable federal actions illustrated in **Figure 5-2**, Cumulative Projects. A map of the grazing allotments overlapping the GCWPA is included as **Figure 3.12-1**. Total past, present, and foreseeable surface disturbance within the CEAA would vary from 21,136 acres to 21,497 acres, depending on the alternative, as indicated in **Table 5-24**, Grazing Cumulative Effects Surface Disturbance. This would represent a loss of 463 to 575 AUMS, depending on the alternative. Total cumulative surface disturbance would affect less than 6 percent of the CEAA.

Principal cumulative effects to livestock and grazing would result from surface disturbance and loss of forage and AUMs, leading to a reduction in rangeland carrying capacity. Most of these reductions would be long-term, until completion of final reclamation. Habitat fragmentation would increase; however, within the GCWPA, increased fragmentation would be minimized due to the limited number of new well pads and related new access roads. Increased development activity also could result in the spread of invasive species. Particularly during construction operations, some increased but limited sediment transport into local drainages could occur, but would be mostly controlled through the application of BMPs.

Oil and gas development could result in, typically temporary, damage to range improvement facilities. For development on federal lands, BLM would require repair, replacement, or relocation of any damaged facilities. Expanded areas of development would likely result in some increased traffic within the oil and gas fields, particularly during periods of overlapping construction, drilling and completion, and production phases. Such traffic increase has the potential to result in collisions with livestock animals, resulting in injury or mortality.

Table 5-24 Grazing Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
BLM/BIA Grazing Allotments Overlapping GCWPA	**367,886**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		3,996	2.16	8,631	2,065	2.81	5,803
Gas Plants and Facilities		6	9.4	56	0	9.4	0
Pipelines		83.0	Variable	813	0	70	0
Mining		3	Variable	37	0	Variable	0
Roads							
Federal and State Highways		21	70	182	0	70	0
County B-Class Roads		190	40	922	0	40	0
County Other Roads		707	25	2,143	0	25	0
Totals				12,785			5,803
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							21,273
Cumulative Alternative B							21,497
Cumulative Alternative C							21,136
Cumulative Alternative D							21,101

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

5.4.12 Access and Transportation

The CEAA for access and transportation facilities is the GCWPA and primary access roads into the GCWPA. Expansion of the existing extensive road network under the any of the four alternatives within and adjacent to the GCWPA to support new oil and gas development could have both positive and adverse effects. Potential positive effects would be the additional maintained roads accessing previously inaccessible (un-roaded) areas where new oil and gas development would occur and where the additional roads would secondarily support expanded recreational activities both spatially and in numbers across the GCWPA and also in adjacent areas supporting oil and gas development. Negative effects resulting from vehicle accidents, including associated releases of trucked product and produced water, could result from increased project-related traffic, particularly during high overlapping activity periods of facilities construction, well drilling, and well completions, along with production related traffic. High activity periods would also increase the rate of road degradation and need for possibly higher frequency and levels of maintenance. Additional adverse effects of increased vehicle accidents also

could occur when oil and gas project-related traffic would be combined with increased recreational uses of the expanded road network. Overall traffic would build during the 10 to 15 years of construction, drilling, and completions coupled with increasing production haul traffic, but would then begin to decrease after about year 10 for the Alternative A and after year 15 for the three action alternatives and would continue to decrease annually for the remaining years of production.

5.4.13 Visual Resources

The CEAA for visual resources is shown in **Figure 5-1a** and consists of a 15-mile BLM VRM background distance zone. Past and present actions and RFFAs are discussed in Sections 5.2 and 5.3.

Past, present, and RFFAs have resulted, or would result, in approximately 34,343 acres of total surface disturbance within the visual resources CEAA of 926,733 acres (**Table 5-25**). The total quantifiable surface disturbances are related to mining, oil and gas development, exploration, land, road, and utility corridor development, and State, county, and private road construction and maintenance actions. Foreseeable actions proposed within the visual resources CEAA consist of foreseeable oil and gas development within the project 15-mile buffer viewshed and cumulative effects area totaling 926,733 acres.

Table 5-25 Visuals Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
GCWPA + 15-mile Buffer	**926,733**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		6,554	2.16	14,157	4,380	2.81	12,308
Gas Plants and Facilities		10	9.4	94	0	9.4	0
Pipelines		80.9	Variable	786	0	70	0
Mining		5	Variable	51	0	Variable	0
Roads							
Federal and State Highways		58	70	491	0	70	0
County B-Class Roads		486	40	2,355	0	40	0
County Other Roads		1,672	25	5,065	0	25	0
Totals				22,999			12,308
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							37,992
Cumulative Alternative B							38,216
Cumulative Alternative C							37,855
Cumulative Alternative D							37,936

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

The past and present and foreseeable oil and gas development projects have been and would be the most likely to introduce visual contrast within the visual resources CEAA. Nearly all of the identified oil and gas and road actions would be located in VRM Class III and VRM Class IV areas. It is anticipated that the visual disturbance would meet the standards of the VRM Class IV objective, which provide for major change in the landscape. It is anticipated that the developments proposed for the viewshed area would not meet the VRM Class III objective, which provide for "moderate change" in the landscape, unless tanks are painted to mimic the colors of the surrounding landscape (BLM Standard Environmental Color Chart) and pads reshaped to repeat the form elements of the background topography. Implementation of the reclamation measures consistent with the BLM's Green River District Reclamation Guidelines and the assumption that similar standard reclamation requirements would be required for permitting of future projects, the cumulative effects to visual resources would be minimized to the degree possible after completion of future projects.

Disturbance and associated effects on visual resources from implementation of the No Action Alternative would be increased by 2,685 acres, resulting in a total cumulative disturbance of approximately 37,992 acres (4.0 percent) of the visual resources CEAA of 926,733 acres. The Proposed Action incrementally would increase disturbance to visual resources by an additional 1,875 acres resulting in a total cumulative disturbance of approximately 38,216 acres (4.0 percent) of the visual resources CEAA). The 1,875 acres of disturbance would result in moderate long- term effects to scenery for viewers traversing the White River, viewers in areas of dispersed recreation, and viewers traveling along roads and trails. Strong contrasts of form, line, and color in areas of no existing development would not be in compliance with VRM Class III objectives and would be in compliance with Class IV objectives. Short-term contrasts would be greater than long-term contrasts and would lessen with time and with the reestablishment of vegetative cover as part of the reclamation process.

The Resource Protection Action and Other Protections Action alternatives would incrementally increase disturbance to visual resources by an additional 1,514 acres and 1,595 acres resulting in a total cumulative disturbance of approximately 37,855 acres (4.0 percent) and 37,936 acres (4.0 percent) of the visual resources CEAA). Both alternatives would respectively and proportionally lower long-term effects in comparison to the No Action and Proposed Action alternatives, and contrasts would comply with both VRM Class III and Class IV objectives.

Pending completion of successful reclamation on all project components, it is anticipated that the Proposed Action and Alternatives would each contribute approximately 4 percent to the overall cumulative disturbance within the visual resources CEAA. Although, successful reclamation would minimize visual effects to the extent possible, the additional cumulative visual effects of the project landforms' shapes, lines, and colors would be noticeable to the casual observer in both the short and long terms.

5.4.14 Recreation

The CEAA for recreation consists of the entire GCWPA plus a 2-mile buffer, an area of 124,718 acres (**Figure 5-1a**). The CEAA is overlapped by four of the reasonably foreseeable federal actions illustrated in **Figure 5-2**; however, effects within the GCWPA would be limited to wells drilled as part of the Greater Natural Buttes oil and gas development. Total past, present, and foreseeable surface disturbance within the CEAA would vary from 13,213 acres (10.5 percent) to 13,574 acres (10.9 percent) of the CEAA, depending on the alternative, as indicated in **Table 5-26**.

Table 5-26 Recreation Cumulative Effects Surface Disturbance

Effect Source and Cumulative Effects Analysis Area (CEAA)	CEAA Extent (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)	Count or Miles	Facility Dist. (acs) or ROW (ft)	Total Disturbance (acs)
GCWPA + 2-mile Buffer	**124,718**	**Past and Present Activities**			**Reasonably Foreseeable Activities**		
Effects Unassociated with Proposed Project							
Minerals Industry							
Oil and Gas Wells		3,015	2.16	6,512	845	2.81	2,374
Gas Plants and Facilities		4	9.4	38	0	9.4	0
Pipelines		80.1	Variable	776	0	70	0
Mining		0	Variable	0	0	Variable	0
Roads							
Federal and State Highways		8	70	70	0	70	0
County B-Class Roads		54	40	261	0	40	0
County Other Roads		209	25	634	0	25	0
Totals				8,290			2,374
Proposed Project Effects							
Alternative A							2,685
Alternative B							1,875
Alternative C							1,514
Alternative D							1,595
Cumulative Effects (Past, Present, Foreseeable, plus Project Effects) [1]							
Cumulative Alternative A							13,350
Cumulative Alternative B							13,574
Cumulative Alternative C							13,213
Cumulative Alternative D							13,294

[1] For Alternatives B, C, and D, cumulative effects include 1,034 acres of site-specific Alternative A disturbance.

Within the CEAA for recreation inclusive of the GCWPA, the addition of well facilities and their operations for the life-of-project would both add and subtract from recreational opportunities. Positive effects could result from the expansion of road-oriented recreational activities such as OHV, motor bike, mountain bike, site-seeing, and improved access for hunting. A network of roads already exists and is maintained within the CEAA due principally to prior and ongoing oil and gas development, and implementation of any of the alternatives would add to this road network. Negative effects could result from temporary restrictions of road use and reduced opportunities and/or experiences for dispersed recreational activities. Dispersed recreation of off-road hiking, camping, and the actual hunting experience has already been affected by previous and ongoing oil and gas development, particularly the construction of roads and life-of-project operations of constructed facilities, including frequent road use, resulting in reduced dispersed recreational opportunities. The addition of development under each alternative would likely have a minimal cumulative effect to recreational activities within the CEAA due the existing and approved industrial conditions throughout the CEAA. Access to and use of Fantasy Canyon, the White River, and the Red Wash OHV Open Ride Area could be incrementally and similarly affected by the cumulative effects of implementation of any of the alternatives within the CEAA.

6.0 Consultation and Coordination

This chapter summarizes the participation by the public, governmental agencies, and interested groups in this EIS, and provides a listing of the personnel who participated in the environmental analysis process. Chapter 1.0 of this EIS describes the determination of which issues and resources would be analyzed, while Chapter 2.0 describes the GCWPA baseline conditions, proposed project, and alternatives to the proposed project which would still meet the purpose and need. The detailed rationale for selecting resources for detailed analysis is included as the ID Team checklist in **Appendix A**.

6.1 Agencies, Tribes, and Groups Consulted

The BLM is the Lead Federal Agency for this EIS, which was prepared by the BLM VFO, Vernal, Utah. A third-party contractor, Petros Environmental Group, was used to conduct the analysis and prepare documentation for the EIS under the guidance and supervision of the BLM. Governmental agencies formally cooperating with BLM on the development of the EIS are:

- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Utah Public Lands Policy and Coordination Office
- Uintah County, Utah

The U.S. Army Corps of Engineers, the BIA, and the Ute Indian Tribe were offered cooperating agency status by BLM but have not responded to date. Regardless of cooperator status, BLM has kept BIA informed throughout the EIS process.

The BLM and cooperating agencies actively participated in preparing and reviewing the Draft EIS, in designing alternative methods of achieving the project purpose and need, and in developing mitigations to reduce project impacts. Other federal, state, and local agencies were consulted regarding specific issues during the EIS development process.

In response to notification from EOG regarding the company's intention to expand oil and gas development within the Greater Chapita Wells area, a kick-off meeting was held to discuss the proposed project at the BLM offices in Vernal, Utah, on December 3, 2008. The meeting included BLM management, key resource specialists, and EOG personnel. A preliminary project description and schedule were presented to BLM by EOG. BLM staff made comments regarding the proposed project and developed an initial Interdisciplinary Team Analysis Record Checklist (January 2009). The Checklist listed the issues and resources to be analyzed in the EIS. It can, and has been, updated during the EIS process as the project itself has evolved and issues not recognized at the time of the kick-off meeting (such as high levels of Uinta Basin winter O_3) have become apparent.

Consultation with USFWS has been ongoing. Initiation of formal Section 7 consultation will occur following the public comment period and prior to publication of the Final EIS and will be finalized prior to issuance of the ROD. Section 106 consultation with the Utah SHPO and affected tribes has been ongoing.

The following Tribes, government agencies, and organizations were contacted during the scoping process for input regarding potential concerns with the proposed project:

Tribes
- Eastern Shoshone Tribe
- Goshute Indian Tribe
- Hopi Tribe
- Laguna Pueblo Tribe
- Navajo Nation
- Northwest Band of Shoshone Tribe
- Santa Clara Pueblo Tribe
- Southern Ute Tribe
- Ute Indian Tribe
- Ute Mountain Tribe
- White Mesa Ute Tribe
- Zia Pueblo Tribe

Federal Agencies
- U.S. Army Corps of Engineers
- U.S. Bureau of Indian Affairs
- U.S. Environmental Protection Agency, Region 8
- U.S. Fish and Wildlife Service
- U.S. Forest Service, Ashley National Forest
- U.S. National Park Service

State of Utah
- Utah Division of Wildlife Resources
- Utah Public Land Policy Coordination Office
- Utah State Division of History
- Utah Trust Lands Administration

Local Governments
- Daggett County Commissioners
- Duchesne County Commissioners
- Grand County Council
- Uintah County Commissioners
- Uintah County Planning Office
- Uintah County Public Lands Committee

Educational Institutions
- Brigham Young University
- Colorado State University
- Utah State University

Organizations
- Center for Native Ecosystems
- Colorado Plateau Archaeological Alliance
- Earth Justice
- Environment Preservation Foundation
- Forest Guardians
- National Trust for Historic Preservation
- Natural Resources Defense Council
- Nine Mile Canyon Coalition
- Oil and Gas Accountability Project
- Sierra Club
- Southern Utah Wilderness Alliance
- Theodore Roosevelt Conservation Partnership
- The Wilderness Society
- The Nature Conservancy
- Uintah Mountain Club
- Utah Cattlemen's Association
- Utah Environmental Congress
- Utah Heritage Foundation
- Utah Historic Trails Consortium
- Utah Rivers Council
- Utah Rock Art Association
- Utah Statewide Archaeological Society
- Western Land Exchange Project

6.2 Summary of Public Participation

The Council on Environmental Quality regulations (40 CFR 1501.7) require an "*early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action*." The BLM ID Team conducted internal scoping to determine an initial listing of issues of concern. The public scoping process was initiated on September 9, 2009 with a publication of the original project (7,028 wells) Notice of Intent in the *Federal Register*.

The BLM prepared a scoping information notice and provided copies to federal, state, and local agencies, Indian tribes with interests in the area, and the general public. Announcements of the scoping opportunities were sent to the Vernal Express, Uintah Basin Standard, and Grand Junction Sentinel newspapers for publication; local Vernal, Utah, area radio stations for announcement; and Channel 6 (i.e., the local Vernal television station), for announcement. A card providing notice of the public scoping period was mailed to the BLM's VFO list of interested parties. A public scoping and information open house was held at the Utah Field House Museum of Natural History in Vernal, Utah on September 29, 2009. The official scoping period ended October 9, 2009.

Public response to the NOI and meetings included a total of nine letters: two from federal agencies, one from a county agency, two from a non-government organization, and four from industry or private individuals. The following lists the letter providers.

- Bill Robinson and Lori Robinson, Whitbeck Investments, Robinson Sheep, Jensen, Utah
- Brooke S. Bell, Anadarko Petroleum Corporation, Denver, Colorado.
- Heather N. Smith, EOG Resources Inc., Denver, Colorado.
- John Ruple, Salt Lake City, Utah.
- David Garbett, Southern Utah Wilderness Alliance, Salt Lake City, Utah in cooperation with Center for Native Ecosystems.
- Erin Robertson, Center for Native Ecosystems, Denver, Colorado in cooperation with Southern Utah Wilderness Alliance.
- Larry Crist, Utah Field Supervisor, U.S. Fish and Wildlife Service, Utah Field Office, West Valley City, Utah.
- Larry Svoboda, NEPA Program, Environmental Protection Agency, Region 8, Denver, Colorado.
- Darlene R. Burns, Michael J. McKee, and Mark D. Raymond - Uintah County Commissioners, Uintah County, Utah.

The scoping process is described in more detail in Section 1.6.2 and Section 1.6.3. Applicable comments were considered during the analysis process, in the development of alternatives and in the statement of purpose and need.

6.3 List of Preparers and Reviewers

Members of the BLM ID Team participating in this project are indicated in **Table 6-1**.

Petros Environmental Group is the third-party environmental contractor responsible for preparing the EIS under the direction of the BLM. The responsibilities, affiliations, and educational backgrounds of the contractor team members are indicated in **Table 6-2**.

Table 6-1 BLM ID Team Participants

Name	Title	Project Responsibility
Stephanie Howard	Environmental Planning Coordinator	NEPA Coordination, Air Quality and Greenhouse Gas Emissions; Environmental Justice; Prime or Unique Farmlands; Access and Transportation; Wetlands and Riparian Areas; Socioeconomics; Hazardous and Solid Wastes
Leonard Herr	Air Resource Specialist	Air Quality
Bill Civish	Recreation Planner	BLM Natural Areas; Areas of Critical Environmental Concern; Wild and Scenic Rivers; Wilderness Study Areas; Lands with Wilderness Characteristics; Recreation; Visual Resources
David Christensen	Archaeologist	Archaeological Resources; Native American Religious Concerns
Blaine Tarbell	Natural Resource Specialist	Fuels and Fire Management
Justin Snyder	Geologist	Geology, Minerals, and Energy Production; Paleontology; Groundwater Quality
Michael McKinley	Water Resources Specialist	Hydrologic Conditions; Surface Water Quality; Waters of the U.S.; Floodplains
Christine Cimiluca	Botanist	Vegetation; Invasive Plants and Noxious Weeds; Soils; Sensitive Plant Species
Margo Roberts	Realty Specialist	Lands
Craig Newman	Range Management Specialist	Livestock Grazing and Rangeland Health Standards
Dusty Carpenter	Range and Wild Horse and Burro Specialist	Wild Horses
Brandon McDonald	Wildlife Biologist	Wildlife; Migratory Birds; Sensitive Animal Species
David Palmer	Forester	Woodlands and Forestry
Jason West	Recreation Planning	BLM Natural Areas; Areas of Critical Environmental Concern; Wild and Scenic Rivers; Wilderness Study Areas; Lands with Wilderness Characteristics; Recreation; Visual Resources
Betty Gamber	Geologist	Geology, Minerals, and Energy Production; Paleontology; Groundwater Quality
Maggie Marston	Botanist	Vegetation; Invasive Plants and Noxious Weeds; Soils; Sensitive Plant Species
Cindy Bowen	Realty Specialist	Lands
James Hereford II	Natural Resource Specialist	Hydrologic Conditions; Surface Water Quality; Waters of the U.S.; Floodplains

Table 6-2 Preparers and Reviewers for Petros Environmental Group and Subcontractors

Name & Affiliation	Education	Project Responsibility
Petros Environmental Group		
Joe Fetzer	M.S. Geology, 1973, Ohio State University B.S. Geology, 1970, Ohio State University	Project Manager, Project Description, Alternatives, Cumulative Effects, Geology and Energy Production, Paleontology, Livestock and Grazing
Richard Bell	M.S. Studies - Agronomy, Soils Science, Colorado State University B.A. Distributive Major: Biology, Geology, Chemistry, 1974, University of Colorado	Asst. Project Manager, Project Description, Alternatives, Soils, Recreation, Access and Transportation
AECOM		
Anne Doud	M.S. Ecology 1992 University of California, Davis B.A. Biology, 1987 Colorado College	Sr. Project Coordinator, Alternatives
Chris Dunne	B.S. Natural Resources Management 2007 Colorado State University	Project Coordinator, Administrative Record
Dan Gregory	M.S. Geology, 1982, Colorado State University B.S. Geology, 1974, Colorado College	Sr. NEPA Reviewer, Alternatives
Courtney Taylor	M.S. Atmospheric Science, 2006, Colorado State University B.A. Environment, Economics, and Politics, 2000, Claremont McKenna College	Sr. Air Quality Technical Review
Caitlin Shaw	M.S. Atmospheric Science, 2009, University of Nebraska B.S. Meteorology, 2006, Valparaiso University	Air Quality
David Fetter	B.S. Watershed Science, 2004, Colorado State University	Floodplains, Water of the U.S.
Bill Berg	M.S. Geology, 1980 University of Wyoming B.S. Geology 1976, Colorado State University	Groundwater Quality
Jim Burrell	M.S. Civil Engineering, 1989, Colorado State University B.S. Forest Management, 1974, Colorado State University	Surface Water Quality
Patricia Lorenz	B.S. Wildlife Biology, 2002, Colorado State University	Vegetation, Special Status Plants, Wildlife Senior Review
Steve Graber	B.S. Natural Resources Management, 2002, Colorado State University B.A. Economics, 2002, Colorado State University	Socioeconomics and Environmental Justice
Merlyn Paulson	MLA II Landscape Architecture and Geographic Information Systems, 1975, Harvard University BLA Landscape Architecture and Environmental Planning, 1972, Utah State University	Visual Resources

Table 6-2 Preparers and Reviewers for Petros Environmental Group and Subcontractors

Name & Affiliation	Education	Project Responsibility
Ben Tracy	B.A. Humanities, 2002, Arizona State University B.S. Natural Resources, Minor in GIS, 2013, Colorado State University	GIS Specialist
Sue Coughenour	General Education, Western Illinois University	Sr. Document Production
Clint Anders	B.S. Biology, Minor Chemistry, 2013, Sam Houston State University	Administrative Record
Pioneer Environmental Consultants		
Steven Faulk	B.S. Natural Resources Management, 2002, Colorado State University B.S. Biology, 1991, Denison University	Wildlife, Special Status Animals
Montgomery Archaeological Consultants		
Jody Patterson	Ph. D. Anthropology, 2010, University of Alaska M.A. Anthropology, 1996, New Mexico Highlands University B.A. Anthropology and Sociology, 1994, New Mexico Highlands University	Cultural Resources, Native American Religious Concerns
Sammons/Dutton LLC		
Ron Dutton	M.S. Economics, 1976, University of Wyoming B.S. Economics, 1974, University of Wyoming	Socioeconomics and Environmental Justice
Alpine Geophysics		
Dennis McNally	M.S. Atmospheric Sciences, 1994, University of California, Davis B.S. Chemical Engineering, 1987, University of Colorado	Air Quality Modeling Lead, Far-field Modeling, Air Quality Technical Support Documentation
Cynthia Loomis	B.S. Mathematics and Computer Science, 1987, California State University Sacramento	Far-field Modeling
Ramboll ENVIRON International		
Sue Kemball-Cook	Ph. D. Atmospheric Science, 1999, University of California Davis M.S. Physics, 1995, San Francisco State University B.A. Physics, 1987, Yale University	Air Emissions QA/QC, Near-field Modeling, Air Quality Technical Support Documentation
John Grant	B.S. Environmental Engineering, 2000, Humboldt State University	Air Emissions Inventories, Near-field Modeling, Air Quality Technical Support Documentation

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8.0 Glossary

Acre-foot	Volume of water required to cover 1 acre to a depth of 1 foot; equivalent to a volume of 43,560 cubic feet, approximately 325,829 gallons, or approximately 7,758 barrels of water.
Air Quality Related Values	Includes visibility, atmospheric deposition, and acid neutralization capacity.
Alluvial	Pertaining to material or processes associated with transportation or deposition of soil and rock by flowing water (e.g., streams and rivers).
Alluvium	Unconsolidated or poorly consolidated gravel, sands, and clays deposited by streams
Ambient noise	Total, all-encompassing noise associated with a given environment and time.
Aquifer	A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.
Archaeology	The scientific study of material remains (as fossil relics, artifacts, and monuments) of past human life and activities.
Barrel	Volume equivalent to 42 gallons of water; approximately 7,758 barrels are equivalent to 1 acre-foot of water.
Biological soil crust	A community of living organisms on the soil surface in semi-arid and arid ecosystems. Major components are cyanobacteria, green algae, microfungi, mosses, liverworts, and lichens.
Blowout preventer	A large valve at the top of a well that may be closed if the drilling crew loses control of pressurized formation fluids.
Borehole	The wellbore itself, including the openhole or uncased portion of the well. Borehole may refer to the inside diameter of the wellbore wall, the rock face that bounds the drilled hole.
Botany	A branch of biology dealing with plant life.
Casing annulus	The space between the wellbore and casing where fluid can flow.
Census Designated Place (CDP)	Identified geographic area of concentrated population that lacks a separate local government, but which physically resembles an incorporated village or town. CDPs are used by the U.S. Census Bureau to report demographic and housing data.
Completion	A generic term used to describe the assembly of downhole tubulars and equipment required to enable safe and efficient production from an oil or gas well, including inserting and cementing casing, perforating, and often, hydraulically fracturing the reservoir.

Condensate	A low-density, high-API gravity liquid hydrocarbon phase that generally occurs in association with natural gas. Its presence as a liquid phase depends on temperature and pressure conditions in the reservoir allowing condensation of liquid from vapor.
Critical habitat	Habitat that is present in minimum amounts and is the determining factor in the potential for population maintenance and growth.
Crude oil	A general term for unrefined petroleum or liquid petroleum.
Cumulative effects	The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be significant. Included are activities of the past, present, and reasonably foreseeable future; synonymous with cumulative impacts.
dBA	A-weighed decibel. The most commonly used frequency weighting measure; simulates human sound perception and correlates well with human perception of the annoying aspects of noise.
Depletion	The drop in reservoir pressure or hydrocarbon reserves resulting from production of reservoir fluids.
Derrick	The structure used to support the crown block and the drillstring of a drilling rig. Derricks are usually pyramidal in shape, and offer a good strength-to-weight ratio.
Direct effects	Effects that are caused by the action and occur at the same time and place (40 Code of Federal Regulations 1508.7); synonymous with direct impacts.
Directional drill	A means of subterranean drilling that can be carried out and controlled in terms of depth and direction.
Disturbed area	An area where natural vegetation and soil conditions have been altered.
Drill cuttings	Small pieces of rock that break away due to the action of the bit teeth.
Dry hole	A wellbore that has not encountered hydrocarbons in economically producible quantities.
Effect	A modification in the status of the environment brought about by the Proposed Action or an alternative.
Endangered species	Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.
Evapotranspiration	The portion of precipitation returned to the air through evaporation and plant transpiration.

Fauna	Animal life.
Floodplain	That portion of a river valley, adjacent to the channel, that is built of sediments deposited during the present regimen of the stream and that is covered with water when the river overflows its banks at flood stages. The 100-year floodplain is that portion of the river valley adjacent to the channel, which has a 1 in 100 chance of being inundated in a given year.
Flora	Plant life.
Formation	A body of rock that is sufficiently distinctive and continuous that it can be mapped. In stratigraphy, a formation is a body of strata of predominantly one type or combination of types; multiple formations form groups, and subdivisions of formations are members.
Fugitive dust	Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.
Gathering pipeline	Typically smaller diameter pipelines connecting production wells to central gathering locations, such as tank batteries for hydrocarbon liquids or compressor stations for natural gas. For natural gas, gathering pipelines are upstream of transmission pipelines, which are upstream of distribution pipelines.
Greenhouse Gas (GHG)	Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, carbon dioxide, methane, nitrous oxide, and ozone.
Hydrocarbon resources	Naturally occurring organic compounds comprising hydrogen and carbon. The most common hydrocarbons are natural gas, oil, and coal.
Indirect effects	Impacts that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 Code of Federal Regulations 1508.8); synonymous with indirect impacts.
Injection well	A well in which fluids are injected rather than produced, the primary objectives typically being to maintain reservoir pressure or to dispose of waste water. Two main types of injection are gas and water.
Intermittent stream	A stream that flows only part of the time or during part of the year.
Irretrievable	Applies primarily to the lost production of renewable natural resources during the life of the project.
Irreversible	Applies primarily to the use of nonrenewable resources, such as minerals, cultural resources, wetlands, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.
Lek	An assembly area where grouse conduct display and courtship behavior.
Migration	The long-distance movement of wildlife, usually between breeding and non-breeding areas.

Mitigate, Mitigation	To cause to become less severe or harmful; actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.
Mud	A term that is generally synonymous with drilling fluid and that encompasses most fluids used in hydrocarbon drilling operations, especially fluids that contain significant amounts of suspended solids, emulsified water, or oil.
National Environmental Policy Act (NEPA)	The National Environmental Policy Act of 1969; the national charter for protecting the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations from 40 Code of Federal Regulations 1500-1508 implement the act.
National Pollutant Discharge Elimination System (NPDES)	A part of the Clean Water Act that requires point source dischargers to obtain Elimination System permits. These permits are referred to as NPDES permits and are administered by the U.S. Environmental Protection Agency.
National Register of Historic Places (NRHP)	A list, maintained by the National Park Service, of areas that have been designated as being of historical significance.
Native species	Plants that originated in the area in which they are found (i.e., they naturally occur in that area).
Noise	Unwanted sound; one that interferes with one's hearing or activities; a sound that lacks agreeable musical quality or is noticeably unpleasant.
Paleontology	A science dealing with the life of past geological periods as known from fossil remains.
Perennial stream	A stream or reach of a stream that flows throughout the year.
Perforation	The communication tunnel created from the casing or liner into the reservoir formation, through which oil or gas is produced.
Plug and abandon	To prepare a well to be closed permanently, usually after either logs determine there is insufficient hydrocarbon potential to complete the well, or after production operations have drained the reservoir.
Primary production or recovery	The means by which the initial reservoir production is achieved, such as natural production from a gas-drive reservoir. In many cases, a secondary recovery method, such as waterflood, is required to maintain a viable reservoir production rate.
Produced water	Groundwater pumped to the surface during reservoir production.
Producing zone	A layer of reservoir rock containing economically recoverable volumes of oil or gas.
Production tubing	A wellbore tubular used to produce reservoir fluids. Production tubing is assembled with other completion components to make up the production string.

Raptors	Birds of prey such as hawks, eagles, and owls.
Reclamation	Rehabilitation of a disturbed area to make it acceptable for designated uses. This process consists of two stages, interim and final: *Interim Reclamation* – Involves shaping, stabilizing, re-vegetating, or otherwise treating disturbed areas in order to provide a self-sustaining and productive use of the land during production operations. *Final Reclamation* – Involves returning the land to a condition after production and operations cease that approximates the condition prior to disturbance and maintains a stable and productive condition compatible with the land use.
Reserve pit	An earthen-bermed storage area for discarded drilling mud.
Reservoir	A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids.
Rig	The machine used to drill a wellbore. The rig includes virtually everything except living quarters. Major components of the rig include the mud tanks, the mud pumps, the derrick or mast, the drawworks, the rotary table or topdrive, the drillstring, the power generation equipment and auxiliary equipment.
Right-of-Way (ROW)	Strip of land or corridor designated via an administrative grant through which a pipeline, power line, access road, or maintenance road would pass.
Riparian	Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian vegetation is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.
Roost	A place where birds customarily rest.
Runoff	Surface water received as precipitation that flows and is collected in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.
Scoping	Discussion with and disclosure to agencies and the public with regard to a project or undertaking wherein areas of concern or issues to be addressed in a NEPA document are determined.
Sediment	Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion and rock weathering, as well as construction activities or anthropogenic sources, such as forest or agricultural practices.
Sediment yield	Quantification of the amount of sediment transported.

Seismic	Pertaining to waves of elastic energy, such as that transmitted by P-waves and S-waves, in the frequency range of approximately 1 to 100 Hz. Seismic energy is studied by scientists to interpret the composition, fluid content, extent and geometry of rocks in the subsurface. Also – of, subject to, or caused by an earthquake; of or relating to an earth vibration caused by something else.
Seismicity	Relative degree to which an area is subject to earth movement caused by earthquakes or other seismic activity.
Shale	A fine-grained, fissile, detrital sedimentary rock formed by consolidation of clay- and silt-sized particles into thin, relatively impermeable layers. It is the most abundant sedimentary rock.
Significance	Significance is defined by NEPA regulations at CFR 40 Section 1508.27 and depends upon both the context and intensity of expected effects.
Stratigraphy	Form, arrangement, geographic distribution, chronological succession, classification, and relationships of rock strata.
Tertiary	The geologic span of time between 65 and 3 to 2 million years ago.
Threatened species	Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
Visual resource	The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.
Water disposal well	A well used for disposal or injection of produced water or other fluids.
Watershed	A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.
Well casing	Large-diameter pipe lowered into an openhole and cemented in place. The well designer must design casing to withstand a variety of forces, such as collapse, burst, and tensile failure, as well as chemically aggressive brines. Casing is run to protect fresh-water formations, isolate a zone of lost returns or isolate formations with significantly different pressure gradients.
Well pad	A temporary drilling site, usually constructed of local materials such as gravel, shell or even wood. After the drilling operation is over, most of the pad is usually removed or contoured.
Wellbore	Synonym: borehole.
Wellhead	The surface termination of a wellbore that incorporates facilities for installing casing hangers during the well construction phase.

Wetlands	Areas that are inundated by surface or groundwater with a frequency sufficient to support (and under normal circumstances do or would support) a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.
Workover	The process of performing major maintenance or remedial treatments on an oil or gas well. In many cases, workover implies the removal and replacement of the production tubing string after the well has been killed and a workover rig has been placed on location.

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