REGION 8

DENVER, CO 80202

Climate, Environmental Justice and Tribal Interest Analysis

Prepared for the Region 8 Decision on the Aquifer Exemption Request from Aethon Energy Operating LLC Marlin No. 29-21 WDW

April 11, 2024

Aethon Energy Operating LLC, Marlin No 29-21 WDW
Climate, Environmental Justice and Tribal Interest Analysis

1.0 Introduction

This document sets forth the U.S. Environmental Protection Agency (EPA) Region 8's Climate, Environmental Justice and Tribal Interest analysis for the Safe Drinking Water Act (SDWA) Underground Injection Control (UIC) aquifer exemption (AE) request submitted by the Wyoming Oil and Gas Conservation Commission (WOGCC) for the Athon Energy Operating LLC (Aethon), Marlin No. 29-21 WDW (Marlin well) in the Moneta Divide oil and gas development area located in Fremont County, Wyoming. This analysis includes considerations relevant to the aquifer exemption process at 40 CFR § 144.7 and the EPA's evaluation of the aquifer exemption criteria at 40 CFR § 146.4.

1.1 Safe Drinking Water Act

Section 1421 of the SDWA requires the EPA to develop UIC program requirements that protect underground sources of drinking water (USDWs) from endangerment. A USDW is defined at 40 CFR § 144.3 as an aquifer that supplies any public water system; or contains a sufficient quantity of groundwater to supply a public water system; and currently supplies drinking water for human consumption; or contains fewer than 10,000 mg/L total dissolved solids (TDS); and which is not an exempted aquifer. The EPA promulgated program requirements that protect USDWs through the regulation of underground injection. States or Tribes can be authorized to administer the UIC program through the approval of primacy programs as described under 40 CFR part 145, or alternatively under section 1425 of the SDWA for Class II wells only. In Wyoming, EPA has approved the WOGCC to regulate Class II wells throughout the state except in Indian country as defined at 18 U.S.C. § 1151. Class II wells inject fluids associated with oil and natural gas production into underground formations. Even where a state or Tribe has primacy, the EPA retains the authority for final AE decisions. While state or Tribal primacy programs have an AE process, if the state or Tribe wishes to exempt an aquifer, it must submit the aquifer exemption package to the EPA for final decision, in accordance with 40 CFR § 144.7.

The SDWA does not include an aquifer exemption provision. However, when promulgating the UIC regulations, the EPA recognized that not all aquifers meeting the definition of a USDW would have potential to serve as a source of drinking water. See 49 Fed. Reg. 30137, 30141 (May 11, 1984). Therefore, the EPA developed the aquifer exemption process, which provides the EPA discretion to exempt aquifers or portions of aquifers that do not currently serve as a source of drinking water and cannot now and will not in the future serve as a source of drinking water based on certain regulatory criteria. AEs can allow aquifers that meet the definition of a USDW but have no potential as a source of drinking water to be used by energy and mining companies for oil or mineral extraction or disposal purposes in compliance with the EPA's UIC requirements under SDWA. The EPA may approve an AE request if it determines that the regulatory criteria are met and retains discretion even when the criteria are met, to deny an AE request to further the purposes of the SDWA to protect potential sources of drinking water.

1.2 Applicable SDWA Aquifer Exemption Criteria

The UIC regulations include the following provisions:

40 CFR § 146.4 Criteria for exempted aquifers.

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in § 146.3 may be determined under § 144.7 of this chapter to be an "exempted aquifer" for Class I-V wells if it meets the criteria in paragraphs (a) through (c) of this section. Class VI wells must meet the criteria under paragraph (d) of this section:

(a) It does not currently serve as a source of drinking water; and

(b) It cannot now and will not in the future serve as a source of drinking water because:

(1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.

(2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

(3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

(4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or

(c) The total dissolved solids content of the ground water is more than 3,000 and less than 10,000 mg/L and it is not reasonably expected to supply a public water system.

(d) The areal extent of an aquifer exemption for a Class II enhanced oil recovery or enhanced gas recovery well may be expanded for the exclusive purpose of Class VI injection for geologic sequestration under § 144.7(d) of this chapter if it meets the following criteria:

(1) It does not currently serve as a source of drinking water; and

(2) The total dissolved solids content of the ground water is more than 3,000 mg/L and less than 10,000 mg/L; and

(3) It is not reasonably expected to supply a public water system.

40 CFR § 144.7

The following regulations under § 144.7 are applicable to AEs for Class II injection wells:

(a) The Director may identify (by narrative description, illustrations, maps, or other means) and shall protect as underground sources of drinking water, all aquifers and parts of aquifers which meet the definition of "underground source of drinking water" in § 144.3, except to the extent there is an applicable aquifer exemption under paragraph (b) of this section or an expansion to the areal extent of an existing Class II enhanced oil recovery or enhanced gas recovery aquifer exemption for the exclusive purpose of Class VI injection for geologic sequestration under paragraph (d) of this section. Other than EPA approved aquifer exemption expansions that meet the criteria set forth in § 146.4(d) of this chapter, new aquifer exemptions shall not be issued for Class VI injection wells. Even if an aquifer has not been specifically identified by the Director, it is an underground source of drinking water if it meets the definition in § 144.3.

(b)(1) The Director may identify (by narrative description, illustrations, maps, or other means) and describe in geographic and/or geometric terms (such as vertical and lateral limits and gradient) which are clear and definite, all aquifers or parts thereof which the Director proposes to designate as exempted aquifers using the criteria in § 146.4 of this chapter.

(2) No designation of an exempted aquifer submitted as part of a UIC program shall be final until approved by the Administrator as part of a UIC program. No designation of an expansion to the areal extent of a Class II enhanced oil recovery or enhanced gas recovery aquifer exemption for the exclusive purpose of Class VI injection for geologic sequestration shall be final until approved by the Administrator as a revision to the

applicable Federal UIC program under part 147 or as a substantial revision of an approved State[1] UIC program in accordance with § 145.32 of this chapter.

(3) Subsequent to program approval or promulgation, the Director may, after notice and opportunity for a public hearing, identify additional exempted aquifers. For approved State programs exemption of aquifers identified

(i) under § 146.04(b) shall be treated as a program revision under § 145.32;
(ii) under § 146.04(c) shall become final if the State Director submits the exemption in writing to the Administrator and the Administrator has not disapproved the designation within 45 days. Any disapproval by the Administrator shall state the reasons and shall constitute final Agency action for purposes of judicial review.

(c)(2) For Class II wells, a demonstration of commercial producibility shall be made as follows:

(ii) For Class II wells not located in a field or project containing aquifers from which hydrocarbons were previously produced, information such as logs, core data, formation description, formation depth, formation thickness and formation parameters such as permeability and porosity shall be considered by the Director, to the extent such information is available.

2.0 Project Background and Aquifer Exemption Request

2.1 Moneta Divide Natural Gas and Oil Development Project

The Marlin well was constructed as part of the Moneta Divide Natural Gas and Oil Development Project (Moneta Divide Project). Under this project, Aethon and Burlington Resources Oil & Gas Company LP (Burlington) propose to drill and produce oil and gas resources and construct associated facilities. The project area lies primarily in Fremont and Natrona counties in Wyoming approximately 37 miles east of Riverton, and partially in Sweetwater County as shown in Figure 1. The project involves the exercise of existing lease rights to drill for, extract, remove, and market commercial quantities of oil and natural gas.

The Bureau of Land Management (BLM) Wyoming State Office released a Draft Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA) for the Moneta Divide Project on April 19, 2019, and a Final EIS (FEIS) on February 21, 2020. The BLM released a Record of Decision (BLM ROD) on August 7, 2020, approving the Preferred Alternative discussed in Section 7.10 of the BLM FEIS. Under the BLM ROD, Aethon may submit Applications for Permit to Drill (APDs) for as many as 4,100 natural gas and oil wells at a rate of up to 300 wells site-specifically approved per year during the approximate 15-year development period. Burlington may submit APDs for as many as 150 natural gas and oil wells at a rate of up to 25 wells site-specifically approved per year during the approximate 15-year development period. The BLM ROD approves up to 20,132 acres of short-term disturbance and up to 6,208 acres of long-term disturbance during the anticipated 65-year life of the project. More than 830 wells have already been developed in the project area, with some plugged and abandoned.

Produced water is a byproduct that is generated during oil and gas extraction and is typically high in salt content and contains hydrocarbons as well as a diverse range of chemicals associated with well drilling, completion, hydraulic fracturing, production and maintenance activities. The Moneta Divide project is predicted to yield an

[1] Approved "State" includes Indian Tribes that have EPA approval to be treated in a similar manner as a state for specific SDWA provisions. 40 C.F.R. § 145.52 (1994).

extremely high volume of produced water at up to 58.8 million gallons or 1.4 million barrels (bbl) per day at maximum development. BLM ROD at 10. The BLM ROD authorizes Aethon to develop up to 160 Class II injection wells for subsurface disposal of produced water and produced water concentrate, a byproduct of the proposed water treatment processes. Under the BLM ROD, Aethon may construct 150 disposal wells within the Shotgun Disposal Area and 10 disposal wells within the Madison Disposal Area, subject to permitting and aquifer exemption requirements. Both disposal areas are outlined in green boundaries in Figure 1. The target formations for injection wells located in the Shotgun Disposal Area are the Shotgun Member and/or the Lower Fort Union Member of the Fort Union formation and the Lance formation. The BLM FEIS Preferred Alternative assumes Aethon would not receive an aquifer exemption to inject into the Madison Formation and all disposal wells in the Madison Disposal Area are assumed to inject into the Nugget and Tensleep Formations. FEIS at 2-62. The BLM selected the Preferred Alternative in the Record of Decision. BLM ROD at 4. Thus, an aquifer exemption to inject produced water from the Moneta Divide project into the Madison and Amsden Formations appears inconsistent with the Preferred Alternative adopted in the BLM ROD. At the time the BLM ROD was approved, the projected injection capacities within both disposal areas were estimated to be up to 320,000 bbl total per day (2,000 bbl per well per day). The BLM ROD states that if Aethon proposes to surpass this volume of disposal, additional NEPA analysis may be required. BLM ROD at 13.

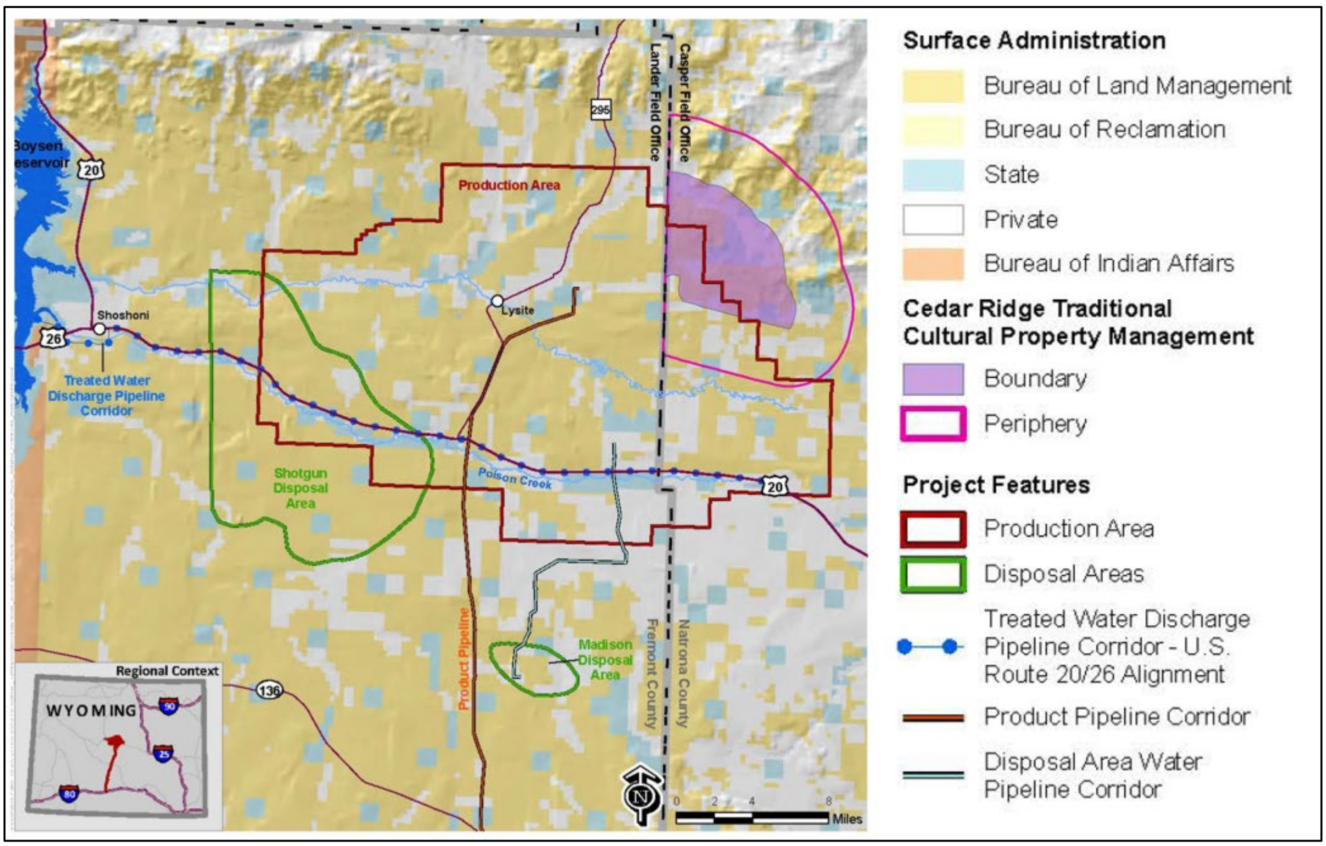

Figure 1. Moneta Divide Natural Gas and Oil Development Project Area
(Map 1 from Bureau of Land Management February 2020 Environmental Impact Statement Record of Decision)

2.2 Requested Aquifer Exemption for Marlin No. 29-21 WDW

In 2012, Encana, the previous owner of the Marlin well, requested an exemption for disposal into the Nugget, Tensleep and Madison Formations at the Marlin 29-21 well. On April 10, 2012, WOGCC issued a conditional authorization with the stipulation that Encana demonstrate through analysis of aquifer fluids to be collected after the well was drilled, that the aquifers exhibit TDS concentrations greater than 5,000 mg/L.[2] Encana drilled the Marlin 29-21 WDW well to a total depth of 15,364 ft. in May 2012. Following well completion, at this location, the Nugget was determined not to be prospective as a disposal interval and the Tensleep was sampled and found to exhibit a TDS concentration above 5,000 mg/L, but formation testing indicated disposal capacity below the desired volume. Samples collected from the Madison exhibited TDS concentrations ranging from 910 to 1,200 mg/L. Because the Madison TDS concentrations did not meet the condition for approval set by the WOGCC, Encana was not authorized to inject into the Madison formation at this well site. In November 2012 (Docket 3-2013), Encana submitted to WOGCC a request to exempt the Madison aquifer at the Marlin 29-21 well on the basis that the aquifer is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical. On June 11, 2013, WOGCC issued an Order reaffirming a January 8, 2013, decision to approve Encana's aquifer exemption request for the Madison aquifer along with directives that the matter would be reviewed in approximately one year; that Encana conduct necessary tests, refine the reservoir model, provide more detail on the geology of the formation; submit spinner survey results; and recognizing that the EPA would continue to analyze the request and any concerns would result in the matter being brought back to the Commission. The Order also reaffirmed the disposal well permit under the same conditions and stipulations imposed in Conclusion of Law No. 6 contained in the Report of the Examiners in Docket No. 438-2011 (dated April 10, 2012). Multiple hearings were held before the WOGCC from 2013 to 2015, and additional hydrogeologic analyses, including sampling and radiocarbon age dating of Madison groundwater and numerical modeling to estimate the extent of injectate migration, were performed for Encana by Tetra Tech (Tetra Tech, 2015). The EPA did not receive a request for an aquifer exemption from WOGCC during this timeframe.

Aethon acquired the Moneta Divide Project, including the Marlin well, from Encana in April 2015 and requested an aquifer exemption for a ¼-mile radius around the Marlin well. On May 14, 2019, the WOGCC denied Aethon's request, finding that it did not meet the criteria that the aquifer is situated at a depth or location that makes recovery of fresh and potable water economically or technologically impractical. The Commission expressed concerns about the model, and whether the injected water would stay within a reasonable distance of the wellbore or whether it could migrate out of the injection zone. In addition, the Commission expressed concerns about the structural complexity - including faults and related fractures, reservoir heterogeneity, compartmentalization and different pressure regimes – that were not adequately addressed with regard to water movement in preferential directions related to the geology.[3] The Commission also raised questions or concerns regarding proximity to outcrops, radius of injection, containment, and use of the Madison aquifer as a source of water in Gillette.[4] The Marlin well is currently shut-in with the Madison perforations squeezed under a

[2] WOGCC Docket No. 438-2011, Order No. 1, Conclusions of Law #5. (April 10, 2012), at 5.

[3] WOGCC Docket No. 3-2013, Order No. 3, Findings of Fact #12. (May 14, 2019), at 5.

[4] WOGCC's 2020 aquifer exemption submission package to the EPA (July 28, 2020), which includes Aethon's AE application, WOGCC's Report of the Examiners and hearing transcript for Docket 1711-2020, public comments, and supplemental information (hereinafter "WOGCC AE Submission"), at 300. Page references refer to the page number of the PDF document that Wyoming submitted to the EPA. The link to the application and exhibits available on the WOGCC website is http://pipeline.wyo.gov/db/cardfile/1711-2020.htm.

cement retainer and the Tensleep perforations open. Thus, no additional water-quality data has been gathered since 2014.

On August 14, 2020, WOGCC received an aquifer exemption application that extends to the Madison aquifer and overlying Amsden Formation within a three-mile radius of the Marlin well (Docket 1711-2020). Aethon's application presented additional hydrogeologic analysis. Specifically, the model was revised to include the Darwin Sandstone member of the Amsden as a separate layer, the Reservoir Saturation Sigma Log was reprocessed to provide more accurate porosity values, and 2D seismic data were acquired and utilized to refine local structure mapping. WOGCC published a public notice on September 4, 2020, in the *Casper Star Tribune*, a paper in circulation in Natrona County and in general circulation in Wyoming, for a hearing initially scheduled for October 12, 2020, that was moved to November 10, 2020. WOGCC published a public notice on October 4, 2020, in the *Casper Star Tribune* for the WOGCC hearing that occurred on November 10, 2020.[5] The public notices initiated WOGCC's public comment period which continued through November 10, 2020. On the date of the public hearing, the WOGCC voted (4 to 1) to approve the AE, and the Wyoming Department of Environmental Quality (WDEQ) found the documents presented evidence generally supportive of the proposed AE on December 4, 2020. The WOGCC issued an Order approving the AE on July 27, 2022.

On July 29, 2022, the EPA received a request from the WOGCC to approve an exemption of the Madison and Amsden aquifers within a three-mile radius of the Marlin injection well as shown in Figure 2. At the well site, the Madison aquifer occurs between 15,003 and 15,365 feet measured depth (MD), and the Amsden aquifer occurs between 14,795 and 15,003 feet MD. The requested aquifer exemption is for the Amsden and Madison formations. The EPA treats the two formations as one for purposes of this aquifer exemption request, as any fluids injected into one formation has the potential to migrate into the other.[6] The TDS concentration of the Madison aquifer at this site ranges from 910 to 1200 mg/L. Additional information on the water quality of the Madison aquifer at this location is included in the accompanying EPA Record of Decision. The source of injectate will be produced water from Aethon-operated wells in the project vicinity that produce primarily from the Lower Fort Union and Lance formations.[7] The produced water will contain native formation fluid, hydraulic fracturing flow-back fluids from any newly constructed well and any existing wells that undergo re-stimulation, and chemicals used in maintenance and oil recovery treatment processes.

Native formation fluid will contribute to the chemical composition of the produced water. In both the Water Management Plan (BLM FEIS Appendix K, Figure 7) and Water Resources Technical Report (BLM FEIS Appendix M, Table 25), the chemical composition of untreated produced water from existing wells within the Moneta Divide Project Area was disclosed. Analytical results indicate the presence of toxic constituents and multiple chemical contaminants that exceed EPA maximum contaminant levels or drinking water standards. These constituents include fluoride, barium, copper, lead, benzene, ethyl benzene, toluene, and xylene. It should also be noted that the produced water also contained boron in extremely high concentrations (15 mg/L). Boron is known to be harmful to crops and the USDA has set the boron tolerance limits between 0.05 – 5.7 mg/L for tolerant crops. The Federal Government does not regulate boron in drinking water, and public drinking water systems are not required to monitor for this contaminant. However, some states have drinking water standards

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[5] WOGCC AE Submission, *supra* note 4, at 286 states that a notice also was published in *The Ranger*, a publication based in Riverton, WY, on Oct. 6, 2020, however the EPA was not able to locate this notice in Wyoming's Public Notices database (https://www.wyopublicnotices.com/).

[6] WOGCC AE Submission, *supra* note 4, at 287.

[7] WOGCC AE Submission, *supra* note 4, at 17 and 135.

or guidelines for boron (California, Florida, Maine, Minnesota, New Hampshire and Wisconsin); these range from 0.6 to 1 mg/L.[8]

During the development and production processes, produced water generated in the project area will be a complex mixture, containing known chemicals (BLM FEIS Appendix J, Table J-6), as well as naturally occurring formation constituents, and unknown constituents (e.g., proprietary chemicals, secondary compounds formed under subsurface conditions). Per the Final EIS Volume 2 Appendices-Appendix J, well completion operations will involve both slickwater and gel-based hydraulic fracturing. Both the chemicals used and/or transformation by-products from those chemicals used in maintenance processes and hydraulic fracturing will be part of the produced water stream for any source wells that are hydraulically fractured. In the Final EIS, Appendix J, the list of chemicals for both processes contains proprietary ingredients and numerous chemicals that have proven toxic and carcinogenic effects (i.e., Polycyclic Aromatic Hydrocarbons, BTEX, Alkylphenols and their derivatives, biocides, etc.). Currently, there are various types of treatment technologies. However, there are not approved analytical methods for a large portion of the chemical additives and hence a way to adequately assess treatment technology efficacy.

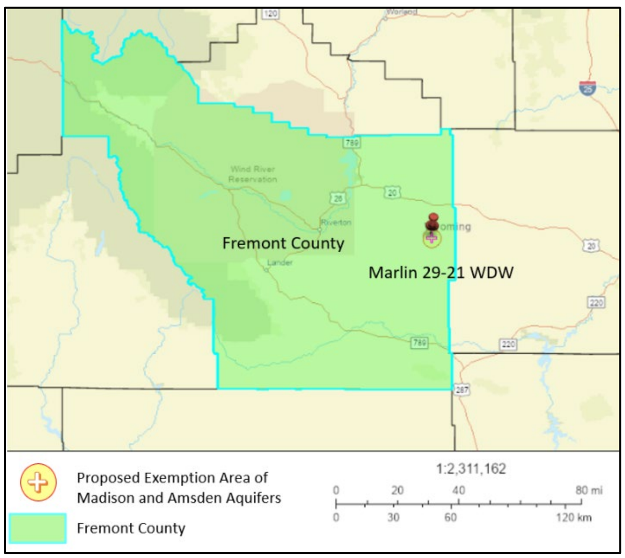

Figure 2. Location of the Marlin 29-21 WDW and the proposed aquifer exemption area within Fremont County. The depiction of the Wind River Indian Reservation for this and all maps in this document are for general reference purposes only.[9]

3.0 Public Comments

While all aquifer exemption decisions are made by EPA, under the SDWA regulations, where states or Tribes implement the federal UIC permitting programs relevant to an AE request, they undertake a public engagement process before submitting an AE request to the EPA. With respect to this AE request, WOGCC published public notices in September and October of 2020, initiating the public comment period which continued through November 10, 2020, the date of the WOGCC public hearing.

[8] U.S. ENV'T PROT. AGENCY, Summary Document from the Health Advisory for Boron and Compounds, Doc No. 822-S-08-003, (2014) https://www.epa.gov/sites/default/files/2014-09/documents/summary_document_from_the_ha_for_boron.pdf.
[9] Indian country in Wyoming includes lands within the exterior boundaries of the Wind River Indian Reservation subject to *Wyoming v. EPA*, 875 F.3d 505 (10th Cir. 2017), *cert. denied*, 138 S. Ct. 2677 (2018); any land held in trust by the United States for an Indian Tribe; and any other areas that are "Indian country" within the meaning of 18 U.S.C. § 1151.

The WOGCC submittal to the EPA includes written comments from 111 separate commenters and a public hearing transcript. Based on the addresses that some included in the comment record, WOGCC received comments from individuals and groups in numerous WY counties and communities, including Alta, Banner, Beulah, Black Hills of Wyoming, Buffalo, Burns, Casper, Cheyenne, Clark, Cody, Crook, Douglas, Dubois, Evanston, Fremont, Gillette, Powell, Ranchester, Riverton, Sheridan, Wheatland, and Wilson. Additional public comments were made during the public hearing process. WOGCC responded to what it characterized as 18 unique comments submitted by the 111 commenters and to five comments made during the public hearing that WOGCC identified as warranting a response.[10] WOGCC noted that it received an additional written comment after the close of the public comment period that it did not include as part of its record but that it reviewed the comment and concluded no new information was presented that would lead to a different decision.

The 111 written comments referenced by WOGCC as submitted during its formal public comment period are uniformly in opposition to approval of an exemption that would allow Aethon to inject oil and gas produced water contaminants into the Madison aquifer. Commenters emphasize the good water quality of the Madison at the Marlin well injection site; the current and potential future viability of the Madison aquifer as a source of drinking water for individuals and communities in the Wind River and Big Horn Basins; potential impacts related to injection of oil and gas wastewater; technological advancements improving the performance and costs of developing and delivering deep groundwater resources; concerns about WOGCC's departure from its previous disapprovals of AE requests at this site; concerns with exempting the aquifer from protection considering climate and climate change concerns; and interests of Indigenous Peoples and the Tribal governments on the Wind River Indian Reservation. Comments made during WOGCC's public comment and hearing processes, and public input received by the EPA are briefly summarized below. Information provided pursuant to the EPA's Tribal consultation process is included in Section 5.2.2.

The EPA's FY 2022-2026 Strategic Plan sets forth the agency's goals which include centering its mission on the integration of justice, equity, and civil rights across the nation's environmental protection enterprise to achieve measurable environmental, public health, and quality of life improvements in the most overburdened, vulnerable, and underserved communities.[11] The Strategic Plan notes that information from community engagement activities, along with other actions to consider more fully environmental justice and civil rights, should be regularly reflected and addressed throughout the EPA's decisions.[12] Thus, this discussion begins by summarizing public input received by the WOGCC and by the EPA during this most recent Marlin AE process.[13]

Comments Concerning Aquifer Water Quality

- Total Dissolved Solids (TDS): water quality and yield data obtained to date from the Marlin 29-21 WDW indicate that the Madison aquifer water quality at this location is very good with TDS less than 1,100 mg/L and very low dissolved metals and radionuclides.[14]
- Benzene: while the applicant concludes that groundwater in the Madison Aquifer contains benzene, there is no data to indicate the presence of a hydrocarbon reservoir in the vicinity of the Marlin well.

[10] WOGCC AE Submission, *supra* note 4, at 386.
[11] U.S. Env't Prot. Agency, FY 2022-2026 EPA Strategic Plan 27 (2022) (hereinafter "EPA Strategic Plan").
[12] *Id.* at 34.
[13] The section below paraphrases some of the comments received by WOGCC and EPA. The summary is not exhaustive of the comments received, nor does it reflect any position by the EPA as to their content or veracity.
[14] Sue Ann Spencer, Technical Review of the August 13, 2020 Amended Application for Aquifer Exemption (AE) and Underground Disposal of Water in Accordance with Wyoming Oil and Gas Conservation Commission (WOGCC) Rules and Regulations Chapter 4, Sections 5 and 12 (October 29, 2020) (hereinafter "Spencer 2020"), at 2.

Benzene concentrations in the samples collected from the Marlin well were 110 µg/L on July 3, 2012; 22 µg/L on July 5, 2012; and 18 µg/L on July 9, 2012. This variation indicates that it is unlikely that benzene is naturally occurring and more likely that it was the result of contaminants introduced during drilling and well construction.[15]

Comments Concerning Current and Potential Future Use of the Aquifer

<u>Current Use of the Madison Aquifer</u>

- The Paleozoic Aquifer System, which includes the Madison aquifer, is the most reliable and prolific aquifer system in the state. This aquifer systems currently supplies reliable, good quality groundwater to Gillette, Newcastle, Laramie, Pine Haven, Vista West, Beulah, Moorcroft, Dayton, Lander, Laramie, Douglas, Glenrock, and most towns in the southeastern Bighorn Basin.[16]
- The Big Horn Regional Water System is comprised of a 70-mile pipeline that extends from Greybull to Kirby and provides water to 15 public water systems. This system is supplied by eight water supply wells, all of which are completed in the Madison aquifer.[17]
- There are public health and economic benefits to consolidating numerous small PWSs into larger regional groundwater-based water supply systems. For example, the Big Horn Regional Water Supply System has more than 70 miles of pipeline serving what was previously 15 individual modest-sized public water systems, spanning three counties and covering more than 800 square miles (citations omitted). The BHRWS serves several entities and consecutive water systems in Big Horn, Washakie and northern Hot Springs Counites. The water system has been operating successfully for several years, using three high quality, high yielding water sources which are artesian well fields in the Madison Limestone aquifer.[18]
- The Madison aquifer also supplies large quantities of groundwater to many ranching operations and rural residents in the Bighorn Basin, Power River Basin, and the Black Hills of eastern Wyoming.[19]
- The Madison Formation of the Southern Bighorn is where many ranchers and rural residents get their water.[20]
- Gillette, Wyoming pumps groundwater from the Madison Aquifer well field over 25 miles at a cost of over $200 million.[21]

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[15] *Id.* at 5.
[16] Letter from Powder River Basin Resource Council and Wyoming Outdoor Council to WOGCC re: Docket 1711-2020 Aethon Madison Aquifer Exemption Marlin 29-21 Disposal Well (previously associated with Docket 3-2013) (November 6, 2020) (hereinafter "PRBRC 2020"), at 1; Spencer 2020, *supra* note 14, at 1.
[17] PRBRC 2020, supra note 16, at 1; Spencer 2020, *supra* note 14, at 1.
[18] Robert S. Raucher & Karen Raucher, *Economic Arguments for Denying an Aquifer Exemption Request for the Madison Formation*, Prepared in support of: Powder River Basin Resource Council, Wyoming Outdoor Council, and Natural Resources Defense Council, For submittal to: USEPA, Region 8, Water Division (March 15, 2021) (hereinafter "Raucher Report"), at 10-11.
[19] PRBRC 2020, *supra* note 16, at 1; Spencer 2020, *supra* note 14, at 1.
[20] WOGCC AE Submission, *supra* note 4, at 392.
[21] *Id*. at 455; The EPA calculated $265,120,358 for initial construction of the Madison wells and pipeline to the City of Gillette: $190,120,358 appropriated from the Wyoming legislature and $75,000,000 of matching funds from Campbell County. Wyoming Water Development Commission 2023 Legislative Report at 76; City of Gillette, City Council Workshop, 2018 Regional Water Extensions WWDC Grant Funding Agreements (July 24, 2018). https://www.gillettewy.gov/home/showpublisheddocument/39509/636682836480370000 at 8.

- The Marlin 29-21 well is located in exactly the kind of geological structure targeted for well siting studies. It is remarkable that that far into the basin the water quality is as good as it is, which indicates that it is a suitable structure for developing a potential municipal water supply.[22]

Potential Future Use of the Madison Aquifer

- Wyoming state agencies have identified the Madison aquifer as critically important for current and future water supply to communities in the Wind River and Big Horn Basins.[23] The Wyoming Water Development Commission (WWDC) has increasingly prioritized funding of well siting studies that target this aquifer in suitable hydrogeologic areas due to high potential yields, excellent water quality, and reliability as a groundwater source that is less influenced by drought than shallower aquifers.[24] Riverton and Shoshoni rely on water supply wells completed in the Wind River Aquifer which has marginal water quality and quantities in some areas, and because it is relatively shallow with limited recharge potential, it is susceptible to drought and potential for contamination.[25] The Wind River Aquifer is the sole source of potable water for the Town of Pavillion and many landowners and many residents' potable water supplies have been impacted from contamination to the shallow Wind River Aquifer.[26]
- According to the USGS, while supplying water to Gillette, Douglas, and many other communities, the Madison is among the most prolific and reliable aquifers in Wyoming.[27]
- One commenter identifies as a former member of the WY Water Development Commission and states that the Madison has been determined to be a viable source to supply the needs of communities in the Southern Big Horn and Wind River Basins. Where there is demand, groundwater will be tapped, depth notwithstanding. As the state continues to grow, this groundwater source will become even more critically valuable. The uncertainties of surface water availability and quality make continued protection of this source all the more essential.[28]
- Particularly in the west, water that can potentially be used by towns and agriculture is becoming scarcer and the demands for clean water will increase in the future due to climate change.[29]
- The Madison in the Moneta area is part of the wider, highly porous and mobile aquifer. This serves a wide area of the state from north to south. An impact to one area will be seen in another. If we hope to grow and prosper into the future, negative impacts to our finite potable drinking water sources, the Madison in particular, must absolutely be avoided.[30]
- Cites to a 2013 WY Department of Environmental Quality (WDEQ) letter stating, "Clearly, future potential use of the Madison Aquifer in the area of development is within the realm of possibility."[31]
- Aethon's analysis for the communities of Riverton, Shoshoni, Thermopolis, and Casper portraying excesses in current source capacity and ability to have their capacity increased at minimal cost by making enlargements to their SEO groundwater and/or surface water permits is overly optimistic and unrealistic.[32] Riverton, Casper, and Thermopolis are wholly or partially dependent on the use of a water

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[22] *Id*. at 337.
[23] PRBRC 2020, *supra* note 16, at 1.
[24] Spencer 2020, *supra* note 14, at 1.
[25] *Id*. at 2.
[26] *Id*. at 2.
[27] Public Comment Submitted to EPA (Dec. 14, 2022).
[28] WOGCC AE Submission, *supra* note 4, at 516.
[29] *Id*. at 464.
[30] *Id*. at 516.
[31] *Id*. at 455.
[32] Spencer 2020, *supra* note 14, at 2.

treatment plant. The Wind River/Bighorn Basin Groundwater Study noted that because of treatment requirements and recent drought conditions, many municipalities and other public water supply systems are increasingly interested in developing groundwater resources. Under new SDWA regulations, the treatment process is far too expensive for small communities and some towns do not have sufficient water rights to meet their needs for a surface water source supply.[33]

- One commenter stated that based on an injectivity test performed by Aethon's contractor, the aquifer is capable of yielding hundreds of gallons per minute.[34]
- The Madison aquifer's value as a potable water source that can address the needs of municipalities, fish, wildlife, and agriculture in the Wind River and Big Horn Basins will increase in the future.[35]
- Approving the AE could endanger the future of Wyoming growth by sacrificing a potable water source which is so scarce and precious in this state.[36]
- Many WY communities are reliant on shallower aquifers, such as the Wind River aquifer, that have unreliable water quality. A lot of WY towns are actively searching for more reliable groundwater sources.[37]
- Riverton relies on wells completed in the Wind River Aquifer (WRA) for their water supply. The WRA is a relatively shallow aquifer that is comprised of alternating layers of sandstones, siltstones, and shales. The sandstone lenses are the source of groundwater for the aquifer. Water quality in the WRA can be highly variable with high levels of radionuclides and TDS in some areas. Because of localized recharge to the aquifer, the WRA is also susceptible to drought conditions. In some areas, such as the Pavillion area, the WRA has been contaminated by oil and gas activity so there is no other viable water supply source for those residents.[38]
- Many well siting studies in the Big Horn Basin look at structures that can supply distances of 25-40 miles. The economics might push those distant sites toward the bottom of the list, but they're still on the list and might come up later when another community is looking for additional water supply. The fact that they're located further away does not mean they are not a potential source that can be used in the future.[39]

Comments Concerning Injection Impacts

- Aethon estimates injection volumes ranging between 1,000 to 30,000 bbl/d for a period of 50 years with an average daily injection between 4,500 and 9,900 bbl/d. At these rates, the total estimated volume of waste fluids injected into the Madison Aquifer ranges from 15.3 million gallons to 459.9 million gallons of fluids with a TDS of 8,000 mg/L going into the Madison.[40]
- The information presented is regional and is at an inappropriate scale for assessing the sustainable yield of the Madison Aquifer and for evaluating the fate and transport of the contaminant plume that will result from injection of billions of gallons of produced water and other waste fluids.[41]

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[33] *Id*.
[34] *Id*.
[35] WOGCC AE Submission, *supra* note 4, at 518.
[36] *Id*. at 409.
[37] *Id*. at 337.
[38] Raucher Report, *supra* note 18, at 9.
[39] WOGCC AE Submission, *supra* note 4, at 337.
[40] PRBRC 2020, *supra* note 16.
[41] Spencer 2020, *supra* note 14, at 5; PRBRC 2020, *supra* note 16, at 3.

- Aethon is requesting an AE for a 3-mile radius even though the recent modeling suggests the radius of migration could be up to 6.8 miles.[42]
- Personal experience on our ranch. Realize the depth is significantly different from the shallow wells, but the potential harms of injecting pollutants into this aquifer are too great.[43]
- Likely that oilfield waste pumped into the Madison would migrate upgradient, potentially affecting fresh water sources closer to the surface.[44]
- Concerns about leaks, well integrity closer to the surface. Pumping through injection wells would be at high pressure through upper layers. It would be impossible to reclaim higher levels of the aquifer if pipes leak or break.[45]
- The amended application does not provide an adequate characterization of the hydrogeologic setting and the groundwater flow systems to the portion of the Madison Aquifer that is intercepted by the Marlin 29-21 WDW. It is apparent from the data that there is an active flow system in the Madison Aquifer in the vicinity of the well.[46]
- The karstified surface may result in significant porosity and permeability in parts of the upper Madison Aquifer and should not be considered as a low porosity and permeability layer.[47]
- Cumulative Impacts: the AE decision should not be made in isolation. Aethon proposes to develop the Moneta Divide gas field including up to 4,100 wells and cumulative disposal of trillions of gallons of waste fluid. Marlin 29-21 WDW is a small fraction of the total potential disposal needs for the field. Will more Madison disposal wells and AEs be necessary?[48]
- The decision by state and federal agencies comes down to whether to allow an oil company to pollute a valuable asset critical to our very existence for their profit or whether agencies protect the health and future of Wyoming citizens.[49]

Comments Concerning Technological and Economic Considerations

- WY DEQ letter to WOGCC in 2013 noted the cost to develop and transmit Madison aquifer water to Gillette was approximately $200 million and the cost to develop and transmit water supplies from the Madison in the vicinity of the Marlin 29-21 well was estimated to be approximately $169 million[50] and WY DEQ letter also stated it reasonably concluded it is technologically and economically practical to develop the Madison as a source of drinking water.[51]
- Technological advancements in drilling, high-efficiency pumps, energy-recovery devices and cheaper, more effective treatment membranes and water delivery systems have improved the performance and cost of developing and delivering deep groundwater resources.[52]
- With concerns about drought and climate change as well as technical advances in drilling and high efficiency pumps, it is not unreasonable to assume that we would be able to utilize the water in the future.[53]

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[42] Spencer 2020, *supra* note 14, at 4.
[43] WOGCC AE Submission, *supra* note 4, at 521.
[44] *Id*. at 447.
[45] *Id*. at 419.
[46] Spencer 2020, *supra* note 14, at 5; PRBRC 2020, *supra* note 16, at 3.
[47] Spencer 2020, *supra* note 14, at 5.
[48] Spencer 2020, *supra* note 14, at 6; PRBRC 20202 *supra* note 16, at 3.
[49] Public Comment Submitted to EPA (Dec. 14, 2022).
[50] WOGCC AE Submission, *supra* note 4, at 334, 335.
[51] *Id*. at 335.
[52] PRBRC 2020, *supra* note 16, at 3. Spencer 2020, *supra* note 14, at 4.
[53] WOGCC AE Submission, *supra* note 4, at 337.

- Using the raw data provided by Tetra Tech (Percy, 2020), the cost of using the aquifer as a potential source of drinking water for a municipal or regional Public Water System is shown to be very economical (e.g., costing an estimated $134 per household per year, or less for the two examples evaluated).[54]
- There are numerous examples of drinking water sources (including recycled wastewater effluent and desalination of high TDS groundwater or seawater) that were initially considered too expensive and technologically impractical, but that are now tapped in many locations across the country.[55]
- In addition to being economically practical, it is also technologically feasible and practical to tap the deep waters of the Madison Formation using available well drilling technologies.[56]
- The economic analysis presented by Aethon is flawed in numerous ways including omission of potential future use, increasing future value of high-quality water, and future economic practicality of the utilizing the aquifer for drinking water, limited geographic scope, inappropriate cost comparisons.[57]

Comments Concerning Climate and Climate Change

- With climate change and drought in the western U.S., it is reasonable to assume there will be a strong demand for this water by towns, cities, and agriculture in the region.[58]
- Drought, climate change place increased stress on water in western states.[59]
- In WY, and throughout the West, we are experiencing increasingly intense and frequent drought, longer fire seasons, warming surface temperatures, algal blooms, population growth, increased tourism for outdoor recreation, and tensions over water rights and compact compliance.[60]
- According to the drought.gov website, every state from the Great Plains to the West Coast, including WY, has some drought. The Madison aquifer is a clean, viable source of future drinking water. Unpolluted, it could become an extremely valuable source of drinking water. Once polluted, it can never be returned to its pristine condition.[61]
- With climate change and drought becoming increasingly common in the western U.S., it is reasonable to assume that there will be a strong future demand for this water by towns, cities, and agriculture.[62]
- Climate change is placing significant risks on Wyoming's and the broader region's water supply, water quality, and water infrastructure. Access to the Madison Formation is becoming increasingly likely and valuable as a potential future source of high-quality and climate-independent water to meet drinking and other water supply needs.[63]

Comments Concerning Indigenous Peoples and Tribal Governments (note: comments directly from Tribal governments are included in Section 5.2.2):

- The maps presented at the hearing don't include the Wind River Indian Reservation, Dubois, and other small communities besides Riverton. The Reservation is experiencing food insecurity and a third of the wells on the Reservation are polluted by uranium tailings.[64]

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[54] Raucher Report, *supra* note 18, at 2, 4-11.
[55] *Id*.
[56] *Id*.
[57] *Id*. at 4-7.
[58] Spencer 2020, *supra* note 14, at 4.
[59] WOGCC AE Submission, *supra* note 4, at 524.
[60] *Id*. at 518, 519.
[61] *Id*. at 423.
[62] Public Comment Submitted to EPA (Dec. 14, 2022).
[63] Raucher Report, *supra* note 18, at 2.
[64] WOGCC AE Submission, *supra* note 4, at 335.

- The Ethete area water system operated by Northern Arapaho Utilities relies solely upon highly variable (in both quantity and quality) surface water diverted from the Little Wind River. Low flows due to irrigation demands in the summer and natural low flows in the winter often leave Arapaho Utilities unable to divert enough water to meet domestic water needs.[65]

4.0 Climate Conditions and Climate Change

The earth's climate is changing. Understanding and addressing climate change is critical to the EPA's mission of protecting human health and the environment. The EPA's FY 2022-2026 Strategic Plan sets forth an Agency-wide goal of "Tackling the Climate Crisis." One important aspect of achieving that goal includes the EPA's commitment to take necessary actions to anticipate, prepare for, adapt to, and recover from, the impacts of climate change while advancing the climate resilience of Tribes and Indigenous Peoples, states, territories, and communities across the nation.[66]

Executive Order 14008, entitled *Tackling the Climate Crisis at Home and Abroad*, sets the stage for the whole-of-government charge to address climate mitigation, adaptation, and resilience.[67] The EO directs each federal agency to develop climate action plans that describe their agency's climate vulnerabilities and the steps they will take to increase both their and the nation's resilience to the impacts of climate change. Released in October 2021, the EPA's Climate Adaptation Action Plan (CAAP) focuses the Agency's work on five cross-agency priority actions that will help ensure that the EPA continues to fulfill its mission of protecting human health and the environment—even as the climate changes and disruptive impacts increase. The EPA's priority actions are to: 1) integrate climate adaptation into EPA programs, policies, rulemaking processes, and enforcement activities; 2) consult and partner with Tribes, states, territories, local governments, environmental justice organizations, community groups, businesses, and other federal agencies to strengthen adaptive capacity and increase the nation's climate resilience, with a particular focus on advancing environmental justice; 3) implement measures to protect the EPA's workforce, facilities, critical infrastructure, supply chains, and procurement processes from

[65] Raucher Report, *supra* note 18, at 9.
[66] EPA Strategic Plan, *supra* note 11, at 18-20.
[67] Executive Order 14008 establishes an executive policy to "move quickly to build resilience, both at home and abroad, against the impacts of climate change that are already manifest and will continue to intensify according to current trajectories" directing federal agencies to address "climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.'' Exec. Order No. 14008, 86 Fed. Reg. 7619 (Jan. 27, 2021) [hereinafter "EO 14008"]. EO 14008 further declares a policy to "combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure." *Id.* at 7622. Executive Order 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,* establishes a policy that the Federal Government must be guided by the best science and be protected by processes that ensure the integrity of Federal decision-making by directing federal agencies "to listen to the science; to improve public health and protect our environment; to ensure access to clean air and water; to limit exposure to dangerous chemicals and pesticides; to hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; to reduce greenhouse gas emissions; to bolster resilience to the impacts of climate change; to restore and expand our national treasures and monuments; and to prioritize both environmental justice and the creation of the well-paying union jobs necessary to deliver on these goals." Exec. Order No. 13990, 86 Fed. Reg. 7037 (Jan. 25, 2021) [hereinafter "EO 13990"].

the risks posed by climate change; 4) measure and evaluate performance; and 5) identify and address climate adaptation science needs.[68]

The EPA Office of Water developed a "Climate Adaptation Implementation Plan: Advancing Climate Change Adaptation and Resilience Through the EPA's Water Programs" that recognizes that climate change is one of the most urgent and universal challenges facing U.S. communities and the environment. The EPA recognizes that communities across the nation are already experiencing the real and significant impacts of climate change on the social, economic, and environmental systems upon which we depend. As communities experience changes to historical climatic norms, communities frequently feel the effects of those changes through regular interactions with their water resources, including drought across the West, which bring the consequences of a changing climate into our everyday lives.[69] The Office of Water Climate Adaptation Implementation Plan also acknowledges that the impacts of climate change are not equally distributed across locations, communities, and populations. Those experiencing environmental injustices and vulnerable populations already at a disadvantage for coping with climate-related risks are disproportionally vulnerable to the impacts of climate change. Likewise, climate change has direct and cascading effects on water resources that vary across regions and watersheds, presenting a wide range of risks to natural and human systems. Climate change acts as a threat multiplier, exacerbating existing stressors that impact public health, degrade the quality of our waterways, and destabilize the critical water infrastructure upon which we rely. Adapting to the impacts of climate change is vital to maintaining the future success of EPA water programs, as well as the long-term effectiveness of state, Tribal, and local water management programs nationwide.

This section of the analysis includes information on current climate conditions and projected climate change in the State of Wyoming, the Wind River Basin, and on the Wind River Indian Reservation. The analysis discusses the vulnerability of water resources to climate conditions and projected climate change in the Basin that may, in turn, heighten future needs to access groundwater formations and aquifers.

4.1 Climate Summary for Wyoming

The National Oceanic and Atmospheric Administration (NOAA) prepared State Climate Summaries in response to a growing demand for state-level information after the release of the Third National Climate Assessment (NCA) in 2014. The 2022 version of the State Climate Summaries provides information on observed changes in climate, including both long-term trends and extreme weather events relevant to each state. The summaries include observed and projected climate change information and cover topics directly related to historical climate variations and trends, and future climate model projections of climate conditions during the 21st Century. Each summary includes a description of the historical climate conditions in the state as well as climate conditions associated with potential future pathways of greenhouse gas emissions.[70]

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[68] *Id*. at 7622.

[69] U.S. Env't Prot. Agency, EPA-800-R-22-001, Office of Water 2022-2026 Climate Adaptation Implementation Plan (2022) (hereinafter "OW Climate Adaptation Implementation Plan").

[70] The North Carolina Institute for Climate Studies (NCICS), State Climate Summaries 2022, https://statesummaries.ncics.org/ (last visited Nov. 8, 2023). While the datasets and simulations in these state climate summaries are not, by themselves, new (they have been previously published in various sources), these documents represent a targeted synthesis of historical and plausible future climate conditions for each U.S. state. All of the original summaries underwent an anonymous review, with at least two expert reviews completed per state. Each state's 2022 version was revised and reviewed by both NOAA Technical Support Unit staff and the appropriate NOAA Regional Climate Center, as well as, in most instances, by the relevant State Climatologist.

The NOAA State Climate Summary 2022 for Wyoming includes the following:

- **Temperatures in Wyoming have risen about 2.5°F since the beginning of the 20th century** and nearly every year of this century has been above the long-term average. This warming has been observed in all seasons; since 1995, winter and summer temperatures have averaged 1.9°F and 1.3°F above the historical average, respectively. The highest number of very hot days occurred during the 2000s and early 2010s. While warm nights are rare in Wyoming, the number of these nights has generally been above average since 2000. Another indication of the overall trend of higher average temperatures is the generally below average number of very cold days since 2000.
- **Wyoming's topographic variability causes large regional variations in precipitation across the state**.
- **During the summer months, the state experiences frequent thunderstorms, which can produce hail, lightning, and strong winds**.
- **Wyoming's northern location and associated proximity to the jet stream also make it susceptible to the impacts of winter storm systems, including heavy snows, high winds, and low wind chill temperatures**.
- **Chinook winds—warm and dry downslope winds that occur along the eastern slope of the Rocky Mountains—are a hazard unique to Wyoming and western mountain states**.
- **Wyoming is a major source of water for other states, and changes in precipitation can have broad impacts beyond its boundaries**. Water from the state's rivers flows into four major river basins: the Missouri–Mississippi, Green–Colorado, Snake–Columbia, and Great Salt Lake. Yearly variations in late-season snowpack depths are large; for example, April 1 snow water equivalent (the amount of water contained within the snowpack) at Lewis Lake Divide has ranged from less than 20 inches to more than 50 inches since 1981 (Figure 5 in the WY Climate Summary). Such variations have implications for water availability across the West, as snowmelt from the winter snowpack feeds many rivers and streams.
- **In years with heavy snow cover, heavy rains during the spring thaw can cause rapid melting of the snowpack and lead to severe flooding**.
- **Wyoming, like the rest of the Great Plains, is susceptible to droughts, which are occasionally severe**.
- **Under a higher emissions pathway, historically unprecedented warming is projected during this century**. Even under a lower emissions pathway, annual average temperatures are projected to likely exceed historical record levels by the middle of the century. However, a large range of temperature increases is projected under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records. Increases in heat wave intensity are projected, but the intensity of cold waves is projected to decrease.
- **Winter and spring precipitation is projected to increase**. Projected rising temperatures will raise the snow line—the average lowest elevation at which snow falls. This will increase the likelihood that precipitation will fall as rain rather than snow, reducing water storage in the snowpack, particularly at lower mountain elevations that are now on the margins of reliable snowpack accumulation. Higher spring temperatures will also result in earlier melting of the snowpack, further decreasing water availability during the drier summer months. Heavier spring precipitation, combined with a shift from snow to rain, could increase the potential for flooding.
- **The intensity of future droughts is projected to increase, even if precipitation amounts increase.** Increases in evaporation rates due to rising temperatures may increase the rate of soil moisture loss during dry spells. Thus, future summer droughts, a natural part of Wyoming's climate, are likely to

become more intense. This in turn will increase the risk of wildfires, which are projected to become more frequent and severe.[71]

In 2020, the Wyoming Game and Fish Department prepared a report entitled, "Climate Change and Management of River, Riparian, and Wetland Habitats in Wyoming"[72] that includes the following observations:

- Climate projections vary slightly across the local geographies, but all climate models that were examined for this workshop agree that Wyoming will be significantly hotter by 2040-2069 relative to the baseline period of 1971-2000.
- Warming is projected to occur across all seasons, with annual increases ranging from approximately +3^{o}F to +8^{o}F, depending on the climate model and assumptions about future greenhouse gas emissions. Associated with that warming will be an increase in the number of extremely hot days with heat index > 90^{o}F, a longer growing season, and more growing degree days.
- Precipitation projections are more complicated and therefore less certain. However, a majority of climate models project that annual, winter, and spring precipitation will increase. Some climate models project decreases in summertime precipitation, although model agreement is medium-to-low and varies across the four focal geographies. Future projections for snow water equivalent on April 1st vary across the four geographies, with Yellowtail Wildlife Habitat Management Area and Bear River watersheds likely to see declines, Spence Moriarty Wildlife Management Area likely to see increases, and greater uncertainty for the Horse Creek watershed.
- Evapotranspiration is likely to increase at all locations in the spring and summer with the exception of the Horse Creek watershed which may see declines in evapotranspiration in summer.
- Soil moisture is notably difficult to predict using climate models, but the models considered tend to suggest that soil moisture will increase in the spring and decrease in summer and fall. Other climate changes of note include high confidence that there will be increases in the intensity of precipitation events, springtime flooding, and future drought events; in addition to a rise in the elevation of mountain snowlines.

4.2 Climate Conditions in the Wind River Basin

The EPA conducted an assessment of climate conditions in the Wind River Climate Division, which corresponds with the Wind River Basin, as a relevant consideration in determining the potential that the groundwater in the portion of the aquifer requested for exemption may be accessed in the future as a source for drinking water. The Wind River Basin includes portions of Fremont County, Hot Springs County and Natrona County. The EPA conducted a screening process that examines aridity by using the ratio of evapotranspiration to precipitation and by using the Standardized Precipitation Evapotranspiration Index (SPEI) which indicates the presence or absence of drought conditions. The evapotranspiration to precipitation information discussed below provides an estimate of climate conditions in the Wind River Climate Division through 2000. The EPA reviewed SPEI values through 2022. Reviewing SPEI values over time indicates whether there is a trend toward increasing drought conditions that would potentially affect water resources in the area. Climate conditions on the Wind River Indian Reservation within the Wind River Basin information are also summarized below.

One approach for evaluating aridity is to estimate actual evapotranspiration (ET) indirectly by using a water-balance approach and computing an aridity index as a ratio of evapotranspiration to precipitation, ET/P. Sanford

[71] NOAA National Centers for Environmental Information, State Climate Summaries 2022, *Wyoming*, https://statesummaries.ncics.org/chapter/wy/ (last visited Nov. 8, 2023).
[72] Molly Cross et al., *Climate Change & Management of River, Riparian, and Wetland Habitats in Wyoming* (2020), https://nccasc.colorado.edu/sites/default/files/2021-02/2020WCS%20WGFD%20Report_FINAL_0.pdf.

and Selnick, 2012[73] used this approach to estimate ET and compute the ratio ET/P at the county level for the conterminous United States. With this method, precipitation and stream discharge are measured, and ET is computed as the difference between the two. This method is advantageous when the goal is to obtain long-term average ET because when the period of record examined is long enough, short term changes in storage for the water balance can be treated as negligible.

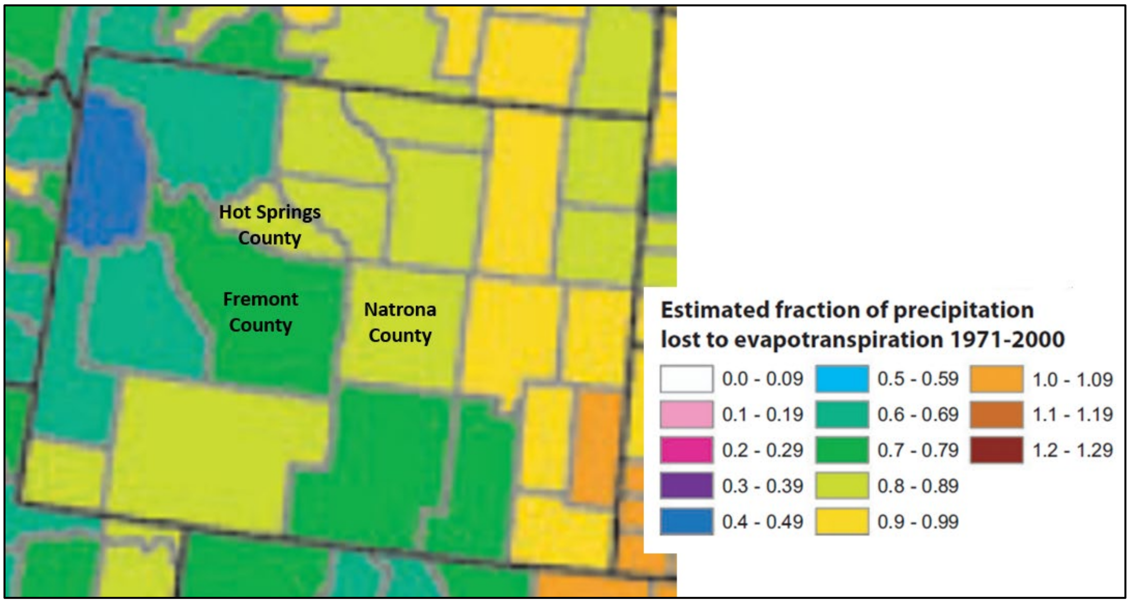

Figure 3. Indication of Aridity by County from Figure 13, Sandford and Selnick, 2012

Figure 3 is an excerpt showing the State of Wyoming from the map in Figure 13 from Sanford and Selnick (2012). Because the Wind River Climate Division and Basin include Fremont and Natrona Counties and the Moneta Divide Project Area lies in both counties, the EPA examined both Fremont and Natrona Counties. In Fremont County the ratio of evapotranspiration to precipitation is between 0.7 to 0.79, which means 70 to 79% of precipitation received in the area is lost to evapotranspiration. In Hot Springs and Natrona Counties the ratio of evapotranspiration to precipitation is between 0.8 to 0.89, which means 80 to 89% of precipitation received in the area is lost to evapotranspiration.

[73] Ward E. Sanford & David L. Selnick*, Estimation of Evapotranspiration Across the Conterminous United States Using a Regression with Climate and Land-Cover Data*, 49 J. AM. WATER RES. ASS'N (JAWRA) 217 (2012).

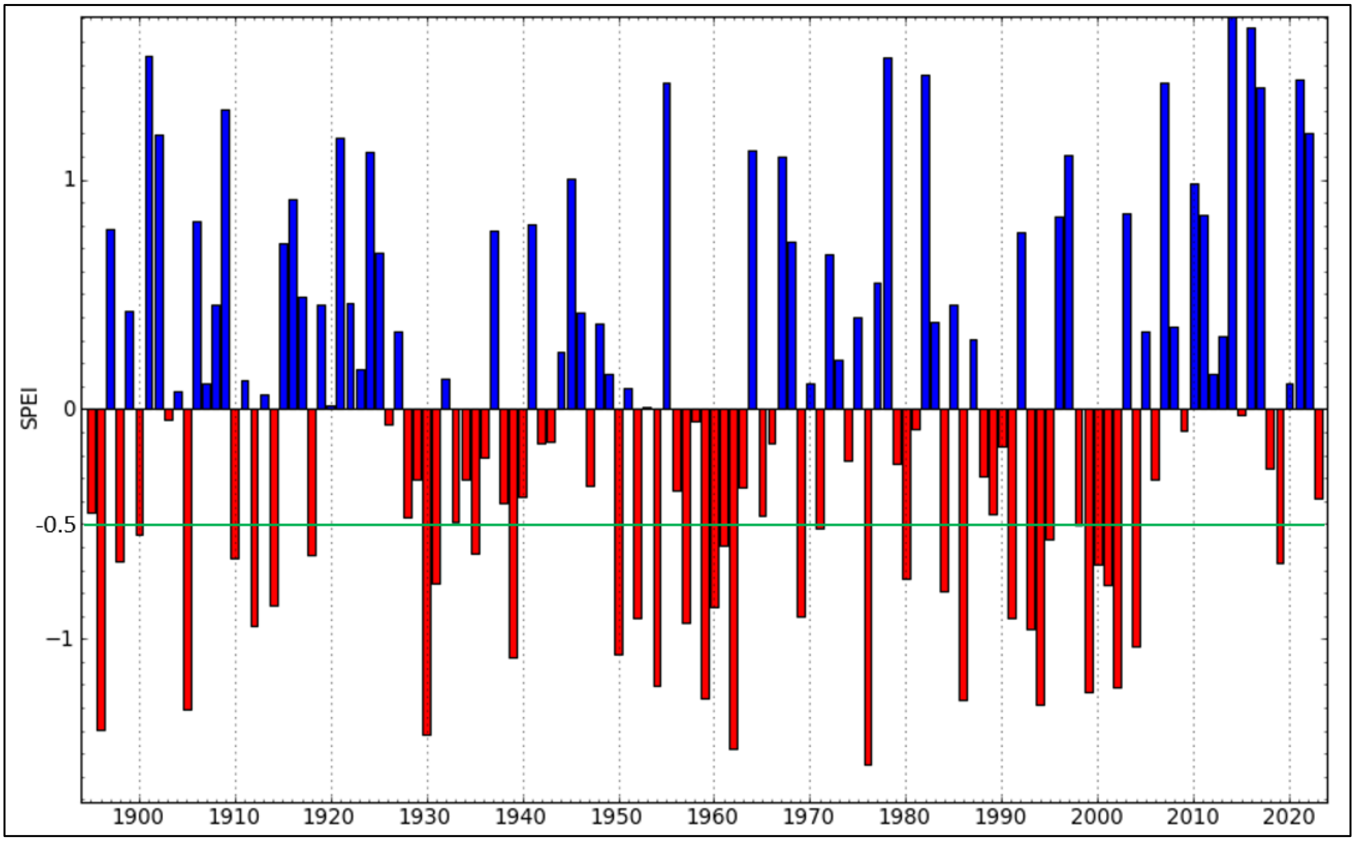

Figure 4. Graph of one-year SPEI values averaged from monthly SPEI values in the Wind River Climate Division.

Figure 4 is a graph showing the one-year SPEI values in the Wind River Climate Division from 1895 through 2023 averaged from monthly values over each year.[74] The SPEI measures the combination of water supply (precipitation) and atmospheric water demand (evapotranspiration, which is related to temperature) to determine whether a certain area is experiencing extreme drought, extreme moisture, or conditions in between.[75] The SPEI uses the monthly (or weekly) difference between precipitation and potential evapotranspiration (PET), and a probability-distribution function is applied to calculate SPEI at different time scales (Vicente-Serrano and others, 2010).[76]

Computation of PET for input to the SPEI can be performed using different methods, but the simple climatic water-balance method of Thornthwaite (1948)[77] is commonly used because it has the advantage of requiring only monthly mean temperature data, which are readily available. The resulting SPEI is a standardized variable, where a value of zero (0) represents average (50 percent cumulative probability) conditions, and the standard deviation is one (1).

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[74] WestWideDroughtTracker, https://wrcc.dri.edu/wwdt/time/. Time Series parameters: Start Year: 1895; End Year: 2023; Ending Month: December; Span: 1-month; Running Average (Years): 1. Graph created 1/25/2024.
[75] U.S. Env't Prot. Agency, *Climate Change Indicators: Drought*, https://www.epa.gov/climate-indicators/climate-change-indicators-drought (last updated Nov. 1, 2023) (hereinafter "Climate Change Indicators: Drought").
[76] Sergio M. Vicente-Serrano et al., *A Multiscalar Drought Index Sensitive to Global Warming: The Standardized Precipitation Evapotranspiration Index*, 23 J. CLIMATE 1696 (2010).
[77] C. W. Thornthwaite, *An Approach toward a Rational Classification of Climate,* 38 GEOGR. REV. 55 (1948).

Drought conditions can be classified according to SPEI values as follows (Wang and others, 2014):[78]

Drought class	SPEI value
Non-drought	SPEI ≥ –0.5
Mild	–1 < SPEI < –0.5
Moderate	–1.5 < SPEI ≤ –1
Severe	–2 < SPEI ≤ –1.5
Extreme	SPEI ≤ –2

Figure 4 shows number of years where the SPEI value is below -0.5 value indicating the Wind River Climate Division experienced some level of drought.

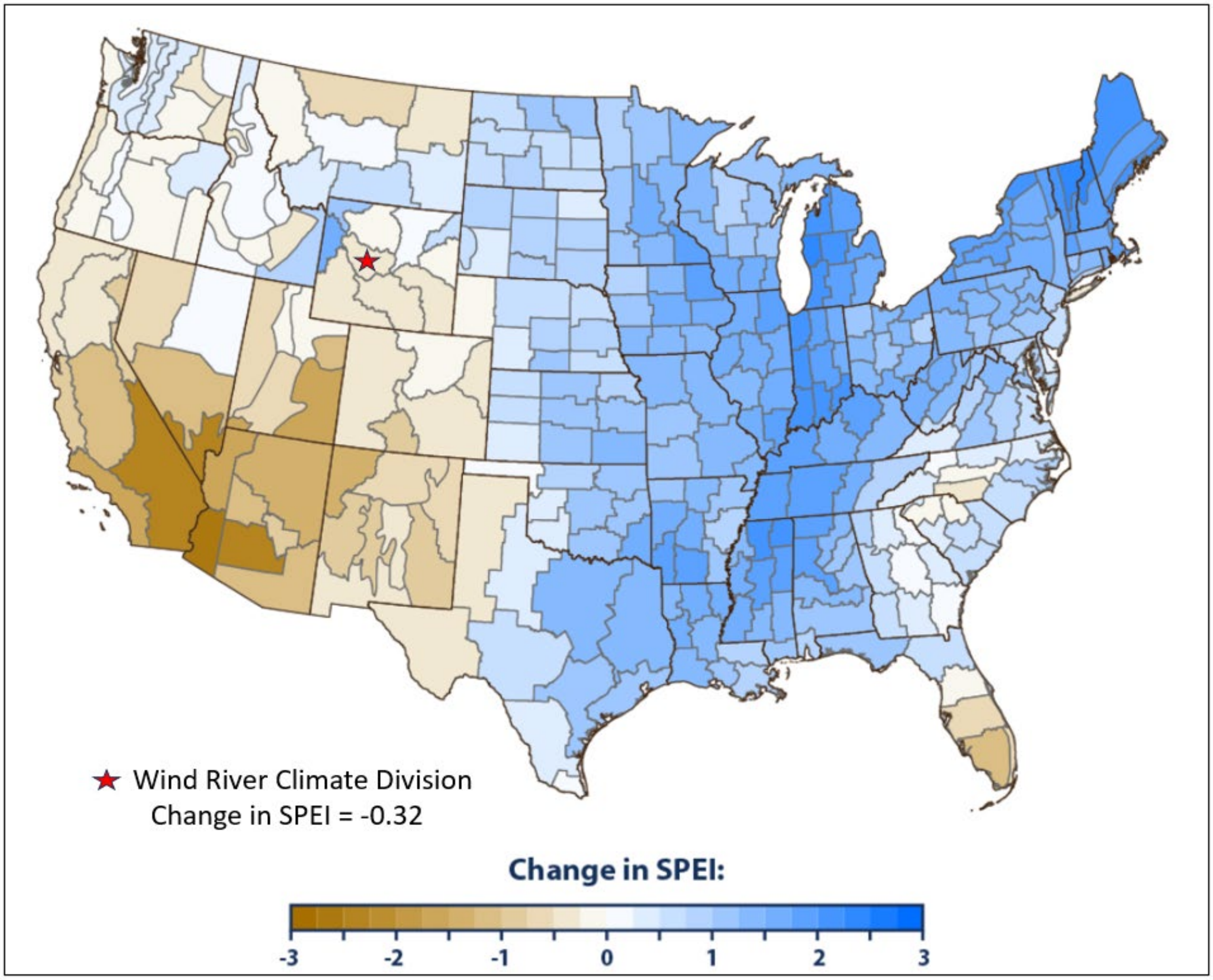

Figure 5. Average Change in Drought (Five-Year SPEI) in the Contiguous 48 States, 1900–2020 (from Figure 3 of the EPA's Climate Change Indicator webpage for Drought).

Figure 5 is the map from Figure 3 of the EPA's Climate Change Indicator webpage for Drought[79] showing how drought conditions have changed across the contiguous 48 states from 1900 to 2020. The map presents the average change in drought based on a five-year leading average of yearly SPEI values. The data are shown for

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[78] Lixin Wang et al., *Global Synthesis of Vegetation Control on Evapotranspiration Partitioning*, 41 GEOPHYSICAL RSCH. LETTERS 6753 (2014).

[79] *Climate Change Indicators: Drought*, *supra* note 75.

each climate division, as defined by the National Oceanic and Atmospheric Administration.[80] Blue areas on the map represent increased moisture, whereas brown areas represent a decrease in moisture or trend toward drier conditions. Figure 5 shows the location of the Wind River Climate Division and the change of SPEI value of -0.32, indicating a trend toward increasing drought. Additional information about the SPEI map and source data is available on the EPA's Climate Change Indicator webpage for Drought.[81]

The Wind River Indian Reservation is located in Fremont and Hot Springs Counties. Because the EPA is aware that the WRIR has experienced increasing drought conditions since the turn of the 21st century as discussed, and in response to concerns raised by the Eastern Shoshone and Northern Arapaho Tribal governments, the EPA conducted the analysis below relevant to an assessment of climate conditions, climate change projections, and the potential need for additional future sources of water supply on the Reservation.

The WRIR has experienced increasingly frequent water shortages since the turn of the 21st century.[82] Although drought is part of natural variability in west-central Wyoming, the Reservation has experienced several severe and long-lasting drought events in the last two decades—most notably during the early 2000s and from 2012–2013. According to the U.S. Drought Monitor,[83] during the 2015 water year, the period spanning October 1, 2014 through September 30, 2015, Fremont County experienced wetter-than-normal conditions. Given these conditions, water availability should not have been an issue in 2015, yet the Reservation experienced water shortages in the Little Wind River Basin. Due to the extreme 2012–2013 drought, reduced spring runoff led to a water management crisis resulting in significant water shortages and devastating impacts to social and ecological systems across the Reservation. Water shortages drastically reduced the summer irrigation season, forcing several local cattle producers to liquidate their herds and causing productive agricultural fields to die.[84] Studies of the 2015 drought on the Reservation concluded that the drought developed as a result of the unique social and environmental conditions of local systems wherein water availability on the Reservation was subject to hydroclimate, infrastructure (storage and delivery systems), legal availability (water rights), and management decisions related to competing water uses and allocation within the Wind River Basin.[85] Because of the devastating impacts to ranching and farming from drought on the WRIR, the Tribes sought assistance to develop strategies for coping with drought. In 2014, the High Plains Regional Climate Center, along with several partners, began working with the Eastern Shoshone and Northern Arapaho Tribes to assist with the development of a Reservation-specific drought adaptation plan. The group developed a Decision Dashboard that allows for real-time monitoring of climate and drought conditions intended to enable the Tribes to make better-informed water management decisions on the Reservation.[86]

In 2018, the North Central Climate Adaptation Science Center, in coordination with the Northern Arapaho and Eastern Shoshone Tribes' Office of the Tribal Water Engineer and Water Resources Control Board, described a project focused on, "The Wind River Indian Reservation's Vulnerability to the Impacts of Drought and the

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[80] *CONUS Climate Divisions*, NOAA: NAT'L CTR. FOR ENV'T INFO., https://www.ncei.noaa.gov/access/monitoring/reference-maps/conus-climate-divisions (last visited Nov. 15, 2023).
[81] *Climate Change Indicators: Drought*, *supra* note 75.
[82] Shannon M. McNeeley et al., *Anatomy of an Interrupted Irrigation Season: Micro-drought at the Wind River Indian Reservation*, 19 CLIMATE RISK MGMT. 61 (2018) (hereinafter "McNeeley et al. 2018").
[83] *Time Series for Fremont County, WY*, U.S. DROUGHT MONITOR, https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx (last visited Feb. 19, 2024).
[84] McNeeley et al. 2018, *supra* note 82.
[85] Crystal J. Stiles et al., *Building Adaptive Capacity in Tribal Communities of the Missouri River Basin to Manage Drought and Climate Extremes: A Case Study From the Wind River Indian Reservation*, 8 J. INDIGENOUS RSCH. 1 (2020); McNeeley et al. 2018, *supra* note 82.
[86] *Wind River Decision Dashboard*, HIGH PLAINS REG'L CLIMATE CTR., https://hprcc.unl.edu/tribal-dashboards/windriver.php (last visited Nov. 9, 2023).

Development of Decision Tools to Support Drought Preparedness."[87] According to a U.S. Geological Survey summary of the work entitled, "Preparing for Drought on the Wind River Indian Reservation," in this semi-arid landscape, the glacier and snowpack-fed tributaries of the Wind River are the main source of water. Yet the region has recently experienced frequent, severe droughts that have threatened ranching and farming; subsistence harvesting, hunting, fishing, and other livelihoods."[88]

Chapter 8 of the Fourth National Climate Assessment,[89] Volume I, Climate Science Special Report is entitled *Droughts, Floods, and Wildfire*. Section 8.1.2 *Recent Major U.S. Droughts*, describes the Great Plains/Midwest drought of 2012 as "the most severe summer meteorological drought in the observational record for that region." One study attributes the 2012 drought to a sequence of three separate patterns of large-scale meteorology that occurred in the area from May through August 2012 preventing the normal frequency of summer thunderstorms. This weather pattern was not predicted by the NOAA seasonal forecasts for that year. One interpretation of this weather pattern classifies it as a "heat wave flash drought," a type of rapidly evolving drought resulting from the relationship between lower soil moisture and higher surface air temperatures during periods of low precipitation. [90]

Observed trends in temperature and precipitation are presented in Chapter 2 of the Fifth National Climate Assessment (NCA5), which is the U.S. Government's preeminent report on climate change impacts, risks, and responses. NCA5 is a congressionally mandated interagency effort that provides the scientific foundation to support informed decision-making across the United States.[91] Chapter 2 discusses climate trends observed in the U.S. and notes that temperature increase in the U.S. is occurring more rapidly than the global average. While there are seasonal and regional variations in temperature trends across the U.S. and its territories, Figure 2.4 of Chapter 2 shows that generally the western U.S. is warming more quickly than the east and winter temperatures are warming nearly twice as fast as summer in many northern states, including in Wyoming. [92]

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[87] *North Central Climate Adaptation Science Center*, W. WATER ASSESSMENT, https://wwa.colorado.edu/network/nc-casc (last visited Nov. 15, 2023).

[88] Climate Adaptation Science Centers, *Preparing for Drought on the Wind River Indian Reservation*, USGS, https://www.usgs.gov/programs/climate-adaptation-science-centers/preparing-drought-wind-river-indian-reservation (last visited Nov. 15, 2023).

[89] The White House Office of Science and Technology Policy stated in the 2023 document *Selecting Climate Information to Use in Climate Risk and Impact Assessments: Guide for Federal Agency Climate Adaptation Planners*, (March 2023) at 5, https://www.whitehouse.gov/wp-content/uploads/2023/03/Guide-on-Selecting-Climate-Information-to-Use-in-Climate-Risk-and-Impact-Assessments.pdf. "Thousands of scientists around the world, including hundreds of U.S. scientists, contribute to each cycle of Intergovernmental Panel on Climate Change (IPCC) reports, which provide a global view of the latest climate science. The National Climate Assessment (NCA) currently serves as our Nation's authoritative and most comprehensive resource on climate change."

[90] Michael F. Wehner et al., Chapter 8, *Droughts, Floods, and Wildfire*, *in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME I 231 (Donald J. Wuebbles et al. eds. 2017), https://science2017.globalchange.gov/chapter/8/.

[91] *The Fifth National Climate Assessment*, *Overview*. https://nca2023.globalchange.gov/.

[92] Kate Marvel et al., Chapter 2, *Climate Trends*, *in* FIFTH NATIONAL CLIMATE ASSESSMENT (Allison R. Crimmins et al. eds. 2023), https://nca2023.globalchange.gov/chapter/2/.

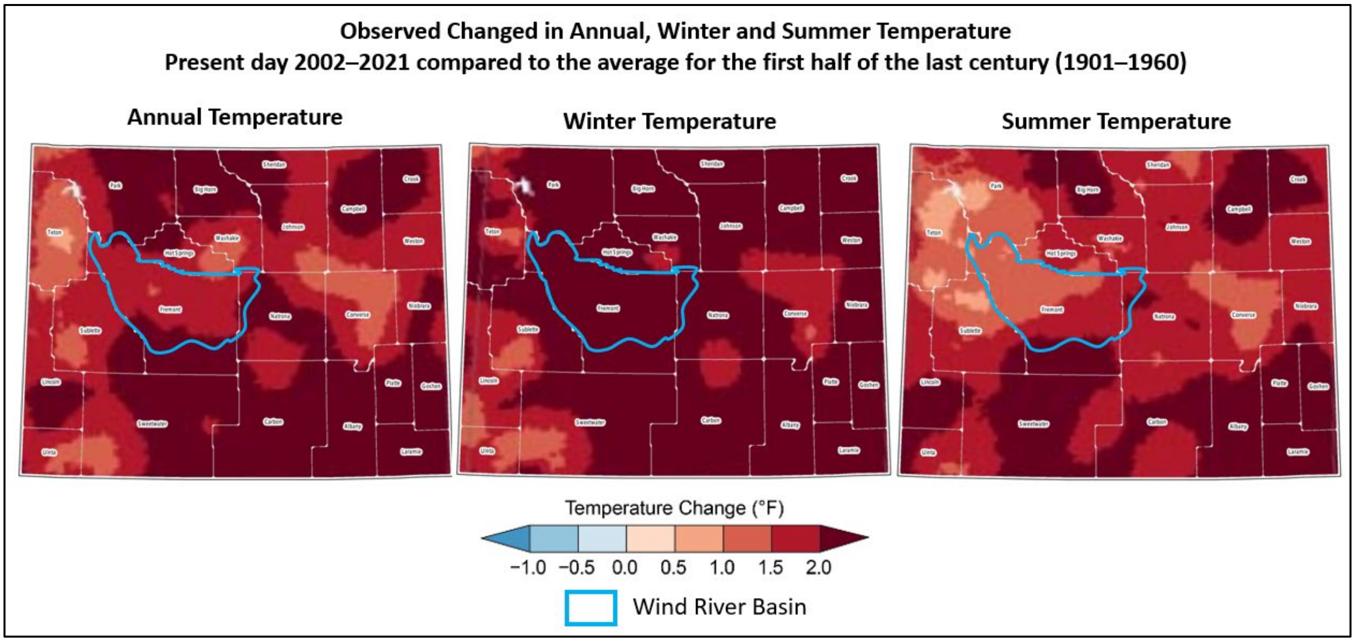

Figure 6. Seasonal temperature change in Wyoming comparing temperatures observed 2002 through 2021 with temperatures observed during 1901 through 1960. From Figure 2.4, Chapter 2, NCA5.

Figure 6 is an excerpt from NCA5 Figure 2.4 showing observed temperature change in Wyoming from the first half of the 20th century (1901-1960) compared with temperatures observed from 2002 through 2021. Winter temperatures have increased by at least 2.0°F throughout the Wind River Basin. Summer temperatures have increased by between 1 and 1.5 degrees in most of the southeastern part of the basin and 0.5 to 1.0 degrees in most of the northwestern portion of the basin. Annual temperatures have increased a minimum of 1.5 degrees over most of the basin.

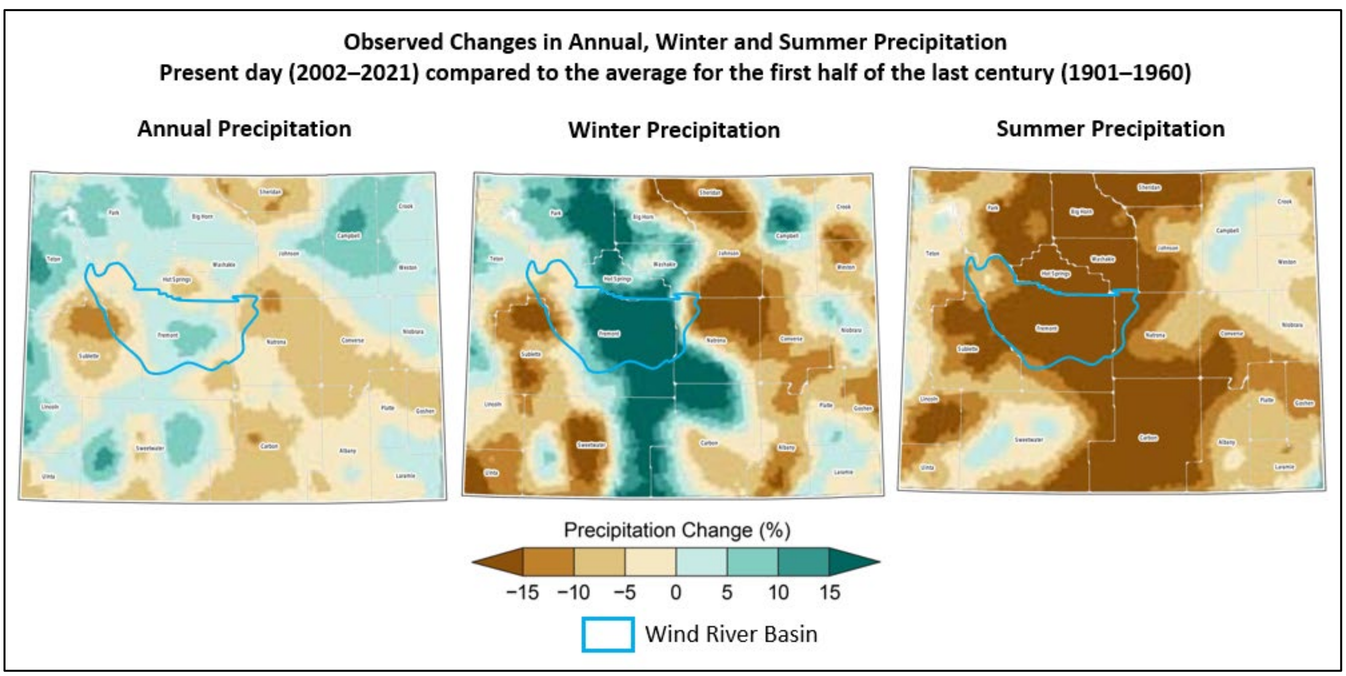

Figure 7. Seasonal precipitation changes in Wyoming comparing precipitation observed 2002 through 2021 with precipitation observed during 1901 through 1960. From Figure 2.4, Chapter 2, NCA5.

Figure 7 is also an excerpt from NCA5 Chapter 2, Figure 2.4 showing observed seasonal precipitation change in Wyoming from the first half of the 20th century (1901-1960) compared with precipitation observed from 2002 through 2021. Although winter precipitation has increased by at least 15% in the central and eastern portions of the Wind River Basin, precipitation has decreased in the western area, where snowpack accumulates in the mountains. Summer precipitation has decreased by at least 15% over most of the basin.

These observed temperature and precipitation trends, the increasing and more severe droughts within the Wind River Basin and the vulnerability of the WRIR to droughts impacts prompted the EPA to examine projected climate change impacts.

4.3 Projected Climate Change in the Wind River Basin

4.3.1 Projected Temperature Increase

NCA5 Chapter 2 also presents information on climate change impacts projections. Projected impacts are discussed in terms of global warming levels (GWLs)[93] which are based on the global average temperature change in degrees Celsius relative to preindustrial temperatures. If the GWL reaches an increase of 2° C by mid-century (2046-2065), the projected number of hot (temperature ≥ 95°F) days will increase and the number of cold (temperature ≤ 32°F) days will decrease in Wyoming as shown in Figure 8. In the Wind River Basin, the map on the left in Figure 8 shows the increase in hot days (≥ 95°F) per year will range from 20 to 25 days in the central portion of the Basin to 0 days in the mountains where maximum average temperatures measured from 1991 to 2020) rarely exceed 70°F.[94] Measures of temperature increases such as the trends indicated in Figure 6, rather than days above 95°F are more useful for understanding potential climate change impacts in high altitude areas with low average temperatures.

[93] NCA5 Chapter 2 references GWLs to mirror the language in the Paris Agreement which calls for limiting global warming to "well below 2°C" relative to preindustrial temperatures. The Paris Agreement is an international climate agreement adopted in 2015 with the central aim to hold global temperature rise in this century well below 2°C above preindustrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

[94] Wyoming Water Resources Data System & State Climate Office, PRISM Normals (1991-2020), Maximum Temperature, http://www.wrds.uwyo.edu/wace/wace.html.

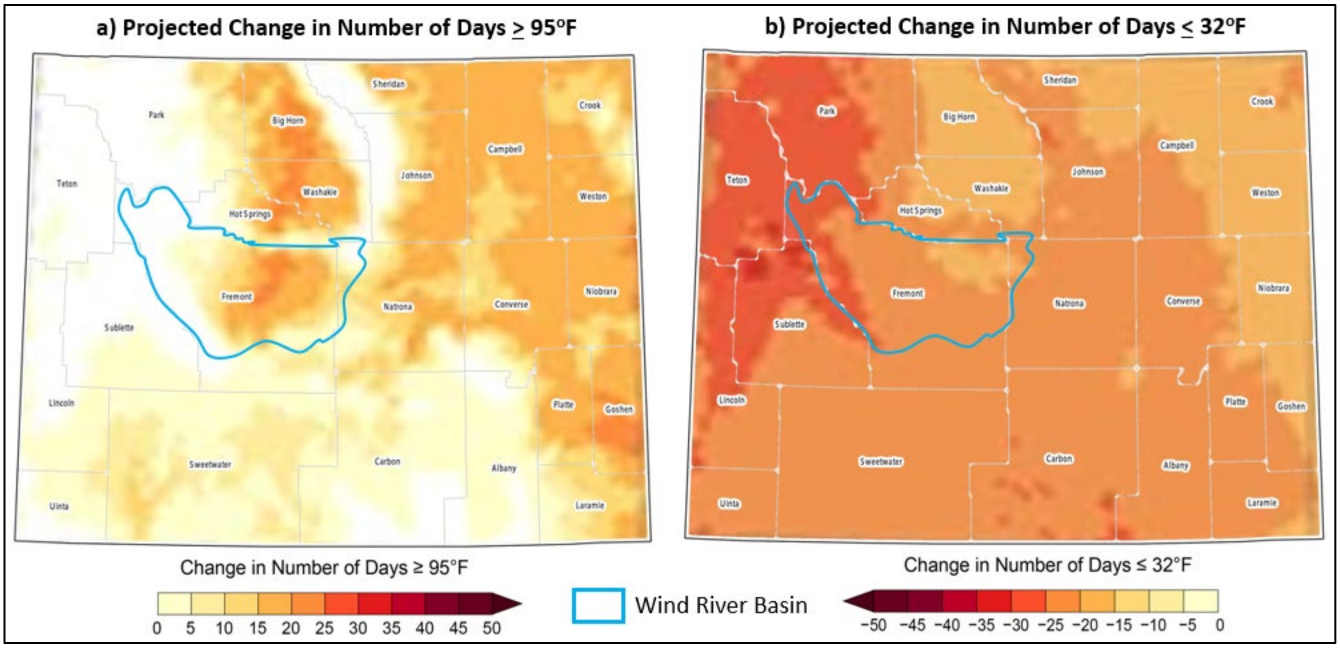

Figure 8. Projected changes are shown for a) the annual number of hot days (days with maximum temperatures greater than or equal to 95°F and b) the annual number of cold days (days with minimum temperature less than or equal to 32° F) at a global warming level of 2.0° C in Wyoming. Changes are relative to the period 1991–2020 (from NCA5, Chapter 2, Figure 2.11).

The map on the right in Figure 8 shows the projected decrease in the number of cold days with minimum temperatures less than or equal to 32°F. In the Wind River Basin, the number of cold days is projected to decrease by 25 to 35 per year in the areas of the basin where the darker orange color appears in the highest elevations of the Wind River Range in the northwest portion of the Basin. Most of the Basin will experience a projected 20 to 25 fewer cold days per year, and the number of colds days in the small area in the northeastern portion of the Basin are projected to decrease by 15 to 20 days.

The area of greatest decrease in cold days in the Wind River Basin coincides with the mountain ranges where the snowpack melting provides the late-summer water supply. As the number of cold days decreases in the high-altitude areas by more than a month by the mid-century, the snowpack duration will be shorter with earlier warming and melting decreasing the late summer water supply, impacting streamflow and water availability in the basin. The EPA's webpage for the Length of Growing Season Climate Change Indicators, *Change in Timing of Last Spring Frost by State, 1895–2020* is shown in webpage figure 5.[95] The interactive map shows that the occurrence of last spring frost has shifted 21 days earlier in the season in Wyoming from 1895 to 2020.[96]

4.3.2 Climate Change Projection Modeling Scenarios

The NCA5 presents global climate projections developed for a range of future scenarios. These projections capture variables such as the relationship between human behavior, greenhouse gas (GHG) emissions, the Earth system processes and responses to changes in concentration of GHGs in our atmosphere and oceans, and

[95] U.S. ENV'T PROT. AGENCY, *Climate Change Indicators: Length of Growing Season*, https://www.epa.gov/climate-indicators/climate-change-indicators-length-growing-season (last visited Nov. 9, 2023) (hereinafter "Climate Change Indicators: Length of Growing Season").
[96]ArcGIS, *Length of Growing Season – Last Spring Frost*, https://www.arcgis.com/home/webmap/viewer.html?webmap=02dd470cd69e4b9e84753515d728be47&extent=-121.4202,30.8369,-69.5648,50.9105 (last visited Nov. 15, 2023).

resulting impacts, including temperature change and sea level rise. Because there are uncertainties inherent in these factors, the resulting range of projections are not predictions but instead reflect multiple potential pathways of climate change impacts. The scenarios do not have relative likelihoods assigned and are all plausible futures.

Table 3. Descriptive Terms for Common Climate Scenarios Used in NCA5

This table summarizes the terms used to describe scenarios from Phases 5 and 6 of the Coupled Model Intercomparison Project (CMIP5 and CMIP6). This standardized terminology is used throughout the report when discussing scenarios to facilitate easier comparison by readers. Sources: Arias et al. 2021; Gidden et al. 2019; Meinshausen et al. 2020; O'Neil et al. 2017; Riahi et al. 2017; van Vuuren et al. 2011 [5,6,7,8,9,10]

Climate Scenario Descriptor	CMIP5	CMIP6	Summary
Very High Scenario	RCP8.5	SSP5-8.5	Among the scenarios described here, these reflect the highest range of carbon dioxide (CO_2) emissions and no mitigation. Total annual global CO_2 emissions in 2100 are quadruple emissions in 2000 (RCP8.5 and SSP5-8.5). Population growth in 2100 doubles from 2000 in RCP8.5, but the SSP5-8.5 population remains relatively stable, with approximately 13% growth in 2100 from 2005. Both scenarios include fossil fuel development, but SSP5-8.5 has higher economic growth than RCP8.5.
High Scenario	RCP6.0	SSP3-7.0	These scenarios reflect high CO_2 emissions with limited (RCP6.0) or no (SSP3-7.0) mitigation. Total annual CO_2 emissions in 2100 are more than 75% higher than in 2000 in RCP6.0, and triple that of 2000 emissions in SSP3-7.0. Compared to 2000, both scenarios include expanded fossil fuel development and population growth but slow economic growth.
Intermediate Scenario	RCP4.5	SSP2-4.5	These scenarios reflect reductions in CO_2 emissions from current levels. Total annual CO_2 emissions in 2100 are 46% (RCP4.5) and 67% (SSP2-4.5) less than the year 2000. Mitigation efforts include low-carbon technology (SSP2-4.5) and expanded renewable energy compared to 2000 (RCP 4.5).
Low Scenario	RCP2.6	SSP1-2.6	These scenarios reflect rapidly declining and net-negative CO_2 emissions (with CO_2 removal from the atmosphere exceeding human-caused emissions) by 2100. Mitigation efforts include increased renewable energy. Adaptive capacity reflects effective governance institutions, reduced inequality, and international cooperation (SSP1-2.6).
Very Low Scenario	n/a	SSP1-1.9	Among the scenarios described here, SSP1-1.9 reflects the greatest reduction in global greenhouse gas emissions and substantial CO_2 removal from the atmosphere. Total annual CO_2 emissions have a steeper decline than SSP1-2.6, dropping by more than 145% by 2100 compared to 2000. Mitigation efforts include a shift to nuclear and renewable energy and sustainable land use. Adaptive capacity benefits from international cooperation and sharing of technology.

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Figure 9. Table 3 from the NCA5 "Report in Brief."

Figure 9 shows Table 3 from the NCA5 *Report-in-Brief* [97] which presents *Descriptive Terms for Common Climate Scenarios Used in NCA5* and summarizes the terms used to describe scenarios from Phases 5 and 6 of the Coupled Model Intercomparison Project (CMIP5[98] and CMIP6[99]).

4.3.3 Projected Impacts to Aridity, Drought, and Soil Moisture

Chapter 4[100] of NCA5 is entitled *Water*. Figure 4.3 in Chapter 4 shows projected change in annual precipitation by mid-21st century (2036-2065) relative to annual precipitation observed from 1991 to 2020. Projected precipitation is presented for a) the average of 31 modeled precipitation projections for the intermediate (RCP4.5) scenario, b) the average of the wettest 20% of the projections, and c) the average of the driest 20% of the projections. Figure 10 is an excerpt from Figure 4.3 showing projections for Wyoming. In the Wind River Basin, under a) an increase in precipitation of 0 to 0.5 inch is projected over most of the Basin. Larger precipitation increases are projected in areas where the mountains are located. Under b) an increase of 1 to 2 inches is projected over most of the Basin, with larger increases in the mountains. Under c) a decrease of 0 to

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[97] U.S. Glob. Rsch. Program, *Fifth National Climate Assessment: Report-in-Brief* (Allison R. Crimmins et al. eds. 2023), https://doi.org/10.7930/NCA5.2023.RiB.

[98] *CMIP5 – Coupled Model Intercomparison Project Phase 5*, PROGRAM FOR CLIMATE MODEL DIAGNOSIS & INTERCOMPARISON, https://pcmdi.llnl.gov/mips/cmip5/ (last visited Dec. 8, 2023).

[99] *CMIP6 – Coupled Model Intercomparison Project Phase 6*, PROGRAM FOR CLIMATE MODEL DIAGNOSIS & INTERCOMPARISON, https://pcmdi.llnl.gov/CMIP6/ (last visited Dec. 8, 2023).

[100] E. A. Payton et al., *Chapter 4, Water*, *in* FIFTH NATIONAL CLIMATE ASSESSMENT, (A. R. Crimmins et al. eds. 2023), https://nca2023.globalchange.gov/chapter/4/.

0.5 inches is projected of over most the Basin with larger decreases in the northwest corner. Comparing the wettest (b) and driest (c) 20% of projections illustrate the range of uncertainty in annual precipitation projections.

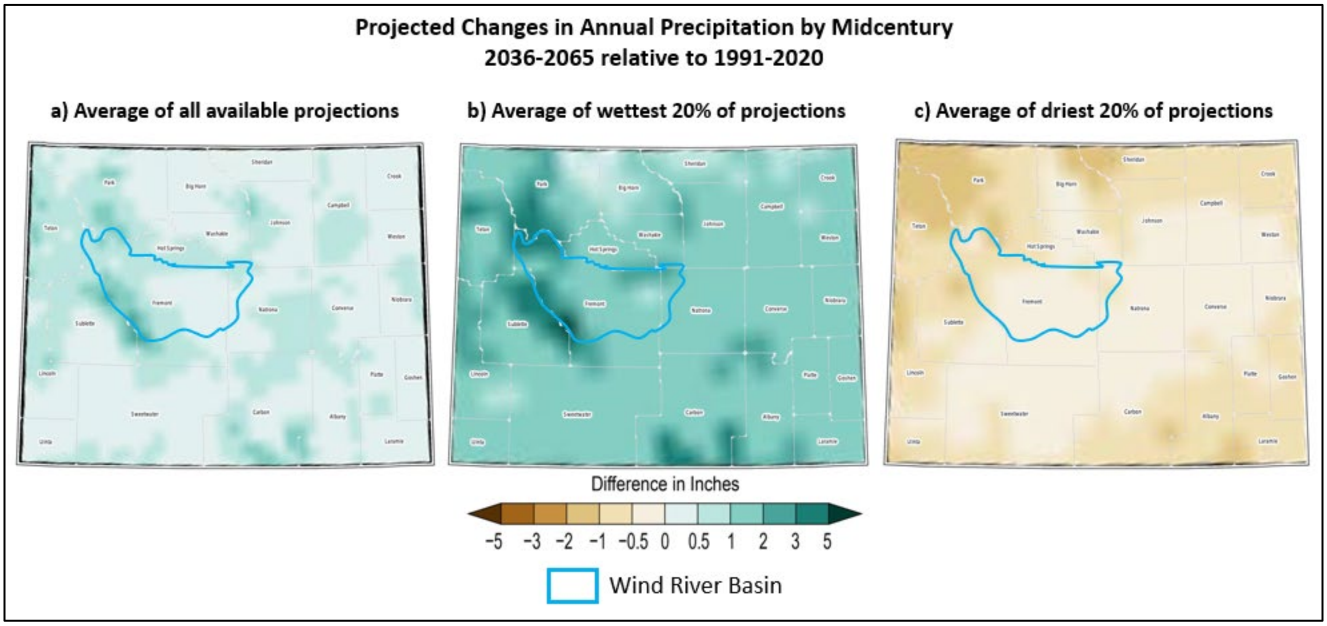

Figure 10. Projected change in seasonal precipitation for the RCP4.5 scenario in Wyoming (excerpted from Chapter 4, Figure 4.3 of the NCA5).

According to the discussions in Chapter 3, Earth System Processes[101] even if precipitation increases in some regions in the future, there remains a concern that evaporation will increase in those same regions with warming, leaving the land surface drier. Model projections and observational analyses for the U.S. suggest that the net effect will be that warming will increase evaporation and surface drying in much of the country.

Evapotranspiration and Soil Moisture

The EPA assessed the potential for increased evaporation and surface drying in the Wind River Basin by reviewing projections for evapotranspiration and soil moisture discussed in NCA5. Evapotranspiration is water that evaporates from soil, snow and surface water or transpires from plants. It is a key component of the water budget and drives irrigation water demands. Actual evapotranspiration is evaporative demand limited by water availability. Increases in temperature and changes in other climate variables alter the evaporation demand (or potential evapotranspiration). In recent decades, evaporative demand has increased in much of the West.[102]

NCA5, Chapter 4, Figure 4.4 shows actual evapotranspiration under an intermediated scenario (RCP 4.5). Higher rates of evapotranspiration can reduce overall water availability even if precipitation does not change or increases; conversely, low water availability can limit actual evapotranspiration.[103]

[101] L.R. Leung, et al., *Chapter 3. Earth systems processes*, *in* FIFTH NATIONAL CLIMATE ASSESSMENT, (A. R. Crimmins et al. eds. 2023), https://nca2023.globalchange.gov/chapter/3/.
[102] Payton et al., s*upra* note 100, at 7*.*
[103] *Id*. at 8.

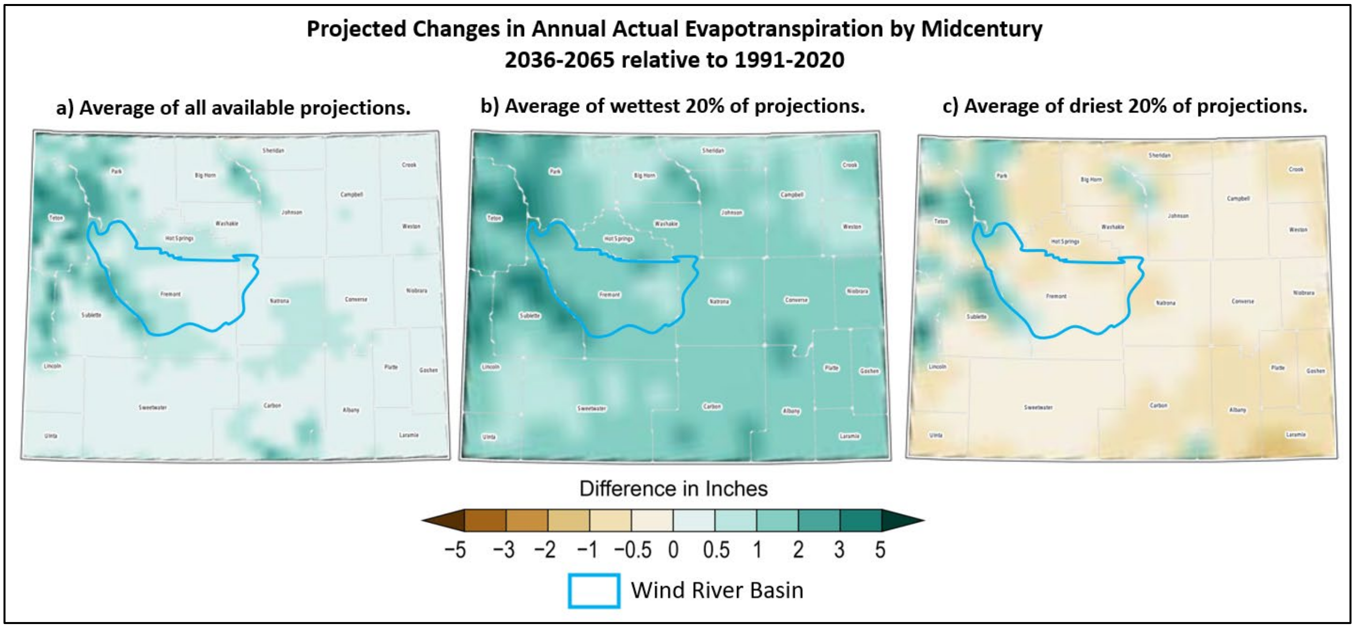

Figure 11. Projected Changes in Annual Actual Evapotranspiration by Midcentury 2036-2065 in Wyoming relative to 1991 – 2020 for the RCP4.5 scenario (excerpted from Chapter 4, Figure 4.4 of the NCA5).

According to NCA5 Chapter 25,[104] which discusses current and project climate change impacts to the Northern Grean Plains, including Wyoming, drought is projected to increase in the region, with localized droughts increasing by 2040 and more widespread regional droughts by 2070, under intermediate (RCP4.5), high (RCP6.0), and very high (RCP8.5) scenarios across wet or dry global climate models. After precipitation, the most significant component of the water budget is evapotranspiration. Projected warming is expected to increase evapotranspiration as shown in Figure 11, which may in turn lead to drier soils later in the growing season (Figure 12). The decrease in evapotranspiration shown in Figure 11c) based on the average of the driest 20% of projections illustrates how low water availability can limit actual evapotranspiration. Summer drought is expected to be more likely than spring drought. Multiple future climate scenarios indicate future increases in moderate, severe, and extreme drought, occurring approximately 10% and 20% more frequently by 2050 and 2100, respectively. Chapter 25 notes that the recent droughts in the upper Missouri River basin between 2000 and 2010 (discussed in Section 4.2.3) were the most severe on record, and flash droughts are a growing concern.

[104] C.N. Knapp, et al., *Chapter 25, Northern Great Plains*, *in* Fifth National Climate Assessment, (A. R. Crimmins et al. eds. 2023), https://nca2023.globalchange.gov/chapter/25/.

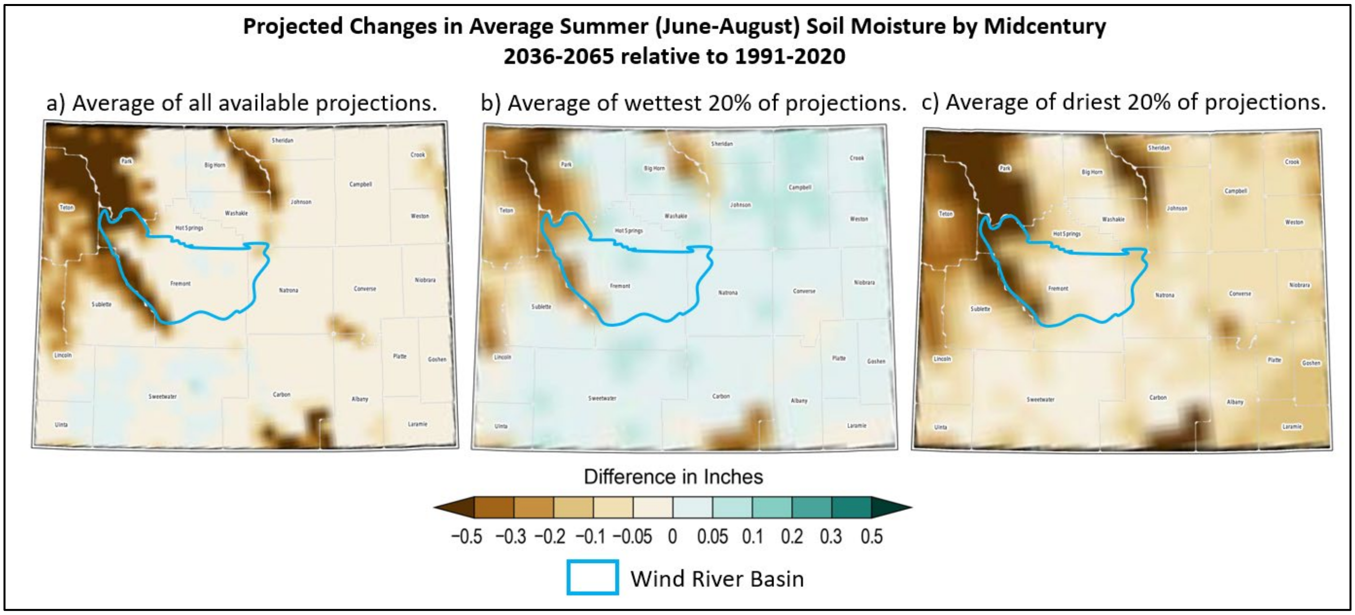

Figure 12. Projected Changes in Average Summer (June-August) Soil Moisture in Wyoming by Midcentury 2036-2065 relative to 1991-2020 for the RCP4.5 scenario (excerpted from Chapter 4, Figure 4.6 of the NCA5).

NCA5 Chapter 25, Figure 25.5 shows evapotranspiration measured from 1991 through 2020 during the June through August months, representing the summer growing season. Figure 25.5 also includes figures showing projected increases in evapotranspiration under both the intermediate RCP4.5 scenario (the same scenario as Figure 12) and the very high scenario (RCP8.5) by mid-21st century (2036-2065) to illustrate how warming is expected to increase evapotranspiration. Potential evaporative demands in the summer months (June, July, and August) increase regionally, especially in western areas under both the moderate climate change and very high climate change scenarios. An increase in potential evapotranspiration typically contributes to a decrease in surface soil moisture.[105]

NCA5 Chapter 4, Figure 4.6 shows projected changes in June through August soil moisture (measured in inches). Surface soil moisture content is projected to decrease across nearly all of the conterminous United States in all seasons, even in regions and seasons where precipitation is projected to increase. This projection is consistent with the increased evapotranspiration occurring with elevated air temperatures. Figure 12 is an excerpt from Chapter 4, Figure 4.6 showing projected changes in the average summer soil moisture in the State of Wyoming for the three average ranges.[106] NCA5 Chapter 25 notes that in the Northern Great Plains, summer drought will be more probable than spring drought, which may lead to drier soils later in the growing season.[107]

<u>Snow-Water Equivalent</u>

NCA5 Chapter 4 describes how warming temperatures result in projected decreases in amount and duration of snowpack. Snow is a natural reservoir, storing cold-weather precipitation and later releasing water through snowmelt. Warming will also cause earlier snowmelt, altered rates of snowmelt and evaporation directly from snow, and longer snow-free periods. Most historical snow-observation records already show trends toward earlier peak snowpack, smaller volumes, and decreasing snow-season duration. In areas of the West where snow is the dominant source of runoff, total seasonal snow water volume is projected to decrease by more than

[105] *Id.* at Figure 25.5.
[106] Payton et al., *supra* note 100.
[107] Knapp, et al., *supra* note 104.

24% by 2050 under the intermediate RCP4.5 scenario. Snow reductions, combined with projected increases to water demand, are expected to stress waters supplies, particularly in the West, where snowmelt supplies a disproportionate amount of water to municipal water supplies and agriculture. Reductions in snow cover are accelerating the retreat of glaciers that are critical for summer streamflow.[108]

According to the discussions in NCA5 Chapter 3, *Earth System Processes,* with warming temperatures, more precipitation will fall as rain instead of snow. Snowpack in many mountainous regions of the U.S. has decreased on average over the last few decades with western U.S. snowpack-driven reservoirs already showing impacts. Projected snowpack decline is expected to be exacerbated by greater increases observed in winter temperatures compared to summer temperatures. Snow albedo feedback is observed when snow cover shrinks and exposes land surface which tends to be much less reflective of solar radiation. Another factor that decreases snowpack is the larger temperature increases occurring at higher altitudes, which increase the frequency of multiyear snow droughts.[109] Decreasing snowpack will alter surface water availability for late season irrigation and may increase pressure on groundwater resources.[110]

Temperature increases allow for a longer growing season which creates an additional demand for late season irrigation. The EPA's webpage for the Length of Growing Season Climate Change Indicators, *Change in Timing of First Fall Frost by State, 1895–2020* is shown in webpage figure 6.[111] The interactive map shows that the occurrence of first fall frost has shifted 13.8 days later into the season in Wyoming, indicating that the growing season and need for irrigation water could extend nearly two weeks.[112]

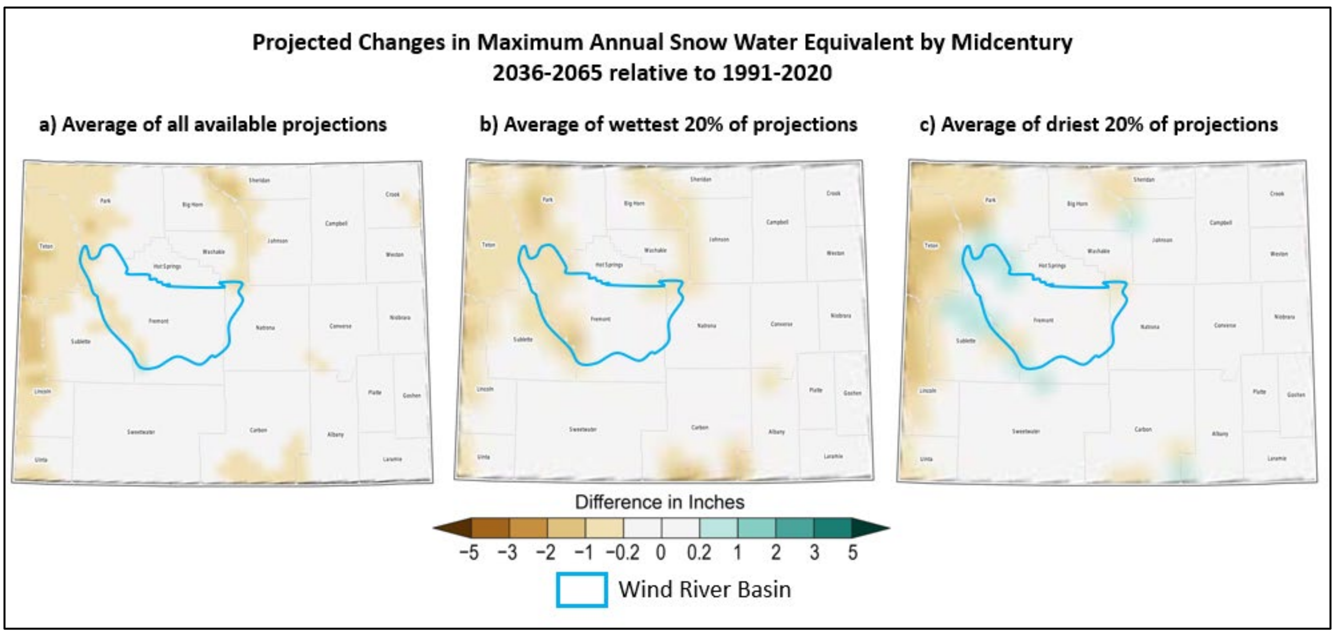

Figure 13. Projected Changes in Maximum Annual Snow Water Equivalent by Midcentury 2036-2065 relative to 1991-2020 for the RCP4.5 scenario (excerpted from Chapter 4, Figure 4.5 of the NCA5).

[108] Payton et al., *supra* note 100.
[109] Leung, et al., *supra* note 101.
[110] Knapp, et al., *supra* note 104.
[111] *Climate Change Indicators: Length of Growing Season*, *supra* note 95.
[112] ArcGIS, *Length of Growing Season – First Fall Frost*, https://www.arcgis.com/home/webmap/viewer.html?webmap=ce7a0379da1943fda56f5f09102b9f67&extent=-123.9099,29.5577,-72.0545,49.9678 (last visited Nov. 15, 2023).

Figure 13 shows the projected changes in the maximum annual snow water equivalent (the amount of water contained within the snowpack) by midcentury in Wyoming. Figure 13a) shows that the average of all available projection simulations under the RCP4.5 scenario indicates a decrease in up to one inch of water within the snowpack in the Wind River Mountains along the southwest border of the Wind River Basin, except for the southern extent of the mountains where there is a projected increase of up to one inch of water within the snowpack. Figure 13b) shows that the average of the wettest 20% of projection simulations under the RCP4.5 scenario indicates a decrease in up to one inch of water within the snowpack over a larger area of in the Wind River Mountains and in the Washakie and Owl Creek Mountains along the northwest boundary of the basin. There is a projected decrease of up to 2 inches in the water within the snowpack of the southern Wind River Range. Figure 13c) shows that the average of the driest 20% of projection simulations under the RCP4.5 scenario indicates an increase in up to one inch of water within the snowpack the northern and southern portions of the Wind River Mountains and in the Washakie and Owl Creek Mountains along the northwest boundary of the basin, with a projected decrease of up to 1 inch in the water within the snowpack in the mid Wind River Range. Information about the model analysis methods and variables included in these model simulations may be accessed in the metadata for NCA5 Chapter 4, Figure 4-5.[113]

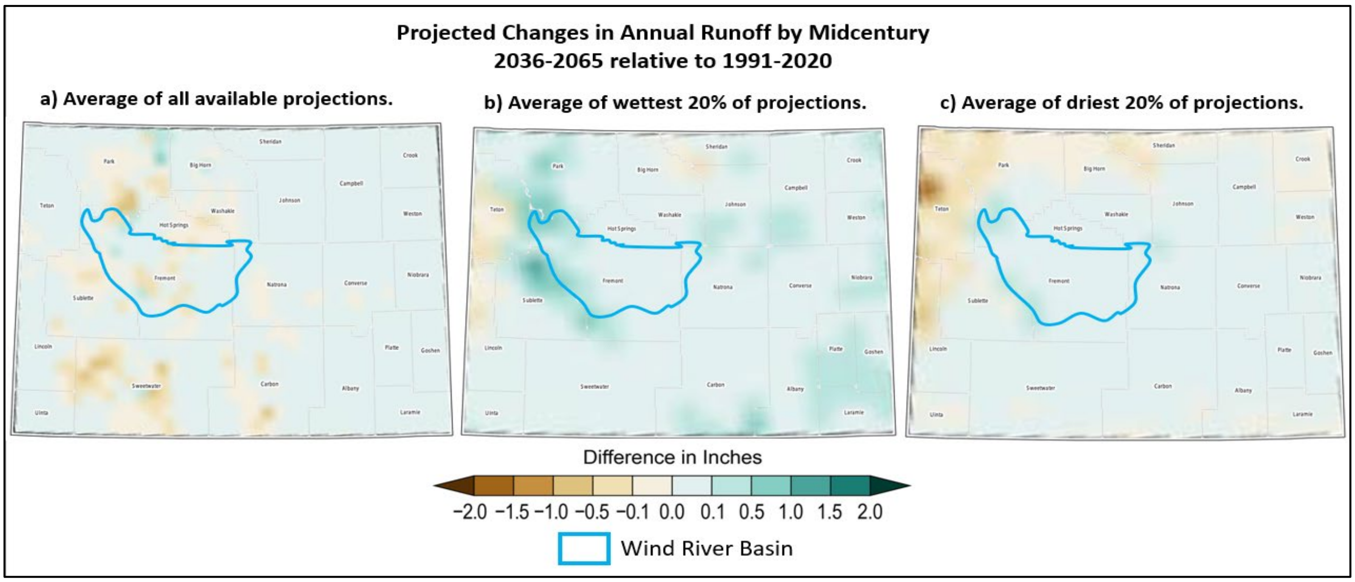

Figure 14. Projected Changes in Annual Runoff by Midcentury 2036-2065 relative to 1991-2020 for the RCP4.5 scenario (excerpted from Chapter 4, Figure 4.7 of the NCA5).

Surface Runoff

Runoff is precipitation that does not soak into the soil but instead moves on the Earth's surface toward streams.[114] Figure 14 shows the projected changes in annual runoff by midcentury (2036-2065) relative to levels observed 1991 through 2020 for the RCP4.5 scenario for the three average ranges. Runoff is affected by the interaction of the water cycle components discussed previously. For example, changes in snowpack amount and timing of snowmelt affect the seasonality of runoff in snowmelt-dominated areas; soil moisture affects the

[113] NCA5 Metadata viewer for Figure 4-5 https://nca2023.globalchange.gov/ml/?figure=%2Freport%2Fnca5%2Fchapter%2Fwater%2Ffigure%2Fnca5-figure-4-5&use_GCIS=1.

[114] National Weather Service, Hydrology Education: The Water Cycle webpage. https://www.weather.gov/lot/hydrology_education_watercycle (last visited 1/17/2024).

amount of precipitation and snowmelt that becomes runoff. In addition to direct precipitation and groundwater, runoff is a primary source of water supply.[115]

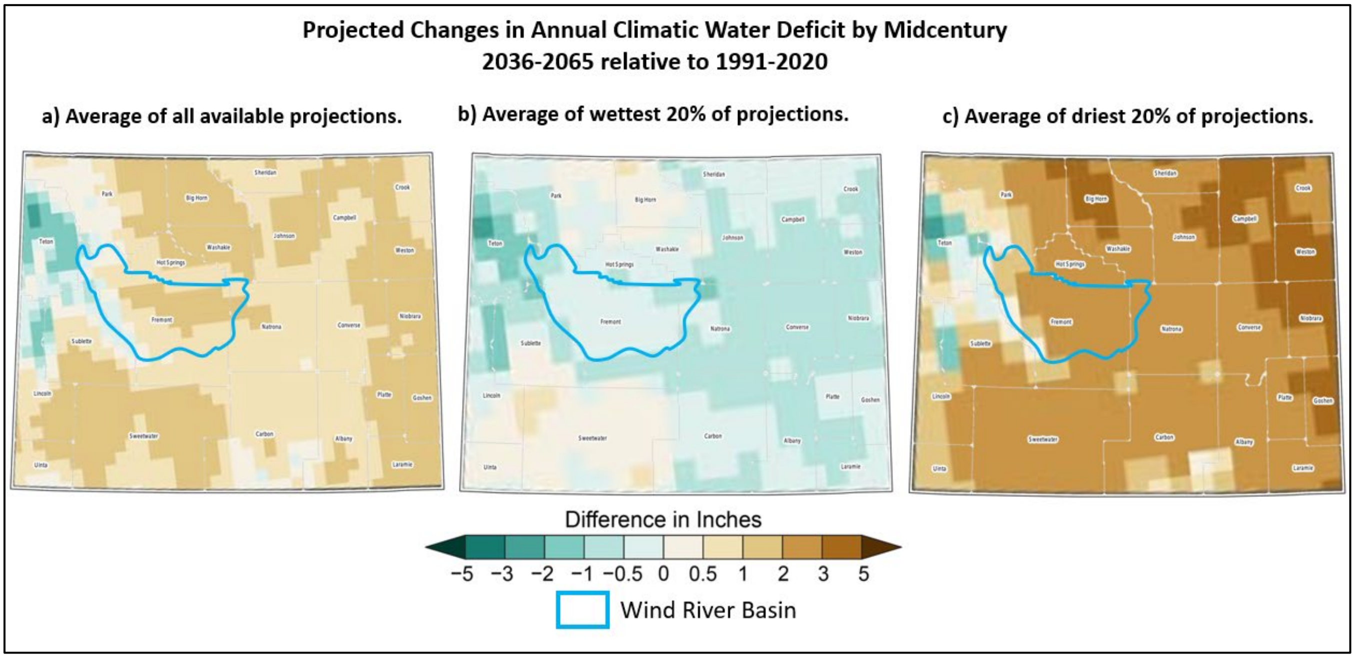

Figure 15. Projected Changes in Annual Climatic Water Deficit by Midcentury 2036-2065 relative to 1991-2020 for the RCP4.5 scenario (excerpted from Chapter 4, Figure 4.9 of the NCA5).

Climatic Water Deficit

Climatic water deficit (CWD) is a measure of drought stress on soils and represents the shortfall of water necessary to fully supply vegetation requirements of an area. CWD is zero if those needs are met, with a higher number indicating drier conditions. Vegetation water needs will increase with increases in temperature; as a result, in the absence of compensating increases in precipitation, CWD is projected to increase. Under an intermediate scenario (RCP4.5), CWD is expected to rise across much of the Nation, with the Great Plains and Southwest seeing the greatest increase.[116] Figure 15 shows the annual climatic water deficit projected under the three average ranges in Wyoming.

4.4 Vulnerability of Wind River Basin Water Resources to Climate Conditions and Climate Change

The Wind River Basin is located in an arid, mountainous region that is susceptible to water resource issues. Due to the region's semi-arid climate, the Tribes on the WRIR depend almost entirely upon snowpack- and glacier-fed tributaries to the Wind River for their water supply. The complex terrain and highly variable climate of the Reservation and surrounding area produce climate extremes that present challenges for natural resource management.[117] Information presented in the NCA5 Chapter 4 related to impacts to evapotranspiration, soil moisture, and snow water equivalent from increasing temperatures and precipitation changes in the Wind River Basin indicates that the WRIR will continue to experience shortages of water needed for growing crops and for livestock ranching. As discussed in the next section, Indigenous Peoples experience climate change impacts in a

[115] Payton et al., *supra* note 100.
[116] *Id.*
[117] Stiles, et al., *supra* note 85.

manner that is unique from other communities and these impacts may be severely detrimental to Tribal culture, livelihood, and quality of life. As discussed in Section 5 herein, the WRIR water management system is already facing challenges. Reservoirs are already overtaxed and run low near the end of the growing season. The loss of late summer streamflow due to earlier snow melt and spring run-off, along with increasing loss of soil moisture, will exacerbate this situation. The result will likely involve increasing reliance on groundwater resources in the future. For this reason, the EPA analyzed the vulnerability of water resources under current climate conditions and levels of use and the impacts of climate change projections on these water resources.

4.4.1 Surface Water

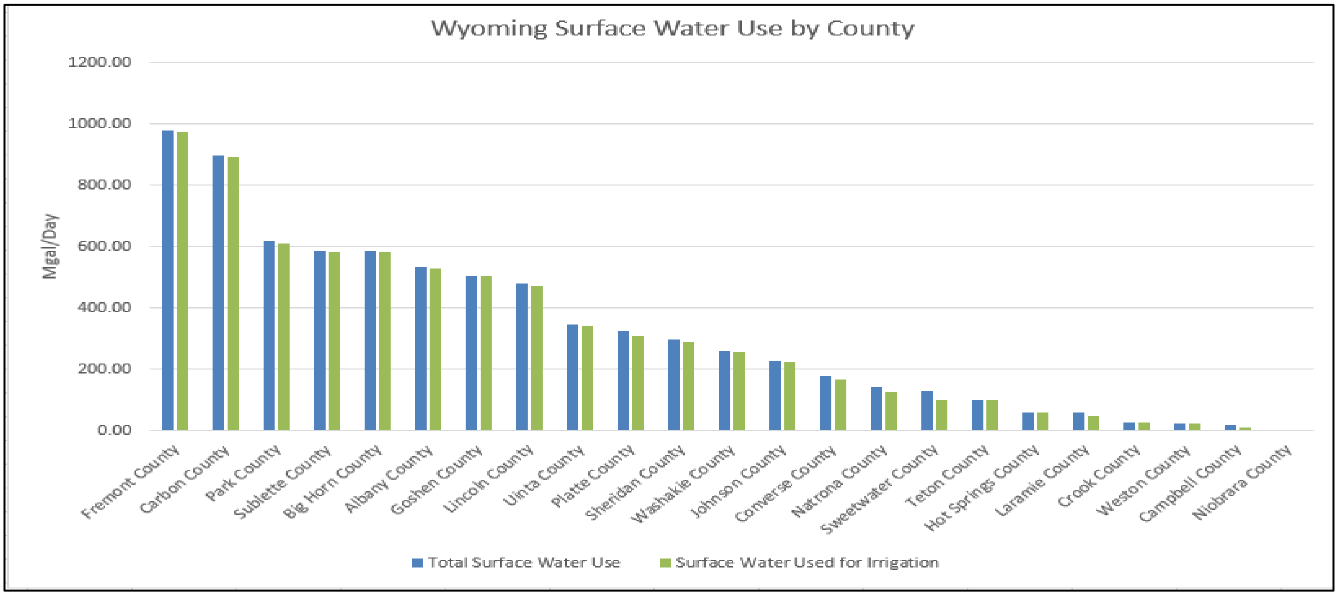

Figure 16. Total Surface Water Use and Surface Water Used for Irrigation by County in Wyoming (from Dieter, C.A., et. al. 2018*).*

Current water usage information is relevant to the EPA's assessment of the vulnerability of Wind River Basin water resources to climate conditions and climate change. Agriculture accounts for approximately 80 percent of the surface water usage in Wyoming. Figure 16 shows the amount of surface water use in Wyoming during 2015 in units of millions of gallons per day by county. The blue columns represent total surface water usage; the green columns represent surface water used for irrigation.[118] Municipal and industrial users are the next largest consumer groups. Separate from surface water usage, the largest amount of surface water is lost to evaporation from the state's many reservoirs.[119] Table 2 in the State of Wyoming, Water Development Office, July 28, 2014 Surface Water Resources Analysis shows that in 2010, 1,080,000 acre-feet of surface water was used for irrigation in the Wind/Big Horn River Basin, while 156,200 acre-feet was lost to reservoir evaporation.[120] Rising temperatures associated with global warming will continue to increase the amount of surface water lost to evaporation. Much of Wyoming has a limited crop growing season (as little as 60 days) due to elevation and

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[118] Cheryl A. Dieter et al., *Estimated Use of Water in the United States County-Level Data for 2015*, USGS: SCIENCEBASE-CATALOG (JUNE 19, 2018), https://www.sciencebase.gov/catalog/item/get/5af3311be4b0da30c1b245d8.
[119] CALEB CARTER ET AL., WYOMING SMALL ACREAGE IRRIGATION 11 (Steve Miller ed., 2017), https://www.uwyo.edu/barnbackyard/_files/documents/resources/irrigation/wysmallacreageirrigationguide.pdf.
[120] THE STATE OF WYO. WATER DEP'T OFF., SURFACE WATER RESOURCES ANALYSIS, https://waterplan.state.wy.us/plan/statewide/govstrategy/20140728-WWDO-SWRA.html.

latitude and therefore relies on late-summer and early-fall streamflow for agricultural water supply.[121] Irrigation is the largest use of surface water in the Wind River Basin.[122] Figure 7 of this document shows the observed decrease in precipitation observed in the Wind River Basin during the summer season. More than half of the land area within the Wind River Basin is used for agriculture. Approximately 6 percent of the Basin is irrigated cropland, and 85 percent of the cropland is on the WRIR. Croplands are located primarily along the major streams because of access to surface water sources for irrigation.[123]

Sixty-three glaciers in the Wind River Mountain Range covered approximately 17 square miles in 2003 with 77% of this area contributing to Wind River Basin. Glacial melt water contributes to the flow in the Wind River Basin and is especially important during the low precipitation seasons of late summer and early fall for supplementing flows needed for irrigation and fisheries and for the fulfillment of interstate water compacts. In recent decades, measurements of glacier areas show them to be receding, and some studies predict they will be completely gone in 20 years if current weather trends continue. If this were to occur, flows in the Wind River resulting from glacial melt alone could be diminished by as much as 8%, impacting irrigators, instream flow demands, and interstate compacts.[124] In addition to providing melt runoff, glaciers also serve to prolong melting of the snowpack in the Wind River Mountains. Glaciers and glacier-controlled later season snowmelt provide the source of streamflow during this critical late-summer and early-fall growing season. Earlier melting of winter snowpack and earlier peak runoff due to more rapid springtime warming have resulted in lower stream flows in the late summer, increasing reliance on water in reservoirs and groundwater resources. Shifts in the hydrological regime due to accelerated glacial melt will alter stream water volume, water temperature, runoff timing, and aquatic ecosystems in these regions.[125]

Projected temperature increases will impact surface water resources in various ways, including by increasing reservoir evaporation rates, and inducing earlier snow melt and glacial recession. These projected impacts may lead to increased future reliance on groundwater resources especially during the summer and early agricultural fall growing season.

4.4.2 Groundwater

More than 75 percent of Wyoming's population relies on groundwater for part, or all, of their drinking water supply.[126] In 2015, Natrona and Fremont Counties had the second and third largest populations (11,845 and 10,590, respectively) receiving domestic water supply from wells. In 2015, the Natrona County population was 82,178, the second largest populated county in WY; the Fremont County population was 40,315, the fifth largest populated county in WY. In Natrona County, groundwater was used mainly for public drinking water systems, followed by industry, domestic wells, and livestock. In Fremont County, groundwater was used mainly for public drinking water systems, followed by domestic wells, livestock, and industry.

[121] Kyle Cheesbrough et al., *Estimated Wind River Range (Wyoming, USA) Glacier Melt Water Contributions to Agriculture*, 1 REMOTE SENSING 818, 818 (2009).
[122] Maria Plafcan et al., *Water Resources of Fremont County, Wyoming*, USGS WATER-RESOURCES INVESTIGATIONS REPORT 95-4095 (1995).
[123] Paul Taucher, et al., WYOMING STATE GEOLOGICAL SURVEY, WIND/BIGHORN RIVER BASIN WATER PLAN UPDATE GROUNDWATER STUDY LEVEL 1 (2008–2011) 3-23 (2012), https://waterplan.state.wy.us/plan/bighorn/2010/gw-finalrept/gw_toc.html.
[124] HAROLD J. HUTSON, WYO. WATER DEP'T OFF., WIND/BIGHORN RIVER BASIN PLAN WIND RIVER RANGE GLACIERS, (2003), https://waterplan.state.wy.us/plan/bighorn/techmemos/glaciers.html.
[125] Upmanu Lall et al., *Water*, *in* IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 145 (David Reidmiller et al. eds, 2018), https://nca2018.globalchange.gov/chapter/water.
[126] Wyoming Department of Environmental Quality Know Your Well website. https://deq.wyoming.gov/water-quality/groundwater/know-your-well/#:~:text=If%20you%20live%20in%20a,from%20more%20than%2090%2C000%20wells.

The most groundwater well development in Fremont County occurs in the Wind River Formation of Tertiary age; the unconsolidated Quaternary alluvial and colluvial deposits are second most developed aquifers. These geologic units form the surface geology in the central portion of the Wind River Basin. The Wind River Formation is the formation that comprises most of the surface geology in Fremont County, ranging in thickness from about 100 feet where it thins along the mountains to about 5,000 feet in the central portion of the Wind River Basin. Figure 17 shows the extent of the Wind River Formation within the Wind River Basin. The Wind River Formation varies in lithology and contains many coarse-grained permeable sandstone and conglomerate beds that are lenticular, discontinuous, and separated by confining shale, mudstone, and siltstone units. Water yield and water quality from the Wind River Formation vary greatly and are affected by the lithology of the formation and recharge process.[127]

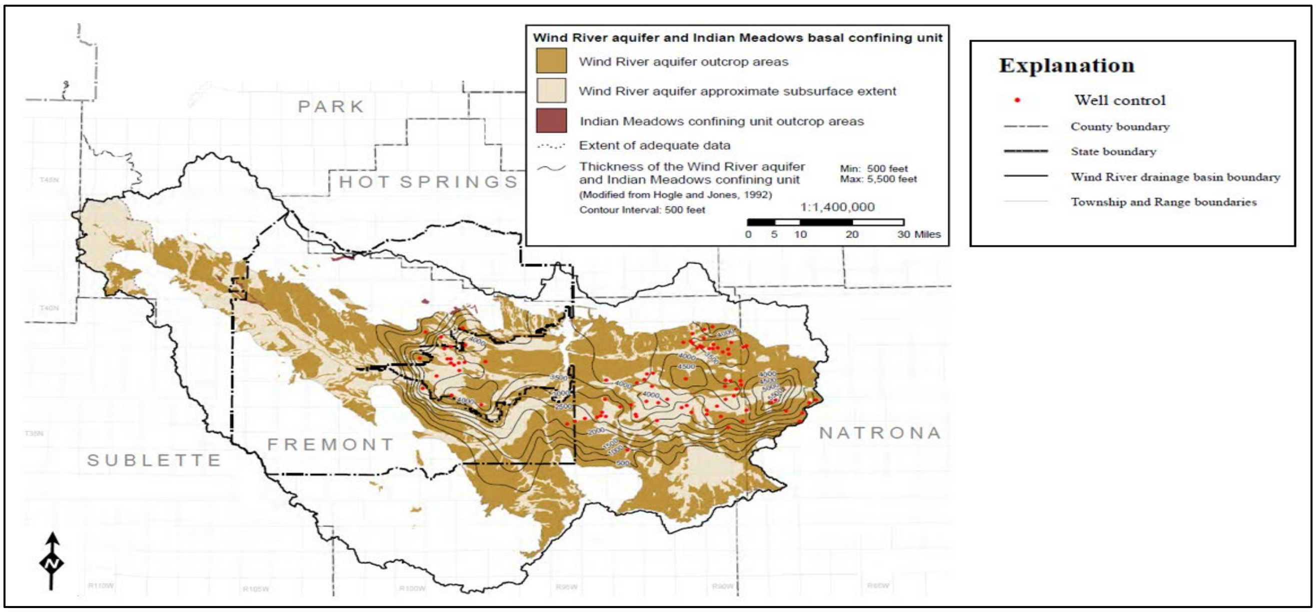

Figure 17. The extent of the Wind River Formation within the Wind River Basin. From Plate VII. Isopach Maps of Selected Aquifers - Wind River Basin of the Wind/Bighorn River Basin Water Plan Update Groundwater Study Level 1 (2008–2011).[128] The depiction of the Wind River Indian Reservation for this and all maps in this document are for general reference purposes only.

Groundwater wells completed in the Wind River Formation yield water from both unconfined and confined sandstone layers. Wells less than 90 ft. deep usually yield water from unconfined sandstone layers recharged primarily by water from overlying Quaternary deposits and irrigation return flow. Wells completed in the Wind

[127] H.R. Richter, Jr., *Occurrence and Characteristics of Ground Water in the Wind River Basin, Wyoming*. Volume IV-A, Report to US EPA, Contract Number G 008269-79 (1981), https://nepis.epa.gov/Exe/ZyNET.exe/94009NPZ.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1981+Thru+1985&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&Qfield=&QfieldYear=&QfieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5Cindex%20Data%5C81thru85%5CTxt%5C00000031%5C94009NPZ.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

[128] Taucher, et al., *supra* note 112323.

River Formation and more than 100 ft. deep usually yield ground water from confined sandstone layers. These layers usually are recharged by surface water or by infiltration of precipitation.[129]

Quaternary aquifers have local development potential. Depending upon hydrogeologic conditions, individual well yields may typically range from 100 to 500 gpm. Because these aquifers are heavily dependent on surface water for recharge, susceptibility to surface water contamination sources impact water quality issues that must be addressed.[130] Quaternary deposits range from 5 to 200 feet thick but are typically less than 40 feet thick. The majority of wells are completed in alluvium along the Wind, Little Wind, and Popo Agie rivers and along Beaver, Muskrat, Muddy, and Fivemile creeks. Groundwater in Quaternary deposits is unconfined. Water table in these deposits is dependent on seasonal recharge and varies widely throughout the year. The water quality in these quaternary deposits varies widely, affected by the type of underlying bedrock geology and impacts from surface activity that contaminate the recharge water.[131]

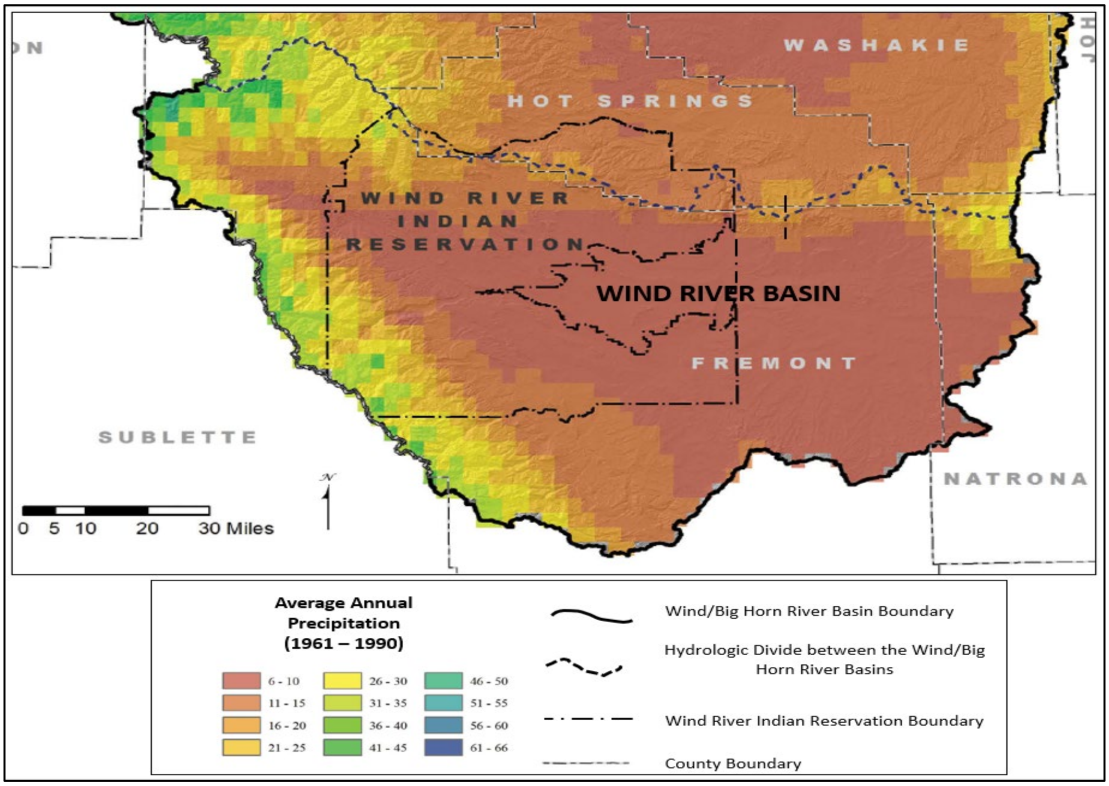

Figure 18. Average annual precipitation (1961 – 1990), Wind River Basin from Figure 3-3, Wyoming State Geological Survey, 2012, Wind/Bighorn River Basin Water Plan Update Groundwater Study Level 1 (2008–2011). The depiction of the Wind River Indian Reservation for this and all maps in this document are for general reference purposes only.

Figure 18 shows the average annual precipitation within the Wind River Basin based on data from 1961 through 1990. The areas of lowest precipitation are in the interior portion of the Basin where the Wind River Formation and Quaternary aquifers occur.

In the dry climate of Wyoming, most natural recharge is directly from precipitation and occurs in the mountain ranges surrounding the basin, on thick alluvial materials that border the mountain ranges, and along stream

[129] Richard L. Daddow, WATER RESOURCES OF THE WIND RIVER INDIAN RESERVATION, WYOMING, USGS WATER RESOURCES INVESTIGATIONS REPORT 95-4223 (1996), https://pubs.er.usgs.gov/publication/wri954223.
[130] MEMORANDUM FROM MARK E. STACEY & CHRIS LIDSTONE, LIDSTONE & ASSOCS., INC. TO DOUG BEAHM & JON WADE, WYO. WATER DEV. COMM'N (Jan. 14, 2003), https://waterplan.state.wy.us/plan/bighorn/2003/techmemos/grnddet.html (hereinafter "Lidstone & Assocs.").
[131] H.R. Richter, Jr., *supra* note 127

channels within and underlain by thick, permeable alluvial deposits. Most recharge in Wyoming occurs during late fall, winter, and early spring: vegetation is dormant, evapotranspiration (ET) is minimal, precipitation is generally higher, and snowpack functions as a reservoir maximizing contact with the ground surface and enhancing infiltration. In the central basin areas where the ET rate generally exceeds the precipitation rate, the opportunity for widespread recharge is limited to infrequent high precipitation and thick snowpack melting events. Recharge to bedrock within interior basin areas is also hindered by the generally flat-lying strata of the Tertiary hydrogeologic units (the Wind River Formation) because permeability is generally less efficient across stratification.[132]

The 2012 Wyoming State Geological Survey, Wind/Bighorn River Basin (WBRB) Water Plan Update Groundwater Study Level 1 includes a statewide quantitative evaluation of recharge prepared by the Spatial Data and Visualization Center (SDVC). *The Wyoming Ground Water Vulnerability Assessment Handbook*[133] is referenced for the evaluation of recharge over the WBRB discussed in Section 6.2.2 of the Study. Average annual recharge to the WBRB, shown in Figure 5-2 of the Study, is based on average annual precipitation data from 1961 through 1990 and on published percolation percentages for documented soil/vegetation combinations.

Figures 19 and 20 show higher recharge in the mountain and foothill areas than the lowlands in the basins because of:

- greater precipitation and more persistent snowpack;
- more abundant vegetation;
- soil and vegetation combinations more favorable to infiltration;
- less evapotranspiration;
- better exposure of the upturned and eroded edges of hydrogeologic units and associated greater permeability parallel to bedding; and
- structural features that enhance recharge: faults, fractures, fault/fracture-controlled surface drainage.

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[132] Taucher, et al., *supra* note 123.

[133] JEFFREY D. HAMERLINCK, & CHRISTOPHER S. ARNESON, WYO. DEP'T ENV'T QUALITY, WYOMING GROUND WATER VULNERABILITY ASSESSMENT HANDBOOK (1998).

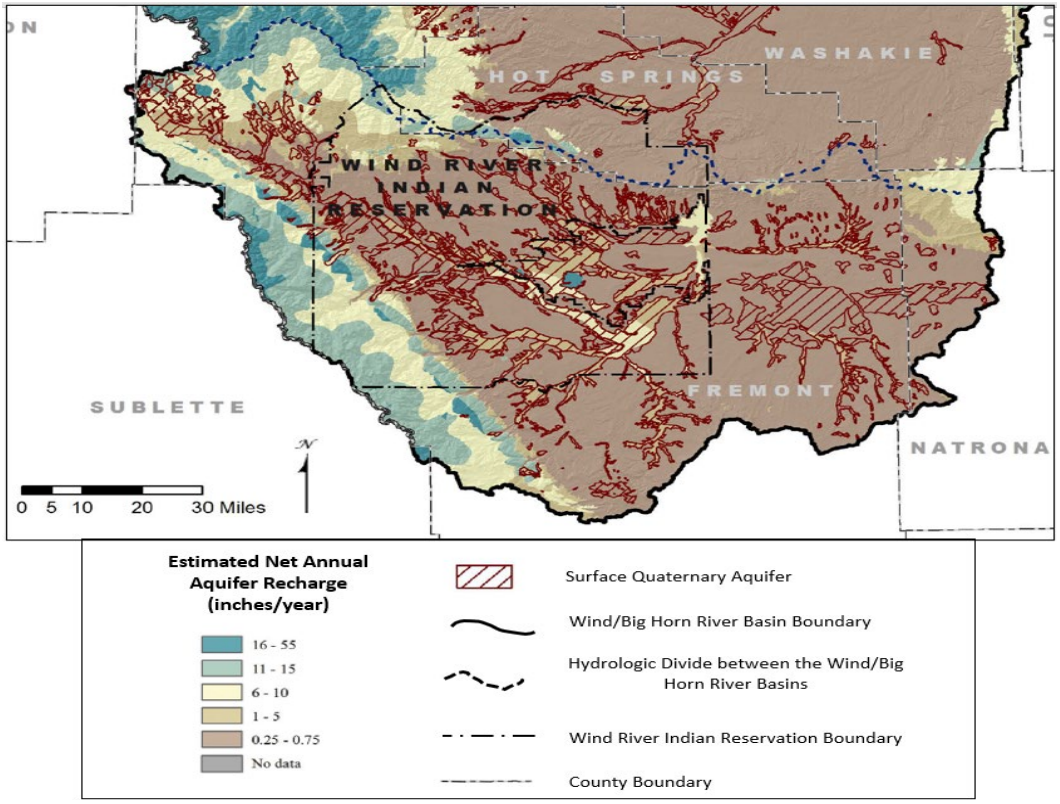

Figure 19. Estimated net annual Quaternary aquifer recharge in the Wind River Basin from Figure 6-2, Wyoming State Geological Survey, 2012, Wind/Bighorn River Basin Water Plan Update Groundwater Study Level 1 (2008–2011). The depiction of the Wind River Indian Reservation for this and all maps in this document are for general reference purposes only.

Figure 19 shows the estimated net annual recharge to the Quaternary aquifers in the Wind River Basin. Compared with Figure 18, the tan and yellow areas show greater recharge to alluvial aquifers that occur along rivers and tributaries. These aquifers are not only recharged from direct infiltration of precipitation and ephemeral and perennial streamflow losses, but also from infiltration of diverted surface water through unlined irrigation canals and ditches, from water applied to fields, and, in the case of Quaternary aquifers, discharge from underlying aquifers.[134] Figure 20 shows the estimated net annual recharge to the Quaternary and surficial exposure of the Wind River Formation aquifers occurs in the interior portion of the Wind River Basin.

[134] Taucher, et al., *supra* note 123, at 115, 122.

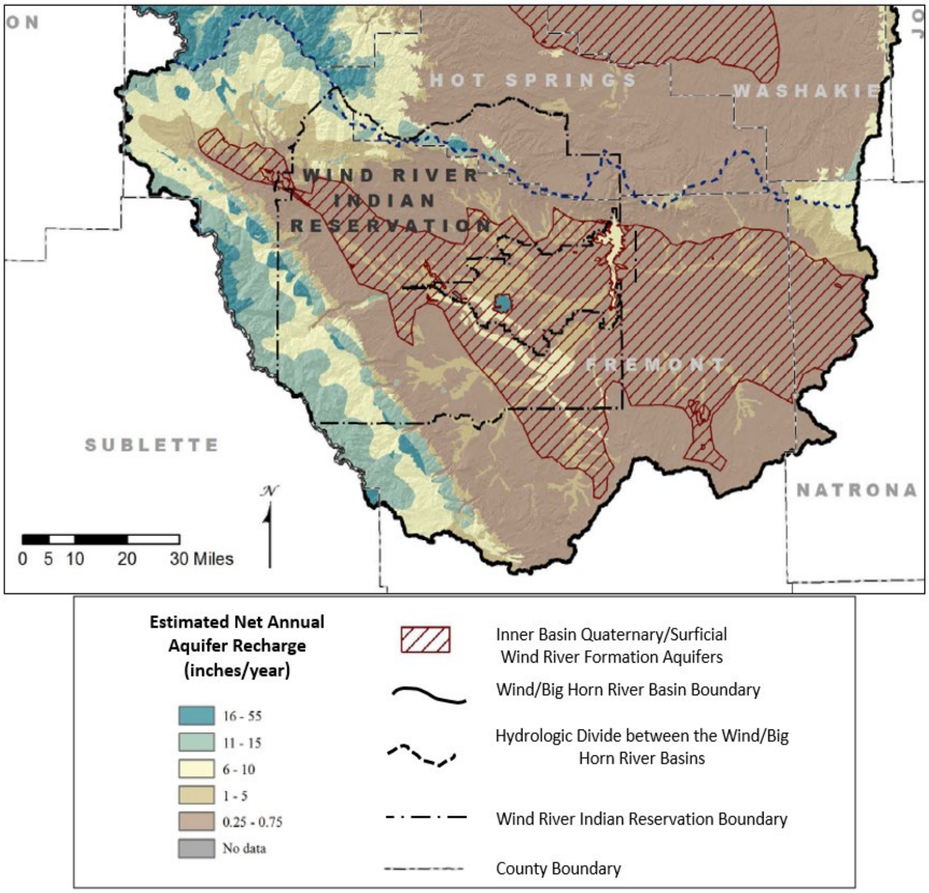

Figure 20. Estimated net annual recharge to the inner basin Quaternary/Surficial Wind River Formation aquifer in the Wind River Basin from Figure 6-3, Wyoming State Geological Survey, 2012, Wind/Bighorn River Basin Water Plan Update Groundwater Study Level 1 (2008–2011). The depiction of the Wind River Indian Reservation for this and all maps in this document are for general reference purposes only.

The Wind/Bighorn River Basin Water Plan Update Groundwater Study Level 1 presents estimates of groundwater volume. In this estimate, the Quaternary aquifers are grouped with the upper portions of the Wind River Formation and represented as the Q/T aquifer with a thickness of 1,000, which encompasses the portions of these aquifers with most of the well development. Groundwater volume estimates for the upper 1000 feet of the Q/T Aquifer were calculated for the entire stratigraphic volume rather than for individual hydrogeologic units, as adequate data for the more detailed estimates are not available. To account for uncertainty in the grain-size distribution (and associated average porosity), the volume estimates were calculated over a representative range of mixed sand (and coarser) and fine-grained porosities.

Groundwater volume estimates are presented in Chapter 6. Although estimates show that the available groundwater exceeds current demands, the Wind River Formation aquifer has shown a drop in water table near areas of high use. One example is near Riverton where municipal wells have been pumping groundwater from the Wind River Formation since 1924. Prior to 1981, Riverton's municipal water supply was entirely from ground water. Water levels in the well field typically were deepest in August when demand for water was greatest. Riverton installed a surface water treatment plant in 1981 that has reduced demands on the Wind River aquifer between May and September. Since 1981, ground water has been pumped only to supplement the surface-water treatment plant. Consequently, the water levels now are deepest in the winter and spring (January through May). Water levels in the Wind River Formation near the Riverton municipal well field appeared to rise during 1983 to 1985 after the plant began operating in 1981.[135] However, water levels have not fully recovered in some locations in the aquifer and remain lower than those reported in the 1940s.[136]

Some aquifers occurring deep in the Wind River Formation are confined (the potentiometric surface elevation is above the top of the aquifer). Some deep wells completed in these aquifers flow water at the land surface. USGS inventoried 26 wells located near Arapahoe and Riverton ranging from 225 to 450 ft deep that flow or have flowed to the ground surface. Flow rates of 0.1, 2.5, and 5.0 gal/min were measured at three of these wells. Some of the 26 inventoried wells that were flowing in the 1950's and 1960's were not flowing from 1989 through 1991. Increased well drilling and pumping of wells near the flowing wells are likely major causes of the cessation of flow.[137]

The sensitivity of water levels in the Wind River Formation was recognized as early as 1958 during a pump test study (Robinove, 1958)[127] that examined effects on wells flowing at ground surface near the town of Arapahoe. The study involved conducting an aquifer pump test at a newly drilled, 450 ft deep, high-capacity (250 to 300 gal/min) industrial well about two miles southwest of Riverton. During the pump test, the hydraulic heads in the four flowing wells completed in the same geologic unit declined below land surface or below the point of use. When pumping in the industrial well ceased, one well resumed flowing at the ground surface and hydraulic heads in the three other wells increased but did not resume flowing to ground surface. These results indicate water level did not fully recover in all areas of the aquifer after the pump test and the Wind River aquifer is sensitive to rates of groundwater pumping required to support large populations. Recorded declines in water levels and wellhead pressures in wells completed in the Wind River Formation may necessitate the need for management of groundwater withdrawal from this aquifer.[138]

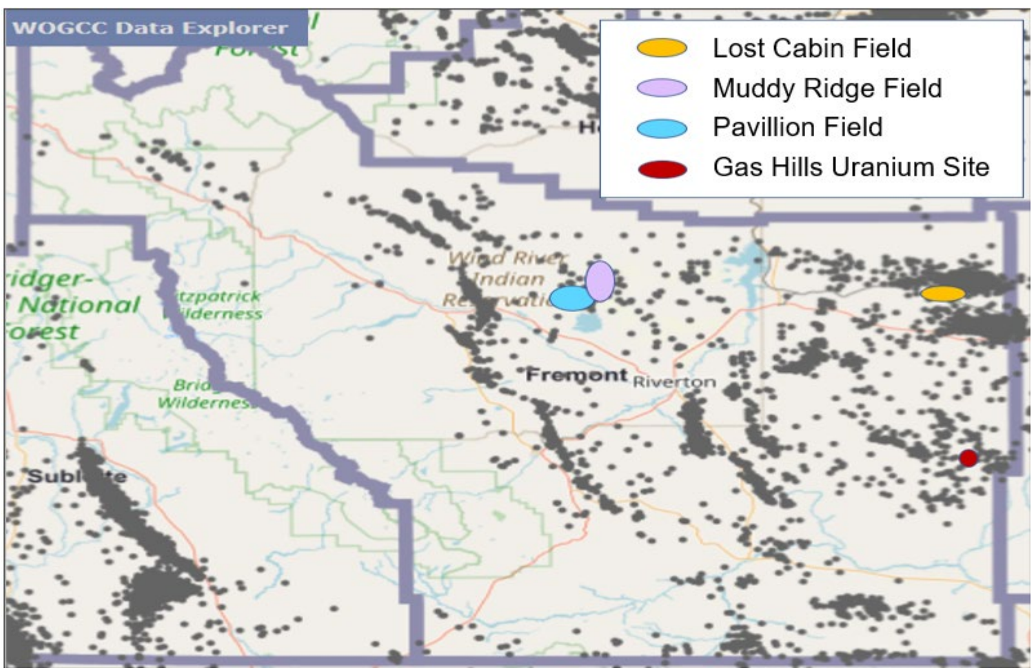

Figure 21. Location of the Lost Cabin Field, Pavillion and Muddy Ridge Oil and Gas Fields in the Wind River Formation and the Gas Hills Uranium site in Fremont County, WY. (modified from the WOGCC Data Explorer)[139]

[135] Plafcan et al., *supra* note 122122.
[136] Lidstone & Assocs., *supra* note 130130.
[137] Daddow, *supra* note 129.
[138] Lidstone & Assocs., *supra* note 130.
[139] WOGCC Data Explorer, https://dataexplorer.wogcc.wyo.gov/ and Interactive Oil and Gas Map of Wyoming https://portal.wsgs.wyo.gov/arcgis/apps/webappviewer/index.html?id=d42f571b87fa4234b03d66ca7ae311a4 (last visited Feb. 20, 2024).

Water quality in the Wind River aquifer is variable based on depth and location. USGS evaluated the water quality in the Wind River Formation based on chemical analyses of 128 to 154 water samples and 205 specific-conductance measurements of water samples collected from selected wells. Dissolved-solids concentrations ranged from 211 to 5,110 mg/L. The chemical quality and ionic composition of water samples collected from the Wind River Formation were variable because this geologic unit has highly variable lithology, permeability, and recharge conditions. Some general changes in ionic composition of water samples were related to the variation in dissolved-solids concentration.[140] The water quality of the Wind River aquifer may not be suitable for drinking water use in locations where it hosts oil and gas and uranium deposits. In Fremont County oil and gas are produced from the Wind River Formation in the Lost Cabin Field within the Moneta Divide Projection Area in northeastern Fremont County and the Pavillion and Muddy Ridge Fields on the WRIR. The locations of these oil and gas fields are shown in Figure 21. The Wind River Formation also hosts uranium deposits in the Gas Hill Uranium District in the southcentral Wind River Basin also shown in Figure 21. All known economic uranium deposits of the Gas Hills Uranium District, estimated at 10 million tons of ore, occur in the Wind River Formation.[141]

Taucher et al. (2012)[142] provides a summary of water quality for aquifers identified as having high or moderate potential for development. These aquifers include the Quaternary, Wind River, Mesaverde, Tensleep and Madison Formations. Water quality of each aquifer was evaluated based on environmental water samples from wells and springs and on produced water samples from wells. TDS concentrations in environmental samples from the Quaternary aquifers ranged from 102–4,630 mg/L; 224-5,110 mg/L for the Wind River, 1,100 to 1,470 for the Mesaverde Formation, and 146-1,060 mg/L for the Tensleep. TDS concentrations in produced water samples from the Wind River ranged from 1,060–38,800 mg/L; 1,710 to 15,300 for the Mesaverde Formation, and 167-25,600 mg/L for the Tensleep. Based on TDS information, the Madison Formation at the Marlin well has better water quality than the Mesaverde aquifer and some sampled locations within the Quaternary, Wind River, and Tensleep aquifers. The Madison aquifer at the Marlin well has among the highest water quality of aquifers identified as having high or moderate development potential in the Wind River and Bighorn River Basins, with a low TDS concentration and few contaminants of concern. The Amsden aquifer was not specifically sampled at the Marlin well location; however, because it likely is hydraulically connected to the Madison, its water quality is assumed to be similar.

Quaternary aquifers may have local development potential. Depending upon hydrogeologic conditions, individual well yields may typically range from 100 to 500 gpm. Water quality impacts from underlying bedrock and susceptibility to contamination from surface water sources of contamination present challenges for using these aquifers.[143] The Wind River Aquifer is already heavily developed within the Wind River Basin, but opportunities for additional groundwater development and installation of high-capacity wells may be possible in areas not currently developed. Local water quality conditions may constrain development in certain areas.[144]

The Wind River Formation and Quaternary aquifers are the most heavily used sources of groundwater in the Basin and are dependent on surface water for recharge. Therefore, future groundwater availability in these aquifers will be affected by the climate change impacts to surface water discussed in the previous section. Slow recovery from high rates of groundwater withdrawal in the aquifers indicates this groundwater source may have limited ability to support increased future demand for groundwater. There is also documented variability in water quality and potential for surface contamination. These water quality and quantity issues indicate the potential need for deeper groundwater sources to be developed to support future water supply needs.

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[140] Daddow, *supra* note 129.

[141] Paul E. Soister, USGS PRO. PAPER 594-A, *Stratigraphy of the Wind River Formation in South-Central Wind River Basin, Wyoming* (1968), https://pubs.usgs.gov/pp/0594a/report.pdf.

[142] Taucher, et al., *supra* note 123123.

[143] Lidstone & Assocs., *supra* note 130.

[144] *Id.*

4.4.3 Projected Population Growth and Water Use in the Wind River Basin

In 2017, the EPA published a technical report entitled *Multi-Model Framework for Quantitative Sectoral Impacts Analysis, A Technical Report for the Fourth National Climate Assessment.*[145] This report summarizes and communicates the results of the second phase of quantitative sectoral impacts analysis under the Climate Change Impacts and Risk Analysis (CIRA)[146] project (for information on the first phase, see the CIRA Project Background section). This effort was intended to inform the Fourth National Climate Assessment (NCA4) of the U.S. Global Change Research Program (USGCRP). The goal of this work is to estimate climate change impacts and economic damages to multiple U.S. sectors (e.g., human health, infrastructure, and water resources) under different scenarios.

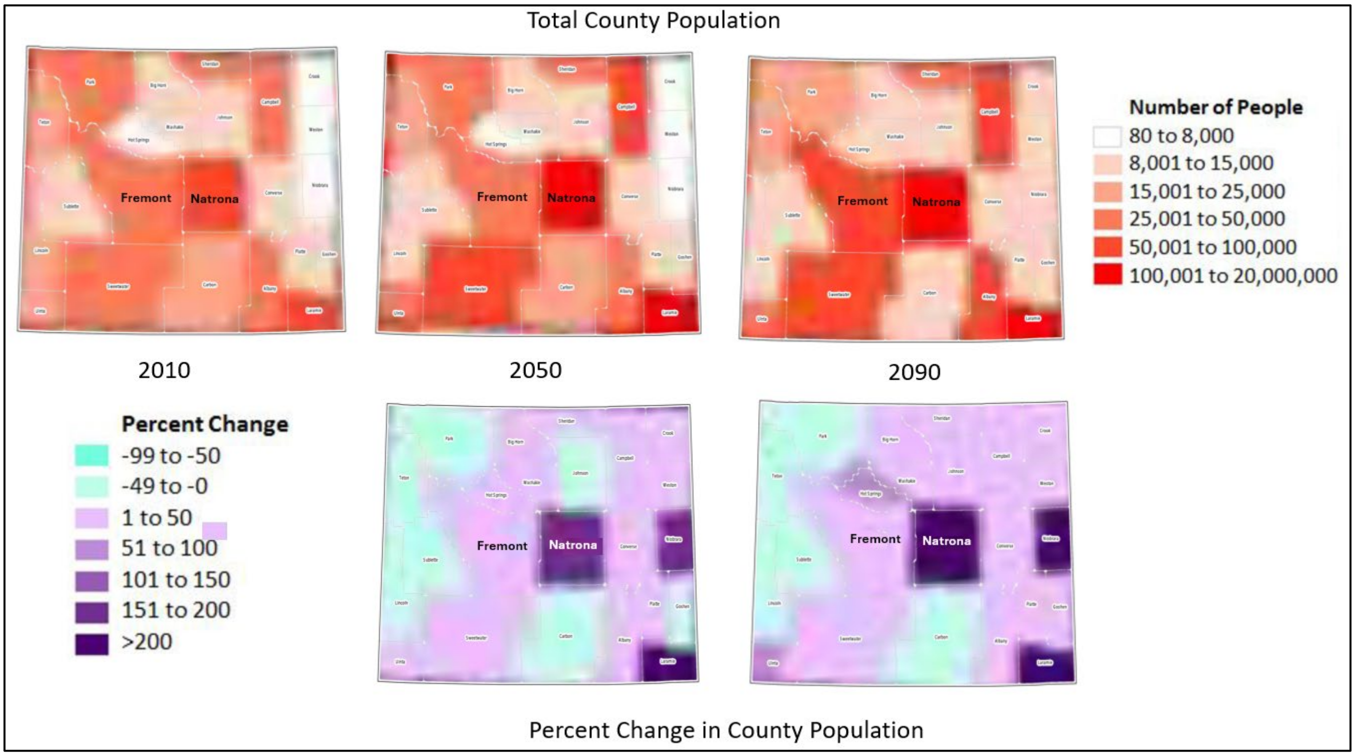

Figure 22. Projected change on county population due to impacts of climate change (from Figure 1.4, Projected County-Scale Population Change in EPA, 2017, Multi-Model Framework for Quantitative Sectoral Impacts Analysis, A Technical Report for the Fourth National Climate Assessment.

In this report, the EPA's Integrated Climate and Land Use Scenarios version 2 (ICLUSv2) model[147] was used to develop a map showing county-scale population projections driven by the future climate patterns. Figure 22 shows projected population change in Wyoming counties, including migration as a result of climate change. The population in Fremont County is projected to experience a roughly 50% increase from the 2010 census level of 40,123 to over 60,000 by 2090. Natrona County, the adjacent county to the east, is anticipated to experience up to a 200% increase from the 2010 census level of 75,450 to over 225,000 by 2090.

Figure 9.1 of the EPA report shows that projected population change due domestic migration induced by climate effects alone results in an increase of 0.1 to 3.0 percent in Fremont County population by mid-century (2050)

[145] U.S. ENV'T PROT. AGENCY, EPA 430-R-17-001, *Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment* (2017). https://www.epa.gov/cira/multi-model-framework-quantitative-sectoral-impacts-analysis.

[146] U.S. ENV'T PROT. AGENCY, *Climate Change Impacts and Risk Analysis (CIRA)*, www.epa.gov/cira (last updated Feb. 6, 2024).

[147] U.S. ENV'T PROT. AGENCY, *About ICLUS*, https://www.epa.gov/gcx/about-iclus (last updated Jan. 22, 2024).

under both the RCP8.5 and RCP4.5 scenarios and 3.1 to 6.0 percent increase under both scenarios by the end of the century (2090). In Natrona County, population is projected to decrease by greater that 9 percent under both scenarios by 2050 and 2090.

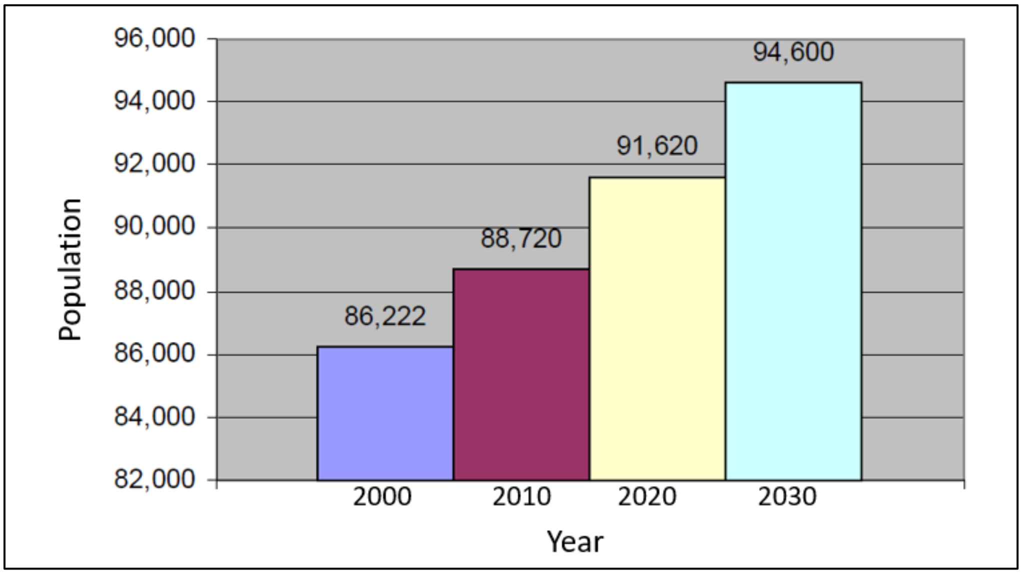

Figure 23. Projected population growth for the Wind/Big Horn River Basin based on a moderate population growth model from the BRS Engineering 2003 Technical Memorandum: Wind/Big Horn Basin Plan, Municipal and Domestic Water Demand and Projections.

The 2003 Technical Memorandum: *Wind/Big Horn Basin Plan, Municipal and Domestic Water Demand and Projections*[148] was developed by BRS Engineering to support the Wind/Bighorn River Basin Water Plan 2003 Final Report. The Tech Memo discusses projected municipal and domestic water use in the basin which includes Big Horn, Fremont, Hot Springs, Park and Washakie Counties. The 2000 census population for these counties was 86,222.[149] Fremont County is the most populated county of the five WBHB counties. In 2000, Fremont County had a population of 35,840; currently Fremont County has an estimated population of 39,472. Figure 23 shows Figure 21 from the Tech Memo which presents the projected population growth for the basin as a whole assuming moderate growth. The moderate growth model estimated the five-county area to be 91,620 by 2020. The actual 2020 population was 92,685, 1,065 more than the estimate. The July 1, 2022, Census Bureau estimation for the WBHB counties shows a population of 94,152.[150]

[148] BRS ENGINEERING, TECHNICAL MEMORANDUM: WIND/BIG HORN BASIN PLAN: MUNICIPAL AND DOMESTIC WATER DEMAND AND PROJECTIONS (2003), https://waterplan.state.wy.us/plan/bighorn/2003/techmemos/municipal.html.

[149] U.S. CENSUS BUREAU, PHC-3-52, WYOMING: 2000 POPULATION AND HOUSING UNIT COUNTS (2003).

[150] U.S. CENSUS BUREAU, *QuickFacts: Washakie County, Wyoming; Park County Wyoming; Hot Springs County, Wyoming; Big Horn County, Wyoming; Fremont County, Wyoming*, https://www.census.gov/quickfacts/fact/table/washakiecountywyoming,parkcountywyoming,hotspringscountywyoming,bighorncountywyoming,fremontcountywyoming/POP010210 (last visited Nov. 15, 2023).

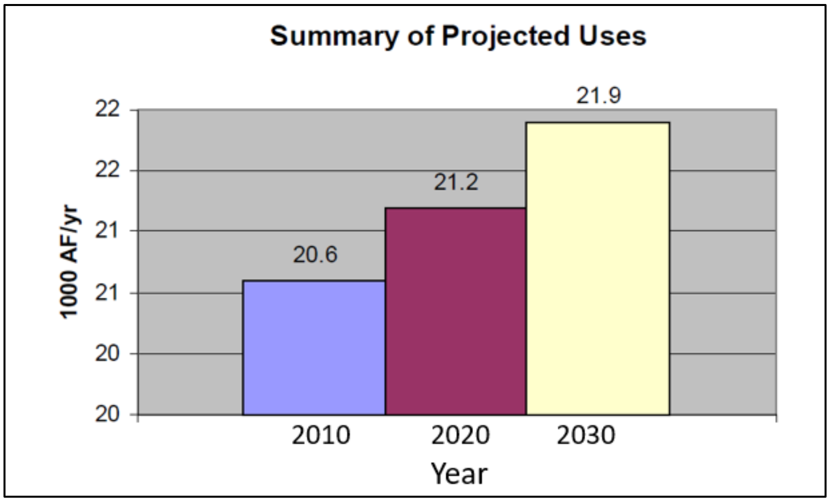

Figure 24. Projected municipal and domestic water demand for the Wind/Big Horn River Basin based on a moderate population growth model from the BRS Engineering 2003 Technical Memorandum: Wind/Big Horn Basin Plan, Municipal and Domestic Water Demand and Projections.

The moderate growth model was used to project future water demand for domestic and municipal use in the WBHB through 2030. The Tech Memo estimated the average daily municipal water use for the WBHB to be approximately 12.2 million gallons per day (MGD), or roughly 207 gallons per day per person. The water sources were estimated to be 68% surface water and 32% groundwater. Based on rural domestic and non-municipal public water system usage, total domestic water usage in the basin was estimated to range from 6.5 to 10.4 MGD. Of the total domestic water usage, roughly 26% was supplied by surface water and 74% by groundwater. Although data on water quality for private domestic water sources were generally not available, in many areas the shallow aquifers accessible to these users did not meet drinking water standards. Some communities were experiencing water shortages in 2003. Figure 24 estimates the projected municipal and domestic water demand by 2030 to be 21.9 MGD.

4.5 Conclusion

Climate conditions, climate change projections, vulnerability of water resources, and population trends in the Wind River Basin foretell increasing pressures on surface and groundwater resources. NCA5 discusses the impacts of climate change on the Northern Great Plains, including Wyoming. Climate model projection scenarios indicate that conditions in Wyoming will become consistently warmer in two to three decades and temperatures will rise steadily towards the middle of the century. The NOAA State Climate Summary 2022 for Wyoming identified three key messages:

> 1) Temperatures in Wyoming have risen about 2.5 degrees Fahrenheit since the beginning of the 20th century. Warming is most evident in winter and is reflected in a generally below average number of very cold days since 2000. Under a higher emissions pathway, historically unprecedented warming is projected during this century; 2) Winter and spring precipitation is projected to increase. Heavier spring precipitation, combined with a shift from snow to rain, could increase the potential for flooding; and 3) Increases in evaporation rates due to rising temperature may increase the rate of soil moisture loss and

the intensity of naturally occurring droughts. The frequency and severity of wildfires are projected to increase.[151]

In the Wind River Basin, the projection of days with temperatures over 95°F are anticipated to increase while the number of cool days below 32°F is expected to decrease. The greatest decrease in cold days in the Wind River Basin coincides with the mountain ranges where the snowpack melting provides the late-summer water supply. As the number of cold days decreases in the high-altitude areas by more than a month by the mid-century, the snowpack duration will be shorter, causing snowmelt to occur earlier in the spring season and glacial mass to decline. The Wind River Range glaciers are critical because they preserve the snowpack later into the summer sustaining late summer and early fall surface water flows needed to support agriculture and other uses. Warming temperatures are also projected to decrease soil moisture during the late summer and early fall growing seasons, requiring additional irrigation water. The intensity of future drought events in the Wind River Basin is projected to increase, even if precipitation amounts increase, due to corresponding increases in evapotranspiration rates due to rising temperatures. This overall warming trend will jeopardize the late season surface water flows and increase dependency on groundwater in the Wind River Basin.

The majority of groundwater use in the Wind River Basin is for public water supply. The two most highly developed aquifers in the Wind River Basin, the Wind River Formation and Quaternary deposits, demonstrate variable water quality across the Basin. Both aquifers are highly dependent on precipitation and surface water flow for recharge but occur mainly in the central portion of the Wind River Basin where annual precipitation is the lowest. As discussed above the average of all available climate model simulations under the RCP4.5 (mid-range) scenario project increase in annual precipitation by midcentury based; however, the large range in projected precipitation between the wettest 20% of model simulation (projecting increased precipitation) and driest 20% of simulations (projecting decreased precipitation) illustrates the degree of uncertainty in annual precipitation projections. Estimates show that the available groundwater in these two aquifers currently exceed demands; however, water level studies of the Wind River Formation aquifer show that it has experienced groundwater level declines in areas of high usage. In addition, the vulnerabilities of currently used aquifers to projected climate change impacts and projected population growth in the Wind River Basin and surrounding regions will likely place additional pressure on groundwater supplies.

Climate conditions and projected climate change impacts in the Wind River Basin and throughout the state and region generally indicate a trend toward drier conditions, increasing pressures on surface and groundwater resources. These pressures may heighten the need to access groundwater sources and further drive technological and economic advancements in accessing deeper, high quality groundwater resources for drinking water purposes. The Wind River Indian Reservation has recently experienced several severe drought events and climate impacts; a trend that will be exacerbated by climate change. These climate and water resource considerations inform the EPA's assessment of the potential that the groundwater in the portion of the Madison aquifer requested for exemption may be accessed in the future as a source for drinking water.

[151] STATE CLIMATE SUMMARIES 2022, Wyoming, *supra* note 71.

5.0 Equity, Environmental Justice and Tribal Interests

Consistent with the SDWA and the regulatory authorities set forth at 40 CFR § 146.4, Executive Orders 12898[152] and 14096,[153] and EPA policies, this section evaluates equity, environmental justice, and Tribal interests relevant to protection of the aquifer as a potential sources of drinking water. The first section below assesses equity[154] and environmental justice[155] considerations in the Wind River Basin and surrounding areas. Equity considerations are particularly important in more sparsely populated and rural areas such as Fremont County

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[152] Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, lays the foundation of the federal environmental justice and equity policies, directing each federal agency, to the greatest extent practical and permitted by law, to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Exec. Order No. 12898, 59 Fed. Reg. 7629 (Feb. 16, 1994) [hereinafter "EO 12898"]. As underscored in the Presidential memorandum accompanying EO 12898, existing environmental and civil rights statutes provide many opportunities to ensure that all communities and persons live in a safe and healthful environment. *See* Memorandum on Environmental Justice, 30 WEEKLY COMP. PRES. DOC. 279 (Feb. 11, 1994).

[153] Executive Order 14096, *Revitalizing Our Nation's Commitment to Environmental Justice for All,* supplements EO 12898 and reinforces the federal government's commitment to advancing environmental justice, equity, and civil rights, establishing a policy that "every person must have clean air to breathe; clean water to drink; safe and healthy foods to eat; and an environment that is healthy, sustainable, climate-resilient, and free from harmful pollution and chemical exposure." Exec. Order No. 14096, 88 Fed. Reg. 25251 (Apr. 21, 2023) [hereinafter "EO 14096"]. It sets forth a government-wide approach to environmental justice that includes directives that each agency, as appropriate and consistent with applicable law: identify, analyze, and address disproportionate and adverse human health and environmental effects (including risks) and hazards of Federal activities, including those related to climate change and cumulative impacts of environmental and other burdens on communities with environmental justice concerns; evaluate relevant legal authorities and, as available and appropriate, take steps to address such effects; identify, analyze, and address historical inequities, systemic barriers, or actions related to any Federal regulation, policy, or practice that impair the ability of communities with environmental justice concerns to achieve or maintain a healthy and sustainable environment; identify, analyze, and address barriers related to Federal activities that impair the ability of communities with environmental justice concerns to receive equitable access to human health or environmental benefits, including benefits related to natural disaster recovery and climate mitigation, adaptation, and resilience; where available and appropriate, consider adopting or requiring measures to avoid, minimize, or mitigate disproportionate and adverse human health and environmental effects (including risks) and hazards of Federal activities on communities with environmental justice concerns, to the maximum extent practical; and provide opportunities for the meaningful engagement of persons and communities with environmental justice concerns who are potentially affected by Federal activities. *Id.* at 15253-54.

[154] Executive Order 14091, *Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, defines the term "equity" as "the consistent and systematic treatment of all individuals in a fair, just, and impartial manner, including individuals who belong to communities that often have been denied such treatment, such as Black, Latino, Indigenous and Native American, Asian American, Native Hawaiian, and Pacific Islander persons and other persons of color; members of religious minorities; women and girls; LGBTQI+ persons; persons with disabilities; persons who live in rural areas; persons who live in United States Territories; persons otherwise adversely affected by persistent poverty or inequality; and individuals who belong to multiple such communities." Exec. Order No. 14091, 88 Fed. Reg. 10825, 10831-32 (Feb. 16, 2023) [hereinafter "EO 14091"]. It defines the term "underserved communities" as "those populations as well as geographic communities that have been systematically denied the opportunity to participate fully in aspects of economic, social, and civic life, as defined in Executive Orders 13985 and 14020." *Id*. at 10832.

[155] EO 14096 defines "environmental justice" as "the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people: (i) are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers; and (ii) have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices." EO 14096, *supra* note 153, at 15253.

where, as indicated by the screening information below, communities experience disproportionate health and environmental burdens as compared to the rest of the state or country. The analysis discusses drinking water challenges and the manner in which climate change impacts are exacerbated in communities experiencing disproportionate health and environmental impacts such as those found in the Wind River Basin. The next section focuses specifically on the Wind River Indian Reservation, most of which is included within the Wind River Basin and implicates both equity and environmental justice considerations. While there is overlap in assessing EJ and equity considerations on the WRIR with those of the Wind River Basin more broadly, the WRIR discussion focuses on Tribal interests specifically, consistent with the federal government's trust relationship with the Northern Arapaho and Eastern Shoshone Tribes. The analysis includes information about the Northern Arapaho and Eastern Shoshone Tribes; their interests and concerns regarding this aquifer exemption request; socioeconomic, environmental and health data; and cumulative impacts, including to water resources on the Reservation. The analysis examines these issues in light of historic, present, and potential future impacts to human health and the environment, including to water resources. The analysis also considers impacts from the Moneta Divide project on water resources including groundwater aquifers and multimedia cumulative impacts on human health and the environment in the Wind River Basin.

This section on equity and environmental justice considerations in the Wind River Basin is relevant to the Agency's assessment of the potential future needs for drinking water resources in the Wind River Basin, including the potential use of the Madison aquifer in the vicinity of the Marlin well as a future source of drinking water.

5.1 Equity and Environmental Justice Considerations in the Wind River Basin

The EPA's FY 2022-2026 Strategic Plan centers its mission on the integration of justice, equity, and civil rights across the nation's environmental protection enterprise to achieve measurable environmental, public health, and quality of life improvements in the most overburdened, vulnerable, and underserved communities.[156] The EPA's Strategic Plan is consistent with EO 14096 which reinforces the federal government's commitment to advancing environmental justice, equity, and civil rights, establishing a policy that "every person must have clean air to breathe; clean water to drink; safe and healthy foods to eat; and an environment that is healthy, sustainable, climate-resilient, and free from harmful pollution and chemical exposure."[157] The Order further recognizes that "communities with environmental justice concerns exist in all areas of the country, including urban and rural areas and areas within the boundaries of Tribal Nations and U.S. Territories."[158] It builds upon EO 13895 which establishes a comprehensive federal government approach to address inequities in the implementation of laws, policies and programs and in the protection afforded by those laws and policies and to promote equal opportunity for underserved communities that have been denied fair, just, and impartial treatment, including Indigenous and Native American persons and persons who live in rural areas.[159]

[156] EPA Strategic Plan, *supra* note 11, at 27.
[157] EO 14096, *supra* note 153, at 25251.
[158] *Id.*
[159] Executive Order 13985, *On Advancing Racial Equity and Support for Underserved Communities Through the Federal Government,* establishes a whole-of-government equity agenda to address inequities in the implementation of laws, policies and programs and in the protection afforded by those laws and policies and to promote equal opportunity for underserved communities that have been denied fair, just, and impartial treatment, including Indigenous and Native American persons and persons who live in rural areas. Exec. Order No. 13985, 86 Fed. Reg. 7009 (Jan. 25, 2021) [hereinafter "EO 13985"].

This section of the analysis includes information on the populations and communities potentially impacted by the EPA's aquifer exemption decision. The Aethon AE request is for an aquifer exemption for a three-mile radius around the well site, amounting to six miles in diameter. However, the potentially impacted communities on the surface extend farther, to those areas that could potentially utilize the groundwater in the future but would be precluded from doing so were the AE request to be approved. As indicated by the geographic distribution of comments received and the potential to pipe water miles from well sites, the geographic scope of interested communities is broad. This equity and environmental justice analysis focuses on the Wind River Basin where the Marlin 29-21 well is located, as encompassing the communities that are practically and economically the most likely to initially utilize the water as a potential drinking water source in the future. For consistency purposes, the Wind River Basin also coincides largely with the Wind River Climate Division discussed above. The Wind River Basin is largely comprised of Fremont County which, in turn, includes most of the Wind River Indian Reservation. The analysis below considers socioeconomic, environmental, and health information in Fremont County and specifically on the Wind River Indian Reservation.

The EPA used EJScreen for the initial data-gathering step of assessing conditions in Fremont County and on the Wind River Indian Reservation. EJScreen is the EPA's environmental justice mapping and screening tool that provides the EPA with a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators.[160] The EPA generates Community Reports from EJScreen for areas of interest and conducts an initial screening of the information to determine if more in depth analysis is warranted.[161] Further review may include considering other factors and other sources of information such as health-based information, local knowledge, proximity and exposure to environmental hazards, susceptible populations, unique exposure pathways, and other federal, regional, state, and local data. For this analysis, the EPA Region 8 considered initial screening information and additional analysis on health and environmental impacts as described in this section.

5.1.1 Environmental, Socioeconomic and Health Information

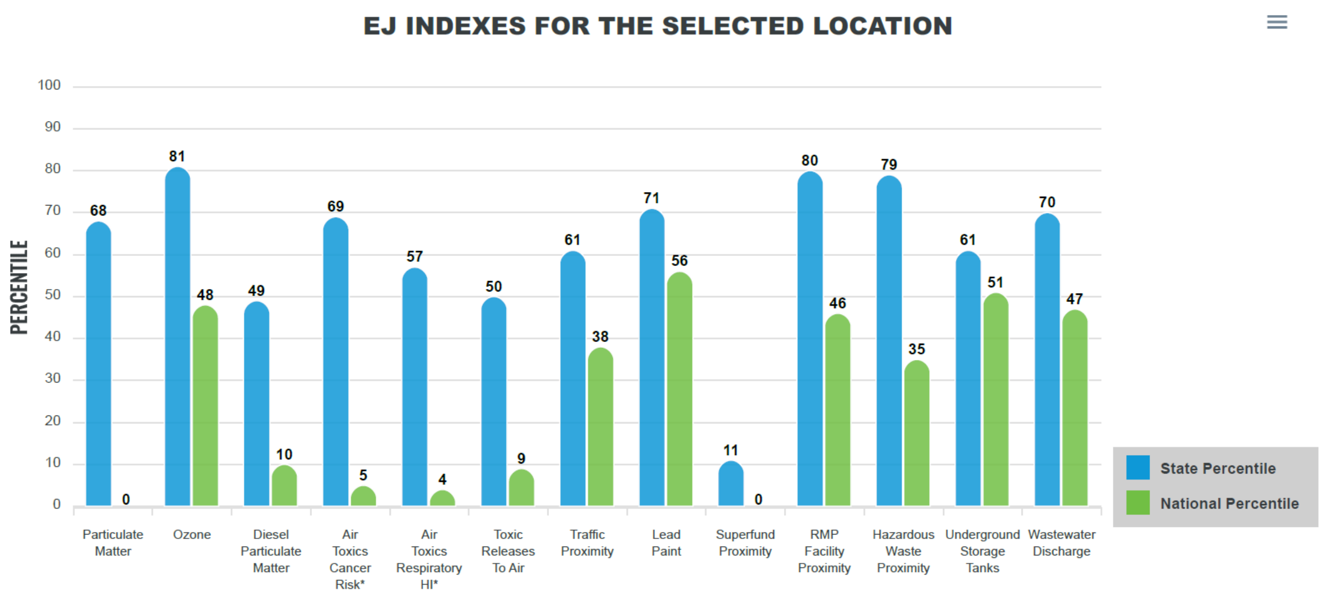
Fremont County Screening Information

The EPA used EJScreen to generate a Community Report for Fremont County, Wyoming. Information from this report is summarized in Figure 25.

[160] U.S. ENV'T PROT. AGENCY, *What is EJScreen?*, https://www.epa.gov/ejscreen/what-ejscreen (last visited Dec. 15, 2023).
[161] U.S. ENV'T PROT. AGENCY, *How Does EPA Use EJScreen?*, https://www.epa.gov/ejscreen/how-does-epa-use-ejscreen (last visited Dec. 15, 2023).

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.



SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	3.33	3.5	38	8.08	0
Ozone (ppb)	59.2	58.8	61	61.6	33
Diesel Particulate Matter (µg/m^3)	0.0465	0.109	36	0.261	3
Air Toxics Cancer Risk* (lifetime risk per million)	9.8	11	1	25	0
Air Toxics Respiratory HI*	0.098	0.13	1	0.31	0
Toxic Releases to Air	2.5	2,200	29	4,600	5
Traffic Proximity (daily traffic count/distance to road)	36	66	54	210	34
Lead Paint (% Pre-1960 Housing)	0.23	0.26	58	0.3	51
Superfund Proximity (site count/km distance)	0.0041	0.044	4	0.13	0
RMP Facility Proximity (facility count/km distance)	0.13	0.15	67	0.43	39
Hazardous Waste Proximity (facility count/km distance)	0.12	0.3	62	1.9	24
Underground Storage Tanks (count/km^2)	4.3	3.9	71	3.9	74
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.28	0.13	96	22	87

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
SOCIOECONOMIC INDICATORS					
Demographic Index	33%	22%	84	35%	56
Supplemental Demographic Index	15%	11%	78	14%	59
People of Color	31%	17%	87	39%	50
Low Income	36%	28%	71	31%	64
Unemployment Rate	9%	4%	83	6%	78
Limited English Speaking Households	0%	1%	0	5%	0
Less Than High School Education	8%	6%	68	12%	49
Under Age 5	7%	6%	63	6%	65
Over Age 64	19%	18%	58	17%	62
Low Life Expectancy	19%	18%	72	20%	48

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	19%	18%	72	20%	48
Heart Disease	6.6	5.7	76	6.1	62
Asthma	10.7	9.8	87	10	71
Cancer	6.6	6.4	50	6.1	59
Persons with Disabilities	14.3%	13.7%	58	13.4%	61

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	11%	11%	57	12%	68
Wildfire Risk	70%	71%	33	14%	87

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	17%	13%	72	14%	68
Lack of Health Insurance	20%	12%	91	9%	91
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	No	N/A	N/A	N/A	N/A

Figure 25. Fremont County EJScreen Community Report – EJ Indexes, Environmental (Pollution and Sources), Socioeconomic, Health and Climate Indicators, and Critical Service Gaps (highlighting added to show Fremont County percentages higher than state or national averages)

The EJScreen Community Report for Fremont County includes a population of 39,434 and an area of 9265.69 square miles. The Report indicates that EJ Indexes for ozone, RMP facility proximity, and hazardous waste proximity are around the 80% range and the Socioeconomic Indicators for People of Color,[162] Low Income, Unemployment Rate, Less Than High School Education, Under Age 5, and Over Age 64 are higher than the average state values, prompting additional investigation.

The Wastewater Discharge Environmental Indicator (Pollution and Sources) value for Fremont County is 0.28 compared to the State Average value of 0.13. The Wastewater Discharge Indicator quantifies a block group's

[162] The Fremont County EJScreen Community Report "Breakdown by Race" section provides further specifics on the *People of Color* category which includes the following for this screened area: White - 71%; Black - 1%; Asian - 0%; Hispanic - 8%; American Indian - 20%; Hawaiian/Pacific Islander - 0%; Other race: 2%; and Two or more races: 6%. EPA understands that "American Indian" largely correlates with Tribal membership.

relative risk of exposure to pollutants in downstream water bodies. EJScreen determines the Wastewater Discharge Indicator using pollutant loadings from the Discharge Monitoring Report (DMR) Loading Tool along with the Risk-Screening Environmental Indicators (RSEI) Model to estimate concentrations of pollutants in downstream water bodies and derive a toxicity-weighted concentration.[163] EJScreen is currently using wastewater discharge source data provided by the EPA's Office of Pollution Prevention and Toxics (OPPT) on March 15, 2021 from 2019 Risk-Screening Environmental Indicators (RSEI) modeled results.[164]

Table 1. Wyoming Counties with the highest Wastewater Environmental Indicator Values

County	Wastewater Discharge Environmental Indicator Value (State Average Value = 0.13)	State Percentile
Hot Springs County	1.4	98
Natrona County	0.43	97
Big Horn County	0.31	96
Fremont County	0.28	96
Washakie County	0.28	96

To investigate the Fremont County Wastewater Discharge Indicator in more depth, the EPA reviewed this indicator value for other Wyoming counties and found that Fremont County ranks 4th along with Washakie County out of the 23 Wyoming Counties, exceeded by the counties listed in Table 1. The three counties ranking at the 50th state percentile for Wastewater Discharge Environmental Indicator have values ranging from 0.00036 to 0.00038. These values show that Wyoming counties in general have low Wastewater Discharge Environmental Indicator values, compared with the U.S. average value of 22.

The EPA used the EPA Enforcement and Compliance History Online (ECHO) database Water Pollution Search[165] to investigate the DMR data available for Fremont County and identify the specific constituents that contribute to the Wastewater Discharge Environmental Indicator value. The EPA reviewed DMR data for Fremont County in 2019 (from 31 facilities) and in 2023 (from 42 facilities). The EPA examined 2019 data because that is the year of the source data used by EJScreen and 2023 data to review the most recently reported data.

Table 2. Top Pollutants by Toxic-Weighted Equivalent Pounds (TWPE) in 2019 and 2023 from DMR.[166]

Pollutant Name	TWPE 2019	TWPE 2023
Sulfide	170,507	313,276
Radium-226	120	114
Sulfate	21	12
Chloride	5	8

[163] U.S. ENV'T PROT. AGENCY, EJScreen Technical Documentation, October 2022, https://www.epa.gov/sites/default/files/2021-04/documents/ejscreen_technical_document.pdf, at 22-23.
[164] *Id*. at 13.
[165] U.S. ENV'T PROT. AGENCY, ECHO Water Pollution Search webpage. https://echo.epa.gov/trends/loading-tool/water-pollution-search (visited 2/1/2024).
[166] 2019 results: https://echo.epa.gov/trends/loading-tool/water-pollution-search/results?s=a17d9eb0d582f4aed5394a5b1e8164d67dea54bc (visited 2/20/2024).
2023 results: https://echo.epa.gov/trends/loading-tool/water-pollution-search/results?s=61815317eacaef33c68598fd712f52f516cf7463 (visited 2/20/2024).

Table 2 lists the top pollutants and their TWPE discharged under NPDES permits. TWPE is the mass of a pollutant or chemical discharged that accounts for its relative toxicity. To convert pollutant loadings into TWPE, the EPA multiplies the pollutant mass (in pounds) by its toxic weighting factor.[167] The top four pollutants listed are released from crude petroleum and natural gas facilities as identified by the associated Standard Industry Classification codes. The list of these facilities can be viewed at the links provided in the footnotes for Table X2. The EPA also reviewed information available for Fremont County in the RSEI Model through the EasyRSEI Dashboard version 2.3.11. RSEI uses information reported through the Toxic Release Inventory (TRI). The only facility in Fremont County reporting TRI data is the Chemtrade Refinery Services Inc facility, which reports air stack releases but not discharges to water.[168] This facility has an NPDES permit, which is discussed in more detail in Section 5.2.4.

Having reviewed the information contributing to the Wastewater Discharge Indicator value for Fremont County, the EPA does not have concerns about the value 0.13. As mentioned above, this low value ranks at the 96th State Percentile for Wyoming because Wyoming counties in general have low Wastewater Discharge Environmental Indicator values compared to the U.S. average of 22 for this Indicator.

The Health Indicators for Low Life Expectancy, Heart Disease, Asthma, Cancer, and Persons with Disabilities are all elevated in Fremont County compared to state and/or national averages. The Climate Indicator for Wildfire Risk is elevated compared to the U.S. average. Critical Service Gaps for Broadband Internet and Lack of Health Insurance are elevated compared to both the state and U.S. averages. EJScreen identifies this area as one that includes Indian Reservation Lands, a "Justice40 (CEJST)" disadvantaged community, and an EPA IRA disadvantaged community. This initial screening information prompted the EPA to review the additional community health information available through the University of Wisconsin Population Health Institute's County Health Rankings & Roadmaps (County Health Rankings & Roadmaps) program which produces county-wide health information throughout the country.[169] As shown in Table 3, the County Health Rankings & Roadmaps report ranks Fremont County as the least healthy of the 23 counties in Wyoming. Further information on the data and results is included below.

Table 3. Health Outcomes and Health Factors Rankings for Wyoming Counties[170]

		Health Outcomes		**Health Factors**	
State	County	Z-Score	Rank	Z-Score	Rank
Wyoming	Albany	-0.48	6	-0.65	2
Wyoming	Big Horn	0.08	15	0.48	20
Wyoming	Campbell	0.08	14	0.32	18
Wyoming	Carbon	0.47	18	0.56	21
Wyoming	Converse	-0.03	12	0.06	14

[167] U.S. ENV'T PROT. AGENCY, TRI and DMR Comparison Dashboard Help website (last visited 2/20/2024) https://echo.epa.gov/help/loading-tool/tri-dmr-comparison-dashboard-help#:~:text=TWPE%20Released%3A%20Toxic%20Weighted%20Pounds,toxic%20weighting%20factor%20(TWF).
[168] U.S. ENV'T PROT. AGENCY, EasyRSEI Dashboard version 2.3.11. https://edap.epa.gov/public/extensions/EasyRSEI/EasyRSEI.html (last visited 2/1/2024).
[169] COUNTY HEALTH RANKINGS & ROADMAPS, https://www.countyhealthrankings.org/explore-health-rankings/wyoming/fremont?year=2023 (last visited Nov. 29, 2023).
[170] COUNTY HEALTH RANKINGS & ROADMAPS, *2023 County Health Rankings Wyoming Data: Outcome & Factors Rankings*, https://www.countyhealthrankings.org/explore-health-rankings/wyoming/data-and-resources (last visited Feb. 25, 2024) (select "2023 Wyoming Data" hyperlink to download spreadsheet). See https://www.countyhealthrankings.org/health-data/methodology-and-sources/rankings-data-documentation for national data.

Wyoming	Crook	-0.38	9	-0.18	7
Wyoming	**Fremont**	**1.68**	**23**	**0.98**	**23**
Wyoming	Goshen	-0.09	11	-0.02	13
Wyoming	Hot Springs	1.14	22	-0.03	12
Wyoming	Johnson	-0.49	5	-0.42	4
Wyoming	Laramie	0.02	13	-0.21	6
Wyoming	Lincoln	-0.19	10	-0.12	9
Wyoming	Natrona	0.43	17	0.44	19
Wyoming	Niobrara	0.23	16	0.75	22
Wyoming	Park	-0.62	3	-0.49	3
Wyoming	Platte	0.59	20	0.19	17
Wyoming	Sheridan	-0.50	4	-0.14	8
Wyoming	Sublette	-0.46	7	-0.10	10
Wyoming	Sweetwater	0.58	19	0.14	15
Wyoming	Teton	-1.65	1	-1.26	1
Wyoming	Uinta	0.62	21	0.15	16
Wyoming	Washakie	-0.40	8	-0.40	5
Wyoming	Weston	-0.63	2	-0.06	11

Table 3 measures "Health Outcomes" and "Health Factors." "Health Outcomes" represents how healthy a county is right now, in terms of length of life and quality of life. For example, "Health Outcomes" includes data on premature death, percentage of adults reporting fair or poor health, poor physical health days, poor mental health days, and low birth weight. The full table shows how high the Fremont County score is compared to the rest of the counties in the state. The next highest county is Hot Springs County which is adjacent to Fremont County and includes the portion of the WRIR that is not in Fremont County. The county average for "Health Outcomes" in Wyoming is 0; Fremont County ranks 23rd with a score of 1.68.

"Health Factors" represent health conditions that can be modified to improve the length and quality of life for residents. For example, "Health Factors" incorporates data on Health Behaviors (such as adult smoking, adult obesity, physical inactivity, alcohol-impaired deaths, and teen births), Clinical Care (such as percent uninsured, ratio of health care providers to population, and preventable hospital stays), Social & Economic Factors (such as high school completion, unemployment, children in poverty, children in single-parent households and injury deaths) and Physical Environment (such as air pollution, drinking water violations, and severe housing problems). The county average for "Health Factors" in Wyoming is –0.01. Fremont County ranks 23rd with a score of 0.98.

Table 4. Health Outcomes and Health Factors Sub-rankings for Wyoming Counties[171]

	Length of Life		**Quality of Life**		**Health Behaviors**		**Clinical Care**		**Social & Economic Factors**		**Physical Environment**	
County	Z-Score	Rank	Z-Score	Rank	Z-Score	Rank	Z-Score	Rank	Z-Score	Rank	Z-Score	Rank
Albany	-0.54	2	0.06	14	-0.22	2	-0.11	4	-0.32	2	0.00	10
Big Horn	0.24	19	-0.16	8	-0.06	7	0.22	22	0.28	22	0.04	18
Campbell	-0.04	12	0.12	16	0.22	20	-0.03	9	0.11	17	0.02	14
Carbon	-0.07	10	0.54	23	0.19	19	0.08	19	0.25	21	0.03	16

171 *Id. Outcomes & Factors SubRankings.*

Converse	-0.28	7	0.26	18	0.02	14	0.06	18	0.07	14	-0.09	1
Crook	-0.15	9	-0.23	5	-0.02	12	0.01	14	-0.24	3	0.07	22
Fremont	**1.25**	**23**	**0.43**	**21**	**0.32**	**23**	**0.14**	**21**	**0.43**	**23**	**0.10**	**23**
Goshen	0.08	16	-0.17	7	0.08	17	-0.02	10	-0.09	10	0.01	13
Hot Springs	1.17	22	-0.03	12	0.09	18	-0.08	6	0.02	12	-0.07	3
Johnson	-0.41	4	-0.08	11	-0.08	6	-0.21	1	-0.08	11	-0.06	4
Laramie	-0.02	13	0.05	13	-0.03	10	-0.11	5	-0.12	7	0.04	19
Lincoln	-0.07	11	-0.12	9	-0.04	9	0.02	16	-0.13	5	0.03	15
Natrona	0.14	18	0.29	19	0.22	21	-0.01	11	0.23	19	-0.01	9
Niobrara	0.00	14	0.23	17	0.23	22	0.25	23	0.23	20	0.03	17
Park	-0.33	5	-0.29	3	-0.15	3	-0.16	3	-0.12	6	-0.05	6
Platte	0.51	21	0.08	15	0.03	15	0.12	20	0.06	13	-0.01	8
Sheridan	-0.28	6	-0.22	6	-0.02	11	-0.06	7	-0.09	9	0.04	20
Sublette	0.02	15	-0.48	2	-0.11	5	0.01	13	0.08	15	-0.08	2
Sweetwater	0.11	17	0.48	22	-0.05	8	-0.03	8	0.17	18	0.04	21
Teton	-0.90	1	-0.74	1	-0.57	1	-0.17	2	-0.52	1	0.00	11
Uinta	0.29	20	0.33	20	0.01	13	0.05	17	0.08	16	0.01	12
Washakie	-0.16	8	-0.24	4	-0.15	4	0.01	12	-0.21	4	-0.05	5
Weston	-0.54	3	-0.09	10	0.08	16	0.02	15	-0.11	8	-0.04	7

Table 4 presents sub-rankings for specific measures that contribute to the more general Health Outcomes and Health Factors. These measures include Length of Life, Quality of Life, Health Behaviors, Clinical Care, Social & Economic Factors, and Physical Environment. The County Health Rankings & Roadmaps report provides additional information related to Length of Life, including causes of premature death and disaggregation of premature death by race. The percentage of alcohol-impaired driving deaths in Fremont County is 62%, compared with 32% for Wyoming and 27% for the U.S. Children living in poverty is 19% for Fremont County, compared with 12% in Wyoming and 17% in the U.S. Children in single-parent households is 30% for Fremont County, compared with 19% in Wyoming and 25% in the U.S. The percentage of disconnected youth is 14% in Fremont County, compared with 7% in Wyoming and 7% in the US.

Wind River Indian Reservation Screening Information

The EPA generated an EJScreen Community Report for the three census tracts in Fremont County that are within the Wind River Indian Reservation as depicted in the map below.[172] Not all lands within the three census tracts are WRIR Indian country lands and the census tracts for City of Riverton are not included in the Report.[173] The EJScreen Community Report also excludes the relatively small northeast portion of the WRIR located in Hot Springs County. This Report is intended to provide general screening information for the WRIR.

[172] The three census tracts in Fremont County included in this EJScreen Community Report are tract numbers 56013940100; 56013940201 and 56013940202 with a population of 13,062 and an area of 3080.85 square miles.

[173] Due to a Tenth Circuit Court decision (*Wyoming v. EPA*, 875 F.3d 505 (10th Cir. 2017)) certain lands within the three census tracts and the City of Riverton are diminished from the Reservation. However, since much of the area within the three census tracts depicted in Figure 26 remains Reservation and Indian country land as defined at 18 U.S.C. § 1151 and because many Tribal members reside within the screening area, general demographic information for the broader area is presented herein.

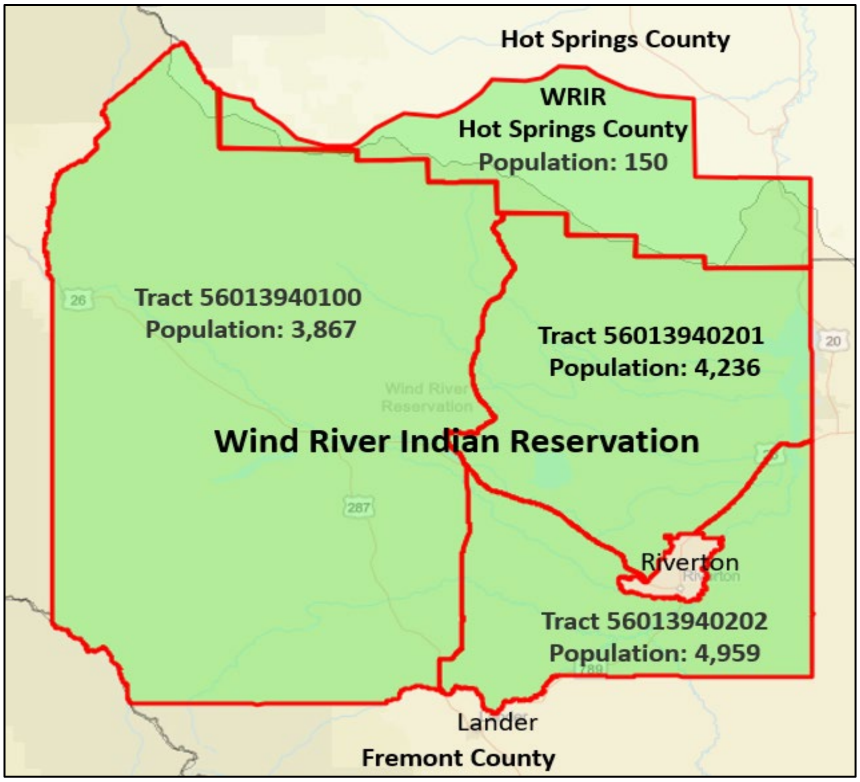
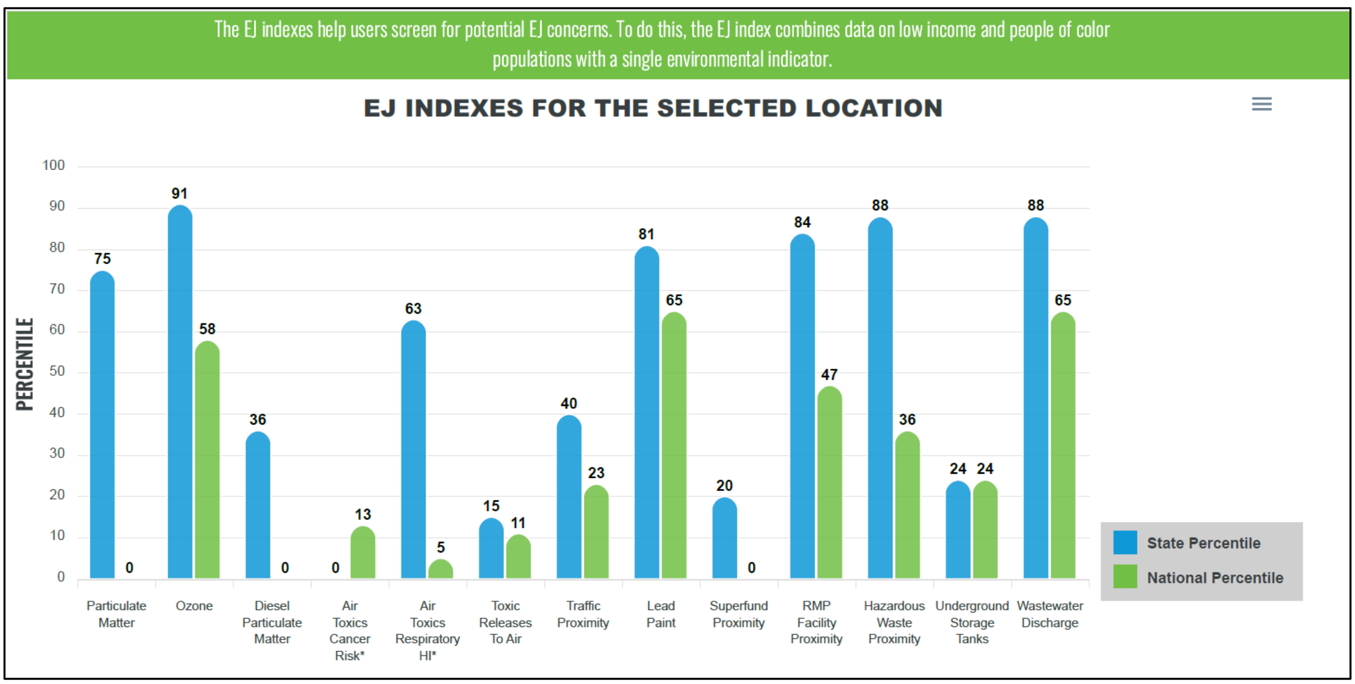


Figure 26. The EJScreen Community Report includes the three census tracts within the Wind River Indian Reservation in Fremont County, excluding the census tracts for the City of Riverton in Fremont County and the portion of the Hot Springs County census tract that includes Reservation land. This depiction of the Wind River Indian Reservation for this and all maps in this document are for illustrative and general purposes only (supra notes 9 and 173)



SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (μg/m^3)	3.25	3.5	36	8.08	0
Ozone (ppb)	58.7	58.8	53	61.6	29
Diesel Particulate Matter (μg/m^3)	0.0212	0.109	13	0.261	1
Air Toxics Cancer Risk* (lifetime risk per million)	10	12	0	28	1
Air Toxics Respiratory HI*	0.097	0.13	1	0.31	0
Toxic Releases to Air	1.4	2,200	28	4,600	5
Traffic Proximity (daily traffic count/distance to road)	3.3	66	15	210	9
Lead Paint (% Pre-1960 Housing)	0.16	0.26	48	0.3	44
Superfund Proximity (site count/km distance)	0.0041	0.044	4	0.13	0
RMP Facility Proximity (facility count/km distance)	0.086	0.15	47	0.43	24
Hazardous Waste Proximity (facility count/km distance)	0.085	0.3	58	1.9	17
Underground Storage Tanks (count/km^2)	0.019	3.9	28	3.9	23
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0012	0.13	67	22	50

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
SOCIOECONOMIC INDICATORS					
Demographic Index	47%	22%	96	35%	72
Supplemental Demographic Index	17%	11%	87	14%	68
People of Color	55%	17%	98	39%	69
Low Income	40%	28%	79	31%	69
Unemployment Rate	13%	4%	92	6%	87
Limited English Speaking Households	0%	1%	0	5%	0
Less Than High School Education	10%	6%	80	12%	59
Under Age 5	7%	6%	64	6%	66
Over Age 64	15%	18%	40	17%	46
Low Life Expectancy	20%	18%	80	20%	53

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	20%	18%	80	20%	53
Heart Disease	7	5.7	84	6.1	69
Asthma	11.9	9.8	98	10	90
Cancer	6	6.4	41	6.1	43
Persons with Disabilities	13.1%	13.7%	46	13.4%	54

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	11%	11%	61	12%	70
Wildfire Risk	44%	71%	24	14%	85

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	22%	13%	82	14%	78
Lack of Health Insurance	27%	12%	95	9%	97
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	No	N/A	N/A	N/A	N/A

Figure 27. Wind River Indian Reservation EJScreen Community Report for the three census tracts in Figure 26 - EJ Indexes, Environmental (Pollution and Sources), Socioeconomic, Health and Climate Indicators, and Critical Service Gaps (highlighting added to show WRIR percentages higher than state or national averages).

The EJScreen information for the three Fremont County census tracts that include portions of the WRIR indicates a population of 13,062 and an area of 3080.85 square miles. The EJ Index for Ozone is 91%, Lead Paint 81%, RMP Facility Proximity 84%, Hazardous Waste Proximity 88%, and Wastewater Discharge 88% compared to state percentiles. The Socioeconomic Indicators for People of Color, Low Income, and Unemployment Rate are significantly higher than both the state and U.S. averages. The EJScreen "Breakdown by Race" section explains that the People of Color category largely reflects an American Indian population for this screened area.[174] The indicator for Under Age 5 is slightly elevated compared to both the state and U.S. averages and the indicator for Less Than High School Education is higher than the state average. Low Life Expectancy, which is included as both a Socioeconomic Indicator and a Health Indicator, is higher than the state average. The Heart Disease and Asthma Health Indicators are elevated compared to the both the state and U.S. averages. The Climate Indicator for Wildfire Risk is elevated compared to the U.S. average. Critical Service Gaps for Broadband Internet and Lack of Health Insurance are elevated compared to both the state and U.S. averages and Transportation Access is flagged as a concern. EJScreen identifies this area as a "Justice40 (CEJST)" disadvantaged community. This initial screening information prompted the EPA to conduct further review of the environmental and health burdens on the Wind River Indian Reservation.

The Centers for Disease Control (CDC) Environmental Justice Index (EJI)[175] includes additional health vulnerability information, some of which is not included in EJScreen. The CDC Health Vulnerability measures indicate whether there is a high estimated prevalence of a pre-existing chronic disease, including asthma, cancer, high blood pressure, diabetes, and poor mental health, within a given census tract. The EJI shows there is a high estimated prevalence of asthma, diabetes, and poor mental health in the western and southeastern census tracts for Fremont County on the WRIR; the mid-eastern census tract does not indicate elevated risk, and the census tract for Hot Springs County that overlaps with a portion of the WRIR has a high estimated prevalence of cancer, high blood pressure, and diabetes.

As the WRIR is located within Fremont County, the County Health Rankings & Roadmaps report described above is relevant to the health conditions on the Reservation. The report also shows that four times as many of the premature deaths in Fremont County were Native Americans. The percentage breakdown of the cause of death is shown in Table 5.[176]

[174] The EJScreen "Breakdown by Race" section explains that in the screened area, the *People of Color* category reflects: White - 48%; Black - 0%; Asian - 0%; Hispanic - 5%; American Indian - 47%; Hawaiian/Pacific Islander - 0%; Other race: 1%; and Two or more races: 5%. EPA understands that "American Indian" largely correlates with Tribal membership as this analysis is focused on an Indian Reservation with two federally recognized Tribes.

[175] Agency for Toxic Substances and Disease Registry, *Environmental Justice Index*, https://www.atsdr.cdc.gov/placeandhealth/eji/index.html (last visited Nov. 17, 2023).

[176] Premature Mortality includes all deaths among people under age 75 and the rates are age-adjusted to the US 2000 population. Since counties have different age make-ups, age-adjustment can help in comparing health measures between counties. *CDC Wonder*, Ctrs. for Disease Control & Prevention, https://wonder.cdc.gov/WelcomeT.html (last visited Nov. 17, 2023); *Premature Death: Wyoming*, Cnty. Health Rankings & Roadmap, https://www.countyhealthrankings.org/explore-health-rankings/county-health-rankings-model/health-outcomes/length-of-life/premature-death?state=56&year=2023#map-anchor (last visited Nov. 17, 2023).

Table 5. Breakdown of the causes of premature death by percentage.[177]

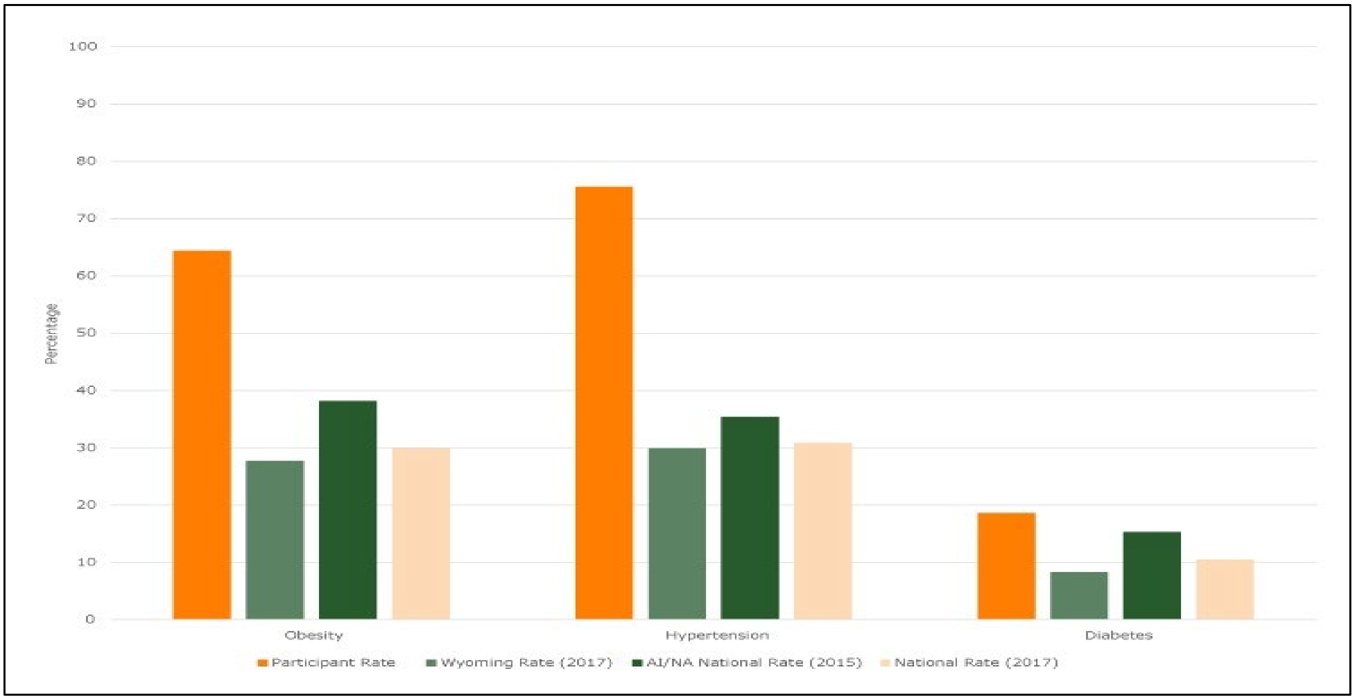
Percentage of Premature Deaths	Cause of Death
31%	malignant neoplasms*
24%	heart disease
20%	accidents
16%	liver disease
9%	chronic lower respiratory disease

*The term "neoplasm" refers to an abnormal growth of tissue. The term "malignant" means the tumor is cancerous and is likely to spread (metastasize) beyond its point of origin.

Additional Tribal health information was collected for a 2019 abstract entitled, *Adult Health Status Among Native American Families Participating in the Growing Resilience Home Garden Study w*hich found that the participant members of the Northern Arapaho and Eastern Shoshone living on the WRIR in Wyoming suffer worse average health status than adults at state and national levels, including among American Indians/Alaska Natives (AIs/ANs) at large. The obesity rate is 70% higher than the national AI/AN average, hypertension rates are more than double, and high LDL cholesterol rates are one-third higher. The diabetes rate is 2.3 times the Wyoming average and 23% higher than AI/AN averages. The 65% food insecurity rate is more than 10 times the national 30-day rate.[178]

[177] *Fremont, WY (2023)*, CNTY. HEALTH RANKINGS & ROADMAPS, https://www.countyhealthrankings.org/explore-health-rankings/wyoming/fremont?year=2023 (last visited Nov. 15, 2023) (select "Premature Death" to find Leading Causes of Death Under Age 75 in Fremont (FR) County table).

[178] Christine M. Porter et al., *Adult Health Status Among Native American Families Participating in the Growing Resilience Home Garden Study*, 16 PREVENTING CHRONIC DISEASE (2019).



Metric	Study Participant Rates, 2016–2018 %	Rates in Wyoming, 2017	American Indian/Alaska Native National Rates, 2015	US National Rates, 2017
Obesity	64	28	38	30
Hypertension	76	30	35	31
Diabetes	19	8	15	11

Figure 28. Tribal health information compared with state and national rates. State and national data are from the Behavioral Risk Factor Surveillance System (6,7). Abbreviation: AI/AN, American Indian/Alaska Native (from Christine M. Porter, et al.).

The abstract acknowledges limitations in that the small sample size constrained analyses by sex or age, and data were not taken from a random sample. The study concludes that although results may not be fully generalizable to the WRIR adult population, the severity of poor health in this sample suggests that WRIR communities are living with enormous health challenges. The study states that the data also comprise the most complete set that is publicly available about adult health status on the Reservation.

As indicated by EJScreen and the County Health Rankings & Roadmaps report information, the increased vulnerabilities in Fremont County and on the WRIR may be attributable to an accumulation of negative or lack of positive environmental, health, economic, or social conditions within these populations or places. Multiple factors, including environmental and socio-economic stressors, may act cumulatively to affect health and the environment and contribute to persistent environmental and health disparities. The screening information indicates that Fremont County and the Wind River Indian Reservation are overburdened communities, in that they include low income, Tribal, and Indigenous populations experiencing disproportionate environmental harms and risks, which correlates with greater exposure and vulnerability to environmental hazards, health related impacts, or other factors.

5.1.2 Drinking Water Challenges in Rural and Underserved Communities

The EPA recognizes that not everyone experiences water quality equally. The nation's health and wellbeing are dependent on equitable access to drinking water, wastewater, and water quality planning, but thousands of communities nationwide are burdened by aging systems that threaten public health. In addition, there are communities that have never had adequate water service and infrastructure. Pollution and climate change exacerbate the impacts of the lack of modern infrastructure and contribute to health disparities in these communities.[179] For this reason, the EPA Office of Water is focused on providing resources to underserved communities including low-income, smaller, and rural communities disproportionately impacted by water related challenges.[180] The EPA is committed to prioritizing equity, environmental justice, and the lived experience of those most impacted by water pollution and is working to ensure all communities in America have access to safe drinking water and effective wastewater management.[181]

EO 14096 recognizes that communities with environmental justice concerns experience disproportionate and adverse human health or environmental burden arising from a number of causes that may include inequitable access to clean water and underinvestment in basic infrastructure and services, including safe drinking water.[182] Small towns and rural communities are critical to the progress and prosperity of our nation but face significant challenges with drinking water and wastewater infrastructure. The EPA has noted that small water systems often face unique financial and operational challenges, including aging infrastructure, workforce shortages including trained and certified treatment plant operators, increasing costs, and declining rate bases.[183] Rural communities and communities with EJ concerns often experience historic inequities, systemic barriers, and disproportionate environmental and health impacts, including with respect to drinking water challenges. Congress has recognized these challenges by enacting legislation to provide additional drinking water infrastructure support to small, underserved, and disadvantaged communities.[184]

According to the Wyoming Association of Rural Water Systems (WARWS) and the National Rural Water Association (NRWA), over 91% of the approximately 50,000 community water systems in the U.S. serve fewer than 10,000 persons and 81% serve fewer than 3,300 persons. Small and rural communities often have difficulty complying with complicated federal mandates and providing safe/affordable drinking water and sanitation due to limited economies of scale and lack of technical expertise. The bulk of Wyoming's systems serve under 1,000 people and may experience challenges due to a number of factors including size, expertise, personnel costs, energy costs, and supply chain issues impacting water treatment chemicals and availability of parts. Fremont

179 U.S. Env't Prot. Agency, Pub. No. 850B22001, National Water Program Guidance: FY 2023-2024, 5 (2022) (hereinafter "OW National Water Program Guidance"), https://www.epa.gov/system/files/documents/2022-10/fy-2023-2024-ow-npg_1.pdf. The NCA5 report also states, "Older adults, children, and residents of low-income neighborhoods and rural areas are at greatest risk of exposure to pathogens and pollutant from climate-change driven impacts to water quality." NCA5, Payton et al., s*upra* note 100, at 4-19 (internal citations omitted).

180 *Id.* at 9.

181 *Id.* at 6.

182 EO 14096, *supra* note 153, at 25251.

183 Press Release, U.S. Env't Prot. Agency, EPA Announces $25.7 Million in Grants to Support Water Systems in Rural and Small Communities (Dec. 12, 2022), https://www.epa.gov/newsreleases/epa-announces-257-million-grants-support-water-systems-rural-and-small-communities.

184 The *Water Infrastructure Improvements for the Nation Act (WIIN Act)* addresses, supports, and improves America's drinking water infrastructure. Included in the WIIN Act drinking water grants are grants focused on small, underserved, and disadvantaged communities. The 2023 *Bipartisan Infrastructure Law* includes grant funding to communities through the EPA's Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) Grant Program to promote access to safe and clean water in small, rural, and disadvantaged communities while supporting local economies.

County has developed a guide, *Tips for Rural Living,*[185] to inform citizens of potential challenges associated with living in rural areas where the county government may not be able to provide the same level of service that city governments with larger populations provide such as road maintenance, sewer services, and water supply services. The guide notes that public water or sewer and other services may or may not be available in rural areas. Due to water rights issues, property owners should not assume they can use water flowing across their property and should contact the servicing water district to see if they have access to a supply of treated domestic water. If not, the guide notes that residents will need to locate an alternative domestic water supply with the most common method being the use of a water well. The quality and quantity of well water can vary considerably from location to location and from season to season. It may also be difficult to find enough water to provide for residents' needs even after securing the proper permit. Cisterns (water tanks) are another alternative. The guide also provides helpful information for rural residents that may experience more severe impacts from climate and weather conditions. The challenges described in this guide highlight the heighten equity concerns in rural areas where people more often reside in underserved communities, including those with drinking water infrastructure challenges and greater reliance on groundwater sources. In 2015 61% of the Fremont County population relied on groundwater for a water supply (31% on groundwater-based PWSs; 29% on domestic wells).[186]

5.1.3 Climate and Climate Change Impacts in Overburdened Communities

This section addresses the nexus between climate change and environmental justice, specifically the manner in which climate conditions and climate change exacerbate disproportionate impacts already being experienced in overburdened communities such as those in Fremont County and on the Wind River Indian Reservation.

The EPA's Office of Water (OW) developed a 2022-2026 Climate Adaptation Implementation Plan entitled, "Advancing Climate Change Adaptation and Resilience Through EPA's Water Programs" that sets forth the priorities guiding OW's work over the next several years to support states, communities, and the water sector in their efforts to adapt to a changing climate. With respect to challenges in overburdened communities, the OW Climate Adaptation Implementation Plan states:

> communities of color, low-income communities, and rural populations face disproportionately high pollutant exposures, including exposure to drinking water contamination and impaired water quality (Schaider et al., 2019). Because of existing impairments, these communities will face greater challenges in meeting water quality goals for drinking water and surface waters as the climate changes. Increasing costs for water treatment and water infrastructure upgrades and repairs will create a significant barrier for protecting and improving water quality. For example, as discussed above, rate hikes to cover increased costs can decrease water service affordability and jeopardize access to clean, safe water for low-income customers or those already facing economic hardships. Furthermore, communities of color and low-income communities often experience capacity barriers in securing financing for water management projects that offer climate resilience. Decision-makers in these communities often lack the staff and access to the information needed to secure resources for climate risk assessment, planning, and project implementation. Rural water systems frequently have fewer ratepayers to share the cost of system improvements. Rural, agriculturally-focused communities may face additional

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[185] FREMONT COUNTY, WYO., *Tips for Rural Living*, https://www.fremontcountywy.org/government/departments/planning_department/tips_for_rural_living.php (last visited Nov. 15, 2023).

[186] Based on EPA calculations using data from Dieter et al., supra note 118.

economic hardship as climate variability makes crop production—and associated water quality management challenges—more uncertain and difficult.[187]

In 2021, the EPA prepared a report entitled, *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts* (EPA Climate Change and Social Vulnerability Report).[188] This Report explains that those who are already vulnerable due to a range of social, economic, historical and political factors have a lower capacity to prepare for, cope with, and recover from climate change impacts. This inequality can lead to communities being more likely to suffer harm from the impacts of climate change. Additionally, children, older adults, and people with disabilities or pre-existing health conditions may be more susceptible to the environmental and health impacts of climate change. The EPA Climate Change and Social Vulnerability Report contributes to a better understanding of the degree to which four socially vulnerable population categories—defined based on income, educational attainment, race and ethnicity, and age—may be more exposed to the highest impacts of climate change.

The EJScreen Reports for Fremont County and the Wind River Indian Reservation indicate the vulnerabilities for these population categories. The low-income population is 36% in Fremont County and 40% on the Wind River Indian Reservation compared to the state average of 28%. The unemployment rate is 9% in Fremont County and 13% on the WRIR compared to the state average of 4%. The EPA Climate Change and Social Vulnerability Report found that low-income individuals are more likely than their reference population to currently live in areas with the highest increases in childhood asthma diagnoses from climate-driven changes in PM2.5; the highest percentage of land lost to inundation; the highest increases in mortality rates due to climate-driven changes in extreme temperatures; the highest rates of labor hour losses for weather-exposed workers due to extreme temperatures; and the highest increases in traffic delays associated with high-tide flooding. Low-income households may live in aging or poorly constructed buildings that lack adequate cooling during heat waves. These households may also struggle to prepare for and recover from storms, floods, and other climate-related disasters. Those with limited financial resources also may lack adequate health insurance or access to health care.

The average population lacking health insurance is 20% in Fremont County and 27% on the WRIR compared to the state average of 12%. Climate change can exacerbate existing health threats or create new public health challenges through a variety of pathways which can then lead to negative effects on health such as heat-related illnesses, cardiopulmonary illnesses, food-, water-, and vector-borne diseases, and mental health consequences and stress.[189] Socially vulnerable groups, including low-income populations and communities of color, low-

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[187] CLIMATE ADAPTATION IMPLEMENTATION PLAN, *supra* note 69. The EPA's OW National Water Program Guidance for FY 2023-2024 reinforces the vulnerability of underserved and overburdened communities to impacts from climate change. "Climate stress is often experienced as water stress through drought, flooding, and sea level rise, as well as more frequent extreme storms that increase the amount of polluted runoff entering our waterways and challenge the operational and infrastructure resilience of water utilities. Overburdened and underserved communities and individuals are particularly vulnerable to these impacts. Likewise, climate change has direct and cascading effects on water resources that vary across regions and watersheds, presenting a wide range of risks to natural and human systems. Climate change acts as a threat multiplier, exacerbating existing stressors that degrade the quality of our waterways and destabilizing critical water infrastructure we all rely upon." OW National Water Program Guidance, *supra* note 179, at 7.

[188] U.S. ENV'T PROT. AGENCY, EPA 430-R-21-003 (2021). https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf (hereinafter "EPA Climate Change and Social Vulnerability Report").

[189] U.S. ENV'T PROT. AGENCY, *Understanding the Connections Between Climate Change and Human Health*, https://www.epa.gov/climate-indicators/understanding-connections-between-climate-change-and-human-health (last updated Aug. 14, 2023).

income populations, certain immigrant groups, and those with limited English proficiency may have additional challenges with respect to their abilities to prepare for, and cope with, climate hazards. These groups may be more at risk because they live in locations that are prone to climate-related health hazards, experience greater rates of existing medical conditions, live in urban or rural areas with poorly maintained or aging infrastructure, may experience difficulties in accessing resources and care during or following extreme weather events, and may have limited financial resources or cultural, language, or citizenship barriers that restrict access to critical services and health needs.[190] With respect to existing health conditions, heart disease indicators are 6.6% in Fremont County and 7% on the WRIR compared to the state average of 5.7%; asthma indicators are 10.7% in Fremont County and 11.9% on the WRIR compared to the state average of 9.8%; and cancer rates in Fremont County are 6.6% compared to 6.4% average in the state. The higher percentage of the population lacking health insurance in these communities as compared to the state, further exacerbates climate-related health threats.

The Persons with Disabilities population average is 14.3% in Fremont County compared to 13.7% in the state. Persons with disabilities may be more vulnerable to climate change than the general population for a number of reasons. Emergency warnings and other important messages may not be designed with accessibility in mind. This can make it difficult for people with disabilities (such as those with low vision or blindness, hearing loss, or mobility issues) to plan for extreme weather events. They may need ongoing medical care, which can be disrupted before, during, and after a natural disaster or extreme weather event. People with disabilities are more likely to experience social and economic risk factors, such as poverty and unemployment, that put them at greater risk.[191]

The EJScreen Report socioeconomic indicator for Less Than High School Education is 8% in Fremont County and 10% on the WRIR compared to 6% in the state. The socioeconomic indicator for Over Age 64 is 19% in Fremont County compared to 18% in the state. Specific to the Northern Great Plains Region, the EPA Climate Change and Social Vulnerability report notes that those ages 65 and over are 15% more likely than younger individuals to currently live in areas with the highest projected inland flooding damages, and those with no high school diploma are 19% more likely than those with a high school diploma to currently live in areas with the highest projected labor hour losses for weather-exposed workers due to extreme temperatures.[192] The lack of broadband internet, another critical service gap, is 17% in Fremont County and 22% on the WRIR compared to the state average of 13%.

In conclusion, this section of the analysis identifies disproportionate environmental and health burdens in the Wind River Basin, including in Fremont County and on the Wind River Indian Reservation, where many of the environmental, socioeconomic, and health indicators are elevated compared to state and national averages. Fremont County, which includes the WRIR, is largely comprised of rural areas where drinking water infrastructure challenges may exist as discussed in the County's guidance. Equity concerns are heightened in rural areas where people more often reside in underserved communities, including those with drinking water infrastructure challenges and greater reliance on groundwater sources. The existing socioeconomic and health vulnerabilities in these communities make them even more susceptible to adverse impacts from climate change, which include impacts to health and to existing and future water sources. Further analysis is provided below on equity and environmental justice considerations for the Wind River Indian Reservation, including discussion of cumulative impacts to water and health on the Reservation. The final sub-section discusses cumulative impacts

[190] *Climate Change and the Health of Socially Vulnerable People*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/climateimpacts/climate-change-and-health-socially-vulnerable-people (last updated Oct. 16, 2023).
[191] *Understanding the Connections Between Climate Change and Human Health, supra* note 189.
[192] EPA Climate Change and Social Vulnerability Report, *supra* note 188, at 84.

to health and the environment in the Wind River Basin from the Moneta Divide oil and gas development projects and other activities.

5.2 Environmental Justice and Tribal Considerations on the Wind River Indian Reservation

The Northern Arapaho and Eastern Shoshone Tribes raised environmental justice concerns regarding disproportionate health and environmental impacts, including to water resources, on the Wind River Indian Reservation. While there is overlap in assessing EJ and equity considerations on the WRIR with those of the Wind River Basin more broadly, this section focuses specifically on Tribal interests, consistent with the federal government's trust relationship with the Northern Arapaho and Eastern Shoshone Tribes. The Northern Arapaho Tribe and the Eastern Shoshone Tribe are separate sovereign federally recognized Tribes that jointly occupy and govern on the Wind River Indian Reservation located primarily in Fremont County and partially in Hot Springs County, Wyoming.

The Northern Arapaho Tribe of Wyoming is one of four groups of Arapaho who originally occupied the headwaters of the Arkansas and Platte Rivers. They speak a variation of the Algonquin language and are the Arapaho People's most southwest extension. Tribal departments include the Arapaho Language and Culture Commission, Water and Sewer, Economic Development Commission, and Housing and Education programs. The Northern Arapaho Tribe has a vibrant culture and community and is governed by a six-member Business Committee and Tribal Code.

The Eastern Shoshone Tribe describes its presence in the Wind River Range and its environs as extending back for 12,000 years. Tribal programs include support for an Eastern Shoshone Cultural Center, Buffalo Enclosure program, Education program, and creation of an Oral History Project. The Eastern Shoshone Tribe holds a strong commitment to its rich culture and community and is governed by a six-member Business Committee and Tribal Code.

The Northern Arapaho Tribe and the Eastern Shoshone Tribe have jointly established a "Law and Order Code of the Shoshone and Arapaho Tribes of the Wind River Indian Reservation, Wyoming" that includes a Title XI, "Regulation of Natural Resources and Land." This Title sets forth a Tribal Water Code that established the Tribes' Water Resources Control Board and the Office of the Tribal Water Engineer and identifies key uses of water on the Reservation including agriculture, drinking water, fisheries, and cultural ceremonies.

The Wind River Indian Reservation is located within the Wind River Climate Division and the Wind River Basin. As depicted in Figure 29 below, the WRIR is located approximately 25 miles from the Marlin well. Both the Eastern Shoshone and Northern Arapahoe Tribal governments indicated an interest in the EPA's aquifer exemption decision, raising among other issues, concerns about climate change, environmental justice, and protection of water resources. This section of the analysis focuses on Tribal government interests and concerns. The first sub-section includes summary information about Tribal histories related to the land and water resources in the area followed by information on the EPA's consultation discussions and concerns raised by the Northern Arapaho and Eastern Shoshone Tribal governments. The next sub-sections discuss climate change impacts on Indigenous Peoples and information on cumulative water impacts on the WRIR related to potential future water needs.

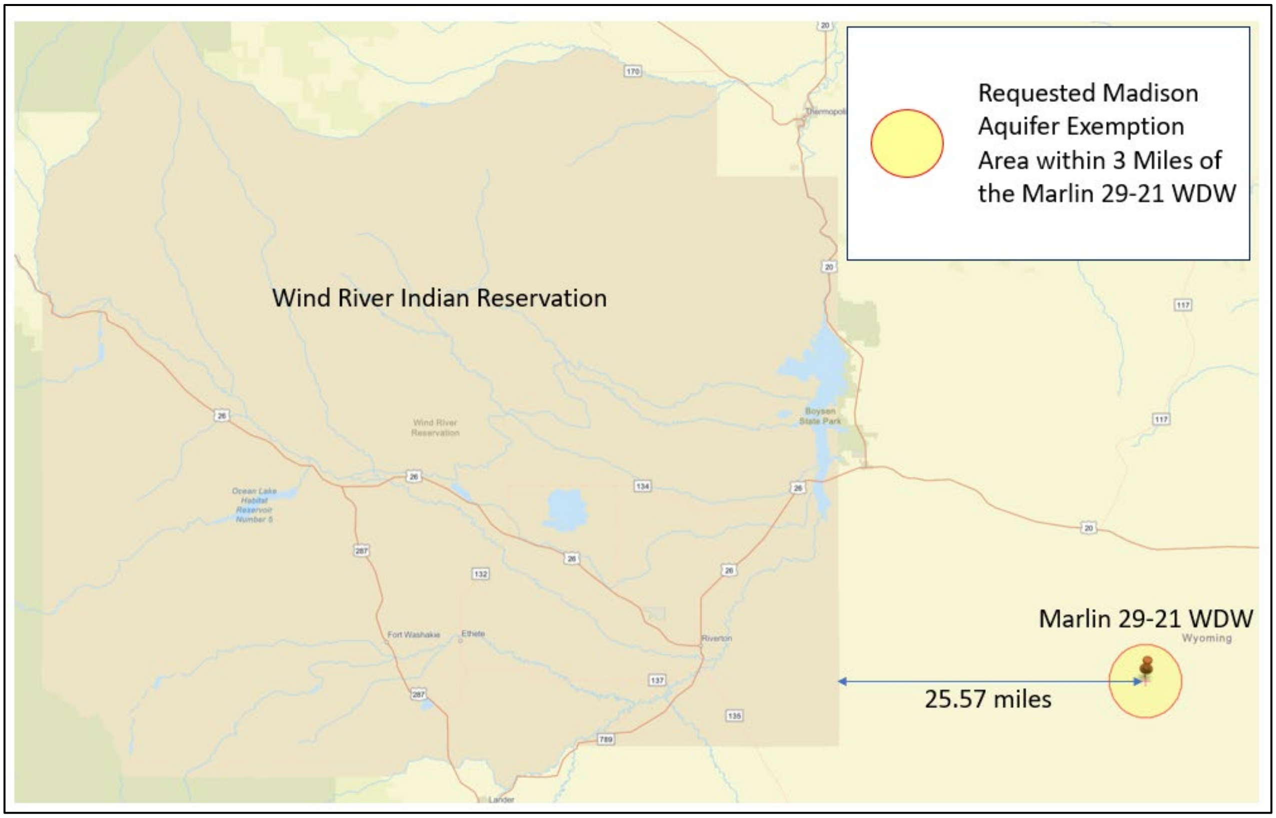

Figure 29. The location of the Marlin 29-21 WDW well relative to the Wind River Indian Reservation. The depiction of the Wind River Indian Reservation for this and all maps in this document are for general reference purposes only (see supra notes 9 and 173)

5.2.1 Historical Context

The Shoshone Indian Tribe's occupation of the Wind River country well preceded the formal establishment of the Wind River Indian Reservation by treaty in 1868. The Shoshone Tribe historically hunted game and gathered food throughout an 80-million-acre territory that now comprises the states of Colorado, Idaho, Nevada, Utah and Wyoming.[193] The California Gold Rush and the Mormon westward migration in the 1840's brought an increasing number of travelers and settlers to this territory. The influx of settlers led to competition for game and resulted in inevitable conflicts among the settlers and Indians.[194] The 1862 Homestead Act, 12 Stat. 392 (1862) further encouraged settlement in western territories. The United States negotiated a series of treaties with the various bands of Shoshone, including the 1863 Treaty of Fort Bridger, 18 Stat. 685 (1863) with the Eastern Shoshone. This (First) Fort Bridger Treaty between the United States and the Eastern Shoshones established routes for travel for people emigrating west as well as for communications and railroad passage and described the boundaries of "Shoshonee country" as an area encompassing approximately 44,672,000 acres of land located in what are now the states of Colorado, Utah, Idaho and Wyoming.[195]

The end of the Civil War in 1865 and population growth led to further western migration and the United States negotiated a new treaty that would further restrict the area of Shoshone occupancy. In the Second Fort Bridger Treaty of 1868, the Tribe ceded to the United States its right to occupy the 44 million acres described in the First Fort Bridger Treaty in exchange for exclusive occupancy of a far smaller Reservation in the Wind River region.

[193] Northwestern Bands of Shoshone Indians v. United States, 324 U.S. 335, 340 (1945).
[194] *Id.* at 341.
[195] United States v. Shoshone Tribe of Indians of the Wind River Reservation in Wyoming, 304 U.S. 111, 113 (1938).

The 1868 Treaty set apart a 3,054,182-acre Reservation for "the absolute and undisturbed use and occupation of the Shoshonee Indians . . . and the United States now solemnly agrees that no persons except those herein designated and authorized so to do . . . shall ever be permitted to pass over, settle upon, or reside in the territory described in this article for the use of said Indians . . . ." 15 Stat. 673, 674. See also Shoshone, 304 U.S. at 113. Thus, the Wind River Indian Reservation was established by the treaty among the United States, the Eastern Band of the Shoshonee and the Bannack Tribe of Indians.[196]

The Northern Arapaho Tribe of Wyoming is one of four groups of Arapaho that originally occupied parts of Colorado, Kansas, Montana, Nebraska, and Wyoming.[197] By 1811, the Arapaho occupied an area that ranged primarily along the North Platte River and as far south as the Arkansas River. Buffalo hunting was a primary means of subsistence and of cultural significance to the Tribe.[198] In 1851, the Arapaho was one of a number of Tribes that signed the Treaty of Fort Laramie.[199] Pursuant to the 1851 Treaty, the Arapaho and Cheyenne Tribes' territory encompassed areas of southeastern Wyoming, northeastern Colorado, western Kansas and western Nebraska.[200] Despite this treaty, entry by settlers began to occur in Arapaho territory. As a result of game disturbance and other factors, the Northern Arapaho Tribe began to withdraw north of the Platte River into Wyoming and Montana.[201] In 1868, the Northern Arapaho Tribe and the United States entered into another treaty whereby the Tribe agreed to accept either some portion of Medicine Lodge Creek, an area on the Missouri River near Ft. Randall, or the Crow Agency near Otter Creek on the Yellowstone River.[202] Between 1870 and 1877, the Northern Arapaho Tribe was not settled upon any defined reservation and continued to negotiate with the United States for a separate reservation.[203] In 1878, following a visit to Washington, D.C. by a delegation of the Northern Arapaho Tribe, and as recognized by the United States executive branch, the Northern Arapaho Tribe settled on the Wind River Indian Reservation.[204]

This very abridged summary of the extent of the historical territories of the Eastern Shoshone Tribe and Northern Arapaho Tribe is important to understand historic and ongoing inequities with regard to the Tribes' connections to land and water. The history informs the vast breadth of the Tribes' respective ties to lands and resources well beyond the present-day Reservation and the inequities experienced by the Tribes with regard to land and water resources in which the Tribes continue to hold significant interests.[205] The Reservation is the Tribes' permanent homeland and as they cannot move elsewhere if water resources in and around the Reservation are degraded, they maintain a strong interest in the protection of potential existing and future

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196 The Wind River Indian Reservation was established for the Eastern Shoshone, while the Bannack Tribe (today formally known as the Shoshone-Bannock Tribes of the Fort Hall Reservation) selected a Reservation in southeastern Idaho. *See Swim v. Bergland*, 696 F.2d 712, 714 (9th Cir. 1983).

197 *See* Loretta Fowler, *Arapaho*, in HANDBOOK OF NORTH AMERICAN INDIANS VOLUME 13, PART 2 OF 2, 840-41 (Raymond J. DeMallie, ed., 2001).

198 *Id*. at 842, 847-48.

199 11 Stat. 749 (1851).

200 Fowler, *supra* note 197**Error! Bookmark not defined.**, at 842.

201 *Id*.

202 15 Stat. 655, 656 (1868).

203 Fowler, *supra* note **Error! Bookmark not defined.**197, at 843.

204 *Id.*

205 The Council on Environmental Quality *Guidance for Federal Partners and Agencies on Indigenous Knowledge* states, "Persons affiliated with Tribes and Indigenous Peoples continue to face historical inequities and experience the impacts of intergenerational trauma resulting from a vast loss of homelands and the legacy of detrimental federal policies attempting to separate Tribes and Indigenous Peoples from their culture, including relationships with land, waters, and basic social systems." Memorandum for Heads of Federal Departments and Agencies, CEQ Office of Science and Technology Policy, *Guidance for Federal Partners and Agencies on Indigenous Knowledge* (November 30, 2022) https://www.whitehouse.gov/wp-content/uploads/2022/12/OSTP-CEQ-IK-Guidance.pdf (last accessed, Jan. 22, 2024).

water resources. This historic context lays the foundation for the environmental justice concerns raised by the Tribes and reinforces the Tribes' strong interest in water resources, including the potential future use of groundwater resources in and around the Wind River Indian Reservation.

5.2.2. Tribal Interests and Tribal Consultation

The EPA is committed to consulting with Tribal governments on actions or decisions that may affect Tribes. On December 7, 2023, the Agency released the EPA Policy on Consultation with Indian Tribes[206] which revises its 2011 EPA Policy on Consultation and Coordination with Indian Tribes. The EPA's policy is to consult on a government-to-government basis with federally recognized Tribal governments when EPA actions or decisions may affect Tribes. The EPA's Tribal consultation responsibilities consistent with EO 13175 are distinct from the agency's equity and environmental justice responsibilities under EOs 14096 and 12898. The EPA's consideration of Tribal government interests under EO 13175 stem from the federal government's unique relationship with federally recognized Tribes. As discussed below, the EPA consulted with the Eastern Shoshone and Northern Arapaho Tribes of the Wind River Indian Reservation. Engagement with both Tribes was consistent with the procedures discussed in both the previous and updated EPA consultation policies.

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* directs federal agencies to establish regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have Tribal implications, to strengthen the United States government-to-government relationships with Indian Tribes, and to reduce the imposition of unfunded mandates upon Indian Tribes.[207] This EO recognizes the right of Indian Tribes to self-government, supports Tribal sovereignty and self-determination and reaffirms the trust relationship between the federal government and federally recognized Indian Tribes as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions.[208] The EPA has a long-standing commitment to work directly with federally recognized Tribes as partners on a government-to-government basis to protect Tribal health and environments, as set forth in the EPA's Policy for the Administration of Environmental Programs on Indian Reservations (EPA Indian Policy)[209] and related Headquarters and Regional policy statements and guidance documents. The EPA Indian Policy, reaffirmed by each EPA Administrator since its adoption, recognizes the importance of ensuring close involvement of federally recognized Tribal governments in making decisions and managing environmental programs affecting their areas and members. In 1996, the EPA Region 8 adopted a parallel Policy for Environmental Protection in Indian Country.[210]

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[206] U.S. ENV'T PROT. AGENCY, EPA Policy on Consultation with Indian Tribes, (2023) https://www.epa.gov/system/files/documents/2023-12/epa-policy-on-consultation-with-indian-tribes-2023_0.pdf

[207] Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, directs federal agencies to establish regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have Tribal implications, to strengthen the United States government-to-government relationships with Indian Tribes, and to reduce the imposition of unfunded mandates upon Indian Tribes. Exec. Order No. 13175, 65 Fed. Reg. 67249 (Nov. 9, 2000) (hereinafter "EO 13175"). EO 13175 recognizes the right of Indian tribes to self-government and supports tribal sovereignty and self- determination and reaffirms the trust relationship between the federal government and federally recognized Indian tribes as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions.

[208] *Id.*

[209] U.S. ENV'T PROT. AGENCY, EPA POLICY FOR THE ADMINISTRATION OF ENVIRONMENTAL PROGRAMS ON INDIAN RESERVATIONS (1984). The Policy was issued by then-Administrator William D. Ruckelshaus and is available at https://www.epa.gov/sites/default/files/2015-04/documents/indian-policy-84.pdf. This memorandum was recently reaffirmed by President Biden.

[210] EPA REGION 8 POLICY FOR ENVIRONMENTAL PROTECTION IN INDIAN COUNTRY (1996). https://www.epa.gov/sites/default/files/2018-04/documents/1996_r8_indian_country_environmental_protection_policy.pdf

In early 2021 and late 2022, the Eastern Shoshone and Northern Arapaho Wind River Water Resource Control Board (WRWRCB) and the Office of the Tribal Water Engineer (OTWE) sent letters to the EPA raising concerns about this aquifer exemption request.[211] The WRWRCB and OTWE are charged with the administration and protection of the water resources of the Wind River Indian Reservation. The letters state that while the Marlin 29-21 well site is located outside the boundaries of the WRIR, Aethon's application requests injection of produced water into the Madison formation "which is proven to be the best formation for drinking water in the entire area" and noting that parts of the Madison formation underlie the Wind River Indian Reservation.[212] The letters describe the claim that the aquifer cannot now and will not in the future serve as a source of drinking water to be "shortsighted at best," noting that with "a changing climate and increasing use of water, it is difficult to accurately predict what the economics of groundwater sourced drinking water will be in the near or long term."[213] The WRWRCB and OTWE letters further assert that the Madison aquifer may, in the future, serve as a supplemental supply to the Wind River and/or the Wind River Indian Reservation for a variety of uses, concluding with their strong opposition to approval of the aquifer exemption request.

Consistent with the Agency's consultation policies, in response to the letters from the WRWRCB and OTWE Region 8 offered to engage in consultation discussions with the Eastern Shoshone and Northern Arapaho Tribes. On April 12, 2023, EPA Regional leadership met with the Tribal governments followed by further technical discussions on June 14, 2023, between the EPA Region 8 Water Division and the Tribal Water Engineer's Office. The EPA's April 2023 consultation discussions and June 2023 technical discussions with the Northern Arapaho and Eastern Shoshone Tribal leadership reinforced the WRWRCB and OTWE concerns and are summarized below. During these meetings the Tribes emphasized that water of high quality will be needed in the future. They described historic and ongoing impacts to surface and groundwater including at Pavillion, the Chemtrade sulfuric acid plant, and the uranium tailings site and discussed water quality and quantity impacts to the aquifers currently being used. They reported that some residents say their shallower private wells have gone dry and residents' voluntary samples have shown some contamination of private drinking water wells. Some homes reportedly rely on the delivery of water. The Tribes discussed their treaty rights, including their reserved water rights,[214] as well as hunting and fishing rights. They stated that they anticipate a need for water from nearby aquifers due to climate change, particularly as future snowpack may diminish and other sources including the Madison aquifer may need to be accessed. They described their work with the University of Wyoming to study timing and spatial distribution of snowpack and melting and the rate of snowmelt in the Wind River range over time. The Tribes conveyed their views that an approval of the Madison aquifer exemption would be detrimental to the Tribes and other communities in the Wind River and Big Horn Basins. They emphasized that water is sacred to the Tribes and the need to preserve the Madison aquifer water for future generations. The Tribes raised questions about alternatives to disposal into the Madison such as whether the water can be reused or injected back into the producing formation.

Following these meetings, the Northern Arapaho Tribe sent a letter to the EPA expressing its strong opposition to the requested aquifer exemption. Specifically, the Tribe shared the following concerns and perspectives:

- The Tribe, as a sovereign nation and governmental entity, provides drinking water to Tribal members and the broader community on the Wind River Indian Reservation. Preservation of groundwater quality

[211] Letters from Eastern Shoshone and Northern Arapaho Wind River Water Resource Control Board and Office of the Tribal Water Engineer to EPA (Jan. 6, 2021 & Dec. 14, 2022).
[212] *Id.*
[213] *Id.*
[214] The Tribes maintain reserved water rights as determined in a line of court decisions including *Big Horn I,* where the Wyoming Supreme Court held that Congress intended to reserve water rights for the Wind River Indian Reservation by the 1868 Treaty. *In re General Adjudication of All Rights to Use Water in Big Horn River Sys.,* 753 P.2d 76 (Wyo. 1988).

on the Reservation and in surrounding communities is extremely important to the Tribe's ability to permanently persist on the Reservation.

- The Tribe is a permanent place-based community. The Tribe cannot simply move if water quality or quantity degrades. The Tribe and its members will forever reside on the Wind River Indian Reservation, and accordingly must plan for the long-term sustainability of its Tribal members. Water is crucial to the future of livelihood of the Tribal Nation, and the unknown future impacts of climate change make the need to preserve drinking water fundamental to the existence of the Tribe.

- Water is essential to the Tribe's way of life, community development, economic growth, and ability to maintain its permanent sovereign existence on the Reservation. Potable drinking water is an increasingly valuable resource, and that value will greatly increase over time as climate change and drought impose scarcity. The Tribe intends to use groundwater for drinking water, including groundwater from the Madison Aquifer.

- The Madison Aquifer is well known for its capability to transmit large volumes of water and is hydrologically connected across the Wind River basin. The Madison Aquifer is extensive and underlies most of the Wind River Indian Reservation. It currently serves as a municipal water supply in the region and the Wind River/Bighorn Basin Groundwater Study anticipates that use of the aquifer is steadily growing.

- The Madison Aquifer near the proposed injection well is a valuable source of rare and extremely high-quality water. Those residing on the Reservation are increasingly likely to use the aquifer as a groundwater source of drinking water given growing Tribal populations on and around the Reservation, increasing drought vulnerability, limited sources of high-quality drinking water, and decreasing costs of drilling. The aquifer also has potential use to support the Tribe's ranching operations, or to supplement drinking water supplies such that current water supplies may be used for ranching.

- The Northern Arapaho Water and Sewer Department has four existing groundwater wells and is drilling six more. Numerous wells outside of Arapaho and Ethete provide drinking water to communities throughout the Reservation. The Tribe's population is growing and housing is dispersed throughout the Reservation. The Tribe anticipates increasing reliance on groundwater for drinking water and anticipates drilling into deeper aquifers such as the Madison Aquifer as resources grow scarcer over time.

- Drought is a significant and growing concern. In 2018, the North Central Climate Adaptation Science Center, in coordination with the Northern Arapaho Tribe's and Eastern Shoshone Tribe's Office of the Tribal Water Engineer and Water Resources and Control Board, produced a report entitled, "The Wind River Indian Reservation's Vulnerability to the Impacts of Drought and the Development of Decision Tools in Support of Drought Preparedness"[215] detailing the ongoing and increasing occurrence of drought in the region, in coordination with numerous federal agencies and universities. According to a USGS summary, "[i]n this semi-arid landscape, the glacier and snowpack-fed tributaries of the Wind River are the main source of water. Yet the region has experienced frequent, severe droughts that have threatened ranching and farming, subsistence harvesting, hunting, fishing, and other livelihoods."[216] The

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[215] Cody Knutson et al., *The Wind River Indian Reservation's Vulnerability to the Impacts of Drought and the Development of Decision Tools to Support Drought Preparedness*, USGS (2015), https://www.sciencebase.gov/catalog/item/55159d4be4b03238427817e2.
[216] Climate Adaptation Science Centers, *Preparing for Drought on the Wind River Indian Reservation*, USGS, https://www.usgs.gov/programs/climate-adaptation-science-centers/preparing-drought-wind-river-indian-

Reservation's vulnerability to drought is increasing and increases the value of groundwater and the justifiable expense to access groundwater.

- There is a heavy presumption that injection is not allowed into aquifers with potential to provide high-quality drinking water, because such water is a rare and valuable commodity that is permanently ruined by injection. The resource at risk is finite and vulnerable. Water in the Madison Aquifer is limited and may not replenish. Using radioisotopes to date the water samples in the Wind River Basin, we are aware that the Madison Aquifer is thousands of years old. Water has migrated to the basin over eons from outcroppings, where the aquifer is exposed at the surface, and along the Wind River and Owl Creek mountains many miles away. The Madison Aquifer is a non-renewable resource that will not be soon replenished and contamination of such a vital resource would be permanent and devastating.

- The enormous volumes of injection proposed by the applicant is of serious concern to the Tribe and suggest that contamination will extend far beyond the area anticipated. Wyoming seeks to inject a staggering volume of contaminated liquids, up to 30,000 bb/day for 50 years, for a total volume of up to approximately 22 billion gallons. The produced water into the Marlin aquifer would permanently degrade the aquifer with significant uncertainty with respect to the spatial extent of the contamination. There is significant uncertainty in modeling of aquifer flows and contamination. The Wind River basin has a karst structure with very a complex flow pattern that is subject to significant uncertainty in modeling the dispersal of contaminants and flow of water. The extent of migration of contaminants from the area, both laterally and vertically, cannot be assured. The Tribe has great concern for the future safety of their drinking water should the aquifer exemption be approved.

- The application must be denied because Wyoming cannot demonstrate that the Madison Aquifer will not in the future serve as a source of drinking water. The Madison Aquifer is a likely source of drinking water for the Northern Arapaho Tribal members and families. The Tribe intends to use the Madison Aquifer for drinking water in the future. While the depth and location near the Marlin 29-21 well present current challenges to extract and utilize the water resource, those barriers are reducing over time. Moreover, as the climate changes, the Tribe is likely to become reliant upon the Madison Aquifer as a valuable source of drinking water.

- This is not the first time the Tribe could experience the contamination of an aquifer, and further contamination would pose significant cumulative effects on Tribal water resources. The Wind River Reservation, the Tribe's permanent homeland, is plagued with ongoing contamination of a shallow aquifer. Tailings from a former uranium mill operated over twenty years ago are currently leaching uranium into the aquifer. The Tribe was told that the contamination could take up to one hundred years to flush and attenuate by natural processes, but the Tribe now knows this was a very conservative estimate. The Tribal government is undertaking costly monitoring of the contamination and will suffer as a result of the loss of this drinking water supply. It is crucial to the livelihood of the Tribal community that this contamination and loss of valuable drinking water will not occur again.

- If the EPA were to approve the aquifer exemption request compliance with the National Historic Preservation Act would be required.

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reservation#:~:text=To%20improve%20drought%20preparedness%20on,indicator%20information%20for%20each%20season.

In August 2023, the Eastern Shoshone Business Committee further shared that current and future water quality are of significant interest to the Tribe and Tribal members, not only for drinking water and daily consumptive use for now and in perpetuity, but that clean water and access to clean water is extremely important and sacred to the Eastern Shoshone Tribe. Clean natural water is important for daily cultural practices such as sweat, prayer, and morning ceremonies. The Tribe identified that clean water is vital for consumptive use in significant ceremonies, daily practices, and community engagements where clean water is deeply integrated in Shoshone culture, where songs, prayers, and use include and rely upon these waters. The Tribe also referenced the healing waters and the Tribe's connection to those waters and geothermal springs both on the Reservation and in relation to the hot springs located in Hot Springs County. The Eastern Shoshone Business Council also shared their interest in clean water for agricultural uses, for domestic and wildlife existence, and, for the communities beyond the Tribes.[217] The Tribe further emphasized the role of the Water Resources Control Board in communicating Tribal water concerns.

5.2.3. Climate Change Impacts and Indigenous Peoples

The EPA recognizes that Tribes and Indigenous Peoples are disproportionately vulnerable to the impacts of climate change, due in part to their multi-generational connections to specific geographic areas for their livelihood; unique cultural, economic and political characteristics; and often, limited resources to prepare for, respond to, and recover from climate-related hazards.[218] Indigenous Peoples can be more vulnerable to the health impacts of climate change than the general population for a number of reasons. In general, Indigenous populations have higher rates of certain medical conditions than the general U.S. population, such as asthma, heart disease, diabetes, obesity, and dementia, placing individuals at more risk for illness and injury as the climate changes. Indigenous Peoples generally have a special connection to the natural environment. Climate change is threatening natural resources and ecosystems that are essential to people's livelihoods, food sources, and cultural practices. Institutional barriers can affect Tribes' abilities to adapt by limiting access to, and control over, traditional lands and natural resources that will be increasingly impacted by climate change. Many Indigenous populations struggle with poverty, inadequate infrastructure impeding access to essential services such as transportation, drinking water, sanitation, disaster response, and health care, challenges that further restrict their ability to cope with climate-related threats.[219]

The screening information above describes disproportionate health vulnerabilities on the Wind River Indian Reservation compared to the rest of the state and/or the nation, including higher rates of heart disease, asthma, cancer, diabetes, and poor mental health. These existing medical conditions can increase sensitivities to climate

[217] Verbal comments conveyed from Shoshone Business Council to the EPA Administrator and Region 8 Regional Administrator in reference to the April 2023 consultation regarding water quality importance to the Tribe. August 8, 2023.
[218] U.S. ENV'T PROT. AGENCY, CLIMATE ADAPTATION ACTION PLAN (2021). https://www.epa.gov/system/files/documents/2021-09/epa-climate-adaptation-plan-pdf-version.pdf.
[219] U.S. ENV'T PROT. AGENCY, CLIMATE CHANGE AND THE HEALTH OF INDIGENOUS POPULATIONS (Dec 27, 2023). https://www.epa.gov/climateimpacts/climate-change-and-health-indigenous-populations#:~:text=In%20many%20Indigenous%20communities%2C%20relationships,risk%20of%20mental%20health%20i "Indigenous peoples in the United States are diverse and distinct political and cultural groups and populations. Though they may be affected by climate change in ways that are similar to others in the United States, Indigenous peoples can also be affected uniquely and disproportionately. Many Indigenous peoples have lived in particular areas for hundreds if not thousands of years, and their cultures, spiritual practices, and economies have evolved to be adaptive to local seasonal and interannual environmental changes. Thus, Indigenous knowledge systems differ from those of non-Indigenous peoples who colonized and settled the United States, and they engender distinct knowledge about climate change impacts and strategies for adaptation." Lesley Jantarasami et al., Ch 15 *Tribes and Indigenous Peoples*, *in* IMPACT, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 572 (David Reidmiller et al. eds., 2018), at 3. https://nca2018.globalchange.gov/chapter/15/.

hazards and further exacerbate the disproportionate health burdens in the Reservation communities. The significant disparities in health insurance coverage may further compound the extent and severity of adverse health conditions. Climate change also exacerbates existing impacts to natural resources and ecosystems essential to the Tribes' livelihoods and well-being, including impacts to water resources.

The EPA OW Climate Adaptation Implementation Plan provides information on the manner in which climate change can disproportionately impact Indigenous Peoples, including with respect to impacts to water resources. "The wellbeing of tribal and indigenous communities is at risk from climate change. Climate change is affecting water resources that are often critical to their cultures, traditional lifeways, spiritual practices, and economies. . . . Indigenous communities represent diverse cultures, histories, governments, and environments, so their individual experiences with climate change will differ. Indigenous peoples and their partners have undertaken a wide range of adaptation projects over the last decades, but the inequitable burden of adaptation costs and sociopolitical barriers are leaving tribal nations at a disadvantage for implementing climate adaptation efforts."[220]

Specific to the Northern Great Plains Region, which includes the Wind River Basin, the NCA4 states, "Indigenous peoples of the Northern Great Plains are at high risk from a variety of climate change impacts, especially those resulting from hydrological changes, including changes in snowpack, seasonality and timing of precipitation events, and extreme flooding and droughts as well as melting glaciers and reduction in streamflows. These changes are already resulting in harmful impacts to tribal economies, livelihoods, and sacred waters and plants used for ceremonies, medicine, and subsistence." Indigenous Peoples in the Northern Great Plains are experiencing climate change impacts affecting livelihoods and traditional subsistence and wild foods, wildlife, plants and water for ceremonies, medicines, and health and well-being. Some Tribes and Indigenous Peoples face high poverty and unemployment, and many are still directly reliant on natural resources, which places them among the most at risk to climate change.[221]

5.2.4. Impacts to Water Resources on the Wind River Indian Reservation

The Northern Arapaho and Eastern Shoshone Tribes describe cumulative impacts to water resources on the WRIR disproportionately and adversely affecting the Tribes and communities and contributing to their concerns about the aquifer exemption request. This section analyzes historic and ongoing impacts to Reservation water resources that could lead to increased reliance by the Tribes on off-Reservation water resources, including groundwater aquifers such as the Madison aquifer at the Marlin well site in the future. It also considers the possibility that exempting aquifers outside the Reservation may increase pressures by off-Reservation users to utilize on-Reservation or other water resources in which the Tribes may have an interest.

[220] OW Climate Adaptation Implementation Plan, *supra* note 69, at 15.

[221] R.T. Conant, et al., Ch 22 *Northern Great Plains*. *in* IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 145 (David Reidmiller et al. eds, 2018), https://nca2018.globalchange.gov/chapter/northern-great-plains.

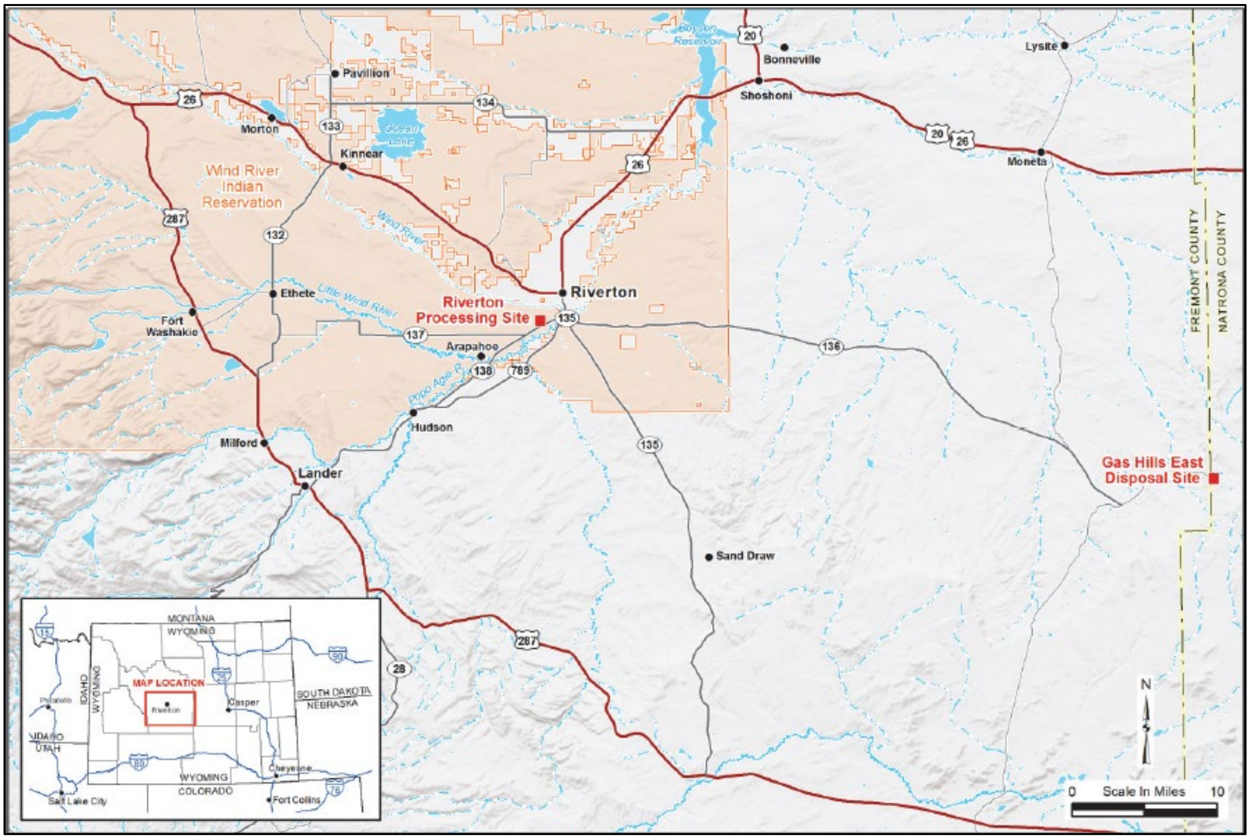

Figure 30. Map showing locations of the Riverton Processing Site and the Gas Hills Disposal Site (Figure 1 from DOE, 2021)[222]

Riverton Uranium Processing Site

The Riverton, Wyoming, Processing Site or Uranium Mills Tailing Site is located on the Wind River Indian Reservation between the Big Wind and Little Wind Rivers which are the primary sources of Reservation water. It is two miles southwest of the town of Riverton on land currently owned by Chemtrade Refinery Services Inc. The site is the location of a former uranium and vanadium ore processing mill that operated from 1958 to 1963 and processed 816,470 tons of uranium ore mined in the Gas Hills mining district in Wyoming. Past milling operations created radioactive mill tailings and uranium, radium, and thorium contamination in soils and construction debris. A tailings pile covered about 72 acres of the 140-acre site to an average depth of four feet. In 1988 and 1989, the tailings pile was excavated down to an average depth of four feet below ground surface (bgs) based on a radium-226 soil standard in 40 CFR § 192. Surface remediation activities resulted in removal of approximately 1.8 million cubic yards of tailings and associated materials, which were encapsulated at the Gas Hills East, Wyoming, Disposal Site located about 45 miles away from the processing site as shown in Figure 30.[223]

[222] U.S. DEP'T ENERGY, OFF. LEGACY MGMT., LMS/RVT/S32810, 2020 VERIFICATION MONITORING REPORT, RIVERTON, WYOMING, PROCESSING SITE (2021) (hereinafter "DOE Verification Monitoring Report"). https://lmpublicsearch.lm.doe.gov/lmsites/s32810-vmr.pdf.

[223] U.S. DEP'T ENERGY, OFF. LEGACY MGMT., FACT SHEET: RIVERTON, WYOMING, PROCESSING SITE (2023) (hereinafter "DOE Fact Sheet: Riverton"), https://www.energy.gov/lm/articles/riverton-wyoming-processing-site-fact-sheet.

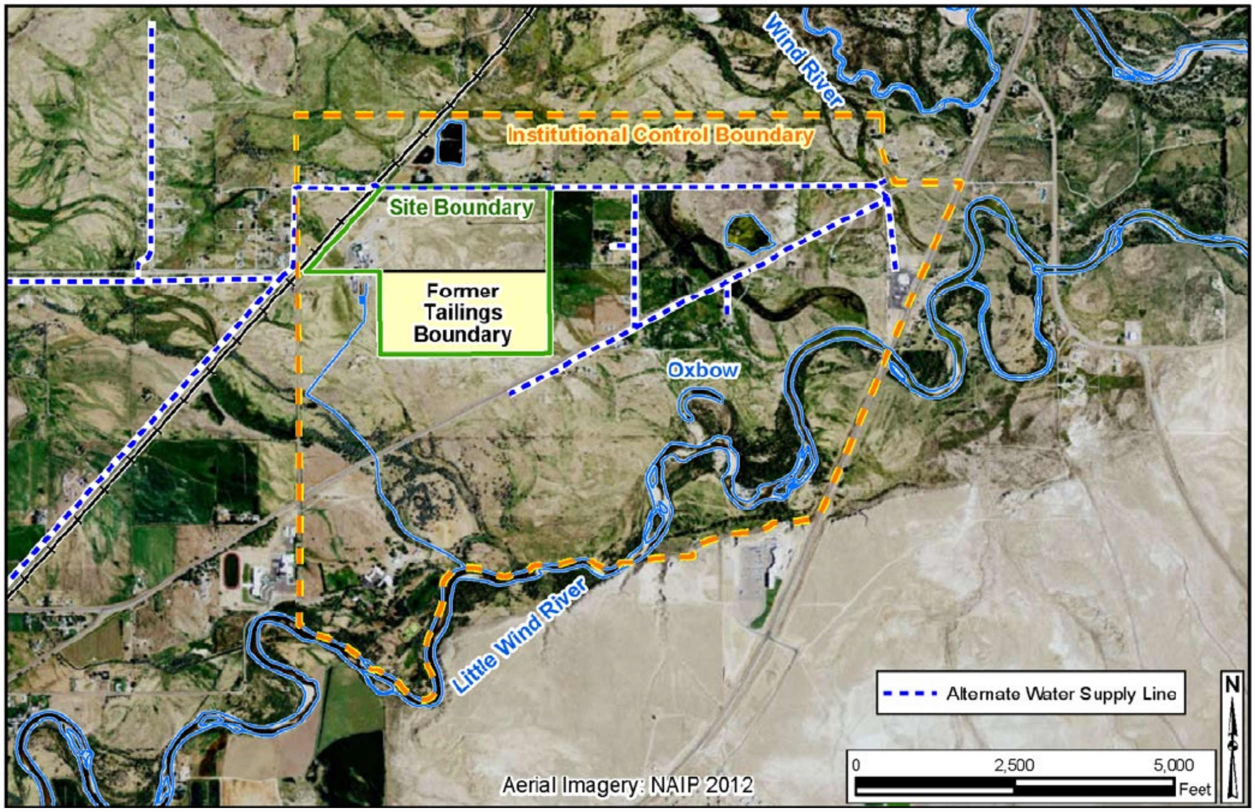

Figure 31. Institutional Control Boundary, Site Boundary, Former Tailings Boundary, and Alternate Water Supply Lines at the Riverton Processing Site (from DOE, 2023a).

Milling operations at the site also caused surface and groundwater contamination in the surficial aquifer. The surficial aquifer consists of 15 to 20 feet of alluvial sand and gravel lying between the Wind River and the Little Wind River as shown in Figure 31.[224] Depth to groundwater in the surficial aquifer ranges from three to six feet below ground surface. Groundwater flow is generally to the southeast toward the Little Wind River, which is about 3,200 feet to the south. Samples from the surficial aquifer have shown concentrations of milling-related molybdenum and uranium measuring 15 to 130 times greater than their respective maximum concentration levels.[225]

The site is regulated under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 (Public Law 95-604)[226] which applies to sites where uranium ore milling had ceased and the milling licenses had been terminated as of 1978, when UMTRCA was passed. Congress assigned responsibility for remediating these sites to the U.S. Department of Energy (DOE).[227] DOE established institutional controls at the site and in surrounding areas. These institutional controls include an alternate drinking water supply system to provide potable water to residents within the institutional controls boundary, restrictions on new wells and land use, and a deed restriction on state-owned property at the site.[228]

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[224] DOE Fact Sheet: Riverton, *supra* note 223223.
[225] *Id.*
[226] DOE Verification Monitoring Report, *supra* note 222; Uranium Mill Tailings Radiation Control Act of 1978, 42 U.S.C. 7901-7942 (1978).
[227] U.S. DEP'T ENERGY, OFF. LEGACY MGMT., FACT SHEET: UMTRCA TITLE I & II DISPOSAL AND PROCESSING SITES (2023), https://www.energy.gov/lm/articles/umtrca-title-i-and-ii-disposal-and-processing-sites-fact-sheet [hereinafter "DOE Fact Sheet: UMTRCA"].
[228] DOE Fact Sheet: Riverton, *supra* note 223.

According to DOE, requirements controlling new wells and land use within the institutional control boundary include:

- Tribal ordinance that places restrictions on well installation, prohibits surface impoundments, and authorizes access to inspect and sample new wells.
- State of Wyoming Department of Environmental Quality notification of existing groundwater contamination to persons on privately owned land who apply for a gravel pit.
- Wyoming State Engineer's Office notification to DOE when permit applications are received for wells or surface impoundments.

The perpetual deed restriction for the former mill site property restricts well drilling and restricts land development.[229]

Figure 31 shows the institutional control boundary (orange dashed line), the processing site boundary (green solid line), the former tailings area (yellow rectangle inside the solid green line) and the alternative water supply lines (blue and white dashed lines).

DOE's groundwater remediation compliance strategy for the Riverton site is natural flushing in conjunction with institutional controls and monitoring. Groundwater modeling conducted in the 1990s predicted that site-related molybdenum and uranium in the surficial aquifer would flush naturally to levels below their maximum concentration limits within the 100-year time frame allowed in 40 CFR § 192. Results of the verification monitoring indicated that natural flushing was generally progressing as expected until a flood event impacted the site in June 2010 and significant increases in contaminant concentrations were measured in several wells downgradient of the site in the flooded area.[230]

As a result of this event, DOE has been conducting hydrogeological investigations at the site to update the conceptual site model (CSM) and reevaluate alternatives to the compliance strategy. Among other components, the updated CSM takes into consideration an ongoing contaminant source zone underneath the former tailings impoundment beneath the water table in the surficial aquifer, secondary contaminant sources within the uranium plume footprint in evaporite minerals above the water table, and naturally reduced zones (NRZs) in saturated portions of the surficial aquifer. Data from 2020 confirmed the presence of an ongoing source underneath the former tailings pile that contributes to a persistent uranium plume with onsite concentrations up to 1.6 mg/L. The CSM also suggests that the unsaturated zone above the plume footprint has elevated solid-phase contaminants as seasonal high-water levels bring and store contaminants into the typically unsaturated sediments from the underlying groundwater. During these high-water levels, contaminants are wicked up and stored in the silt layer overlying much of the surficial aquifer and can be released during river flooding or other high recharge events (direct rain or snow melt infiltration). This release of contaminants from the unsaturated zone into the groundwater was confirmed after flooding in 2010, 2016, and 2017. Data from 2020 also confirmed the CSM in a year without flood-induced input of secondary source from the unsaturated zone, contaminant concentrations in the surficial aquifer groundwater decreased through natural flushing processes.[231]

All the information evaluated by DOE, including evaluation of contaminants mobilized by flood events, the current plume size and contaminant concentration levels, comparison of results to groundwater modeling

[229] *Id.*

[230] U.S. DEP'T ENERGY, OFF. LEGACY MGMT., LMS/RVT/S26137, THREE YEARS OF MULTILEVEL MONITORING DATA AT THE RIVERTON, WYOMING, PROCESSING SITE THAT SHOW CONTAMINANT INCREASES AFTER RIVER FLOODING EVENTS AND A LARGE RECHARGE EVENT (2019). https://www.energy.gov/lm/articles/three-years-multilevel-monitoring-data-riverton-wyoming-processing-site-show.

[231] DOE Verification Monitoring Report, *supra* note 222 at 9 of PDF.222

predictions, historical data, and experience at other UMTRCA sites, indicates that natural flushing of the surficial aquifer is occurring at the Riverton site, but as DOE acknowledges, not at a rate that will meet the 100-year regulatory time frame. Based on this information, the DOE Office of Legacy Management (LM) continues to evaluate contaminant behavior characteristics, the CSM, and alternative groundwater remedies for the site.[232]

Chemtrade Refinery Services Inc

Chemtrade Refiner Services Inc (Chemtrade) is a facility operating on the Wind River Indian Reservation that produces sulfuric acid. The facility has two primary sulfuric acid (H_2SO_4) production plants that manufacture H_2SO_4 in varying concentrations. Plant #1 produces H_2SO_4 using elemental sulfur as a feedstock. Plant #2 produces H_2SO_4 by a regeneration process using spent acid and elemental sulfur (from the petroleum refining or other industries) as a feedstock. In the elemental sulfur portion of the process, sulfur is burned to form SO_2, and SO_2 is converted to SO_3. The SO_3 can then be used to enhance the strength of existing oleum (fuming sulfuric acid) or mixed with water to form sulfuric acid. The spent portion of the process involves decomposition of the spent acid into gaseous components, cleaning of the gas, and formation of sulfuric acid from SO_2.[233]

Table 6. Fluid Sources and Approximate Average Flows for the Waste Streams at Chemtrade.

Source	Approximate Flow, mgd
Cooling tower blowdown	0.094
Process Condensate-Weak acid stripper	0.010
TGS SBS/Acidulation Stripper blowdown	0.017
Tanker (Maintenance wash water)	<0.001
Hydrostatic testing wash water	<0.001
Steam heating condensate	0.006
Water softener regeneration	<0.001
Boiler blowdown	0.006
Reverse osmosis concentrate	0.003
Machinery coolers and pump seals	0.086
Neutralization (Lime and soda ash)	0.01
Stormwater runoff	Negligible

Chemtrade's NPDES permit application provided the average flow of total wastewater at 0.202 million gallons per day (mgd), April 2013 through March 2014. The application includes the information in Table 6 for the average flows for the waste streams going to the wastewater treatment system.

Chemtrade implements a waste fluid treatment process prior to discharge consisting of mixing, neutralization, settling, and non-biological aeration. Wastewaters enter sump A, where a lime slurry is added at approximately 1.4 lbs/min. Wastewater then enters sump B, where soda ash slurry is added at 0.75 lbs/min. Wastewater then passes through sump C and into the retention ponds, where aeration fountains begin aerating the wastewater. After the wastewater leaves the retention ponds it is aerated again in an aeration basin prior to discharge.[234]

[232] *Id.* at 7 of PDF.
[233] U.S. ENV'T PROT. AGENCY, STATEMENT OF BASIS FOR THE NPDES PERMIT NO. WY-0034207 (2020), https://www.epa.gov/sites/default/files/2020-11/documents/wy0034207-chemtrade-sob-2020.pdf [hereinafter "NPDES Statement of Basis"]. See also, U.S. ENV'T PROT. AGENCY, AIR POLLUTION CONTROL SYNTHETIC MINOR SOURCE PERMIT TO CONSTRUCT # SMNSR-WR-000003-2013.001 FOR CHEMTRADE (2015), https://19january2021snapshot.epa.gov/sites/static/files/2015-08/documents/chemtrade_refinery_services_riverton_final_tribal_smnsr_permit.pdf.
[234] *Id*.

Table 7. Summary of Self-Monitoring Results for Outfall 001 May 2010 – June 2019[235]

Effluent Characteristic	Monthly Average			7-day Average			Daily Maximum			Effluent Limitation		
	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Monthly	7-day	Daily
TSS (mg/L)	2	18	160	-	-	-	2	18	160	30	-	60
TDS (mg/L)	633	2189	3583	-	-	-	668	2734	4940	3940	-	5000
Oil and Grease (mg/L)	0									No sheen & 10 mg/L max.		
pH	-						6.2	-	8.8	Not less than 6.0 nor greater than 9		
Temperature (°C)	8.5	19.8	27.2	9.1	21.9	28.7	10.3	23.0	29.7	-	-	-
Oxygen (mg/L)	-	-	-	-	-	-	7.12	10	15.8	-	-	-
Oxygen Saturation (%)	-	-	-	-	-	-	80	98	111	-	-	
Sulfate (mg/L)	-	-	-	-	-	-	254	1383	3200	-	-	-
Flow (MGD)	0.020	0.211	0.307	-	-	-	0.152	0.255	0.557	-	-	-

Table 7 is a summary of the discharge monitoring report (DMR) self-monitoring results for outfall 001 from May 2010 – June 2019. It shows there were total suspended solids (TSS) exceedances. Sulfate is a component of the total dissolved solids (TDS) content. These exceedances were addressed in the EPA NPDES permit effective January 1, 2021.

The discharge from the wastewater treatment system goes to an unnamed ditch that flows to the southwest where it flows into the "West Side Irrigation Ditch" and into the Little Wind River near St. Stevens. The total distance from the point of discharge to the confluence with the Little Wind River appears to be approximately 1 to 1.5 stream miles.

In an effort to maintain water quality in the West Side Irrigation Ditch, the EPA NPDES Permit requires an effluent limitation on dissolved oxygen (DO) at least 80% of saturation. The purpose of the DO limitation is to try to prevent the growth of sulfate reducing bacteria that previously caused the formation of a black residue in the receiving waters. Based on the available USGS gaging station (No. 06235500) flow information at the Little Wind River and Chemtrade flow of 200,000 gpd, the vast majority of the time the dilution ratio would be at least 100 to 1. Chemtrade also aerates the discharges before they enter the West Side Irrigation Ditch. With the addition of an effluent limitation that requires the discharge to be at least 80% saturated with dissolved oxygen, it appears that the discharge is no longer causing black residue in the receiving waters.[236]

<u>The Riverton Unit</u>

The Riverton Unit includes a series of dams, a power plant, main canals, laterals and drains located in the north-central portion of the Wind River Basin. As of 1996, direct flow water from the Wind River and stored water from Bull Lake Creek are used to provide irrigation service to approximately 73,000 acres of ceded lands. The Riverton Unit receives its water supply from the Wind River and its tributaries diverted from the Wind River by a diversion dam. The Wind River Diversion Dam is located 32 miles northwest of Riverton, Wyoming near the town of Kinnear. The diversion dam serves as the headworks to the Wyoming Canal which has a flow volume capacity of 2,200 cubic feet per second. The principal storage is provided by Bull Lake Reservoir on the WRIR. The Bull Lake Reservoir is located south of the river channel upstream of the diversion dam. Supplemental storage is provided by Pilot Butte Reservoir, an offstream reservoir supplied with water diverted from the Big Wind River by the Wind River Diversion Dam. The Pilot Butte Reservoir is located downstream of the diversion

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[235] *Id*. at Table 1.

[236] *Id*. at 4.

dam north of the Wind River. Water released from Bull Lake Reservoir flows through Bull Lake Creek to the Big Wind River where it augments the natural flow of that stream. Water for unit lands is delivered through the Wyoming Canal, which leads from Wind River Diversion Dam to Pilot Butte Reservoir and beyond to the distribution system. Pilot Canal flows in a generally easterly direction from Pilot Butte Reservoir, servicing lands lying south of those supplied by the Wyoming Canal.[237]

The First Nations Development Institute developed a Tribal asset tracking tool that estimates that over a period of 14 years, the Bureau of Reclamation had diverted over 2.7 million acre-feet of Tribal water resources out of the Wind River often dewatering large stretches of the Wind River downstream of the diversion dam.[238]

Oil and Gas Development

Oil and gas development, both on and off the WRIR, impacts surface water and groundwater resources on the Reservation. Produced water is a byproduct that is generated during oil and gas extraction and that is typically high in salt content and contains hydrocarbons water as well as a diverse range of chemicals associated with well drilling, completion, and maintenance activities. WOGCC regulates injection wells on non-Indian country lands and EPA regulates injection wells on Indian country lands. According to information in the WOGCC Data Explorer, there are 30 injection wells permitted for the disposal of produced water in Fremont County and four injection wells currently permitted for the disposal of produced water on the WRIR. The EPA has issued aquifer exemptions for the injection zones of several WOGCC and EPA disposal wells in Fremont County. The EPA and the Wyoming Department of Environmental Quality (WDEQ) have issued Clean Water Act permits for the discharge of produced to surface water.[239] These permits require treatment of produced water to meet permit limits before discharge.

Conclusion

The Northern Arapaho Tribe and the Eastern Shoshone Tribe have expressed their strong interests in the EPA maintaining protection of the Madison aquifer at the Marlin 29-21 well location, raising among other issues concerns about climate change, environmental justice, and protection of water resources. The Tribes hold unique perspectives given their respective historic ties to the land and water resources in the area, their long-term interests as sovereign nations in safeguarding high quality water resources as critical to enabling future generations to permanently persist on the Reservation, and their cultural and spiritual ties to water. Environmental, socioeconomic, and health screening information and further analysis describes existing vulnerabilities experienced disproportionately by individuals and communities on the Reservation, raising environmental justice concerns. Indigenous Peoples can be more vulnerable to climate change health impacts than the general population with higher rates of certain medical conditions placing individuals at increased risk

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[237] *Riverton Unit*, U.S. BUREAU OF RECLAMATION, https://www.usbr.gov/projects/index.php?id=386 (last visited Nov. 17, 2023).

[238] FIRST NATIONS DEVELOPMENT INSTITUTE, NATIVE WATER RIGHTS AND RESOURCES: MANAGING THE TRUST ASSET WIND RIVER INDIAN RESERVATION, A CASE STUDY IN THE MANAGEMENT AND PROTECTION OF TRIBAL WATER RESOURCE ASSETS, APPENDIX 4 (2009), https://www.firstnations.org/publications/case-study-4-native-water-rights-and-resources-managing-the-trust-asset-wind-river-indian-reservation-a-case-study-in-the-management-and-protection-of-tribal-water-resource-assets/.

[239] The EPA permits issued in Indian country may be accessed at https://www.epa.gov/npdes-permits/wyoming-npdes-permits. The WDEQ permits issued outside of Indian country may be accessed at https://deq.wyoming.gov/water-quality/wypdes/discharge-permitting/ by clicking on "Issued Permits."

for illness and injury as the climate changes and because climate change threatens natural resources and ecosystems that are essential to their livelihoods, food sources, and cultural practices.

The Northern Arapahoe and Eastern Shoshone Tribes and the individuals on the WRIR experience ongoing and historic inequities and disproportionate health and environmental burdens, including cumulative impacts to water resources. This section of the analysis describes activities that result in cumulative and disproportionate adverse impacts on Reservation water resources including the Uranium Mill Tailings Site, sulfuric acid plant, oil and gas development activities, and the diversion of the Big Wind River for irrigation uses outside the Reservation. These Tribal interest considerations inform the EPA's assessment of the request to remove SDWA protections that apply to the Madison aquifer at this location.

5.3 Cumulative Impacts from the Moneta Divide Project in the Wind River Basin

Cumulative impacts can expose individuals to numerous stressors from a wide array of sources through multiple pathways. These stressors can aggregate and accumulate over time, affecting health and wellbeing. The sections above summarize the socioeconomic, environmental, and health conditions and concerns in Fremont County and on the Wind River Indian Reservation. In communities with equity and environmental justice concerns such as in Fremont County and the WRIR, the combined exposures to these stressors (i.e., cumulative impacts) can increase their vulnerability to new or ongoing environmental hazards, which can cause, perpetuate, or exacerbate disproportionate environmental and public health harms and risks.[240] The EPA's Office of Research and Development's definition of cumulative impacts includes consideration of chemical and nonchemical stressors and their effects on health, well-being, and quality of life outcomes.[241]

The Marlin 29-21 well is part of a much larger oil and natural gas development project with cumulative impacts to health and the environment. Cumulative impacts from the Moneta Divide Projects, particularly with regard to surrounding water resources and health, inform the EPA's considerations of whether to maintain or remove the existing protections that apply to the groundwater aquifer at the well site. As described in Section 2.1, the Moneta Divide Project involves drilling 4,250 production wells at an average rate of 280 to 325 wells per year for 15 years. BLM ROD at 2. Each of the production wells is estimated to utilize 175,000 bbl of water for drilling and completion. BLM ROD at 10. The source of the water will be a combination of fresh groundwater either from existing water supply wells or through purchase from private fee owner sources and recycled produced water. Id. Less than 1% of the produced water generated from the project would be reused for drilling and completion activities. FEIS at 2-26. The life of the project, including drilling, production, and final reclamation, is expected to be approximately 65 years, assuming the average life of a well is 50 years. BLM ROD at 2. The project is predicted to yield a high volume of produced water of up to 1.4 million bbl or 58 million gallons per day at maximum development. BLM ROD at 10. The EIS authorizes up to 160 Class II injection wells to dispose of produced water. The management of this volume of produced water is a significant issue of concern. The EPA Region 8 submitted comments during the BLM NEPA process raising concerns about, among other things, the

240 U.S. Env't Prot. Agency, Pub. No. 360R22002, EPA Legal Tools to Advance Environmental Justice: Cumulative Impacts Addendum 1 (2023) https://www.epa.gov/system/files/documents/2022-12/bh508-Cumulative%20Impacts%20Addendum%20Final%202022-11-28.pdf. (hereinafter "Legal Tools 2023 CIA").

241 U.S. Env't Prot. Agency. Cumulative Impacts Research: Recommendations for EPA's Office of Research and Development. EPA/600/R-22/014a, (2022) at 9. https://www.epa.gov/system/files/documents/2022-09/Cumulative%20Impacts%20Research%20Final%20Report_FINAL-EPA%20600-R-22-014a.pdf.

exceptionally high volume of produced water. The EPA noted that the 160 UIC disposal wells would likely involve injection into underground sources of drinking water, implicating an unprecedented number of aquifer exemptions for a single project.[242]

To inform equity and environmental justice considerations associated with cumulative impacts from the Moneta Divide Project, this section of the analysis draws upon the EIS and related information relevant to impacts to community health and water resources in the Wind River Basin. The information is not comprehensive of the corresponding sections of the EIS analysis, nor does it constitute an endorsement of the adequacy of the analysis.

5.3.1 Moneta Divide - Water

Surface Water

The BLM EIS includes information on cumulative impacts to water resources in the project area. The EPA provided comments throughout the Moneta Divide NEPA process and recommended that site-specific NEPA assessments be conducted regarding the environmental effects of water disposal options.[243] In BLM's EIS, the cumulative impact analysis area (CIAA) for surface water was comprised of the Wind River Basin including all waters draining into Boysen Reservoir (*see* FEIS Map 13 in Figure 32) as well as the product pipeline corridor. FEIS at 5-23.

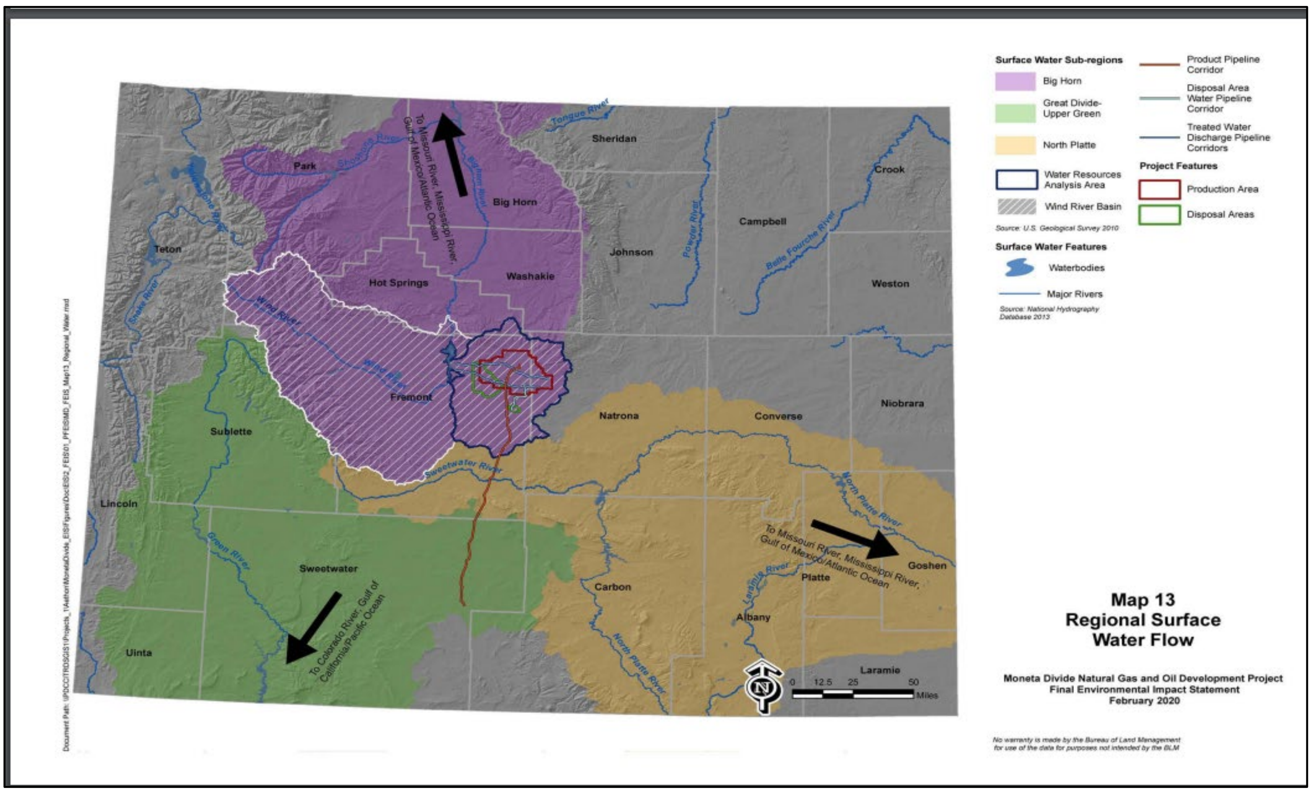

Figure 32. Map 13 Regional Surface Water Flow from BLM FEIS.

The Moneta Divide Project Area includes the Production Area, the Shotgun and Madison Disposal Areas, the Treated Water Discharge Pipelines, and the Product Pipeline Corridor. FEIS at 3-35. The Water Resources

[242] EPA comment letter to BLM regarding the Final Environmental Impact Statement for the Moneta Divide Natural Gas and Oil Development Project (March 23, 2020) (hereinafter "EPA March 23, 2020 Comment Letter"), at 2.
[243] *Id.*

Analysis Area and the majority of the Project Area lie within the Big Horn subregion. The Product Pipeline Corridor crosses the North Platte and Great Divide Upper Green subregions. Waters from both the Big Horn subregion and the North Platte subregion ultimately drain eastward, and flow via the Missouri and Mississippi Rivers to the Gulf of Mexico (Atlantic Ocean). Waters from the Great Divide-Green River subregion ultimately flow via the Colorado River towards the Gulf of California (Pacific Ocean). In the Water Resources Analysis Area, the Badwater, Lower Wind, and Muskrat subbasins lie within the Wind River geographic basin, which is part of the Big Horn hydrologic basin. Poison Creek is the main drainage in the Lower Wind subbasin on the east side of Boysen Reservoir, where the Production Area and Disposal Areas are located. Badwater, Poison, and Muskrat Creeks flow east to west and drain into Boysen Reservoir. Boysen Reservoir was created by the construction of the earthen-filled Boysen Dam across the Wind River (Class I) between 1947 and 1952 (citing U.S. Bureau of Reclamation 2013). After exiting Boysen Reservoir, the Wind River flows northward, becoming the Big Horn River at the Wedding of the Waters. The Big Horn River flows northeast into Montana to join the Yellowstone River, which in turn flows into the Missouri River. FEIS at 3-35. The Product Pipeline Corridor extends beyond the Wind River Basin but was considered in the CIAA for surface water because water quality impacts such as erosion and sedimentation could occur where the pipeline crosses water features. FEIS at 5-23.

Although not specifically included in the CIAA, according to the FEIS, effects to surface water features immediately downstream of Boysen Reservoir, including the Wind River and the Big Horn River, were also described due to their importance to downstream users and public concerns about impacts. FEIS at 5-23. Surface water impacts were analyzed qualitatively rather than quantitatively because site-specific impact and design specifications were not available. FEIS at 4-84. The BLM identified its analysis as programmatic (versus site-specific) requiring additional analysis on a site-specific basis in the future, including regarding effects of the various water disposal options. BLM ROD at 4.

According to the EIS, as surface water in the Badwater, Lower Wind, and Muskrat subbasins flows downstream, natural erosional processes increase sediment and total dissolved solid (TDS) loads and influence downstream water quality. Existing discharges from oil and gas development and irrigation return flow also affects water quality. Most of the analysis area has thin soils derived from highly erodible, saline, alkaline, and/or phosphate-rich geologic materials. Water flow in Alkali Creek and Badwater Creek downstream of Alkali Creek is dominated by oil and gas production discharge water. Water quality is influenced by increased erosion and sediment transport from the discharge water, and the quality of the discharge water. In Project Area drainages where vegetation is sparse, runoff from summer thunderstorms causes flash flooding that leads to erosion, gullying, and sediment loading. All streams in the analysis area carry a high sediment load when they are flowing, with suspended sediment concentrations frequently exceeding 20 grams per liter near the mouth of streams. FEIS at 3-38 (internal citations omitted). The BLM EIS identifies the following Moneta Divide Project activities that could affect water resources:

- Construction activities and other surface disturbances, which may cause increased sediment discharge and impact water quality in creeks and Boysen Reservoir.
- Surface discharge of water to creeks and directly to Boysen Reservoir, which may change the existing hydrology and water quality.
- Removal of groundwater during oil and gas production.
- Disposal of produced water via injection into groundwater, which may affect groundwater flow and quality.
- Transportation and storage of produced water, chemicals, and petroleum products, which could be spilled or released.

FEIS at 3-34 – 3-38.

According to BLM's cumulative impacts analysis, the primary activities that could affect water resources within the CIAAs include other oil and gas development projects (more than 1,900 oil, gas, and disposal wells in over 50 well fields exist currently in the CIAA for surface water (WOGCC 2013c)), uranium mining, pumping from municipal wells, and pumping from local livestock and domestic wells, as well as surface water use for recreation, irrigation, stock watering, and domestic and municipal purposes. The type and nature of cumulative impacts on surface water would include impacts on surface water hydrology from increased erosion and sedimentation, increased ion or salt concentrations, and potential leaks and spills. Water quality, including temperature, could also be negatively affected by cumulative impacts. FEIS at 5-24, 5-25.

While at the time the EIS was developed 31 oil and gas projects were identified as reasonably foreseeable future actions (RFFAs) within the CIAA, none of these projects were identified as overlapping with the surface watersheds or groundwater aquifers associated with the Moneta Divide Project. FEIS at 5-24. The RFFAs that were identified in the EIS as potentially causing cumulative impacts on water resources in the CIAA include the following:

1. One land use plan: Boysen Reservoir RMP and Boysen State Park Master Plan that identify several physical improvements to the recreation infrastructure in the state park including new camping areas and new off-highway vehicle routes, which the implementation of these improvements could increase surface runoff, generate erosion, and transport sediment into Boysen Reservoir, although the scale of these impacts would be minor compared to the discharge into the reservoir from the Moneta Divide Project and could be minimized through adequate stormwater controls (see Final EIS Project ID 51 in Table W-1 in Appendix W, *Cumulative Impacts Supporting Documentation*).
2. One road improvement project: Additional lanes between Waltman and Shoshoni on U.S. Route 26 that could mobilize sediment and increase salinity of receiving waters during runoff events, which would combine with similar impacts resulting from construction-related activity of the Moneta Divide Project (see Final EIS WYDOT Project # N342047 and N341113; Project ID 45 in Table W-1 in Appendix W).
3. One uranium project: Gas Hills In Situ Recovery Uranium Project that is estimated to disturb up to 1,500 acres in the uppermost reaches of the Muskrat Creek and Poison Creek subbasins during construction (see Final EIS Project ID 20 in Table W-1 in Appendix W).
4. One pipeline project: Riley Ridge to Natrona CO2 Pipeline Project that could mobilize sediment and increase salinity of receiving waters during runoff events, which would combine with similar impacts resulting from construction-related activity of the Moneta Divide Project (see Final EIS Project ID 25 in Table W-1 in Appendix W). FEIS at 5-24.

The Boysen Reservoir is actively used for recreation, fishing, and water supply. FEIS at 3-39. As the water flows out of Boysen Reservoir, through the WRIR, the Wind River is classified as a Class 1 surface water. Boysen Reservoir serves a transient non-community drinking water system and is used extensively for primary and secondary contact recreation as well as fishing. FEIS at 3-39; EPA March 23, 2020, comment letter, at 5. Produced water from the Moneta Divide project has been discharged to surface waters for decades. The EIS did not conduct a site-specific assessment of the potential impacts to water quality in receiving waters and downstream but noted that potential cumulative effects from potential future discharges include water temperature and quality in Boysen Reservoir, such as increased erosion, sediment, siltation, and possibly perennial flows in drainages that could reach Boysen Reservoir along with discharge flows from the permitted discharge points in the Wind River Basin that reach Boysen Reservoir (see Final EIS Section 7.0 in Appendix M, *Water Resources Technical Report*, for additional information on permitted discharges in the Wind River Basin). The *Water Resources Technical Report* describes the Tribes' reserved water rights of approximately 500,000 acre-feet in Boysen Reservoir noting that they hold the most senior water rights appropriation date (1868) in the Wind River drainage basin. *Id.* at M-117. Additionally, invasive weed control through spraying with herbicides as proposed for the Moneta Divide Project (see FEIS *Moneta Divide Weed Control Plan* Attachment A of Appendix E, *Reclamation Plan*), has the potential to adversely impact surface water quality through direct application or runoff. FEIS at 5-25.

Groundwater

The BLM EIS CIAA for groundwater resources included the aquifers in the Wind River Basin east of Boysen Reservoir. FEIS at 5-23. The NEPA documents identified that impacts to groundwater quality and quantity from oil and gas extraction and disposal water injection from the Moneta Divide Project and other RFFA projects in the CIAA would cumulatively affect the aquifers in which these actions take place. FEIS at 5-23, 5-24.

More specifically, the EIS includes information on injection wells in the Moneta Divide field. As of the date of the EIS analysis, BLM identified 22 active, abandoned, and proposed produced water disposal wells in the analysis area. FEIS at 3-45. Between January and July 2013, 14 wells were operating. These 14 wells injected into the Fort Union-Lance aquifer. FEIS at 3-45. The injection volumes from January through July 2013 for the 14 operating wells are summarized in the Water Resources Technical Report accompanying the EIS. FEIS at 3-45. The Marlin disposal well (operated by Aethon), located in the Madison Disposal Area, is currently permitted by the WOGCC to inject water into the Nugget and Tensleep formations. FEIS at 3-45. On December 13, 2017, the Tensleep interval of the Marlin well was hydraulically fractured to enhance the disposal capacity of the well. FEIS at 3-45.

The EIS describes that shallow unconfined groundwater in the Quaternary unconsolidated deposits and Wind River aquifer are vulnerable to contamination from surface sources. FEIS at 3-44. A fall 2011 sampling round of 32 water wells in the analysis area noted the presence of VOCs and/or coliform bacteria in several samples. FEIS at 3-44. CH_4 was detected in six samples, diesel was detected in two samples, oil and grease was detected in one sample, and ethylene was detected in one sample. FEIS at 3-44. Total coliform bacteria were detected in 16 samples, fecal coliform bacteria were detected in one sample, and E-coli coliform bacteria were detected in four samples. FEIS at 3-44.

According to the Final EIS, Table W-1 in Appendix W, *Cumulative Impacts Supporting Documentation* included 31 oil and gas projects identified as RFFAs; however, none of the RFFAs within the groundwater CIAA would include injection into the same formations or extraction of groundwater from the same aquifers as Moneta Divide's Preferred Alternative. FEIS at 5-24. The Final EIS concludes that no cumulative impacts on groundwater is anticipated from those projects. FEIS at 5-25. Another potential RFFA that could result in cumulative impacts on groundwater resources in the CIAA includes the implementation and operation of the Gas Hills In Situ Recovery Uranium Project (See Final EIS Project ID 20 in Table W-1 in Appendix W). According to the EIS, the Gas Hills Project is expected to circulate water in the Wind River aquifer, introducing a chemical solution into the groundwater to dissolve and remove uranium from the subsurface ore deposit. Groundwater quality outside mine units could be affected if groundwater contaminated with the chemical solution or uranium leaves the monitoring well ring around each mine unit (BLM 2013b). Id. The EIS states however, that potential groundwater impacts from uranium mining activities are closely monitored, and no measurable contributions to cumulative groundwater impacts are expected from the mine located within the CIAA for groundwater. The EIS further states that groundwater drawdown would not be anticipated with the Gas Hills Project. Id. The Gas Hills Project drilled two deep disposal test wells in 2011 (BLM 2013b). FEIS at 5-26. The EPA approved an aquifer exemption to dispose of water into the Flathead formation at each well. (Wyoming DEQ 2014a). Because disposal would occur in different aquifers with no known connection to project-disposal aquifers, the EIS did not identify cumulative effects. Id. The EIS concludes that no other RFFAs would contribute to a cumulative impact on groundwater quantity or quality in conjunction with the Moneta Divide Project and therefore no cumulative impacts were identified.

The Moneta Divide Preferred Alternative utilizes groundwater wells in the Wind River aquifer for drilling operations. The project's groundwater model predicted that there would be minimal drawdown effects on the Wind River aquifer. Given that the groundwater model was constructed based on limited data and for the purposes of a programmatic Final EIS, quantitative conclusions concerning the magnitude of impacts from withdrawals and injection have large uncertainty. EPA March 23, 2020, comment letter at 6. Because limited hydrogeologic data were available to evaluate the effects of withdrawals and injection for the FEIS, conducting more site-specific analysis based on hydrogeologic data collected as new wells are drilled would assist with assessing cumulative effects of injection and withdrawals more accurately. Id. at 7.

Another cumulative effects consideration with respect to impacts to groundwater aquifers in the Moneta Divide Project area is that if the EPA were to authorize the requested aquifer exemption at the Marlin 29-21 well, it is likely that Aethon would request additional aquifer exemptions for the Madison formation, which, if approved by EPA, would result in cumulative adverse effects to the Madison aquifer from the Moneta Divide Project.

Produced Water Reuse and Recycling Advancements and Technologies

The EPA strongly encourages the treatment and recycling of produced water for all drilling and completion activities for Moneta Divide operators rather than using fresh water sources. Reuse and recycling produced water within the oil field has a dual benefit of decreasing the amount of fresh water used for drilling and production and decreasing the volume of produced water for disposal.

According to the BLM EIS, less than 1% of the produced water generated from the Moneta Divide Project would be reused for drilling and completion activities. FEIS at 2-26. The FEIS states that Aethon will use fresh groundwater (est. 5,000 bbls) to drill each well and produced water (est. 170,000 bbls) for the completion of each well. Burlington plans to use fresh groundwater for both drilling and completion (20,000 bbls of fresh water per well). Fresh groundwater will be obtained from either existing water supply wells or purchased from private fee land-owner sources. BLM ROD at 10.

Development technologies for oil and gas operations have dramatically improved over the past decade. One of the major breakthroughs has been in the development of salt-tolerant fracturing chemicals that allow for use of produced water for fracking operations. Technology has continued to improve and using high TDS produced water for completion activities is becoming a more common practice. Current examples of treatment and reuse of produced water within the field can be seen in multiple basins across the U.S., including but not limited to Permian, Williston, Denver-Julesburg, and Powder River Basins. The value of fresh water is a growing topic of interest due to declining supplies, increases in population growth, and climate change impacts. Climate change is increasingly challenging many communities to meet their long-term water needs, particularly in the arid west.[244]

[244] EPA has taken a lead role in the development of a National Water Reuse Action Plan (WRAP) in collaboration with partners across the water sector. The WRAP reflects the coordinated efforts of more than 100 organizations to build state and local capacity to advance reuse and strengthen water security, sustainability, and resilience. This effort is especially important in the face of the need to adapt to a changing climate. The WRAP Collaborative Implementation Plan describes numerous actions to be taken by various water partners to support consideration of water reuse, which can improve the

For operations like Moneta Divide, where there are large return flows of produced water and a capacity for large volume storage ponds exist, recycling of produced water for in field use is ideal. Many western states are forming produced water consortiums that consist of non-profits, local/state/federal government, academia and industry. These consortiums are evaluating their regulatory frameworks with an overarching goal to strategically manage of both freshwater resource consumption and produced water recycling.[245]

5.3.2 Moneta Divide - Air

Information on air quality impacts from the Moneta Divide Project is relevant to the equity and environmental justice considerations of cumulative impacts to community health in the Wind River Basin. Thus, this section is thus focused on air pollutants related to human health associated with the Moneta Divide Project. As noted in the BLM EIS, air quality can affect the health and welfare of those who live, work, or visit the area as well as the local (near-field) and regional (far-field) environment. FEIS at 3-3. When the EIS was developed, air quality data from monitoring sites within and around the Moneta Divide Project Area indicated that air quality both within the Project Area and in the surrounding areas met national and state air quality standards. FEIS at 3-3. Data available from the EPA's design values webpage indicates the area is still meeting the human health-based National Ambient Air Quality Standards (NAAQS).[246] However due to some high measurements within the Project Area, fine particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) is a potential pollutant of concern for the area.

FEIS at 3-3. Table 8 – NAAQS and 2022 Design Values

portfolio of available fresh water. Actions in the plan are intended to drive progress on reuse and address local and national barriers across a range of topics including technical, institutional, and financial. There are over 100 action leaders and partners, including a federal Interagency Working Group collaborating to advance reuse around the country.

[245] For example, in response to drought, Colorado's House Bill 23-1242 identifies increasing the recycling of produced water in field to aid in the conservation of freshwater resources. The Act requires the commission to adopt rules, on or before December 31, 2024, "requiring a statewide reduction in usage of fresh water and a corresponding increase in usage of recycled or reused water in oil and gas operations." Water Conservation in Oil and Gas Operations, CO H.B. 1242 (2023). https://leg.colorado.gov/bills/hb23-1242. New Mexico also has an initiative for produced water in field reuse aimed at decreasing the consumption of freshwater resources. The Produced Water Act provides jurisdictional and legal clarity over produced water in New Mexico and "encourages the oil and natural gas industry to favor reuse, recycling and treatment options instead of a reliance on limited freshwater resources." N.M. ENV'T DEP'T, PRODUCED WATER FACTSHEET, https://www.env.nm.gov/wp-content/uploads/sites/16/2019/10/Produced-Water-Factsheet_ENGLISH_-FINAL-191010.pdf. Texas is modernizing their rule that regulates the management of oil and gas waste and includes rules for commercial recycling. The Commission is moving towards adopting rules to "encourage fluid oil and gas waste recycling for beneficial purposes and set standards for issuing permits for commercial recycling of fluid oil and gas waste." The announcement discusses a rapidly evolving need to "encourage the treatment and recycling of produced water for beneficial uses within the oil and gas industry" and for novel beneficial uses outside of the industry. RAILROAD COMMISSION OF TEXAS, PROPOSED CHANGES TO 17 TAC §3.8 AND §3.57, AND 16 TAC CHAPTER 4, https://rrc.texas.gov/media/ahxjghue/informal-public-comment-chapter-4-synopsis_final_10-2-2023.pdf.

[246] *Air quality Design Values*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/air-trends/air-quality-design-values (last updated Aug. 7, 2023).

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	NAAQS Level	2022 Design Value	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	0.4 ppm (Converse County site ID 560090010)	Not to be exceeded more than once per year
			1 hour	35 ppm	0.5 ppm (Converse County site ID 560090010)	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 μg/m^3 [1]	NA – no lead monitoring in Wyoming; non lead nonattainment or maintenance areas	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	4 ppb (Spring Creek site ID 560130232)	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb [2]	1 ppb (Spring Creek site ID 560130232)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm [3]	0.065 ppm (Spring Creek site ID 560130232)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 μg/m^3	3.7 μg/m^3 (Spring Creek site ID 560130232; invalid design value)	annual mean, averaged over 3 years
		secondary	1 year	15.0 μg/m^3	NA	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 μg/m^3	20 μg/m^3 (Spring Creek site ID 560130232; invalid design value)	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 μg/m^3	0 (design value represented as number of exceedances; 99th percentile averaged over three years = 48 μg/m^3 (Spring Creek site ID 560130232)	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb [4]	47 ppb (site monitor; Lost Cabin site ID 560130003) 1.9 ppb (Riverton Mobil site ID 560130004; fourth-highest 2022 concentration, data	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Pollutant [links to historical tables of NAAQS reviews]	Primary/ Secondary	Averaging Time	NAAQS Level	2022 Design Value	Form
				certification not required)	
	secondary	3 hours	0.5 ppm	NA	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.
(2) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.
(3) Final rule signed October 1, 2015 and effective December 28, 2015. The previous (2008) ozone standards are not revoked and remain in effect for designated areas. Additionally, some areas may have certain continuing implementation obligations under the prior revoked 1-hour (1979) and 8-hour (1997) O3 standards.
(4) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet one year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)).

The BLM EIS cumulative impact analysis area (CIAA) for air quality includes the area encompassed by the four-kilometer resolution regional scale photochemical grid model (PGM), Community Multiscale Air Quality (CMAQ) modeling grid (see Figure D4-1 in Appendix D, Air Quality Assessment Technical Support Document), plus several Class I and sensitive Class II areas located outside of the 4-kilometer grid (Figure D4-2 in Appendix D). FEIS at 5-10. Geographically this covers most of the State of Wyoming, and portions of several surrounding states. FEIS at 5-10. Table 5-1 *Cumulative Impact Analysis Areas and Rationale* identifies that the far-field impacts of Moneta Divide specific emissions, as well as cumulative emission impacts, are assessed in a region centered on the Production Area which includes all of Wyoming, eastern Idaho, northeastern Utah, northern Colorado, western Nebraska, western South Dakota, and southern Montana (within 12-kiolometer and 4-kilometer resolution grids centered on and surround the Production Area.) FEIS at 5-2. Ozone, fine particulate matter ($PM_{2.5}$) and visibility are regional-scale air quality issues and the cumulative effects of emissions from various sources within the CIAA may affect air quality concentrations and air quality-related values throughout the region. FEIS at 5-10. Modeled Attainment Test Software (MATS), which normalizes predicted impacts to performance of the base year to monitored air quality indicated that the Moneta Divide Project could contribute 0.5 ppb to 8-hour ozone concentrations at the Spring Creek monitoring site location when cumulative 4th highest daily 8-hour ozone concentrations were 55.9 ppb (a reduction from the base year modeled cumulative concentration of 59.5 ppb). Details regarding CMAQ model performance and estimated project, and cumulative impacts may be found in Appendix C and D of the Moneta Divide Final EIS.

Because the CMAQ emission inventory incorporates emissions from all sources within the modeling domain, the CMAQ modeling results represent the cumulative impacts from all sources within the region, including reasonably foreseeable development emissions from oil and gas development projects within the CIAA. FEIS at 5-10. Ongoing actions and Reasonably Foreseeable Future Actions (RFFAs) include a number of oil and gas projects located in Wyoming and the surrounding states including Converse County, LaBarge, Blacks Fork, Normally Pressured Lance, and others (some of which have not moved forward to implementation). FEIS at 5-10. Table W-2 in Appendix W, *Cumulative Impacts Supporting Documentation* identifies the reasonably foreseeable development projects that were included in the CMAQ modeling to capture cumulative emissions in the analysis area. FEIS at 5-10.

Along with the projects listed in Tables W-1 and W-2 of Appendix W of the Moneta Divide FEIS, there are significant contributions to criteria pollutant emissions from electric generation sources (coal and natural gas), residential and commercial fuel usage sources, transportation, agriculture and other industrial process in the region. FEIS at 5-10. Cumulative impacts of emissions from Moneta Divide and other sources vary by pollutants across the CIAA. Emissions of nitrogen oxide (NO_x), volatile organic compound (VOC), and sulfur dioxide (SO_2) have the potential to contribute to regional-scale ozone and $PM_{2.5}$ concentrations, as well as regional-scale visibility impairment, deposition of nitrogen and sulfur to soils, and acidification of sensitive lakes. Emissions of particular matter (PM_{10}) and carbon monoxide (CO) are most likely to affect concentrations of these same pollutants within the Project Area or the region immediately surrounding the source area.

The EPA made recommendations on the Final EIS for the Moneta Divide Project with regard to impacts that could result beyond what was modeled for near-field impacts during well development as well as potential reasonable considerations to minimize the risk of exposure to predicted HAPs from the disposal wellfield (specifically evaporation ponds). The EPA's Final EIS comment letter noted that when air pollutant levels exceed the NAAQS or state specific standards, people breathing that air are likely to experience adverse health effects. The agencies working on the Interagency Review Team (IART) therefore consistently strive to keep emissions in NEPA projects from exceeding the NAAQS. Additionally, because there is some inherent uncertainty in modeling, preventing exceedances also provides a buffer to reduce the chance that NAAQS violations could occur. The BLM's air quality modeling for this project predicts exceedances of Wyoming's Air Quality Standard (WAAQS) for annual PM10 when using Tier 2 hydraulic fracturing pump engines. Additionally, the EPA's comments throughout the NEPA process identified elements of the modeling approach that would underestimate the project's emissions and impacts to air quality.

If BLM's approach conformed to the EPA's *Guideline on Air Quality Modeling*, the predicted near-field air quality impacts disclosed in Chapter 4 would likely be higher and potentially further exceed the 1-hour NO2, 24-hour PM2.5, and 24-hour PM10 NAAQS. Additionally, there are discrepancies between the information provided in Chapter 4 and the analyses presented in attachments to the Air Quality Assessment Technical Support Document (AQTSD). Chapter 4 states that only the WAAQS annual PM10 standard would be exceeded with Tier 2 controls on the hydraulic fracturing pump engines and that the remaining pollutants would be below the applicable NAAQS standards. However, the model results presented in the AQTSD predict that Tier 2 hydraulic fracturing pump engines will exceed the 24-hour PM10, 24-hour PM2.5, and 1-hour NO2 NAAQS during completion activities.

The Final EIS and AQTSD also disclose the potential for elevated cancer risks resulting from exposure to hazardous air pollutants (HAPs) from evaporation ponds and disposal well areas. Although the Final EIS provides measures that operators could take to reduce these risks, it does not propose management actions to minimize this risk to residences and occupied structures.

5.3.3 Moneta Divide - Greenhouse Gas Emissions

The FEIS general assessment of climate change impacts in the project area is consistent with the information Section 4.0 herein. According to the FEIS, "[t]he U.S. Global Change Research Program has reported significant trends in regional climate over the last few decades. Data collected during the last half century in Northern Great Plains shows an approximate 1°F to 3°F increase in average surface temperature (GCRP 2018), with the largest increase in average temperature occurring in the winter months. The research also notes a decrease in the number of relatively cold days, an increase in the number of relatively warm days, and an increase in precipitation. The latest assessment (GCRP 2018) predicts that temperatures and precipitation over the region will continue to increase, especially if GHG emissions remain high. In addition, the assessment predicts that the frequency of extreme weather events such as heat waves, droughts, and heavy rainfall will also increase and may affect water resources, forests and wilderness areas, agricultural and ranching activities, recreation and tourism, energy resources, indigenous peoples, and human health." FEIS at 3-13.

In addition to climate conditions, the FEIS presents information on GHG emissions in the Moneta Divide Project Area. The FEIS identifies numerous types of activities and actions resulting in GHG emissions in the Mountain West including southwest Wyoming and the Project Area, with the largest contributors being the combustion of fossil fuels in power plants; on-road and off-highway vehicles; drilling engines, pumps, and compressors used in oil and natural development; industrial processes; fire events; livestock grazing; and construction equipment (GCRP 2018). Energy demand, the main driver for natural gas development, is influenced by regional and national population growth, economic development, and seasonal weather conditions. Methane emissions also result from the development of fossil fuel resources, landfills, and agricultural and livestock activities. In addition to direct GHG emissions from these activities, indirect GHG emissions in the Project Area include the demand for electricity generated outside the area. Id. The analysis describes local, regional, statewide, national, and global GHG emissions as well as climate change policies in place at the time the EIS was prepared.

The FEIS estimates annual direct GHG emission totals for CO2, CH4, N2O, and CO2-equivalents for the Proposed Action for the 15-year development period and the full development and production period for the Moneta Divide field. The document discusses the direct and indirect emission estimates of the potential for GHGs released into the atmosphere from initial wellsite construction, well drilling and completion, production, and downstream use. The emissions of all three GHGs are highest for the production phase of development. Table 4-1 presents the total annual direct GHG emissions from all activities for Alternative 2. The table includes estimates for CO2-equivalent emissions using the 100-year GWP values for CH4 and N2O. Average year direct emissions would be approximately 4 million metric tons (MMT) of CO2-equivalent. The minimum annual direct emissions would be less than 1 MMT. Using the 20-year GWP values, peak year direct emissions would be approximately 6 MMT of CO2-equivalent instead of 5 MMT and project lifetime direct emissions would be 302 MMT instead of 283 MMT. Similar to VOC emissions, the emissions of all direct GHG emissions are expected to reach their peak by the 15th year of development when the field is in full production. FEIS at 4-33. During that year, the direct annual CO2-equivalent emissions is approximately equal to the annual emissions produced by approximately 1.1 million passenger vehicles or 649,000 households (EPA 2018). FEIS at 4-37. Average year indirect emissions would be approximately 22 MMT of CO2- equivalent. Using the 20-year GWP values, peak year indirect emissions would be approximately 62 MMT of CO2-equivalent instead of 60 MMT and project lifetime indirect emissions would be 1,491 MMT instead of 1,460 MMT. The minimum annual indirect emissions would be approximately 2 MMT. Id.

In addition to the emissions generated during the development of the Moneta Divide field, the oil and natural gas extracted from the field will contribute to indirect GHG emissions when it is used “downstream” for combustion in reciprocating engines, electric generation, or other energy-generation sources and activities. According to the FEIS, average year indirect emissions would be approximately 22 MMT of CO2- equivalent. Using the 20-year GWP values, peak year indirect emissions would be approximately 62 MMT of CO2-equivalent instead of 60 MMT and project lifetime indirect emissions would be 1,491 MMT instead of 1,460 MMT. The minimum annual indirect emissions would be approximately 2 MMT. The total (i.e., direct and indirect emissions) annual CO2-equivalent emissions, 66 MMT, for Year 15 of the development of the Moneta Divide field are approximately equal to the annual emissions produced by nearly 14 million passenger vehicles or approximately 7,900,000 households (EPA 2018). FEIS at 4-37 and 4-38. Since the Proposed Action would contribute to the overall regional and global budget of GHGs in the atmosphere, the Proposed Action could contribute to climate change effects. FEIS at 4-41.

5.3.4 Moneta Divide - Cultural Resources

The BLM EIS describes the known cultural resources that occur in the Project Area including prehistoric and historic archaeological sites, historic linear resources (historic trails, roads, and railroads), and sacred sites that are of cultural and/or religious significance to Native American Tribes associated with the region.

The EIS focuses on two areas of analysis. The Main Analysis Area would involve the most intensive development and includes the Production Area, two treated water discharge pipelines to Boysen Reservoir, the Shotgun Disposal Area, and the Madison Disposal Area, as well as a water pipeline to the Madison Disposal Area. These components would be in a geographically contiguous and definable area associated with the Badwater and Poison Creek watersheds within the Wind River Basin. The Product Pipeline Corridor Area extends for 106 miles south of the Production Area. The setting of both of these areas is characterized by large areas of undeveloped land interspersed with groupings of residential and commercial structures and a wide dispersion of industrial facilities and linear infrastructure associated with oil and gas development. The main analysis area in particular includes large tracts of undeveloped land that is crossed only by occasional two-track roads and fence lines. This leaves many portions of the analysis area remote and difficult to access. As such, locations containing cultural resources are not frequently visited and remain relatively undisturbed. Modern roads, local ranches, existing oil and gas facilities, and access roads are present, but concentrated in the northern and central Production Area surrounding the towns of Lysite and Lost Cabin and extending down to the vicinity around Moneta. FEIS at 3-76.

The EIS describes potential direct and indirect impacts to cultural resources including physical impacts related to surface-disturbing construction activities and indirect impacts including visual impacts from built infrastructure (e.g., wells, roads, pipelines, and associated facilities) and auditory and atmospheric impacts on those cultural resources that retain setting and feeling as aspects of integrity; these cultural resources include eligible historic linear resources and sites of Native American concern (TCPs, sacred sites, potential sacred sites). Indirect impacts such as visual changes to the setting may adversely affect the Cedar Ridge TCP and Tribally identified sacred sites within the area. Indirect impacts are associated with project-related activities include upgrading of existing roads and the development of new roads, which would improve access to the Project Area and, in turn, improve access to eligible cultural resources. Studies have shown that this could result in an increase in unauthorized artifact collection by relic hunters and site vandalism (Hedquist and Ellison 2010; Nickens et al. 1981; Spangler et al. 2006; Williamson and Ferriman 2011). Other indirect impacts could occur in the form of auditory and atmospheric disturbances. These impacts could affect the integrity of the setting and the ability of cultural resources to evoke the aesthetic or historic sense characterized by the historic linear resources and Native American sacred sites. Temporary project-related facilities, such as drill rigs, could have direct physical impacts, as well as indirect effects such as visual impacts on eligible cultural resources. Permanent project facilities, such as wells and production facilities, could present long-term indirect impacts on these resources for the life of the project (65 years). All project-related surface disturbances to eligible cultural resources are also a form of permanent irreversible effects. Direct physical impacts from project activities on cultural resources and Native American sites would cause permanent and irreparable damage. The EIS states that known, eligible cultural resources would be avoided whenever possible or if avoidance is not possible then mitigation measures would be taken consistent with the Moneta Divide Programmatic Agreement (PA) for Section 106 of the National Historic Preservation Act. Although all known eligible cultural resources would be avoided or appropriately mitigated, damage to buried and unknown cultural resources could occur, the likelihood of which would increase based on the amount of development proposed under a given alternative. Implementation of Resource Protection Measures would protect eligible cultural resources and Native American sacred sites (see Appendix F, Resource Protection Measures). The EIS states that even with these protective measures in place, each alternative has the potential to cause varying amounts of adverse effects on eligible cultural resources. FEIS at 4-190.

The FEIS cumulative impacts analysis area (CIAA) for cultural resources and Native American concerns encompasses the Project Area and includes significant historic linear resources that extend beyond the Project Area boundary. The CIAA includes significant cultural resources and sacred sites within 15 miles of the Project Area that BLM determined could be affected by visual, auditory, and atmospheric impacts. The FEIS describes the types of adverse cumulative impacts that are likely to affect cultural resources and Native American sacred sites including direct impacts such as physical impacts, which are long-term and irreversible, and visual impacts, which can be short-term or long-term and last for the life of the project. Potential indirect cumulative impacts include audio and atmospheric impacts as well as an increased frequency of unauthorized artifact collection due to new and improved roads that provide access to previously remote areas where cultural resources are located. Within all components of the Project Area, and including the cultural resources identified during the 5,001-acre sample inventory, identified 1,717 known prehistoric and historic cultural resources. Of these sites, 224 have been recommended as eligible for inclusion in the National Register of Historic Places and are significant (Weston et al. 2014a, Weston et al. 2014b). Cumulative impacts would result from any undertaking that has the potential to physically or visually impact cultural resources through surface disturbances, visual intrusions, increased potential for unauthorized artifact collecting, or potential to introduce auditory and atmospheric disturbances. A number of undertakings have affected or have the potential to affect cultural resources within the CIAA. The EIS describes Reasonably Foreseeable Future Actions that could result in cumulative impacts on cultural resources in the CIAA including, Land Use Plan - Boysen Reservoir RMP and Boysen State Park Master Plan; a road improvement project - Additional Lanes between Waltman and Shoshoni on U.S. Route 26; a pipeline project - Riley Ridge to Natrona CO2 Pipeline Project, which connects to the existing Greencore Pipeline at the Lost Cabin Gas Plant located within the Production Area; an oil and gas project - Continental Divide-Creston Natural Gas Project; three uranium projects - Gas Hills In Situ Recovery Uranium Project, Lost Creek Uranium In Situ Project Amendment and the Sheep Mountain Uranium Project. FEIS 5-44.

The EPA notes that the position of the Northern Arapaho Tribe is that the BLM Programmatic Agreement for the Moneta Divide program is insufficient, and that the Tribe is not a signatory to the agreement.[247]

5.3.5 Moneta Divide - Socioeconomics and Environmental Justice

The analysis area for the socioeconomic and environmental justice sections of the Moneta Divide Project includes the counties of Fremont, Natrona, and Sweetwater in central Wyoming. These counties, and the communities within these counties, would be those most directly affected by the Moneta Divide Project. FEIS 3-109. The analysis area is essentially a rural area, with the largest community (Casper) having less than 65,000 residents. The main sources of income for the local population are mining and non-labor income (i.e., income from investments, payments associated with aging, and payments associated with economic hardship). Local governments, retail trade, and accommodation and food services are other important sources of employment. Household incomes are largely associated with mining, tourism, local government, and government transfers. Farming and ranching are also traditional activities in the area that contribute to the region’s economy, culture, and rural way of life. The potential for socioeconomic impacts from the Moneta Divide Project on the analysis area stem largely from its potential to change the current sources of employment and income for the local population, attract in-migration, and alter the livelihoods of communities and their quality of life. FEIS at 3-110.

[247] Letter from Northern Arapaho Business Council to EPA regarding the Marlin aquifer exemption action (Aug. 18, 2023), at 6.

The FEIS describes several “boom and bust” resource development cycles in the project area. Between the mid-1950s and the late 1980s, uranium exploration in Fremont County fueled the growth of cities and towns like Riverton and Jeffrey City, the latter becoming virtually deserted with the end of the uranium business in the county. Other “boom and bust” mining cycles in Fremont County in the twentieth century were related to coal (1900s to 1920s) and iron ore (1960s to 1980s). Natural gas has become increasingly important since the 1980s, when technological improvements made it possible to drill to depths previously beyond reach. A survey conducted for the State of Wyoming on priorities and values of the population is consistent with the history of “boom and bust” cycles and outdoor livelihoods of the communities in the analysis area. The survey found that residents place the highest value on caring and safe communities (typically associated with small towns) and enjoying the great outdoors (associated with open spaces, outdoor recreation, and the beauty of nature). The study also concluded that residents are concerned about the impacts of “boom and bust” cycles, as well as the feeling of remoteness or lack of access to such things as health care and options for entertainment and shopping. FEIS at 3-111, citations omitted.

According to the FEIS, development in the Production Area (under any of the FEIS action alternatives) would result in rapid population growth stemming from the influx of oil and gas workers during the drilling phase of the project and construction of infrastructure. The sudden influx has the potential to adversely affect quality-of-life factors in surrounding communities, including a potential increase in crime that could disproportionately affect Tribal communities. The Bureau of Justice Statistics has found that Native Americans experience violent crimes at rates far greater than the general population (Bureau of Justice Statistics 2004). The FEIS states since Native Americans have a history of being disproportionately affected by crime, it would stand to reason that rising crime rates would also have a disproportionately adverse impact on members of the Eastern Shoshone and the Northern Arapaho Tribes. Of Tribal members, women would be most likely to disproportionately experience violent crime. While BLM found no information available at the time to indicate that this would occur as a result of development within the Moneta Divide Project Area, it identified mitigation measures that involve encouraging the company to adopt and incorporate best practices from the United Nations Guiding Principles on Business and Human Rights (United Nations 2011) as part of their worker safety and environmental training program. FEIS at 3-128, 4-297 – 4-299.

In 2016, the Wind River Indian Reservation population (26,760) represented approximately 66 percent of the Fremont County population. Communities within the Wind River Reservation include Arapahoe, Ethete, and Fort Washakie, all of which have Native American/American Indian populations. The FEIS also identified Superior and Wamsutter within Sweetwater County as communities with environmental justice concerns. Arapahoe, Ethete, and Fort Washakie in Fremont County and Edgerton in Natrona County were found to be communities with poverty rates at least 10 percentage points above those of the State of Wyoming. The poverty rates in Arapahoe, Fort Washakie, and Edgerton were also 10 percentage points above those of the U.S. The FEIS discusses scoping comments received from the Northern Arapaho Tribe expressing concern with water discharged into the Boysen Reservoir and Wind River Canyon, and its potential impact on water quality, as contamination could pose risks to both aquatic life and human health. FEIS at 3-125 – 3-128.

5.4 Conclusion

This section of the analysis identifies disproportionate environmental and health burdens in Fremont County and on the Wind River Indian Reservation, where many of the environmental, socioeconomic, and health indicators are elevated compared to state and national averages. Equity concerns are heightened in rural areas where people more often reside in underserved communities, including those with drinking water infrastructure challenges and greater reliance on groundwater sources. Fremont County is largely rural and drinking water infrastructure challenges may exist as discussed in the County’s guidance. The existing socioeconomic and health vulnerabilities in these communities make them even more susceptible to adverse impacts from climate change, which include impacts to health and to existing and future water resources. On the Wind River Indian Reservation, Indigenous Peoples experience historic inequities and disproportionate health and environmental burdens, including cumulative impacts to water resources. The Tribes hold unique perspectives given their historic ties to the land and water resources in the area, their long-term interests as sovereign nations in safeguarding high quality water resources as critical to enabling future generations to permanently persist on the Reservation, and to their cultural and spiritual ties to water. Environmental, socioeconomic, and health screening information and further analysis describes existing vulnerabilities experienced disproportionately by individuals and communities on the Reservation, raising environmental justice concerns. Indigenous Peoples can be more vulnerable to health-related climate change impacts than the general population due to higher rates of certain medical conditions that place individuals at increased risk for illness and injury as the climate changes and because climate change threatens natural resources and ecosystems that are essential to their livelihoods, food sources, and cultural practices. This section also identifies cumulative impacts from the Moneta Divide Project which are relevant to understanding the potential health and environmental burdens, including adverse and cumulative impacts to water resources, in the surrounding communities.

6.0 Climate, Environmental Justice and Tribal Interest Conclusion

This Climate, Environmental Justice and Tribal Interest Analysis informs the EPA's considerations of the request to remove existing statutory and regulatory protections for the Madison and Amsden aquifers at the Marlin 29-21 well site.

Climate conditions, climate change projections, vulnerability of water resources, and population trends in the Wind River Basin foretell increasing pressures on surface and groundwater resources. Climate conditions in Wyoming, including the Wind River Basin, indicate a progressive warming trend observed in all seasons with overall temperatures in the state having risen approximately 2.5°F since the beginning of the 20th century. Wyoming, like the rest of the Great Plains, is susceptible to droughts, which are occasionally severe. The Wind River Indian Reservation has recently experienced several severe drought events and climate impacts, a trend that will be exacerbated as the climate continues to change.

Climate model projection scenarios indicate that conditions in Wyoming will become consistently warmer in two to three decades, and temperatures will rise steadily towards the middle of the century. These climate conditions will continue to impact surface water resources, including increasing reservoir evaporation rates and decreasing duration of critical snowpack, causing snowmelt to occur earlier in the spring season and glacial mass to decline. The intensity of future droughts is projected to increase, and the overall warming trend will jeopardize the late season surface water flows and increase dependency on groundwater in the Wind River Basin. The Wind River aquifer, a current primary source of groundwater for communities in the Basin, is vulnerable to impacts from climate change and surface contamination, can be unreliable, may not have significant quantities of water in the future, and requires treatment technologies that can be expensive. Therefore, surrounding communities may need to rely on other sources of water in the future. Current climate conditions, increasing water demands for agricultural, energy development, and domestic purposes, continuing impacts to surface and groundwater quality and quantity, population growth projections, and climate change may heighten the need to access groundwater sources and further drive technological and economic advancements in accessing deeper, high quality groundwater resources for drinking water purposes in the Wind River Basin. The Eastern Shoshone and Northern Arapaho Tribes foresee increased reliance on groundwater for drinking water purposes and anticipate needing to access deeper aquifers, such as the Madison aquifer, as the climate changes and water resources grow scarcer. Climate conditions, climate change projections, vulnerability of water resources, and population trends in the Wind River Basin indicate increasing pressures on surface and groundwater resources which, in conjunction with the high quality of the groundwater in the Madison and Amsden USDWs at the Marlin 29-21 well site, support maintaining the existing SDWA protections that apply to the aquifers consistent with Congressional intent to protect both current and potential future sources of drinking water.

This analysis identifies equity and environmental justice concerns in Fremont County and on the Wind River Indian Reservation, where many of the environmental, socioeconomic, and health indicators are elevated compared to state and national averages. Equity concerns are heightened in rural areas where people more often reside in underserved communities, including those with drinking water infrastructure challenges and greater reliance on groundwater sources. The existing socioeconomic and health vulnerabilities in these communities make them even more susceptible to adverse impacts from climate change. On the Wind River Indian Reservation, Indigenous Peoples experience historic inequities and disproportionate health and environmental burdens, including cumulative impacts to water resources. The Tribes hold unique perspectives given their historic ties to the land and water resources in the area, their long-term interests as sovereign nations in safeguarding high quality water resources as critical to enabling future generations to permanently persist on the Reservation, and their cultural and spiritual ties to water. Indigenous Peoples can be more vulnerable to climate change health impacts than the general population. This analysis also identifies cumulative impacts from the Moneta Divide Project that contribute to health and environmental burdens, including impacts to water resources, in the surrounding communities. Removing the existing statutory and regulatory protections for a potential source of high-quality drinking water for these Tribal, rural and overburdened communities would further exacerbate existing inequities particularly with respect to historic and ongoing adverse and cumulative impacts to water resources and community health. Thus, equity, environmental justice, and Tribal interest considerations, in conjunction with the high quality of the groundwater in the Madison and Amsden USDWs at the Marlin 29-21 well site, support maintaining the existing SDWA protections that apply to the aquifers consistent with Congressional intent to protect both current and potential future sources of drinking water.