WYOMING TROUT UNLIMITED

July 5, 2019

Jason Thomas
Department of Environmental Quality
Water Quality Division
200 West 17th St
Cheyenne, WY 82002

Re: Comments on the Aethon Energy Operating, LLC Proposed Renewal of WYPDES Permit Number WY0002062

Dear Mr. Thomas,

Please accept the following comments on behalf of the Wyoming Council of Trout Unlimited, referred to in the rest of this document as WYTU. We sincerely appreciate the opportunity to participate in this comment process. The WYTU is a group of committed volunteers from throughout the state that work to enhance and protect coldwater fisheries in Wyoming. We represent 12 local chapters, two of whom are located within the region of Boysen Reservoir and its watershed (the Popo Agie Anglers Chapter in Lander and the East Yellowstone Chapter in Cody), and more than 1,600 members who are anglers and conservation-minded people. We are affiliated with our national organization, Trout Unlimited, whose mission is to protect, restore, reconnect and sustain our nation's trout and salmon fisheries and their watersheds.

The WYTU Council and its Conservation Committee have reviewed Aethon's proposed permit renewal application, Wyoming DEQ's draft permit, and the report prepared by Aethon's consultant, Environmental Resources Management (ERM). In addition, members of WYTU attended the Riverton and Thermopolis public meetings sponsored by DEQ and members of the Conservation Committee participated in a field tour of the Boysen Reservoir proposed mixing zone (Badwater Creek Bay), and the project area where discharge of produced water is occurring (Badwater Creek and Alkali Creek areas). Our Conservation Committee is composed of members who have in-depth experience with fisheries biology, professional chemistry backgrounds, medical backgrounds, and science-based backgrounds. We have tried to better understand the complicated and complex analyses conducted which are offered as supportive documentation for approving the permit renewal for Aethon's discharge activities.

General Overview Comments

According to ERM's modeling studies and DEQ's draft permit, the addition of 8.27 million gallons per day of produced water along with the discharge of 2,161 tons/month of total dissolved solids (TDS) and 719 tons/month of chloride will be undetectable in the Wind River below Boysen Dam (a Class 1 coldwater fishery and Blue Ribbon trout stream). Additionally, DEQ states that once the discharges enter Boysen Reservoir (a Class 2 waterbody) into the identified mixing zones, the reservoir itself will act as a dilution mixer. This dilution is to be the preferred method of treatment.

We have many concerns about the DEQ's approval of this permit and at this time cannot support the permit renewal given the insufficient data presented in the analyses. Based on our collective reviews, our overriding concern is that the DEQ has not provided adequate or thorough analyses of the discharge issues; nor has the DEQ investigated the chemical evaluations of the components that will be discharged into the tributaries that drain into Boysen Reservoir. At best, the data presented do not begin to provide the comprehensive and robust analyses required for the types of discharge increases, both treated and untreated, and the chemical contents that are proposed for Aethon's Moneta Divide planning area and the subsequent discharge areas that eventually connect into Boysen Reservoir. We are deeply disappointed in the quality of review and oversight conducted by the DEQ.

The following summarizes WYTU's specific concerns with a detailed discussion following this list.

1. DEQ must conduct a more thorough internal review of the permit application as well as an independent third-party review that does not entirely depend upon the operator's own analyses.
2. A more thorough and researched evaluation of the chemicals that are contained in the produced water discharges is needed. Chemicals used in drilling subsurface oil and gas products even after mixing with water, are extremely hazardous, and have many challenges in reducing toxic elements prior to discharge.
3. Other methods of disposal of untreated and treated produced water should be thoroughly analyzed, including reinjection, as less harmful options for remediating the expected increases of produced water discharges.
4. Water quality standards must not be exceeded either above Boysen Dam , within Boysen Reservoir and especially below Boysen Dam where water quality standards must be maintained at the levels set in 1979 when the Wind River was designated as a Class 1 watershed.
5. Aethon does not have the capacity at its Neptune Water Treatment plant to treat all of the current produced water discharges, let alone the proposed 8.27 million gallons/day. That deficiency should be Aethon's responsibility to correct.
6. If surface discharge is to be the primary method for getting rid of produced waste water, water must be fully treated prior to any discharge, with treated waters consisting of a quality level that does not harm fish, wildlife, the surrounding aquatic and riparian communities, and the general public which live and recreate in the discharge areas.

7. A rigorous water sampling protocol and methodology, results analysis, and monitoring program must be implemented and available for public review. That program should be inclusive of all chemical properties of the produced water, in particular those known to be hazardous and/or toxic.
8. Recreation in and around Boysen Reservoir is important economically to the area, and potential impacts to recreation, to crops, to municipal water supplies, etc., have not been fully scrutinized.

Specific Comments

1. **DEQ must conduct a more thorough internal review of the permit application as well as an independent third-party review that does not entirely depend upon the operator's own analyses.**

Wyoming TU Council has concerns about DEQ's relying entirely on the operator Aethon for providing the studies and analyses. In our review of the ERM's documents, several items were of obvious concern to us, including the lack of a true chemical representation, and omission of a thorough downstream water quality analysis and associated chemical reactions with the downstream environment. From the DEQ presentations in Riverton and Thermopolis, the history of discharge, monitoring, and reporting of activities within this oil and gas planning area indicates that operators have traditionally been handling their production activities with little input or oversight from DEQ or without regard to the regulations. Thus, we have concerns about how Aethon may be representing their data for this permit renewal and request that DEQ provide an independent technical and scientific analysis of the ERM modeling. Based on our review and the review from others, it appears the ERM study is very limited and does not provide the comprehensive analyses required for surface water discharges of produced wastes.

For instance, interactions that both treated and untreated produced waters will have with soils, vegetation, air, and downstream mixing with other small drainages need to be incorporated into the permit review and overall chemical analysis. We are familiar enough with the geography and geology of the area to know that it contains highly alkaline soils which are also highly erodible. Chemical interactions with discharge waters and downstream flows must be considered; concentrations of chemicals in the increased discharge efforts must be considered; a better understanding of the constituent interactions among the physical and chemical properties must be considered.

Furthermore, there seems to be some discrepancies between the Aethon permit application and the measured water quality data and the DEQ's proposed discharge permit relying on one sample at Outfall 6 as the "go to" water quality analyses for consideration of the permit. We recommend DEQ conduct a second, intense review of the data sets provided by Aethon and ERM and the logical procession of produced waters release, both untreated and treated. This is of particular importance, it seems, based on the lack of numerous water chemistry analyses that should be part of this evaluation.

The WYTU has had the chance to review a recent report compiled for the Wyoming Outdoor Council (WOC) that thoroughly addresses significant inadequacies with the DEQ's proposed discharge permit,

and Aethon's water quality analyses and modeling study conducted by their own contractors, ERM.[1] This report provides further supportive evidence that the DEQ cannot approve the current permit renewal without violating state and federal regulations regarding water quality resources. We urge DEQ to consider amending the Aethon permit renewal to incorporate the recommendations of the Bergman-Meyer memorandum provided to DEQ by WOC. The concerns of water quality and chemistry in the effluent of the proposed revision, the effects of the produced water on aquatic organisms, the potential effects on the geomorphology on Alkali and Badwater Creeks and the effects on the fishery in Badwater Bay and Boysen Reservoir as a whole are too serious to justify approving the permit renewal application as it is now written.

2. **A more thorough and researched evaluation of the chemicals that are contained in the produced water discharges is needed. Chemicals used in drilling subsurface oil and gas products even after mixing with water, are extremely hazardous, and have many challenges in reducing toxic elements prior to discharge.**

Produced waters from oil and gas drilling activities contain numerous chemicals, many toxic and hazardous to the environment. The DEQ permit mainly addresses TDS contaminants yet an assortment of chemicals are either added to the production process (fracking compounds and others) or are by-products of produced waters during the production and the treatment process of this "by-product" water. Treatment of produced waters and resulting products will need to be based on whether produced water will be from gas production or oil production, since TDS, oil and grease contents differ. This affects the amount of water to be treated, the water chemistry involved in treating, and how the resulting product will be handled. The permit must not be renewed until these chemical parameters are fully understood, measured, and monitored in future discharge activities.

Other chemicals or chemical parameters that are not being monitored or considered in the permit renewal application are those naturally occurring radioactive materials, waxes, greases, alkalinity and bicarbonates, potassium, benzene and the BTEX contaminants (Benzene, Toluene, Ethylbenzene and Xylene), pH, carbon dioxide, hydrogen sulfide and other sulfide gases, hydrocarbons, production chemicals and an assortment of various elemental metals. The presence of all of these chemicals and compounds exist in the properties of produced water. Many of these materials are known to be highly toxic (radioactive substances, aromatic hydrocarbons, potassium, hydrogen sulfide, selenium and others). The literature is full of references to support that statement. And depending on where the reservoir geology happens to be located, especially for the planned increase in oil and gas wells currently under analysis in the Moneta Divide planning area, these discharge quantities can be anything but consistent in their chemical properties.

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[1] [1] Harold Bergman, PhD, Joseph Meyer, PhD. "*Analysis of, and comments on, proposed WDEQ Wastewater Discharge Permit for Aethon Energy Operating, LLC – WY0002062 Renewal.*" Memorandum prepared for Wyoming Outdoor Council. June 27, 2019.

3. **Other methods of disposal of untreated and treated produced water should be thoroughly analyzed, including reinjection, as less harmful options for remediating the expected increases of produced water discharges.**

We understand that reverse osmosis can remove TDS and other dissolved organic compounds effectively – and we support beneficial use of the resulting water supplies; yet, studies have repeatedly shown that problems with reverse osmosis treatment is the negative effect from high TDS and oil contents of produced water, resulting in membrane filtration being negatively affected with the resulting product not necessarily of beneficial use quality. We do support beneficial use of these by-product waters if the results do not harm fish, wildlife, livestock, human health, or the ecology of the area. But we have significant concerns about how Aethon and DEQ permit discharge water without appropriate and complete chemical analyses that include all of the chemicals and physical properties mentioned under discussion point 2.

Injection into a disposal well or reinjection into subsurface geology that does not contaminate groundwaters should be considered in the permitting process. It is a solution that provides the least amount of risk for environmental harm. While we understand DEQ has responsibilities that address only surface discharge, the permit review can include options and recommendations that protect surface contamination from happening. Without adequate sampling, chemical analyses, and oversight monitoring required in the permit, it currently appears that reinjection must be an option to consider. Produced water is an industrial waste and Wyoming's watersheds and reservoirs, especially popular recreation areas, should not be used as the dilution platform for handling this waste.

4. **Water quality standards must not be exceeded either above Boysen Dam, within Boysen Reservoir and especially below Boysen Dam where water quality standards must be maintained at the levels set in 1979 when the Wind River was designated as a Class 1 watershed.**

The Clean Water Act prohibits the discharge of any pollutant from a point source into navigable waters of the United States without a National Pollutant Discharge Elimination (NPDES) permit. These NPDES permits are overseen by the U.S. Environmental Protection Agency (EPA) who has delegated the responsibility for issuing the NPDES permits to Wyoming DEQ. Wyoming statutes refer to produced waters from oil and gas production as by-product water, but Wyoming has few statutes that address produced water handling. The Wyoming Oil and Gas Commission has the authority and rules to prevent the pollution of fresh water supplies by oil, gas, or salt water and can also regulate the various activities associated with the production of these contaminated waters, including disposing of produced waters and wastes.[2]

Understanding the various agency responsibilities is key to understanding how important it is that DEQ provide the upmost robust set of analyses and resulting required permit guidelines in order to protect Wyoming's waters and landscapes. Wyoming law does not allow for contaminating, disposing or comingling of produced waters into live streams, lakes, reservoirs, groundwater aquifers, or other

[2] W.S. 30-5-104(d)(i)(C).

surface water course, without application and approval by agencies such as the Wyoming State Engineer's office, Wyoming Oil and Gas Commission and/or DEQ.

Wyoming DEQ's water quality rules have very specific requirements for produced water management. However, currently DEQ's definition of produced water is very weak and defines it as "underground water which surfaces through oil and/or gas wells."[3] This definition almost seems to provide an escape clause for lessening strict discharge requirements of produced waters. Nevertheless, any operator wishing to discharge production water from an oil and gas production facility into surface waters must obtain a permit and comply with specific national and state regulations. These include but are not limited to:

- Have sufficient quality to be used for wildlife or livestock watering or other agricultural uses and is actually put to those uses during discharge;
- Not contain toxic materials in concentrations or in combinations that are toxic to human, animal or aquatic life;
- Not damage land or vegetation;
- Be discharged from a clearly identified facility;
- Minimize erosion of the drainage at the point of discharge;
- Not contain substances that will settle to form sludge or other deposits that adversely affect water supplies or use or that degrade the aesthetics or habitat;
- Satisfy additional requirements when used for stock and wildlife consumption.[4]

We believe all of the above has occurred in the past operations in the Moneta Divide planning area, is occurring at some levels currently, and has the potential to significantly increase under the current permit renewal process DEQ is proposing, and therefore, the renewal of this permit should not be approved.

Our research has found that EPA is currently conducting a study that will take a holistic look at how EPA, states, tribes and stakeholders regulate and manage wastewater from the oil and gas industry.[5] Recognizing that there are limits to discharging, to reinjecting, and to unhealthy discharges, there is a need for new approaches in handling these waters. We recommend the DEQ review and monitor this study and visit the website which discusses a companion portion of the study with EPA and the state of New Mexico where policy issues were developed on produced water.[6]

5. **Aethon does not have the capacity at its Neptune Water Treatment plant to treat all of the current produced water discharges, let alone the proposed 8.27 million gallons/day.**

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[3] Department of Environmental Quality, Water Quality Rules, Chapter II, Section 3(b)(1xxx).
[4] Ibid.
[5] https://www.epa.gov/eg/study-oil-and-gas-extraction-wastewater-management. Accessed June 24, 2019.
[6] https://www.epa.gov/uog/memorandum-understanding-between-state-new-mexico-and-epa-governance-produced-water-new-mexico

During the Riverton and Thermopolis public meeting presentations, DEQ discussed the uniqueness of this discharge permit and the significantly large quantities of produced water discharge being proposed. Also presented were the past challenges in getting TDS levels down to the requisite 908 tons/month level, proposed through the permitting of an injection well. However, the permitting of the well failed, and the TDS levels remained high despite Aethon's attempts to lower them during a three-year permitting trial. Thus, Aethon invested in the development of the Neptune Treatment Plant which currently treats enough water to stay at the required 908 TDS tons/month. While Aethon recently made improvements to the facility in order to handle up to 3,900 bbls, that still leaves considerable discharge amounts of untreated produced waters eliminated onto ground surfaces and into ephemeral, intermittent and perennial drainages. In addition, chloride exceedances, even with Neptune's facility expansion efforts, are occurring according to DEQ's presentations (currently at 2,000-2,400 ppm where the chloride standard is 230 ppm).

Under the current proposed permit renewal application, Aethon is requesting that 5.838 MGD be treated at the Neptune Plant using reverse osmosis, and the remaining balance be left untreated and discharged onto surface areas. This is of concern to us since the analysis model used by ERM assumes that all discharge gets to Boysen. Yet, DEQ is also assuming that Badwater Creek and Alkali Creek are intermittent and will be dry by mid-summer. This is an assumption based on past and inconsistent data and much lower discharge amounts (although Badwater Creek's flow has fluctuated with increases over the years). With the significant amount of increased discharge into this drainage system, we believe DEQ is remiss in not considering how the Badwater Creek and Alkali Creek drainages will be affected. Concerns for water quality conditions remain high with WYTU.

Our field trip on June 18, 2019 showed a very full and flowing Badwater Creek from Lost Cabin (see Photo 1), to Lysite (Photo 2), to Bonneville (Photo 3) and the flow into Boysen Reservoir's Badwater Bay (Photo 4). Understanding that runoff was still occurring, the flows still presented concerns based on the level of permitted discharge at this time period. We viewed all kinds of siltation, wetland and riparian impacts, and erosion issues at various points along our route.

Photo 1. View of Badwater Creek looking downstream from the Lost Cabin bridge. June 18, 2019.

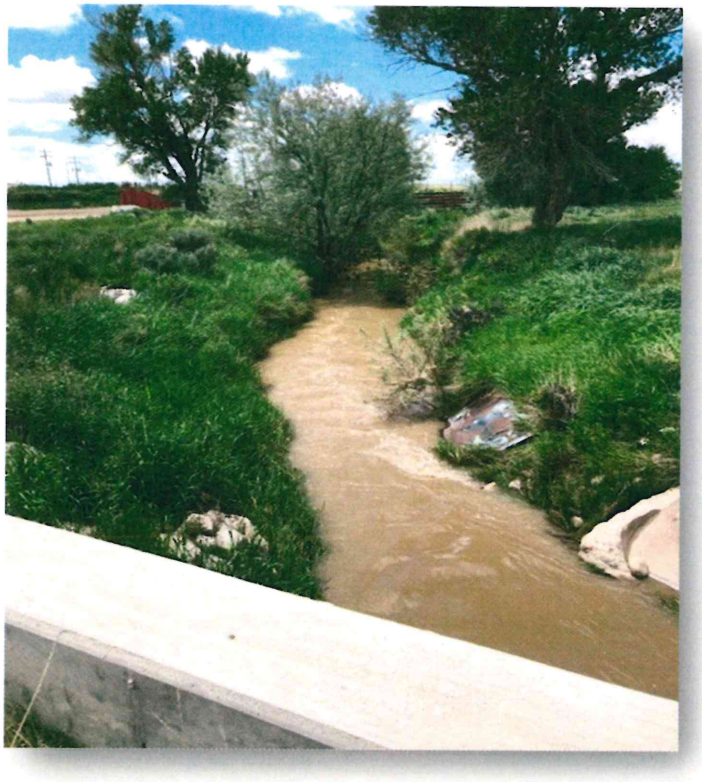

Photo 2. View of Badwater Creek downstream Lysite bridge. June 18, 2019.

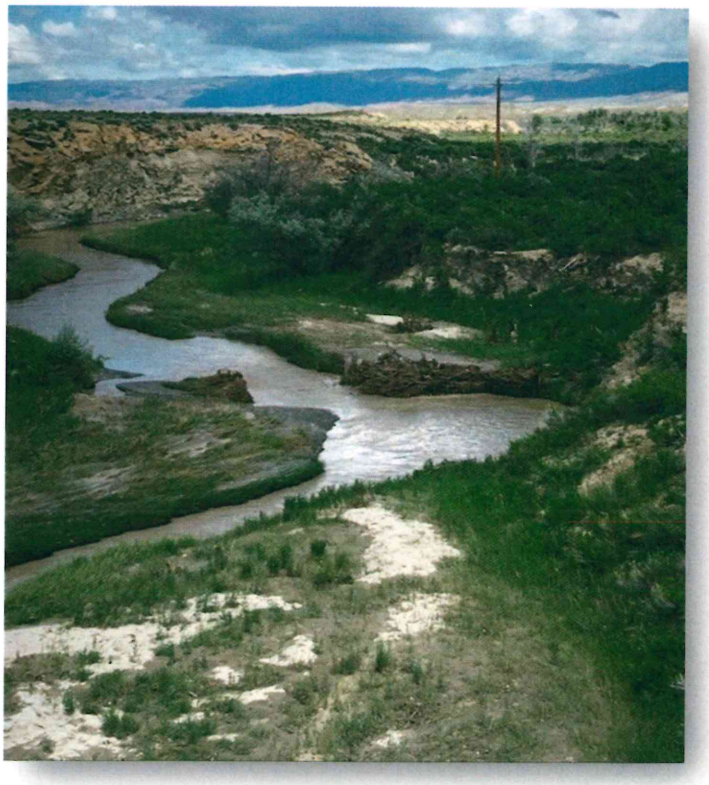

Photo 3. View of Badwater Creek from Bonneville train bridge. June 18, 2019.

Photo 4.. View of Badwater Bay from Highway 789 across from Bonneville turnoff. June 18, 2019.

DEQ states that increased erosion incidents occurred in past discharge activities by previous operators resulting in blowouts and significant degradation to surrounding riparian and wetland habitats and increased sedimentation levels. Our concerns that these same types of events will occur with the increase in discharges are logical since we saw no analyses from either DEQ or ERM -- and we request that DEQ address these issues in the analysis.

DEQ removed monitoring limits for selenium and radium after adding them and several other parameters in 2011, essentially concluding that the levels were insignificant based on previous monitoring data. Based on the lack of a thorough sampling data regime proposed and the lack of a refined and definitive sampling protocol for such monitoring during that time period, we are concerned that DEQ may be hasty in removing those elements from the permit.

6. **If surface discharge is to be the primary method for getting rid of produced waste water, water must be fully treated prior to any discharge, with treated waters consisting of a quality level that does not harm fish, wildlife, the surrounding aquatic and riparian communities, and the general public which live and recreate in the discharge areas.**

Surface discharge is not WYTU's preferred route for dealing with produced water waste. The impacts from untreated and excessive discharge amounts downstream from outfall discharges have not been fully monitored in the past by DEQ and thus, permitting renewals for increased discharge amounts without adequate and detailed studies concerns us. Interactions with groundwater and cumulative downstream impacts need to be analyzed. Downstream chemical reactions including carbon dioxide degassing from the high bicarbonate levels in the downstream flows and the resulting pH increases in water have not been considered in the current analysis. This impact on downstream pH is a well-known chemical reaction that has not been considered in the permit application. Aethon's analysis is limited and speculative and does not provide the public with any level of confidence that all protective measures will be employed in advancing water quality standards from the produced water treatments and discharges.

All water quality parameters that affect aquatic and riparian habitat must be considered and should include the entire length of the drainages of Badwater and Alkali Creeks. Badwater Creek is classified as a Class 2 A-B water and has historically supported a variety of fish species. Wyoming Game and Fish Department has inventoried drainages in the Badwater and Alkali areas and have found numerous species of game and many sensitive fish.[7] DEQ states that increased erosion incidents occurred in past discharge activities by previous operators resulting in blowouts, severe headcutting and significant degradation to surrounding riparian and wetland habitats and Boysen itself.

Furthermore, and of significant importance, Badwater Bay is an important brooding and rearing area for numerous fish species including sauger, an important sport fish and native to many drainages in the Wind River system. Sauger also has a high conservation value.[8] Badwater Bay (along with Poison

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[7] Wyoming Game and Fish Department. Lander Fisheries Supervisor Craig Amadio, personal conversations.

[8] https://county10.com/wyoming-game-fish-water-sauger-numbers-rise-wr-basin/

Creek Bay on the west side of the Reservoir) provide essential nursery requirements for this species survival. Extensive research, inventories and propagation efforts have occurred in the last decade to return sauger to their previous levels in the Boysen Reservoir system. Since Badwater Bay has been identified as potential mixing zone for produced water discharges, WYTU has strong concerns about the impacts increased levels of produced water discharge will have on these critical fish habitats. Silt, sedimentation, erosion and increased chemical constituents flowing into these two Bays can negatively affect future populations of sauger and other species who depend on these critical refuges for their survival.

We strongly urge DEQ to review the literature on impacts to streams and rivers from produced water surface discharges containing high concentrations of TDS and other constituents. Many studies have been done in Wyoming on adverse effects of discharging oil and gas production waters and wastes on aquatic life, and wetland and riparian habitat.[9] In addition, treatment of produced waters must be carefully analyzed in consideration for the numerous interactions on aquatic life.[10]

7. **A rigorous water sampling methodology, results analysis, and monitoring program must be implemented and available for public review.**

Because of the uncertainties and lack of historically consistent monitoring and sampling studies of produced waters released into surface areas within the project location, WYTU supports DEQ implementing a rigorous and comprehensive monitoring program. This monitoring program should include a plan that demonstrates monthly sampling, increasing the parameters that should be monitored including but not limited to potassium, bicarbonate and alkalinity requirements, and should be completed for treated and untreated waters. These data should be posted and made publicly available.

Current sampling points should be expanded to include upstream and downstream points along a series of drainages flowing into and within Badwater Bay and other areas along the Reservoir, and below the dam. In addition, seasonal and monthly sampling must be included in the plan. Sampling once a year, as indicated in the permit renewal documents, is not scientifically valid nor does it provide any sense of confidence that impacts to the watershed are not occurring.

Finally, the monitoring plan must include a contingency plan of action for times when water quality becomes adversely impacted, including enforcement and compliance actions.

8. **Recreation in and around Boysen Reservoir is important economically to the area, and potential impacts to crops, municipal water supplies, etc., have not been fully scrutinized.**

With 76 miles of shoreline surrounding Boysen Reservoir State Park, Boysen Reservoir remains one of the largest reservoirs in the state and is well known for its popularity with anglers in all seasons and is particularly attractive as an ice-fishing destination. It has some of the best walleye and trout fishing

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[9] USGS. https://pubs.usgs.gov/wri/wri014279/html/report.htm; https://pubs.usgs.gov/sir/2013/5179/

[10] https://www.fws.gov/mountain-prairie/contaminants/papers/documents/R6721C05.pdf.

available in a reservoir setting in Wyoming. It is also a popular water sport reservoir, providing numerous access areas for swimming, boating and water skiing.

Fish species in this reservoir are numerous and include walleye, sauger, perch, crappie, ling, rainbow, cutthroat and brown trout, largemouth bass, bluegill, stonecat, black bullhead, mountain whitefish, lake trout, brook trout and splake. One of the ponds off of Badwater Bay contains tiger muskie. Non-game species include carp, fathead minnow, plains killifish, golden and sand shiners; flathead, lake and creek chubs; white, longnose and northern redhorse suckers; and the river carpsucker.[11]

The U.S. Bureau of Reclamation and Wyoming State Parks recently completed an updated Resource Management Plan (RMP) in 2018 for Boysen that includes management objectives for recreation and natural resources in this state park. [12] The RMP's management direction is to improve camping and fishing access and facilities across the state park, with an increase in designated camp sites from 258 to 406 – many which include dispersed camping areas.

Of particular interest are the locations for improved camping and public recreation access in the proposed produced water mixing zone (Badwater Bay). Public health issues must be addressed in analyzing the permit renewal application. While DEQ dismissed any concerns for public health issues, stating that discharges will be minimal if any by the time the flows reach the output at Badwater Bay, there is real concern among the public that the proposed increases in discharges will indeed flow into the Reservoir. Boysen should not be the mixing vehicle for hazardous and toxic chemicals. And the public should have high confidence levels that any discharges will be cleared of chemicals and hazardous compounds.

The RMP discusses concerns about potential threats to water quality from runoff impacts from impervious surfaces, such as paved parking areas. If the RMP notes these types of threats, we can only imagine how they might address threats from significant increases in discharge of treated and untreated produced waters into these popular recreation sites.

Conclusion

The WYTU Council is not opposed to energy development – many of our members work in the energy field. We support responsible energy development and the resultant jobs that are subsequently created. Our first concern, however, is that water quality stays in the Class 1 category for the Wind River downstream from Boysen Dam, that Boysen itself remain a Class 2 fishery without impacts from increased manmade runoff from oil and gas discharges, that fish and wildlife habitat do not deteriorate, and that public health is not compromised.

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[11] Wyoming Game and Fish Department: Lander Region Angler Newsletter. 2017. https://wgfd.wyo.gov/WGFD/media/content/PDF/Fishing/LR_ANGLERNEWS_2017.pdf

[12] "Reclamation: Managing Water in the West". Boysen Reservoir Resource Management Plan. Finding of No Significant Impact, Decision and Environmental Assessment. March 2018. file:///C:/Users/Cathy.Purves/Downloads/Boysen%20State%20Park%20RMP_EA_FONSI%20Vol%201%20(2018).pdf

As reviewed, WYTU believes the proposed permit renewal data and analyses presented by DEQ is lacking in thoroughness, in consideration for all chemical and other constituent compounds, and does not capture the larger picture of what long-term discharges will do to the planning area.

Sincerely,

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