Tongue River Modeling Salinity Modeling Report, May 2023 Draft

Montana Department of Environmental Quality Response to Comments

11/16/23

DESCRIPTION

Montana Department of Environmental Quality (DEQ) received several pages of comments related to the draft of the Tongue River Modeling Report Draft completed in May 2023. Included in this document is a summary of those comments which were related to the model report, as well as DEQ's response.

RESPONSE TO COMMENTS

Comment #1: And we also wonder what has happened to the facts presented at the August 2018 stakeholder meeting in the detailed power point presentation ("Tongue River Salinity TMDL Project"; attached) that specifically showed that the salinity load (based on 2016 data) had to be reduced by 21.5% (slide 56). Is this 21.5% reduction in load still part of the effort?

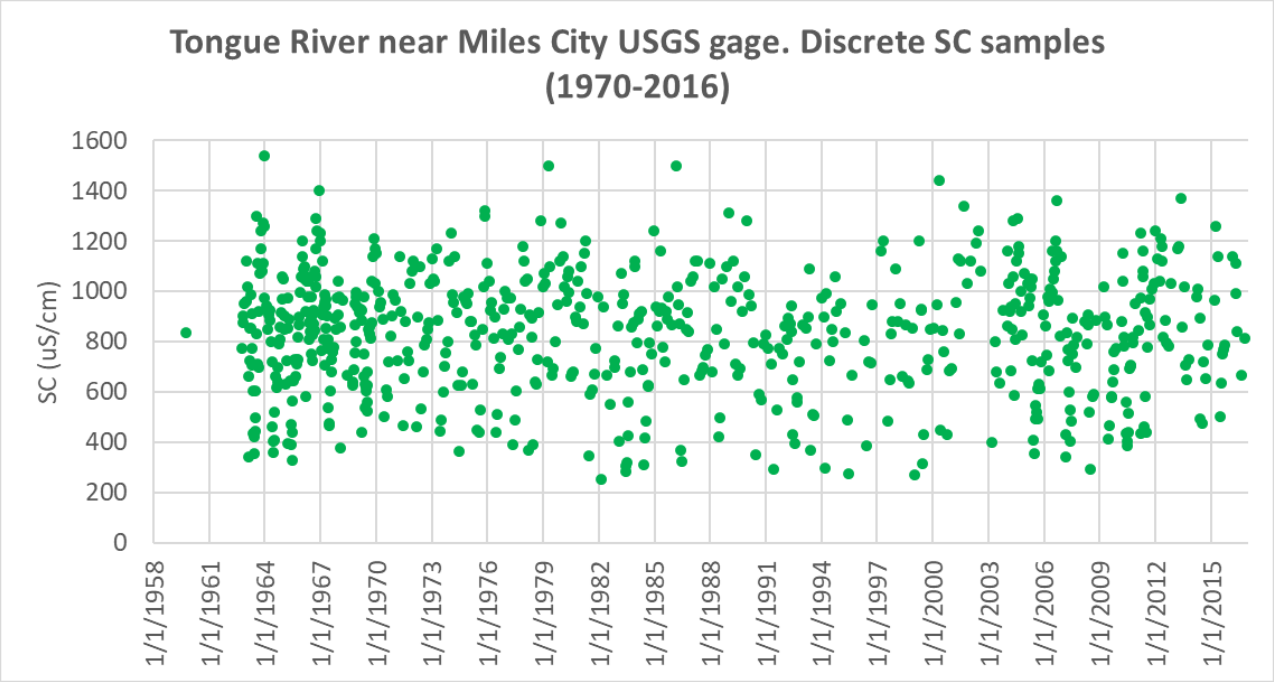
DEQ Response: Slide 56 was an example at the USGS Brandenberg gage of a four-day average SC measurement as compared to the monthly SC standard for the Tongue River. It represented an example of what percent SC concentration reduction was needed on those four days to meet the SC monthly standard of 1,000 umhos/cm. Because it compared the measured in-stream value over 4 days during a time of the highest SC in 2016, it was not a realistic scenario of the reductions needed to meet the TMDL, but rather a near worst-case example. For those four example days at Brandenberg, the necessary reductions to reach the monthly SC standard were 21.5%.

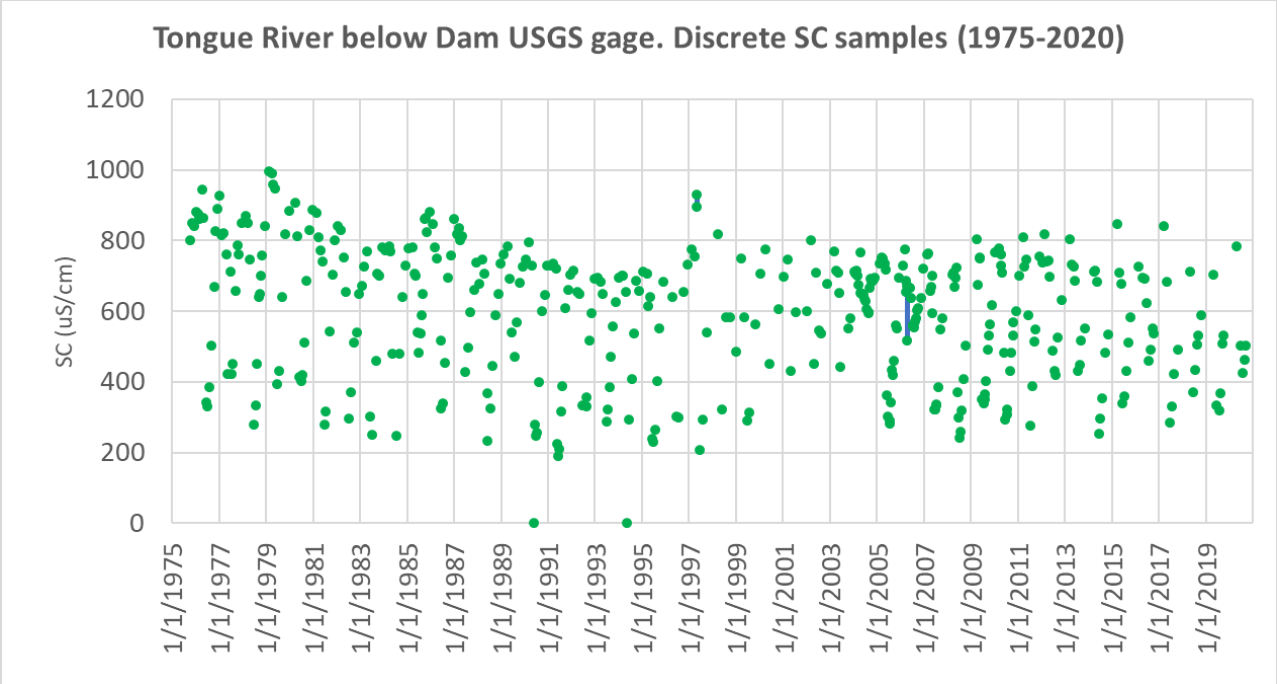
The following slide (#57) showed what reductions might be realized through discharge reductions, land management changes and dam management changes as based on the draft model presented in August 2018. Slide #57 showed that approximately 75% of those reductions were realized through a hypothetical change in the management and increased water releases from the Tongue River Dam (TRD). DEQ determined those management changes and additional flows from the TRD are no longer viable due to both cost and management issues associated with the Yellowstone River Compact. Once the reductions simulated from the TRD management change are removed from slide #57, the available reductions are only about 25% of that needed to meet the needed example reduction of 21.5%. Even though the reduction values in slide #57 were based on the draft model in 2018, which was significantly revised for the 2023 draft model report, both models resulted in the same conclusion that even by combining all the potential options for reducing SC concentrations from anthropogenic sources the TMDL cannot be met in the Tongue River.

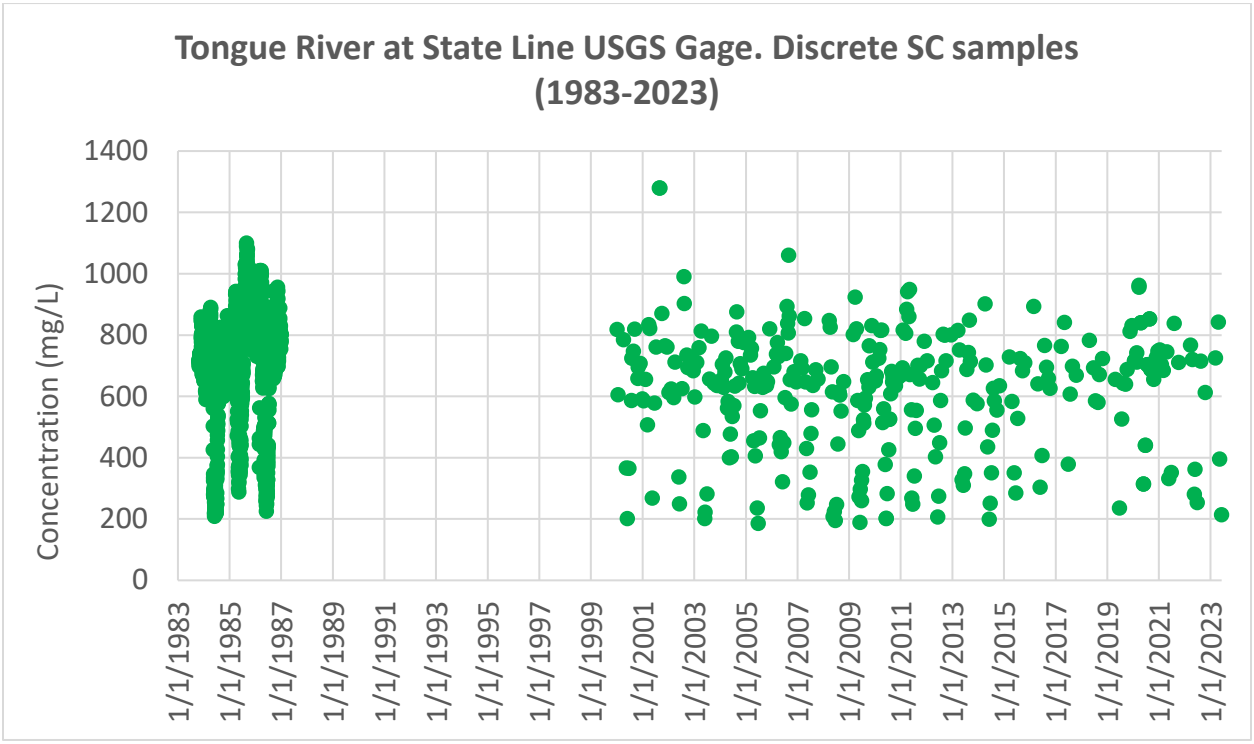
Comment #2: Unfortunately, no data were routinely or regularly collected before energy development began in the region, thus such data were not included. Additionally, data were not collected for salinity until after the guidelines were set up that began limiting discharges of CBM wastewater. So, the water quality of the river pre-CBM development is only known from a few

USGS “grab samples” (which are not useful for this sophisticated model) and by the irrigators in the drainage who used the river water on their fields and long knew of its quality (and when not to use it).

DEQ Response: DEQ disagrees with the characterization that pre-CBM water quality “…is only known from a few USGS “grab samples””. The United States Geological Survey (USGS) collected over 200 SC samples pre-1999 at both the Miles City (291 samples) and Tongue River dam (218 samples) gages. In addition, the Tongue River state line gage has over 3 years of daily SC data consisting of over 1,000 data points from 1983 through 1986. Without adjusting for flow none of these datasets show any visible increase in SC from pre-CBM development (approximately 1999) to post-CBM development (see graphs below of the three USGS gages with pre and post 1999 discrete (grab) SC samples)



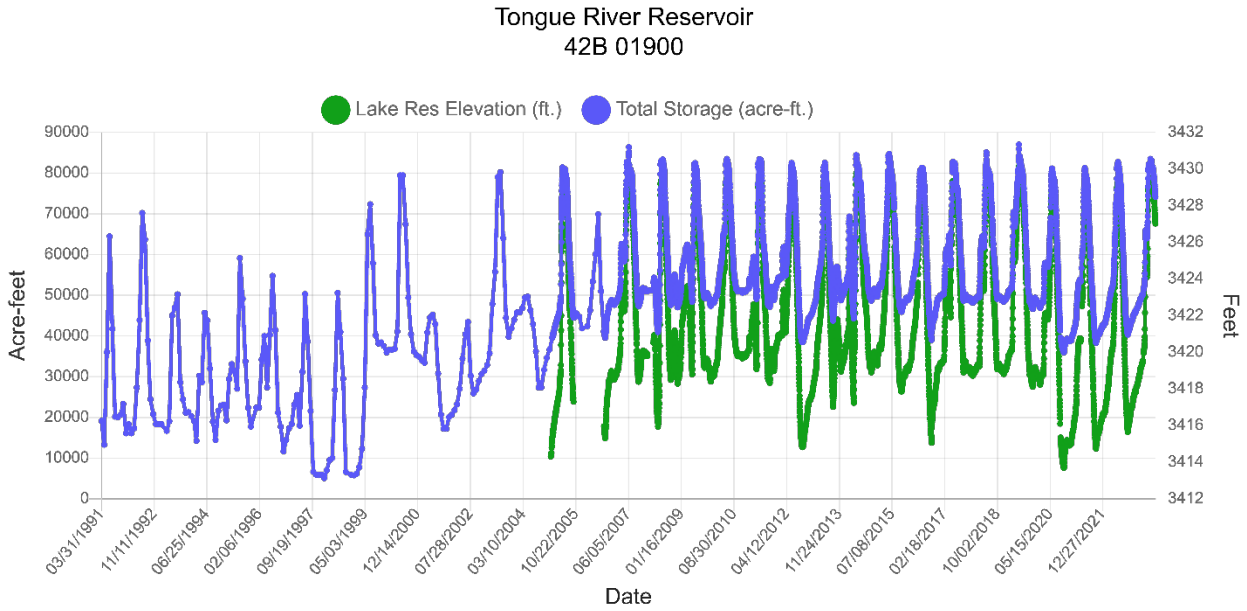




Comment #3: Consequently, the model is constructed using data from an already impaired river system, and, if approved, would be used to figure out how to impair the river system even further.

DEQ Response: One of the most important aspects of developing a watershed model is calibrating the model. Using a time period with the most amount of measured data provides the best verification of the model. The fact that discharges were already occurring during the model period can, contrary to the comment, be advantageous because the model has to simulate those discharges in addition to the natural processes to attain a calibrated model. The model scenarios then removed those discharges one at a time and cumulatively to predict the river quality without anthropogenic sources. The result is a simulated estimate of the natural quality of the river, and of the impacts from each of the identified anthropogenic salinity sources.

Another benefit of the modeling period is that it occurs after the TRD was rehabilitated by DNRC (1996-1999) and raised by 4 feet. This improvement allowed more water to be held in the dam prior to the irrigation season and potentially altering the hydrology below the dam. If the model calibration period had been prior to 1999, any changes due to the dam would have needed to be estimated or not included in the model scenarios. Both options would have reduced the model accuracy to predict future conditions with the dam at its current height and management. The below graph shows changes in storage of the dam after modifications occurred.



Whether estimated discharges were added to a model calibrated to pre-anthropogenic effects or removed from a model that was calibrated to post-anthropogenic effects (as was done) the relative impacts to water quality from each anthropogenic source would be the same.

Comment #4: Nowhere is there any hard data about the original water quality of the Tongue, how much salt the river system can actually tolerate, or the real-world impacts on the river and its users of continued degradation.

DEQ Response: See response #2 regarding available historic data. The purpose of the TMDL and the model is not to determine what level of water quality is necessary to support the various uses, the existing water quality standards were developed previously to address that issue.

Comment #5: The model is also based on many assumptions that are generally dependent on averages. For example, climate. Nothing is average when it comes to climate: sometimes southeastern Montana gets excess precipitation and at other times the area is in drought. Averages cannot account for what is actually happening. And, with the changes we are all seeing in our climate regime, we may be experiencing many more years of drought (for example) than the average used as the basis for the model. This is only one of many averages that this model depends on that have the potential to compromise its reliability.
DEQ Response: The climate parameters used in the model were based on daily values measured at the nine weather stations listed in Table 5-3; the climate parameters used in the model were not based on averages. Table 5-3 included temperature and precipitation averages just for comparison and reference, but those averages were not used in the model. Table 5-3 and Section 5.7 will be updated in the model report to clarify that averages were not used.

Comment #6: Our members in the area are well aware that the CBM ponds for produced water often became "saltier" over time due to evaporation and that during major precipitation events could discharge extremely saline water into the river system via overflow into tributaries to the river. The model does not appear to deal with this, and this flaw in the model is of significant concern to Northern Plains.
DEQ Response: The loading of salts from CBM ponds were primarily based on the average salt concentration measured and reported to Montana and Wyoming on discharge monitoring reports (DMR). With the information available it was not possible, nor was it necessary to meet the project goals, to simulate individual discharges from ponds that were designed to over-top and release produced water during specific precipitation events.

Comment #7: It does not seem reasonable to us that tributaries are not included in this model as they are often critical to the water quality of the mainstem river.
DEQ Response: The model report describes that the three major tributaries (Pumpkin Creek, Otter Creek and Hanging Woman Creek) and the upper Tongue River above the TRD are included in the model as point sources of inflow and salt loads. Those four model point sources (streams) used the measured streamflow, measured salinity, and regression analyses to fill in the missing data on a daily basis. Using measured data to estimate the salinity contributions from those four streams to the impaired sections of the Tongue River is a better method in terms of accuracy and resources than simulating those sources. Because the project is focused on the impaired sections of the Tongue River below the TRD the tributaries and upper Tongue River contribution to the lower Tongue River was the most important information needed; being able to simulate changes to those four streams was not necessary to meet the project goals.

It is important to note that as discussed in the report, the scenarios removed anthropogenic salinity sources from the lower Tongue River and from the four streams contributing to the lower Tongue River as point sources. Therefore, the model scenarios account for all identified anthropogenic sources in the entire Tongue River watershed.

Comment #8: Without looking at the issue of the Tongue River's water quality in the context of the entire watershed/drainage, including all its tributaries to its headwaters in Wyoming, any true understanding of this river system's baseline water quality, reasons for impairments, or attempts at salt load remediation are likely futile.
DEQ Response: The entire watershed was accounted for in the calibrated model, see response to comments #3 and #7. The natural conditions scenarios described in Sections 7.5.1 and 7.5.2 provided simulations of the river water quality without anthropogenic effects, which is an estimate of natural conditions or "baseline water quality." This simulations included removing points sources and impacts of agriculture in the Montana as well as Wyoming portion of the watershed. As a result, the model does provide both valuable information on the natural water quality and insight on what actions might have the best chance of improving water quality in the Tongue River.

Comment #9: And, when combined with Figure 6-25, which indicates that 60% of the salt load in the Tongue River is coming from the Tongue Reservoir, DEQ should be able to understand our concern that this salinity model begins below the reservoir dam and does not truly consider water coming from the Wyoming headwaters. It is known that during winter, water flowing into the reservoir sinks, and salt accumulations in the reservoir rise. Again, without looking at the issue of the river's water quality throughout the entire drainage, any true understanding or attempts at remediation are likely pointless.
DEQ Response: See response to comments #3, #7 and #8.

Comment #10: Additionally, the SAR and EC standards established by the BER are based on readings taken at Miles City at the mouth of the Tongue River where it flows into the Yellowstone River. Consequently, we have long been concerned about what is happening regarding SAR and EC at Miles City. But the report admits that, "The model performs better at the reaches located farther upstream . . . The figures in Appendix H illustrate the inability of the simulation to capture some of the peaks in SC and SAR, particularly for the Miles City section . . . Due to the poorer performance in the Miles City reach, the model results for this section may not be as suitable to be used in management decisions without further re-examination or re-calibration." Because the SAR and EC standards are legally set for obtaining those readings at Miles City, it is incomprehensible to us that this model could be useful nor should it be used for any kind of process involving approval of additional salt discharges into the river.
DEQ Response: The EC and SAR standards established by the BER were based on protecting existing agricultural uses of Tongue River water in the watershed, and monitoring information at Miles City and other locations were used as part of that process. As described in the draft model report, there are two sections of the Tongue River that are impaired. The upper section runs from the confluence of Beaver Creek down to Twelve Mile Dam (T&Y Diversion). The lower section runs from the T&Y diversion to the mouth of the Tongue River. The lower impaired section has higher salinity concentrations as compared to the upper impaired section. The section of the river referred to as the "Miles City section" in the draft model report refers to that lower impaired section (the draft model report will be updated to clarify that the Miles city section is the lower impaired section). The model is calibrated and useful for assessing salinity

loading and sources in the upper impaired section. The model showed that the upper impaired section would exceed water quality standards even under natural conditions. However, model performance was much lower for the Miles City section (Table 6-12 and Figure 6-22 in model report). The simulation did not adequately capture some of the peaks in SC and SAR. This uncertainty farther downstream may be due to the model inputs not adequately characterizing some of the more complex hydrology and soils in that section. If any further decisions are made on the lower impaired section that utilizes the model results, DEQ will revise the model to recalibrate the lower impaired section as described in the draft model report. The current version of the model will not be used to inform management decisions for the Miles City section.

Comment #11: It appears to us that the model is built by using SAR numbers that are extrapolated from EC numbers. It also appears to us that these SAR numbers are based on "normal" conditions in the river, but if a pulse of high SAR/EC water is released, the relationship being used for estimation will not work. As DEQ must be aware, estimated numbers are not enforceable for proving SAR violations.

DEQ Response: As described in the draft model report, the model used intermittent USGS measured (not regressed) salt (calcium, magnesium and sodium) concentrations and daily USGS flow measurements to inform the model of the salinity loads and flows from four streams (Pumpkin Creek, Otter Creek, Hanging Woman Creek and the upper Tongue River above the TRD) entering the model area. Because there are a limited number of days of measured salt concentrations available, the dates with missing salt concentrations were then estimated using the LOADEST regression program to provide salt loads on a daily basis for the model.

The comment confuses the data used in the building the model with the data used to calibrate the model. For SAR, the calibration data was based on USGS published SAR values that were regressed from continuous SC monitors deployed by the USGS. The increase in data calibration points gained by using daily regressed SAR data far outweighs the errors associated with the regression as compared to using a smaller number of samples analyzed via laboratory methods. For example, the number of days with regressed SAR at the T&Y USGS gage available for calibration is 1,437 days as compared to 101 days with SAR samples measured in a laboratory.

DEQ's approach is adequate for purposes of model calibration in order to understand long-term trends in SAR and relative impacts of anthropogenic factors, but it would not be adequate for permitting purposes. Any future permits regarding discharges to the Tongue River or its tributaries related to SAR would require measurements of sodium, calcium and magnesium to make the SAR calculation, and would not be based on a relationship to SC.

Comment #12: So, while this model might be used for some understanding of the past conditions in the watershed, it certainly cannot be used for predicting future changes or as a basis for permitting additional discharges. Consequently, for example, we do not believe that DEQ could use this model to predict how any new mining or any new CBM development would change the salt load.

DEQ Response: DEQ disagrees with the comment, see response to comments #3, #7, #8, and #10.

Comment #13 The federal Clean Water Act requires that TMDLs shall be established for all pollutants preventing or expected to prevent attainment of water quality standards. 40 C.F.R.130.7(c)(1)(ii); see also 33 U.S.C. § 1313(d)(1)(C). Section 1313(d) further provides that TMDLs shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.
DEQ Response: DEQ is aware of the requirement in 75-5-703, MCA to develop TMDLs for waterbodies impaired by a pollutant. A total maximum daily load (TMDL) is not being written at this time for the Tongue River because our analysis indicates that the total natural salinity concentration in the lower segments of the Tongue River is higher than the monthly water quality standard of 1,000 µS/cm during the spring months in most years. As discussed at the January 11, 2023. stakeholder meeting in Miles City, a TMDL may be written in the future, depending on the outcome of DEQ's EC water quality standards evaluation for the Tongue River and a water quality reassessment.

Comment #14: The 2005 to 2013 years used [for the modelling period] were because those were the years that the Tongue River was the most polluted by Coal Bed Methane discharges and discharges from the coal mines. The years that should have been used are the Pre Decker-Coal years.
DEQ Response: See response to comment #3. The model period was chosen to include the time period when the greatest amount of climatic, hydrologic, and water-quality data was available. Using the Pre Decker-Coal years as the modeling period would have been futile as there was no or little data for climate parameters or measured data for calibration.

Comment #15: One of Fidelity discharge permits from the year 2000 to the year 2011 allowed 17,347,291 Pounds Per Year of total dissolved solids (salt) in the river or 6,796,301 Pounds of Sodium. You add the discharges from Decker East and Decker West along with what was being discharged in Wyoming's side of the Tongue River Valley, the Tongue River Reservoir became an industrial waste dump. It is no wonder that the standards for EC and SAR cannot be met using the data from 2005 to 2013.
DEQ Response: DEQ worked with Hydrosolutions to conduct a flow-adjusted trend analysis (Hydrosolutions, 2022) to determine SC and SAR trends at three USGS gage stations from the years 2000-2020] (access report page by searching "Tongue River Watershed Project Outreach" or link found in "References" section below). Those stations include the Tongue River at State Line, Tongue River at Tongue River Dam, and Tongue River at Birney Day School. The results indicate SAR acted as a better indicator of CBM discharge impacts than SC because the SAR concentration of CBM discharge water is comparatively much higher than Tongue River water. Note that this trend analysis was based on actual measured SAR derived from calcium, magnesium, and sodium ion concentrations and not SAR derived from SC data. The trend analysis was able to identify a trend in SAR during CBM activity that was not found for SC. The SAR levels at the Tongue River at State Line station (which only received CBM discharges from Wyoming) indicated a decreasing trend over the entire study period (2000-2020), indicating no

impacts from CBM discharges in Wyoming. However, the two downstream stations did show increases in SAR levels during the peak of CBM development but then decreases after CBM development decreased. The two downstream stations were downstream of Montana CBM discharges which were largely direct discharges to the Tongue River in comparison to the CBM discharges from Wyoming which were largely pond discharges. In addition, see response to comment #3.

Comment #16: The rules written for the standards by the DEQ clearly do not protect the ranchers and farmers of the valley.
DEQ Response: This comment is outside the scope of the draft model report and this project.

Comment #17: DEQ should move forward with the fossil fuel component that is presented in Combined Scenario 1. More specifically, DEQ must immediately limit CBM and coal discharges to zero.
DEQ Response: Combined scenario 1 includes altering management of the TRD to release additional water from a water right held by the Northern Cheyenne Tribe (NCT). DEQ determined those management changes (and additional flows from the TRD) are no longer viable due to both cost and management issues associated with the Yellowstone River Compact. However, the scenario demonstrates that additional releases from the dam can have a significant impact on lowering the salinity in the Tongue River below the TRD, including the two segments impaired for salinity. That information may be useful in future management of salinity issues on the Tongue River.

Any future surface water discharges from coal mines or coalbed methane production are considered point sources and are subject to Montana Pollutant Discharge Elimination System permitting by DEQ (75-5-402, MCA and ARM 17.30.1301). Prohibiting discharges from a facility that can meet discharge requirements and applicable water quality standards is not consistent with state law.

Comment # 18: While DEQ can do little about naturally occurring salinity levels, it has an obligation to protect resources from sources of pollution, namely coal mines and coalbed methane that contribute to an already difficult situation. Simply concluding that no scenario would remove all exceedances of the standard is not an adequate justification to ignore the problem or avoid doing a full TMDL. DEQ has verified that fossil fuel extraction is contributing to a serious problem, and it should therefore act on that information, complete the TMDL, and require coalbed methane production and coal mines to have zero discharges to the watershed.
DEQ Response: Not having a TMDL in place does not preclude DEQ from regulating new and existing permitted discharges of salinity in Montana. Any surface water discharges from coal mines or coalbed methane production are considered point sources and are subject to Montana Pollutant Discharge Elimination System permitting by DEQ (75-5-402, MCA and ARM 17.30.1301). 75-5-402, Montana Code Annotated directs DEQ to issue discharge permits for discharges of pollutants into state waters via the Montana Pollutant Discharge Elimination System (MPDES) (Administrative Rules of Montana 17.30.1301). During MPDES permit development, water quality based effluent limits are developed for all discharges that have

reasonable potential to cause or contribute to an excursion of applicable water quality standards, including Montana's electrical conductivity (EC) water quality standards for the Tongue River and its tributaries. Water quality based effluent limits ensure the protection of state waters regardless of whether a TMDL is in place. Prohibiting discharges from a facility that meets discharge requirements is not consistent with state law.

Comment #19: The Tongue River Gauge above T&Y was installed years ago on my bridge across the Tongue River. I read that this gauge was used for one of the points for calibration. The gauge was paid for by Fidelity for settlement of a lawsuit that Northern Plains won against them. They funded it for a few years and then continued to fund it for a couple of years after that. It can no longer be used to calibrate the model.
DEQ Response: The Tongue River above T&Y gauge had available streamflow and salinity data for 7 of the 9 years of the model calibration period. Therefore, it was used as part of the model calibration.

There are currently six active gages from the state line to Miles City (the most of any river in Montana), several of which are partly funded by DEQ. However, DEQ agrees the T&Y gauge was an important one for estimating water withdrawals and balance in the model. While future estimates are possible using other means, the gauge was helpful for water balance estimates. Due to the high cost of funding these gauges, there are currently no plans to reinstate this gauge.

Comment #20: It appears that the best way to protect the Tongue River is still the TMDL. The presentation given in 2018 pointed out that salinity needed to be reduced by 21.5%.
DEQ Response: Salinity sources for the Tongue River are mostly natural and model results indicate that the EC water quality standard for the Tongue River cannot always be met even when anthropogenic sources are removed . A total maximum daily load (TMDL) is not being written at this time for the Tongue River because the total natural salinity concentration in the lower segments of the Tongue River is higher than the monthly water quality standard of 1,000 µS/cm during the spring months in most years. Thus, an approvable TMDL cannot be written . See DEQ Response 1 for additional information regarding the 21.5% reduction presented in 2018.

Comment #21: It is obvious that the major source of CBM influence for the Tongue comes from Wyoming. EPA will have to intervene to provide guidance for protection for the entire Tongue River watershed, not just the Montana part of the Tongue below the Tongue River dam.
DEQ Response: Figure 5-4 of the draft model report showed that the estimated direct discharges from Montana were higher than the estimated Wyoming discharges during the first part of the model period when CBM discharges were high. The trend analysis results (Hydrosolutions, 2022) suggested that direct discharges of CBM water from Montana had a more immediate and significant impact to water quality than discharges from on-channel and off-channel ponds in Wyoming.

DEQ has coordinated with EPA for the entirety of this project and will continue to work with EPA to find achievable solutions to protect water quality in the Tongue River. In addition, see response to comments #3 and 13.

Comment #22:
The Tribe wants to ensure that it can continue to protect its hard-fought water-rights through its Northern Cheyenne Water Code (2001), participation in the adjudication of non-Indian state water right claims in the Tongue River and Rosebud Creek Basins in the Montana Water Court and its continuation on Compact implementation issues.
I support the Northern Cheyenne Tribe Water Quality Standards (2023).
DEQ Response:
DEQ recognizes that the Northern Cheyenne Tribe has water rights as part of the Tongue River Compact. However, DEQ itself does not deal directly with water rights as part of its work.

Any future efforts by DEQ regarding water quality standards will consider the protection of beneficial uses of the Tongue River. DEQ will continue to coordinate with the Northern Cheyenne Tribe, and to discuss any proposed changes to the Montana state water quality standard which may occur to reflect natural salinity conditions.

REFERENCES:
Hydrosolutions. February 2022. Tongue River Trend Analysis. Prepared for Montana Department of Environmental Quality.
file:///C:/Users/cba263/Downloads/Tongue%20River%20Trends%20Project%20Report-Final_20220224%20(2).pdf