

LIST OF SCENARIOS FOR THE TONGUE RIVER SALINITY WATER QUALITY MODEL – DECEMBER 2016

These tables contain potential model scenarios, based on Montana DEQ's source-assessment needs/considerations and suggestions received at the October 11, 2016 stakeholder meeting in Miles City. The scenarios are divided into three major categories: natural condition scenarios, modifications to land uses and other conditions within the Montana portion of the watershed, and considerations of salinity sources within the Wyoming portion of the watershed. The second column of each table reflects Montana DEQ's decisions on what scenarios to run.

Natural Condition

Natural condition scenarios involve removing anthropogenic sources of salinity throughout the watershed within Montana and Wyoming.

Scenario	Run Scenario?
Remove coal mines from the watershed	Yes Considers natural contribution from coal seams
Remove only the Decker coal mine (as part of this scenario, consider the natural contribution of salt from the coal seams beneath the Tongue River Reservoir)	Combined with above scenario
Remove all coal bed methane wells from the watershed	Yes
Remove all irrigation from the watershed	Yes
Remove the Tongue River Reservoir dam to represent natural flow condition	Yes
Pre-1970/1980 water quality conditions & comparison to current conditions	Limited data. DEQ has looked at this and many of the scenarios that will be run will address the conditions that may have been in existence in the 1970s (pre-industrial development). The modeling report produced for this project will include a narrative summary of what was different then (in the 1970s) versus now.

Montana or Tribal Jurisdiction

This category is for modifications to land uses and other conditions within Montana. This only includes activities within the jurisdiction of Montana (state agencies, other organizations, or landowners) or within the jurisdiction of the Northern Cheyenne or Crow tribes.

Scenario	Run Scenario?
Coal Mines	
Lower surface water permit discharge limits for coal mines in the watershed (i.e., decrease salt load in the discharge)	Yes
Increase the Decker coal mine's discharge to their maximum permit limit (The Decker mine currently discharges salt at levels that are under/less than their permit limit)	Yes
Increase the number of coal mines discharging to surface water in the watershed (a hypothetical future growth scenario) <ul style="list-style-type: none"> Potential new coal mines in Montana include the Otter Creek and Big Metal mines 	Yes Note that this does not include modeling of specific/individual proposed mines; DEQ will model estimated flows and concentrations associated with an increase in this source.
Coal Bed Methane (CBM) Production	
Lower surface water permit discharge limits for CBM operations (i.e., decrease salt load in the discharge)	Yes Removes both flow and concentration from each CBM operation
Incorporate a time lag of CBM discharge water reaching surface water (after infiltration into groundwater, etc.)	Potential future CBM increases inherently captured in below scenario. Lacking data to develop this scenario.
Increase the number of CBM wells discharging to surface water in the watershed (a hypothetical future growth scenario)	Yes Note that this does not include modeling of specific/individual proposed CBM wells; DEQ will model estimated flows and concentrations associated with an increase in this source.
Irrigation	
Increase irrigation in the Montana portion of the watershed to reflect 100% usage of allotted water rights	Yes, if possible. Many rivers in Montana are over-allocated and cannot supply enough water to fulfill all water rights.
100% usage of Tribal water rights	Combined with above
Modify irrigation practices <ul style="list-style-type: none"> Convert more flood irrigation to sprinkler systems Account for new/increased irrigation on N.C. Reservation T&Y Canal flow modification 	Yes (the struck scenario is combined with the 2 nd irrigation scenario)
Tongue River Dam and Reservoir Operations	
Evaporation and other potential impacts linked to increased reservoir size (what if the dam was never raised?)	Yes

Scenario	Run Scenario?
Add hydroelectric power generation to the dam (does this have ability to impact flows or salinity?)	No Negligible impact on salt and flow.
Minimum flow considerations for fisheries or other uses	Combined with below
Seasonal reservoir flow release modifications	Yes – probably a function of water year statistics. Includes fisheries considerations.
Hydrology	
Modify run-off/high flow time periods	No Better addressed with dam release scenarios (see above scenario)
Other Point Sources	
Addition of new point source on Northern Cheyenne Reservation – Potential redevelopment of old timber mill	No Impacts of potential future point sources are integrated in above scenarios. Could be incorporated as a future source as more information is available (specifically discharge flow and concentration information).

Wyoming Jurisdiction

This category encompasses modifications to salinity loading from Wyoming. Although Montana does not have jurisdiction within Wyoming, activities within Wyoming have the potential to influence salt loading at the border and concentrations all along the Tongue River within Montana. Therefore, it is important to understand how increasing or decreasing salt loads from Wyoming will impact Tongue River salt concentrations within Montana. Modifications to salinity loading in Wyoming will be performed by adjusting the salt load at the state border. This will involve evaluating different ranges of salt loading that are affected by various sources of salinity.

Scenario	Run Scenario?
Possible Sources that could Influence Salt Loading from within the Wyoming Portion of the Watershed	
<ul style="list-style-type: none"> Discharges from existing and potential new coal mines <ul style="list-style-type: none"> Existing mines include the Big Horn mine (although there is no associated NPDES permit) Potential new coal mine discharges include the Youngs Creek and Brook mines Discharges from existing and potential new coal bed methane operations Discharges from wastewater treatment facilities Irrigation practices 	Yes Scenarios will likely take on the form of percent increase or decrease adjustments to the load at the border (e.g., plus or minus 20% load change) that could result from any combination of land use modifications within Wyoming such as those identified under the Possible Sources column.