## 7.4 WATER QUALITY

### 7.4.1 Water Quality in the Lakes of the Mainstem Reservoir System

An impact analysis was conducted for the CWCP, the MCP, and the four GP options to determine potential impacts to mainstem lake water quality. Based on this analysis, the water quality assessment for the alternatives discussed in this chapter is presented in Table 7.4-1. The table provides a detailed description of the potential water quality impacts under the CWCP, the qualitative effects of the MCP and the four GP options, the rationale for the conclusion regarding the potential effects, and non-operational impact reduction activities. The qualitative effects of the five alternatives are presented in a progressive manner: effects of a change from the CWCP to the MCP, effects of a change from the MCP to the GP1528 option, and effects of a change from the GP1528 option to the other GP options.

Compared to the CWCP, the MCP improves water quality in the mainstem lakes. The increase in water conservation during droughts within the mainstem lakes reduces the fluctuations in lake level and volume. This additional water storage increases aquatic coldwater habitat and aids in the lakes' ability to avoid eutrophic conditions.

Water quality in the mainstem lakes improves under the GP1528 option, the potential starting point for the GP options. Under this option, the lower summer release causes the lakes to be held at slightly higher levels through the mid-summer and fall timeframe, which slightly improves and protects coldwater fish habitat in the months when coldwater habitat may be lowest. There is also greater protection against developing eutrophic conditions by having more water in storage to dilute nutrient loading from tributaries.

To provide a perspective for how water quality could change in the future if changes are made under the GP1528 option, the following describes the lake water quality changes for the other GP options relative to the potential starting point option. The GP2021 option has a lower summer release, the 25/21-thousand cubic feet per second (kcfs) split summer release, from Gavins Point Dam. This improves lake water quality over the GP1528 option by another, slightly greater, increase in lake levels in the latter half of the summer and fall months. This water quality improvement occurs within the three upper lakes in the Mainstem Reservoir System. With the same summer flow of the 25/21-kcfs split from Gavins Point Dam, a slight water quality improvement over the GP1528 option is obtained through slightly higher lake levels. With a change in only the spring rise amount from 15 kcfs to 20 kcfs, as with the GP2028 option, no additional improvement in water quality is expected in the mainstem lakes over the potential starting point option (GP1528).

### 7.4.2 Water Quality in the River Reaches of the Missouri River

An impact analysis was conducted for the CWCP, the MCP, and the four GP options to determine potential water quality impacts to the river reaches downstream of the mainstem dams. Based on this analysis, the water quality assessment for the alternatives discussed in this chapter is presented in Table 7.4-2. This table provides a detailed description of the potential water quality impacts under the CWCP, the qualitative effects of the MCP and the four GP options, the rationale for the potential conclusion regarding the effect, and non-operational impact reduction activities. Again, the effects will be presented in a progressive manner, as they were for the lake water quality.

Compared to the CWCP, the MCP improves water quality conditions downstream of Fort Peck Dam. The MCP has a release, via the spillway, that will be used to move warmer water from the surface of the lake into the Missouri River. This spillway water mixes with the powerplant's colder water to increase the water temperature downstream from the spillway. The spillway and powerplant releases meet about 6 miles downstream from the dam. Negative effects on water quality downstream of Fort Peck Dam under this alternative may include an increase in the total dissolved gas concentration in the water and an increase in stream bank erosion on the opposite side of the river from the spillway and the associated sediment loading to the river.

Water quality in the Missouri River decreases under the GP1528 option, the potential starting point option, when the 15-kcfs spring rise and the minimum navigation service flat release at Gavins Point Dam are added to the MCP. Under the GP1528 option, the summer flows at Gavins Point Dam are lower than the MCP flows. This provides less downstream dilution of point and nonpoint pollutants. This lack of dilution may periodically affect aquatic life and recreational use water

**Table 7.4-1.** Water quality effects of the alternatives on the Missouri River mainstem lakes.[1/]



| Potential Impact | Description | Lake | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Arsenic concentrations may increase in water column, exceeding Tribal and State water quality standard for domestic drinking water and aquatic life. | Arsenic from the Missouri River basin (natural background and nonpoint sources) becomes adsorbed onto solids entering and being deposited in the lake. The wave action erodes and agitates the lake sediments during low lake levels, potentially causing elevated dissolved arsenic concentrations in the water column. Elevated arsenic concentrations during low lake elevations and drought conditions may affect domestic water usage (requiring additional treatment prior to domestic use) and cause chronic effects to aquatic life in lakes. | All | NC | NC | NC | NC | NC | Adverse effects are greatest during droughts when lakes are drawn down and bottom sediments are exposed to erosive effects of waves on the lakes. The alternatives generally have lower or higher lake levels than the CWCP during droughts and, no matter what the alternative is, the lake levels will expose sediments containing adsorbed arsenic. | Sediments with arsenic are already deposited in the lakes from background, point and nonpoint sources. Accumulation of additional arsenic in the top layers of deposited sediments can be reduced if the arsenic can be stopped at the source. Domestic water systems should test for arsenic, metals, and other pollutants to ensure water supplies are protective of human health. |
| There may be an increase in exposure of fish to sediment containing mercury, pesticides, and other toxic pollutants that will accumulate in fish tissue. | Consumption advisories have been issued for fish caught in the Missouri River mainstem lakes in Montana, North Dakota, South Dakota, and Nebraska. Montana suggests limiting the consumption of walleye, northern pike, lake trout, and Chinook salmon due to elevated levels of mercury. In North Dakota, all species and size of fish tested were found to contain mercury. Elevated levels of PCBs and dieldrin in channel catfish taken from the river were found in Nebraska. | All | NC | NC | NC | NC | NC | The lakes receive sediment, metals, nutrients, pesticides, and other pollutants from upstream watershed areas. Lakes are sediment sinks that contain adsorbed metals and pollutants that can be in high concentrations. Chemical dynamics between the sediment and water column will continue to expose aquatic life to metals and pollutants. The flow regimes of the alternatives relative to the CWCP will have no effect on the overall exposure and biological uptake of these pollutants by fish in the lakes. | The EPA should work with Tribes, States, and other entities to establish an integrated monitoring program to assess increased bioaccumulation of toxic pollutants in lakes. As part of the Missouri River adaptive management process, bioaccumulation of metals and pesticides should be addressed based upon reliable water quality and fish monitoring data. Action needs to be taken in the watershed to reduce point and nonpoint sources of pollutants that bioaccumulate in fish tissue. |

**Table 7.4-1.** Water quality effects of the alternatives on the Missouri River mainstem lakes. [1/]



| Potential Impact | Description | Lake | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Severe fluctuations in lake elevations in Fort Peck Lake, Lake Sakakawea, and Lake Oahe may affect the size and quality of coldwater fish habitat. | Reduction in coldwater habitat in lower portions of lakes occurs in Fort Peck Lake, Lake Oahe, and Lake Sakakawea. The low lake volume in combination with warmwater temperatures can decrease the dissolved oxygen concentrations below State water quality standards. The hypolimnion during summer stratification conditions can offer limited habitat area for coldwater fish species that require dissolved oxygen greater that 5 mg/L and a water temperatures less than 10°C. | FPL, SAK, OAHE | + | + | + | + | NC | The (+) for the MCP means a positive impact to the Missouri River relative to the CWCP. Aquatic habitat models indicate an improvement in coldwater fish habitat due to increased drought conservation measures (see Section 7.7.2). The (+) for GP1528 reflects additional improvement in aquatic habitat relative to the MCP by additional conservation measures due to the lower summer flows. The (+) for the GP2021 and GP1521 options indicates even greater annual summer conservation measures with Gavins Point Dam releases. NC for the remaining option GP2028 means there is no additional improvement to the lake fluctuations relative to option GP1528. | As part of the Missouri River adaptive management process, the Corps, Tribes, States, and EPA should evaluate the relationship between coldwater habitat and water quality to lake elevations based upon reliable water quality monitoring data. |
| Low lake levels contribute to the development of eutrophic conditions (nutrient enrichment) in the lakes. | Nutrient concentrations in lakes may increase due to reduced lake volumes in extended droughts that provide less dilution to nutrient loads under normal conditions. This reduced level condition would provide less dilution to nutrient loads. Nutrient and metal releases from anoxic conditions may occur. The decomposition of organic matter may decrease available dissolved oxygen concentrations in the hypolimnetic region of the lake. Blue green algae blooms can also cause aesthetic and water quality problems. | All | + | + | + | + | NC | The (+) for the MCP means a positive impact to the Missouri River relative to the CWCP. Additional conservation initially increases the volume of water in the lakes and slows down the severe drops in lake elevations in the drought periods. The (+) for GP1528 reflects additional annual summer conservation, and higher lake levels and more lake volumes to dilute nutrient loading. Additional conservation with the lowest summer release from Gavins Point Dam for the GP2021 and GP1521 options indicates a (+) change for the GP1528 option. NC for GP2028 means there is no additional improvement towards reducing lake eutrophication relative to the GP1528 option. | Reduce nutrient loading from point and nonpoint sources within the watersheds. Under the adaptive management strategy, the Corps Tribes, States, and EPA should review potential water quality concerns referencing water quality monitoring data specific to eutrophic conditions. |

**Table 7.4-1.** Water quality effects of the alternatives on the Missouri River mainstem lakes. [1/]



| Potential Impact | Description | Lake | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Missouri River flows will transport and deposit large amounts of sediment, causing more problems in achieving narrative sediment standards. | Narrative water quality standards for sediment (siltation) are being exceeded in lakes (Sharpe, Oahe, Francis Case and Lewis and Clark Lakes). Siltation and sediment accumulation that is affecting the designated uses is the reason for lake impairment. | SRP, LFC, OAHE, LC | NC | NC | NC | NC | NC | Sediment erosion, transport, and deposition are normal processes when operating dams systems. The dam system developed on the Missouri River has resulted in less total suspended solid loading throughout the river system than under natural conditions. The total amount of sediment loading will not be affected by the alternatives' spring and summer flow regimes in the river. High sediment loading into lakes comes from tributaries within watersheds with highly erodible soils. Tributaries with high sediment loading into the mainstem lakes include the Bad River (Lake Sharpe), the White River (Francis Case Lake), the Niobrara River (Lewis and Clark Lake), and the Cheyenne River Arm (Lake Oahe). | Control sediment loading through source control in the watersheds. Implement nonpoint and stormwater control practices such as the Section 319 Project on the Bad River. Erosion control studies that involve both structural controls and best management practices are needed to reduce high sediment loading. |

1/ Legend for abbreviations used in table:
(+) means positive improvement to the environment
NC means no change
(-) means negative impact to environment
All - All lakes in Missouri River Mainstem System
FPL - Fort Peck Lake
SAK - Lake Sakakawea
OAHE - Lake Oahe
SRP - Lake Sharpe
LFC - Lake Francis Case Lake
LC - Lewis and Clark Lake

**Table 7.4-2.** Water quality effects of the alternatives on the river segments of the Missouri River.[1/]



| Potential Impact | Description | River Reach | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Water discharged from dams causes channel alterations via bank and channel cuts that affect aquatic life habitat. | Dam discharges are considered to be aggressive since they are not in equilibrium with the receiving water sediment conditions, causing sediment erosion downstream. Erosion of river banks and channels near the dam discharge location can also be influenced by discharge velocity, channel morphology, and soil erosion potential. Erosion scours the river bed, which impacts benthic aquatic life and lowers the elevation of the river bed. The lowering of the river bed elevation in turn lowers the local groundwater table, which affects vegetation and side channels. | Downstream of Fort Peck Dam | - | NC | NC | NC | NC | The MCP has a negative (-) effect relative to the CWCP. The MCP and all the other alternatives have a spring water release from Fort Peck Dam. The spillway on the Fort Peck Dam will be used to draw warm water from the lake. The spillway will discharge water into the downstream reach at a high velocity causing stream bank erosion on the opposite side of the discharge location. Increased bank erosion and sediment loading may occur. NC means no change for the other options relative to the MCP. | Pilot testing will be performed by the Corps to assess potential erosion problems using the spillway for thermal mixing downstream. Portions of the stream bank areas being eroded by the high velocity spillway discharges may be stabilized using best management practices for erosion control. |
| Releases of cold water at Fort Peck, Garrison, and Oahe Dams may affect downstream habitat by not meeting thermal water quality standards. | Discharge water from dams introduces cold hypolimnetic water downstream. Coldwater releases into designated warmwater habitats have negatively affected aquatic life downstream until temperature equilibrium conditions are restored. | Downstream of Fort Peck Dam | + | NC | NC | NC | NC | The (+) for the MCP means a positive impact to the aquatic environment. The MCP has a dam release that will be used to discharge warmer water from the lake into the Missouri River via the spillway. Mixing with water released from the powerhouse will increase water temperatures downstream. The NC means that the other options also contain this spillway release activity and there is no change relative to the MCP. | Construction of a selective withdrawal structure through which releases could be taken from optimum lake depths will improve thermal problems downstream. Use of spillway discharge from Fort Peck Dam will allow mixing of the warmer surface water with the cold bottom release water in order to comply with and maintain thermal standards. The TMDL study being performed by the State of Montana, EPA, and the Fort Peck Tribe will review and assess alternatives to achieve water quality standards below Fort Peck Dam. |
| | North and South Dakota have not identifed that coldwater releases from Garrison and Oahe contribute to water quality problems. | Downstream of Garrison and Oahe Dams | NC | NC | NC | NC | NC | Garrison and Oahe Dam releases are not significantly affected by the alternatives. | N/A |

**Table 7.4-2.** Water quality effects of the alternatives on the river segments of the Missouri River.[1/] 

| Potential Impact | Description | River Reach | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Flow regime changes from Gavins Point Dam will affect downstream NPDES permits for thermal discharges. | Lower flow conditions, especially during summer and drought conditions, may affect critical low-flow assumptions (7Q10) in permits. Change in flow regimes may cause temperature violations for powerplants using water for once-through cooling. Reduced flows in the Missouri River could cause some river segments to not meet thermal water quality standards. | Downstream of Gavins Point Dam to the Mississippi River | NC | NC | - | - | NC | Relative to the CWCP, the MCP will have no change. Downstream discharges from Gavins Point Dam are similar. GP1528 has a lower summer discharge that the MCP, but not enough to impact downstream thermal conditions. The (-) for GP2021 and GP1521 reflects a more reduced summer flow (21 kcfs) than the MCP and GP1528. Downstream thermal impacts may occur for flows less than 25 kcfs at Gavins Point Dam. GP2028 has summer releases similar to GP1528 and no change is expected. | States will enforce NPDES permit conditions for thermal discharges. Renewed NPDES permits may need to be changed due to the change in flow regimes from Gavins Point Dam. Powerplants may need to consider using cooling ponds or towers to reduce thermal discharges into the river. Powerplants may have to reduce power generation capabilities when discharges at Gavins Point Dam are 21 kcfs. EPA is studying thermal discharges and verifying mixing zone calculation assumptions on the Missouri River. |
| Flow regime changes from Gavins Point Dam will affect downstream NPDES permits for industrial and Publicly Owned Treatment Works (POTW) dischargers. | Low summer flow conditions and drought conditions, may affect critical low-flow assumptions and calculations in NPDES permits. Flows used to determine chronic effluent discharge limits (7Q10) and acute discharge limits (1Q10) may change. With less dilution available, water quality-based NPDES permit limits may have to be reduced. | Downstream of Gavins Point Dam to the Mississippi River | NC | NC | NC | NC | NC | NC means that there will be no change relative to the CWCP. Studies have indicated that above 9 kcfs adequate flows exist for NPDES 7Q10 flows. Historically, flows below 9 kcfs at Gavins Point Dam occurred during the drought years. No water quality problems associated with NPDES permits or water quality impacts were reported to the Corps. | N/A |
| Changing flow regimes will affect waters designated as outstanding water resources (Tier III Anti-degradation) | Low-flow conditions may affect Missouri River segments designated as "outstanding waters" in Nebraska and Iowa due to sediment erosion and deposition and elevated pollutant concentrations. According to the Clean Water Act, the water quality of outstanding waters must be maintained and protected. No water quality degradation can occur. | Iowa-Missouri state line to Big Sioux confluence, and Nebraska from Nebraska-South Dakota state line to Niobrara River and from Niobrara River to Big Sioux River | NC | NC | NC | NC | NC | The alternatives have a spring flow ranging from 34.5 to 54.5 kcfs and a summer flow range of 21 to 34.5 kcfs. These flows are well within the range of flows that have occurred under the CWCP. No water quality degradation has occurred in these outstanding water resources under the CWCP. No change in the condition of outstanding water resources is expected. | No water quality impacts expected. The Missouri River adaptive management process should be used to ensure that designated high quality water resources will not be negatively affected. |

**Table 7.4-2.** Water quality effects of the alternatives on the river segments of the Missouri River.[1/] 

| Potential Impact | Description | River Reach | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Low-flow conditions may make portions of the river unsuitable for domestic drinking water uses. | Low-flow conditions of the Missouri River may provide less dilution to tributary loading of pollutants. Higher concentrations of pollutants may be realized in isolated stream reaches, exceeding domestic drinking water standards. | Downstream of Gavins Point Dam to Mississippi River | NC | NC | NC | NC | NC | Low-flow studies performed by the Corps conclude that the critical flow from Gavins Point Dam that will affect drinking water quality is 9 kcfs. Alternative flows are well above this critical flow value. No change in water quality is expected. | No water quality concerns expected. The Missouri River adaptive management process should be used to assess the river water quality and operational changes necessary to ensure that impairment to drinking water resources will not occur in the Missouri River. |
| Low-flow conditions may cause portions of the river to exceed water quality standards for recreation and aquatic life uses. | During low-flow conditions, less dilution may be available to the river to reduce pollutant concentrations in the Missouri River. Pollutant loading may be from tributaries, overland runoff, stormwater drainage from urban areas, combined sewer overflows, and wastewater by-passing. Water quality criteria for aquatic life (chronic) and recreation standards may be exceeded, especially near tributaries and urban areas. Metal, nutrient, pathogen, and basic water quality criteria may be exceeded periodically. | Downstream of Gavins Point Dam to the Mississippi River | NC | - | - | - | NC | Reductions in summer flows are most critical. The MCP flows are the same as the CWCP; therefore, no change is expected. GP1528 has a lower summer flow than the MCP, thus providing less dilution to downstream pollutant sources. There is a lack of available information to determine the critical summer releases from Gavins Point Dam that could cause an aquatic life criteria to be exceeded below flows of 25 kcfs. It seems possible that lower Missouri River flows in combination with lower tributary flows could create conditions that cause aquatic life criteria to be temporarily exceeded. GP2021 and GP1521 have lower summer flows than GP1528 and have a higher potential of causing aquatic life criteria to be exceeded. GP2028 and GP1528 summer flows are similar and no change is expected. During the last drought, no water quality problems were reported to the Corps. | The Missouri River adaptive management process should review monitoring data collected on the Missouri River to determine if water quality problems occur during low summer flow and drought conditions. Water quality studies to address this critical flow issue should be designed and executed by the Tribes, States, EPA, and the Corps. Modeling studies can be performed to estimate critical flow in order to maintain water quality standards. Modeling studies need to be verified by water quality monitoring and analysis. |

**Table 7.4-2.** Water quality effects of the alternatives on the river segments of the Missouri River.[1/] 

| Potential Impact | Description | River Reach | Effects of Alternatives Compared to CWCP | | | | | Rationale for Effect | Impact Reduction |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCP | GP1528 | GP2021 | GP1521 | GP2028 | | |
| Pollutant loading from the Missouri River basin into the Mississippi River contributes to the Gulf of Mexico's hypoxia condition. | Nonpoint sources such as nutrients, pesticides, metals, and sediment from the Missouri River basin are discharged into the Missouri River. The combination of the nutrient and organic chemical loading from both the Mississippi River and Missouri River basins cause extremely poor water quality conditions in the Gulf of Mexico (low dissolved oxygen, eutrophic conditions, and toxic metal concentrations). | Confluence with the Mississippi River to the Gulf of Mexico | NC | NC | NC | NC | NC | The alternatives will have no effect on the hypoxic conditions in the Gulf of Mexico. Essentially, the same amount of water and mass loading of chemical constituents will be released at Gavin Point Dam on an annual basis relative to the CWCP. | Nonpoint source pollution needs to be controlled at the source within watersheds. Best management practices need to be implemented to control pollutant runoff into surface waters. |
| Releases from dams may exceed the National standard of 110% saturation for total dissolved gases. | Waters being discharged from dams can become aerated to the extent that supersaturation of gases, especially nitrogen, can occur. States have not listed total dissolved gases as a cause of water quality impairment. | Immediately downstream of Fort Peck and Gavins Point Dams | - | - | NC | NC | NC | It is possible that aeration will occur during spring rise discharges over spillways, which can lead to high total dissolved gases. The CWCP has fewer operational spillway discharges. The (-) for the MCP means that spillway discharges that will occur at Fort Peck Dam have the potential of increasing total dissolved gas concentrations. In relation to the MCP, GP1528 will have spillway discharges from both Fort Peck Dam and Gavins Point Dam. High concentrations of dissolved gases are harmful to fish; therefore, a negative (-) impact is shown. The GP2021, GP1521, and GP2028 options have the same spillway discharge activity as GP1528; therefore, no change is expected. | As part of the Missouri River adaptive management process, the Corps should monitor dissolved gas concentrations during spillway discharge conditions. No water quality problems have been observed by the Corps from spillway discharges at Gavins Point Dam. |

1/ Legend for abbreviations used in table:
NC means no change relative to the CWCP
(+) means positive change or improved impact to environment
(-) means negative impact to environment

quality. The GP1528 option includes spillway discharges from both Fort Peck Dam and Gavins Point Dam during the spring rise releases. This leads to the possibility of exceeding the National standard for total dissolved gas concentrations.

To provide a perspective for how water quality could change in the future if changes are made to the potential starting point option, the following describes the downstream reach water quality changes relative to the GP1528 option. The GP2021 option has the 20-kcfs spring rise above full service navigation and 25/21-kcfs split summer release from Gavins Point Dam. The reduced summer release discharge relative to that of the GP1528 option causes less dilution of pollutants entering the river. Summer low-flow conditions may negatively affect aquatic life and recreational uses due to a loss of pollutant dilution and may require reduced powerplant thermal discharges to the river. The effects of a change to the GP1521 option are similar because the summer low flows are similar under both GP options. With a change in only the spring rise amount from 15 kcfs to 20 kcfs, as with the GP2028 option, no change in water quality is expected in the Missouri River relative to the GP1528 option.

### 7.4.3 Water Quality for Tribal Reservations

There are numerous beneficial uses for the Missouri River designated by the Tribes, EPA, and the States. These designated uses include coldwater and warmwater aquatic life, domestic drinking water, recreation, agriculture, and industrial uses. Tribes have water rights to the Missouri River and are actively involved with managing their water resources.

Compared to the CWCP, the MCP with its spring rise provides some improvement to water quality in the Fort Peck reach in some years. The MCP provides an increase in conservation within the upper three mainstem lakes that reduces the fluctuations in lake levels and volume. The MCP provides no change to water quality in the Lower River compared to the CWCP.

The four GP options (GP1528, GP2021, GP1521, and GP2028) have the same drought conservation measures as the MCP; however, they have spring rise and lower summer flows than the MCP. They also have Fort Peck Dam spring rise releases. These four options have implications on water quality for both the lakes and river reaches that are adjacent to Tribal Reservations along the Mainstem Reservoir System and the Lower River. The four GP options have different impacts to individual Reservations, depending upon the location within the Missouri River. The lower summer releases from Gavins Point Dam cause more water to be retained in the lakes during the mid-summer through fall period. The drought conservation measures are most beneficial for Reservations that are adjacent to the major lakes (Fort Peck Lake, Lake Sakakawea, and Lake Oahe).

The Missouri River downstream from Fort Peck Dam and adjacent to Fort Peck Reservation is designated for the following uses: domestic drinking water, recreation, agriculture, and industry. The two Missouri River water quality issues related to Fort Peck Reservation are coldwater releases and erosion of sediment into the river. The MCP and the four GP options have a spring rise discharge from Fort Peck Dam. Water released from the dam is mixed with warmer water released from the spillway, raising the downstream water temperature for the native river fish. Increased erosion is expected across the river from the spillway because the releases are directed at the opposite stream bank. Local residents are concerned about increased erosion in the spring, but the Corps' studies indicate that long-term erosion beginning a few miles downstream from the spillway (where the spillway releases have fully merged with the powerhouse releases) should be similar for alternatives with or without the spring rise.

Water quality concerns for Fort Berthold Reservation are dependent upon the conditions of Lake Sakakawea. Lake Sakakawea water quality concerns include suspension of metals, uptake of these metals by fish, nutrient loading leading to eutrophication, and loss of coldwater habitat for some lake fish species. The MCP and the four GP options have increased drought conservation measures and lower releases from the system during the summer. Limiting the decline of the lake level in droughts through increased drought conservation maintains greater amounts of coldwater habitat and provides greater volumes of water in the lakes to dilute nutrient loads and reduce eutrophication. The lower summer releases from Gavins Point Dam also slightly reduce the drawdown of the lake in non-drought periods, which should also slightly reduce these water quality concerns. Neither the MCP nor the four GP options limit the suspension of metals into the water column and the accumulation of metals and

other toxic elements in fish tissue in Lake Sakakawea.

Standing Rock Reservation and Cheyenne River Reservation are located on Lake Oahe. This lake shares the same water quality issues as Lake Sakakawea. The MCP and the four GP options improve the water quality conditions by increased water conservation during droughts. The eutrophication and coldwater habitat effects are reduced during droughts under these alternatives. Lake Oahe is also held at slightly higher level from the mid-summer through the fall, which should also slightly help these water quality concerns in non-drought periods. None of the alternatives limits the suspension of metals into the water column and the accumulation of metals and other toxic elements in fish tissue in Lake Oahe.

Lower Brule Reservation and Crow Creek Reservation are located on Lake Sharpe. Water quality concerns within this lake include metals, nutrient loading, and accumulated sediment. The MCP and the four GP options provide no water quality changes to this area because water levels on Lake Sharpe are controlled at a relatively consistent level under the CWCP, the MCP, and the GP options. Tributaries into Lake Sharpe are the major source of metals, sediments, and nutrients coming from both point and nonpoint sources.

Yankton Reservation is located primarily on Lake Francis Case. This lake has water quality concerns including bioaccumulation of metals in fish tissue, accumulated sediment, nutrient loading leading to potential eutrophication, and siltation. The MCP and the four GP options have no water quality effects on Lake Francis Case because the lake is maintained at comparable elevations for the CWCP, the MCP, and the GP options. Tributaries carrying high sediment, nutrient, and metal loads from highly erodible watersheds heavily influence the water quality of Lake Francis Case.

Ponca Tribal Lands and Santee Reservation are located adjacent to the headwaters of Lewis and Clark Lake. Water quality concerns include bioaccumulation of metals in fish tissue, accumulated sediment, and nutrient loading. No differences in lake levels are expected among the CWCP, the MCP, and the four GP options; therefore, no differences in the water quality issues are expected. Tributaries carrying high sediment, nutrient, and metal loads from highly erodible watersheds heavily influence the water quality of Lewis and Clark Lake.

There are several Reservations located on the Missouri River downstream from Sioux City, including Winnebago, Omaha, Iowa, and Sac and Fox Reservations. The water quality issues in this river reach include NPDES permit discharge requirements, thermal discharges, designation of the reach adjacent to Omaha Reservation and Winnebago Reservation by the State of Iowa as an outstanding water resource, drinking water degradation, and water quality standards for recreation and aquatic life issues. The alternatives with lower summer flows, the four GP options, may adversely affect all of these issues, especially the GP1521 and GP2021 options with their lowest summer release of 21 kcfs from mid-July to mid-August.