Sun River Watershed Restoration Plan – January 2012

Under the 1987 amendments to the U.S. EPA's Clean Water Act, Section 319 provides funding to states to mitigate nonpoint source pollution. As a recipient of a 319 grant (Sun River #209065), the Sun River Watershed Group (SRWG) must produce a Watershed Restoration Plan (WRP) for the Sun River that includes nine minimum elements. The nine elements are numbered below, along with a description of how they will be addressed.

The WRP is intended to provide a broad overview of what the SRWG plans to do to address water quality concerns in the Sun River watershed. It is meant to be a living document. It will be amended from time to time as water quality issues are resolved and, potentially, as new ones arise. The SRWG maintains a 5-year work plan to guide efforts at the project level. The work plan is reviewed and updated annually. The SRWG is in the process of developing a Quality Assurance Project Plan (QAPP) to guide data collection and analysis efforts. The SRWG will develop contracts, scopes of work, project plans, Sampling and Analysis Plans (SAPs) or other documents to guide work on individual projects.

Section 1.0 – Causes of Impairment

Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level along with estimates of the extent to which they are present in the watershed (e.g., X number of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; Y acres of row crops needing improved nutrient management or sediment control; or Z linear miles of eroded streambank needing remediation).

Tables 1, 2, 4, 5, 6 and 7 were adapted from information in the Montana 2010 Final Water Quality Integrated Report. Probable causes for which a TMDL has not been completed are noted with italics. Of the italicized causes, the only one that may eventually get a TMDL will be total phosphorus in Freezeout Lake.

Section 1.1 – Ford Creek

Table 1 - Ford Creek, from mouth 2 miles upstream

Probable Causes	Probable Sources	Affected Uses
Alteration in stream-side or littoral vegetative covers	*Channel Erosion/Incision from Upstream Hydromodifications, Grazing in Riparian or Shoreline Zones, Streambank Modifications/Destablization*	*Aquatic Life, Cold Water Fishery*
Other anthropogenic substrate alterations	*Channel Erosion/Incision from Upstream Hydromodifications, Grazing in Riparian or Shoreline Zones, Streambank Modifications/Destablization*	*Aquatic Life, Cold Water Fishery*

Sedimentation/Siltation	Channel Erosion/Incision from Upstream Hydromodifications, Grazing in Riparian or Shoreline Zones, Streambank Modifications/Destablization	Aquatic Life, Cold Water Fishery

Ford Creek Sediment Sources
Based on information contained in *Water Quality Restoration Plan and Total Maximum Daily Loads For the Sun River Planning Area* (Sun River TMDL):

- Historic influences such as riparian grazing, floods and beaver removal have lead to severe channel entrenchment and erosion. (97.8% of total sediment load)
- Roads and current grazing practices. (2% of human-caused load)

Based on information contained in *Water Quality Restoration Plan and Total Maximum Daily Loads For the Sun River Planning Area* (Sun River TMDL), only 2% of the human-caused sediment load in Ford Creek comes from roads and current grazing practices. The remainder of the sediment load comes from historic influences. Overall, historic influences and natural background erosion accounts for 97.8% of the sediment load in Ford Creek. Historic influences such as riparian grazing, floods and beaver removal have lead to severe channel entrenchment. The Sun River TMDL estimates that it will take about 23 years for the stream to reestablish a floodplain and reduce loading from historic influences by two thirds (TMDL, pg 131 to pg 141).

Section 1.2 – Freezeout Lake

Table 2 - Freezeout Lake

Probable Causes	Probable Sources	Affected Uses
Aquatic Plants - Native	*Agriculture, Irrigated Crop Production*	*Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation*
Phosphorus (Total)	*Agriculture, Irrigated Crop Production*	*Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation*
Selenium	Agriculture, Irrigated Crop Production, Source Unknown	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Sulfates	Agriculture, Irrigated Crop Production	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Total Dissolved Solids	Agriculture, Irrigated Crop Production	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation

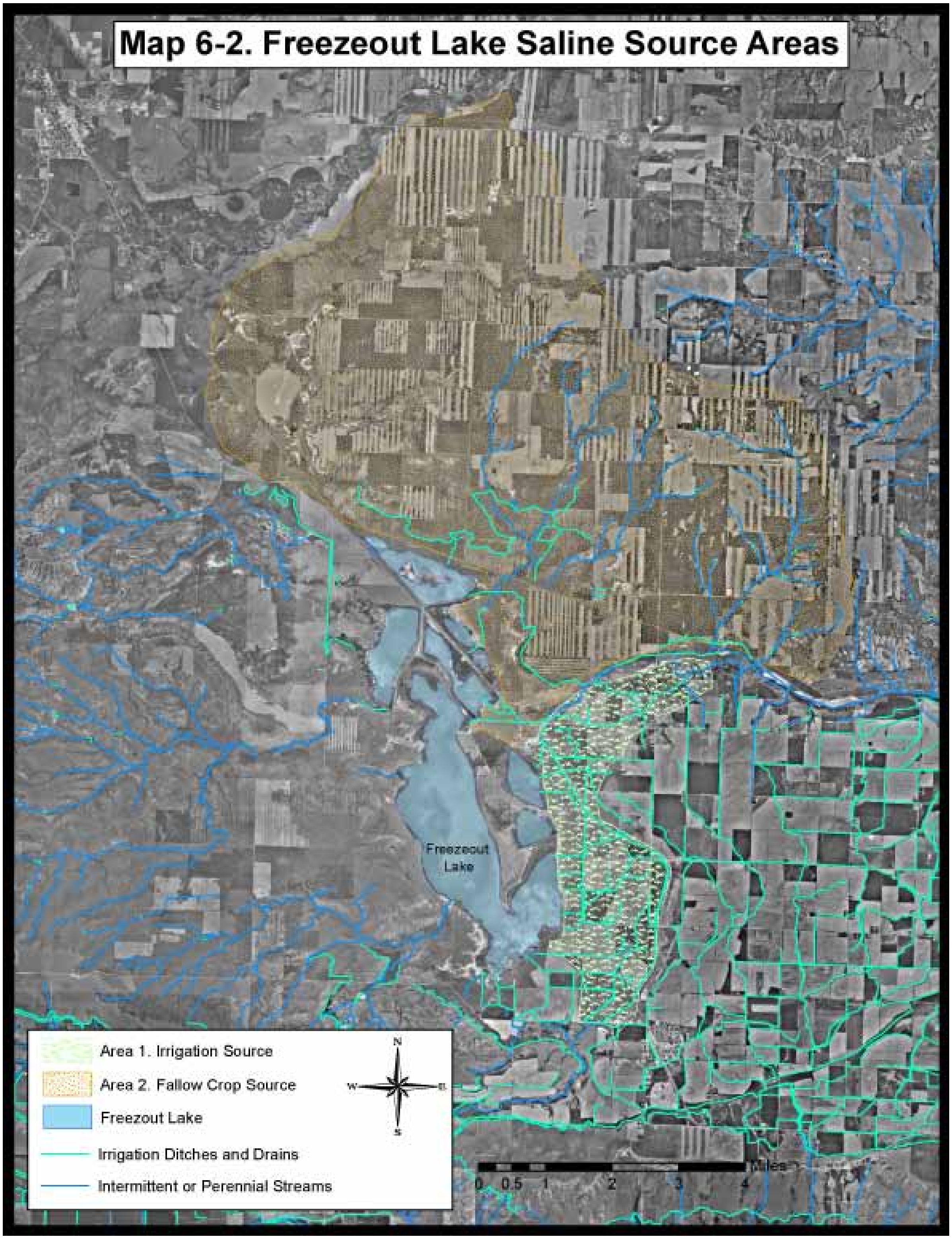
Freezeout Lake Sulfates and Dissolved Solids Sources
From Section 6.1.2 of the Sun River TMDL:

- “The largest human caused contributor of salts [sulfates and dissolved solids] to Freezeout Lake is irrigation occurring on glacial lake deposits.”
- “The second largest human caused contributor of salts is fallow cropping small grain production on glacial lake deposits, glacial drift, and Colorado shale.”

From Section 6.1.4 of the Sun River TMDL:

- “Irrigated areas are estimated to contribute 93 percent of the salt loads to Freezeout Lake.”

Figure 1 (Map 6-2 from the Sun River TMDL) identifies the specific areas around Freezeout Lake that are believed to be contributing salts to the lake water.



Map 6-2. Freezeout Lake Saline Source Areas
Freezeout Lake
Area 1. Irrigation Source
Area 2. Fallow Crop Source
Freezout Lake
Irrigation Ditches and Drains
Intermittent or Perennial Streams
N
W
E
S
Miles
0 0.5 1 2 3 4

Freezeout Lake Selenium Sources
Section 7.1 of the Sun River TMDL indicates:

- The primary, human-caused source of selenium in Freezeout Lake is drainage from irrigated and non-irrigated agriculture.

Table 3, below, identifies the specific source areas and their relative contributions to selenium loading in Freezeout Lake (adapted from Table 7-4 in the Sun River TMDL).

Table 3 - Selenium Source Areas for Freezeout Lake

Location	Irrigated (I) Non-irrigated (NI)	Drainage Area (acres)	Percent of Total Load	Area of Discharge
Greenfields Bench, SW corner	I	1,820	0.5	Main Freezeout Lake
Greenfields Bench, NW corner	I	2,140	5	Pond 1 Pond 5
Off-bench Area, S & E of Freezeout Lake	I	3,580	87	South Freezeout Pond 1 Pond 5
West of Freezeout Lake	NI	45,700	<0.5	Main Freezeout Lake
East of Freezeout Lake	NI	23,700	7	Pond 1

Freezeout Lake Phosphorus Sources
Section 8.6 of the Sun River TMDL discusses the potential for nutrient (e.g. phosphorus) impairment in Freezeout Lake. The Lake is naturally eutrophic, and the Sun River TMDL casts doubt on whether or not the human-caused nutrient contributions are significant enough to actually be causing an impairment of the Lakes beneficial uses. The Sun River TMDL suggests that nutrient levels not be allowed to increase, and recommends that further assessment, followed by possible reclassification of the Lake and its impairment status with respect to nutrients be considered. The Sun River TMDL document does not identify a specific timeline for the reassessment. DEQ is responsible for assessing and classifying waterbodies within the state of Montana.

Section 1.3 – Sun River, Gibson Dam to Muddy Creek (Upper Sun River)

Table 4 - Sun River, Gibson Dam to Muddy Creek (Upper Sun River)

Probable Causes	Probable Sources	Affected Uses

Alteration in stream-side or littoral vegetative covers	*Channelization, Impacts from Hydrostructure Flow Regulation/Modification*	*Aquatic Life, Cold Water Fishery*
Other flow regime alterations	*Channelization, Impacts from Hydrostructure Flow Regulation/Modification*	*Aquatic Life, Cold Water Fishery*
Sedimentation/Siltation	Agriculture, Grazing in Riparian or Shoreline Zones	Aquatic Life, Cold Water Fishery
Temperature, water	Channelization, Impacts from Hydrostructure Flow Regulation/Modification	Aquatic Life, Cold Water Fishery

Upper Sun River Sediment Sources

Section 9.4.2 of the Sun River TMDL describes sediment sources for the main stem (only) of the upper Sun River:

- Natural sources. (43% of the load)
- Bank erosion attributable to hydromodification, caused by operation of the Gibson Dam and numerous irrigation water withdrawals and return flows. (39.4% of the load)
- Bank erosion caused by current agricultural activities, primarily grazing in riparian areas. (16.9% of the load)
- A combination of historic sources of bank erosion, the Sun Prairie Village wastewater treatment facility, and roads. (1.5% of the load) – Note: There is an error in the TMDL. The Sun Prairie Village wastewater treatment facility does not affect the *upper* Sun River. Rather, it affects the lower Sun River.

Tributary bank erosion sources were not assessed during TMDL development, and at least the following tributaries are believed to be sources of unnatural sediment production: Duck Creek/Big Coulee, Mill Creek, and Adobe Creek.

Upper Sun River Thermal Sources

Section 10.0 of the Sun River TMDL describes thermal influences on the upper Sun River. TMDL developers and others spent a great deal of time and energy conducting monitoring and modeling to try and identify the causes (sources) of thermal loading to the Sun River. Due to complex and confounding influences on temperature, the TMDL developers were largely unable to pinpoint and separate the sources of temperature change for specific locations along the River. However, they were able to identify several, widespread influences that alter the natural temperature of the River. These influences include:

- Dewatering of the River by irrigation diversions.
- Surface return flows from irrigated agriculture.
- Subsurface return flows from irrigated agriculture.
- Changes in seasonal water levels due to the effects of operating Gibson Reservoir and Willow Creek Reservoir.
- Lack of shading from riparian vegetation (from the Highway 287 bridge to Muddy Creek). Often the lack of shading is attributable to the death or stunted growth of riparian vegetation that becomes stranded (loses its access to water) as a result of dewatering during the irrigation season. In other instances, the lack of riparian vegetation is the result of excessive livestock grazing along the stream banks.

Section 1.4 – Sun River, Muddy Creek to Mouth (Lower Sun River)

Table 5 - Sun River, Muddy Creek to Mouth

Probable Causes	Probable Sources	Affected Uses
Nitrogen (Total)	Agriculture, Irrigated Crop Production, Rangeland Grazing	Agricultural, Aquatic Life, Industrial, Primary Contact Recreation, Warm Water Fishery
Other flow regime alterations	*Irrigated Crop Production*	*Agricultural, Aquatic Life, Warm Water Fishery*
Phosphorus (Total)	Agriculture, Irrigated Crop Production, Rangeland Grazing	Agricultural, Aquatic Life, Industrial, Primary Contact Recreation, Warm Water Fishery
Sedimentation/Siltation	Channelization, Irrigated Crop Production, Rangeland Grazing	Agricultural, Aquatic Life, Industrial, Primary Contact Recreation, Warm Water Fishery
Total Suspended Solids (TSS)	Channelization, Irrigated Crop Production, Rangeland Grazing	Agricultural, Aquatic Life, Industrial, Primary Contact Recreation, Warm Water Fishery

Lower Sun River Nitrogen and Phosphorus Sources

The Sun River TMDL describes the nitrogen and phosphorus sources in the lower Sun River:

- Muddy Creek. Sources within Muddy Creek are described in Section 1.5, below. (85% of the total nitrate load and 63% of the total phosphorus load).
- The upper Sun River, upstream from Muddy Creek. (15% of the total nitrate load and 37% of the total phosphorus load)
- Contributions from nitrogen and phosphorus sources along the banks and immediate tributaries to the lower Sun River are considered. (negligible quantities)

Lower Sun River Sediment and Suspended Solids Sources

The Sun River TMDL estimates the sediment contributions to the lower Sun River (see Table 6 below, adapted from Table 9-10 in the Sun River TMDL). However, the Sun River TMDL figures do not account for sediment contributions from tributaries to the upper Sun River, Muddy Creek, or the lower Sun River. These tributaries likely may also contribute significant amounts of sediment. Overall, the main, human-caused sources of erosion in the lower Sun River are hydromodification and riparian agriculture.

Table 6 - Lower Sun River Sediment Sources

Source Area	Main Stem Bank Erosion (ton/yr)	Upland Background (ton/yr)	Point Sources (ton/yr)	Roads (ton/yr)	Total (ton/yr)

Upper Sun River	Hydromodification - 20,867 Riparian Agricultural - 8,943 Natural - 7,742 Historic - 367 **Total:** 37,919	14,901	6.6	193	53,020
Muddy Creek	Hydromodification - 28,977 Riparian Agricultural - 3,585 Natural - 3,585 **Total:** 36,147	4,822	none	177	41,146
Lower Sun River	Riparian Agricultural - 3,107 Natural - 3,107 **Total:** 6,214	921	2	34	7,171

Section 1.5 – Muddy Creek

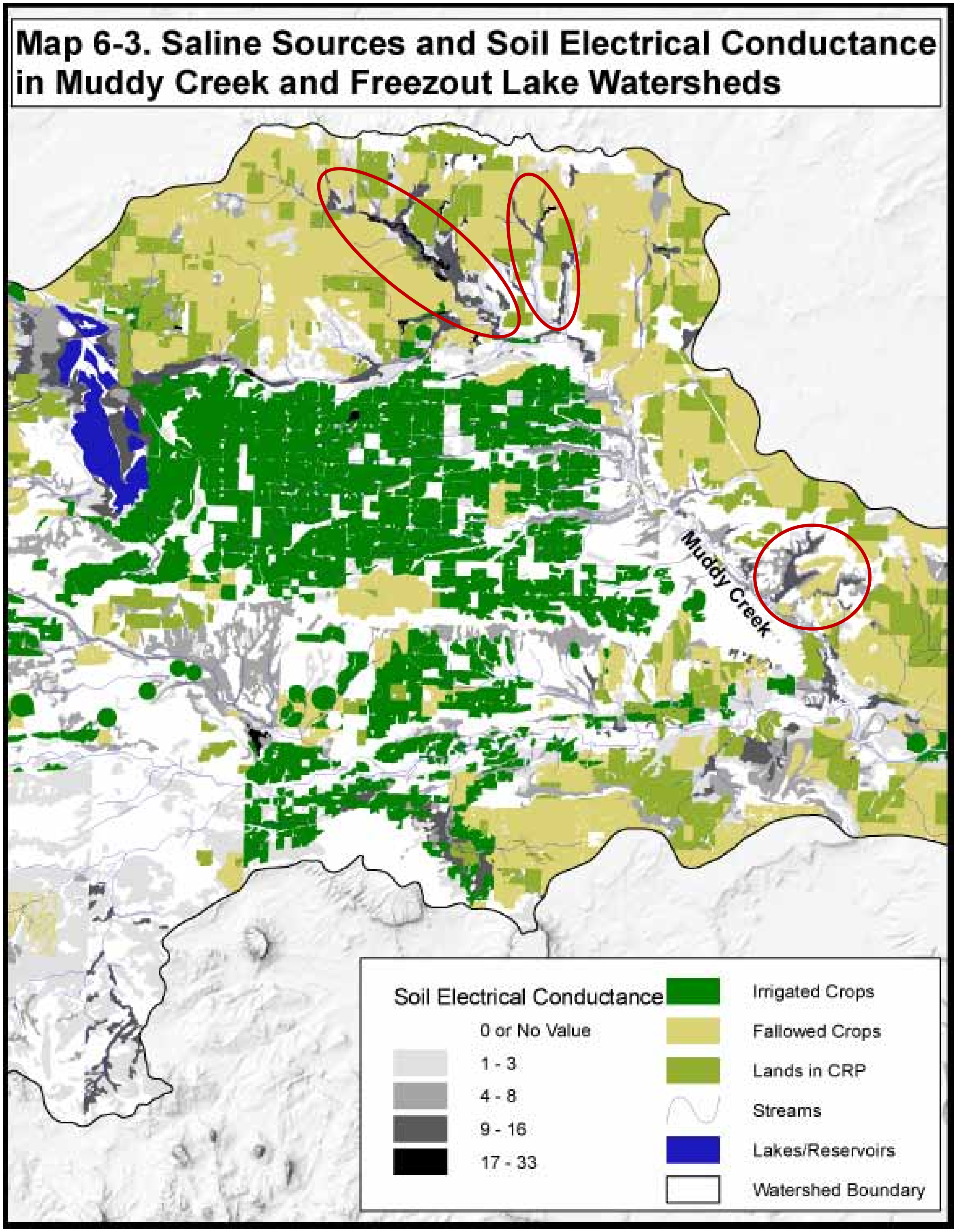
Table 7 - Muddy Creek, headwaters to mouth

Probable Causes	Probable Sources	Affected Uses
Nitrogen (Total)	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Phosphorus (Total)	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Salinity	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Sedimentation/Siltation	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Selenium	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Aquatic Life
Sulfates	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation
Temperature, water	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation

Total Dissolved Solids	Agriculture, Channel Erosion/Incision from Upstream Hydromodifications, Habitat Modification - other than Hydromodification, Streambank Modifications/Destablization	Agricultural, Aquatic Life, Cold Water Fishery, Drinking Water, Primary Contact Recreation

Muddy Creek Salinity, Sulfates and Total Dissolved Solids (aka Salinity) Sources

The most significant, human-caused source of salinity in Muddy Creek is saline seepage down-gradient from fallow cropland overlying salt-bearing, porous soils (see Section 6.2.2 of the Sun River TMDL). Figure 2 (adapted from Map 6.3 in the Sun River TMDL) identifies the primary sources of salinity within Muddy Creek.



Muddy Creek Selenium Sources

Section 7.2 of the Sun River TMDL suggests that the most significant, human-caused source of selenium in Muddy Creek is groundwater discharge from fallow cropland. Figure 2, above, identifies the fallow cropland within the Muddy Creek watershed. Currently, there is no known information with which to more precisely pinpoint the areas contributing selenium to Muddy Creek.

Muddy Creek Nitrogen Sources
Section 8.4.2 of the Sun River TMDL suggests that the most significant, human-caused source of nitrate nitrogen in Muddy Creek is leached fertilizer in surface and groundwater drainage from irrigated agriculture on the Greenfields Bench. In 2002, the Montana Bureau of Mines and Geology (MBMG) analyzed samples from surface water in tributaries and groundwater wells to determine nitrate as nitrogen levels. However, the MBMG study was unable to conclusively determine the relative contributions from the surface water and groundwater tested at five different Muddy Creek tributaries and 16 wells. Please see MBMG 463 for a full description of the MBMG study.

Muddy Creek Phosphorous Sources
Section 8.4.2 of the Sun River TMDL suggests that most significant source of phosphorus in Muddy Creek comes from excess sediment that enters the Creek as a result of bank erosion. Bank erosion in Muddy Creek is largely the result of increased flows from irrigation return flow. The Sun River TMDL notes that the most severe bank erosion in Muddy Creek occurs between the "Muddy Creek near Vaughn" and the "Muddy Creek at Vaughn" USGS stations, and that total phosphorous loads increase by around 53% between these two sites.

Muddy Creek Sediment Sources
Excess sediment in Muddy Creek comes from bank erosion and downcutting in Muddy Creek tributaries and in Muddy Creek itself. The bank erosion and downcutting are both the result of increased stream flow from irrigation returns from the Greenfields Bench. Overgrazing in riparian areas has increased bank instability, speeding up erosion. Section 8.4.2 of the Sun River TMDL indicates that within Muddy Creek itself, the most severe bank erosion occurs between the "Muddy Creek near Vaughn" and the "Muddy Creek at Vaughn" USGS stations. Section 9.3.1 of the Sun River TMDL describes some of the geological features that make this section of Muddy Creek especially susceptible to erosion and downcutting.

Muddy Creek Thermal Sources
Section 10.2.3 of the Sun River TMDL identifies two, human-caused sources of thermal loading in Muddy Creek. The vast majority of thermal loading comes from overland return flows from irrigated agriculture on Greenfields Bench. Loss of riparian cover along Muddy Creek and its tributaries, as a result of riparian grazing, also increases the temperature of the water.

SECTION 2.0 – LOAD REDUCTION ESTIMATES

An estimate of the load reductions expected from management measures.

One of the main goals of the SRWG is to improve water quality to the point where all waterbodies in the Sun River watershed are supporting all of their beneficial uses. SRWG members, along with countless other stakeholders, were involved in the creation of the Sun River TMDL. SRWG expects that the management measures called for in this WRP will achieve the load reduction estimates identified in the Sun River TMDL. The load reduction estimates may be found in the following locations in the Sun River TMDL:

Ford Creek Sediment

Section 9.2.3 of the Sun River TMDL calls for a 2/3 reduction in sediment loading from bank erosion within three decades. In other words, a 66.7% reduction in sediment loading from bank erosion will be necessary in order to achieve water quality standards for sediment by 2034. This reduction is expected to come as a result of natural floodplain development in the currently entrenched channel. Current entrenchment is the result of historic, human-caused influences. These influences have been eliminated, but it will take time for the stream channel to return to its natural geometry.

Freezeout Lake Sulfates and Dissolved Solids

The Sun River TMDL expresses the sulfate and dissolved solids load reductions as reductions in Total Dissolved Solids (TDS) contributions. Table 7 (below) has been adapted from Table 6-6 in the Sun River TMDL.

Table 8 - TDS Allocation to Sources

Location	Existing Load (lbs/day)	Percent Load Reduction Needed to Meet Allocation	Allocated Load (lbs/day)	Percent Allocation of TMDL	Load per Acre Allocation (lbs/day)
Irrigated areas including NW portions of Greenfields Bench and off-bench area S&E of Freezeout Lake	217,807	37.5	136,229	87.9	23.7
Dry land areas (grazing/fallow crops)	15,996	37.5	9,945	6.4	0.14
Fairfield Wastewater Treatment Plant	1,130	0	1,130	0.7	----
Margin of Safety	----	----	7,755	5	----
Freezeout Lake TMDL	----	----	155,056	----	----

Freezeout Lake Selenium

Section 7.1.3 of the Sun River TMDL contains load reduction estimates for selenium in Freezeout Lake. Table 8 (below) has been adapted from Table 7-6 in the Sun River TMDL.

Table 9 - Total Recoverable Selenium Allocation for Freezout Lake

Area	Average Annual Discharge	Average Selenium Concentration (ug/L)	Average Annual Selenium Load (lbs/yr)	Allocation to Specific Sources (lbs/yr)	Percent Reduction Needed ((existing load - allocation)/existing load)
Fallow Crop	360 Acre Feet	99	97	5	95
Irrigated Lands	2557 Acre Feet	Irrigation 46 Non-Irrigation	485	35	93

		83			
Fairfield Wastewater Treatment Facility	0.59 cfs	?	?	0.02	Likely no reduction needed, phased waste load assessment

Freezeout Lake Phosphorus
The Sun River TMDL suggests that there are likely several human-caused sources of phosphorus loading to Freezeout Lake. However, the Lake is naturally eutrophic, and there is little or no evidence suggesting that the additional nutrient loads are causing an impairment of the Lake's beneficial uses. At this time, there are no phosphorus load reductions proposed for Freezeout Lake.

Upper Sun River Sediment
Section 9.4.3 of the Sun River TMDL calls for the following sediment load reductions, based on 2004 loading:

- 33% reduction overall.
- 80% reduction in loads from riparian agricultural impacts.
- 50% reduction in loads from hydromodification impacts.

Upper Sun River Thermal Sources
Section 10.1.4 of the Sun River TMDL explains that it is not feasible to calculate % load reductions for thermal inputs in the upper Sun River drainage. Instead, the Sun River TMDL recommends the following, performance-based actions:

- In the stretch of river between highway 287 and Muddy Creek, increase river shading from 14% (2004 level) to 22%.
- Achieve Fish, Wildlife and Parks' wetted perimeter discharge requirements for survival of aquatic communities (drought minimum – 100 cfs above Elk Creek, drought minimum – 130 cfs below Elk Creek, and non-drought minimum – 220 cfs for all).

Lower Sun River Nitrogen
The Sun River TMDL does not identify a specific load reduction needed to address nitrogen. Instead, it provides a discharge-dependent equation for calculating the TMDL. The equation is: TN TMDL (lbs/day) = 2.959*Discharge (in CFS).

Lower Sun River Phosphorus
The Sun River TMDL does not identify a specific load reduction needed to address phosphorus. Instead, it provides a discharge-dependent equation for calculating the TMDL. The equation is: TP TMDL (lbs/day) = 0.269*Discharge (in CFS).

Lower Sun River Sediment and Suspended Solids
Section 9.5.3 of the Sun River TMDL calls for the following sediment load reductions, based on 2004 loading:

- 35% reduction overall.
- 15% reduction in loads from Muddy Creek.
- 33% reduction in loads from the upper Sun River.

- 80% reduction in loads from riparian agricultural impacts.

Muddy Creek Salinity, Sulfates and Total Dissolved Solids (aka Salinity)
Section 6.2.3 of the Sun River TMDL identifies the following necessary load reductions:
- For irrigated agriculture in the Muddy Creek watershed, no increase in Total Dissolved Solids loading.
- For fallow cropping, a 20% reduction in TDS loading, measured in the month of April.

Muddy Creek Selenium
Section 7.2.3 of the Sun River TMDL identifies the following necessary load reductions:
- "When comparing the 1991-2000 measured loads to the TMDL, an average load reduction of 36% is needed to meet the TMDL during February-April." (pg 85)
- Loads from fallow crop areas must be reduced by 41% from February-April.

Muddy Creek Nitrogen
The Sun River TMDL does not identify a specific load reduction needed to address nitrogen. Instead, it provides a discharge-dependent equation for calculating the TMDL. The equation is: TN TMDL (lbs/day) = 3.497*Discharge (in CFS).

Muddy Creek Phosphorous
The Sun River TMDL does not identify a specific load reduction needed to address phosphorus. Instead, it provides a discharge-dependent equation for calculating the TMDL. The equation is: TP TMDL (lbs/day) = 0.269*Discharge (in CFS).

Muddy Creek Sediment
Section 9.3.3 of the Sun River TMDL calls for a 15% reduction in the 3-year average suspended solids load at Vaughn.

Muddy Creek Thermal Sources
The Sun River TMDL does not identify a specific load reduction needed to address temperature (see Sections 10.2.4 and 10.2.5 of the Sun River TMDL). Instead, it provides two, discharge-dependent equations for calculating the TMDL, and calls for the TMDL to be met by reducing thermal loading from overland irrigation water return flow from the Greenfields Bench. The equations for calculating the TMDL are:
- Instantaneous load limit: Maximum Load (in kilocalories/second) = Discharge (cfs)*676.206
- Average weekly load limit: Maximum Load (in mega-calories/week) = Discharge (7-day average discharge in cfs)*32351.07

SECTION 3.0 – MANAGEMENT MEASURES

A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in Section 2, and a description of the critical areas in which those measures will be needed to implement this plan.

Ford Creek Sediment
The Sun River TMDL suggests that ongoing practices within the watershed are not causing significant impairment, and that it will take approximately 23 years for Ford Creek to redevelop its natural

floodplain and recover from historic, human-caused entrenchment. No additional management measures are needed in order to achieve recommended load reductions.

Freezeout Lake Sulfates and Dissolved Solids (aka salinity)
The main priority for addressing salinity loading to Freezeout Lake is to address loading from irrigated agriculture on lands located between Freezeout Lake and the Greenfields Bench. With respect to this geographical area, the following management measures should be considered:

- Avoid conversion of un-cropped or non-irrigated land to fallow cropping or irrigated cropland.
- Switching from flood to pivot irrigation.
- Conduct an irrigation ditch water loss study for the area and for ditches directly up gradient of adjacent, glacial lake deposits.
- Ensure that water savings are put into Freezeout Lake through surface water pathways (to aid dilution).

It may also be important to address salt inputs to surface and groundwater from saline seeps caused by fallow cropping practices. Saline seep recharge areas should be identified, and cropping practices should be altered, where practical, to dry up seeps and prevent new ones from forming. However, these management measures should be a distant secondary priority in comparison to measures addressing impacts from irrigated agriculture.

Freezeout Lake Selenium
The major sources and causes of selenium loading to Freezeout Lake are the same as those for salinity. Therefore, the management measures identified above for addressing salinity will also address selenium.

Freezeout Lake Phosphorus
The Sun River TMDL suggests that there are likely several human-caused sources of phosphorus loading to Freezeout Lake. However, the Lake is naturally eutrophic, and there is little or no evidence suggesting that the additional nutrient loads are causing an impairment of the Lake's beneficial uses. At this time, there are no phosphorus-load-reducing management measures proposed for the Freezeout Lake watershed.

Upper Sun River Sediment
The following management measures should be implemented within the upper Sun River watershed:

- Reduce irrigation withdrawals and return flows, and create a more natural flow regime in the Sun River and its tributaries.
- Develop and implement grazing management plans for all riparian grazing lands.
- Where practical, establish riparian buffers along the Sun River and its tributaries.
- Evaluate and address erosion sources/causes within Duck Creek / Big Coulee.

Upper Sun River Thermal Sources
Management measures for addressing temperature impairments in the upper Sun River must focus on the following:

- Leaving more water in the stream.
- Reducing or eliminating irrigation water from returning to the River via surface flow.
- Increasing the amount of vegetative stream cover.

To that end, the following management measures should be implemented:

- Capture all or most of the surface irrigation waste water and devise a more efficient approach to water delivery on all major conveyance ditches.
- Use evapotranspiration or soil moisture monitoring for irrigation scheduling.
- Install head gates that can be fully or even remotely controlled.
- Switch from flood irrigation to pivot irrigation to reduce surface runoff and return flows.
- Apply irrigation savings to in-stream flow.
- Develop and implement grazing management plans for all riparian pastures.
- Time pasture use to promote grazing, not browse.
- Place supplemental feed or salt in upland areas to promote even grazing in pastures that include riparian areas.
- Develop alternative watering sources and fence livestock out of riparian areas wherever possible.
- Replant native shrubs and trees in formerly over-grazed riparian areas.

Lower Sun River Nitrogen

The majority of the nitrogen pollution in the lower Sun River comes from Muddy Creek. Implementing the management measures identified below for addressing nitrogen loading in Muddy Creek, is expected to achieve desired load reductions in the lower Sun River.

Lower Sun River Phosphorus

The majority of the phosphorus pollution in the lower Sun River appears to be coming from Muddy Creek. Implementing the management measures identified below for addressing phosphorus loading in Muddy Creek may achieve desired load reductions in the lower Sun River. However, some additional management measures may need to be implemented in the upper Sun River and its tributaries. The additional management measures should focus on reducing sediment inputs from stream bank erosion. Eroded sediment is believed to be the primary source of phosphorus loading in the upper Sun River watershed.

Lower Sun River Sediment and Suspended Solids

Sediment loading in the lower Sun River is almost exclusively the result of upstream sources in the upper Sun River and Muddy Creek. Implementation of sediment reduction measures upstream will address sediment-related impairments in the lower Sun River.

Muddy Creek Salinity, Sulfates and Total Dissolved Solids (aka Salinity)

Figure 2 (above) roughly identifies the areas within the Muddy Creek drainage that contribute salts via saline seepage. Within the contributing areas, the following management measures should be taken:

- Identify individual saline seeps, and estimate their relative salt contributions to Muddy Creek and its tributaries.
- Identify the recharge areas for the saline seeps.
- Work with landowners to implement cropping practices to dry up the seeps (e.g. switching from crop/fallow to perennial crops or forage).

Muddy Creek Selenium

The major sources and causes of selenium loading to Muddy Creek are the same as those for salinity. Therefore, the management measures identified above for addressing salinity will also address selenium.

Muddy Creek Nitrogen

The following management measures are prioritized (from greatest to least) according to their potential to reduce nitrogen loading to Muddy Creek:

- Develop and implement farm-specific nutrient management plans for irrigated lands on the Greenfields Bench.
- Implement irrigation water management measures to reduce irrigation losses to groundwater and surface water from irrigated lands on the Greenfields Bench. Management measures might include switching from flood to pivot irrigation, automating irrigation ditch monitoring and management to reduce irrigation return flows, or lining irrigation ditches to prevent seepage loss.
- Develop and implement farm-specific nutrient management plans for animal feeding operations located within 300 feet of streams, drainages, ditches and other waterways.
- End the practice of using irrigation canals/ditches as winter cover for livestock.
- Reduce the intensity of riparian grazing.

Muddy Creek Phosphorous

The following management measures are prioritized (from greatest to least) according to their potential to reduce phosphorus loading to Muddy Creek:

- Implement irrigation water management measures to reduce sediment erosion from irrigation return flows. Management measures might include switching from flood to pivot irrigation, automating irrigation withdrawal management, lining irrigation ditches to prevent seepage loss, or recapturing irrigation return flows for reuse or slow release.
- Promote the natural growth of soil-stabilizing riparian vegetation. This could be done by changing riparian grazing practices, creating riparian buffers, or planting additional vegetation.
- Develop and implement farm-specific nutrient management plans for animal feeding operations located within 300 feet of streams, drainages, ditches and other waterways.
- End the practice of using irrigation canals/ditches as winter cover for livestock.

Muddy Creek Sediment

Section 9.3.5 of the Sun River TMDL includes a prioritized list of restoration activities (management measures) for addressing sediment loading to Muddy Creek. The List (below) is prioritized according to the activity's potential for significantly reducing sediment loading, from greatest to least.

- Capturing all or most of the surface irrigation waste water and/or devising a more efficient approach to water delivery on Greenfields Bench that may include draining surface waste water to Freezeout Lake instead of Muddy Creek.
- Preventing on-farm surface irrigation water runoff from exiting fields or ditches.
- Studying water loss in ditches, prioritizing ditch lining using water loss study, and lining ditches in areas that leak the most, especially near the periphery of the Greenfields Bench in Muddy Creek's watershed. Using evapotranspiration or soil moisture monitoring for irrigation scheduling.
- Installing head gates that can be fully controlled, if not already in use.
- Using efficient irrigation methods on Greenfields Bench.
- Leaving crop residue on fields by using low/no till methods when possible.

Muddy Creek Thermal Sources

Management measures should focus primarily on reducing the amount of irrigation waste water that enters Muddy Creek via surface flow. Where reducing or limiting surface water return flow is not feasible, increasing vegetative stream cover may provide some cooling effect. Management measures should include:

- Capturing all or most of the surface irrigation waste water and/or devising a more efficient approach to water delivery on Greenfields Bench that may include draining surface waste water to Freezeout Lake instead of Muddy Creek.
- Preventing on-farm surface irrigation water runoff from exiting fields or ditches.
- Studying water loss in ditches, prioritizing ditch lining using water loss study, and lining ditches in areas that leak the most, especially near the periphery of the Greenfields Bench in Muddy Creek's watershed. Using evapotranspiration or soil moisture monitoring for irrigation scheduling.
- Installing head gates that can be fully controlled, if not already in use.
- Using efficient irrigation methods on Greenfields Bench.
- Leaving crop residue on fields by using low/no till methods when possible.
- Reducing bank erosion to enable vegetation regrowth in riparian areas.
- Fencing livestock out of riparian areas.
- Replanting native, riparian shrubs and trees.

SECTION 4.0 – TECHNICAL AND FINANCIAL ASSISTANCE

Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

<u>Ford Creek Sediment</u>
The Sun River TMDL suggests that ongoing practices within the watershed are not causing significant impairment, and that it will take approximately 23 years for Ford Creek to redevelop its natural floodplain and recover from historic, human-caused entrenchment. No additional management measures are needed in order to achieve recommended load reductions.

1) MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:

- Best Management Practices (BMPs) for grazing, including rotational grazing and cross-fencing.
- Producer no longer removing willows to increase grass production and plant crops.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:

- None required

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:

- None required

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- None required

<u>Freezeout Lake Sulfates and Dissolved Solids (aka salinity)</u>

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:

- Irrigation Water Management (IWM) practices including installation of pivots and matching water application to actual plant demand to reduce excess irrigation water transporting dissolved solids.
- Lined five miles of irrigation delivery canal to reduce groundwater movement.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:

- Additional 200 acres need to be converted from flood to pivot irrigation to reduce groundwater movement.

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:

- NRCS assistance to cost-share pivot installation.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- Two landowners need to install pivots on 200 acres at estimate of $500/acre for $100,000. Project will take one year to install once funds are appropriated.

Freezeout Lake Selenium

The same measures that have been and still need to be installed for dissolved solids listed above apply to this problem.

Freezeout Lake Phosphorus

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:

- SRWG assessed possible human-caused phosphorus sources and determined that the primary cause/source was discharge from the town of Fairfield's sewage lagoon.
- Town of Fairfield is installing a lining in lagoons to reduce the amount of waste entering Freezout Lake.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:

- Town of Fairfield needs to complete lagoon lining completion of lagoon upgrades.

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:

- Town of Fairfield, Montana Department of Commerce and the Montana Department of Natural Resources and Conservation (DNRC) will split financial costs to upgrade lagoon.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- $1 million one year after funds are appropriated to upgrade lagoon.

Upper Sun River Sediment

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:

- Noxious weed control including biological and chemical along 20 miles of the Sun River so deep-rooted grasses can flourish instead of weeds.

- Grazing management along 30 miles of the Sun River through grazing rotation to increase willow, cottonwood and grass growth.
- Modified seven irrigation diversion structures on Elk Creek and tributaries to eliminate frequent "dozing up gravel" for irrigation water.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:

- Accomplish irrigation water management by using flow gauges to ensure control excess flows and high flow fluctuations in Sun River tributaries

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE :

- GID and Broken O start using existing gauges to track flows to improve use.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- GID and Broken O over next five years use existing gauges to track flows and improve use.

Upper Sun River Thermal Sources

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:

- Irrigators have improved flows throughout the year by monitoring flow gage data better to ensure instream flows do not fall below desired minimum levels.
- Irrigators have installed water saving projects including canal lining, replacement of open ditches with pipe, conversion from flood to pivot irrigation and improved irrigation management to meet crop demands.
- Increased vegetation by removing noxious weed and improving grazing management over 50 miles of river corridor.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:

- Improve irrigation efficiency to reduce water demands to increase Sun River flows during summers months including.
    - Conversion of 20 miles of open ditches to pipe to reduce waste and waste water entering (specifically) Mill Coulee.
    - Conversion of one mile of open ditches to pipe.
    - Conversion of 1,000 acres of flood irrigation to pivot.

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:

- Greenfields Irrigation District needs to improve irrigation efficiency by 30,000 acre-feet annually.
- Fort Shaw Irrigation District needs to improve irrigation efficiency by 5,000 acre-feet annually.
- NRCS may provide technical and cost-share assistance to individual producers to implement Irrigation Water Management (IWM) practices to reduce on-farm water demands.
- Bureau of Reclamation may provide technical and cost-share assistance to improve off-farm irrigation efficiency and reduce irrigation water withdrawals.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- $10 million to install GID Ashelot Bench pipeline system with five years to implement.
- $1 million to install FSID pipeline projects with two years to implement.

- $1 million to convert on-farm practices from flood to pivot irrigation with ten years to implement.

Lower Sun River Nitrogen

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:
- Improved farming practices/less fertilizer on Fairfield Bench which reduced nitrogen contribution to Muddy Creek and in-turn lower Sun River.
- Improved farming practices/less fertilizer in Fort Shaw area which reduced nitrogen contributions to lower Sun River.
- Sun Prairie upgraded sewage lagoon to reduce waste entering Sun River.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:
- Improve farming practices to reduce fertilizer use and animal waste on 5,000 acres in Muddy Creek drainage to improve quality of water entering Sun River.
- Improve Vaughn wastewater treatment system so less waste being placed into Sun River.
- Improve septic tank conditions in Sun River area to reduce waste entering Sun River.

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:
- 20 farmers with financial contribution from NRCS to improve farming practices.
- Town of Vaughn with financial cooperation from Department of Commerce and DNRC to upgrade sewage lagoons that will take waste to fields instead of dumping into the Sun River.
- Citizens monitor septic tanks better to ensure proper operation.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:
- $2 million to upgrade farming practices at $400 per acre over two years.
- $2 million to upgrade Vaughn's sewage lagoon system and two years once funds appropriated.
- $100,000 to help citizens to improve septic tank monitoring over next 10 years

Lower Sun River Phosphorus
Same measures that have been and still need to be installed for nitrogen listed above apply to this problem.

Lower Sun River Sediment and Suspended Solids
Same measures that have been and still need to be installed in Muddy Creek (listed below) apply to this problem.

Muddy Creek Salinity, Sulfates and Total Dissolved Solids (aka Salinity)

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:
- Converted traditional cropping methods to CRP.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:
- Modify traditional farming practices to no-till and alfalfa crops on 1,000 acres.

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:

- NRCS and MSCA may provide financial and/or technical assistance to help farmers change farming practices.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- $100,000 at $100 per acre over two years to locate specific sites that need to have land management changes; five years to implement land use changes; five years to see actual changes from projects.

Muddy Creek Selenium

Same measures that have been and still need to be installed for salinity (listed above) apply to this problem.

Muddy Creek Nitrogen

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED:

- Producers are applying less chemicals ensuring better plant consumption.
- Producers improving irrigation practices to reduce amount of irrigation waste water entering Muddy Creek.

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED:

- Improve farming practices to reduce fertilizer use and animal waste on 5,000 acres in Muddy Creek drainage
- Improve septic tank conditions in the Muddy Creek drainage to reduce waste entering Muddy Creek and its tributaries.

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE:

- 20 farmers with financial contribution from NRCS to improve farming practices.
- Citizens monitor septic tanks better to ensure proper operation.

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES:

- $2 million to upgrade farming practices at $400 per acre over two years.
- $100,000 to help citizens to improve septic tank monitoring over next 10 years

Muddy Creek Phosphorous

Same measures that have been and still need to be installed for nitrogen listed above apply to this problem.

Muddy Creek Sediment

1)MANAGEMENT MEASURES THAT HAVE ALREADY BEEN INSTALLED INCLUDE;

- Installed pump back system to reuse irrigation waste water, reducing excessive flows in Muddy Creek that contribute to erosion
- Enlarged reregulating reservoir to reuse waste water
- Placed over 500 rock barbs to stabilize stream banks
- Placed 13 drop structures to slow water to reduce erosion

- Installed riparian fencing to improve grazing management
- Installed off-stream waters to reduce animal impacts to stream banks
- Planted thousands of willows and cottonwood trees to increase vegetation on streambanks

2) TYPE AND MAGNITUDE OF THE MANAGEMENT MEASURES THAT STILL NEED TO BE IMPLEMENTED INCLUDE;

- Reduce excess tailwater by 50% by improving on-farm irrigation practices and off-farm canal delivery efficiency on 1,000 acres

3) PARTNERS THAT MAY BE ABLE TO HELP WITH THE REMAINING WORK, AND THE NATURE OF THE HELP THAT THEY MAY BE ABLE TO PROVIDE

- NRCS may provide technical and financial assistance to help landowners improve IWM on 1,000 acres of farmland.
- GID and the Bureau of Reclamation (BoR) will improve IWM by modifying J-lake to increase holding capacity and regulate flow fluctuations, converting one mile of open ditch to pipe, and installing a pumpback system to reuse tailwater

4) AMOUNT OF MONEY AND TIME IT COULD TAKE TO IMPLEMENT THE MANAGEMENT MEASURES

- On-farm costs will be $400 per acre for total of $400,000. On-farm projects can be completed within a year of obtaining the necessary funding.
- Off-farm projects will cost $1 million, and will take 10 years to complete once funding has been acquired.

Muddy Creek Thermal Sources
Same measures that have been and still need to be installed for sediment listed above apply to this problem. The solutions are similar because solving both problems requires reducing the amount warm irrigation tailwater entering Muddy Creek, along with increasing the amount of vegetation along the streambanks.

SECTION 5.0 – INFORMATION AND EDUCATION

An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

Sun River Watershed Information and Education Activities:

1. Web site: Has been used to convey watershed facts to the public. It is being upgraded to post, at one site, all watershed group information, watershed data, past watershed studies and current activities.

2. Newsletter: Sent to all landowners and interested people to educate people on current activities, proposed projects and interesting news that is relevant to the watershed efforts.

3. Watershed Display: Set up at community events to showcase past projects.

4. Watershed Workgroup Meetings: Open to the public and used to discuss status of past projects and direction for future projects.

5. Conservation District Board Updates: Monthly updates by the Coordinator on current projects as well as requests for ideas for future projects.

6. FSID and GID Meetings: Attended monthly by coordinator to better understand current issues and discuss ideas for future projects.

7. Other Group Meetings: Coordinator and SRWG Executive Committee members attend meetings of County commissioners, City of Great Falls, community of Fairfield, Power Water & Sewer, Trout Unlimited, Medicine River Canoe Club, Audubon, and any others that request information on watershed issues.

8. Stakeholder Briefings: Coordinator frequently meets with small groups or individual stakeholders around the watershed are held to explain current projects and gather ideas for future projects.

9. Watershed Tours: Held to show completed projects and highlight areas where work still needs to be done to improve the overall health of the watershed.

10. Annual Meeting: Public meeting held to showcase completed projects and receive input on future needs.

11. Phone Calls and Emails: Coordinator and Executive Committee members regularly respond to and initiate phone calls and emails to respond to watershed concerns of local citizens, government agency staff, and the media.

Barriers to Gaining Support and Implementing Projects:

1. Limited Resources: All government agencies and watershed partners have increasingly limited technical and financial resources to address watershed issues. This is the primary barrier these days to effective communication and project implementation. With so many watershed groups, local needs, and state-wide problems, everyone is stretched so thin that it is hard to maintain the level of communication necessary to keep everyone on the same page and projects moving forward.

2. Limited Watershed Group Staff Time: In order to maintain consistent, meaningful watershed restoration efforts, the Coordinator's time is stretched very thin. A growing lack of funding support for watershed programs is preventing SRWG from hiring additional staff to help fill more of the watershed restoration needs.

3. Technological Changes: Rapid changes in communication, media, and watershed restoration techniques are very difficult for small groups to keep pace with. Groups often do not have the financial ability to attend extra training or purchase the latest communication tools (e.g. website construction software, mapping programs). As technology, restoration techniques, and grant reporting and tracking requirements continue to become more complex, it is difficult for small watershed groups to maintain the same level of watershed restoration and community education services.

Outreach and Education Efforts That Might Address or Overcome the Barriers:

1. Educate government agencies on the value of agency field staff and the need for more of them. Additional agency field staff would provide a substantial boost to getting projects on the ground.

2. Educate funding agencies and groups on the dire need for core operating funds for staffing and administrative support. Watershed groups currently spend much of their time trying to raise basic operating funds, at the expense of being able to spend more time developing and implementing projects. Funding entities like to fund project implementation, but don't seem to understand all of the coordination and staff time it takes to put a project together.

3. Educate government agencies on the need to set up a stable, dependable source of technical assistance to help all watershed groups develop and manage web sites, newsletters, mailing lists, maps, grant tracking and reporting, and other activities that depend upon the use of current technology and techniques.

SECTION 6.0 – IMPLEMENTATION SCHEDULE

Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

Ford Creek Sediment
The Sun River TMDL suggests that ongoing practices within the watershed are not causing significant impairment, and that it will take approximately 23 years for Ford Creek to redevelop its natural floodplain and recover from historic, human-caused entrenchment. No additional management measures are needed in order to achieve recommended load reductions.

Freezeout Lake Sulfates and Dissolved Solids (aka salinity)
IWM and placing an additional 200 acres under pivot:

- Five years to acquire funding and one year to implement.
- Another five years for groundwater movement to stabilize before actual reductions seen.

Freezeout Lake Selenium
Same measures and timelines as for Freezeout Lake sulfates and dissolved solids as listed above.

Freezeout Lake Phosphorus
Five years to acquire grant funds, two years to implement and another five years to see change in water quality.

Upper Sun River Sediment
Two years to acquire funds and two years to modify irrigation practices and water delivery in Sun River tributaries by GID and Broken O to reduce excess tailwater and flow fluctuations.

Upper Sun River Thermal Sources
Improve irrigation efficiency to reduce water demands to increase Sun River flows during summer months:

- Five years to acquire funds for GID project with another five-years to implement.
- Two years to acquire funds for FSID project and another two years to implement.
- Will be approximately total of 10 years before actually see enough increase in instream flows for temperatures to meet water quality standards.

Lower Sun River Nitrogen

Five years to acquire grant funds, two years to implement and another five years to see change in water quality.

Lower Sun River Phosphorus
Same measures and timelines as for Lower Sun River nitrogen listed above.

Lower Sun River Sediment and Suspended Solids
Same measures and timelines as for Muddy Creek sediment listed below.

Muddy Creek Salinity, Sulfates and Total Dissolved Solids (aka Salinity)
Over two years to locate specific sites that need to have land management changes, five years to implement land use changes, and five years to see actual changes from projects.

Muddy Creek Selenium
Same measures and timelines as for Muddy Creek salinity listed above.

Muddy Creek Nitrogen
Will take over five years to implement and another 10 years to see actual changes in water quality.

Muddy Creek Phosphorous
Same measures and timelines as for Muddy Creek nitrogen listed above.

Muddy Creek Sediment
Projects will take 10 years to implement and another 10 years for Muddy Creek to stabilize enough to see water quality changes.

Muddy Creek Thermal Sources
Same measures and timelines as for Muddy Creek sediment listed above.

SECTION 7.0 – INTERIM MEASURABLE MILESTONES

A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

Ford Creek Sediment
Assess stream every five years during the 23 year timeframe established in the TMDL to ensure stream is establishing a floodplain as anticipated. No additional management measures are needed in order to achieve recommended load reductions.

Freezeout Lake Sulfates and Dissolved Solids (aka salinity)
Prior to installing any new practices, monitor water quality in 2013 to see if projects installed in 2008 though 2010 have made significant changes.

Freezeout Lake Selenium
Prior to installing any new practices, monitor water quality in 2013 to see if projects installed in 2008 though 2010 have made significant changes.

Freezeout Lake Phosphorus

Monitor water quality in 2013 to see if any of the lagoon improvements to date have improved water quality.

Upper Sun River Sediment
GID and Broken O modify irrigation practices and water delivery within next five years to reduce excess tailwater and flow fluctuations in the Sun River tributaries. Yearly monitoring completed to track project results.

Upper Sun River Thermal Sources
FSID conversion of open ditches to pipe to take place within next two years. Yearly monitoring completed to track project results.

Lower Sun River Nitrogen
Town of Vaughn acquires funding to pump and apply waste onto nearby fields in two years and implements project in another two years. Yearly monitoring completed to track project results.

Lower Sun River Phosphorus
Town of Vaughn acquires funding to pump and apply waste onto nearby fields in two years and implements project in another two years. Yearly monitoring completed to track project results.

Lower Sun River Sediment and Suspended Solids
Same measures that need to be installed for Muddy Creek salinity listed below apply to this problem.

Muddy Creek Salinity, Sulfates and Total Dissolved Solids (aka Salinity)
Identify sites for specific land use changes, such as converting from crop/fallow to alfalfa or CRP over next two years. Start land use changes after specific sites identified, knowing will take over five years to implement.

Muddy Creek Selenium
Same measures that need to be installed for salinity listed above apply to this problem.

Muddy Creek Nitrogen
Implementation of land use changes to reduce amount of fertilizer application on 1,000 acres within next five years. Yearly monitoring completed to determine effects of projects on water quality.

Muddy Creek Phosphorous
Same measures that need to be installed for nitrogen listed above apply to this problem.

Muddy Creek Sediment
Acquire funding and install pump-back system within three years. Acquire funding and modify J-lake within five years. Yearly monitoring completed to determine effects of projects on water quality.

Muddy Creek Thermal Sources
Same measures that need to be installed for sediment listed above apply to this problem.

SECTION 8.0 – MEASURES OF PROGRESS

A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

Section 8.1 – Scope

Due to technical and financial limitations, it is not practical for the SRWG to directly measure load reductions or water quality standards attainment. However, the SRWG can keep track of certain indicators of progress. These indicators can be used to infer the level of progress that has been made toward achieving load reductions and meeting water quality standards. The inferred progress can be recorded and transmitted to stakeholders via reports and newsletters. Progress can also be communicated to DEQ so that their staff can know when to come back into the watershed and conduct a formal assessment to see if standards are being met and waterbody segments are ready to be removed from the List of Impaired Waters.

Section 8.2 – Criteria

The Sun River Watershed Group is currently working with MSU Extension and DEQ to develop a QAPP to be used for evaluating actual effects of completed projects on water quality, as well as overall progress towards meeting water quality standards. The QAPP should be completed by July 1, 2012 and will be refined as additional monitoring data is received. Once the QAPP is completed it will be added to Section 9.0 of the WRP.

SECTION 9.0

A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established in Section 8.

PROJECT MONITORING: The Sun River Watershed Group is working with MSU Extension and DEQ to develop a QAPP that, upon completion, will be added to Section 9.0 of the WRP. Once SRWG begins implementing the QAPP, the SRWG Water Quality Workgroup will review monitoring results on an annual basis to identify changes in water quality. In addition to water quality sampling, the SRWG will monitor the success of individual projects once every five years. Project reviews will consist of site tours and photo point photo comparisons. The SRWG Water Quality Workgroup feels that a 5-year recurrence interval is necessary to allow time for natural processes to create visible change at individual project sites. The SRWG may choose to use the DEQ Field Evaluation form or similar tool to guide the review of individual project sites.

MONITORING EFFECTIVENESS: The Sun River Watershed Group's project effectiveness monitoring will be comprised of:

1. Sediment - Take physical measurements at each project site to document rate of change and BEHI basic modeling approach.
2. Nutrient, selenium and salinity - Use basic water quality and flow monitoring to track load reductions

LONG-TERM TRENDS: The Sun River Watershed Group long-term trend monitoring to track water quality improvements for flow and temperature will use real-time gauges located at: 1) Sun River near Augusta, Bureau of Reclamation gauge SRBM; 2) Sun River at Simms, USGS gauge 06085800; and 3) Sun River near Vaughn, USGS gauge 06089000. To track water quality for sediment the Sun River near Vaughn, USGS gauge 06089000 will be used.