



Swan Lake Watershed TMDL Implementation Evaluation



July 2017

Steve Bullock, Governor
Tom Livers, Director DEQ



Prepared by:

Water Protection Bureau
Watershed Protection Section
Robert Ray, Water Quality Specialist

Contributors:

DEQ Water Protection Bureau
Watershed Protection Section
DEQ Water Quality Planning Bureau
Monitoring and Assessment Section
Swan Valley Connections
Flathead National Forest
Flathead Biological Station
Weyerhaeuser

Cover photo: Jim Creek Bridge on FSR 888, Flathead National Forest

Montana Department of Environmental Quality
Water Protection Bureau
1520 E. Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901

Suggested citation: Prepared by Robert Ray. 2017. Swan Lake Watershed TMDL Implementation Evaluation. Helena, MT: Montana Dept. of Environmental Quality.

TABLE OF CONTENTS

REVISION HISTORY	i
Acronyms	ii
Document Summary	1
1.0 – Introduction and Background	1-1
2.0 – TMDL Document Summary	2-1
3.0 – Indicators of Progress	3-1
4.0 – Findings and Recommendations	4-1
5.0 – Conclusions	5-1
6.0 – References.....	6-1
Appendix A – Jim Creek Sediment Assessment Summary	23
Appendix B – Select Swan Lake Water Quality Data.....	26

ACRONYMS

BMP – Best Management Practice
CWA – United States Clean Water Act
DEQ – Montana Department of Environmental Quality
DNRC – Montana Department of Natural Resources and Conservation
DO - Dissolved oxygen
EPA – United States Environmental Protection Agency
FONSI - Finding of No Significant Impact
FR – Forest Road
FRoSAM – Forest Road Sediment – Source Assessment Methodology
GRAIP - Geomorphic Road Analysis and Inventory Package
HCP – Habitat Conservation Plan
MCA – Montana Code Annotated
MDT – Montana Department of Transportation
PIBO – Pacific Anadromous Fish Strategy/Inland Fish Strategy Biological Opinion
QAPP – Quality Assurance Project Plan
RCP – Reasonable land, soil, and water Conservation Practice
RHCA- Riparian Habitat Conservation Area
SAP – Sampling and Analysis Plan
SEC – Swan Ecosystem Center
SVC Swan Valley Connections
TAG Technical Advisory Group
TIE – TMDL Implementation Evaluation
TMDL – Total Maximum Daily Load
TMDL document – A document produced by DEQ to describe the total maximum daily load of a pollutant that a waterbody can receive and still maintain all of its beneficial uses. The document typically also contains pollutant source assessment information and a restoration strategy.
TSS – Total Suspended Solids
USFS – United States Forest Service
USFWS – United States Fish and Wildlife Service
WEPP – Water Erosion Prediction Project
WRP – Watershed Restoration Plan

DOCUMENT SUMMARY

The “*Water Quality Protection Plan and TMDLs for the Swan Lake Watershed*” were developed in June 2004 and accepted by EPA in August 2004. Sediment Total Maximum Daily Loads (TMDLs) were written for Jim and Goat Creeks (listed as impaired for cold-water fish and aquatic life) and a protective TMDL was written for Swan Lake (listed as “threatened” for cold-water fish and aquatic life). The causes of impairment for Jim and Goat Creeks were identified as fine sediment. For Swan Lake, particulate organic carbon was identified as potentially threatening decreased dissolved oxygen in the bottom waters of the lake. Since the completion of TMDLs, the Swan Ecosystem Center, now called Swan Valley Connections, has coordinated and led efforts in the watershed to implement the load reductions called for by the Water Quality Protection Plan.

This TMDL Implementation Evaluation summarizes the efforts of Swan Valley Connections and its partners in addressing water quality concerns in the watershed, with a focus on Jim Creek. As discussed further in this document, Swan Valley Connections has planned, coordinated and supported implementation and monitoring of reasonable conservation practices, along with the Flathead National Forest, Montana Department of Natural Resources and Conservation, Plum Creek Timber Company (now Weyerhaeuser) and other partners. Water quality protection and improvement efforts have been on-going and are continuing in the Swan Lake watershed.

Monitoring in the Jim Creek watershed indicates aquatic life beneficial uses are fully supported. DEQ’s Monitoring and Assessment Section has conducted a formal assessment of current conditions in Jim Creek with respect to the sediment impairment listing. DEQ will propose that aquatic life is no longer impaired from sediment/siltation in the 2018 DEQ Integrated Report. Jim Creek de-listing may occur with EPA approval.

Based on large-scale riparian zone changes in forestry practices and native fish conservation plans discussed in this document, as well as road sediment reduction best management practices, it is likely that water quality has improved in Goat Creek. A field review of existing contributing sediment sources in Goat Creek is recommended to determine if a reassessment of the Goat Creek sediment impairment listing is justified at this time.

Data for Swan Lake, collected by DEQ, the Swan Ecosystem Center, Whitefish Lake Institute and the Swan Lakers suggests that Swan Lake is naturally pre-disposed to low dissolved oxygen (DO) due to its morphometry. Chlorophyll, nitrogen and phosphorus concentrations in Swan Lake indicate largely oligotrophic (few nutrients) conditions and good water quality. Nevertheless, increased DO in bottom water of the north and south basins has not occurred with pollutant source reductions in the watershed. Late summer low DO and continued variability in chlorophyll and total phosphorus levels justify keeping the total organic carbon “threatened” listing for Swan Lake aquatic life use.

1.0 – INTRODUCTION AND BACKGROUND

This Swan Lake Watershed Total Maximum Daily Load (TMDL) Implementation Evaluation is intended to serve several purposes, including:

- Summarize and acknowledge water quality restoration activities in the Swan Lake watershed
- Provide constructive feedback to those pursuing water quality improvements
- Identify potential water quality success stories
- Provide recommendations for Watershed Restoration Plan improvements
- Provide recommendations for future TMDL document improvements
- Provide additional guidance or suggestions for best management practices (BMPs)
- Provide additional suggestions for voluntary monitoring or other types of monitoring to help evaluate progress
- Provide a TMDL evaluation process that is consistent with, and satisfies the requirements under Montana Code Annotated (MCA) 75-5-703(9)

In general terms, most of the land within the 420,000 acre Swan Lake watershed is managed by the Flathead National Forest and the Montana Department of Natural Resources and Conservation. This includes a large-scale transfer (on the order of 60,000 acres) of private lands owned by Plum Creek Timber Company to state and federal agencies that occurred in 2011. Private lands in the watershed (about 25%) are found at lower elevations and along streams and lakes.

In 2004 DEQ evaluated available and relevant data and developed a “Water Quality Protection Plan and TMDLs for the Swan Lake Watershed” (DEQ, 2004). At that time the following impaired or threatened waterbodies were identified within the boundaries of the Swan Lake Watershed:

- Jim Creek (impaired by sediment/siltation)
- Goat Creek (impaired by sediment/siltation)
- Swan Lake (threatened by low dissolved oxygen in summer bottom water)

Pollutants of concern include the following:

- Fine sediment (Jim and Goat Creeks)
- Particulate organic carbon (Swan Lake)
- Nutrients (nitrogen and phosphorus) (Swan Lake)

Within the Swan Lake Watershed, the main pollutant sources include:

- Forest roads network, the largest anthropogenic source of sediment
- Historical riparian timber harvesting
- Slash disposal and ground disturbing activities associated with timber harvesting
- Septic systems adjacent to waterbodies

The Swan Ecosystem Center (SEC, now Swan Valley Connections, SVC) has organized, convened and facilitated a water quality technical advisory group (TAG) of experts from the agencies and organizations involved in water quality restoration work in the watershed. This group reviewed the recommendations in the TMDL document, prioritized actions and developed an action plan. In 2006 SEC applied for and was awarded a 319 contract that began implementation of the action plan. SEC continued to apply for and receive 319 funding annually through 2010. The SEC was also the recipient of 319 funds in 2012 through a sole source procurement process.

The Technical Advisory Group has consisted of the following organizations/individuals:

- Flathead National Forest (Beth Gardner)
- Department of Natural Resources and Conservation (Tony Nelson)
- Missoula County (Vickie Edwards)
- PBS&J Consultants (Atkins) (John DeArment)
- Plum Creek Timber Company (Brian Sugden, now with Weyerhaeuser)
- Friends of the Wild Swan (Arlene Montgomery)
- Trust for Public Land (Robert Rasmussen)
- Department of Environmental Quality (Robert Ray)
- Swan Valley Connections (previously Swan Ecosystem Center, Anne Dahl, Maria Mantas)

Others receiving TAG e-mails, meeting summaries, etc. included: Flathead Biological Station, Montana Fish Wildlife and Parks, Flathead Basin Commission, U.S. Fish and Wildlife Service, Swan Lakers and Lake and Missoula County.

In 2009-2010 the SEC temporarily hired AmeriCorps VISTA member, Ali Vissichelli, whose primary responsibility was to develop a Watershed Restoration Plan (called a “watershed-based” plan by EPA) for the Swan Lake watershed. That document, titled the “Swan Basin Restoration: Coordinated Approaches to Water, Wildlife, Forests, Wetlands and Native Fish”) was updated in 2012 and accepted by DEQ in May of 2012.

As previously noted, a significant change in land ownership in the Swan Lake watershed took place over the span of several years and was finalized in 2011 through the Montana Legacy project. Approximately 44,000 acres of formerly Plum Creek Lands were transferred to Flathead National Forest, and about 20,000 acres to the Montana Department of Natural Resources and Conservation (DNRC).

It is important to point out that prior to 1990 in Montana; water quality protection associated with forestry activities was addressed through voluntary application of Best Management Practices (BMPs). In 1989 the Montana Legislature enacted the “BMP Notification Law” and in 1991 the “Streamside Management Zone Law”. These two laws significantly improved implementation of forestry practices designed to protect water quality, as demonstrated by the biennial Forestry Management Practices Monitoring audits (now call field reports) conducted by the DNRC Forestry Division.

Additionally, the bull trout “threatened” listing under the Endangered Species Act, in 1998 drove the development of US Fish and Wildlife Service (USFWS) Biological Opinion, also known as PIBO, based on “PACFISH/INFISH” (Pacific Anadromous Fish Strategy/Inland Fish Strategy) developed by the US Forest Service (USFS) and Bureau of Land Management. The strategies are intended to provide protection against extinction or further endangerment of bull trout and steelhead fish stocks. Agreed upon actions include riparian management goals and objectives, delineating riparian habitat conservation areas (RHCAs), standards and guidelines for RHCAs, criteria and a process to designate key watersheds, watershed restoration actions, and effectiveness and implementation monitoring. In 2000 Plum Creek Timber Company developed a Native Fish Habitat Conservation Plan (HCP) and in 2005 DNRC published a HCP – “Aquatic Conservation Strategies for Bull Trout, Westslope Cutthroat Trout, and Columbia Redband Trout”, DNRC, 2005). Implementation of these strategies and plans have led to improved riparian and water quality conditions, as documented in PIBO monitoring, and other required reporting (e.g. “Native Fish HCP 15-Year Review and Project Document Archive” available from brian.sugden@weyerhaeuser.com).

2.0 – TMDL DOCUMENT SUMMARY

2.1 Goals and Targets

Section 7.0 of the TMDL document provides goals and targets for impaired and threatened waterbodies in the Swan Lake watershed. The primary water quality protection goals are: reduce the overall threat of impairment to any of the beneficial uses supported by Swan Lake; ensure full recovery of the cold-water fish beneficial uses to Jim and Goat Creeks; and limit pollutant loads consistent with protecting Flathead Lake.

Water quality targets are numeric or measurable values that represent desired conditions and achievement of water quality standards. Jim and Goat Creek targets are based on meeting the state’s narrative standard for “...naturally occurring concentrations of sediment or suspended sediment...” Swan Lake targets focus on particulate organic carbon related threats- mainly the link to low dissolved oxygen levels in summer at the bottom of Swan Lake.

DEQ has updated its sediment assessment methods for determining full beneficial use support that supersede the sediment targets established for Jim and Goat Creeks in the Swan Lake TMDL. Current assessment protocols, based on use of reference conditions, are used to determine sediment-related targets and determine use-impairment conditions. Montana’s sediment assessment methodology assesses specific water body physical parameters in comparison to relevant reference reach data.

2.2 Allocations

For Jim and Goat Creek, three source area types were identified: road erosion; riparian and streambank protection; and “other timber harvest impacts”. Road erosion allocations were set using the forest roads sediment model (FRoSAM) at 6 tons per year for Jim Creek, a 10% reduction, and 17 tons for Goat Creek above Squeezer Creek confluence, a 40% decrease in road sediment loading. For riparian and streambank protection, the allocations for both creeks were performance-based, with a 10% increase in canopy density and increased large woody debris recruitment. Other timber harvest impacts in both creeks were allocated “no increases other than those associated with 100% compliance with forestry BMPs”. Overall, for Jim Creek a 10% reduction in fine sediment delivery to Jim Creek was called for. For Goat Creek, a net reduction of 33% in fine suspended sediment during peak flows, based on 1997 data, was identified as necessary to achieve water quality standards.

For Swan Lake, in addition to the three source area types identified above, four additional source area types were identified: septic systems (near-shore) and additional private (non-timber) management activities; road traction sanding; airborne sources; and future point sources. The allocation for “septic/near-shore” was set at existing loads. This equates to no increased nitrogen, phosphorus, or sediment loads to Swan Lake. Reduced loads were allocated to road traction sanding. No allocations were provided for airborne or future point sources, with an expectation that airborne source would be controlled based on load allocations developed for Flathead Lake.

2.3 Restoration Activities

The Swan Lake Watershed TMDL document recommends specific restoration activities for addressing pollutants within the Swan Lake Watershed.

These recommendations are summarized by waterbody, below:

- Jim Creek

- Road erosion BMPs
- Riparian and streambank protection
- Ensure mass wasting , peak flow increases, road failures, and hill slope erosion impacts are controlled via implementation of BMPs
- Goat Creek
 - Road erosion BMPs
 - Riparian and streambank protection
 - Ensure mass wasting , peak flow increases, road failures, and hill slope erosion impacts are controlled via implementation of BMPs
- Swan Lake
 - Road erosion BMPs
 - Riparian and streambank protection
 - Ensure mass wasting , peak flow increases, road failures, and hill slope erosion impacts are controlled via implementation of BMPs
 - Septic maintenance, upgrades and other BMPs
 - Road sanding and sediment delivery BMPs

The TMDL document recommends the following types of monitoring activities:

- Jim Creek
 - McNeil Core sampling at existing sampling locations
 - Pools with cover, large woody debris – upper reaches of Jim Creek- above and below Jim Lake
 - Macroinvertebrate assemblages
- Goat Creek
 - Macroinvertebrate assemblages
 - Total Suspended Solids – lower portion of Goat Creek, above confluence with Squeezer Creek, focus on rising limb and peak of hydrograph (no longer used for sediment use-impairment determinations).
- Swan Lake
 - Water column dissolved oxygen at variable locations including deeper portions of South Bay prior to fall lake turnover
 - Secchi depth, Chlorophyll *a*, total phosphorus in north and south basins

3.0 – INDICATORS OF PROGRESS

Indicators of progress towards achieving “Water Quality Protection Plan and TMDLs for the Swan Lake Watershed” targets generally fall into one of three major categories: 1) Planning, 2) Restoration and 3) Monitoring.

3.1 – Planning

Not long after the Swan Lake Watershed TMDL was completed (2004), the Swan Ecosystem Center was awarded a 319 contract (#206048). As part of that contract, a “*Swan Lake Watershed TMDL Implementation Program Quality Assurance Project Plan (QAPP)*” was completed in November, 2006. The QAPP includes Cold Creek restoration monitoring (Total Suspended Solids and Wolman pebble counts); and long-term monitoring recommendations in the Swan River (3 stations) and 5 tributary streams (temperature); and Swan Lake Monitoring (8 stations: dissolved oxygen (DO), temperature and redox profiles, Secchi disk).

A 2009 319 contract (#209068) initiated a planning process that resulted in a DEQ-accepted Watershed Restoration Plan in 2012, titled “*Swan Basin Restoration: Coordinated Approaches to Water, Wildlife, Forests, Wetlands, and Native Fish*” (WRP). From a TMDL implementation perspective, the document identifies previous sediment reduction projects implemented by major stakeholders (DNRC, Flathead National Forest) and future road sediment reduction BMPs, implemented on a sub-watershed by sub-watershed basis. The WRP also identifies project effectiveness monitoring, water quality monitoring and PIBO monitoring as critical activities.

As previously discussed Swan Valley Connections supports a Water Quality Technical Advisory Group that meets at least annually to discuss stakeholder activities and needs, and grant opportunities.

SVC planning has included development of a GIS map with known manipulated wetlands. Swan Valley Connections is currently planning working on three private properties that, if completed, will restore an additional 55 acres of wetland and riparian habitat. In addition, USF&WS and SVC are beginning the process of evaluating the Swan River National Wildlife Refuge, which has approximately 1,000 acres of ditched and drained wetlands for restoration possibilities

With the Montana Legacy project and the significant changes in land ownership, the TAG has been working to address legacy road concerns on Plum Creek Timber–divested lands.

3.2 – Restoration

As mentioned in Section 1.0, The USFS (Flathead National Forest), Plum Creek Timber Company, and the Montana Department of Natural Resources and Conservation, all developed Habitat Conservation Plans (HCPs) or similar tools, accepted by the USFWS that are designed to improve native fish habitat, in a large area (Columbia River basin) that includes the Swan Lake watershed. The HCPs include commitments to conservation strategies and actions to address streamside riparian timber harvest, sediment delivery from roads, and grazing. These actions have been on-going in the Swan Lake watershed since the commitments were established (again, between 1998 and 2005) and information on these actions can be found (see references, Section 6.0) or obtained by contacting the individual

entities. Additionally, state forestry laws enacted in the late 80's and early 90's have provided significant positive benefits for riparian area management and in-stream water quality.

A number of Clean Water Act (CWA) Section 319 funded contracts were awarded to SEC through DEQ to coordinate and support sediment load reduction activities or best management practices (BMPs). These forest road BMPs consist mainly of installing culvert replacements, relief ditch installation and clearing, bridge approach road dips, swales, graveling and road decommissioning, summarized below.

<u>319 Grants:</u>	<u>319 \$</u>	<u>Local Match</u>	<u>Fed contribution</u>
2006 – 206048	\$52,200	\$ 63,750	\$ 95,400
2007 – 207047	\$58,340	\$192,767	\$ 13,490
2008 – 208033	\$40,000	\$ 47,768	\$ 17,515
2009 – 209068	\$40,000	\$ 46,706	\$334,500
2010 – 210115	\$49,720	\$132,017	\$801,788
2012 – 212115	\$80,000	\$210,557	Not reported

[Under development: 2017 – Goat, Squeezer, S Woodward Creeks, Whitetail. \$70,000]

319 Grants:

- Jim Creek specific TMDL Implementation projects:
 - Jim, Cold Creeks road BMPs (206048 contract) 2007-2008. 4.4 miles of forest road (FR) BMPs. Jim Lake Road (FR 5968); Cold Lakes Road (FR 9599). 33 tons of sediment reduced per year
 - Contract 212115: 7.3 miles of forest road BMPs. Lower Jim Lakes Roads (FR 10296 and 90548). 0.2 tons of sediment reduced per year. 2015 Chilly-James Flathead NF project (212115 contract) implementation begun in 2016
 - Cold Jim Flathead NF project – not yet implemented (not associated with a 319 project)
- Swan Lake tributaries:
 - Contract 207047: 7 miles of forest road BMPs. Elk Creek Road (FR 9591, from FR 561 to FR 10291). 33.3 tons of sediment reduced per year
 - Contract 208033: 9 miles of forest road BMPs. Herrick Run Road (FR 9575). 37.6 tons of sediment reduced per year
 - Contract 209068: 5 miles of forest road BMPs. Beaver Creek Road (FR 906, 9563, 9570, 9658, and 9656). Sediment load reduction included in reporting on 210015.
 - Contract 210015: Combined with above 2009 contract to double the amount of BMPs place in the Beaver Creek sub-watershed. 55 tons of sediment reduced per year.

The SEC started its Wetland and Stream Restoration Program in 2010. The program provides technical expertise and matching funds from the Partners for Fish and Wildlife Program through the U.S. Fish and Wildlife Service. As of May 2017 SEC/SVC has implemented ten wetland, stream or riparian restoration projects on nine privately owned parcels (92.25 acres total) and one on public land (12 acres), mainly through the plugging of historic wetland drainage ditches. The SVC has also begun working on restoration plans with the USFWS and Flathead National Forest on a 35-acre wetland under Forest Service management in the Cold Creek drainage that had been ditched and drained as part of the Cold/Jim landscape restoration project (L. Lamar, 2017).

Beth Gardner, Fisheries Biologist for the Flathead National Forest in a May 11, 2015 memo titled *“Results of Monitoring Data on Road BMP Effectiveness at Reducing Sedimentation to Streams”*

documented 300 previously inventoried road stream crossings throughout the Swan Lake watershed which found that 75 sites contributed the majority of sediment delivery to watershed streams. “Many of these sites were addressed incrementally by Plum Creek Timber Company, Forest Service and Department of Natural Resources from 2003 to 2010. A 2011 resurvey of the top 75 sites using FroSAM (Forest Road Sediment-Source Assessment Methodology) found a reduction from 539 tons to 184 tons, a 66% decrease over time.” This memo indicates that numerous Forest road BMPs have been installed throughout the Swan Lake watershed that are not specifically identified in this TMDL Implementation Evaluation (TIE).

The Flathead National Forest Beaver Creek Landscape Restoration Project Decision Notice (December, 2016) has proposed five aquatic restoration activities (culvert replacements, fish barriers, soil remediation on road template); road BMPs on 47.9 miles; 4.5 miles of road decommissioning; and 12.6 miles road intermittent stored service. The implementation of this project is expected to begin in 2017 if there are no legal objectors.

Flathead National Forest’s Cold-Jim Fuels Reduction and Forest Health Project September 2016 Decision Notice and FONSI (Finding of No Significant Impact) is being implemented by Flathead National Forest. Although this project was not focused on water quality improvement, 6 miles of Forest Service roads used for timber hauling will be brought up to Forest Service BMP standards and 1.9 miles of road decommissioning will be part of the project. Implementation of this project is expected to begin in 2017.

Flathead National Forest Chilly James Restoration Project Decision/FONSI (April 2016) provides for: road BMPs on 20.9 miles; 4.8 miles of system roads into storage; passive decommission 14 miles of system roads; actively decommission 9.8 miles of system roads identified as having slight to moderate negative impact on water quality and fish habitat; decommission and re-contour 2.4 miles of system roads that have substantial impact on water quality and fish habitat. Implementation of this project was started in 2016 and is expected to be completed in 2017.

In 2016 Swan Valley Connections submitted a 319 project proposal that is expected to be funded in 2017. Implementation of road BMPs in Goat and Squeezer Creek drainages and South Woodward Creek, and stabilizing a slope mass-wasting failure in Whitetail Creek are planned. Work is expected to start in summer of 2017.

The Montana Department of Transportation tracks traction sand application along state highway 83 in the Swan Lake watershed on an annual basis. The MDT is now applying about 50% of the traction sand that they were when the TMDL was written (M. Miller, 2017). From route post 32 to 79 (47 miles), the average pounds of traction material per year per mile plowed has gone from approximately 500 pounds to 250.

3.3 – Monitoring

Monitoring in the watershed after the TMDL was completed, has been coordinated by the SEC, now SVC and has included:

- Watershed road sediment source assessment (by the SVC Technical Advisory Group)
- Swan Lake water quality monitoring (summer efforts that have included DO, temperature and redox profiles, chlorophyll *a*, nutrients and Secchi depth, at a minimum)

- 3 Swan River and 5 tributary creeks temperature monitoring, with data available through EPA’s STORET system
- Project effectiveness, largely using FroSAM and more recently, Water Erosion Prediction Project (WEPP) modeling
- PIBO monitoring by the National Forest at 8 sites, every five years, done by crews out of the Boise Idaho National Forest Research Center
- Aquatic Habitat Monitoring in the Swan Lake watershed. Beth Gardner, Fisheries Biologist, Flathead National Forest. 2009, 2013 and 2015 Status Reports. 34 locations throughout the Swan, each location sampled once every five years for a subset of PIBO. Data parameters include: residual pool depth, Wolman pebble counts, channel width to depth ratio, and large woody debris.
- McNeil Core, bull trout redd counts and fish surveys by Montana Fish Wildlife and Parks. McNeil Core data at 10 sites from 1987 through present. Bull trout red counts at 10 sites, from 1982 through present. Recent McNeil Core and bull trout redd counts in Jim Creek indicate that Jim Creek is consistent with other sites in the watershed
- Core wetlands area reference map completed by Swan Ecosystem Center
- DEQ monitoring of Swan Lake: “Water Quality Data Summary for Major Tributaries, Lakes and Reservoirs in the Flathead Lake Watershed: 2007-2008” by Kyle Flynn and Eric Regensburger, 2011”. 2 Lake stations (mid-point and outlet) 8 times, plus 2 Swan River stations (above lake and above dam near Big Fork
- 2010 – 2016 Swan Lake water quality investigation by the Kootenai Lodge Estates, Swan Lakers, Whitefish Lake Institute and SEC
- DEQ monitoring for physical parameters associated with sediment/siltation and “other habitat alteration” in Jim Creek – a Sampling and Analysis Plan (SAP) was developed in 2013 and finalized and implemented in 2014 by Eric Trum. Monitoring was completed by Eric Trum, Katie Steele, Maria Mantas and Robert Ray in 2015
- The US. Forest Service Rocky Mountain Research Station reported on an in-depth “GRAIP” (Geomorphic Road Analysis and Inventory Package) assessment of road sediment contribution to waters in the Cold Creek watershed (Cissel et al., 2014) as part of a larger (Southwest Crown of the Continent) road sediment assessment. 123 miles of road were inventoried and assessed. The report concluded that Cold Creek (adjacent to , but not including Jim Creek watershed) falls within the “typical” range for landslide risk, gully risk, stream crossing plugging potential, diversion potential, drain point problems, fill erosion, and stream crossing fill at risk.

Actual data and more specific information on the above-listed monitoring efforts can be obtained by contacting the entities listed in the references section of this document.

Watershed Summary of Monitoring Results

Road sediment: Have decreased sediment loads throughout the watershed.

- The WRP identifies that between 2006 and 2010 “3 restoration projects completed on roads classified as among the top 75 sediment-producing.”
- An estimated 130 tons of sediment reduced per year from 8 of the top 70 sediment producing road locations (J. DeArment, June 2008)
- The Flathead National Forest identified sediment reduction from three projects (Elk Creek road, Beaver Creek roads and Cold Creek bridges) resulted in a decrease of 70 tons per year (B. Gardner, Flathead National Forest, May 11, 2015).

- A 2011 resurvey of the 2002 FroSAM inventory of the top 75 sediment producing road/stream crossings found reduction of 355 tons per year (B. Gardner, May 11, 2015).
- The Flathead National Forest using the WEPP model estimated that the Lower Jim BMP project is expected to reduce sediment by 328 pounds per year, or about 0.2 tons per year (B. Gardner, May 20, 2015).
- Since 2002 FS has reduced 60 tons of sediment independently (non-319) through timber sale BMPs and appropriated funding.
- Plum Creek reported 36% reduction in sediment from their lands since mid-1990's through BMP implementation on haul roads (Sugden, 2016).
- MDT – decrease of about 50% in traction (sand) material applied per mile of plowed highway. From about 500 pounds per mile plowed to 250 pounds per mile plowed per year (M. Miller, 2017). This dramatic decrease occurred between 2006 and 2007.
- Streamside management changes as a result of the SMZ law have provided increases in canopy density and in-stream large woody debris (Sugden, 2016).

Jim Creek Summary of Monitoring Results

- 2006 319 contract 206048: 33 tons of sediment reduced per year.
- DEQ 2014-15 Jim Creek monitoring and assessment analysis documents that sediment is no longer impairing aquatic life use. DEQ will propose that aquatic life is no longer impaired from sediment/siltation in the 2018 DEQ Integrated Report. Jim Creek de-listing may occur with EPA approval. See Appendix A for summary.

Goat Creek

- 2017 contract (not initiated) – load reduction estimates associated with road sediment reduction project.
- DEQ will conduct a field assessment of road-generated sediment sources in 2017.
- Identified as a candidate for an updated sediment impairment using DEQ's current methodology to address multiple forms of potential sediment impairment including fine sediment deposition and TSS. Forest Service PIBO data for Goat Creek through 2016 has been provided to DEQ.

Swan Lake

- Spatial extent of hypolimnetic dissolved oxygen depletion between 2004 and 2006 increased (reported by PBS&J in 2008). No further studies have been done on the changes in spatial extent of the low DO.
- 2007-2008 DEQ monitoring finding: "Both Swan and Whitefish Lake had very good water quality as well [as Hungry Horse Reservoir] and all acted as buffer from contributing watershed sediment and nutrient loads." (Flynn et al. 2011)
- No apparent trends in DO (2011 WLI report). Primary TMDL target continues to be met
- No apparent trend in chlorophyll, Secchi disk depth, total phosphorus. Primary target continues to be met (2012 WLI report).
- 2015-2016 Swan Lakers monitoring of TN, TP, DO, chlorophyll, Secchi disk. 2015 and 2016 fall monitoring in the south basin has observed decreased DO (close to 0) (Tom Bansak – March 9, 2017 e-mail).

4.0 – FINDINGS AND RECOMMENDATIONS

Suggestions for additional restoration work are outlined below. They represent “suggestions” only. It may be entirely possible to meet TMDL targets and water quality standards by implementing all, some, or none of the described suggestions; or by implementing an entirely different set of actions.

- Continued Swan Lake monitoring – evaluate chlorophyll and nutrients levels, including areas of potential near-shore septic system impacts.
- Work with Lake County health department/sanitarian on septic system inspection and maintenance outreach and education adjacent to Swan Lake
- Field assessment of Goat Creek for road-related sediment sources to determine if a DEQ reassessment of Goat Creek is warranted.
- Use previous PBS&J monitoring survey design and re-examine spatial extent of low (< 5mg/l) hypolimnetic DO levels in north and especially south Swan Lake basins.
- Watershed-wide assessment of former Plum Creek Timber roads that could be decommissioned
- Implement all 3 Records of Decision documented in previous sections (Beaver Creek, Chilly James, and Cold Jim).
- Implement 2017 contract projects in Goat, Squeezer, South Woodward and Whitetail Creeks
- Review activities completed under 2010/2012 Swan Lake Watershed Restoration Plan. Swan Valley Connections should consider updating the Swan Lake Restoration Plan.
- Review activities completed under 2006 QAPP/SAP. Swan Valley Connections should consider updating the 2006 QAPP/SAP based on a review of the QAPP and current needs and activities.

5.0 – CONCLUSIONS

- Improvements in application of forestry best management practices, including streamside management have resulted in habitat and water quality improvements on a large scale on managed forest lands.
- Jim Creek: DEQ will propose that aquatic life is no longer impaired from sediment/siltation for the 2018 DEQ Integrated Report. Jim Creek de-listing may occur with EPA approval.
- Goat Creek (headwaters to Squeezer Creek): Needs field review of existing contributing sediment sources and monitoring. DEQ will prioritize Goat Creek for field review and possible reassessment in the next 2-5 years.
- Swan Lake: Currently identified as a threatened waterbody. DEQ 2011 report suggests that the lake is currently meeting narrative water quality standards. Development of lake numeric standards for chlorophyll, nitrogen, phosphorus and clarity would be useful and is recognized as a need by DEQ's Standards program.

6.0 – REFERENCES

A wide variety of information sources were consulted during the preparation of the Swan Lake TMDL Implementation Evaluation. They included reports, databases, and websites, and personal communications. Detailed questions concerning the construction and content of the Water Quality Protection Plan and TMDLs for the Swan Lake Watershed Implementation Evaluation should be directed to Dean Yashan, Section Supervisor, Montana Department of Environmental Quality Watershed Protection Section, (406) 444-5317, or dyashan@mt.gov.

Cissel, Richard; Black, T.; Neslon, N.; Luce, C. August 2014. U.S. Forest Service. Rocky Mountain Research Station. *Southwest Crown of the Continent GRAIP Watersheds Roads Assessment – Blackfoot and Swan Watersheds; Lolo, Helena and Flathead National Forests, Montana.*

DeArment, J. PBS&J. 2006. *Swan Lake Watershed TMDL Implementation Program. Quality Assurance Project Plan (QAPP)*. November 29, 2006. Missoula, MT. (319 contract #206048).

DeArment, J. PBS&J. 2008. *Swan Lake Watershed TMDL Implementation Program: Project Status Report*. June 30, 2008. Missoula, MT. (319 contract #206048).

DeArment, J. PBS&J, an Atkins Company. 2010. *Swan Lake TMDL Planning Area Road Sediment Assessment: Sampling and Analysis Plan*. October 13, 2010. Missoula, MT. (319 contract #210115).

DeArment, J. Atkins. April 2012. *Swan Lake TMDL Planning Area Road Sediment Assessment Results*. (319 contract #210115).

Flathead National Forest. April 2016. *Chilly James Restoration Project Decision Notice/Finding Of No Significant Impact*.

Flathead National Forest. September, 2016. *Cold Jim Fuels Reduction and Forest Health Project Decision Notice and Finding of No Significant Impact*.

Flathead National Forest. December 2016. *Decision Notice Beaver Creek Landscape Restoration Project*.

Flynn, K., Regensburger, E., and Granger, M. 2011. *Water Quality Data Summary for Major Tributaries, Lakes and Reservoirs in the Flathead Lake Watershed: 2007-2008*. Helena, MT. Montana Department of Environmental Quality.

Gardner, Beth. Fisheries Biologist, Flathead National Forest. *2009 Status Report. Aquatic Habitat Monitoring in the Swan Valley*.

Gardner, Beth. March, 2014. Swan Lake Ranger District, Flathead National Forest. *Monitoring of tributary streams in the Swan River Basin, Montana Findings from 1997- 2013*.

Gardner, Beth. Fisheries Biologist, Flathead National Forest. May 11, 2015. *Results of Monitoring Data on Road BMP Effectiveness at Reducing Sediment to Streams*.

Gardner, Beth. Fisheries Biologist, Flathead National Forest. May 20, 2015. *Jim Creek and Cold Creek Restoration Project memo to Maria Mantas, Executive Director, Swan Ecosystem Center*.

Gardner, Beth. Fisheries Biologist, Flathead National Forest. March 2016. Swan Lake Ranger District, Flathead National Forest. *Monitoring of tributary streams in the Swan River Basin, Montana Findings from 1997- 2015.*

Lamar, Luke. Conservation Director, Swan Valley Connections. E-mail May 5, 2017 to Robert Ray. *Swan Watershed TIE Comments.*

Miller, Mike April 2017. Montana Department of Transportation (Roadside and Winter Maintenance Specialist). E-mail to Doug Compton. Subject: RE: Swan Lake Watershed TMDL Implementation Evaluation.

Montana Department of Environmental Quality. June, 2004. *Water Quality Protection Plan and TMDLs for Swan Lake Watershed.*

Montana Department of Environmental Quality, September 2014. *Jim Creek TMDL Implementation Evaluation Sediment and Habitat Assessment Sampling and Analysis Plan.*

Montana Department of Natural Resources and Conservation, 2005. Forest State Trust Lands. Habitat Conservation Plan. *Aquatic Conservation Strategies for Bull Trout, Westslope Cutthroat Trout, and Columbia Redband Trout.*

Sugden, Brian. Forest Hydrologist, Weyerhaeuser. December 2016. *Fifteen Year Review of the Weyerhaeuser Company Native Fish Habitat Conservation Plan.*

Shultz, Bill. 1992 Montana Forestry Best Management Practices Implementation Monitoring –The 1992 Forestry BMP Audits Final Report. Montana Department of State Lands, Forestry Division, Missoula, Montana .

USDA Forest Service, USDI Bureau of Land Management, US Fish and Wildlife Service, USDC NOAA Fisheries. 2003 Implementation Monitoring program module for Pacfish/Infish and the 1998 Biological Opinions for salmon, steelhead, and bull trout- program manual.

U.S. Department of Commerce National Marine Fisheries Service. 1998 Endangered Species Act – Section 7 Consultation Biological Opinion. Land and Resource Management Plans for National Forests and Bureaus of Land Management Resource Areas in the Upper Columbia River Basin and Snake River Basin Evolutionary Significance Units. Northwest Region, Seattle, Washington

Vissichelli, Ali. 2012. AmeriCorps VISTA. Swan Ecosystem Center. *Swan Basin Restoration: Coordinated Approaches to Water, Wildlife, Forests, Wetlands, and Native Fish.* July 30, 2010. Updated February 2012.

Whitefish Lake Institute. 2012. *Swan Lake Water Quality Investigation 2011 Summary Report.* May 15, 2012. Whitefish, MT.

Whitefish Lake Institute. 2013. *Swan Lake Water Quality Investigation 2012 Summary Report.* February 5, 2013. Whitefish, MT.

Ziesak, Roger. 2016. Forest Practices Program Manager, Montana Department of Natural Resources and Conservation, Forestry Division, Missoula, Montana. *Montana Forestry Best Management Practices Monitoring- 2016 Forestry BMP Field Review Results Report*.

Swan Ecosystem Center, various dates. 319 Grant Final Reports for contracts:

- 206048
- 207047
- 208033
- 209068
- 210015
- 212115

APPENDIX A – JIM CREEK SEDIMENT ASSESSMENT SUMMARY

Summary taken from Jim Creek sediment assessment prepared by Al Nixon, March 21, 2017

Jim Creek is assigned the State classification of B-1. Waters classified as B-1 are to be maintained suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. (DEQ. ARM 17.30.623(1))

Jim Creek is listed as impaired by Sediment/Siltation on the 2016 DEQ Integrated Report. This cause of impairment affects aquatic life uses. The source of impairment is Silviculture Harvesting. The Jim Creek waterbody status category is 4A, "All TMDLs needed to rectify all identified threats or impairments have been completed and approved". The TMDL (Land & Water Consulting, Inc., MT DEQ, Lake County Conservation District. 2004) was approved by the EPA on August 31, 2004. Sediment is the only cause of impairment identified for Jim Creek. This assessment delists the Sediment/Siltation cause of impairment and changes the listing status from category 4A to category 2, "Waters for which those beneficial uses that have been assessed are fully supported, but some applicable uses have not been assessed". Drinking Water uses have not been assessed for Jim Creek. Agricultural and Primary Contact/Recreation uses have the use support status of "fully supported" in the 2016 DEQ Integrated Report but drinking water has not.

The assessment of physical parameters uses comparisons to reference reach data from the Flathead-Stillwater TMDL planning areas for most parameters, and from the Kootenai- Fisher TMDL planning area for other parameters (**Table 1**). The McNeil core percent fines target is based on the Flathead Basin Commission, 1993-1994 Biennial Report guidance, which established a threshold of 35% fines less than 6.35mm for spawning habitats.

The beneficial use support decision process allows for one sediment assessment parameter to not meet its target, provided that it does not amount to overwhelming evidence of impairment. The assessed waterbody is considered impaired by Sedimentation/Siltation when two or more parameters are out of reference range, and human-caused sediment sources are present. (Kusnierz, P., A. Welch, and D. Kron. 2013).

Riffle pebble count fine sediment parameters are within their targets (**Table 2**). The grid toss reach average of percent fines less than 6 mm is within the target. (**Table 2**) McNeil cores do not meet the target based on the Flathead Basin guidance for bull trout streams (**Table 2**). All stream channel and habitat assessment parameters meet the respective targets (**Table 2**). **Figure 1** shows the McNeil core percent fines sediment less than 6.35 mm data and regression line for Jim Creek, collected by Montana Fish, Wildlife and Parks.

The sampling of macroinvertebrates and periphyton algae yielded results that indicate a high level of biological integrity on Jim Creek. The three macroinvertebrate samples had an average HBI value of 1.96 (range: 1.84-1.97). The probability of impairment by sediment was just 16 percent, which is very low, based on the periphyton sample.

Table 1. Sediment Assessment Targets Applied to Jim Creek

Fine Sediment Assessment Parameters				Coarse Sediment and Habitat Assessment Parameters			
Riffle Pebble Count ⁽²⁾		Grid Toss ⁽²⁾	McNeil Core	Channel Form		Instream Habitat	
% <6mm	% <2mm	Pool % <6mm	% <6.35 mm	W/D Ratio ⁽²⁾	Entrenchment Ratio	Residual Pool Depth (ft) ⁽²⁾	Pools / Mile
≤ 17%	≤ 10%	≤ 24%	≤ 35%	Rosgen B & C channels with bankfull width < 30ft: ≤ 21	Rosgen C channels: > 2.2	< 20' bankfull width: ≥ 0.6 ft; < 38' bankfull width: ≥ 0.8 ft	< 20' bankfull width: ≥ 81

⁽²⁾ Reach average)

Table 2. Jim Creek Sediment Assessment Data Compared to Targets

Reach/Site ID	Assessment Year	Mean BFW (ft)	Gradient (%)	Existing Stream Type	Fine Sediment Parameters				Coarse Sediment and Habitat Assessment Parameters			
					Riffle Pebble Count		Grid Toss	McNeil Core	Channel Form		Instream Habitat	
					% <6mm	% <2mm	Pool % <6mm	% <6.35 mm	W/D Ratio	Entrenchment Ratio ¹	Residual Pool Depth (ft)	Pools / Mile
DEQ	2014	18.3	2.64	C4b	43	20.1	23.4		9.2	See Comment ⁽¹⁾	1.7	98
197	2013						22.3					
197	2008						30.6					
197	2003						32.1					
7091	2012				6.0	4.4	10.1					
7093	2012				8.8	6.3	2.2					
7094	2012				9.8	5.8	29.2					

7096	2012			15.5	11.1	3.1	Most recent 5-year average : 38.3				
	2011-2015										
Averages				16.6	9.5	19.1	38.3				

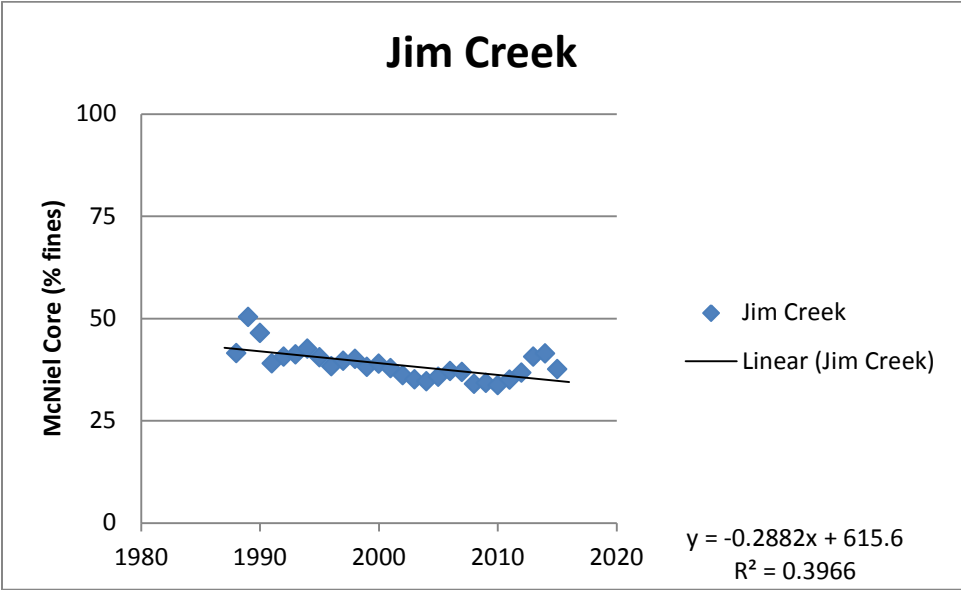


Figure 1. Regression trend line for Jim Creek McNeil Core sediment data.

APPENDIX B – SELECT SWAN LAKE WATER QUALITY DATA

