Town of Stevensville

Wastewater Treatment Plant Improvements

Preliminary Engineering Report

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Section I. Executive Summary

The Town of Stevensville was issued a new MPDES permit on October 1, 2006 for their wastewater treatment plant (WWTP). The new permit includes average monthly limits and maximum daily limits for nitrogen and phosphorus. In addition the renewed permit set forth new limitations on *E. coli* Bacteria and total residual chlorine. These requirements are summarized in Table I-1.

Table I-1. MPDES Nutrient Discharge Limits

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
Total Nitrogen[1,2]	lb/day	41.2	NA	60.3
Total Phosphorus[2]	lb/day	9.1	NA	12.3
E. coli Bacteria[3,5]	cfu/100 mL	126	252	NA
E. coli Bacteria[4,5]	cfu/100 mL	630	1260	NA

Footnotes:
1. Calculated as the sum of Nitrate + Nitrite as N and Total Kjeldahl Nitrogen (TKN) concentrations.
2. This limitation applies from June 1 through September 30, annually.
3. This limitation applies from April 1 through October 31 annually.
4. This limitation applies form November 1, through March 31, annually.
5. Report Geometric Mean, if more than one sample is collected in the reporting period.

The renewed permit also included the following special conditions:

- The Town of Stevensville must discharge the WWTP effluent at the permitted discharge point in the mainstem of the Bitterroot River. The Town's WWTP effluent currently discharges in a side channel of the Bitterroot River. Any upgrades and construction must be completed by July 31, 2010.
- Final Effluent E. coli Bacteria and Total Residual Chlorine limitations must be met by midnight July 31, 2010.
- The Town of Stevensville is required to determine the need for a groundwater outfall associated with the polishing lagoon cell. The polishing lagoon cell is unlined and known to leak.

The Stevensville WWTP reported an average month total phosphorus value of 9.59 lbs/day, exceeding the average monthly limit allowed in the permit for the months of June through September. This was not a permit violation, but indicates that the facility is very close to the allowable average monthly limit for total phosphorus. Work is underway to develop the Bitterroot River TMDL and numeric water quality standards for the Bitterroot River. It is estimated that numeric water quality standards for the Bitterroot River will be similar to the Upper Clark Fork River, 20 ug/L of total phosphorus and 300 ug/L of total nitrogen. Instream data shows that the Bitterroot River is nearing or already at these levels. Initial implications of the Bitterroot River TMDL would require stream dischargers to perform some level of nutrient removal.

In addition to the permit and water quality required improvements, parts of the Stevensville WWTP need upgrades. The Stevensville WWTP Headworks and Oxidation Ditch were placed into operation in 1979. These facilities are reaching the end of their useful life. The Headworks screen consists of a manual bar rack that must be cleaned by hand. Grit removal does not exist at the facility and, as a result, plant staff spends a significant amount of resources maintaining the many submersible pumps installed as part of the 1998 Wastewater Treatment Plant Expansion project. The oxidation ditch is shallow, experiences infiltration when groundwater is high and is not capable of performing biological nutrient removal. The facility does not have an emergency power source as required by Circular DEQ 2, Section 56.1. This inadequacy will become more critical with the onset of continuous disinfection requirements.

This preliminary engineering report evaluates alternatives and costs associated with making phased improvements to the Stevensville WWTP to:

- Meet the requirements of the MPDES permit
- Meet the requirements of the future Bitterroot River TMDL
- Meet the requirements of future in-stream water quality standards
- Meet the requirements of Circular DEQ 2
- Provide for renewal, replacement, and upgrade to the existing Headworks and Oxidation Ditch.

Alternatives were evaluated for the following WWTP elements:

- Disinfection
- Polishing pond permitting
- Outfall
- Secondary biological treatment
- Screening
- Grit removal
- Emergency power

Alternatives considered for each of the WWTP elements are summarized below.

Disinfection

- No action
- Chlorine
- Ultraviolet light
- Ozone

Polishing Pond Permitting

- No action
- Decommission Pond
- Permit pond discharge and retain for back-up

Outfall

- No action
- Construct discharge pipe to the Bitterroot River
- Permit current discharge location

Secondary Biological Treatment

- No action
- Upgrade existing oxidation ditch
- Construct new biological nutrient removal basin
- Convert existing aerobic digester to simultaneous nitrification/de-nitrification basin
- Convert existing aerobic digester to conventional biological nutrient removal

Screening

- No action
- Rotary Drum screen
- Perforated Plate screen
- Traveling Rake screen

Grit Removal

- No action
- Vortex grit tank
- Aerated grit tank
- Inclined plate

Emergency Power

- No action
- Connect to alternate source
- Portable generator
- In-place generator

Recommended Plan

The recommended plan includes construction of an ultraviolet light disinfection system; permitting the polishing pond to serve as a back-up effluent storage cell; permitting of the existing effluent discharge location; converting the existing aerobic digester to conventional biological nutrient removal; construction of a new Headworks facility consisting of a perforated plate screen and screenings washer/compactor and vortex grit removal tank and grit washer; and installation of an in-place stand-by generator.

The overall cost of the recommended plan in 2008 dollars is summarized in Table I-2.

Table I-2. Project Cost Summary

Project Element	Estimated Implementation Cost
UV Disinfection	$540,000
Polishing Pond Permitting and Use	$289,000
Outfall Permitting	$10,000
Secondary Biological Treatment	$2,132,000
Headworks Improvements	$1,295,000
Emergency Power	$82,800
Total Estimated Project Cost	$4,348,500

A phased approach to implementing the recommended improvements has been developed to spread the costs over time since not all of the improvements are immediately necessary. The recommended phasing approach is summarized in Table I.3.

Table I-3. Project Phasing Approach

Phase	Year	Description	Estimated Project Cost[1]
1	2010	UV, Emergency Power, Outfall Permitting, Polishing Pond Permitting and Use	$1,076,233
2	2014	Headworks Improvements	$1,733,749
3	~2014-2021	Secondary Biological Treatment	$3,681,505

Footnotes:
1. Project costs have been escalated at an inflation rate of 5% per year from 2008 to the year of implementation. The Secondary Biological Treatment project was escalated to 2020 dollars. These costs do not include

Net Cost per User

The funding plan will only consider Phase 1 since that is the project that is being considered in grant applications for the 2008 funding cycle. The funding plan includes a $100,000 RRGL grant, a $311,000 RD grant, and a $727,000 RD loan at 4.625% over

40-years. The annual loan payment will be approximately $44,000 per year. This equates to $4.15/month per household using an estimated number of households for 2010 of 883. This does not include additional operations and maintenance costs.

Section II. Problem Definition

A. Identify Planning Area and Existing/Potential Service Area

1. Location

The Town of Stevensville, MT is located in the Bitterroot Valley in the northern portion of Ravalli County, approximately 25 miles south of the City of Missoula in western Montana. It is situated on a valley plain bounded on the west by the Bitterroot Mountains and on the east by the Sapphire Mountains. After Hamilton it is the second largest of 10 communities within Ravalli County. The Town is situated on the east side of the Bitterroot River and east of US Highway 93. The Town is located at 46 degrees 30.57 minutes north latitude and 114 degrees 5.77 minutes west longitude (Figure II-1).

The specific planning area for this study encompasses the present Town Limits and unincorporated county areas to the northeast, east and south. The planning area includes those areas east and south of the existing Town Limits where growth is occurring now and is expected to continue during the planning period and where there is sufficient land to support that growth. The planning area includes the extended zoning district as adopted by ordinance of June 24, 1996, as well as other areas of logical extension of municipal services. The Stevensville Planning Area is about 1,438 acres (2.25 square miles) in size. Further expansion to the west beyond the Town Limits is constrained by the Bitterroot River and its associated floodplain.

A map of the planning area is included herein as Appendix A.

Figure II-1: Location of Stevensville, MT

2. Physical Characteristics of the Area

Geology

According to "*Roadside Geology of Montana*" by David Alt and Donald W. Hyndman, the principal geologic units deeply underlying the Stevensville area are granite rocks of the Idaho Batholith. Overlying the basement rock are valley fill sediments of the Renova formation, eroded off the Bitterroot Mountains to the west. Atop this are more geologically recent sediments from successive washout from Glacial Lake Missoula during several cycles of the heavy glaciation followed by periods of melting of ice jams and catastrophic flooding. These sediments have been reworked and redistributed by the Bitterroot River during more recent geological history.

Stevensville sits on a low terrace adjacent to the relict flood plain of the Bitterroot River, which meandered widely during recent geological history. Surface deposits underlying the area consist of alluvium of modern channels and flood plains (quaternary) consisting of well-rounded gravel and sand with lesser amounts of silt and clay.

Topography

The surface topography of Stevensville and environs is relatively flat with a falloff in elevation from east to west towards the Bitterroot River at about one to two percent. The average surface elevation of the Town and its immediate environs is 3,370 feet MSL. A topographic map of the planning area is included in Appendix A.

Soil Types

The majority of the land surrounding the Town of Stevensville WWTP is situated on a soil classified as Holloron loam (Map symbol 120B) on slopes less than 4.0%. This soil type is described as well drained, non-saline soil with moderate available water capacity that rarely experiences flooding.

There are three main soil types found within the WWTP boundary, designated by map symbols 16E, 147A, & 904. The soils are classified as Riverside Tiechute Curlew, Histic Endoaquolls Curlew, and Dumps/Landfill respectively.

A soils map, legend, and soils description of the area is included with the Environmental Checklist in Appendix B.

Groundwater

Groundwater depths in the area around Stevensville are relatively shallow. Thus, dewatering pipeline trenches and structure foundations will likely be required during the construction of system improvements.

A review of well logs in the area indicates that typical depths to groundwater are in the range of 3 to 20 feet below land surface. The depth to groundwater also varies with the irrigation of the surrounding land with high groundwater being reported during months of more intense irrigation of nearby farmlands in June, July and August. The general direction of groundwater flow underlying the area is to the west towards the Bitterroot River. The river surface generally represents the governing "link sink" relative to groundwater levels and localized hydrogeology.

Surface Water

The Bitterroot River is the primary surface water body in the area and is located at the western edge of the Stevensville planning area. Waters in this river are classified by MDEQ as "B-1" and are considered suitable for drinking after conventional treatment. Other suitable uses under this classification include bathing, swimming and aquatic recreation, growth and propagation of salmonid fishes and aquatic life, waterfowl and furbearer habitat, and agricultural and industrial water supply. Flows in the river vary primarily in response to rainfall and snowmelt on the surrounding mountains. In addition, flows in the river are regulated to a considerable extent by the Painted Rocks Reservoir, located on the West Fork of the Bitterroot River upstream of Conner, MT. In addition to this base flow, four other major tributary streams (Sleeping Child Creek, Skalkaho Creek, Blodgett Creek and Bear Creek) contribute substantial flows upstream of Stevensville.

Flows from the river and some of the tributary streams are diverted into irrigation ditches to support agricultural activities in the valley. The Supply Ditch is the primary irrigation ditch within the Planning Area and runs from south to north in the eastern segment of the Planning Area.

Within the planning area, there are two other smaller, but still significant, tributaries of the Bitterroot River: Mill Creek and North Swamp Creek. The Town of Stevensville obtains a substantial portion of its raw water supply indirectly from these two streams by means of a subsurface infiltration system of tile pipe laid parallel to the creeks in fields between the creekbeds. A direct discharge from North Swamp Creek is available in winter months. MDEQ considers the water from this source to be "under the direct influence of surface water" and therefore subject to Surface Water Treatment Requirements (SWTR).

Climatological Information

Climatological information for the Town of Stevensville is summarized in Table II-1. The information in this was obtained from the National Climatic Data Center (NCDC) in Asheville, NC and covers the period from 1911 to 2004. Average annual precipitation is 12.56 inches, which places Stevensville in the "semiarid" category. The average annual maximum and minimum temperature is 58.5 °F and 31 °F, respectively.

Table II-1. Local Climatological Summary

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Avg
Max. Temp. (F)	33.1	39.7	48.8	59.5	68.0	75.2	84.8	83.4	72.1	59.1	43.3	34.6	58.5
Min. Temp (F)	14.9	19.0	24.5	30.6	37.4	44.0	47.1	45.3	38.1	30.5	23.1	17.0	31.0
Total Precip. (in.)	1.07	0.85	0.78	0.83	1.49	1.65	0.87	0.90	1.07	0.88	1.06	1.09	12.56

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Avg
Total Snowfall (in.)	7.7	5.8	4.1	0.4	0.1	0.0	0.0	0.0	0.0	0.2	3.0	5.9	27.3
Snow Depth (in.)	3	2	1	0	0	0	0	0	0	0	1	2	1
*Period of Record: 8/23/1911 to 6/30/2004 **Percent of possible observations for period of record: Max. Temp 98.4%, Min Temp 98.3%, Precip 98.7%, Snowfall 47.2%, Snow Depth 48.3%													

Floodplain

Appendix A includes the FEMA floodplain map for the planning area. The planning area and the proposed improvements are located outside of the 100-year floodplain of the Bitterroot River.

Vegetation and Wetlands

Since Stevensville is the oldest permanent settlement in Montana, dating from 1841, most if not all of the original native vegetation within the existing town limits had been replaced with cultivated varieties of trees, shrubs and grasses. Outside of the existing town limits and within the eastern extent of the planning area, homesteads and small farms with irrigated hay fields or grassy rangelands spread out beyond the Town. For the most part, native grasses and other indigenous herbaceous plants have been replaced with hay and alfalfa fields. With the exception of scattered groupings of pine and fir trees, there are no real stands of native timber left within the planning area. Trees mainly consist of cottonwoods and scattered fruit bearing trees (mainly apple, pear and plum trees) which are generally found along the edges of the creeks and man-made irrigation ditches where there is sufficient year-round moisture to sustain vibrant growth.

Wetlands within the planning area are generally found within the floodplain of the Bitterroot River just west of the planning area and immediately adjacent to the run of area creeks. These are generally confined to the edges of these streams or in isolated pockets were groundwater levels are at or near the surface. Substantial wetland areas along with highly valued waterfowl habitat are found mainly within the confines of the Lee Metcalf National Wildlife Refuge, located just north of the planning area. This refuge contains a diverse combination of wetland types and forested river bottom habitat and is highly protected from any disturbance or perturbations by man.

3. Environmental Resources Present

As part of a previous study by Professional Consultants Incorporated (PCI), information on the environmental resources present in the planning area were collected, and anticipated impacts to the resources from the proposed projects were summarized in their *Uniform Environmental Checklist* (UEC). This information was taken into account for this project's UEC. In addition, a narrative summary of the proposed project was submitted to local, regional, state and federal agencies for comments on the project. This information was used to determine if any environmental resources will be impacted by the project. Potential impacts, along with any mitigation measures where pertinent, are discussed in the following subsections. A copy of the updated, project-specific UEC, accompanying narrative and agency comments received are included in Appendix B.

Historical and Archeological Resources

Saint Mary's Mission, located at the end of 4th Street in the Town of Stevensville, was the first Catholic mission in the northwest and the first permanent white settlement in Montana. The mission was established in 1841 by Father Pierre DeSmet, who came to the Bitterroot Valley in response to requests for "Black Robes" by various Native American tribes of present-day Montana and Idaho. The mission complex includes the chapel/residence, Father Anthony Ravalli's log house and pharmacy, Chief Victor's cabin and the Native American burial plot. All buildings have been restored to the 1880 era and are furnished with items built by Father Ravalli, Montana's first medical doctor. Chief Victor's cabin is restored as an Indian museum. Nearby DeSmet Park was dedicated in 1991 to commemorate the 150th anniversary of the establishment of St. Mary's Mission.

Also included in the complex is the Stevensville Museum. This facility features the early growth and development of the Bitterroot valley with displays of artifacts, pictures and information panels regarding the history of the American Indian population (the Salish Indians), the Lewis and Clark Corps of Discovery expedition through the valley in 1805-1806, the arrival of Father DeSmet in 1841, the establishment of the earliest mission in what is now Montana, the development of Fort Owen as one of the earliest trading posts and the history of Stevensville itself.

The historic Catholic mission complex and Fort Owen will not be impacted by the activities associated with the subject project. The response from the State's Historic Preservation Officer (SHPO) to the Environmental Checklist regarding this PER is included in Attachment B. It indicates a low likelihood of significant impact to both archaeological and historical resources for the proposed project since virtually all actions will be conducted in previously disturbed areas.

Fish, Wildlife and Endangered Species

During the preparation of the UEC, the database of the *Montana Natural Heritage Program* was researched for the presence of sensitive animal, fish or plant species within the planning area. No conflicts relative to the proposed project were noted.

The response received from the US Fish and Wildlife Service, USDI indicated that there are three (3) threatened species that may occur in the Planning Area, namely, the Canada Lynx, the Bull Trout and the Bald Eagle. In addition, the Gray Wolf, considered to be a nonessential experimental species introduced into the area, and the Yellow-billed Cuckoo, a candidate threatened species, may also occur in the area. The response indicated that, considering the nature, scope and location of the project, this agency does not anticipate adverse impacts to any federally listed threatened, endangered, candidate or proposed species or critical habitat.

Agricultural Land

The planning area includes many agricultural parcels. The principal agriculture activities conducted within the planning area are the raising and pasturing of livestock, primarily cattle and horses, and hay cropping on irrigated lands. The upcoming upgrade and expansion of the Town of Stevensville's water system will permit nearby agricultural lands to be developed as residential or commercial use. Overall, higher density development on lands provided with municipal level facilities will require less of the available land area and will ultimately serve to reduce impacts on agricultural lands throughout the general area.

The improvements proposed by this PER are replacements or upgrades to existing facilities and do not directly impact agricultural lands or uses.

Surface Waters, Floodplains and Wetlands

The improvements proposed by this PER do not impact any surface waters, floodplains or wetlands. All work will be conducted away from surface waters, outside of the 100-year flood zone and away from area wetlands. All work will take place within the boundaries of the existing wastewater treatment plant site which is not located in a wetlands, surface water site, or 100 year floodplain.

Groundwater

Groundwater under the Planning Area is known to be plentiful and generally of good quality. The near surface waters are seasonal and supported by summer irrigation of integral and surrounding pasture lands and hayfields.

Water quality testing of Stevensville's municipal drinking water supply both from the infiltration gallery and from the wells had not indicated any persistent or recurring water quality issues.

4. Growth Areas and Population Trends

According to U.S. Census Bureau statistics, the Town of Stevensville had a population of 1,732 persons on July 1, 2002. The year 2000 census population was 1,553 and the year 1990 census population 1,221. There was a 27.2 percent increase in population over the decade from 1990 to 2000 and a 5.8% annual increase from 2000 to 2002. Similarly, Ravalli County posted a 44.2% growth rate over the decade from 1990 to 2000, for a 3.7% compounded annual growth rate. Projections by NPA Data Services place Ravalli County with a 2% annual growth rate for the period from 2005 to 2025 and population growth in the Town is expected to mirror population growth throughout Ravalli County.

The Stevensville 2007 population is based on current water metering information (Table II-2) provided by the Town of Stevensville and an estimated 2.4 people per residential unit from the 2000 U.S. Census.

Table II-2. 2007 Wastewater Service Connections by Line Size

Meter Size	# of Connections	Multiplier	EDU	Population
¾" meter	675	1.0	675	
1" meter	35	1.79	63	
1 ½" meter	19	4.0	76	
2" meter	3	7.14	21	
		Total	**835**	**2,004**

Projected population growth is estimated using the current population of 2,004 and an assumed 2% annual growth rate (Table II-3). Growth trends indicate future growth of the Town is expected to be primarily towards the east and south where there is available suitable land for development.

Table II-3. Projected Population Growth

	Current (Year 2007)	Year 2015	Year 2025	Year 2035
Population	2,004	2,348	2,862	3,486

B. Evaluate Condition of Existing Facilities

1. Schematic Layout

The schematic presented in Appendix C provides the layout of the Town of Stevensville WWTP. As the figure shows, the WWTP has an influent manual bar screen, influent sampling, 9" parshall flume flow measurement, 34,758 cubic foot oxidation ditch for biological treatment, two 30 foot diameter covered secondary clarification units, flow measurement, and a 5.4 acre effluent polishing pond. Effluent from the polishing pond is again measured and discharged to a 3,000 foot drainage ditch that runs directly to the Bitterroot River.

Solids collected in the secondary clarifier are wasted to a 718,125 gallon aerobic digestion complex. Following digestion, waste solids are stored in four sludge drying beds until they can be transported to Eko-Compost in Missoula. Decant from the sludge drying beds is routed to the oxidation ditch for biological treatment.

The WWTP has an abandoned 37,000 gallon final clarifier which was once considered for modification to a primary clarifier. There is also an abandoned 55,000 gallon aerobic digestion tank which sits almost entirely above grade.

2. History

This facility was originally operated as a controlled discharge lagoon. In 1979, the facility began operation as a mechanical treatment plant. Upgrades at that time included flow measurement, biological treatment in the oxidation ditch, final sedimentation, aerobic solids digestion, and solids storage in sludge drying beds.

In 1998 major improvements to the facility were constructed, including the new secondary clarification units, new aerobic digestion facility and blower building complex, and additional sludge drying beds.

3. Analysis of Existing Facilities

3.1 Existing Flows: The monthly influent flow to the Stevensville wastewater treatment plant over the past four years is shown in Table II-4. The annual average daily flow (199,000 gpd) is approaching the plant design capacity of 300,000 gpd.

Table II-4. Monthly Influent Daily Flows [MGD] to Stevensville WWTP

Month	2004	2005	2006	2007	Average
January	0.215	0.177	0.239	0.194	0.206
February	0.260	0.172	0.204	0.221	0.214
March	0.246	0.187	0.197	0.219	0.212
April	0.176	0.181	0.229	0.196	0.195
May	0.221	0.196	0.188	0.203	0.202
June	0.208	0.206	0.195	0.191	0.200
July	0.183	0.199	0.150	0.159	0.173
August	0.192	0.180	0.149	0.174	0.174
September	0.202	0.183	0.164	0.183	0.184
October	0.184	0.197	0.177	0.210	0.192
November	0.205	0.243	0.226	0.203	0.219
December	0.190	0.212	0.215	0.236	0.213
Average	0.207	0.194	0.194	0.199	0.199

With an estimated population of 2,004 in 2007, the average per capita flow corresponds to about 99 gallons per capita per day (gpcpd) as compared to a typical national average of 100 gpcpd.

A review of the plant's daily flow records for the year 2007 indicates a maximum daily flow of 397,000 gpd which corresponds to a 2.0 peaking factor for maximum daily flow. The minimum daily flow recorded was 145,000 gpd which corresponds to a 0.73 peaking factor for minimum to average daily flow. Current peak hour flow is estimated at 720,000 gpd based on a peaking factor of 3.6 calculated from Circular DEQ 2, Design Standards for Wastewater Treatment Facilities. A review of final clarifier and lagoon effluent flow data for 2007 indicates significant infiltration to the WWTP, which is particularly high during summer months and presumably occurring at the oxidation ditch and polishing pond. The average, minimum, and maximum daily effluent flow from the secondary clarifier was recorded as 366,000, 204,000, and 966,000 respectively. These records indicate that as much as 2.5 times the plant inflow is infiltrating the WWTP process through groundwater seepage into the system. Additionally, it could be inferred that during periods of lower groundwater in and around the WWTP, this degree of seepage could be expected to infiltrate the groundwater from the WWTP. It should be noted that the accuracy of the effluent flow measurement at the secondary clarifiers is suspect.

The monthly lagoon effluent wastewater characteristics for 2007 are summarized in Table II-5.

Table II-5. Monthly Lagoon Effluent Wastewater Characteristics for 2007

2007 Month	Average Daily Flow [MGD]	Effluent BOD_5 [mg/l]	Effluent TSS [mg/l]	Effluent TP [mg/l]	Effluent TN [mg/l]	Effluent TKN [mg/l]
January	0.220	2	1	3.11	16.3	3.44
February	0.246	2	4	3.54	18.7	1.36
March	0.245	6	19	2.75	12.6	1.40
April	0.242	3	9	3.45	10.5	2.77
May	0.421	3	1	3.26	10.4	2.23
June	0.659	3	5	3.01	5.19	1.09
July	N/A	2	6	2.28	4.03	1.57
August	0.398	2.8	1.4	2.33	3.81	1.79
September	0.368	2.5	2	2.54	6.11	1.95
October	N/A	2.8	3.3	2.14	7.52	1.55
November	N/A	2	1	2.95	13.2	1.32
December	N/A	4.25	3	3.40	14.8	2.44
Average	0.350	2.95	4.6	2.90	10.26	1.91

Effluent flow data measured at the plant outfall downstream of the polishing pond also shows that a significant amount of infiltration occurs at the WWTP during the months that high groundwater is known to occur (May through September). Comparing the influent flow data with the effluent data from the plant outfall shows that as much as 3.5 times the average plant influent flow or approximately 0.50 MGD infiltrates into the system at the WWTP. Most of this infiltration is thought to occur at the unlined polishing pond.

3.2 Hydraulic and Organic Loading: Table II-6 shows the average monthly water production and average monthly wastewater plant inflow for 2007. Although there are approximately 12 households that are not connected to the wastewater plant, according to Stevensville staff, accounting for these users is not considered significant. The difference in water production and wastewater plant inflow is substantial. The data suggests significant irrigation, or water lost to main line, hydrant or service line leaks.

Table II-6. Monthly Water Production and Wastewater Treatment Plant Inflow for 2007 (in gpd)

Month	Water Production	Wastewater Plant Inflow	Difference
Jan	529,039	193,677	335,362
Feb	489,207	220,500	268,707
Mar	675,509	218,677	456,832
April	538,966	195,656	343,310
May	770,611	202,000	568,611
June	1,226,800	191,133	1,035,667
July	1,668,941	158,741	1,510,200
August	1,695,614	173,000	1,522,614
Sept	1,059,399	183,433	875,966
Oct	1,062,212	210,064	852,148
Nov	572,866	203,000	369,866
Dec	597,580	236,387	361,193
Average	907,229	198,856	708,373

3.3 Treatment Standards: A summary of permit violations from the past seven years is below (violation letters attached in Appendix E):

- February 25, 2008: the Town of Stevensville received a violation letter for a reported discharge value of phosphorus exceeding the permit limit.
- April 18, 2003: the Town of Stevensville received a violation letter for a reported discharge of BOD5 and TSS exceeding the permit limit
- December 8, 2003: the Town of Stevensville alerted MDEQ of a permit violation in a letter for a reported clarifier effluent BOD exceeding permit limitation. This violation may have been a result of faulty RAS/WAS pumping equipment.
- July 30, 2001: The Town of Stevensville received a violation letter for a reported discharge of TSS exceeding the permit limit.

Currently sludge is tested by plant staff for heavy metals, nitrogen, phosphorus, moisture content, pH and other constituents (Appendix E) before it is picked up by Eko-Compost. Eko-Compost then produces a Class A sludge.

The estimated capacities of liquid stream unit processes are summarized in Table II-7. The capacities are compared to MDEQ requirements and/or design guidelines.

Table II-7. Estimated Capacities of Liquid Stream Treatment Processes

Component	Units or Parameter	Initial Design or Current Conditions	Current or Proposed Design Standards	Design Year of Maximum Capacity	Comment
Manual Bar Screen	Spacing in inches	1	1	Outdated	Needs replacement
9" Parshall Flume	MGD	5.73	Measurement required	2870	Good Condition
Oxidation Ditch	Detention time in hrs @ ADF	21	18 to 24 hours	2027	Ditch is too shallow, Significant infiltration into the unit
	Loading rate in lbs BOD/1000cf	11	15	2023	
Final Clarifier	SOR gal/day/sq ft	637	1,000	2029	Good Condition
Polishing Ponds	---	---	Not Required	---	Provides Backup
Outfall	---	---	DEQ preference	---	Not Permitted

The estimated capacities of solids stream unit processes are summarized in Table II-8. The capacities are compared to MDEQ requirements and/or design guidelines.

Table II-8. Estimated Capacities of Solid Stream Treatment Processes

Component	Units or Parameter	Initial Design or Current Conditions	Current or Proposed Design Standards	Design Year of Maximum Capacity	Comment
RAS/WAS Pumps	Capacity, gpm	200	50-150% Q	2015	Problems with Grit
Aerobic Digester	cu ft/P.E.	12	4.5	2360	Oversized
	SRT days	220	27	2225	
Sludge Storage	Sq.ft/P.E.	1	2.5	Basins are full in winter, could use more capacity	

Accurate management of the microorganism population within the system is critical to proper operation of the oxidation ditch. The RAS pumping facilities include six 3.8 HP submersible RAS pumps (two duty and one spare per clarifier), two 3.8 HP submersible WAS pumps, and two 3.8 HP submersible chopper type scum pumps. These pumps experience more than normal wear due to the grit and screenings that make it through the headworks of the plant.

The WWTP includes four covered aerobic sludge digestion tanks with a total capacity equaling 718,000 gallons. There are four 40 HP blowers dedicated to the aerobic digester and all are in good working condition. Solids are pumped from the final clarifier wetwell to the digesters at an average solids concentration of 10,000 mg/L (1.0 percent). Based upon the projected wastewater raw sludge loadings, the existing digesters have capacity to approximately year 2225.

The existing sludge storage basin provides storage capacity for the winter months but due to freezing, it usually cannot be emptied until the spring, when solids are hauled to Eko-Compost. Decant water from the storage basins is routed to the oxidation ditch.

3.4 <u>Lift Stations</u>: The Stevensville collection system contains one lift station on the west side of town. Two pumps, each with a design condition of 180 gpm at 35 feet of total dynamic head, currently serve approximately 30 dwellings. The maximum capacity of this lift station is 270 homes, based on an October 21, 2003 memorandum from PCI to the Town of Stevensville.

3.5 <u>Collection System</u>: Existing collection system mapping was used to develop a spreadsheet-based model in order to evaluate existing sewer collection facilities. The minimum and maximum slopes in the system are 0.0001 and 0.057 ft/ft, corresponding to minimum and maximum full depth capacities of 0.088 and 3.38 MGD. Two subdivisions in development on the eastern edge of town will increase the future load on the existing sewer system. Available capacity will be exceeded in the three segments of mains approaching the WWTP and in the main entering manhole 11. A peaking factor of 3.6 was used to estimate peak hour flows in accordance with Circular DEQ 2. It is recommended that more precise flow data be recorded at the wastewater treatment plant to verify the peak hour value. If plant data reveals a peaking factor smaller than 3.6, then exceeding capacity in the existing collection system may not be a concern. Verification of peak hour flow should be accomplished prior to making expensive improvements to the collection system.

3.6 <u>Impact of Infiltration or Inflow on System Performance</u>: As noted previously there is significant infiltration occurring at the WWTP. It is suspected that the majority of this infiltration occurs at the polishing pond. The increased flows into the plant may be contributing to the violation of permit limits. Infiltration is also suspected in the collection system in the area east of Church Street (PCI 1996 Water and Sewer Facilities Plan) but it is not significant considering that the average monthly flow into the WWTP varies little throughout the year as shown in Table II-4. Even so, the Town of Stevensville has a program in place to perform closed circuit television inspection in areas suspected of infiltration to identify and repair leaks.

3.7 Operational and Management Practices and Capabilities: Operation of the WWTP is overseen by the Town's water/wastewater superintendent. Normal maintenance, operation, and testing duties for the WWTP are shared by two other town employees. These three individuals take care of not only the wastewater treatment plant but also the wastewater collection system, the water treatment plant, wells, water distribution system, streets, swimming pools, parks, and cemetery. The employee time is spread very thin among their duties. It is estimated that the average time spent at the treatment plant is somewhere between 3 to 6 manhours per day (depending on the time of year and the demands of their other tasks).

The existing headworks consists of a manual bar screen with 1" bar spacing which has been modified to allow influent to flow over the top and into the channel during times when operator attention is not available. This was necessary since the screen must be raked by hand and if someone isn't there to rake it when an item blinds the screen, influent can back-up and overflow the channel. The influent screen does not function as required and should be replaced with a mechanically operated fine screen. The existing influent measurement system is a 9" Parshall flume with adequate capacity for future growth (see Figure II-1).

Figure II-1 Photograph of influent screen and Parshall flume showing the modifications to the screen on the left.

There is no grit removal system in place at the WWTP. Grit removal facilities are required by Circular DEQ 2, Design Standards for Wastewater Treatment Facilities. The accumulation of grit in the pumping wetwells in the plant is evident and indicates an overall grit problem throughout the plant. The problems associated with grit distribution in this plant are widespread and significant. Any improvements to the existing WWTP should include addition of a headworks facility that includes a grit removal process. Due to the numerous submersible pumps located in later processes within the WWTP grit removal upgrades are essential. Grit currently entering the plant is continuously damaging pumps, particularly waste activated and return activated sludge pumps, and could lead to a system upset.

Following the Parshall flume, flow is routed directly to the oxidation ditch with a bypass capable of sending the flow to an abandoned primary clarifier. The primary clarifier could be made to function with upgrades. However, it may be more beneficial if converted to an equalization tank. The existing oxidation ditch is around 38,770 cubic feet with sloped sidewalls and a 5 foot operating depth. Current design standards for an oxidation ditch are to use a 15-25 foot operating depth to enhance biological nutrient removal efficiency. Plant flow data shows that significant infiltration from the groundwater is entering the system at the oxidation ditch. Due to the design of the oxidation ditch and the probability of a compromised seal, this system should be decommissed and alternative treatment processes should be investigated.

The effluent from the oxidation ditch is routed to a clarifier influent splitter structure which divides the flow evenly to the two final clarifiers. The covered final clarifiers are 30’ diameter and have adequate hydraulic capacity to design year 2029 with one clarifier out of service. The final clarifiers are currently in good working order. Effluent from the final clarifiers is metered before discharge into an onsite polishing pond.

The polishing pond is hydraulically connected to the groundwater and should be decommissioned due to the health and safety concern for cross contamination. There is currently no form of effluent disinfection in place at the WWTP. Disinfection should be incorporated into the plant effluent management system for public health and safety.

The existing outfall is to a ditch that runs parallel to the permitted outfall, the Bitterroot River, for approximately 3,000 feet before finally discharging into the river. This arrangement is a violation of the current discharge permit since it does not discharge directly to the river.

4. Financial Status of Facilities

The Town of Stevensville has operated with a net income over the reporting period 2005 through 2007 and is projected to do so again in 2008 despite significant bond principal and interest assessments for wastewater upgrades completed in 2000. There is approximately $293,000 cash on hand, $278,000 time deposits and short-term investments, and $51,000 in accounts receivable. The current water and sewer average residential rates are $19.27 and $35.09 respectively for a combined rate of $54.36. The target rate set by the Department of Commerce for the Town of Stevensville is $50.36. Significant improvements to the water and wastewater utilities are being planned. Projected average residential water and wastewater rates are projected to be $29.14 and $40.09 once these projects are completed. A recent income survey performed for a CDBG application resulted in a LMI percentage of 54%.

C. Describe and document the need for the project and the problems to be solved

1. Health and Safety

Protection of public and internal staff health is the primary factor in determining the need for system upgrades. The excessive handling of raw wastewater sewage by Town staff should be accounted for when upgrades to the existing facility are considered. The operations staff must handle screenings several times each day at high moisture and organic content, which is a worker health and safety problem. It is recommended to replace the equipment with a more modern screenings system that includes the capability to mechanically wash and compact screenings prior to disposal.

Potential for contamination of groundwater in the vicinity of the wastewater treatment plant due to leaking process units may dictate the need for additional upgrades. The WWTP discharges to the Bitterroot River which is classified as B-1 suitable for bathing, swimming and aquatic recreation, growth and propagation of salmonid fishes and aquatic life, waterfowl and furbearer habitat, and agricultural and industrial water supply, however; the plant does not currently disinfect its effluent prior to discharge. Year round disinfection is now a requirement of the MPDES permit as a means to protect the public from harmful bacteria and viruses.

The Bitterroot Valley Aquifer has been designated a Sole Source Aquifer (SSA). The overall goal of the designation is

"…to ensure that projects receiving Federal financial assistance in an SSA project review area is designed and constructed in a manner that will prevent the introduction of contaminants into the SSA in quantities that would create a significant hazard to public health."

The Bitterroot Valley aquifer is the Town of Stevensville's sole source of drinking water and is identified as vulnerable to contamination. Public health problems could potentially worsen within the Town's current planning area and adjacent to the wastewater treatment plant. Failure to implement the recommended improvements in a timely manner would have significant adverse impacts on the Town of Stevensville, including:

- Non-compliance with discharge permit requirements;
- Raw sewage spills, and associated public health impacts;
- Water quality impairment of the Bitterroot River; and
- Inability to handle wastewater generated by the community.

The consequences would likely lead to regulatory enforcement actions and fines.

2. System O&M

A primary operations concern at the influent screen is the operator attention required. The screen must be cleaned by hand multiple times each day and irregularities in plant influent that occur when no operator is present could blind the screen and cause an overflow. The screen has been modified to allow unscreened overflow to re-enter the channel on the downstream side of the screen. The operations concern for the screen is the handling of raw sewage by operations staff.

The most intensive maintenance items within the WWTP are the submersible pumps. Due to grit accumulation within the system, the pumps are wearing out more often than should be expected and require frequent replacement.

The other major operations and maintenance concern is the infiltration and exfiltration occurring within the WWTP. The two main sources of leakage are the oxidation ditch and the polishing pond. The leakage occurring not only results in decreased treatment capacity within the WWTP but could also be contaminating the adjacent groundwater.

3. Growth

Future development in the eastern part of town may cause an increase in load that exceeds current collection system capacity. Installation of mains with a diameter larger than 10 inches may be required for the three segments entering the WWTP. An estimated 3,486 users will be served by this project by 2035, as shown in Table II-3, an increase of 1,482 users.

4. Unresolved Problems

All the problems identified above are unresolved and should be addressed by making improvements to the Stevensville WWTP. Portions of the WWTP are nearing the end of their useful life including the influent bar screen and oxidation ditch. The MPDES permit requires disinfection and investigation into potential contamination leakage from the polishing pond. In addition, standby power and grit removal are requirements of MDEQ Circular DEQ 2. The proposed upgrades take the most economic approach to extend the life of the WWTP, meet the requirements of the MPDES permit and MDEQ regulations.

D. General Design Requirements for Improvements

General design criteria are based on the following elements:

- Process Sizing. These criteria specify design loading rates and operating parameters for critical unit treatment processes. Examples include clarifier overflow rates, aeration basin mixed liquor concentrations, hydraulic head loss requirements, and ultraviolet disinfection doses.
- Reliability/Redundancy. These criteria define reliability and redundancy requirements for unit processes and critical equipment.
- Water Quality Parameters. Until a TMDL waste load allocation is established for the Bitterroot River, the currently permitted effluent quality targets will be used for planning.
- Hydraulic and organic load are based on current plant influent data and the historical growth rate of the Town. For design year 2035 the average daily flow is projected to 0.35 MGD and the average BOD_5 load is projected to 550 ppd.

Design requirements for a new headworks with mechanical screen, screenings washer/compactor, and grit removal equipment would most likely include a building to house the influent screen and the grit removal equipment. Due to site limitations it would have to be a long narrow building situated to the south of the existing Parshall flume. Reliability is achieved by including a bypass channel with manual bar screen for use when the mechanical screen is in need of repair.

Grit removal facilities are required by Circular DEQ 2, Design Standards for Wastewater Treatment Facilities. Any improvements to the existing WWTP should include addition of a headworks facility that includes a grit removal process. Grit removal units are typically oversized and have a longer lifespan than other equipment commonly found in a wastewater plant. Sizing for this process equipment should be based on a 30-40 year population projection for the Town. Reliability for this type of system is usually achieved by including a bypass channel.

Since the oxidation ditch is beyond its useful life, a new secondary treatment system will need to be investigated. The design requirements for a new system would be to provide capacity for at least a 20 year design life. Nutrient limitations are becoming stricter and any new biological process will need to be designed to perform nitrogen and phosphorus removal. It is possible, in the Stevensville climate, to meet effluent total nitrogen limits of 7.5 mg/l and effluent total phosphorus limits of 0.5 mg/l. Further reductions in nutrient discharge may be achieved with chemical addition and filtration.

Decommissioning of any wastewater treatment lagoon or pond in Montana is governed by MDEQ 503 and United States EPA MTG650000. EPA requires a minimum of seven grab samples be collected from the bottom of the water body and tested for various constituents such as heavy metals, nitrates, phosphorus, pH, etc. If the samples show levels above those allowed by MTG650000, the entire water body shall be dredged and disposed of in accordance with these regulations. Additionally MDEQ requires the entire water body to be fenced to deter public contact.

Disinfection requirements are permitted in terms of the number of colony forming units (CFU's) of fecal coliform remaining in the effluent following disinfection. Typical disinfection limits are 126 CFU's/100ml. Full redundancy is required for any disinfection system selected.

Section III. Alternative Screening Process

Standby Power Generation

Alternative SPG 1 – No Action Alternative

This alternative does not provide an alternative power source. During a power failure, raw untreated effluent could be discharged directly to the Bitterroot River. This alternative is not suitable for further consideration.

Alternative SPG 2 – Connection of a Second Independent Power Line from a Separate Substation

Only one electrical substation exists in the vicinity. A separate independent power line is not available; this alternative is not suitable for further consideration.

Alternative SPG 3 – Portable Standby Power Generation

This alternative provides an alternate power source and will be evaluated further in a later section.

Alternative SPG 4 – In-Place Standby Power Generation

This alternative provides an alternate power source and will be evaluated further in a later section.

Influent Screen

Alternative IS 1 – No Action Alternative

Due to the health and safety concern, as well as the overall impacts on the WWTP, this alternative is not suitable for further consideration.

Figure III-1 Rotary Screen

Figure III-2 Perforated Plate

Alternative IS 2 – Rotary Screen

A rotary screen contains a basket screen and spiral screw auger that lifts the debris from the semi circular screen and conveys it from the influent channel to a cylinder into a washing section. Organic material is washed from the screenings and returned to the flow stream. The debris continues up the cylinder via the continuous auger into a compaction zone where it is dewatered. Following dewatering, the compacted screenings are discharged into a receiving dumpster cart. This alternative would not require building a structure and will be considered in a later section.

Alternative IS 3 – Perforated Plate Screen

The perforated plate screen is a continuous filter element driven by two conveyor chains. The filter panels are shaped as circular segments cleaned by a rotary brush. Lifting tines allow larger objects, such as stones or wood, to be removed, preventing a build–up of larger solids in the bottom of the channel. The screenings are carried upwards by the filter elements and are continuously removed and discharged by the rotary brush as the screen element moves past the brush. This alternative will be considered further in a later section.

Alternative IS 4 – Traveling Rake Screen

A traveling rake screen consists of a vertical bar screen with multiple rake assemblies that travel along the bar screen via a chain and sprocket drive periodically clearing debris from the leading edge of the bar rack. Debris is dumped onto a chute and into a container for disposal. The screen is capable of removing large items. The mechanism is low profile and has a high hydraulic capacity even with small bar spacing. This alternative will be considered further in a later section.

Grit Removal

Alternative GR 1 – No Action Alternative

Due to the damage the grit is causing to the WWTP's existing submersible pumping system, this alternative is not suitable for further consideration.

Alternative GR 2 – Vortex Grit Removal

Flow enters and exits these grit chambers tangentially and a rotating turbine maintains constant velocity. The propeller creates a toroidal flow path causing particles to settle to the bottom where they are pumped to a dewatering system. This alternative will be considered further in a later section.

Alternative GR 3 – Aerated Grit Removal

In aerated grit chambers, air is introduced at the bottom of a tank on one side to create a spiral flow pattern. Heavy particles settle to the bottom and are pumped to a dewatering system. Adjustment of the air flow determines the size of particles collected. This alternative will be considered further in a later section.

Alternative GR 4 – Inclined Plate Grit Removal

A flow distribution header distributes influent onto multiple trays. Tangential feed establishes a vortex flow pattern where solids settle into a boundary layer on each tray and are swept down to the center underflow collection chamber. These settled solids are continuously pumped to a dewatering system. This alternative will be considered further in a later section.

Secondary Biological Treatment

Alternative SBT 1 – No Action Alternative

This alternative does not address the issue of infiltration to the WWTP, replacement of process tankage and equipment at the end of their useful life, or current nutrient removal requirements. This alternative is not suitable for further consideration.

Alternative SBT 2 – Upgrade the Existing Oxidation Ditch

The existing oxidation ditch infrastructure is nearing the end of its useful life. The system leaks and because it is constructed with sloped side walls of concrete poured against the earth it is difficult to perform long term repairs. In addition the depth of the existing tank limits its ability to perform nutrient removal. This alternative is not suitable for further consideration.

Alternative SBT 3 – Convert a Portion of the Existing Aerobic Digester to an Simultaneous Nitrification/Denitrification Treatment System

This alternative investigates the possibility of converting some of the excess aerobic digester space into a new oxidation ditch secondary biological treatment system. This alternative would result in a technology familiar to the WWTP operators, would be easy to build, and would provide nitrogen removal capacity. It will be considered further in a later section.

Alternative SBT 4 – Convert a Portion of the Existing Aerobic Digester to a Conventional Biological Nutrient Removal System

This alternative investigates the possibility of converting some of the excess aerobic digester space into a new conventional biological nutrient removal treatment system. This alternative would be relatively easy to build, would use existing tank capacity, and would provide nutrient removal. This will be considered further in a later section.

Alternative SBT 5 – Design a Biological Treatment System in Place of the Existing Oxidation Ditch

This alternative investigates the possibility of building a new biological nutrient removal facility within the boundaries of the existing WWTP. This alternative presents the greatest design flexibility and will be considered further.

Polishing Pond Permitting

Alternative PPP 1 – No Action Alternative

It would be possible to continue use of the polishing pond. However, the Town would be required by their MPDES permit to determine the need for a groundwater outfall associated with the polishing pond. The Town intends to remove the polishing pond as part of the plant's everyday discharge but may want to permit it as an emergency storage cell. This alternative is not considered further.

Alternative PPP 2 – Decommission the Polishing Pond

As stated above, the Town wishes to remove the polishing pond from the current discharge process, requiring a decommissioning plan. Details of the decommissioning plan are considered in detail in a later section.

Alternative PPP 2 – Permit Pond Discharge and Retain for Backup

The Town anticipates the pond could be utilized as an emergency, short-term holding pond should a disruption occur in other areas of the WWTP. For example, if both clarifiers were damaged, the Town could store effluent in the pond long enough to service the clarifiers and then pump the water back to the treatment process without having to discharge untreated effluent to the Bitterroot River. This alternative would require performance of a groundwater study and permitting the polishing pond discharge to groundwater. This alternative is considered further in a later section of this report.

Disinfection

Alternative DIS 1 – No Action Alternative

MDEQ regulations require disinfection for protection of public health, therefore this alternative is not suitable for further consideration.

Alternative DIS 2 – Ozone

Ozone is a proven disinfection technology however design standards, operating data, and experience for this process are not well established. This alternative will be evaluated in a later section.

Alternative DIS 3 – Chlorination

Chlorine is available for disinfection gas liquid and pellet form. This alternative will be evaluated carefully due to the chemical costs and potential for staffing and public exposure to chlorine and its by-products.

Alternative DIS 4 – Ultraviolet Disinfection

Ultraviolet (UV) radiation disinfects by altering nucleic acids in bacteria and viruses preventing cell replication and resulting in cell death. MDEQ encourages the use of UV disinfection due to safety and toxicity benefits and the ease of operation and relative cost makes these systems appealing. This alternative will be considered further in a later section.

Outfall

Alternative OF 1 – No Action Alternative

This would be a direct violation of the current MPDES permit and is not suitable for further consideration.

Alternative OF 2 – Have the Existing Discharge Ditch Permitted as the Outfall

This alternative would address the MDEQ Comprehensive Performance Evaluation and will be considered further in a later section.

Alternative OF 3 – Install Effluent Piping from the Current Outfall to a New Outfall on the Bitterroot River

This alternative would address the MDEQ Comprehensive Performance Evaluation and will be considered further in a later section.

Section IV. Alternative Analysis

Standby Power Generation

A. Description

Standby power generation is a secondary source of power which serves as a spare in case the primary source of power goes out. Standby sources could be in the form of secondary connections or could be fuel fired on site generators.

B. Schematic Layout

The location for alternative power source should be located in the vicinity of the blower building. The blower building currently houses much of the plants electrical equipment and would be a connection point for any auxiliary power system employed.

C. Operational Requirements

The standby power generator is available in case the primary power source fails. As a result, the generator is not used often and needs to be exercised as a maintenance requirement. Exercising the generator should be done approximately every 4-6 months and should include turning it on and running it at its full capacity for a period of time determined by the manufacturer of the equipment.

D. Energy Requirements

Generators typically run on diesel fuel; however, they are available to run on natural gas or propane.

E. Regulatory Compliance and Permit

Circular DEQ 2, Design Standards for Wastewater Treatment Facilities states that all plants must be provided with an alternate source of electrical power or pumping capability to allow continuity of operation during power failures unless documentation is received and approved by the reviewing authority verifying that a duplicate line is not necessary.

F. Land Requirements

There is ample space available within the current boundaries of the Stevensville WWTP to implement this improvement.

G. Environmental Considerations

Environmentally, standby power generation is basically a second line of defense. If the power goes out at the WWTP, raw sewage can pass through the plant untreated and discharge to the river. Standby power is used very infrequently, but when necessary, the benefits are significant.

H. Construction Problems

No construction problems are anticipated to implement this upgrade.

I. Cost Estimates

Table IV-1 describes the engineer's estimate of probable construction costs for each alternative.

Table IV-1. Engineer's Estimate of Probable Construction Costs for Standby Power Generation

Alternative	Estimated Construction Cost	Estimated Annual O&M Cost	20 Yr Present Worth
SPG 3	$82,800	$1,500	$100,000
SPG 4	$82,800	$1,500	$100,000

1. Project Costs

The project cost for this alternative includes the cost of purchasing and installing the engine generator with sound attenuating enclosure and self enclosed fuel tank, the switchgear, and engineering the system to operate in the event of a power failure.

2. Annual O&M Costs

The annual operation and maintenance costs are based on hiring a generator technician to visit the site and exercise the generator. The cost to fuel the generator based on its actual operating time averaged out over 20 years is negligible.

3. Present Worth Analysis

The 20-year present worth was calculated based on a 3% annual inflation rate and an 8% annual interest rate.

J. Selection of Preferred Alternative

Table IV-2 provides a comparative analysis of all the alternatives for standby power generation discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. As the table shows, the preferred alternative is either portable or in-place generator; however, due to the preference of the Town of Stevensville and the reliability of the in-place generator, the preferred alternative is the in-place generator (SPG 4).

Table IV-2. Standby Power Generation Selection Logic Matrix

Evaluation Criteria	No Action (SPG 1)	Portable Generator (SPG 3)	In-Place Generator (SPG 4)
Regulatory Coordination	2	4	4
Operations/ Technology	3	4	4
Compatibility with Site	4	3	3
Implementation	3	3	3
Public Health/Safety	2	3	3
Community/ Environmental	1	4	4
Risk	2	3	4
Cost	4	3	2
TOTAL	**19**	**24**	**24**

Headworks Improvements

A. Description

A screen is a device with small openings placed in the path of wastewater flow to retain solids found in the influent and provide for their removal. Screens are classified based on their opening size and methods for solids disposal. Screens are generally the first treatment process at a WWTP and typically the most unhygienic process encountered at a

WWTP. Mechanical grit removal is most commonly located following the screening step. Grit removal chambers are designed to remove grit, consisting of sand, gravel, and other heavy non-organics with high specific gravities from influent wastewater streams. This process is intended to deter buildup of solids within the WWTP and to protect equipment which could be damaged by these constituents.

B. Schematic Layout

As shown in Figure 4 in Appendix C, in order to maintain use of the existing Parshall flume the arrangement of the proposed headworks must be to the south of the flume. Additionally, the oxidation ditch and the property boundary confine the dimensions of the proposed headworks to be long and narrow in form. The proposed layout is typical for a WWTP headworks.

C. Operational Requirements

Operational requirements for the proposed headworks improvements are mainly of a maintenance nature. Although the screen will require less operator attention, the kind of attention that it will require is more technical. For all the equipment considered, maintenance will include mechanical replacement of wear parts and responding to failure alarms. The current operations staff at the Stevensville WWTP have the skills required for these types of maintenance issues.

D. Energy Requirements

With the exception of the do nothing alternative, all alternatives will require more energy. All of the equipment would run on electric motors. The new screen, screenings washer/compactor, grit pumps, and grit washer would all be appoximately 2 HP each.

E. Regulatory Compliance and Permits

The existing manually cleaned bar screens satisfy current regulatory requirements. Circular DEQ 2, Design Standards for Wastewater Treatment Facilities states that all mechanical plants must have grit removal facilities. A single grit chamber with bypass is acceptable for small wastewater treatment plants serving separate sanitary sewer systems.

F. Land Requirements

There is ample space available within the current boundaries of the Stevensville WWTP to implement this improvement.

G. Environmental Considerations

The improvements to the headworks will not have significant impacts on the environment outside of the WWTP. It will eliminate the potential for vector attraction and the illicit transportation of screened material off site.

H. Construction Problems

Construction problems for implementation of the preferred alternative would occur due to limited space in the desired location. The new building would be located between existing utility lines and the current oxidation ditch. Additionally there would be the concern with tying in the new system to the existing. There would need to be a short period of time in which no influent could reach the plant through the parshall flume. Influent would either need to back up in the collection system or be pumped directly to the oxidation ditch from an upstream manhole. Other concerns are high groundwater and the adequacy of on site soils for constructing the required structures

I. Cost Estimates

Table IV-3 describes the engineer's estimate of probable construction costs for each alternative.

Table IV-3. Engineer's Probable Construction Cost for Headworks

Alternative	Estimated Construction Cost	Estimated Annual O&M Cost	20 Yr Present Worth
Influent Screening System			
IS 2	$226,000	$4,730	$290,000
IS 3	$976,000	$9,460	$1,105,000
IS 4	$1,097,000	$9,460	$1,226,000
Grit Removal System			
GR 2	$1,015,000	$8,480	$1,130,000
GR 3	$1,000,000	$8,480	$1,115,000
GR 4	$1,097,000	$8,480	$1,212,000

Project Costs

All grit alternatives and screen alternatives, with the exception of IS 2, would require construction of a headworks building. This requirement is reflected in the higher constructions costs of these alternatives.

2. Annual O&M Costs

Annual operation and maintenance costs for the rotary screen (IS 2 alternative) would be lower than either the perforated plate or traveling rake screen (IS 3 or IS 4). However, the perforated plate or traveling rake would provide a long-term solution to the pre-treatment problem at this WWTP. Also, the perforated plate or traveling rake would provide better removal of debris and result in cleaner, drier screenings.

3. Present Worth Analysis

The 20-year present worth was calculated based on a 3% annual inflation rate and an 8% annual interest rate

J. Selection of Preferred Alternative

Table IV-4 provides a comparative analysis of all the alternatives for influent screening discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. The preferred alternative is the perforated plate screen based on a majority of the criteria utilized for comparison. Although this type of screen cost more than the traveling rake or the rotary screen, it has far superior screening capability and is at the forefront of screening technology.

Table IV-4. Influent Screening Selection Logic Matrix

Evaluation Criteria	Rotary Screen (IS 2)	Perforated Plate (IS 3)	Traveling Rake (IS 4)
Regulatory Coordination	4	4	4
Operations/ Technology	3	5	3
Compatibility with Site	4	3	3
Implementation	3	3	3
Public Health/Safety	3	3	3
Community/ Environmental	4	4	4
Risk	4	4	4
Cost	3	4	4
TOTAL	**28**	**30**	**28**

Table IV-5 provides a comparative analysis of all the alternatives for grit removal discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. The preferred alternative is vortex grit removal based on a majority of the criteria utilized for comparison. The ease of operation, limited space constraint, and overall cost of the units are the driving forces for selection of this technology.

Table IV-5. Grit Removal Selection Logic Matrix

Evaluation Criteria	Vortex Grit (GR 2)	Aerated Grit (GR 3)	Inclined Plate (GR 4)
Regulatory Coordination	4	4	4
Operations/ Technology	4	3	4
Compatibility with Site	4	3	3
Implementation	3	3	3
Public Health/Safety	3	3	3
Community/ Environmental	4	3	3
Risk	4	3	3
Cost	3	2	2
TOTAL	**29**	**24**	**25**

Secondary Biological Treatment

A. Description

Biological treatment is accomplished by using a fluidized culture of microorganisms under aerobic conditions to use organic materials in wastewater as substrates for growth, thereby removing contaminants through respiration and growth. The activated sludge wastewater mixture, termed mixed liquor, moves through a biological reactor with the wastewater absorbing organics and nutrients as it moves. After the mixture leaves the reactor it is separated from the water through the process of clarification. Solids removed from the clarification process are termed activated sludge which are pumped back to the head of the reactor and mixed with raw wastewater to begin the process again. This type of process has many variations that have been optimized to perform under varying conditions. The primary constituents removed from a secondary biological wastewater treatment system are organics (BOD), nitrogen and phosphorus.

The proposed alternatives would result in a secondary treatment system capable of meeting a max month flow rate of 1.5 MGD producing an effluent with a maximum concentration of 8 mg/l nitrogen and 1 mg/l phosphorus. Chemical addition to the secondary clarifiers could provide for additional phosphorus removal capabilities. As the population in the Town of Stevensville increases the actual flow realized by the WWTP may result in the need for sludge thickening under SBT 3 & SBT 4 in order to provide additional capacity in the aerobic digester.

B. Schematic Layout

The proposed biological process would be located in the existing aerobic digester complex (see Figure IV-2). The north two digestion tanks would be converted to biological treatment trains and the south two tanks would remain aerobic digestion. Due to the elevation of the digester complex, an influent pump station would be required to convey influent to the new biological treatment process. The influent piping is valved so it could go to an abandon final clarifier. A simple way to configure the proposed influent pump station would be to use the abandon clarifier as a wet well for the new pump station. The added benefit to this arrangement is the influent flow equalization inherent to this type of setup.

C. Operational Requirements

The number of aeration basins in service will change depending upon the time of year, maintenance activities and plant influent flow. At plant startup, normally one aeration basin will provide adequate capacity to treat the wastewater flow during the dry season and both basins will be needed during the wet season. On a seasonal basis, staff should cycle one of the basins out of service during the dry summer months. The idle basin should be alternated annually. While the basin is empty, the fine bubble diffused aeration system, sluice gates and slide gates should be inspected and cleaned as necessary. The need for two basins during the wet season may be alleviated if removing the polishing pond and oxidation ditch from the process train significantly reduces infiltration into the system.

The dissolved oxygen concentration in the main aeration basin mixed liquor should be maintained at approximately 2 - 3 mg/l. Actual operating experience will determine specific operating dissolved oxygen levels to maintain an adequate BOD reduction and nitrification without excessive energy consumption. Dissolved oxygen meters will measure the DO levels in the aeration basins. Under automatic control, the programmable logic controller (PLC) will modulate the valve position to control the air flow as needed to achieve the desired mixed liquor dissolved oxygen concentration.

Controlling the return activated sludge (RAS) flow balances the distribution of activated sludge between the aeration basin and the secondary clarifier. The proper distribution of activated sludge helps to maintain the aeration basin biomass population necessary to stabilize the wastewater pollutants by keeping the bulk of the biomass in the aeration basin where the treatment occurs. The biomass concentration is determined by the mixed liquor volatile suspended solids (MLVSS) test. Wasting activated sludge from the system controls the biomass.

In addition, RAS flow rate helps determine the RAS concentration and thus the waste activated sludge (WAS) concentration. The process strategy should be to optimize RAS flow to achieve both a minimum sludge detention time in the clarifier and a maximum RAS concentration. Because these are contradictory goals, compromises are necessary. A minimum sludge detention time in the clarifier is important to prevent denitrification and subsequent floating sludge. A maximum RAS concentration is desirable to minimize the RAS flow rate. In addition, maximum RAS concentration (and thus WAS concentration) is desirable to reduce the WAS volumes in subsequent solids handling processes.

The objective of wasting activated sludge is to maintain a balance between the microorganisms in the activated sludge system (system solids inventory) and the amount of food (BOD) applied to the system.

As microorganisms remove organic material and nutrients from wastewater and as suspended solids are adsorbed by the activated sludge floc, the amount of activated sludge increases (microorganisms grow and multiply). The rate at which these microorganisms grow is called the growth rate and is defined as the increase in the amount of activated sludge taking place in one day. Sludge wasting serves to remove just the amount of increase. When this is done, the amount of activated sludge produced by the microorganism growth is balanced by what is removed from the process. This allows the total amount of activated sludge in the process to remain relatively constant. This condition is called steady state and is the desirable condition for operation. However, steady-state conditions can only be approximated because of the variations in the nature and quantity of the food supply and of the microorganism population.

Sludge age or mean cell residence time (MCRT) is a measure of the average number of days the activated sludge remains in the system. The goal of a sludge-wasting program should be to maintain the activated sludge system at a sludge age that based on operating experience, will meet the operating objectives of the plant. These objectives might include parameters such as secondary effluent total suspended solids (TSS) and BOD, sludge volume index (SVI) and extent of nitrification required.

D. Energy Requirements

The energy requirements associated with upgrading the secondary biological treatment process to a biological nutrient removal process include mixed liquor recirculation pumping, basin mixing, and aeration requirements. The existing plant currently employees RAS/WAS pumping so the upgrade would not add energy for that obligation. The mixed liquor pumps would likely consist of two 2 HP MLR pumps operating continuously. The existing blowers in the blower room are sized adequately for the upgrade and would need to be run more frequently. The added air requirements would result in an additional 50-100 HP operating daily.

E. Regulatory Compliance and Permits

Circular DEQ 2, Design Standards for Wastewater Treatment Facilities states that the activated sludge processes “may be employed to accomplish varied degrees of removal of suspended solids and reduction of carbonaceous and/or nitrogenous oxygen demand. All designs must provide flexibility in operation and should provide for operation in various modes. Where primary settling tanks are not provided, effective removal or exclusion of grit, debris, and screening of solids must be accomplished prior to the activated sludge process.” There are many other requirements that deal with arrangement, inlets and outlets, freeboard, aeration equipment, return activated sludge (RAS), waste activated sludge (WAS), etc, that will need to be considered during design of a new treatment train.

F. Land Requirements

There is ample space available within the current boundaries of the Stevensville WWTP to implement this improvement.

G. Environmental Considerations

The proposed improvements to the secondary biological treatment process will have impacts on the environment including a more uniform and healthy point source discharge to the Bitterroot River.

H. Construction Problems

There are no construction problems anticipated for this upgrade.

I. Cost Estimates

Table IV-6 describes the engineer's estimate of probable construction costs for each alternative.

Table IV-6. Engineer's Probable Construction Cost for Secondary Biological Treatment

Alternative	Estimated Construction Cost	Estimated Annual O&M Cost	20 Yr Present Worth
SBT 3	$2,400,000	$30,390	$2,814,000
SBT 4	$2,100,000	$30,390	$2,514,000
SBT 5	$4,500,000	$30,390	$4,914,000

1. Project Costs

Project cost for implementation of a new secondary biological treatment system for the Town of Stevensville as presented in Table IV-6. The estimated construction cost includes engineering, modifications to existing structures, influent pumping modification, all required pumps, mixers, piping, analyzers, modifications to aeration piping and equipment, and flow control gates, valves, and weirs.

2. Annual O&M Costs

The annual operations and maintenance cost for the secondary biological treatment upgrade alternatives are based on the power to operate the blowers, MLR pumps, and mixers only. Power costs are based on $0.06 KW-Hr with all systems operating 24 hours a day 365 days a year at 80% efficiency.

3. Present Worth Analysis

The 20-year present worth was calculated based on a 3% annual inflation rate and an 8% annual interest rate.

J. Selection of Preferred Alternative

Table IV-7 provides a comparative analysis of all the alternatives for secondary biological treatment discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. The preferred alternative is converting a portion of the existing aerobic digester to a conventional biological nutrient removal process based on a majority of the criteria utilized for comparison. This alternative provides treatment capacity for the Town of Stevensville WWTP to design year 2035, represents the lowest cost, and is the easiest to implement.

Table IV-7. Secondary Biological Treatment Selection Logic Matrix

Evaluation Criteria	Upgrade existing (SBT 2)	Convert portion of digester to SNDN System (SBT 3)	Convert portion of digester to conventional BNR System (SBT 4)	New process in place of existing (SBT 5)
Regulatory Coordination	1	3	3	3
Operations/ Technology	4	4	3	4
Compatibility with Site	4	3	3	4
Implementation	1	3	4	2
Public Health/Safety	1	3	3	3
Community/ Environmental	1	3	3	3
Risk	1	3	4	3
Cost	3	4	5	1
TOTAL	**16**	**26**	**28**	**23**

Polishing Pond Permitting

A. Description

The polishing pond was once the primary form of wastewater treatment for the Town of Stevensville. The addition of a mechanical WWTP alleviated the need to use the pond for treatment; however, the pond remains in service as effluent from the secondary clarifiers must pass through the pond to reach the outfall weir. Infiltration into the pond during periods of high groundwater raises volume of effluent flow significantly.

B. Schematic Layout

The polishing pond is located to the south of the existing WWTP inside the perimeter fence for the plant. Due to the normal groundwater elevation at the WWTP, the pond will likely continue to contain water following removal of the wastewater effluent feed.

C. Operational Requirements

The operational requirements for the permit and retain as backup alternative would be minimal. There would be a valve on the effluent pipe that would remain closed under normal operation. No flow would enter the pond from the wastewater treatment plant. Under periods of extreme emergency and following approval from the MDEQ, the valve could be opened allowing flow to enter the pond for emergency storage. Effluent from the pond would be pumped back to the WWTP and would not be directly discharged to the Bitterroot River. Some effluent would be discharged to groundwater since the pond is not lined and is known to be hydraulically connected to groundwater.

D. Energy Requirements

The pond is a passive system and requires no energy to operate.

E. Regulatory Compliance and Permits

Decommissioning of any wastewater treatment lagoon or pond in Montana is governed by MDEQ 503 and United States EPA MTG650000. EPA requires a minimum of seven grab samples be collected from the solids at the bottom of the water body and tested for various constituents such as heavy metals, nitrates, phosphorus and pH. If the samples show levels above those allowed by MTG650000 then the entire water body shall be dredged and disposed of in accordance with said regulations. Additionally MDEQ requires the entire water body to be fenced in to deter public contact. Permitting of the pond as an outfall would be required to maintain it as a backup.

F. Land Requirements

The land requirements for this alternative would be exclusively for the disposal of solids that may be dredged from the bottom of the pond should this be a regulatory requirement based on sampling. If required there may be space within the current boundaries of the WWTP to dispose of the solids.

G. Environmental Considerations

The polishing pond is unlined and likely hydraulically connected to groundwater. Therefore, limiting the use of the polishing pond is suggested to eliminate any potential groundwater contamination.

H. Construction Problems

There are no construction problems anticipated for this upgrade.

I. Cost Estimates

Table IV-8 describes the engineer’s estimate of probable construction costs for each alternative.

Table IV-8. Engineer's Probable Construction Cost for Polishing Pond

Alternative	Estimated Construction Cost	Estimated Annual O&M Cost	20 Yr Present Worth
PPP 1	$220,000	$0	$220,000
PPP 2	$203,000	$0	$203,000
PPP 3	$289,000	$0	$289,000

1. Project Costs

The project cost associated with these alternatives includes coordination with MDEQ to obtain permits for the selected alternative, removal of piping, installation of the required new piping, and any groundwater study or sediment samples that would be required.

2. Annual O&M Costs

There is no annual cost associated with any of these alternatives.

3. Present Worth Analysis

The 20-year present worth was calculated based on a 3% annual inflation rate and an 8% annual interest rate

J. Selection of Preferred Alternative

Table IV-9 provides a comparative analysis of all the alternatives for permitting the existing polishing pond discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. The preferred alternative is to permit the existing polishing pond discharge, shut off flow to the pond, and retain the pond for emergency backup in case of a major system failure

Table IV-9. Polishing Pond Permitting Selection Logic Matrix

Evaluation Criteria	Do not decommission pond (PPP 1)	Decommission pond (PPP 2)	Permit pond and retain for backup (PPP 3)
Regulatory Coordination	4	3	3
Operations/ Technology	3	4	4
Compatibility with Site	3	3	3
Implementation	5	1	3
Public	1	5	4

Evaluation Criteria	Do not decommission pond (PPP 1)	Decommission pond (PPP 2)	Permit pond and retain for backup (PPP 3)
Health/Safety			
Community/ Environmental	1	5	4
Risk	1	3	5
Cost	5	1	3
TOTAL	**23**	**25**	**29**

Disinfection

A. Description

Disinfection is the partial destruction of disease-causing organisms, such as bacteria, protozoa, helminths, and viruses. Commonly used disinfectants at municipal wastewater plants include chlorine, ozone, and UV radiation. Chlorine and ozone utilize a chemical reaction to damage the cell wall. UV radiation is a physical disinfectant that relies on altering the RNA and DNA of the organisms rendering them incapable of reproduction.

B. Schematic Layout

The location and design for the proposed disinfection system are somewhat limited by the available hydraulics at the WWTP. It is recommended with all alternatives to construct a new effluent pump station to allow flexibility for the new disinfection system. The location for the new disinfection system could be anywhere onsite. Preliminary investigations have located space within the blower building to house a closed chamber type UV disinfection system. All other alternatives would require a new structure. The layout of the proposed disinfection system in the blower building is shown in Figure IV-3.

C. Operational Requirements

Operational requirements for both chlorine and ozone are similar. They both require handling of chemicals in some form and they both require operator tuning to maintain the optimal dose. UV disinfection is a self sufficient disinfecting technology which does require some degree of maintenance. Maintenance for UV includes periodic cleaning of the lamps and occasional replacement of the ballasts, wipers, and sensors.

D. Energy Requirements

Energy to run the chlorine disinfection system includes pumping and analyzing of effluent for residuals. Energy required for ozone includes generation of the ozone gas and bubbling the gas through the effluent medium. The energy requirements for a new UV disinfection system will vary depending on which manufacturer's equipment is selected.

A preliminary estimate of the power required to run a system of the size required by the Stevensville WWTP would be between 3 and 6 kW running full time. This system would be connected to the proposed stand-by power generator for reliability.

E. Regulatory Compliance and Permits

Circular DEQ 2, Design Standards for Wastewater Treatment Facilities states that all plants must provide disinfection to meet both the bacterial standards and the disinfection residual limit in the effluent. Specific design requirements vary by disinfection method. The overall requirements are dictated by the discharge permit which requires an organism count of 126 CFU/100 ml.

F. Land Requirements

There is ample space available within the current boundaries of the Stevensville WWTP to implement the disinfection improvements. All alternatives would require a new effluent pumping station. For the case of the chlorine and the ozone alternatives, a new building would be needed to house equipment and service the system as well as a contact chamber. The UV system could be housed in the existing blower building.

G. Environmental Considerations

There are no environmental impacts associated with any of the proposed alternatives.

H. Construction Problems

Construction problems for the ozone and chlorine alternatives as well as the new effluent pumping station include dealing with elevated groundwater. During construction, the contractor will likely need to employ strict dewatering techniques to keep the excavation dry.

I. Cost Estimates

Table IV-10 describes the engineer's estimate of probable construction costs for each alternative.

Table IV-10. Engineer's Probable Construction Cost for Disinfection

Alternative	Estimated Construction Cost	Estimated Annual O&M Cost	20 Yr Present Worth
DIS 2	$880,000	$12,600	$1,052,000
DIS 3	$667,000	$10,800	$814,000
DIS 4	$540,000	$6,600	$630,000

Project Costs: The project cost for each alternative includes the cost to construct a new effluent pumping station. There is substantial cost savings associated with using the available space in the blower building for the UV alternative (DIS -4).

<u>Annual O&M Costs:</u> The annual O&M cost for each alternative is based on power consumption at $0.06/KW, operator attention required at $25/hr, and chemical costs if applicable.

1. Project Costs

The project costs for the described disinfection alternatives include engineering, construction cost for a new effluent pump station, disinfection equipment, and piping and valving required for implementation of the upgrades.

2. Annual O&M Costs

Annual costs for operating and maintaining any of the proposed disinfection systems include energy and/or chemical cost, replacement or wear parts, and staffing requirements to service the system.

3. Present Worth Analysis

The 20-year present worth was calculated based on a 3% annual inflation rate and an 8% annual interest rate.

J. Selection of Preferred Alternative

Table IV-11 provides a comparative analysis of all the alternatives for disinfection discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. The preferred alternative is UV disinfection based on a majority of the criteria utilized for comparison.

Table IV-11. Disinfection Selection Logic Matrix

Evaluation Criteria	Ozone	Chlorination	UV
Regulatory Coordination	2	3	4
Operations/ Technology	3	3	4
Compatibility with Site	3	3	5
Implementation	3	3	4
Public Health/Safety	2	2	3
Community/ Environmental	3	3	4
Risk	2	3	4
Cost	2	3	4
TOTAL	**20**	**23**	**32**

Outfall

A. Description

The outfall is the location where wastewater effluent finally exits the WWTP and enters the receiving water body, in this case a small side stream of the Bitterroot River. The physical configuration is not as important to MDEQ as the location of the outfall.

B. Schematic Layout

The figure in Appendix C shows the location of the outfall in relation to the Bitterroot River and the ditch that currently carries the WWTP effluent to the River.

C. Operational Requirements

The outfall is a passive system and will operate automatically no matter which alternative is selected.

D. Energy Requirements

The outfall will not require any energy to operate regardless of which alternative is selected.

E. Regulatory Compliance and Permits

The current location of the outfall at the Stevensville WWTP is not in compliance with their discharge permit. At one time the river channel existed in the current location of the outfall but the channel has moved. Guidance from the MDEQ will be required in order to address this noncompliance issue.

F. Land Requirements

In discussions with adjacent landowners, it has been determined that they would be unwilling to grant easement for any proposed improvements to the outfall. Should authorities with jurisdiction require an alternative that requires a new outfall, land acquisition through eminent domain would likely be the only alternative for the Town of Stevensville.

G. Environmental Considerations

Constructing a new outfall pipe to the Bitterroot River would require excavation across the floodplain. There are no other known environmental consequences associated with any of the alternatives.

H. Construction Problems

Construction problems for rerouting the outfall would include breaching the Army Corp of Engineers levee and locating and operating equipment on privately owned land.

I. Cost Estimates

Table IV-12 describes the engineer's estimate of probable construction costs for each alternative.

Table IV-12. Engineer's Probable Construction Cost for Outfall

Alternative	Estimated Construction Cost	Estimated Annual O&M Cost	20 Yr Present Worth
OF 2	$10,000	$0	$10,000
OF 3	$300,000	$0	$300,000

1. Project Costs

The project costs associated with OF 2 include coordination with DEQ to obtain a new permit. Alternative OF 3 is based on the required piping and the land requirement. The cost for OF 3 is a rough estimate because it is unknown how the Town would obtain the easement for construction.

2. Annual O&M Costs

There is no annual cost associated with operating an outfall.

3. Present Worth Analysis

The 20-year present worth was calculated based on a 3% annual inflation rate and an 8% annual interest rate.

J. Selection of Preferred Alternative

Table IV-13 provides a comparative analysis of all the alternatives for outfall discussed above. The criteria rankings range from 1 to 5 with 1 being poor, 5 being best. The preferred alternative is to permit the existing discharge ditch as the outfall based on a majority of the criteria utilized for comparison.

Table IV-13. Outfall Selection Logic Matrix

Evaluation Criteria	Permit Existing	New Pipe and Outfall
Regulatory Coordination	3	3
Operations/ Technology	3	3
Compatibility with Site	3	3
Implementation	5	3
Public Health/Safety	3	3
Community/ Environmental	3	3

Evaluation Criteria	Permit Existing	New Pipe and Outfall
Risk	3	3
Cost	5	1
TOTAL	**28**	**22**

Section V. Alternative Analysis and Capital Improvement Plan (Preferred Alternative)

A summary of the preferred alternative for WWTP upgrades at the Town of Stevensville is as follows:

- In-place standby power generator
- Perforated plate influent screen with washer compactor
- Vortex grit removal
- Convert existing aerobic digester to conventional biological nutrient removal
- Permit pond discharge and retain for backup
- UV disinfection
- Permit existing outfall

A. Site Location and Characteristics

Site location of the facility and characteristics of the site have already been discussed in previous sections. The improvements will require no acquisition of new property and are confined entirely to the existing plant site. Drawings and schematics of the proposed improvements have been provided in Appendix C.

B. Operational Requirements

The current operators of the Stevensville WWTP have the expertise required to operate the facility following all recommended upgrades. Construction of a grit removal system will result in less maintenance for the various submersible pumps throughout the WWTP. The new UV system will require a limited amount of maintenance to ensure the lamps are clean and continue to perform as required. Cleaning the lamps will need to occur approximately every two months. Installation of a mechanically cleaned influent screen and washer/compactor will eliminate the need for handling of solids by plant staff. The proposed biological treatment process will require additional sampling to document nutrient removal efficiency. Performing biological nutrient removal will likely require additional lab equipment be purchased.

C. Impact on Existing Facilities

The phased improvements to the WWTP are not expected to impact other facilities operated by the Town of Stevensville. Construction traffic in the vicinity of the WWTP will increase during construction of the proposed improvements. This will also impact the public park adjacent to the WWTP as the access road to the WWTP passes through the park. At no time is public access expected to be blocked. Adding nutrient removal capability at the WWTP should allow the Town to continue to use phosphate based corrosion inhibitors in the water system.

D. Design Criteria

Headworks:

Hydraulic Capacity – 3.0 MGD

Influent Screen:

- 0.70 MGD with single screen
- 3.0 MGD with manual bypass screen
- 6.0 mm perforated plate

Screenings Washer/Compactor:

- Volume Reduction: 80%
- Organic Removal: 90%
- Minimum Solids Concentration: 50%

Grit Removal Capacity:

- 95% removal of grit greater than 50 mesh
- 85% removal of grit greater than 70 mesh
- 65% removal of grit greater than 100 mesh

UV Disinfection

Inactivation to 126 CFU/100 ml with full redundancy

Standby Power Generation

~150KW (to be determined during final design)

Sized to operate critical treatment processes and equipment to meet, at a minimum all MPDES permit parameters.

Biological Treatment Process

7.5 mg/L total Nitrogen

0.50 mg/L total Phosphorus

0.411 MGD average daily flow

E. Cost Summary of the Preferred Alternative

Project Cost Estimate

The overall cost of the recommended plan in 2008 dollars is summarized in Table V-1.

Table V-1. Project Cost Summary

Project Element	Estimated Implementation Cost
UV Disinfection	$540,000
Polishing Pond Permitting and Use	$289,000
Outfall Permitting	$10,000
Secondary Biological Treatment	$2,132,000
Headworks Improvements	$1,295,000
Emergency Power	$99,500
Total Estimated Project Cost	$4,365,500

A detailed cost breakdown for the Phase 1 project in 2010 dollars, the year of construction, is provided in Table V-2. Project elements include UV disinfection, polishing pond permitting and use, outfall permitting and emergency power.

Table V-2 Phase 1 Detailed Project Cost Summary

Project Element	Estimated Implementation Cost
Preliminary Engineering	$31,000
Final Design Engineering	$120,000
Construction Engineering Services	$73,350
Construction	$833,400
Contingency	$83,340
Activity Cost Subtotal	**$1,141,090**
Personnel Costs	$19,760
Office Costs	$2,400
Professional Services	$4,800
Legal Costs	$4,000
Audit Fees	$6,000
Loan Reserves	$40,000

Project Element	Estimated Implementation Cost
Bond Council and Related Costs	$20,000
Administrative Cost Subtotal	**$96,960**
Total Estimated Project Cost	**$1,238,050**

Annual Operating Budget

The funding plan will only consider Phase 1 since that is the project that is being considered in grant applications for the 2008 funding cycle. The funding plan includes a $100,000 RRGL grant, a $311,000 RD grant, and a $727,000 RD loan at 4.625% over 40-years. The annual loan payment will be approximately $44,000 per year. This equates to $4.15/month per household using an estimated number of households for 2010 of 883. This does not include additional operations and maintenance costs.

Income

The vast majority of the Town of Stevensville sewer utility operating budget is from residential user fees. Monthly user fees currently average $35.09 per month for a single family residence. These fees are expected to increase to approximately $40.00 per month once the Phase 1 project is complete. It is estimated that by 2010 there will be 883 equivalent dwelling units served by the sewer system. Income from the users of the system is estimated to be $35,320 per month or $423,840 per year.

O&M Costs

Increased operation and maintenance costs associated with the Phase 1 project are expected to be minimal. The total increase in annual operation and maintenance for the Phase 1 project is estimated to be $8,100 and includes:

Standby Power: $1,500 annual cost for manufacturer’s technician to exercise, test and service the standby generator equipment.

Ultraviolet Light Disinfection: $6,600 annual cost for power consumption; cleaning chemicals; replacement of wear parts including bulbs, ballasts, sleeves, and wipers; and manpower to perform maintenance.

Capital Improvements

Annual costs for replacement of parts and equipment that are required prior to the 20-year life of the standby power and UV Disinfection equipment are included in the operation and maintenance costs described above.

Debt Repayment and Coverage Requirements

The town currently has outstanding loans in the amount of $1,902,822 for improvements made to the WWTP in 2000. The annual average payment for these loans is $111,456. Debt coverage on these loans is equivalent to a single annual payment or approximately $111,456.

Reserves

Reserve requirements will increase by approximately $44,000 due to proposed funding associated with the Phase 1 project bringing the total coverage requirements to $155,456. The majority of the equipment at the WWTP is expected to have a life longer than 15-years.

Section VI. Recommendations and Implementation

Funding Strategy

The Town of Stevensville intends to utilize a combination of RRGL Grant, Rural Development (RD) Grant, RD Loan, and Town funds to finance the Phase 1 project. The RD and RRGL programs do not have match requirements. RRGL provides grants in a maximum amount of 100,000. The RD program typically provides grant/loan packages with a 30%/70% split respectively. RD loans are provided at approximately 4.625% interest over 40-years.

It will be necessary to utilize RRGL and RD grant and loan funds to design and construct the proposed Phase 1 project. It is necessary that the work associated with the Phase 1 project be complete and operational by July 31, 2010. If grant or loan funds are delayed from either program, the Town may be required to seek interim financing. The Town intends to utilize RD grant and loan funds as well as its own cash reserves to proceed with design of the proposed improvements project prior to commitment of the RRGL grant funds to assure that the project is complete and operational in the required time frame. RRGL grant funds will be utilized for construction and engineering service during construction. The proposed amounts to be contributed by each source of funding is as follows:

RRGL Grant - $100,000

RD Grant – $311,000

RD Loan – $727,000

Town Funds - $100,000

The annual debt service for the RD loan will be approximately $44,000 and will result in an increase in the monthly residential sewer charge of $4.14 per month. In addition, increased O&M costs are estimated at $675 per month and will result in an increase in the monthly residential sewer charge of $0.76 per month. The total estimated increase in the monthly sewer charge is $4.90 for a total average monthly residential sewer charge of $40.00.

In addition to the proposed wastewater improvements, the Town is also moving forward with a three-phase water system improvements project. Due to funding agency restrictions, the Town is only allowed to submit one application per cycle for Community Development Block Grant (CDBG) and Treasure State Endowment Program (TSEP) funding. Given the urgency of their water system failures, the Town is pursuing CDBG and TSEP funding for their water system, therefore limiting the funding availability for their wastewater system. The Town will pursue CDBG and TSEP funding for Phase 2 of the wastewater system improvements during the 2009/2010 funding cycle. The Town is also pursuing WRDA and STAG funding for both wastewater and water projects in an attempt to secure as much outside funding as possible.

The Town is currently planning on committing $457,500 to the three phases of their water infrastructure improvements. For Phase 1 of their wastewater improvements, they plan to commit $100,000 from their town funds.

Implementation

Implementation of the recommended plan will require a coordinated effort on the part of the Town of Stevensville, their selected engineer, and the citizens of Stevensville. The Town should complete and submit their loan application as soon as possible to meet the funding sources timeline. The final design, bid, and construction of Phase 1 should be implemented as soon as possible to protect the health and safety of the public. Additionally, construction cost is escalating and any delay will result in increased cost for the required improvements. An approximate schedule for the project is described below:

- Obtaining Phase 1 project funding: June 2009
- Engineering design of Phase 1 improvements: July-December 2009
- Construction of Phase 1: Spring 2010
- Prepare funding application for Phase 2 improvements: Spring 2010
- Engineering design of Phase 2 improvements: Summer 2011
- Prepare funding application for Phase 3 improvements: Spring 2012
- Engineering design of Phase 3 improvements: Summer 2013

To assure successful implementation of the above, it is recommended the Town of Stevensville undertake the following:

- Continue to maintain contact with government leaders, stakeholders, and citizens to further develop a support base for the recommended changes at the WWTP.
- Continue to stay abreast of progress of the Bitterroot River TMDL program and other regional water quality studies.

Public Participation

A public hearing was held on April 21, 2008. A presentation describing in detail the preliminary engineering report was delivered by the project engineer Craig Caprara of HDR Engineering, Inc. The meeting was open to the public. Announcements, minutes and other public hearing documentation are included in Appendix F - Public Involvement.

Appendix A – Planning Area Reference Maps

Appendix B – Environmental Checklist

Appendix C – WWTP Maps

Appendix D – MPDES Permit

Appendix E – MPDES Compliance Inspection Report

Appendix F – Public Involvement

Appendix G – Uniform Application