DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION
MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM

Fact Sheet

Permittee:	Absarokee Sewer District RSID 5 & 7 Stillwater County
Permit No.:	MT0021750
Receiving Water:	Ditch which drains to Rosebud Creek* or Rosebud Creek*
Facility Information:	Absarokee Sewer District Wastewater Treatment Facility
Mailing Address:	P.O. Box 405 Absarokee, MT 59001
County:	Stillwater
Contact:	Cathy McClurg, Manager/Operator
Telephone:	(406) 321-7048
Fee Information:	
Type:	Minor Publicly Owned Treatment Works
Number of Outfalls:	1 (for fee determination purposes)
Type of Outfall:	001 – Facility Discharge (Ditch) or 01A – Facility Discharge (Rosebud Creek)

*Upon completion of wastewater treatment facility upgrade, discharge may be direct to Rosebud Creek.

I. Permit Status

The Montana Pollutant Discharge Elimination System (MPDES) permit for the Absarokee Sewer District RSID 5 & 7 (Absarokee) Wastewater Treatment Facility (WWTF) was issued on December 17, 2009, became effective on February 1, 2010, and had an expiration date of January 31, 2015. The Department of Environmental Quality (DEQ) received a complete permit renewal application from Absarokee on July 23, 2014, and administratively extended the permit by letter dated January 15, 2015. On June 24, 2016, DEQ received an amended NPDES Form

2A from Absarokee requesting a discharge directly to Rosebud Creek upon completion of necessary upgrades to the WWTF. The administratively extended permit is referenced in this Fact Sheet (FS) as the 2010-issued permit.

II. Facility Information

Current Facilities:

The Absarokee WWTF serves the unincorporated community of Absarokee, with a current population of approximately 1,200 people. The existing WWTF is a three-cell aerated lagoon (cells 1 & 1A considered one cell) with a total volume of 2.48 million gallons constructed in 1986. Cell1 contains four aerators, cell 2 contains two aerators and the final cell contains one aerator. The design flow of the facility is 0.35 million gallons per day (mgd).

Discharge from the facility is continuous. Effluent is discharged from a pipe to an unnamed ditch at approximately 45˚31'47" N latitude, 109˚26'28" W longitude. The unnamed ditch enters Rosebud Creek. The facility provides disinfection of the effluent by ultraviolet light (UV). Absarokee has applied for approval to discharge from upgraded facilities at a new location directly to Rosebud Creek at approximately 45˚31'52" N latitude, 109˚26'24" W longitude, which is essentially at or below the confluence of the unnamed ditch with Rosebud Creek.

Table 1: Current Design Criteria Summary* – Absarokee WWTF	
Facility Description: Three-cell Aerated Lagoon with Effluent Disinfection	
Construction Date: 1986	Modification Date: NA
Design Population: 1,253	Current Population: 1,200
Design Flow, Average: 0.35 mgd	Design Flow, Maximum Day: Unknown
Aerated Cells: 2.48 million gallons (total)	Third Cell: 1 Aerator at inlet, then quiescent
Number Aerated Cells: 3	Detention Time @ Design Flow: 7.1 days
Design BOD Load: 213 lb/day	Design TSS Load: 238 lb/day
Collection System: Separate	
Disinfection: Yes	Type: UV
Discharge Method: Continuous	

*Information from SOBs dated 4/13/2000 & 9/2009 and DEQ files.

Effluent data are summarized in Table 2. These data are based on the discharge monitoring reports (DMR) submitted by Absarokee for the discharge from the Absarokee WWTF for the period of record (POR) January 2012 through December 2015. Effluent metals data are from 2010.

The facility has historically experienced extremely high ground water infiltration each year from May through October. The result of the high rate of infiltration is that both the influent and effluent levels of five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) are very dilute during the high influent flow periods, making removal of 85% of the influent BOD_5 very difficult.

Table 2: Effluent Characteristics for the Period January 2012 through December 2015

Parameter	Units	Previous Permit Limits	Minimum	Maximum	Average	Number of Samples
Flow, Daily Average	mgd	-	0.04	0.73	0.24	48
Biochemical Oxygen Demand(1)	mg/L	30/45	2	74	12	48
	lbs/day	75/131	4	268	17.5	48
Total Suspended Solids(1)	mg/L	100/135	1	72	12	48
	lbs/day	292/394	0.9	261	22.4	48
pH(2)	s.u.	6.0 – 9.0	7.0	8.1	-	48
Escherichia coli (1,3)	cfu/100ml	126/252	1	1,395	112	28
Escherichia coli (1,4)	cfu/100ml	630/1,260	3	1,794	115	20
Oil & Grease	mg/L	10	ND(5)	2	1.2	6
Temperature	˚F	-	32	70	52	48
Ammonia, as N	mg/L	-	1.2	29.0	10.3	48
Kjeldahl Nitrogen, as N	mg/L	-	2.8	37.0	12.4	15
Nitrate + Nitrite, as N	mg/L	-	0.04	1.4	0.4	15
Total Nitrogen, as N	mg/L	-	3.0	37.9	12.8	15
Total Phosphorus, as P	mg/L	-	0.42	3.82	1.50	15
Dissolved Oxygen	mg/L	-	4.2	8.1	6.2	15
Beryllium, TR(6)	µg/L	-	ND	ND	ND	1
Nickel, TR(6)	µg/L	-	ND	ND	ND	1
Zinc, TR(6)	µg/L	-	10	10	10	1
Cyanide, Total(6)	µg/L	-	ND	ND	ND	1
Phenols, Total	µg/L	-	20	20	20	1
Hardness, as $CaCO_3$	mg/L	-	159	159	159	1

Footnotes:
1. 30-day average/7-day average
2. Minimum & Maximum reported each month.
3. Geometric mean rather than average for *Escherichia coli*. Limits effective April 1 through October 31.
4. Geometric mean rather than average for *Escherichia coli*. Limits effective November 1 through March 31.
5. ND is "not detected at laboratory reporting levels" – 1 mg/L for oil & grease.
6. Metals are total recoverable (TR) from one sample taken in 2010. Parameters listed as ND were not detected at the minimum reporting levels in the permit. Antimony, arsenic, cadmium, chromium, copper, lead, mercury, selenium, silver and thallium were all reported ND at a lab reporting levels that did not comply with the minimum reporting levels in the permit.

The 2010-issued permit contains a compliance schedule for Absarokee to contract with a consulting engineer to study the infiltration/inflow (I/I) problem and develop a plan for reducing I/I to acceptable levels. The compliance schedule required completion of construction of measures needed to reduce I/I to acceptable levels by April 1, 2014. Consulting engineering services were obtained and a plan was developed to reduce I/I (Stahly Engineering & Associates, Inc., 2011). The plan essentially updated the I/I reduction portion of an earlier preliminary engineering report completed for Absarokee in 2005 by Entranco Engineering (submitted to DEQ by Great West Engineering in April 2005).

I/I reduction work was completed in 2013 that included repair and/or replacement of approximately 1,200 feet of 8-inch sewer main and several manholes in the areas of the community experiencing the highest rates of infiltration. A review of the effluent flows reported on DMRs for the high infiltration months (May through October) for 2013, 2014 and 2015 compared to the flows in 2012 (prior to the I/I work) shows that the average monthly flows were 0.085 mgd less in 2013; 0.066 mgd less in 2014; and 0.076 mgd less in 2015. Accordingly, it appears that the I/I reduction program obtained some success. It should be noted however, that the maximum monthly flow during the high infiltration months of 2015 (0.72 mgd) is essentially the same as the maximum monthly flow during the high infiltration months of 2012 (0.73 mgd), before the I/I reduction program was commenced.

The Absarokee WWTF experienced numerous compliance difficulties over the years and, as a result, an Administrative Order on Consent (AOC) between DEQ and the Stillwater County was agreed upon effective January 4, 2013. Compliance issues that resulted in the AOC included more than 33 violations of the effluent limits of the permit from January 2007 through October 2012. Upon the effective date of the AOC, the effluent limits of the permit were stayed. Effective November 17, 2014, a revised schedule for the upgrades needed to comply with the effluent limits of the present permit was agreed upon.

The final effluent limits in the 2010-issued permit were effective on the date of permit issuance. For the POR, the 95th percentile, 30-day (monthly) average BOD_5 concentration discharged from the WWTF is 27 mg/L and the 95th percentile monthly average BOD_5 load discharged is 34 lbs/day. Similarly, the 95th percentile, monthly average TSS concentration discharged from the WWTF is 53 mg/L and the 95th percentile monthly average TSS load discharged is 92 lbs/day. The WWTF is capable of meeting the concentration and load limits of the 2010-issued permit for both BOD_5 and TSS on a consistent basis. However, in May 2012 the WWTF exceeded both the concentration and load limits for BOD_5 and, in addition, the WWTF failed to meet the minimum percent removal requirement for BOD_5 in 10 months during the POR, for a compliance rate of 79%. Two violation letters were sent by DEQ for permit effluent and percent removal violations for BOD_5 during the POR, all in 2012. As stated previously, the AOC of January 4, 2013 stayed all effluent limits in the 2010-issued permit.

Final effluent limits for *Escherichia coli* (*E. coli*) bacteria represent the water quality standards for the receiving water, with winter limits and more stringent summer limits. The WWTF exceeded the final monthly average effluent limits for *E. coli* during 19 months and exceeded the 7-day (weekly) average effluent limits during 27 months of the POR. Three violation letters were sent by DEQ for permit effluent *E. coli* limit violations during the POR, all in 2012. As

stated previously, the AOC of January 4, 2013 stayed all effluent limits in the 2010-issued permit. The permittee explained that the UV system is more than 28 years old and it is difficult to maintain in proper working condition. The WWTF operator indicated that UV system replacement is planned for 2016.

Monthly DMRs indicate that neither the pH limits nor the oil & grease (O & G) limits were exceeded during the POR.

III. Technology-based Effluent Limits

a. Applicability to Technology-based Limits

The Montana Board of Environmental Review, in Administrative Rules of Montana (ARM) 17.30.1203, adopted by reference 40 Code of Federal Regulations (CFR) 133 which defines minimum treatment requirements for secondary treatment, or the equivalent, for publicly owned treatment works (POTW). Secondary treatment is defined in terms of effluent quality as measured by pH, BOD_5, TSS and percent removal of BOD_5 and TSS.

These requirements may be modified on a case-by-case basis for facilities that are eligible for treatment equivalent to secondary treatment (TES) or alternative state requirements (ASR) for TSS as provided for in 40 CFR 133.105. To determine if a facility is eligible for TES the facility must meet the requirements of 40 CFR 133.101(g) summarized as follows:

1) The BOD_5 and TSS effluent concentrations consistently achievable through proper operation and maintenance of the treatment works exceed the minimum effluent quality described for secondary treatment in 40 CFR 133.102,
2) The treatment works utilize a trickling filter or waste stabilization pond, and
3) The treatment works utilize biological treatment that consistently achieves a 30-day average of at least 65% removal.

The technology-based effluent limits (TBELs) in the 2010-issued permit are based on the national secondary treatment standards (NSS) for BOD_5 and pH and are based on the ASR for TSS. The 2010-issued permit limits are for effluent concentrations plus an 85% removal of BOD_5 and concentrations only (no percent removal) for TSS. Both BOD_5 and TSS also have mass limits.

Based on a review of the DMR data for the POR, the effluent from the WWTF would have met upgraded TSS standards such as the TES, which are 45 mg/L for a monthly average limit and 65 mg/L for a weekly average limit, 94% of the time for the monthly average and 98% of the time for the weekly average. A WWTF that meets BOD_5 and TSS effluent limits 95% of the time is considered capable of meeting the limits. A review of the MPDES permits for POTWs in Montana utilizing aerated lagoons for treatment shows that 74% of the permits require compliance with either TES or the more stringent NSS for effluent TSS. This is an indication that most properly designed and operated aerated lagoons are capable of meeting at least TES effluent limits for TSS.

A more in-depth look at the effluent during the POR shows that one of the months that effluent TSS would have exceeded the TES monthly average limit of 45 mg/L is likely an anomaly since (1) it is the same and only month in the POR that effluent BOD_5 also exceeded the present permit monthly average limit of 30 mg/L and (2) the effluent TSS exceeded the influent TSS. If this month is disregarded as an anomaly, then the effluent from the WWTF would have met TES standards 96% of the time for the monthly average and 100% of the time for the weekly average. Further, following completion of the I/I reduction program in May 2012, effluent TSS from the WWTF exceeded the monthly average TES limit only one time in the subsequent 43 months of the POR, for a compliance level of 98% and the requirement to remove at least 65% of influent TSS was not met only twice, for a compliance level of 95%. It appears that the WWTF is capable of consistently meeting the upgraded TES limits for TSS, although occasional excessive influent flows may result in infrequent but occasional instances of noncompliance with 65% removal of influent TSS.

Proposed TBELs are shown on Table 3. The BOD_5 limit is NSS and includes a requirement for 85% removal. The pH limit is NSS. The TSS limit is TES for lagoons (including aerated lagoons) with a requirement for 65% removal. Mass limits for both BOD_5 and TSS are included in accordance with ARM 17.30.1345(8)(a) and are based on design flow.

Mass Limit Calculations:

Load (lb/day) = Design Flow (mgd) x Concentration Limit (mg/L) x 8.34 lb/gal

BOD_5:	30-day Ave:	Load = (0.35)(30)(8.34) = 87.6 = 88 lb/day
	7-day Ave:	Load = (0.35)(45)(8.34) = 131.4 = 131 lb/day
TSS:	30-day Ave:	Load = (0.35)(45)(8.34) = 131.4 = 131 lb/day
	7-day Ave:	Load = (0.35)(65)(8.34) = 189.7 = 190 lb/day

Note: The 30-day Ave. load for BOD_5 will be capped at 75 lb/day in accordance with the allocated nondegradation loads calculated in the July 17, 1994 Statement of Basis (SOB) and referenced in the April 13, 2000 and September 2009 SOBs.

Table 3: Technology-based Effluent Limits

Parameter	Units	30-Day Average	7-Day Average	Rationale
BOD_5	mg/L	30	45	40 CFR 133.102(a)
	lb/day	75	131	
	% removal	85%	-	
TSS	mg/L	45	65	40 CFR 133.105(b)
	lb/day	131	190	
	% removal	65%	-	
pH	s.u.	6.0-9.0 (instantaneous)		40 CFR 133.102 (c)

b. Nondegradation Allocated Loads

Nondegradation allocated loads for the Absarokee WWTF were determined for BOD_5 and TSS under a previous permitting action and documented in a SOB dated July 17, 1994. The SOBs for the permits renewed on May 1, 2001 and December 17, 2009 referenced and contained the nondegradation loads calculated in 1994.

Table 4 summarizes the nondegradation allocated loads and the actual calculated average loads discharged from the WWTF for the three full calendar years in the POR, i.e. 2013, 2014 and 2015. The data indicate that the facility did not exceed the nondegradation allocated loads for BOD_5 and TSS.

Table 4: Comparison of Allocated Nondegradation Loads & Actual Loads

Parameter	Allocated Load*	Actual Load** (lb/day)		
	(lb/day)	2013	2014	2015
BOD_5	75	14.3	13.1	10.9
TSS	292	13.4	25.2	14.6

*Original allocated loads from SOB dated 7/17/94 & referenced in SOBs dated 4/2000 & 9/2009.
**Actual loads are based on annual averages of the monthly values reported on DMRs.

IV. Water Quality-based Effluent Limits

a. Scope and Authority

Permits are required to include Water Quality-based Effluent Limits (WQBELs) when TBELs are not adequate to prevent excursions of state water quality standards (40CFR 122.44 and ARM 17.30.1344). ARM 17.30.637(2) states that no wastes may be discharged that can reasonably be expected to violate any state water quality standards. Montana water quality standards (ARM 17.30.601, *et.seq.*) define both water use classifications for all state waters and numeric and narrative standards that protect those designated uses.

b. Receiving Water

The Absarokee WWTF discharges treated effluent to a ditch that flows to Rosebud Creek. The point at which the ditch discharges to Rosebud Creek is located about 0.3 mile above the mouth of Rosebud Creek. Rosebud Creek discharges to the Stillwater River, a tributary to the Yellowstone River, at a point located approximately 12 miles above the mouth of the Stillwater River.

The reach of Rosebud Creek that ultimately receives the Absarokee WWTF discharge as well as the ditch that directly receives the discharge are classified as B-1 according to Montana Water Use Classifications [ARM 17.30.611(1)(a)]. Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing,

swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply [ARM 17.30.623(1)].

Rosebud Creek and the ditch that receives the discharge from the Absarokee WWTF are located within the Stillwater watershed identified as United States Geological Survey (USGS) Hydrological Unit Code (HUC) 1007005 and Montana assessment unit MT43C002_100. This assessment unit is listed as impaired on the 2014 303(d) and draft 2016 303(d) lists. The probable impaired use is aquatic life. The probable cause for impairment is identified as benthic-macroinvertebrate bioassessments. The probable sources are listed as unknown. A total maximum daily load (TMDL) has not yet been completed for this assessment unit.

The USGS has a gaging station (06204500) on Rosebud Creek located approximately 2.5 miles south (upstream) of Absarokee. The 7-day, 10-year low flow (7Q10) is reported at 74.7 cubic feet per second (cfs) [48.3 mgd], based on 29 years of record. The seasonal (July-October) 14-day, 5-year (14Q5) low flow at the gaging station is reported at 171 cfs [110.5 mgd], based on 34 seasons of record. The flow at this gaging station is partly regulated by Mystic Lake and the gaging station was discontinued after September 1969.

When the 2010-issued permit was issued, no flow or water quality data existed for the ditch which is the receiving water for the Absarokee WWTF discharge. The 2010-issued permit required the permittee to monitor the ditch at a point upstream from the WWTF discharge for flow, temperature, pH, total ammonia-N and dissolved oxygen on a monthly basis in 2010 and 2011. Based on the flow monitoring data over a 23-month period, the estimated 7Q10 flow in the ditch calculates to be 0.4 mgd and the estimated seasonal (July-October) 14Q5 calculates to be 0.5 mgd.

Table 5A of this FS contains ambient water quality data for the ditch, provided by the permittee in accordance with permit monitoring requirements.

Table 5A: Receiving Water Ditch Ambient Water Quality Data(1)

Parameter	Units	Minimum	Maximum	Average	75th Percentile	Number of Samples
Flow	mgd	0.4	6.4	1.8	(2)	23
pH	s.u.	6.5	7.7	-	7.5	23
Temperature	°C	0	18.8	9.6	16.1	23
Total Ammonia, as N	mg/L	0.04	0.47	0.12	0.13	23
Dissolved Oxygen	mg/L	8.2	9.8	9.0	9.0(3)	23

Footnotes:
1. Immediately upstream from the WWTF discharge point.
2. 10th percentile (7Q10) is 0.4 mgd; 20th percentile of July-October (seasonal 14Q5) is 0.5 mgd.
3. 25th percentile for dissolved oxygen.

Table 5B contains water quality data from DEQ sampling of Rosebud Creek (RC), East Rosebud Creek (ERC) and West Rosebud Creek (WRC), respectively. Data from ERC and WRC, although limited to one sample of each just above the confluence of the two taken at approximately the same time, are included to reinforce the validity of the data for RC, which also consists of only one sample taken at approximately the same time as the samples taken from the ERC and WRC. The samples were taken on August 30, 2004 (RC), August 31, 2004 (WRC) and September 1, 2004 (ERC) – so the data do not reflect year-round water quality.

Table 5B:
Rosebud Creek, East Rosebud Creek, West Rosebud Creek
Ambient Water Quality Data(1)(2)

Parameter	Units	Rosebud Creek 8/30/2004	East Rosebud Creek 9/1/2004	West Rosebud Creek 8/31/2004	75th Percentile(3)	Number of Samples
Flow	cfs	497	47.3	60.9	-	3
pH	s.u.	7.94	7.74	7.76	7.94	3
Temperature	°C	17.8	19.1	19.0	19.1	3
Total Ammonia, as N	mg/L	-	-	-	-	(4)
Nitrate Nitrogen, as N	mg/L	0.02	< 0.01	0.03	0.03	3
Kjeldahl Nitrogen, as N	mg/L	0.18	0.14	0.22	0.22	3
Total Nitrogen, as N	mg/L	0.20	0.14	0.25	0.25	3
Total Phosphorus, as P	mg/L	0.023	0.015	0.018	0.023	3
Hardness, as $CaCO_3$	mg/L	46.7	51.1	31.9	31.9	3
Metals, total recoverable	mg/L	(5)	(5)	(5)	-	2

Footnotes:
1. Less than (<) values are of the detection limit for the parameters reported as "not detected" at RRV.
2. One set of samples taken at each site on the date indicated. The RC site is at Absarokee about 1 mile above mouth; the ERC site is just above Nye Road near the mouth; and the WRC site is just below Fishtail about 2 miles above the mouth.
3. Need more than three data points before 75th percentile calculates to less than the highest value. 25th percentile for hardness.
4. Ammonia not monitored at any site.
5. Metals were sampled at the RC, ERC & WRC sites on the same dates as the other samples. Mercury, lead, silver, thallium, antimony, arsenic, selenium, nickel, beryllium, chromium & copper were found "ND" – not detected at RRV. Cadmium was not found for ERC, but was listed as ND at RC & WRC. Dissolved aluminum was found at 0.02 mg/L at ERC & at 0.01 mg/L at RC & WRC. Iron was found at 0.24 mg/L at RC, 0.16 mg/L at ERC and at 0.14 mg/L at WRC. Zinc was found at 0.001 mg/L at RC, but was ND at both ERC & WRC.

c. Water Quality Standards

Discharges to surface waters classified B-1 are subject to the specific water quality standards of ARM 17.30.623, Circular DEQ-7, and the general provisions of ARM 17.30.635 through 637. Discharges are also subject to ARM 17.30 Subchapter 5 (Mixing Zones), Subchapter 7 (Nondegradation of Water Quality), and Circular DEQ-12A (Montana Base Numeric Nutrient Standards).

d. Mixing Zone

A mixing zone is an area where effluent mixes with the receiving water and certain water quality standards may be exceeded [ARM 17.30.502(6)]. A mixing zone must be of the smallest practicable size, have a minimum effect on water uses, and have definable boundaries [MCA 75-5-301(4)]. No mixing zone will be granted that will impair beneficial uses [ARM 17.30.506(1)]. Acute standards for any parameter may not be exceeded in any portion of the mixing zone unless DEQ specifically finds that allowing minimal initial dilution will not threaten or impair existing beneficial uses [ARM 17.30.507(1)(b)].

The discharge must comply with the general prohibitions of ARM 17.30.637(1) which require that state waters, including mixing zones, must be free from substances which will:

(a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
(b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;
(c) produce odors, colors, or other conditions as to which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
(d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; and
(e) create conditions which produce undesirable aquatic life.

ARM 17.30.505(1) provides that DEQ will determine the applicability of a mixing zone and, if applicable, its size, configuration, and location. Mixing zones are considered on a case-by-case basis. DEQ may decide to not grant a mixing zone or may decide to grant one of the four types of mixing zones, i.e. nearly-instantaneous, standard, alternative or source-specific mixing zone. Mixing zones are granted on a parameter-by-parameter basis only and are not granted for TBELs based on national secondary treatment standards, effluent guidelines or other technology-based standards.

No mixing zone was allowed in the 2010-issued permit. Consideration will be given for a mixing zone on a parameter-by-parameter basis with this renewal. The nearly-instantaneous mixing zone is not appropriate because of lack of complete mixing in the receiving water at the point of discharge at this time. A standard mixing zone has limited applicability because it also does not allow for use of dilution to comply with acute water quality standards. However, a standard mixing zone may be appropriately considered for some human health parameters, like nitrate/nitrite nitrogen, where 25% of the 7Q10 is typically used for dilution for minor discharges

with a dilution ratio of less than 100:1. A standard mixing zone is also typically considered for total nitrogen (TN) and total phosphorus (TP), where the 14Q5 is used for dilution as required in ARM 17.30.635(2). A source-specific mixing zone is not practical because of the lack of the required mixing zone study.

Typically, the most practical mixing zone for minor POTWs is the alternative mixing zone. The alternative mixing zone [ARM 17.30.515(1)(d)] typically applies to minor POTWs, and for the parameters of total residual chlorine (TRC) and total ammonia-N, allows the use of 10% of the 7Q10 for dilution of chronic and 1% of the 7Q10 for dilution of acute. Boundaries for an alternative mixing zone are proposed at 100 feet in length and one-half the estimated low flow receiving water stream width (stream width) for chronic parameters and 10 feet in length and one-tenth the stream width for acute parameters.

e. Basis for WQBELs (Reasonable Potential and Calculations)

Permits are required to include WQBELs when TBELs are not adequate to protect water quality standards and no wastes may be discharged that can reasonably be expected to violate any standard. The need for WQBELs is determined based on reasonable potential (RP) calculations for certain pollutants to determine if numeric or narrative water quality standards may be exceeded. DEQ uses a mass balance equation (*Equation 1*) to determine reasonable potential based on the *EPA Technical Support Document for Water Quality-based Toxics Control (TSD)* and CIRCULAR DEQ-7.

$$C_{RP} = \frac{C_E Q_E + C_S Q_S}{Q_E + Q_S} \qquad \textit{(Equation 1)}$$

Where:

C_{RP} = receiving water concentration (RWC) after mixing, mg/L
C_E = effluent concentration, mg/L
C_S = RWC upstream of discharge, mg/L
Q_S = applicable receiving water flow, mgd
Q_E = facility design flow rate, mgd

Pollutants typically present in effluent from municipal wastewater treatment facilities that may cause or contribute to exceedences of water quality standards include conventional pollutants such as biological material (measured by BOD_5), TSS, O & G, *E coli* bacteria and pH; non-conventional pollutants such as TRC, ammonia nitrogen, nitrate/nitrite, TN and TP; and toxic pollutants such as volatile organics and metals.

It is unknown as to whether the ditch that receives the effluent discharge from the Absarokee WWTF has a fishery or not but, given the year-round nature and volume of flow of the ditch, there is almost certainly an aquatic community of some sort present with a likelihood of at least a few non-salmonid fishes.

In Rosebud Creek, from its mouth through Absarokee to the confluence of East Rosebud and West Rosebud Creeks, brown trout, rainbow trout and mountain whitefish are the salmonids listed by Montana Fisheries Information System (MFISH) as being common or abundant. Non-

salmonid species listed as common in the reach are longnose dace and mountain sucker. Non-salmonid species listed as rare in the reach are longnose sucker and white sucker.

Based on "Spawning Times of Montana Fishes," Don Skaar, Montana FWP, 3/6/01, rainbow trout would be present in early life stages in this reach of Rosebud Creek from March through mid-August; brown trout would be present in early life stages from mid-September through April; and mountain whitefish would be present in early life stages from mid-September through March. Common non-salmonid fishes are present in early life stages from April through July. Accordingly, salmonid and non-salmonid fishes are assumed to be present in early life stages in Rosebud Creek year-round.

1. Conventional Pollutants

TSS, BOD_5, and pH – The WWTF provides a significant reduction in biological material and solids through secondary treatment and TES (for TSS) as addressed in Section III and provides sufficient protection for pH. No additional WQBELs will be necessary for these parameters. Monthly monitoring will be required for effluent BOD_5, TSS and pH, as well as influent BOD_5 and TSS.

O & G – The 2010-issued permit has a daily maximum limit of 10 mg/L for O & G, along with a semi-annual monitoring requirement. Effluent monitoring during the 48-month POR found a maximum level of O & G of 2 mg/L in one sample of six samples. Based on a calculated coefficient of variation (CV) of 0.35, the TSD Table 3.2 multiplier for six samples is 1.6. Application of the TSD multiplier results in a TSD calculated maximum effluent value for O & G of 3.2 mg/L. RP does not exist to exceed the requirements of ARM 17.30.637(b) and an effluent limit is not needed for O & G. However, monitoring for O & G will still be required with the frequency continued at semi-annual.

E. coli – The 2010-issued permit had final effluent limits for *E. coli* that are the water quality standards for the receiving water (ditch), applied at the end of the pipe. The *E. coli* water quality standards for Rosebud Creek are the same as for the ditch.

The water quality standards for the receiving water for *E. coli* are:

- April 1 through October 31, of each year, the geometric mean number of *E. coli* may not exceed 126 colony forming units (cfu) per 100 mL and 10% of the total samples may not exceed 252 cfu per 100 mL during any 30-day period [ARM 17.30.623(2)(a)(i)]; and

- November 1 through March 31, of each year, the geometric mean number of *E. coli* may not exceed 630 cfu per 100 mL and 10% of the samples may not exceed 1,260 cfu per 100 mL during any 30-day period [ARM 17.30.623(2)(a)(ii)].

The final effluent limits on *E. coli* from the 2010-issued permit will be retained in the renewed permit. The monitoring frequency for *E. coli* will be maintained at once per week.

2. Non-conventional Pollutants

TRC – The 2010-issued permit does not have effluent limits for TRC because effluent disinfection is accomplished with UV treatment. No effluent limits for TRC will be needed in the renewed permit.

Total Ammonia-N – There are no total ammonia-N (ammonia) limits in the 2010-issued permit. Ammonia limits are developed based on standards that account for a combination of pH and temperature of the receiving stream, the presence or absence of salmonid fishes (trout, whitefish and salmon), and the presence or absence of fish in early life stages. Water quality standards for ammonia and the resultant effluent limits are determined on an annual basis.

Table 6A contains the applicable water quality standards for ammonia calculated for the ditch at the point of the discharge from the Absarokee WWTF. Table 6B contains the applicable water quality standards for ammonia calculated for a direct discharge to Rosebud Creek.

Ammonia – Discharge to Ditch

Table 6A: Applicable Water Quality Standards for Ammonia in Ditch

Condition	Period	Salmonids Present	Early Life Stages Present	Ambient Condition(1)		Water Quality Standard (2) (mg/L)
				pH (s.u.)	Temperature (°C)	
Acute	Annual	No	NA	7.5	NA	19.9
Chronic	Annual	NA	Yes	7.5	16.1	3.97

NA = Not Applicable
Footnotes:
1. Based on 75th percentile of pH & temperature values from permittee monitoring of ditch in 2010 & 2011.
2. Based on DEQ-7 (October 2012).

Equation 1 was used to determine RP, using a (TSD calculated maximum) effluent ammonia level of 27.1 mg/L, 10% of the 7Q10 for chronic and 1% of the 7Q10 for acute, design WWTF flow and a background concentration of ammonia in the ditch of 0.13 mg/L (based on permittee instream samples taken in 2010 – 2011 [23 samples]). The calculated RP values are 24.3 mg/L for chronic and 26.8 mg/L for acute, both of which exceed water quality standards. Therefore RP exists to exceed the water quality standards for ammonia in the ditch. **However, if a diffuser is installed on the outfall to achieve nearly instantaneous mixing, the full 7Q10 can be used for both chronic and acute dilution, which would result in chronic and acute RP values of 12.7 mg/L. RP would still exist for chronic but RP would not exist for acute - for a nearly instantaneous mixing condition.**

For an alternative mixing zone, with a dilution flow of 0.004 mgd (1% of the 7Q10), the calculated daily maximum ammonia limit is 7.2 mg/L. With a dilution flow of 0.04 mgd (10%

of the 7Q10), the calculated monthly average ammonia limit is 4.9 mg/L. Both limits would apply at end-of-pipe and would be effective January 1, 2021.

For a nearly instantaneous mixing condition, i.e. installation of a diffuser on the outfall in the ditch, the entire 7Q10 can be used to calculate effluent limits on ammonia. For a nearly instantaneous mixing condition, the calculated daily maximum ammonia limit is 13.8 mg/L and the calculated monthly average ammonia limit is 9.4 mg/L. Both limits would apply at end-of-pipe and would be effective January 1, 2021.

RP and effluent limit calculations for a nearly instantaneous mixing zone for discharge to the ditch are found in Appendix A.

Ammonia – Discharge Direct to Rosebud Creek

The water quality standards for ammonia in Rosebud Creek, in the event that the permittee desires to relocate the Absarokee WWTF discharge from the ditch to Rosebud Creek at or near a point immediately downstream from the confluence of the ditch with Rosebud Creek, are calculated and shown on Table 6B. Note the discussion on water quality in Rosebud Creek found in Section IV(b) of this FS and Table 5B. The calculated water quality standards for ammonia in Rosebud Creek shown in Table 6B are based on very limited water quality data.

Table 6B: Applicable Water Quality Standards for Ammonia in Rosebud Creek

Condition	Period	Salmonids Present	Early Life Stages Present	Ambient Condition(1)		Water Quality Standard (2) (mg/L)
				pH (s.u.)	Temperature (°C)	
Acute	Annual	Yes	NA	7.9	NA	6.77
Chronic	Annual	NA	Yes	7.9	19.1	2.10

NA = Not Applicable
Footnotes:
1. Based on an estimated 75th percentile of pH & temperature values – see Table 5B & associated water quality discussion.
2. Based on DEQ-7 (October 2012).

Equation 1 was used to determine RP, using a (TSD calculated maximum) effluent ammonia level of 27.1 mg/L, 10% of the 7Q10 for chronic and 1% of the 7Q10 for acute, design WWTF flow and an estimated background concentration of ammonia in Rosebud Creek of 0.05 mg/L (RRV for ammonia when stream samples were taken). The calculated RP values are 1.88 mg/L for chronic and 11.4 mg/L for acute. The RP value for acute exceeds the acute water quality standards for ammonia, therefore RP exists to exceed the water quality standards for ammonia in Rosebud Creek.

For an alternative mixing zone, with a dilution flow of 0.483 mgd (1% of the 7Q10), the calculated daily maximum ammonia limit is 16.1 mg/L. With a dilution flow of 4.83 mgd (10%

of the 7Q10), the calculated monthly average ammonia limit is 11.0 mg/L. Both limits would apply at end-of-pipe and would be effective January 1, 2021.

RP and effluent limit calculations for an alternative mixing zone for discharge to Rosebud Creek are found in Appendix B.

It should be noted that for a discharge directly to Rosebud Creek, considerable upstream Rosebud Creek monitoring would be required through the life of the permit to generate more data with which to define the water quality of Rosebud Creek for use in the next permit cycle.

Ammonia Mixing Zones

Although the effluent limits for ammonia would apply at the end-of-pipe for a discharge to the ditch as well as a discharge to Rosebud Creek, an alternative mixing zone would be allowed for a discharge to the ditch without an effluent diffuser and a standard (nearly instantaneous) mixing zone would be allowed for a discharge to the ditch with an effluent diffuser.

The dimensions of the alternative mixing zone in the ditch – no outfall diffuser, based on an estimated low flow width of 5 feet at the point of discharge, would be: 100 feet in length and 2.5 feet in width downstream of the point of discharge for chronic water quality standards and 10 feet in length and 0.5 feet in width downstream of the point of discharge for acute water quality standards.

The dimensions of the nearly instantaneous mixing zone are: the width of the ditch and a length of 10 feet downstream from the point of discharge (twice the ditch width).

The dimensions of the alternative mixing zone for a direct discharge to Rosebud Creek, based on an estimated low flow width of 40 feet at the point of discharge, are: 100 feet in length and 20 feet in width downstream of the point of discharge for chronic water quality standards and 10 feet in length and 4 feet in width downstream of the point of discharge for acute water quality standards.

Nitrate plus Nitrite Nitrogen (NO_3/NO_2) – The human health water quality standard for NO_3/NO_2 in waters to be maintained suitable for drinking is 10 mg/L.

Table 2 shows that for the POR, effluent NO_3/NO_2 levels are quite low, averaging 0.4 mg/L, with a maximum level of 1.4 mg/L reported. Based on a calculated CV of 0.98, the TSD Table 3-2 multiplier is 1.8. Applying the multiplier to the maximum reported value, the calculated maximum effluent NO_3/NO_2 concentration is 2.52 mg/L. With a TSD maximum NO_3/NO_2 level of 2.52 mg/L, there is no need for calculations to determine if RP exists. RP does not exist with NO_3/NO_2 levels this low, i.e. below the water quality standard. It should be noted however, that providing the level of nitrification needed to meet future effluent limits on ammonia, may result in relatively high levels of NO_3/NO_2 in the effluent. The permittee may need to balance future WWTF operation to avoid discharging excessively high levels of NO_3/NO_2 while reducing effluent levels of ammonia.

No effluent limits on NO_3/NO_2 will be applied to the discharge from the Absarokee WWTF during this renewal cycle. However, monitoring requirements for NO_3/NO_2 will be continued in the renewed permit.

Nutrients (TN and TP) – Numeric water quality standards for TN and TP have been adopted in Circular DEQ-12A (DEQ-12A) for the receiving water ditch and for Rosebud Creek in the Absarokee area, which is in the Level III Northwestern Great Plains Ecoregion. The numeric water quality standards for TN and TP are 1,300 µg/L and 150 µg/L, respectively, both effective from July 1 to September 30. Critical stream-flow for application of the standards and for determining RP is the seasonal (July-October) 14Q5 low flow.

Absarokee has been required to conduct quarterly WWTF effluent sampling for NO_3/NO_2 (as N) and total kjeldahl nitrogen (as N) [the sum of which is TN] and TP since 2010. In order to develop a sufficient number of seasonal data points, effluent TN data from 2010 through 2015 were used from quarterly samples taken in the months of June and September (11 data points). The June 2010 levels of TN and TP reported are an order of magnitude larger than normal and it is likely that the samples were collected earlier in the quarter, i.e. in April or May, before the level of influent wastewater increased due to high groundwater levels. In any event, the June 2010 data are considered outliers and not used in the calculations.

As discussed in Sections II and IV of this FS, the Absarokee WWTF discharges to a ditch which flows into Rosebud Creek. The permittee, by amended NPDES Form 2A, requested approval to discharge from the upgraded WWTF direct to Rosebud Creek, rather than to the ditch. It is in the best interest of water quality of Rosebud Creek to allow continued discharge to the ditch from the upgraded WWTF while maintaining the water quality standards in Rosebud Creek for the parameters of TN and TP – rather than have a discharge direct to Rosebud Creek. Accordingly, a small amount of dilution from Rosebud Creek (2.5 mgd [< 2.3% of the 14Q5]) will be considered to augment the 14Q5 of the ditch for purposes of calculating RP for nutrients. The permittee has also chosen to pursue a general variance as allowed in DEQ Circular DEQ-12B (DEQ-12B) since the discharge from the existing aerated lagoon system likely results in an exceedance of the water quality standards for nutrients in the ditch at this point in time.

TN – Discharge to Ditch – Existing WWTF

The maximum effluent concentration of TN reported from the Absarokee WWTF, as calculated from the NO_3/NO_2 and total kjeldahl nitrogen levels reported, was 7.0 mg/L. The effluent TN levels reported are quite low due to the high levels of groundwater infiltration experienced during the June through September months.

Based on a calculated CV of 0.3 and 11 samples, the TSD Table 3-2 multiplier is 1.3. Applying the multiplier to the maximum calculated TN value, the calculated maximum July through September effluent TN concentration is considered to be 9.1 mg/L. *Equation 1* was used to determine RP, using a (TSD calculated maximum) effluent TN level of 9.1 mg/L; receiving water flow of 0.5 mgd (14Q5); design WWTF flow (0.35 mgd); and an estimated background level of TN in the receiving water of 0.13 mg/L. The estimated background level of TN is based on the 75th percentile level of

ammonia-N found by permittee monitoring of the ditch upstream in 2010 and 2011. It is assumed that ammonia-N comprises most, if not all, of the background TN in the ditch.

The calculated RP value is 3,820 µg/L, which exceeds the water quality standard of 1,300 µg/L. Therefore, RP does exist to exceed the numeric water quality standards for TN in the receiving water ditch and effluent limits are required.

At the seasonal 14Q5 flow in the ditch, the calculated average monthly (AML) TN concentration limit is 4.1 mg/L and the AML load is 12.0 lb/day. RP and effluent limit calculations are found in Appendix C.

The present aerated lagoon WWTF will not be able to meet the final effluent limits for TN and Absarokee has chosen to pursue a general variance as allowed in DEQ Circular DEQ-12B (DEQ-12B). The request for a general variance from the TN water quality standard established for the ditch in DEQ-12A is tentatively approved.

In accordance with DEQ-12B, a general variance interim effluent limit for TN will be developed for the WWTF, based on maintaining the current level of performance of the existing WWTF, an aerated lagoon system. The general variance interim effluent limit for TN calculates to be an AML of 18.2 lb/day and will apply through the term of the renewed permit. Interim permit limit calculations for TN are found in Appendix E.

A mixing zone is not needed for the general variance TN limit because it is based on the treatment capability of the WWTF and not tied to instream water quality standards for TN.

<u>TN – Discharge to Ditch – Upgraded WWTF with Dilution</u>

Based on a calculated CV of 0.3 and 11 samples, the TSD Table 3-2 multiplier is 1.3. Applying the multiplier to the maximum calculated TN value, the calculated maximum July through September effluent TN concentration is considered to be 9.1 mg/L. *Equation 1* was used to determine RP, using a (TSD calculated maximum) effluent TN level of 9.1 mg/L; receiving water flow of 2.5 mgd (2.3% of the 14Q5); ditch flow of 0.5 mgd (14Q5); design WWTF flow (0.35 mgd); and an estimated background level of TN in Rosebud Creek of 0.25 mg/L.

The calculated RP value is 1,150 µg/L, which does not exceed the water quality standard of 1,300 µg/L. Therefore, RP does not exist to exceed the numeric water quality standards for TN in Rosebud Creek and effluent limits are not required. However, to prevent backsliding and increasing the nutrient load to Rosebud Creek, the general variance interim effluent limit for TN of an AML of 18.2 lb/day will be applied to the discharge. Since the AML for TN is based on current performance of the existing WWTF, the effluent from both the existing and upgraded WWTF should have no problems complying with the limit.

A standard mixing zone will be allowed for TN that includes the width of the ditch from the outfall to the confluence with Rosebud Creek and then extends downstream in Rosebud Creek 400 feet (10 times the estimated stream width at the seasonal low flow) with a width of 20 feet from the east bank.

TN – Discharge Direct to Rosebud Creek – Upgraded WWTF

To determine RP for a discharge directly to Rosebud Creek, *Equation 1* was used with a (TSD calculated maximum) effluent TN level of 9.1 mg/L; receiving water flow of 110.5 mgd (14Q5); design WWTF flow (0.35 mgd); and an estimated background level of TN in the receiving water of 0.25 mg/L (see Table 5B).

The calculated RP value is 280 µg/L, which is less than the water quality standard of 1,300 µg/L. Therefore, RP does not exist to exceed the numeric water quality standards for TN in Rosebud Creek and effluent limits would not be required for TN. However, to prevent backsliding and increasing the nutrient load to Rosebud Creek, the general variance interim effluent limit for TN of an AML of 18.2 lb/day will be applied to the discharge.

A mixing zone is not needed for the TN load limit because it is based on antibacksliding and not tied to instream water quality standards for TN. As stated earlier, the upgraded WWTF should have no problems complying with the AML for TN.

TP – Discharge to Ditch – Existing WWTF

For the same July through September months discussed above, the maximum effluent concentration of TP reported from the Absarokee WWTF was 0.92 mg/L.

Based on a calculated CV of 0.29 and 11 samples, the TSD Table 3-2 multiplier is 1.3. Applying the multiplier to the maximum reported value, the calculated maximum July through September effluent TP concentration is 1.20 mg/L. *Equation 1* was used to determine RP, using a (TSD calculated maximum) effluent TP level of 1.20 mg/L; receiving water flow of 0.5 mgd (14Q5); design WWTF flow (0.35 mgd); and an assumed background level of TP in the receiving water of 0.001 mg/L. No monitoring was conducted for TP in the ditch, therefore a minimal level of TP is assumed equal to the RRV for the parameter of TP. The RRV for TP is 3 µg/L (0.003 mg/L).

The calculated RP value is 495 µg/L, which exceeds the water quality standard of 150 µg/L. Therefore, RP does exist to exceed the numeric water quality standards for TP in the receiving water ditch and effluent limits are required for TP.

At the seasonal 14Q5 flow in the ditch, the calculated average monthly (AML) TP concentration limit is 0.50 mg/L and the AML load is 1.46 lb/day. RP and effluent limit calculations are found in Appendix D.

The present aerated lagoon WWTF will not be able to meet the final effluent limits for TP and Absarokee has chosen to pursue a general variance as allowed in DEQ-12B. The request for a general variance from the TP water quality standard established for the ditch in DEQ-12A is tentatively approved.

In accordance with DEQ-12B, a general variance interim effluent limit for TP will be developed for the WWTF, based on maintaining the current level of performance of the existing WWTF, an aerated lagoon system. The interim limit for TP calculates to be an AML of 2.31 lb/day and will

apply through the term of the renewed permit. Interim permit limit calculations for TP are found in Appendix E.

A mixing zone is not needed for the general variance TP limit because it is based on the treatment capability of the WWTF and not tied to instream water quality standards for TP.

TP – Discharge to Ditch – Upgraded WWTF with Dilution

Based on a calculated CV of 0.29 and 11 samples, the TSD Table 3-2 multiplier is 1.3. Applying the multiplier to the maximum reported value, the calculated maximum July through September effluent TP concentration is 1.20 mg/L. *Equation 1* was used to determine RP, using a (TSD calculated maximum) effluent TP level of 1.20 mg/L; receiving water flow of 2.5 mgd (2.3% of the 14Q5); ditch flow of 0.5 mgd (14Q5); design WWTF flow (0.35 mgd); and an assumed background level of TP in Rosebud Creek of 0.023 mg/L.

The calculated RP value is 143 µg/L, which does not exceed the water quality standard of 150 µg/L. Therefore, RP does not exist to exceed the numeric water quality standards for TP in Rosebud Creek and effluent limits are not required. However, to prevent backsliding and increasing the nutrient load to Rosebud Creek, the general variance interim effluent limit for TP of an AML of 2.31 lb/day will be applied to the discharge. Since the AML for TP is based on current performance of the existing WWTF, the effluent from both the existing and upgraded WWTF should have no problems complying with the limit.

A standard mixing zone will be allowed for TP that includes the width of the ditch from the outfall to the confluence with Rosebud Creek and then extends downstream in Rosebud Creek 400 feet (10 times the estimated stream width at the seasonal low flow) with a width of 20 feet from the east bank.

TP - Discharge Direct to Rosebud Creek – Upgraded WWTF

To determine RP for a discharge directly to Rosebud Creek, *Equation 1* was used with a (TSD calculated maximum) effluent TP level of 1.20 mg/L; receiving water flow of 110.5 mgd (14Q5); design WWTF flow (0.35 mgd); and an estimated background level of TP in the receiving water of 0.023 mg/L (see Table 5B).

The calculated RP value is 27 µg/L, which is less than the water quality standard of 150 µg/L. Therefore, RP does not exist to exceed the numeric water quality standards for TP in Rosebud Creek and effluent limits would not be required for TP. However, to prevent backsliding and increasing the nutrient load to Rosebud Creek, the general variance interim effluent limit for TP of an AML of 2.31 lb/day will be applied to a discharge direct to Rosebud Creek.

A mixing zone is not needed for the TP load limit because it is based on antibacksliding and not tied to instream water quality standards for TP. As stated earlier, the upgraded WWTF should have no problems complying with the AML for TP.

Dissolved Oxygen (DO) – Freshwater aquatic life standards are characterized by the fishery (cold- or warm-water) and by the presence or absence of fish early life stages. Standards are further defined based on a time frame and required DO levels. B-1 waterbody classification states the receiving waters are to be maintained suitable for growth and propagation of salmonid fishes and associated aquatic life. DO standards for B-1 waters are given in Table 7. Both the receiving water ditch and Rosebud Creek are classified B-1.

Table 7: B-1 Water Classification Dissolved Oxygen Standards

Dissolved Oxygen	30-Day Mean (mg/L)	7-Day Mean (mg/L)	7-Day Mean Minimum (1) (mg/L)	1-Day Minimum (1) (mg/L)
Early Life Stages (2)	NA	6.5	NA	5.0
Other Life Stages	6.5	NA	5.0	4.0

Footnotes:
"NA" means "Not Applicable".
1. All minima should be considered as instantaneous concentrations to be achieved at all times.
2. Includes all embryonic and larval stages and all juvenile forms of fish to 30-days following hatching.

Although the Rosebud Creek drainage is listed as impaired for aquatic life, low DO levels are not mentioned as a probable cause. One sample taken by DEQ of Rosebud Creek upstream on August 30, 2004 measured a DO level of 15.2 mg/L, which is quite high for the summer months (the measured water temperature was 64˚F). As shown on Table 5A, the receiving water ditch was monitored on a monthly basis during 2010 and 2011 and the DO levels ranged from a low of 8.2 mg/L to a high of 9.8 mg/L, with the calculated 25th percentile value from the 23 samples being 9.0 mg/L.

The 2010-issued permit required monitoring the WWTF effluent for DO on a quarterly basis. As shown in Table 2, DO levels in the WWTF effluent varied from a low of 4.2 mg/L to a high of 8.1 mg/L, with an average level of 6.2 mg/L. The level of DO measured in the WWTF effluent was less than the 1-day minimum DO water quality standard of 5.0 mg/L for the receiving water only one time for the 48-month POR and with the consistently high receiving water ditch DO levels, likely did not cause receiving water DO levels to drop below the 5.0 mg/L. Given the relatively low level of biological material in the effluent, no adverse impact on instream DO levels is anticipated in either the receiving water ditch or in Rosebud Creek. The renewed permit will continue requiring quarterly monitoring of the WWTF effluent for DO.

3. Toxic Pollutants

Metals – The 2010-issued permit required monitoring for total recoverable metals in 2010. No effluent data for metals were required to be submitted with NPDES Form 2A application for permit renewal because the WWTF design flow is less than 1 mgd.

Samples were taken on March 30, 2010. As shown on Table 2, only zinc was detected in the Absarokee WWTF effluent at a measureable level. The metals beryllium and nickel were reported as "not detected at laboratory reporting levels" (ND) with laboratory reporting levels that complied with the minimum detection levels (ML) of the present permit. The metals antimony, arsenic, cadmium, chromium, copper, lead, mercury, selenium, silver and thallium were also reported ND, but with laboratory reporting levels that did not comply with the MLs of the present permit. The hardness of the effluent was reported as 159 mg/L (as $CaCO_3$), based on a single hardness sample of the effluent, also taken on March 30, 2010.

In order to determine the water quality standards for metals in a receiving water, both the human health standards and the aquatic life standards established in DEQ-7 are considered. Hardness-dependent aquatic life standards are calculated based on the 25th percentile hardness value. No hardness data exist for the receiving water ditch and only one sample exists for Rosebud Creek (see Table 5B). For calculation purposes, the hardness of the WWTF effluent, 159 mg/L (as $CaCO_3$) will be used as an approximation of the hardness in the receiving water ditch and a hardness of 32 mg/L (as $CaCO_3$) will be used as an approximation of the 25th percentile hardness of Rosebud Creek.

Although the metals antimony, arsenic, beryllium, chromium, nickel, selenium, silver and thallium were reported ND in the WWTF effluent at laboratory reporting levels that did not comply with the MLs of the permit, RP has been ruled out for these metals because calculations using metal concentrations at the laboratory reporting levels for each showed no RP. Monitoring of the WWTF effluent for the aforementioned metals will not be required in the renewed permit.

Water Quality Standards for Metals in Ditch:

Metal*	Acute Aquatic Life, µg/L	Chronic Aquatic Life, µg/L	Human Health, µg/L
Antimony	-	-	5.6
Arsenic	340	150	10
Beryllium	-	-	4
Cadmium	3.42	0.38	5
Copper	21.7	13.9	1,300
Chromium	-	-	100
Lead	148	5.75	15
Mercury	1.7	0.91	0.05
Nickel	695	77.3	100
Selenium	20	5	50
Silver	9.03	-	100
Thallium	-	-	0.24
Zinc	177.6	177.6	2,000

*All metals are TR. The receiving water ditch was not monitored for metals.

Although the metals cadmium, copper, lead and mercury were also reported ND in the WWTF effluent at laboratory reporting levels, the laboratory reporting levels did not comply with the MLs of the permit. Further sampling is necessary and will be required in the renewed permit to assure that levels do not exist that might result in RP. Analyses of metal samples must be to the MLs listed in the renewed permit.

Zinc was found in the WWTF effluent at a level of 10 µg/L. Calculations indicate that RP does not exist for zinc as a result of the effluent from the WWTF and monitoring of the WWTF effluent for zinc will not be required in the renewed permit.

No monitoring data exist for the metals cadmium, copper, lead and mercury or hardness in the receiving water ditch upstream from the point of discharge from the WWTF. The renewed permit will not require monitoring for the metals or hardness in the receiving water ditch because installation of a diffuser on the outfall for continued discharge to the ditch after upgrade will allow dilution in RP calculations and will result in no RP for metals in the ditch.

Water Quality Standards for Metals in Rosebud Creek:

Metal*	Acute Aquatic Life, µg/L	Chronic Aquatic Life, µg/L	Human Health, µg/L
Antimony	-	-	5.6
Arsenic	340	150	10
Beryllium	-	-	4
Cadmium	0.67	0.12	5
Copper	4.80	3.54	1,300
Chromium	-	-	100
Lead	19.2	0.75	15
Mercury	1.7	0.91	0.05
Nickel	180	20	100
Selenium	20	5	50
Silver	0.58	-	100
Thallium	-	-	0.24
Zinc	45.8	45.8`	2,000

*All metals are TR. All metals were monitored one time in RC, ERC & WRC – see Table 5B.

As discussed previously, water quality monitoring of Rosebud Creek consists of one set of samples taken in 2004. However, that sampling showed that the hardness of Rosebud Creek is quite low, i.e. in the 30-50 mg/L range (as $CaCO_3$). The acute and chronic aquatic life water quality standards for the metals mentioned herein are "hardness dependent" and calculate to be quite low in "low hardness" waters. In order to cover the possibility of discharge from the WWTF directly to Rosebud Creek in the future, the renewed permit will require monitoring for the metals cadmium, copper, lead and mercury plus hardness in Rosebud Creek above the confluence of the receiving water ditch with Rosebud Creek. If the monitoring shows that RP exists for any and/or all of the metals listed, future permit(s) may include effluent limits for those metals for which RP exists.

Cyanide and phenol – The 2010-issued permit required effluent monitoring for total cyanide and total phenol once in 2010. Monitoring results for cyanide and phenol were not required to be submitted with NPDES Form 2A application for permit renewal because the WWTF design flow is less than 1 mgd.

Samples were taken on March 30, 2010. As shown on Table 2, a reportable level of phenol was detected in the WWTF effluent. Cyanide was reported ND at a laboratory reporting level that complied with the ML of the present permit.

For total cyanide in either the receiving water ditch or Rosebud Creek near Absarokee the aquatic life water quality standards are 22 µg/L (acute) and 5.2 µg/L (chronic) and the human health standard is 140 µg/L. Based on an assumption that the ambient level of cyanide in the receiving water ditch and Rosebud Creek are essentially zero and, conservatively, the level of cyanide in the WWTF effluent is present at the permit ML, calculations indicate that RP would not exist for cyanide as a result of the WWTF effluent. Monitoring of the WWTF effluent for cyanide will not be required in the renewed permit.

For total phenol in either the receiving water ditch or Rosebud Creek near Absarokee there are no aquatic life water quality standards and the human health standard is 300 µg/L. Based on an assumption that the ambient level of phenol in the receiving water ditch and Rosebud Creek are essentially zero and a TSD calculated maximum WWTF effluent concentration is 124 µg/L (20 µg/L times a TSD multiplier of 6.2), calculations indicate that RP does not exist for phenol as a result of the WWTF effluent. Monitoring of the WWTF effluent for phenol will not be required in the renewed permit.

Whole Effluent Toxicity (WET) Testing – ARM 17.30.637(1)(d) requires that state water be free from substances attributable to municipal waste that create conditions which are harmful or toxic to human, animal, plant or aquatic life, except DEQ may allow limited toxicity in a mixing zone provided that there is no acute lethality to organisms.

The Absarokee WWTF is a small discharger averaging 0.24 mgd with no identified industrial contributions. Effluent flows reached as high as 0.73 mgd over the POR, but the high flows reflect high levels of groundwater infiltration and the effluent is very dilute at high flows. No WET testing will be required with this permit cycle.

V. Effluent Limits

Discharge from the existing WWTF will occur through Outfall 001 to the receiving water ditch until construction of an upgraded WWTF is completed and the new facility commences discharge through either Outfall 001 to the ditch or through Outfall 01A directly to Rosebud Creek at approximately 45˚31'52" N latitude, 109˚26'24" W longitude. Discharges through Outfalls 001 and 01A are not allowed to occur simultaneously and no discharge through Outfall 001 shall occur after or if discharge through Outfall 01A is commenced. The Outfall 001 Interim Effluent Limits (Table 8) apply to the discharge from the existing WWTF through Outfall 001. The Outfall 001 Final Effluent Limits (Table 8A) apply if the upgraded WWTF continues to discharge to the ditch rather than directly to Rosebud Creek. Table 9 includes the final effluent limits for a discharge from the upgraded WWTF through Outfall 01A directly to Rosebud Creek rather than to the ditch.

Outfall 001 Interim Effluent Limits

Beginning on the effective date of the permit and lasting through December 31, 2020, the quality of effluent discharged by the facility shall, as a minimum, meet the limits as set forth below:

Table 8: Outfall 001 (Ditch) Interim Effluent Limits

Parameter	Units	Average Monthly Limit(1)	Average Weekly Limit(1)	Daily Maximum Limit(1)
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	--
	lbs/day	75	131	--
BOD_5, Removal	%	85	--	--
Total Suspended Solids (TSS)	mg/L	45	65	--
	lbs/day	131	190	--
TSS, Removal	%	65	--	--
Escherichia coli (E. coli)(2, 4)	cfu/100ml	126	252	--
Escherichia coli (E. coli)(3, 4)	cfu/100ml	630	1,260	--
Total Nitrogen, as N(5)	lbs/day	18.2	--	--
Total Phosphorus, as P(5)	lbs/day	2.31	--	--
pH	s.u.	6.0-9.0 (instantaneous)(6)		

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. This limitation applies from April 1 through October 31.
3. This limitation applies from November 1 through March 31.
4. Report Geometric Mean if more than one sample is collected in the reporting period.
5. **General Variance Limitation.** This limitation applies from July 1 through September 30.
6. For compliance purposes, any single analysis and/or measurement beyond this limit shall be considered a violation of the conditions of this permit.

Outfall 001 Final Effluent Limits

Effective January 1, 2021, and lasting through the term of the permit, the quality of the effluent discharged by the facility shall, as a minimum, meet the limits as set forth below:

Table 8A: Outfall 001 (Ditch) Final Effluent Limits

Parameter	Units	Average Monthly Limit(1)	Average Weekly Limit(1)	Daily Maximum Limit(1)
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	--
	lbs/day	75	131	--
BOD_5, Removal	%	85	--	--
Total Suspended Solids (TSS)	mg/L	45	65	--
	lbs/day	131	190	--
TSS, Removal	%	65		
Escherichia coli (E. coli)(2, 4)	cfu/100ml	126	252	--
Escherichia coli (E. coli)(3, 4)	cfu/100ml	630	1,260	--
Total Ammonia, as N	mg/L	9.4	--	13.8
Total Nitrogen, as N(5)	lbs/day	18.2	--	--
Total Phosphorus, as P(5)	lbs/day	2.31	--	--
pH	s.u.	6.0-9.0 (instantaneous)(6)		

Footnotes:
1 See Definition section at end of permit for explanation of terms.
2. This limitation applies from April 1 through October 31.
3. This limitation applies from November 1 through March 31.
4. Report Geometric Mean if more than one sample is collected in the reporting period.
5. This limitation applies from July 1 through September 30.
6. For compliance purposes, any single analysis and/or measurement beyond this limit shall be considered a violation of the conditions of this permit.

The final effluent limits for ammonia in Table 8A are based on nearly instantaneous mixing at the point of discharge, which requires installation of a diffuser on Outfall 001.

Outfall 01A Final Effluent Limits

Beginning immediately upon commencing discharge to Rosebud Creek (with notification provided to DEQ six months prior) and lasting through the term of the permit, the quality of the effluent discharged by the facility shall, as a minimum, meet the limits as set forth below:

Table 9: Outfall 01A (Rosebud Creek) Final Effluent Limits

Parameter	Units	Average Monthly Limit(1)	Average Weekly Limit(1)	Daily Maximum Limit(1)
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	--
	lbs/day	75	131	--
BOD_5, Removal	%	85	--	--
Total Suspended Solids (TSS)	mg/L	45	65	--
	lbs/day	131	190	--
TSS, Removal	%	65		
Escherichia coli (E. coli)(2, 4)	cfu/100ml	126	252	--
Escherichia coli (E. coli)(3, 4)	cfu/100ml	630	1,260	--
Total Ammonia, as N	mg/L	11.0	--	16.1
Total Nitrogen, as N(5)	lbs/day	18.2	--	--
Total Phosphorus, as P(5)	lbs/day	2.31	--	--
pH	s.u.	6.0-9.0 (instantaneous)(6)		

Footnotes:
1 See Definition section at end of permit for explanation of terms.
2. This limitation applies from April 1 through October 31.
3. This limitation applies from November 1 through March 31.
4. Report Geometric Mean if more than one sample is collected in the reporting period.
5. This limitation applies from July 1 through September 30.
6. For compliance purposes, any single analysis and/or measurement beyond this limit shall be considered a violation of the conditions of this permit.

VI. Self-Monitoring & Other Requirements

a. Self-Monitoring

Effluent samples for all parameters must be obtained immediately following UV disinfection, after treated wastewater flows over the outlet weir.

Influent samples for BOD_5 and TSS are to be taken from the influent Parshall Flume.

Table 10: Monitoring Requirements					
Parameter	Unit	Sample Location	Sample Frequency	Sample Type[1]	ML[2]
Flow	mgd	Effluent	1/Week	Instantaneous	0.001
Biochemical Oxygen Demand (BOD_5)	mg/L	Influent	1/Month	Composite	10
	mg/L	Effluent	1/Month	Grab	2
	% Removal[3]	NA	1/Month	Calculated	0.1
	lb/day	Effluent	1/Month	Calculated	0.1
Total Suspended Solids (TSS)	mg/L	Influent	1/Month	Composite	10
	mg/L	Effluent	1/Month	Grab	10
	% Removal[3]	NA	1/Month	Calculated	0.1
	lb/day	Effluent	1/Month	Calculated	1
pH	s.u.	Effluent	1/Month	Instantaneous	0.1
Temperature	°F	Effluent	1/Month	Instantaneous	0.1
Escherichia coli (E. coli)[4]	cfu/100ml	Effluent	1/Week	Grab	1
Oil and Grease[5]	mg/L	Effluent	2/Year	Grab	0.1
Total Ammonia as N	mg/L	Effluent	1/Month	Grab	0.07
Nitrate + Nitrite as N[6]	mg/L	Effluent	1/Month	Grab	0.02
Total Kjeldahl Nitrogen[6]	mg/L	Effluent	1/Month	Grab	0.225
Total Nitrogen as N[6]	mg/L	Effluent	1/Month	Calculated	0.1
	lb/day	Effluent	1/Month	Calculated	0.1
Total Phosphorus as P[6]	mg/L	Effluent	1/Month	Grab	0.003
	lb/day	Effluent	1/Month	Calculated	0.01
Dissolved Oxygen (DO)	mg/L	Effluent	1/Quarter	Grab	0.1
Cadmium, TR[7]	µg/L	Effluent	2/Year	Grab	0.03
Copper, TR[7]	µg/L	Effluent	2/Year	Grab	0.3
Lead, TR[7]	µg/L	Effluent	2/Year	Grab	2
Mercury, TR[7]	µg/L	Effluent	2/Year	Grab	0.005
Hardness, Total (as $CaCO_3$)	mg/L	Effluent	2/Year	Grab	1

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. ML is the minimum detection level. Analyses for all parameters must be to the ML listed in the permit for the parameter.
3. See narrative discussion in Part I of permit for additional details.
4. Report geometric mean if more than one sample taken during the reporting period.
5. Use EPA Method 1664, Revision A: N-Hexane Extractable Material (HEM), or equivalent.
6. **Monitoring for TN and TP required July 1 through September 30 only.** TN is calculated as the sum of Nitrate + Nitrite (as N) plus Total Kjeldahl Nitrogen (as N) concentrations.
7. Metals shall be analyzed as total recoverable; use EPA Method (Section) 4.1.4 [EPA 600/4-79-020, March 1983] or Equivalent. The permittee may request that the requirement for metals monitoring be terminated if levels in two consecutive samples are found to be "not detected" at the MLs listed in the permit. Samples must be taken in the 1st & 4th quarters each year, commencing with the year 2017.

Receiving Water Monitoring Requirements:

1. Receiving Water Ditch

The receiving water ditch, designated DITA, shall be monitored at the flume near the access road (upstream from Outfall 001) as follows:

Parameter	Unit	Frequency	Type	ML
Flow	mgd	1/Month	Instantaneous	0.01
Temperature	˚F	1/Month	Grab	0.1
pH	s.u.	1/Month	Grab	0.1
Ammonia-N	mg/L	1/Month	Grab	0.07
Total Nitrogen, TN[1]	mg/L	1/Month[1]	Grab	0.1
Total Phosphorus, TP[2]	mg/L	1/Month[2]	Grab	0.003

[1]July through September only. TN is nitrate+nitrite (as N) plus kjeldahl nitrogen (as N).
[2]July through September only.

2. Rosebud Creek Upstream of Proposed Direct Discharge

Rosebud Creek, designated ROSC, shall be monitored at a marked location approved by DEQ, as follows:

Parameter	Unit	Frequency	Type	ML
Temperature	˚F	1/Month	Grab	0.01
pH	s.u.	1/Month	Grab	0.1
Ammonia-N	mg/L	1/Month	Grab	0.07
Nitrate+Nitrite (as N)	mg/L	1/Month	Grab	0.02
Total Nitrogen, TN[1]	mg/L	1/Month[1]	Grab	0.1
Total Phosphorus, TP[2]	mg/L	1/Month[2]	Grab	0.003
Cadmium, TR	µg/L	2/Year[3]	Grab	0.03
Copper, TR	µg/L	2/Year[3]	Grab	0.3
Lead, TR	µg/L	2/Year[3]	Grab	2
Mercury, TR	µg/L	2/Year[3]	Grab	0.005
Hardness (as $CaCO_3$)	mg/L	2/Year[3]	Grab	1

[1]July through September only. TN is nitrate+nitrite (as N) plus kjeldahl nitrogen (as N).
[2]July through September only.
[3]Samples must be taken in 1st and 3rd quarters of the year, commencing in 2017.

NOTE: Permittee may request approval from DEQ to discontinue Rosebud Creek monitoring if the upgraded WWTF will continue to discharge to the ditch rather than direct to Rosebud Creek. The permittee may request that the requirement for metals monitoring be terminated if levels in two consecutive samples are found to be “not detected” at the MLs listed in the permit.

b. Sludge Requirements

This permit will contain standard conditions requiring compliance with 40 CFR 503 for any removal or disposal of biosolids from the Absarokee WWTF.

c. Pretreatment Program

The facility is not currently operating under the EPA Pretreatment Program. The permit will include standard language restricting introducing certain pollutants to the Absarokee WWTF and requiring the facility to provide adequate notice to DEQ if a new source, volume or character of industrial pollutant is introduced to the system.

VII. Nonsignificance Determination

The facility must meet present permit limits for BOD_5, pH and *E.coli*; more stringent concentration, percent removal and load limits for TSS; new concentration limits on total ammonia-N and nondegradation limits on TN and TP. The requested relocation of the discharge point to Rosebud Creek is at or downstream from the confluence of the receiving water ditch with Rosebud Creek. The discharge does not constitute a new or increased source of pollutants pursuant to ARM 17.30.702(17). Therefore, a nonsignificance analysis is not required [ARM 17.30.705(1)].

VIII. Compliance Schedules

Table 11 below summarizes the activities required in the Compliance Schedules and due dates for each action item.

a. Total Ammonia-N

Final effluent limits for ammonia are included in the renewed permit to meet the water quality standards for discharge through Outfall 001 to the receiving water ditch or, in the alternative, for discharge through Outfall 01A direct to Rosebud Creek. The final effluent limits for ammonia are effective January 1, 2021 for discharge through Outfall 001 and immediately upon commencing discharge through Outfall 01A.

The permittee must provide annual reports to DEQ, the first due by no later than January 28, 2017, and subsequent reports due by January 28 of subsequent years, that summarize the progress made toward meeting the final ammonia effluent limits by the deadline of January 1, 2021. Annual reports should address typical project milestones such as completion of preliminary engineering report, securing project funding, completion of plans and specifications and completion of construction.

b. Outfall Diffuser

The final effluent limits for total ammonia-N for discharge through Outfall 001 are based on installation of a diffuser on Outfall 001 in the Ditch.

The annual reports required for total ammonia-N above must address the requirement for installation of a diffuser on Outfall 001 in the Ditch. If the upgraded WWTF will discharge directly to Rosebud Creek rather than to the ditch, installation of a diffuser on Outfall 001 is a moot issue.

c. Notification of Intent to Discharge through Outfall 01A

If the permittee decides to discharge direct to Rosebud Creek from the upgraded WWTF rather than continue to discharge through Outfall 001 to the Ditch, the permittee shall provide written notification to DEQ no later than six months prior to commencing discharge from the upgraded WWTF direct to Rosebud Creek through Outfall 01A.

d. Nutrient Variance

Because nutrient variance limits have been allowed for the discharge from the WWTF, the permittee must complete a Facility Optimization Study and Nutrient Reduction Analysis (Study) as required by DEQ-12B. The Study must be completed by December 31, 2018 and submitted to DEQ by January 28, 2019.

e. Compliance Schedule Table

The actions listed in the table below must be completed on or before the respective scheduled completion dates. The completion of all actions or deliverables must be reported to DEQ at the address listed in Part II.D. of the permit and in accordance with the signatory requirements of Part IV.G. of the permit.

Table 11. Compliance Schedule

Action	Frequency	Scheduled Completion Date of Action (1)	Report Due Date (2)
Complete a Facility Optimization Study and Nutrient Reduction Analysis	Single Event	By December 31, 2018	NA
Submit Notification that the Facility Optimization Study and Nutrient Reduction Analysis is Complete	Single Event	By December 31, 2018	January 28, 2019
Submit Annual Reports Documenting Progress Towards Achieving Final Total Ammonia-N Effluent Limits Including the Installation of a Diffuser at Outfall 001	Annually	NA	January 28th of 2017, 2018, 2019 and 2020
Submit Written Notice to the Department of Upgraded WWTF Discharge to Rosebud Creek from Outfall 01A	Single Event	Six Months prior to Discharge from Outfall 01A	Six Months prior to Discharge from Outfall 01A

Footnotes:
NA = Not Applicable
1. The actions must be completed on or before the scheduled completion dates.
2. This notification must be postmarked or electronically submitted to the Department on or before the scheduled due date.

IX. Information Sources

a. Federal Water Pollution Control Act (Clean Water Act), 33 U.S.C. §§ 1251-1387, October 18, 1972, as amended 1973-1983, 1987, 1988, 1990-1992, 1994, 1995 and 1996.

b. US Code of Federal Regulations, 40 CFR Parts 122-125, 130-133, & 136.

c. Montana Code Annotated (MCA), Title 75-5-101, *et seq*., "Montana Water Quality Act," 2011.

d. Administrative Rules of Montana Title 17 Chapter 30 - Water Quality
   - Subchapter 2 - Water Quality Permit and Application Fees.
   - Subchapter 5 - Mixing Zones in Surface and Ground Water.
   - Subchapter 6 - Montana Surface Water Quality Standards and Procedures.
   - Subchapter 7 - Nondegradation of Water Quality.
   - Subchapter 12 - Montana Pollutant Discharge Elimination System (MPDES) Standards.
   - Subchapter 13 - MPDES Permits.

e. Montana Department of Environmental Quality Circular DEQ-7, Montana Numeric Water Quality Standards, October 2012.

f. Integrated 303(d)/305(b) Water Quality Report for Montana (2014) and draft Integrated 303(d)/305(b) Water Quality Report for Montana (2016).

g. McCarthy, P.M., 2016, Streamflow Characteristics Based On Data Through Water Year 2009 For Selected Streamflow Gaging Stations In Or Near Montana: U.S. Geological Survey Scientific Investigations Report 2015-5019-E, XX.

h. US EPA Technical Support Document for Water Quality-Based Toxics Control, EPA/505/2-90-001, March 1991.

i. US EPA National Pollutant Discharge Elimination System (NPDES) Permit Writers' Manual, EPA 833-K-10-001, September 2010.

j. Montana Department of Fish, Wildlife and Parks, Don Skaar, Spawning Times of Montana Fishes, March 2001.

k. Montana Fisheries Information System (MFISH)

l. MPDES Permit Number MT0021750:
   1. Administrative Record.
   2. Renewal Application NPDES Form 2A, July 2014.
   3. Amended Application NPDES Form 2A, June 2016.

m. Montana DEQ Circular DEQ-12A, Montana Base Nutrient Standards, July 2014.

n. Montana DEQ Circular DEQ-12B, Nutrient Standards Variances, July 2014.

FS Prepared By: James F. Brown, August 2016

Appendix A: Reasonable Potential & Effluent Limit Calculations: NH_3-N (Discharge to Ditch – with Diffuser on Outfall)

$C_{rp} = [C_eQ_e + C_sQ_s] / [Q_e + Q_s]$ & $C_e = [C_{rp}(Q_e + Q_s) - C_sQ_s] / Q_e$

Where:
C_{rp} = receiving water concentration after mixing, mg/L
C_e = effluent concentration, mg/L
C_s = receiving water concentration upstream of discharge, mg/L
Q_e = facility design flow rate, mgd
Q_s = applicable receiving water flow, 100% of 7Q10 w/diffuser, mgd

Reasonable Potential Calculations:
from DMRs (71 mo): Max Rpd – 29.0 mg/L; calc. CV – 0.76; EPA TSD Table 3.2 mult. – 0.934
C_e = 27.1 mg/L; C_s = 0.13 mg/L; Q_e = 0.35 mgd; Q_{s7Q10} = 0.40 mgd
Chronic WQS – 3.97 mg/L; Acute WQS – 19.9 mg/L (assume no salmonids present)

Chronic:
$C_{rp} = [(27.1)(0.35) + (0.13)(0.40)] / [0.35 + 0.40] = 9.54 / 0.75 = 12.7$ mg/L > 3.97 mg/L N.G.

Acute:
$C_{rp} = [(27.1)(0.35) + (0.13)(0.40)] / [0.35 + 0.40] = 9.54 / 0.75 = 12.7$ mg/L < 19.9 mg/L O.K.
Note: Acute WQS w/salmonids present is 13.3 mg/L – O.K. (no RP) w/salmonids present.

Reasonable Potential for exceeding water quality standards for NH_3-N exists for chronic.

Effluent Limit Calculations:

Chronic:

$C_e = [(3.97)(0.35 + 0.40) – (0.13)(0.40)] / 0.35 = 2.93 / 0.35 = 8.4$ mg/L $WLA_{chronic}$

Acute:

$C_e = [(12.7)(0.35 + 0.40) – (0.13)(0.40)] / 0.35 = 9.47 / 0.35 = 27.1$ mg/L WLA_{acute}

from EPA TSD:
for assumed CV of 0.6; 1 sample/mo; WLA @ 99%; MDL @ 99%; AML @ 95%

from Table 5.1 – acute WLA multiplier = 0.321; chronic WLA multiplier = 0.527
from Table 5.2 – MDL multiplier = 3.11; AML multiplier = 2.13

$LTA_{chronic} = (8.4)(0.527) = 4.43$ mg/L; $LTA_{acute} = (27.1)(0.321) = 8.70$ mg/L chronic controls

MDL = (4.43)(3.11) = 13.8 mg/L; AML = (4.43)(2.13) = 9.4 mg/L

Appendix B: Reasonable Potential & Effluent Limit Calculations: NH_3-N (Discharge to Rosebud Creek)

$C_{rp} = [C_eQ_e + C_sQ_s] / [Q_e + Q_s]$ & $C_e = [C_{rp}(Q_e + Q_s) - C_sQ_s] / Q_e$

Where:
C_{rp} = receiving water concentration after mixing, mg/L
C_e = effluent concentration, mg/L
C_s = receiving water concentration upstream of discharge, mg/L
Q_e = facility design flow rate, mgd
Q_s = applicable receiving water flow, 10% of 7Q10 (chronic), 1% of 7Q10 (acute), mgd

Reasonable Potential Calculations:
from DMRs (71 mo): Max Rpd – 29.0 mg/L; calc. CV – 0.76; EPA TSD Table 3.2 mult. – 0.934
C_e = 27.1 mg/L; C_s = 0.05 mg/L; Q_e = 0.35 mgd; Q_{s10} = 4.83 mgd; Q_{s1} = 0.483 mgd
Chronic WQS – 2.10 mg/L; Acute WQS – 6.77 mg/L

Chronic:
$C_{rp} = [(27.1)(0.35) + (0.05)(4.83)] / [0.35 + 4.83] = 9.73 / 5.18 = 1.88$ mg/L < 2.10 mg/L O.K.

Acute:
$C_{rp} = [(27.1)(0.35) + (0.05)(0.483)] / [0.35 + 0.483] = 9.51 / 0.833 = 11.4$ mg/L > 6.77 mg/L N.G.

Reasonable Potential for exceeding water quality standards for NH_3-N exists for acute.

Effluent Limit Calculations:

Chronic:

$C_e = [(1.88)(0.35 + 4.83) – (0.05)(4.83)] / 0.35 = 9.50 / 0.35 = 27.1$ mg/L $WLA_{chronic}$

Acute:

$C_e = [(6.77)(0.35 + 0.483) – (0.05)(0.483)] / 0.35 = 5.62 / 0.35 = 16.1$ mg/L WLA_{acute}

from EPA TSD:
for assumed CV of 0.6; 1 sample/mo; WLA @ 99%; MDL @ 99%; AML @ 95%

from Table 5.1 – acute WLA multiplier = 0.321; chronic WLA multiplier = 0.527
from Table 5.2 – MDL multiplier = 3.11; AML multiplier = 2.13

$LTA_{chronic} = (27.1)(0.527) = 14.28$ mg/L; $LTA_{acute} = (16.1)(0.321) = 5.17$ mg/L acute controls

MDL = (5.17)(3.11) = 16.1 mg/L; AML = (5.17)(2.13) = 11.0 mg/L

Appendix C: Reasonable Potential & Effluent Limit Calculations: TN (Discharge to Ditch)

$C_{rp} = [C_eQ_e + C_sQ_s] / [Q_e + Q_s]$ & $C_e = [C_{rp}(Q_e + Q_s) - C_sQ_s] / Q_e$

Where:
C_{rp} = receiving water concentration after mixing, mg/L
C_e = effluent concentration, mg/L
C_s = receiving water concentration upstream of discharge, mg/L
Q_e = facility design flow rate, mgd
Q_s = applicable receiving water flow, 10% of 7Q10 (chronic), 1% of 7Q10 (acute), mgd

Reasonable Potential Calculations:
from DMRs (11 mo): Max Rpd – 7.0 mg/L; calc. CV – 0.3; EPA TSD Table 3.2 mult. – 1.3
C_e = 9.1 mg/L; C_s = 0.13 mg/L; Q_e = 0.35 mgd; Q_{s14Q5} = 0.50 mgd
Chronic WQS – 1.30 mg/L

Chronic:
$C_{rp} = [(9.1)(0.35) + (0.13)(0.50)] / [0.35 + 0.50] = 3.25 / 0.85 = 3.82$ mg/L > 1.30 mg/L N.G.

Reasonable Potential for exceeding water quality standards for TN exists.

Effluent Limit Calculations:

Chronic:

$C_e = [(1.30)(0.35 + 0.50) – (0.13)(0.50)] / 0.35 = 1.04 / 0.35 = 2.97$ mg/L $WLA_{chronic}$

from EPA TSD:
for assumed CV of 0.6; 1 sample/mo; WLA @ 95%

from Table 5.1 – chronic WLA multiplier = 0.644
from Table 5.2 – AML multiplier = 2.13

$LTA_{chronic} = (2.97)(0.644) = 1.92$ mg/L

AML = (1.92)(2.13) = 4.1 mg/L

$AML_{load} = (4.1)(0.35)(8.34) = 12.0$ lbs/day

Appendix D: Reasonable Potential & Effluent Limit Calculations: TP (Discharge to Ditch)

$C_{rp} = [C_eQ_e + C_sQ_s] / [Q_e + Q_s]$ & $C_e = [C_{rp}(Q_e + Q_s) - C_sQ_s] / Q_e$

Where:
C_{rp} = receiving water concentration after mixing, mg/L
C_e = effluent concentration, mg/L
C_s = receiving water concentration upstream of discharge, mg/L
Q_e = facility design flow rate, mgd
Q_s = applicable receiving water flow, 10% of 7Q10 (chronic), 1% of 7Q10 (acute), mgd

Reasonable Potential Calculations:
from DMRs (11 mo): Max Rpd – 0.92 mg/L; calc. CV – 0.29; EPA TSD Table 3.2 mult. – 1.3
C_e = 1.20 mg/L; C_s = 0.001 mg/L; Q_e = 0.35 mgd; Q_{s14Q5} = 0.50 mgd
Chronic WQS – 0.150 mg/L

Chronic:
$C_{rp} = [(1.20)(0.35) + (0.003)(0.50)] / [0.35 + 0.50] = 0.42 / 0.85 = 0.495$ mg/L > 0.150 mg/L N.G.

Reasonable Potential for exceeding water quality standards for TP exists.

Effluent Limit Calculations:

Chronic:

$C_e = [(0.150)(0.35 + 0.50) – (0.001)(0.50)] / 0.35 = 0.127 / 0.35 = 0.363$ mg/L $WLA_{chronic}$

from EPA TSD:
for assumed CV of 0.6; 1 sample/mo; WLA @ 95%

from Table 5.1 – chronic WLA multiplier = 0.644
from Table 5.2 – AML multiplier = 2.13

$LTA_{chronic} = (0.363)(0.644) = 0.234$ mg/L

AML = (0.234)(2.13) = 0.498 = 0.50 mg/L

$AML_{load} = (0.50)(0.35)(8.34) = 1.46$ lbs/day

Appendix E: (Interim) General Variance Nutrient Limits Calculations (Applicable to Discharge to Ditch and/or Direct Discharge to Rosebud Creek)

Month	Year	Total N mg/L	Total P mg/L
Sept	2010	2.22	0.53
June	2011	5.22	0.44
Sept	2011	3.26	0.40
June	2012	3.0	0.42
Sept	2012	5.9	0.89
June	2013	6.0	0.56
Sept	2013	5.20	0.70
June	2014	5.50	0.62
Sept	2014	7.0	3.64
June	2015	5.74	0.68
Sept	2015	5.45	0.76

Long Term Averages (LTA)	4.95	0.63
Standard Deviation	1.47	0.18
Calculated CV	0.3	0.29

From EPA TSD Table 5.2:

LTA Multiplier (95th Percentile, n = 4)	1.26	1.25

Average Monthly Limit (AML) Calculations:

AML [conc.] = (LTA)(LTA Multiplier)	6.24	0.79

General variance nutrient limits for lagoons are expressed in terms of load only, based on the design flow of the WWTF.

@ lagoon system WWTF design flow of 0.35 mgd;

AML_{TN} = (6.24)(0.35)(8.34) = 18.2 lbs/day

AML_{TP} = (0.79)(0.35)(8.34) = 2.31 lbs/day