

**MONTANA DEPARTMENT OF
ENVIRONMENTAL QUALITY**

Permitting and Compliance Division
Water Protection Bureau
P.O. Box 200901, Helena, MT 59620-0901

**Modification - Fact Sheet
Montana Ground Water Pollution Control System (MGWPCS)**

Applicant: Roseburg Forest Products Co.

Permit No.: MTX000099 (Issued on October 16, 2012)

Facility Name: Roseburg Forest Products - Missoula

Facility Location: 3300 Raser Drive,
Missoula, Montana
SE ¼ Section 08, Township 13 North, Range 19 West,
Missoula County

Facility Contact: Ellen Porter
Roseburg Forest Products Co.
P.O. Box 1088
Roseburg, OR 97470
(541) 679-2130

Receiving Water: Class I Ground Water

Number of Outfalls: 1

Outfall(s)/Type: 001 – Infiltration Pond (Industrial Wastewater)

I. PERMIT STATUS

Roseburg Forest Products Co. (RFP) was issued a Montana Ground Water Pollution Control System (MGWPCS) permit on October 16, 2012, for the RFP - Missoula facility. The Montana Department of Environmental Quality (DEQ) received an application and applicable fees from RFP to modify the permit on October 17, 2013. DEQ requested additional information regarding the MGWPCS application on November 14, 2013, and February 26, 2014. DEQ received subsequent responses and the application to modify was determined to be complete on May 23, 2014.

RFP has requested the following modifications:

- Addition of a wastewater stream from the biofilter - air pollution control system;
- Addition of a wastewater stream from the regenerative thermal oxidizer (RTO) - air pollution control system; and
- Change in the effluent sampling procedure due to the alteration of the wastewater system.

With a permit modification, only the conditions subject to modification are reopened (ARM 17.30.1361). This fact sheet addresses these proposed modifications.

II. FACILITY DESCRIPTION/INFORMATION

A. Facility Location

RFP is located immediately north of the City of Missoula. The RFP property is predominantly bounded by Interstate 90, Raser Drive, Phillips 66 property, and the Thatcher Company.

B. General Facility

RFP is a manufacturer of various wood building products, including particleboard, wood paneling and melamine. Current RFP operations contributing wastewaters are:

- boiler blowdown,
- refiner non-contact cooling water,
- line chiller, and,
- water softener recharge.

C. Proposed Wastewater Generators

1) Biofilter

The modified permit authorizes the discharge of wastewater associated with the operation of the biofilter - air pollution control system. The biofilter controls air emissions generated from the particleboard presses. The source water originates from the Fire Pond which is actively amended with Bacterius 1B for control of organic matter.

RFP proposes to collect the wastewater in a sump and intermittently pump approximately every 90 minutes to the infiltration pond (Figure 1). This biofilter is estimated to generate approximately 4,320 gallons per day (gpd) of wastewater.

2) Regenerative Thermal Oxidizer

The modified permit authorizes the discharge of wastewater associated with operation of the regenerative thermal oxidizer (RTO) - air pollution control system. The RTO controls emissions of volatile organic hazardous air pollutants from the wood-fired green furnish pre-dryer. The operation of the RTO results in generation of wastewater every 12 hours.

RPF proposes to collect the wastewater in a sump and intermittently pump the wastewater to the infiltration pond (Figure 1). The RTO is estimated to generate approximately 288 gallons per day (gpd) of wastewater.

3) Summary

In summary, potential generators of wastewater include:

- Boiler blowdown (7,200 gpd),
- Refiner non-contact cooling water (57,600 gpd),
- Line chiller (1,440 gpd),
- Water softener recharge (4,032 gpd),
- Biofilter wastewater (4,320 gpd), and,
- RTO wastewater (288 gpd).

Table 1 below provides a summary of the wastewater system. An updated wastewater line diagram is included as Figure 1. Effluent characteristics as reported by the applicant are discussed below.

Table 1: Collection, Treatment, and Disposal System Summary	
Outfall 001 - Industrial (or other) Wastewater	
Method of Disposal: Infiltration to ground water	
Disposal Structure: Infiltration Pond (Outfall 001)	
Southeast ¼ of Section 8, Township 13 North, Range 19 West	
Latitude: 46° 53' 48.7" North; Longitude: -114° 01' 28.2" West	
Existing Contributing Sources: Non-contact cooling water, Boiler blowdown, and, Water softener regeneration.	
Proposed Contributing Sources: Biofilter water (air pollution control system), and, Regenerative thermal oxidizer (RTO) washout water (air pollution control system).	
Average Daily Infiltration Discharge (gpd): 108,000	Daily Maximum Infiltration Discharge (gpd): 108,000
Effluent Sampling Location: Infiltration pond (EFF-002).	
Flow Monitoring Equipment: In-situ data logger. Located near end of pipe, just prior to discharge to infiltration pond (FM-002).	
Treatment: None	

D. Effluent Characteristics

Pursuant to the Administrative Rules of Montana (ARM) 17.30.1023, DEQ requires the applicant to disclose the quality of the effluent to be discharged such that the potential pollutants can be identified and the modified discharge can be examined to determine if it will cause pollution of state water, 75-5-605, Montana Code Annotated (MCA). The modified effluent quality has been estimated by the applicant using effluent quality from current operations and the proposed generators (biofilter, RTO). The projected effluent quality data for Outfall 001 is summarized within Appendix I.

E. Ground Water Quality Characteristics - Ambient

The applicant reported ground water quality data collected from the irrigation well (MBMG, GWIC: 169058). This well was established by the 2012 permit as a temporary source for ambient ground water quality of the receiving ground water (Figure 2). The reported ground water quality results are summarized in Appendix II.

III. MIXING ZONE

A mixing zone was authorized in the current permit (DEQ, 2012a) for the total dissolved solids (TDS) parameter. The applicant has since proposed the introduction of new wastewater generators (Section II.C.). As part of the water quality assessment, the concentration of pollutants at the downgradient boundary of the mixing zone must be estimated in accordance with ARM 17.30.517 to determine if additional pollutants qualify for mixing. After an assessment of the application information (ARM 17.30.505), DEQ will authorize the parameters nitrogen and phenol, as based on the modified effluent characteristics. Table 2 summarizes the characteristics of the modified mixing zone.

Table 2: Mixing Zone Information		
Parameter	Units	Value
Mixing Zone Type	-	Standard
Authorized Parameters	-	Nitrogen Phenol TDS (2012)
Ground Water Flow Direction	azimuth/bearing	S52°W
Length of Mixing Zone	feet	500
Thickness of Mixing Zone	feet	15
Volume of Ground Water Available for Mixing (Q_{gw})	ft ³ /day	97,789

IV. RATIONALE FOR MODIFIED DISCHARGE LIMITATIONS AND CONDITIONS

Section IV presents the basis for discharge limitations in accordance with the requirements of 75-5-402 MCA, ARM 17.30.1031, ARM 17.30.1005, and ARM 17.30.1006.

A. Water Use Classification & Applicable Water Quality Standards

As discussed in Section II, the receiving water for Outfall 001 is Class I ground water (ARM 17.30.1006) and high quality waters of the state (75-5-103, MCA). The quality of Class I ground water must be maintained so that these waters are suitable for the following beneficial uses with little or no treatment (ARM 17.30.1006):

- Public and private water supplies;
- Culinary and food processing purposes;
- Irrigation;
- Drinking water for livestock and wildlife; and,
- Commercial and industrial purposes.

Persons may not cause a violation of the following specific water quality standards in Class I ground water, pursuant to ARM 17.30.1006, except within a DEQ approved mixing zone as provided in ARM 17.30.1005:

- The human health standards for ground water listed in Circular DEQ-7; and,
- For concentrations of parameters for which human health standards are not listed in DEQ-7, no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class I water. DEQ may use any pertinent credible information to determine these levels.

Parameter ⁽¹⁾	Units	17.30.1006(1)(b)(i) Human Health Standards - Ground Water	17.30.1006(1)(b)(ii) Beneficial Uses - Ground Water	2012 Permit
Nitrate + Nitrite (as N)	mg/L	10.0	-	-
Nitrogen, Total Inorganic (TIN) ⁽²⁾	mg/L	-	10.0	-
Oil & Grease	mg/L	-	-	10
pH	s.u.	-	-	6.0 - 9.0
Total Dissolved Solids (TDS)	mg/L	-	-	500

Footnotes:

s.u. = standard units

These standards establish the maximum allowable changes in ground water quality and are the basis for limiting discharges to ground water, ARM 17.30.1005; and Circular DEQ-7 (2012), Footnote 16.

(1) Includes known pollutants and parameters of concern only.

(2) Beneficial Uses: ARM 17.30.1006(1)(b)(ii); No increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class I water. The department may use any pertinent credible information to determine these levels.

B. Pollutants and Parameters of Concern

DEQ has identified pollutants and parameters of concern (POCs) based on reported effluent characteristics, water quality standards, and water use classification of the receiving ground water. Each POC will undergo a reasonable potential analysis (RPA). All identified POCs are listed within Appendix III.

C. Reasonable Potential Analysis

A RPA is used to determine whether a discharge to a water body, either alone or in combination with other sources of pollutants, could lead to an excursion above an applicable water quality standard. DEQ will conduct a RPA for each POC. Pending the outcome of the assessment, development of an effluent limitation or mitigation through best management practices (BMPs) may be established.

For the RPA, DEQ uses procedures as presented in the United States Environmental Protection Agency (USEPA) Technical Support Document (TSD) document (USEPA, 1991). This includes use of a mass-balance equation, which is a simple steady-state model, used to determine the POC concentration after accounting for other sources of pollution in the receiving water and any dilution as provided by a mixing zone. The mass-balance equation (Equation 1) derived for ground water is as follows:

Equation 1:

$$Q_{gw}C_{gw} + Q_{eff}C_{eff} = Q_{comb}C_{proj}$$

Where:

Q_{gw}	=	ground water available for mixing
C_{gw}	=	ambient receiving ground water concentration
Q_{eff}	=	maximum design capacity of wastewater system
C_{eff}	=	adjusted critical effluent pollutant concentration (TSD - 95%)
Q_{comb}	=	combined ground water and effluent ($Q_{comb} = Q_{gw} + Q_{eff}$)
C_{proj}	=	projected pollutant concentration (after available mixing)

The adjusted effluent concentration is based on the 95th percentile of the expected effluent concentration observed or predicted in the discharge. DEQ follows the estimation procedures described in the USEPA TSD document to estimate the 95th percentile of the daily values, by multiplying the maximum discharge concentration observed during the period of record by the TSD (Table 3-2) multiplier factor.

The mass-balance equation can be expressed in terms of the dilution ratio at the downgradient edge of the mixing zone when authorized. The dilution ratio is the volume of ground water available for mixing to the volume of effluent. Below is the mass-balance equation (Equation 2) arranged to solve for the projected pollutant concentration receiving water concentration:

Equation 2:

$$C_{\text{proj}} = \frac{C_{\text{eff}} + (D \times C_{\text{gw}})}{(1 + D)}$$

Where:

D = dilution ratio ($Q_{\text{gw}}/Q_{\text{eff}}$)

After available mixing, if the projected pollutant concentration (C_{proj}) exceeds any applicable water quality standard then there is a reasonable potential and an effluent limit or BMP must be developed. Appendix IV provides a summary of the RPA. The projected pollutant concentrations listed are not used in development of effluent limits which are further discussed in the following section.

D. Development of Effluent Limits

ARM 17.30.1005 states that the ground water standards establish the maximum allowable changes in ground water quality; are the basis for limiting discharges to ground water; and may only be exceeded within a mixing zone authorized by DEQ. As previously discussed in Section III, the mixing zone and authorized parameters are displayed within Table 2.

1) Water Quality Based Effluent Limitations

ARM 17.30.1006 sets forth the basis for developing effluent limitations based on water quality for the parameters listed below. The allowable discharge concentrations will be derived from a mass-balance equation pursuant to ARM 17.30.517. The mass-balance equation provided in Equation 1 has been arranged to calculate effluent limits so that the discharge does not cause or contribute to an exceedance of the applicable water quality standard. This equation can be applied to any effluent and receiving water where the applicable dilution ratio is known. This equation will only be used for the parameters [total dissolved solids (TDS), nitrogen, and phenol which have been authorized mixing (Table 2).

Equation 3:

$$C_{\text{lim}} = C_{\text{std}} + D(C_{\text{std}} - C_{\text{gw}})$$

Where:

C_{lim} = effluent limitation concentration

C_{std} = water quality standard concentration

C_{gw} = ambient receiving ground water concentration

D = dilution ratio ($Q_{\text{gw}}/Q_{\text{eff}}$)

a. Total Dissolved Solids (TDS)

A limit for total dissolved solids was established within the 2012 permit. Application materials indicate that total dissolved solids will still be present in the modified wastewater stream. Therefore, in protection of beneficial uses (ARM 17.30.1006), DEQ will update the current effluent limit for total dissolved solids using projected effluent characteristics, updated ambient ground water quality data, and credit for dilution.

b. Total Inorganic Nitrogen (TIN)

Application materials indicate that inorganic nitrogen will be present in the modified wastewater stream. In protection of beneficial uses [ARM 17.30.1006(1)(b)(ii)], there shall be no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class I water. DEQ will therefore assume that the entire inorganic nitrogen load in the wastewater is converted to nitrate at the end of the mixing zone.

A RPA was performed to project nitrate concentrations. The analyses projected a reasonable potential to exceed the water quality standard (Appendix IV). An effluent limit will therefore be established for total inorganic nitrogen with credit for dilution.

c. Oil & Grease

The current permit limit (2012) for Oil & Grease has been retained.

d. pH

The current permit limit (2012) for pH has been retained.

e. Additional Parameters

In addition, effluent characteristics as submitted within application materials indicate that additional pollutants and parameters were present in the projected effluent (Appendix III). A RPA was individually performed for each of these parameters. The analyses did not project a reasonable potential to exceed the respective water quality standard. Therefore effluent limitations have not been established for these parameters (Appendix IV).

E. Final Effluent Limitations

Based on the information and analyses presented in Sections III and IV above and pursuant to 75-5-402, MCA and ARM 17.30.1031, DEQ proposes the following numerical effluent limitations. In addition to the current limits (2012), the modified limitations are the most stringent applicable limitations as developed in this fact sheet. Effluent limitations have been established for those parameters which may cause a violation of a human health standard (ARM 17.30.1006(1)(b)(i)), or has demonstrated an interference with or a threat to the beneficial use (ARM 17.30.1006(1)(b)(ii)) of the receiving water. Effluent limits

based on water quality standards are expressed as a daily maximum concentration and have been summarized below.

Table 4: Proposed Modified Effluent Limits - Outfall 001				
Parameter	Units	Effluent Limitations		Rationale
		Daily Minimum ⁽¹⁾	Daily Maximum ⁽¹⁾	
Dissolved Solids, Total (TDS)	mg/L	-	1103	Current Limit - Modified
Nitrogen, Total Inorganic (as N)	mg/L	-	65.5	Protection of Beneficial Uses
Oil & Grease	mg/L	-	10	Current Limit
pH	s.u.	6.0	9.0	Current Limit
Footnotes:				
s.u. = standard units				
Beneficial Uses: ARM 17.30.1006				
(1) See definition in Part V of permit.				

V. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

ARM 17.30.1031 requires that all issued MGWPCS permits contain monitoring requirements that assure compliance with the developed numeric effluent limitations. This section explains and specifies monitoring and reporting requirements.

A. Effluent Monitoring - Compliance

Final numeric effluent limitations are developed in this document with specific magnitudes and durations based on site-specific conditions that ensures the discharge does not cause or contribute to an exceedance of an applicable water quality standard (see Sections III and IV). Accordingly, the permittee is required to monitor and report effluent quality at a specified frequency in order to demonstrate compliance with the effluent limits.

Effluent monitoring and reporting requirements are summarized in Appendix V for Outfall 001. Parameter analytical methods must be in accordance with the Code of Federal Regulations, 40 CFR Part 136.

B. Effluent Monitoring - Supplemental

DEQ may require the submission of additional data and information where warranted by the potential impacts of a source (ARM 17.30.1023). In order to fully characterize the effluent, DEQ will require monitoring for pollutants and parameters of concern as identified in Section IV. Also, in order to collect additional information in regards to nitrogen speciation and fate, reporting of organic nitrogen (total Kjeldahl nitrogen) will also be required.

Effluent monitoring and reporting requirements are summarized in Appendix V for Outfall 001.

C. Effluent Monitoring - Sampling Method

Samples and measurements shall be representative of the volume and nature of the monitored discharge (Part II.A. of the permit). The permittee shall collect a depth proportioned sample from a centroid location within the infiltration pond due to the following:

- Possible stagnate conditions at the infiltration pond (Outfall 001) may lead to stratification of the collected wastewaters.
- Multiple intermittent wastewater generators have also been proposed within this modification.

The permittee shall develop (or update) a sampling operation procedure (SOP) manual which will be used as a guide in preparing and collecting effluent samples using best management practices. SOP requirements are summarized in Section VI.

D. Ground Water Quality Monitoring

Ground water monitoring as established within the 2012 permit will be retained within the modified permit for monitoring wells MW-2, MW-3, and MW-4. Sampling requirements have been updated to reflect the effluent parameters of concern as discussed within Section IV. Also, in order to collect additional information in regards to nitrogen speciation and fate; reporting of organic nitrogen (total Kjeldahl nitrogen) and dissolved oxygen will also be required. Ground water monitoring and reporting requirements for these wells are summarized in Appendix VI.

VI. SPECIAL CONDITIONS

In accordance with ARM 17.30.1031 this section contains the basis for special permit conditions that are necessary to assure compliance with the ground water quality standards and the Montana Water Quality Act. The following special conditions are in addition to those established within the 2012 permit.

A. Best Management Practices - Sampling Operation Procedure Manual

Within six months of the permit effective date, the permittee shall develop (or update) a sampling operation procedure (SOP) manual. The manual must document best management practices to be used in consistent preparation, collection, documentation, and reporting of effluent samples.

Samples and measurements shall be representative of the volume and nature of the contained wastewater of the infiltration pond. In development, at minimum, the SOP manual must address or include the following:

- Vertical stratification (equal depth proportioned sample, representative of the infiltration pond's vertical profile);
- Establishment of a centroid sample location within the pond; and,

- Sample avoidance of the near-bottom and the near-surface of the pond.

The following documents may be referenced in development of the SOP manual:

- Guideline for Sampling at Still-Water Sites (USGS, 2006), or similar; and,
- Water Quality Monitoring (WHO, 1996), or similar.

A copy of the procedure manual shall be kept on site at all times. Upon modification, and prior to SOP implementation (Section VII), the permittee shall use best management practices in collecting effluent samples.

A report documenting development and implementation of the manual must be received by DEQ due on or before the 28th day of the month following the completion date. The respective completion and reporting dates are listed within Table 5. Any subsequent amended manuals must also be reported to DEQ.

VII. COMPLIANCE SCHEDULE

A compliance schedule is included to allow a reasonable opportunity for the permittee to attain compliance with permit requirements and to stay in compliance with the Water Quality Act and the Administrative Rules of Montana. The actions listed in Table 5 have been updated to reflect requirements as developed within this fact sheet and those retained from the 2012 permit. These actions must be completed on or before the respective scheduled completion date. A report documenting each respective action must be received by DEQ on or before the scheduled reporting date. The action and reporting due dates of the 2012 permit, have been adjusted due to the timing of this modification. Completion of all actions or deliverables must be reported to DEQ in accordance with Part II.D and Part IV.G of the permit.

Table 5: Compliance Schedule

Origin/Authority	Action	Freq.	Scheduled Completion Date of Action ⁽¹⁾	Scheduled Report Due Date ⁽²⁾
2012 Permit	Begin ground water quality monitoring of MW-2	Quarterly	December 01, 2012	Quarterly Monitoring Well DMRs
2012 Permit	Install and begin monitoring continuous effluent flow recording equipment	Single event	November 01, 2013	November 15, 2013 (2012 Permit, Part ILE.)
2012 Permit	Submit plan to install monitoring wells ⁽³⁾	Single event	March 31, 2015	April 28, 2015
ARM 17.30.1031	Develop (or update) and implement a Sampling Operation Procedure Manual.	Single event	<i>Within six months of the permit modification date</i>	<i>28th day of the month following action date.</i>
2012 Permit	Install monitoring wells	Single event	September 30, 2015	December 28, 2015
2012 Permit	Submit report documenting installation of monitoring wells. ⁽⁴⁾	Single event	November 30, 2015	December 28, 2015
2012 Permit	Begin ground water quality monitoring of MW-3 and MW-4	Quarterly	January 01, 2016	Quarterly Monitoring Well DMRs
2012 Permit	Submit information regarding the physical characterization of the aquifer	Single event	September 30, 2016	October 28, 2016

Footnotes:

- (1) The actions must be completed on or before the scheduled completion dates.
- (2) Reports must be received by DEQ on or before the scheduled report due dates. The reports must include all information as required for each applicable action as listed in the permit Part I.D. or Part I.E.
- (3) The completed plan or diagram (action), in place of a written report, must be received by DEQ on or before the scheduled "report" due date.
- (4) The written report documenting monitoring well installation, must include final location, drilling methods used, borehole lithologic log, well construction details, elevation of measuring point, and the depth to the top contact of the first ground water bearing zone.

VIII. NONSIGNIFICANT DETERMINATION

DEQ has determined that the activity is not considered to be a new or increased source resulting in a change of existing water quality occurring on or after April 29, 1993 (ARM 17.30.702). DEQ is therefore not required to conduct a significance determination (ARM 17.30.715). The applicable water quality standards for Class I ground water are summarized in Table 3. This permit includes monitoring, reporting, and corrective action requirements to establish, confirm, and maintain compliance with permit limitations.

IX. REFERENCES CITED

Administrative Rules of Montana, October 2012, Title 17, Chapter 30, Sub-chapter 5 – *Mixing Zones in Surface and Ground Water.*

Administrative Rules of Montana, October 2012, Title 17, Chapter 30, Sub-chapter 7 – *Nondegradation of Water Quality.*

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Prepared By: Chris Boe July 31, 2014

FIGURES

Figure 1

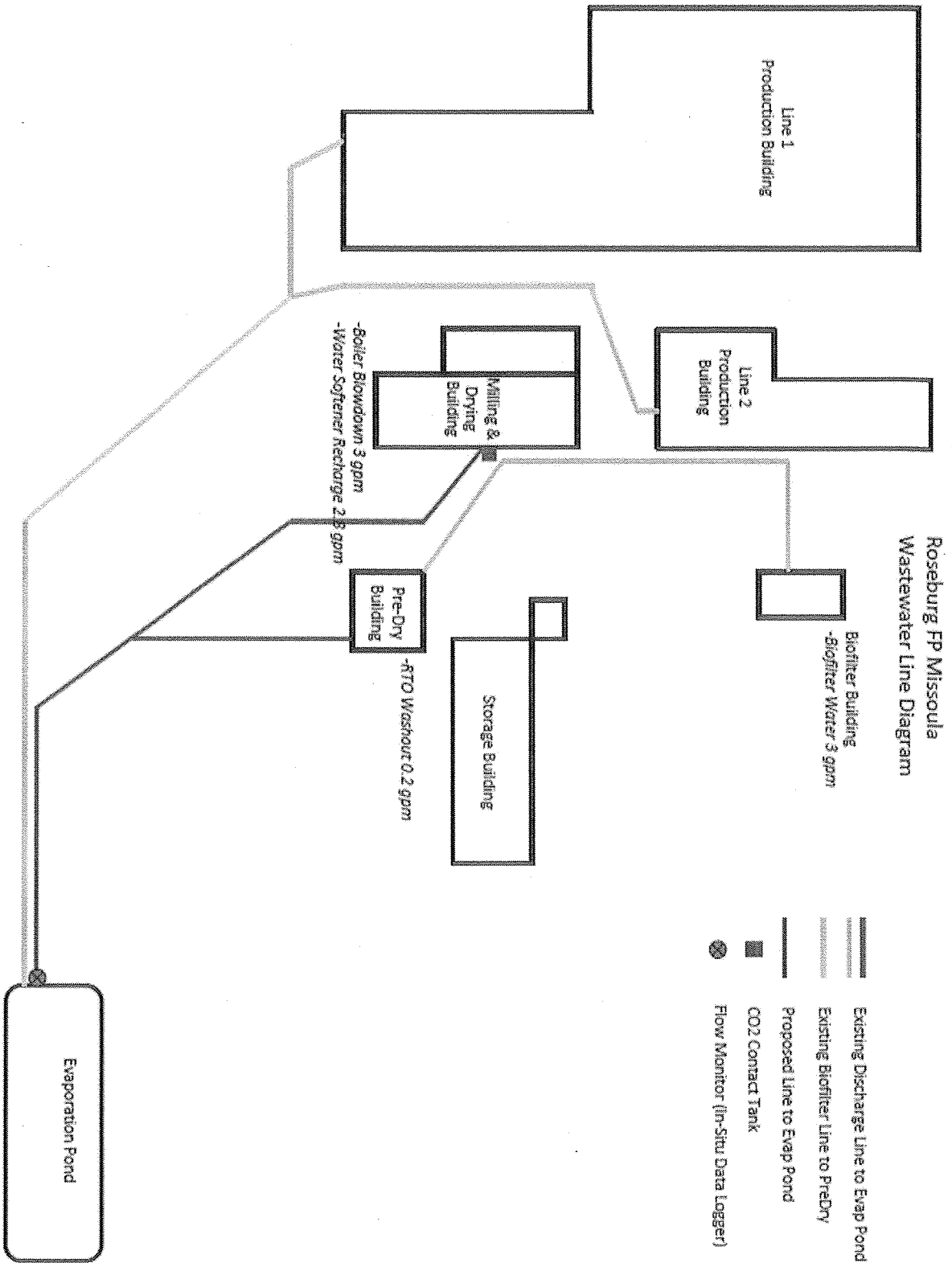
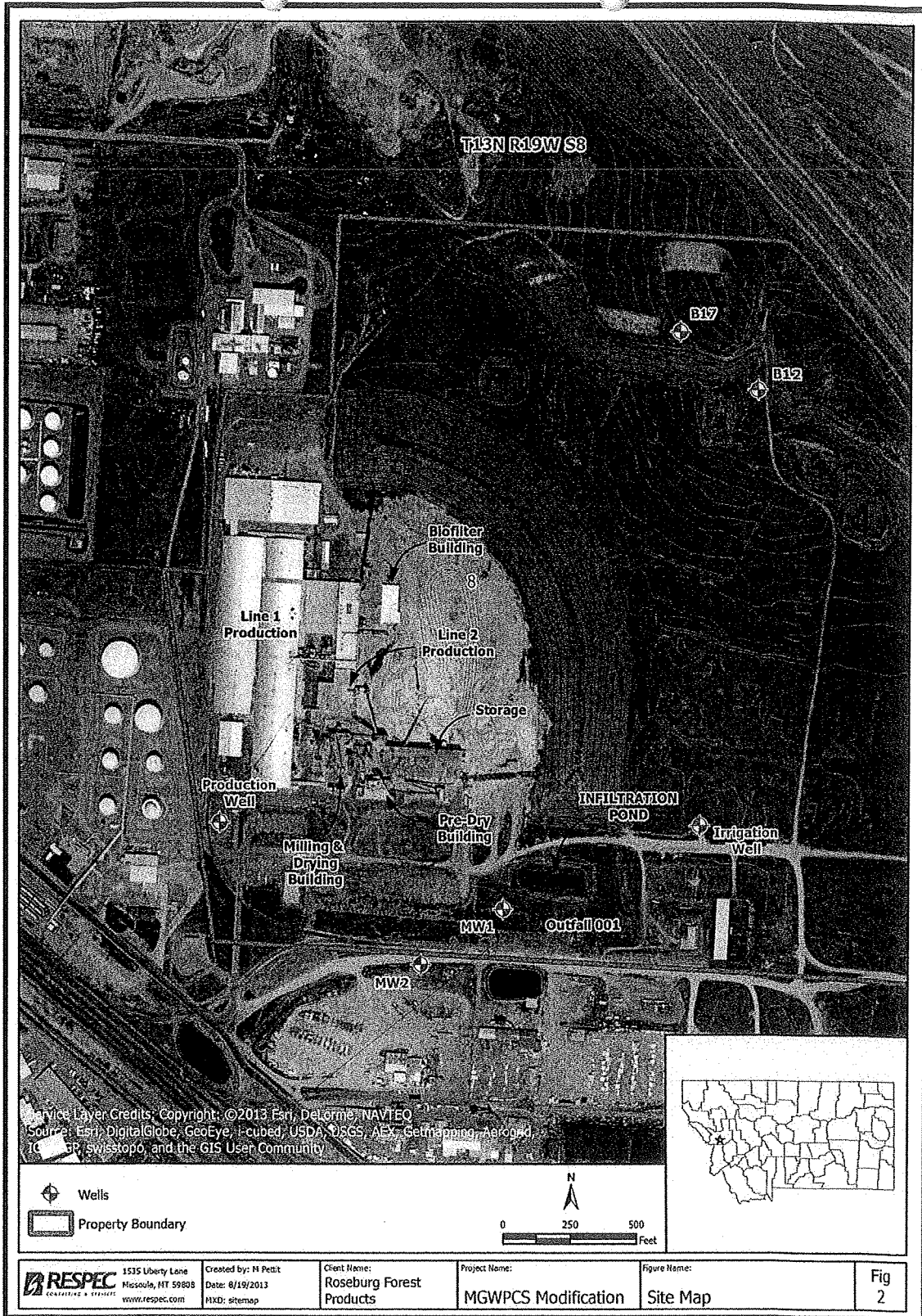


Figure 2

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APPENDIX I - ESTIMATED EFFLUENT QUALITY

Estimated Effluent Quality - Outfall 001					
Parameter	Location	Units	Projected Average Value	Projected Maximum Value	Source of Data
<i>Acid-Extractable Compounds⁽¹⁾</i>	EFF-001		ND	ND	App
Aluminum	EFF-001	mg/L	NR	NR	App
Antimony, Total	EFF-001	mg/L	NA	NA	App
Arsenic, Total	EFF-001	mg/L	0.001	0.002	App
Barium	EFF-001	mg/L	NR	NR	App
<i>Base-Neutral Compounds⁽¹⁾</i>	EFF-001		ND	ND	App
Benzene	EFF-001	mg/L	<0.0005	<0.0005	App
Beryllium, Total	EFF-001	mg/L	NA	NA	App
BOD ₅	EFF-001	mg/L	NR	NR	App
Cadmium, Total	EFF-001	mg/L	<0.001	<0.001	App
Chloride (as Cl)	EFF-001	mg/L	200	212	App
Chlorine, Total Residual	EFF-001	mg/L	NA	NA	App
Chromium, Total	EFF-001	mg/L	<0.01	0.01	App
Coliform, Total	EFF-001	col/100ml	NR	NR	App
Conductivity, Specific (25°C)	EFF-001	umhos/cm	1367	1466	App
Copper, Total	EFF-001	mg/L	0.014	0.036	App
Cyanide, Total	EFF-001	mg/L	0.016	0.024	App
Dissolved Solids, Total (TDS)	EFF-001	mg/L	609	773	App
Formaldehyde	EFF-001	mg/L	<0.25	<0.25	App
Iron, Total	EFF-001	mg/L	0.11	0.14	App
Lead, Total	EFF-001	mg/L	<0.0005	0.0008	App
Magnesium	EFF-001	mg/L	30	36	App
Manganese, Total	EFF-001	mg/L	0.03	0.04	App
Mercury, Total	EFF-001	mg/L	<0.0001	<0.0001	App
Nickel, Total	EFF-001	mg/L	<0.005	<0.005	App
Nitrogen, Ammonia (as N)	EFF-001	mg/L	26.42	52.95	App
Nitrogen, Kjeldahl, Total (TKN)	EFF-001	mg/L	60.3	61.9	App
Nitrogen, Nitrate + Nitrite (as N)	EFF-001	mg/L	6.86	17.69	App
Nitrogen, Total Inorganic (TIN)	EFF-001	mg/L	33.28	70.64	Calc
Nitrogen, Total (TN)	EFF-001	mg/L	67.2	79.6	Calc
Oil & Grease	EFF-001	mg/L	4.15	8.38	App
Oxygen, Dissolved	EFF-001	mg/L	NA	NA	App
pH	EFF-001	s.u.	NR	NR	App
Phenanthrene	EFF-001	mg/L	<0.0002	<0.0002	App
Phenol, Total (TRP)	EFF-001	mg/L	0.08	0.18	App
Phosphorus, Total (as P)	EFF-001	mg/L	0.14	0.21	App
Selenium, Total	EFF-001	mg/L	<0.001	<0.001	App
Silver, Total	EFF-001	mg/L	<0.001	<0.001	App
Sulfate	EFF-001	mg/L	NR	NR	App
Thallium, Total	EFF-001	mg/L	NA	NA	App
Toluene	EFF-001	mg/L	<0.001	<0.001	App
TPH	EFF-001	mg/L	NR	NR	App
Zinc, Total	EFF-001	mg/L	0.01	0.04	App
<i>VOC Parameters Group⁽¹⁾</i>	EFF-001		ND	ND	App

Footnotes:
App = Application Form GW-2 and/or supplemental materials.
BOD = Biochemical Oxygen Demand
EFF-001: Wier, just prior to infiltration pond.
ND = Not Detected
NA = Not Analyzed
NR = Not Reported
s.u. = standard units
TPH = Total Petroleum Hydrocarbons
TRP = Total Recoverable Phenolics (distilled).
VOC = Volatile Organic Compound
(1) List of additional analyzed parameters listed in MGWPCS Form GW-2, Section N, Version 1.1. Unless segregated and individually listed above, parameter has been reported as non-detect.

APPENDIX II - GROUND WATER QUALITY MONITORING RESULTS

Table L-1 Summary of Irrigation Well Analytical Data
Roseburg Forest Products

Summary of Irrigation Well Analytical Results							
Roseburg Forest Products-Missoula							
Conventional Pollutants	Units	Minimum Concentration	Maximum Concentration	Average Concentration	No. of Samples	Analytical Method	ML
pH	s.s.	7.3	7.6	7.5	5	AA500-H-8	0.1
Oxygen Demand, Biochemical (BOD)	mg/l					AS210 B	2
Oil & Grease (O&G), Sulfur Corrected	mg/l	<1	<1	<1	3	E166AA	1
Chlorine, Total Residual	not analyzed						
Total Coliforms/E. Coli (present)	not analyzed						
Dissolved Oxygen	not analyzed						
Nitrogen, Ammonia as N	mg/l	<0.1	<0.1	<0.1	3	E350.1	0.1
Nitrogen, Kjeldahl, Total as N	mg/l	<0.5	<0.5	<0.5	3	E351.1	0.5
Nitrogen, Nitrate Nitrite as N	mg/l	1.71	2.00	1.84	3	E353.1	0.2
Phosphorus, Total as P	mg/l	0.50	0.60	0.56	1	E365.1	0.1
Solids, Total Dissolved	mg/l	285	496	385	56	A2540 C	10
Conductivity @ 25 C	umhos/cm	659	810	752	1	A2510 B	5
Chloride	mg/l	14	18	15	1	E300.8	10
Iron, Dissolved	mg/l	<0.03	<0.03	<0.03	1	E300.8	0.03
Manganese, Dissolved	mg/l	<0.01	<0.01	<0.01	1	E300.8	0.010
Metals (Dissolved), Cyanide, Phenols and Hardness							
Arsenic	mg/l	<0.001	0.001	<0.001	2	E200.8	0.001
Cadmium	mg/l	<0.001	<0.001	<0.001	2	E200.8	0.001
Chromium	mg/l	<0.005	<0.005	<0.005	2	E200.8	0.005
Copper	mg/l	<0.005	<0.005	<0.005	2	E200.8	0.005
Lead	mg/l	<0.0005	<0.0005	<0.0005	2	E200.8	0.0005
Magnesium	mg/l	51	52	52	2	E200.7	1.000
Zinc	mg/l	0.02	0.02	0.02	2	E200.8	0.01
Cyanide	mg/l	<0.02	<0.02	<0.02	2	Volata mod.	0.02
Phenolics, Total Recoverable	mg/l	0.01	<0.01	0.01	2	E401.4	0.5
Formaldehyde	mg/l	<0.25	<0.25	<0.25	2	N3500d	0.25
Volatile Organic Compounds							
Acrylonitrile	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Benzene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Bromofens	ug/l	<0.5	<0.5	<0.5	1	E624	0.5
Carbon Tetrachloride	ug/l	<0.5	<0.5	<0.5	1	E624	0.5
Chlorobenzene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Chlorodifluoro-Methane	ug/l	<0.5	<0.5	<0.5	1	E624	0.5
Chloroethane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1-Chloro-2-Ethyl Ethyl Ether	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Chloroform	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Dichlorobromo-Methane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,1-Dichloroethane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,2-Dichloroethane	ug/l	<0.5	<0.5	<0.5	1	E624	0.5
Trans-1,2-Dichloro-Ethylene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,1-Dichloromethylene	ug/l	<0.5	<0.5	<0.5	1	E624	0.5
1,2-Dichloropropane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,3-Dichloro-Propylene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Ethylbenzene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Methyl Bromide	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Methyl Chloride	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Methylene Chloride	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,1,2,2-Tetrachloro-Ethane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Tetrachloro-Ethylene	ug/l	0.42	0.82	0.62	2	E624	0.5
Toluene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,1,1-Trichloroethane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
1,1,2-Trichloroethane	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Trichloroethylene	ug/l	<0.5	<0.5	<0.5	2	E624	0.5
Vinyl Chloride	ug/l	<0.5	<0.5	<0.5	2	E624	0.5

APPENDIX III - POLLUTANTS & PARAMETERS OF CONCERN

Pollutants & Parameters of Concern - Outfall 001.	
Parameter	Basis for Identifying as a Pollutant of Concern
Arsenic	Present
Copper	Present
Cyanide	Present
Lead	Present
Nitrogen, Total Inorganic	Present
Phenol, Total (TRP)	Present
Zinc	Present
TRP = Total Recoverable Phenolics (distilled).	

APPENDIX IV - REASONABLE POTENTIAL ANALYSIS

Reasonable Potential Analysis Summary - Outfall 001.										
Parameter	Units	WQS	Max.⁽¹⁾ Observed Effluent Conc. Value	# of Samples⁽²⁾	TSD Multiplier	Adjusted Effluent Conc. Value	Mixing Zone- Parameter Authorized?	Projected Pollutant Conc.	Limit Needed?	Reason
Arsenic	mg/L	0.010	0.002	5	2.31	0.005	N	0.005	N	Did not exceed WQS
Copper	mg/L	1.3	0.036	5	2.31	0.083	N	0.083	N	Did not exceed WQS
Cyanide	mg/L	0.20	0.024	5	2.31	0.055	N	0.055	N	Did not exceed WQS
Lead	mg/L	0.015	0.0008	5	2.31	0.002	N	0.002	N	Did not exceed WQS
Nitrogen Inorganic, Total	mg/L	10.0	70.6	5	2.31	163.1	Y	86.5	Y	Protection of Beneficial Uses
Phenol, Total (TRP)	mg/L	0.30	0.18	5	2.31	0.42	Y	0.22	N	Did not exceed WQS
Zinc	mg/L	2.0	0.04	5	2.31	0.09	N	0.09	N	Did not exceed WQS

Footnotes:
TSD = USEPA Technical Support Document For Water Quality-Based Toxics Control, EPA/505/2-90-001.
TRP = Total Recoverable Phenolics, Phenol
WQS = Water Quality Standard
Projected pollutant concentration includes dilution when authorized within mixing zone.
Beneficial Uses: ARM 17.30.1006
(1) Appendix I
(2) Form GW-2, Section N and supplemental materials.

APPENDIX V - EFFLUENT MONITORING AND REPORTING REQUIREMENTS

Effluent Monitoring and Reporting Requirements - Outfall 001							
Parameter /Code/Method	Monitor Location	Units	Sample Type	Minimum Sample Frequency	Reporting Requirements ⁽¹⁾⁽²⁾	Report Freq.	Rationale
Antimony, Dissolved /01095	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Arsenic, Dissolved /01000	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Beryllium, Dissolved /01010	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Calcium, Dissolved /00915	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
Chloride (as Cl) /00940	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Chlorine, Total Residual /50060	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Coliform, Total /74058	EFF-002	CFU/100m	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Copper, Dissolved /01040	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Cyanide, Dissolved /00723	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Dissolved Solids, Total (TDS)/70296	EFF-002	mg/L	Depth Integrated	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Flow Rate, Effluent	FM-002	gpd	Continuous	Continuous	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Formaldehyde/71880	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
Iron, Dissolved /01046	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Lead, Dissolved /01049	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Magnesium, Dissolved /00925	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
Nitrogen, Ammonia, Total (as N)/51446	EFF-002	mg/L	Depth Integrated	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Permit Compliance Effluent Characterization
Nitrogen, Kjeldahl, Total (TKN)/51449	EFF-002	mg/L	Depth Integrated	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Nitrogen, Nitrate + Nitrite (as N)/51450	EFF-002	mg/L	Depth Integrated	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Permit Compliance Effluent Characterization
Nitrogen, Total (as N) ⁽³⁾ /51425	EFF-002	mg/L	Calculate	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Nitrogen, Inorganic Total (as N) ⁽⁴⁾ /00640	EFF-002	mg/L	Calculate	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Permit Compliance Effluent Characterization
Oil & Grease (1664A, HEM)	EFF-002	mg/L	Depth Integrated	1/Quarter	Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Permit Compliance
Oxygen, Dissolved (DO) /00300	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Oxygen, Chemical Demand (COD)/80108	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
pH	EFF-002	s. u.	Depth Integrated-Instantaneous	1/Quarter	Daily Minimum ⁽⁵⁾ Daily Maximum Quarterly Average	Quarterly	Current Permit Requirement Permit Compliance
Phenol (TRP) (distillation)/70029	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
Phosphorus, Total (as P) /51426	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
Sodium, Dissolved/00930	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement
Specific Conductivity	EFF-002	µS/cm	Depth Integrated-Instantaneous	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization
Thallium, Dissolved /01057	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Effluent Characterization
Zinc, Dissolved /01090	EFF-002	mg/L	Depth Integrated	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement Effluent Characterization

Footnotes:
EFF-001: End of pipe, just prior to discharge to infiltration pond (2012 permit).
EFF-002: Infiltration pond, near the centroid location of the pond as established within the Sampling Operation Procedure Manual (Section VI). Prior to the manual's report due date (Table 5) the permittee shall use best management practices in collection of effluent samples.
FM002: In-situ data logger. Located near end of pipe, just prior to discharge to infiltration pond.
Depth Integrated Sample Type: A depth proportioned sample shall be collected in accordance with the Sampling Operation Procedure Manual (Section VI). Prior to development of the manual, the permittee shall use best management practices.
Dissolved: Metal parameters will be analyzed using the dissolved portion (0.45 micron filter), ARM 17.30.100(6).
If no discharge occurs during the reporting period, "no discharge" must be recorded on the effluent (outfall) LMR reports.
Parameter analytical methods shall be in accordance with the Code of Federal Regulations, 40 CFR Part 136, unless specified above.
CFU= colony forming units
s.u. = standard units
TRP = Total Recoverable Phenolics (distilled)
(1) See definitions in Part V of the permit
(2) Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report (DMR).
(3) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.
(4) Total Inorganic Nitrogen is the sum of Nitrate + Nitrite and Ammonia.
(5) Daily Minimum: Report lowest measured daily value for the reporting period on Discharge Monitoring Report (DMR).

APPENDIX VI - GROUND WATER MONITORING AND REPORTING REQUIREMENTS

Ground Water Monitoring and Reporting Requirements - MW-2						
Parameter /Code/Method	Location	Units	Sample Type ⁽¹⁾	Minimum Sampling Frequency	Reporting ⁽¹⁾ Requirements	Reporting Frequency
Arsenic, Dissolved /01000	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Chloride (as Cl) /00940	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Copper, Dissolved /01040	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Cyanide, Dissolved /00723	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Dissolved Solids, Total (TDS) /70296	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Iron, Dissolved /01046	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Lead, Dissolved /01049	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Manganese, Dissolved /01056	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Ammonia, Total (as N) /51446	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Kjeldahl, Total (TKN) /49579	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Nitrate + Nitrite (as N) /51450	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Total (as N) ⁽²⁾ /51425	MW-2	mg/L	Calculate	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Inorganic Total (as N) ⁽³⁾ /00640	MW-2	mg/L	Calculate	1/Quarter	Quarterly Average	Quarterly
Oil & Grease (1664A, HEM)	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Oxygen, Dissolved /00300	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
pH	MW-2	s.u.	Instantaneous or Grab	1/Quarter	Daily Minimum ⁽⁴⁾ Daily Maximum Quarterly Average	Quarterly
Phenol (TRP) /32730/(distillation)	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Phosphorus, Total (as P) /00665	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Specific Conductivity	MW-2	µS/cm	Instantaneous or Grab	1/Quarter	Quarterly Average	Quarterly
Static Water Level (SWL) ⁽⁵⁾	MW-2	ft-bmp	Instantaneous	1/Quarter	Quarterly Average	Quarterly
Zinc, Dissolved /01090	MW-2	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly

Footnotes:

At no time shall the permittee report "no discharge" on any monitoring well DMR report.

MW-2 is located at end of mixing zone, possible second water bearing zone at 57.5 feet in depth.

Parameter analytical methods shall be in accordance with the Code of Federal Regulations, 40 CFR Part 136, unless specified above.

Dissolved: Metal parameters will be analyzed using the dissolved portion (0.45 micron filter), ARM 17.30.1006(6).

ft-bmp = feet below measuring point

s.u. = standard units

TRP = Total Recoverable Phenolics (distilled)

(1) See definitions in Part V of the permit.

(2) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.

(3) Total, Inorganic Nitrogen is the sum of Nitrate + Nitrite and Ammonia.

(4) Daily Minimum: Report lowest measured daily value for the reporting period on Discharge Monitoring Report (DMR).

(5) Measuring point (point of reference) for SWL measurements shall be measured to within 1/100th of one foot.

Ground Water Monitoring and Reporting Requirements - MW-3, and MW-4, Separately

Parameter /Code/Method	Location	Units	Sample Type ⁽¹⁾	Minimum Sampling Frequency	Reporting ⁽¹⁾ Requirements	Reporting Frequency
Arsenic, Dissolved /01000	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Chloride (as Cl) /00940	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Copper, Dissolved /01040	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Cyanide, Dissolved /00723	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Dissolved Solids, Total (TDS) /70296	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Iron, Dissolved /01046	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Lead, Dissolved /01049	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Manganese, Dissolved /01056	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Ammonia, Total (as N) /51446	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Kjeldahl, Total (TKN) /49579	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Nitrate + Nitrite (as N) /51450	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Total (as N) ⁽²⁾ /51425	MW-3 MW-4	mg/L	Calculate	1/Quarter	Quarterly Average	Quarterly
Nitrogen, Inorganic Total (as N) ⁽³⁾ /00640	MW-3 MW-4	mg/L	Calculate	1/Quarter	Quarterly Average	Quarterly
Oil & Grease (1664A, HEM)	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Oxygen, Dissolved /00300	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
pH	MW-3 MW-4	s.u.	Instantaneous or Grab	1/Quarter	Daily Minimum ⁽⁴⁾ Daily Maximum Quarterly Average	Quarterly
Phenol (TRP) /32730/(distillation)	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Phosphorus, Total (as P) /00665	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly
Specific Conductivity	MW-3 MW-4	µS/cm	Instantaneous or Grab	1/Quarter	Quarterly Average	Quarterly
Static Water Level (SWL) ⁽⁵⁾	MW-3 MW-4	ft-bmp	Instantaneous	1/Quarter	Quarterly Average	Quarterly
Zinc, Dissolved /01090	MW-3 MW-4	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly

Footnotes:

At no time shall the permittee report "no discharge" on any monitoring well DMR report.

MW-3 is to be located on downgradient edge of mixing zone and constructed in the shallow (first receiving) water bearing zone.

MW-4 is to be located upgradient of infiltration pond and constructed in the shallow (first receiving) water bearing zone.

Parameter analytical methods shall be in accordance with the Code of Federal Regulations, 40 CFR Part 136, unless specified above.

Dissolved: Metal parameters will be analyzed using the dissolved portion (0.45 micron filter), ARM 17.30.1006(6).

ft-bmp = feet below measuring point

s.u. = standard units

TRP = Total Recoverable Phenolics (distilled)

(1) See definitions in Part V of the permit.

(2) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.

(3) Total, Inorganic Nitrogen is the sum of Nitrate + Nitrite and Ammonia.

(4) Daily Minimum: Report lowest measured daily value for the reporting period on Discharge Monitoring Report (DMR).

(5) Measuring point (point of reference) for SWL measurements shall be measured to within 1/100th of one foot.