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M E M O R A N D U M

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SUBJECT: **Staff Analysis for Draft Wastewater Reuse Permit WRU M-0012-02 (Municipal Wastewater) – City of St. Maries**

Table of Contents

1.0 Purpose 2
2.0 Summary of Events 2
3.0 Project Description 2
4.0 Discussion 4
4.1 Hydraulic Management Unit Configuration 4
4.2 Soils 5
4.3 Ground Water 6
4.4 Surface Water 6
4.5 Wastewater Flows and Constituent Loading Rates 8
4.6 Buffer Zones and Site Management 12
4.7 Compliance Activities 13
5.0 Conclusions 14
5.1 Loading Rate Recommendations 14
5.2 Monitoring Recommendations 15
5.3 Other Recommendations 15
6.0 References Cited 15
7.0 Appendices 18
7.1 IWR Formulation Methodology 18
7.2 Site Map Showing Buffer Distances 20
7.3 2002 Staff Analysis Memo 22

1.0 Purpose

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400.05 (*Recycled Water Rules*) for processing wastewater recycled water permit applications. This memorandum states the principal facts and significant questions considered in preparing the draft permit conditions, and a summary of the basis for approval with references to applicable requirements and supporting materials.

2.0 Summary of Events

The City of St. Maries received its original wastewater land application permit in 1988. The original permit was administratively extended through 1996 as well as each year from 1996 to 2002. The city currently continues to operate under the conditions of the permit issued on May 5, 1989. The city submitted an application for permit renewal in January 2002. Draft Permit LA-000012-02 was issued for public comment on July 22, 2002; however; the draft permit was not finalized and/or officially issued. The Department of Environmental Quality (DEQ) received a new application for re-permit on April 17, 2008 and determined the application incomplete on June 26, 2008. The application was then re-submitted by the permittee and received by DEQ on April 29, 2009. It is recommended that the new draft recycled water permit be labeled as WRU M-0012-02 to replace the draft that was not finalized.

3.0 Project Description

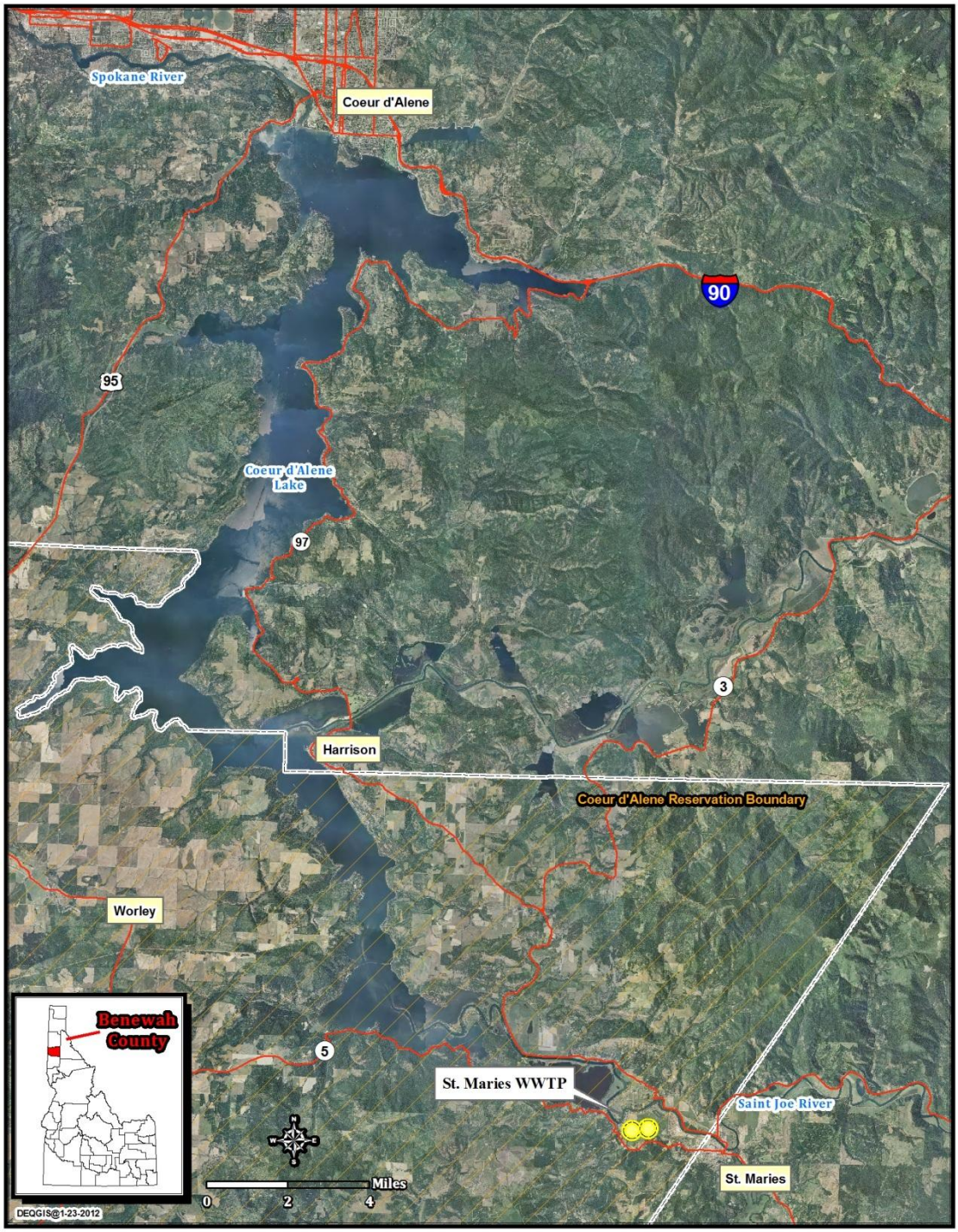
The City of St. Maries (City) operates a municipal wastewater treatment facility in St. Maries, Idaho, Benewah County, approximately 30 miles southeast of Coeur d'Alene, Idaho. The facility treats wastewater generated by residences and businesses within the City limits and the surrounding area of Benewah County. The City disposes of treated wastewater through irrigation during the growing season and discharges treated wastewater to the St. Joe River under a National Pollutant Discharge Elimination System (NPDES) permit (ID-002279-9) during the non-growing season (November 1 to June 30). The recycled water irrigation fields and treatment plant are located within the boundaries of the Coeur d'Alene Reservation, as shown in Figure 1.

The design maximum flow of the treatment facility is 0.6 million gallons per day (MGD) during dry weather conditions and 0.8 MGD during wet weather conditions. Treatment facilities are located at two sites on the north side of the City. The raw wastewater is collected through the City sewer collection system and treated in two- 23.5 million-gallon (MG) primary facultative lagoons located on the north side of the St. Joe River. A transfer station located near the primary lagoons pumps lagoon effluent across the river to the second treatment site. Facilities on the south side of the river include a pump house and chlorination room, a chlorine contact chamber, a 39 MG settling/polishing lagoon, and irrigation fields.

Chlorinated effluent is disposed of by means of slow rate land application (irrigation) on 175 acres planted with forage crops. Irrigation is accomplished via two center pivot sprinkler systems each irrigating an area of approximately 87.5 acres. Past crops grown at this site include grass hay, oats, and peas. The current permit allows the City to irrigate between July 1st and October 31st of each year.

The City discharges wastewater to the St. Joe River during the non-growing season (November 1st through June 30th of each year) and operates under NPDES permit ID-002279-9. The permit was issued on October 1, 2007 and will expire at midnight on September 30, 2012.

Figure 1: Vicinity Map



The 2010 Annual Report indicates that 100 tons (1.14 tons/acre) of grass hay were harvested from the east pivot and about 50 tons (0.57 tons/acre) of grass hay were harvested from the west pivot. The 2010 Annual Report indicated that there were several factors that inhibited production on these fields, the foremost being an unusually wet growing season. Other factors included equipment malfunction, and pesticide applications on the fields without the City's or farmer's knowledge. Table 1 below compares crop yields from the City reuse site to reported yields from similar crops grown in Kootenai County. The USDA National Agricultural Statistics Service (NASS) website did not contain crop yield information for Benewah County however; information for several Kootenai County crop yields is listed. Information for grass hay yields was not available therefore alfalfa yields were compared as the closest related crop to hay.

Table 1: 2010 Crop Yields

2010 East Pivot Yield (tons/acre)	2010 West Pivot Yield (tons/acre)	2010 Kootenai Co. Yield* (tons/acre)
1.14	0.57	3.2**

*Kootenai County information obtained from NASS website www.nass.usda.gov
**yield for alfalfa

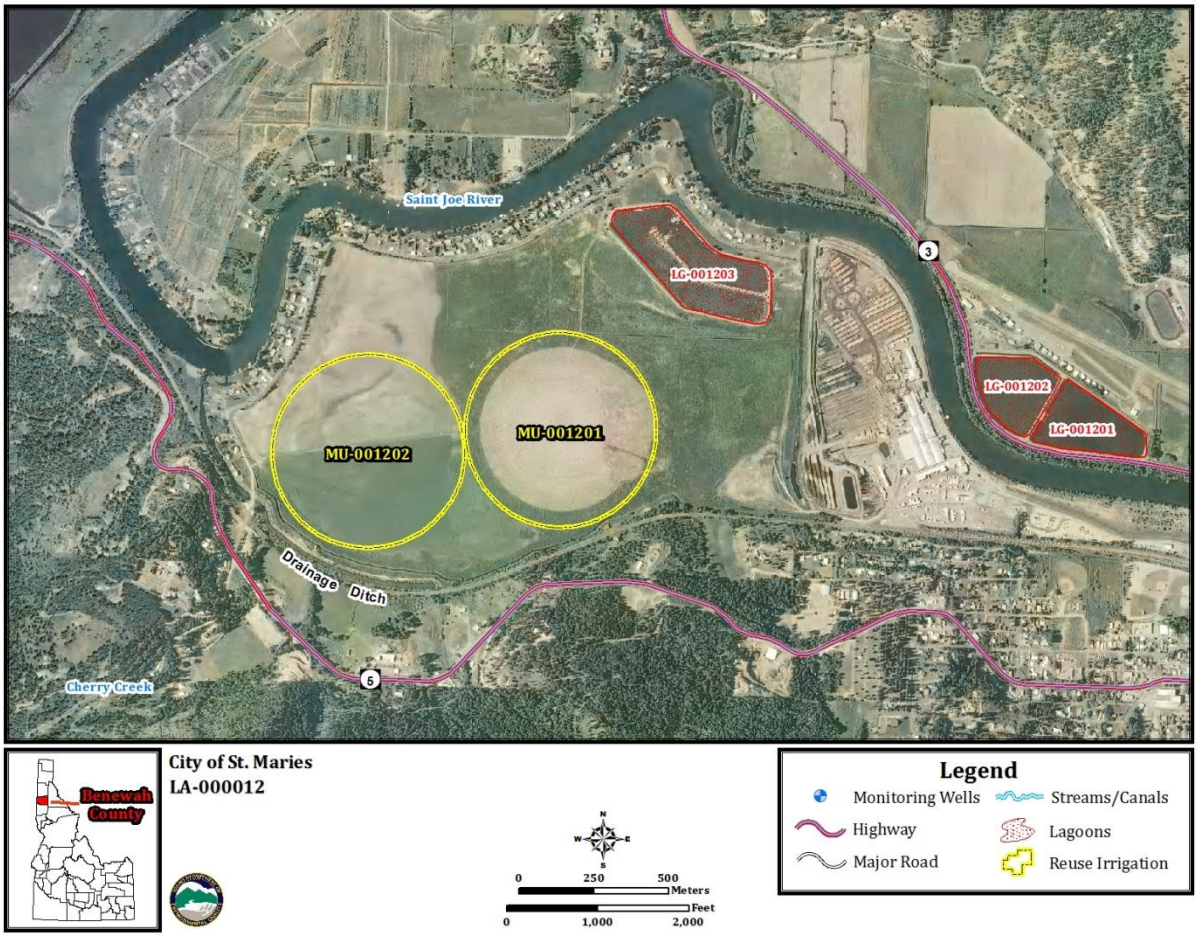
4.0 Discussion

4.1 Hydraulic Management Unit Configuration

The irrigation site consists of two hydraulic management units (HMUs) located south of the St. Joe River and southwest of the polishing lagoon and treatment plant as shown in Figure 2. Two (2) center pivot sprinklers are used to irrigate the two (2) 87.5-acre fields. The irrigation system is considered to be "center pivot" for the purpose of characterizing the irrigation efficiency in Appendix 7.1. No changes to the current irrigation system were proposed by the permittee.

The two fields have tile underdrain systems constructed by the Army Corps of Engineers underlying a portion of each field. The underdrain systems drain shallow ground water which allows the fields to be utilized for agriculture (See Figure 3). The underdrain system underlies the southern half of each pivot site and consists of 60 lengths of 4-inch perforated pipe spaced every 75 feet and oriented north to south. The pipes are buried approximately forty-two (42) inches below ground surface and discharge to a collection ditch along the south end of the irrigation fields which enters Cherry Creek. The underdrain system currently represents a potential short-circuit for the irrigated wastewater to end up in the local surface water (Cherry Creek). Piezometers were placed at two locations in each field in July of 2011 to allow City staff to monitor groundwater levels prior to irrigation. Sections 4.3 and 4.4 of this report include further discussion of the underdrains and piezometers.

Figure 2: City of St. Maries Wastewater Treatment Plant and Irrigation Sites



4.2 Soils

The soils at the land application area are classified by the United States Department of Agriculture National Resource Conservation Service as Ramsdell-DeVoignes, with 60% consisting of Ramsdell silt loam and 35% DeVoignes silt loam. Both soil types are deep and poorly drained with a tendency for seasonally high water tables. An organic (sapric) layer exists at the 9 to 24-inch depth, which has a much lower permeability (0.06 – 0.2 inches per hour) than the 0 to 9-inch depth, which has a permeability of 0.6 – 2.0 inch per hour. The land application site is nearly level with a slope of 0 to 2%. Soil characteristics have not been altered over the last permit cycle.

Under the current permit, the permittee is not required to perform soil monitoring. The permittee has requested that no soil monitoring be required by the new permit. While the permitee's request has been taken into consideration, staff recommends that soil sampling be implemented in the draft permit at a frequency of twice per year (spring and fall) for the full permit cycle to establish baseline data for the site and show any nutrient accumulation trends from irrigation practices. Soil sampling would also be an effective tool for determining nutrient uptake efficiency by the crop and may help establish adequate nutrient loading rates in future permits.

Staff recommends that the site be sampled for electrical conductivity, nitrate-N, pH, ammonia-N, total phosphorus and plant-available phosphorus. Current guidance suggests that ten (10) soil sample locations be selected for each soil management unit (SMU). Three samples are to be collected at each location, one at 0 to 12 inches, one at 12 to 24 inches and other at 24 to 36 inches or refusal. The samples collected at each depth are composited to yield three (3) samples for each SMU.

The data generated will provide baseline data for future operations. Discussion of the results for each year and a comparison to preceding years' data is expected to be included in the annual report submitted each year. This discussion should include evaluation of any apparent trends in the data.

4.3 Ground Water

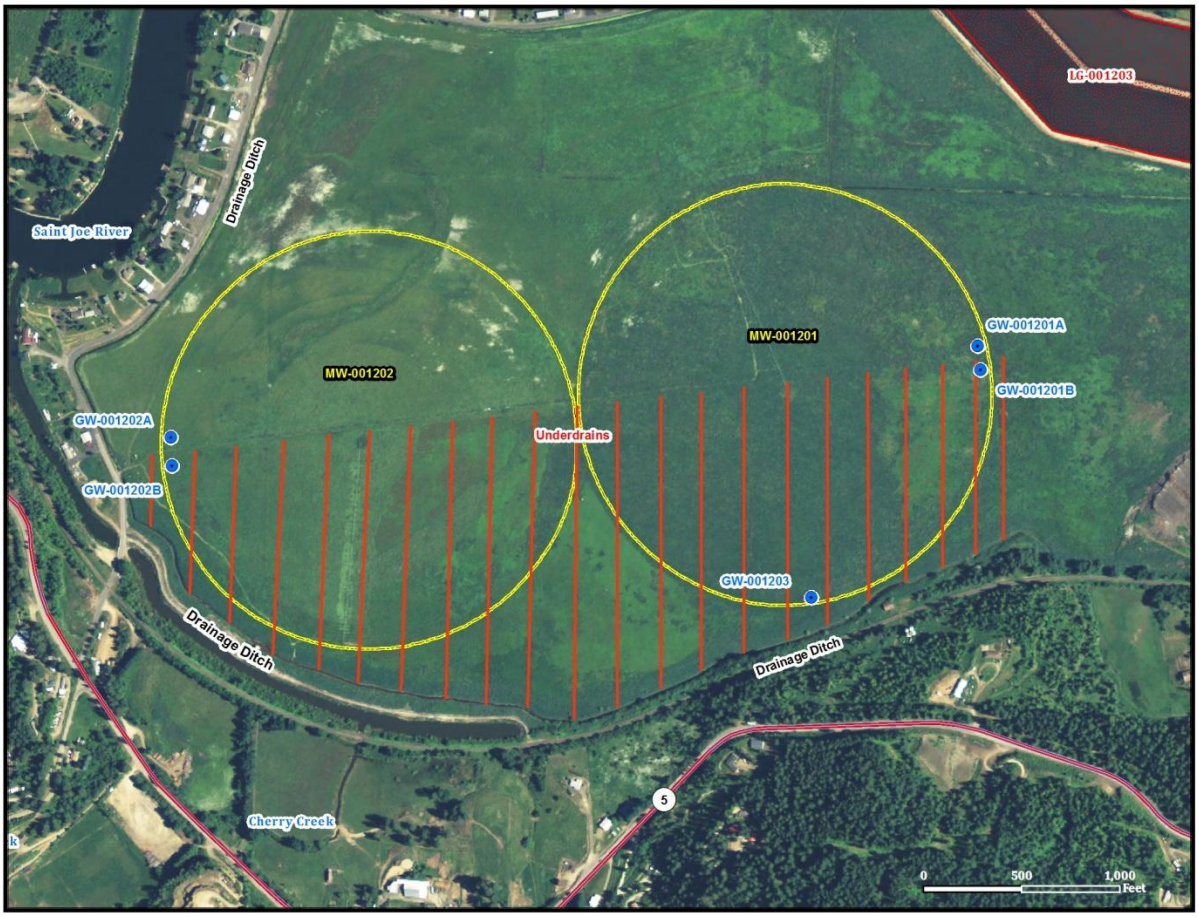
Based on the current regulatory boundaries of the Spokane Valley-Rathdrum Prairie Aquifer (SVRPA), ground water under the site is not part of SVRPA.

The current permit does not require ground water monitoring at the irrigation site. Based on ground water well logs for wells near the site, ground water is estimated to be between three (3) and one hundred eighty (180) feet below the site. City staff recently installed two piezometers at each hydraulic management unit (HMU) to measure the approximate depth to shallow ground water (see Figure 3). For each HMU, one piezometer is located in the portion of the unit with the underdrain system (GW-001201B and GW-001202B) and one where there is no underdrain (GW-001201A and GW-001202A). Additionally, a sampling station was installed to allow the operator to collect samples directly from the underdrain. Figure 3shows the configuration of the field underdrains, piezometer locations, and location of the sample station (GW-001203). Staff recommends that the depth to ground water must be at least three (3) feet from the ground surface as measured in both piezometers before irrigation could occur in a HMU. The three-foot distance to groundwater in conjunction with hydraulic loading rates that match the crop irrigation water requirements should allow for proper utilization of nutrients in the wastewater by the crop and prevent any nutrients from reaching the groundwater. In addition, Staff recommends that total phosphorous, nitrate, nitrite, and Total Kjeldahl Nitrogen (TKN) samples be collected from the underdrain sampling location once annually prior to starting irrigation and monthly when irrigating. No other ground water monitoring will be required.

4.4 Surface Water

The St. Joe River runs east to west approximately 150 feet from the north edge of the irrigation site, with Cherry Creek and its associated drainage ditch running along the southwestern edge of the site; Lake Coeur d'Alene is approximately five (5) miles to the northwest. Water from the underdrains discharges to a drainage ditch and is then pumped into Cherry Creek.

Figure 3: City of St. Maries Irrigation Sites



The current permit requires the operator to sample water from the drainage ditch. A sampling point (SW-001201) is located in the pump house that pumps water from the drainage ditch to Cherry Creek. Data from sampling of the underdrain from 2008 through 2010 are shown in Table 2 below along with the associated wastewater sampling data. The data shows elevated concentrations of nitrogen and phosphorous in the water being pumped into Cherry Creek. While the data does not rule out a possible contribution from the irrigated wastewater to the water being pumped from the ditch to Cherry Creek, it is not possible to distinguish the source of the nutrients because of the multiple sources of nutrients influencing the ditch (field underdrains, wetlands vegetation decomposition, and potential log deck runoff from the Potlatch Mill located to the east of the irrigation site). During discussions with the operator, he explained that water is only pumped from the drainage ditch to Cherry Creek to collect samples and that if not for the sampling, it would not be necessary to pump the ditch to Cherry Creek during the irrigation season. Staff recommends that no further sampling be required from the pump house sampling point (SW-001201). Discontinuing sampling from the pump house would prevent water with high nutrient concentrations from being pumped into Cherry Creek.

As discussed in Section 4.3, Staff recommends that the irrigation fields underdrain sampling location (GW-001203 - *see Figure 3*) be monitored for total phosphorous, nitrate, nitrite, and Total Kjeldahl Nitrogen (TKN) once annually prior to starting irrigation and monthly when irrigating in lieu of sampling from the ditch water discharged to Cherry Creek. The underdrain sampling location would better represent the contribution, if any, of nutrients to the drainage ditch from the irrigation site. The annual sample taken prior to commencing irrigation would give background levels of nutrients naturally occurring in the ground water.

Table 2 Monitoring Data Comparison for Wastewater (WW) and Underdrain (Cherry)

(mg/L)	TKN		Nitrate+Nitrite		Phosphorus	
Sample Date	WW	Cherry	WW	Cherry	WW	Cherry
7/18/2008	1.42	3.46	0.189	<0.0500	1.93	0.33
8/21/2008	2.13	10.5	0.159	<0.0500	1.66	1.39
9/16/2008	1.59	1.10	0.128	<0.0500	2.67	0.14
10/23/2008	3.15	0.66	0.314	0.071	2.11	0.15
7/15/2009	1.53	5.37	0.0893	<0.0500	1.48	0.76
8/13/2009	1.80	0.876	<0.0500	<0.0500	2.08	0.10
9/10/2009	3.54	0.86	0.0851	0.0523	1.68	0.07
10/14/2009	5.16	19.2	0.395	0.544	2.42	3.11
7/14/2010	6.11	<2.50	0.580	<0.0500	0.18	1.41
8/4/2010	3.74	1.65	0.473	<0.0500	2.64	0.26
9/2/2010	7.83	1.40	<0.0500	<0.0500	2.45	0.20
10/6/2010	4.73	3.40	0.0884	<0.0500	2.45	0.55
Maximum	7.83	19.2	0.580	0.544	2.67	3.11
Minimum	1.42	0.66	<0.0500	<0.0500	0.18	0.07
Mean	3.561	4.248	0.217	0.093	2.063	0.706
Median	3.345	2.075	0.144	<0.0500	2.265	0.295

4.5 Wastewater Flows and Constituent Loading Rates

Discussed below are the wastewater flow rates and rationale for constituent and hydraulic loading rates appearing in the proposed permit.

4.5.1 Wastewater Flows

From data supplied in the 2008-2010 annual reports, influent to the treatment plant has ranged from 279.0 million gallons (MG) in 2010 to 347.8 MG in 2008. NPDES discharge has ranged from 170.4 MG in 2010 to 191.3 in 2009 and discharge to the reuse site has ranged from 18.3 MG in 2008 to 35.9 MG in 2009 over the same period. A rough water balance of inflow minus outflow for each of the last three years shows a difference (unaccounted losses) of 142.3 MG in 2008, 92.4 MG in 2009 and 75.7 MG in 2010. No estimate is available for the evaporation or seepage rate from the lagoons. Staff recommends a complete water balance be prepared to evaluate the difference between wastewater discharged or irrigated and influent volumes (see Section 4.7.3).

4.5.2 Loading Rates

The sections below discuss proposed constituent loading rates, including nitrogen, total dissolved solids, hydraulic, chemical oxygen demand (COD), and phosphorus. Recommended loading rates for inclusion into Section F of the renewal permit are also discussed.

4.5.2.1 Nitrogen Management and Loading Rates

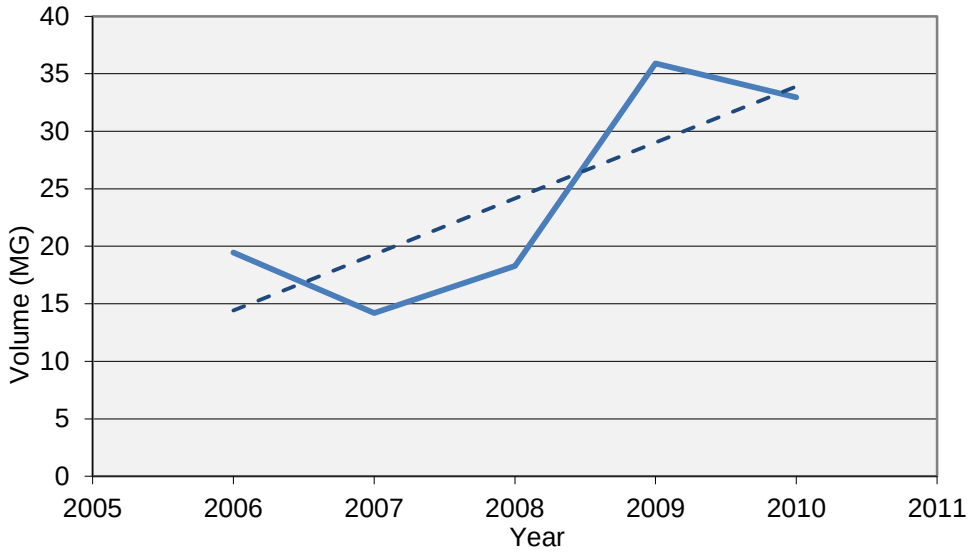
According to the permittee's annual reports for the period 2008 to 2010, total nitrogen applied to the entire irrigation site has ranged between 4.15 lbs/acre in 2008 to 18.8 lbs/acre in 2010 and these loading practices do not appear to have been detrimental to the site. The current permit does not contain a nitrogen-loading rate. Staff recommends that a limit of "150% of Typical Crop Uptake or UI Fertility Guide" be included in the draft permit. "Typical Crop Uptake" is defined as the median constituent crop uptake from the three (3) most recent years the crop has been grown. It is determined for each HMU separately. For new crops having less than three years of on-site uptake data available, typical nutrient content values or other values approved by DEQ may be used to calculate the uptake.

The permittee has used hay, feed peas, and oats over the last few seasons to remove entrenched weeds and beneficially use the nutrients in the effluent from the treatment plant. For the next permit cycle, the permittee intends to grow hay exclusively on both management units. Staff recommends that the permittee perform crop tissue sampling of all crop harvests from the site.

4.5.2.2 Hydraulic Loading Rates

From 2006 to 2010, the permittee has irrigated between 14.2 MG and 35.9 MG to the irrigation fields. Figure 4 shows hydraulic loading reported by the permittee for these years.

Figure 4 St. Maries site-wide historical wastewater loading (2006 – 2010).



Growing season hydraulic loading should be substantially equal to the irrigation water

requirement (IWR) for the crop grown on the site. Evapotranspiration (ET) data were taken from the University of Idaho Research and Extension Center at Kimberly, Idaho website (http://www.kimberly.uidaho.edu/ETIdaho/) for the Saint Maries and Coeur d'Alene Stations. As discussed in Section 4.5.2.1 above, the permittee has grown hay, peas and oats on the site to beneficially use the wastewater. Only hay will be grown on the irrigation fields during the next permit cycle. "Grass Hay" values have been used to calculate an IWR for the hay. The site irrigation system consists of two center pivots, one on each management unit as described in Section 4.4. From Table 4-12 of the Guidance (DEQ, 2007), the irrigation system efficiency was estimated to be 75% for low-pressure center pivots. Using these approximations, the permittee loadings were calculated to give the sprinkler system growing season values in Table 3 for each month. For a more complete description of the process used to derive the irrigation rates, see Appendix 7.1.

Table 3 Grass Hay IWR[1] for St. Maries

	Grass Hay	
	Acre-in/acre	**Gallons/acre[2]**
April	1.69	45,800
May	4.31	117,100
June	4.96	134,700
July	5.00	135,900
August	3.82	103,800
September	2.16	58,600
October	0.13	3,500
Total	**22.07**	**599,400**

[1] Based on precipitation deficit data from http://www.kimberly.uidaho.edu/ETIdaho/ for the Saint Maries and Coeur d'Alene stations.
[2] Based upon conversion factor of 27,154 gallons per acre-inch.

As shown in Figures 5 and 6 below, site hydraulic loading has not always been in accordance with IWR for the various crops. Figure 5 shows that the calculated IWR for hay is significantly less than the historical October loading on the East Pivot. Figure 6 shows that the loading of the West Pivot significantly exceeded the IWR for the crops grown (peas and oats) in September and October.

In both cases, the crop water needs at the end of the growing season are significantly less than the volume of reuse water being applied. The permittee is encouraged to apply their wastewater in accordance with the general trend of the IWR, with the majority of the water applied during the warmer, summer months and smaller volumes applied at the beginning and end of the growing season. Irrigating at rates substantially less than the IWR, or deficit irrigation, can increase the salt content of the soil by reducing leaching below the necessary leaching requirements. Deficit irrigation may result in reduced crop yield and reduced nutrient uptake. Irrigating above the IWR increases leaching through the root zone thereby increasing transport of constituents to ground water (or in the case of St Maries, through the underdrains). Staff recommends that hydraulic loading rates be substantially equal to the IWR values listed in Table 3.

Figure 5 Comparison of HLR to IWR for St. Maries East Pivot (2008 - 2010)

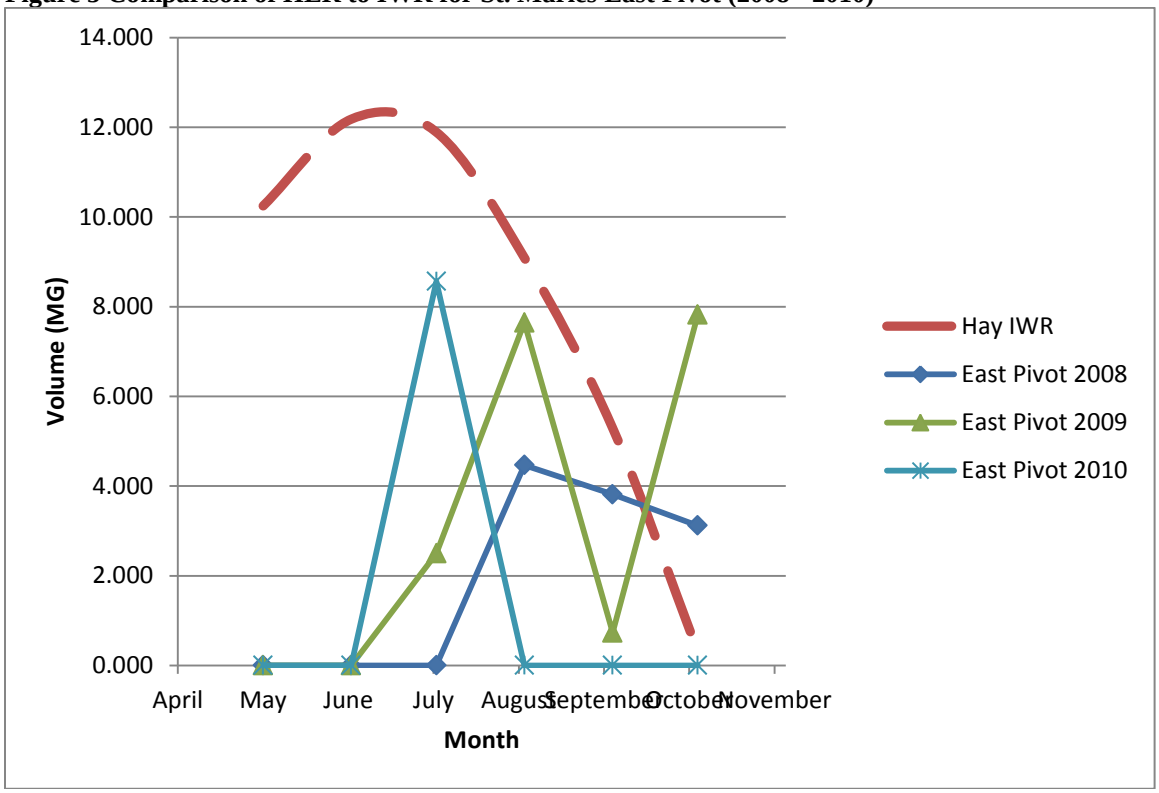
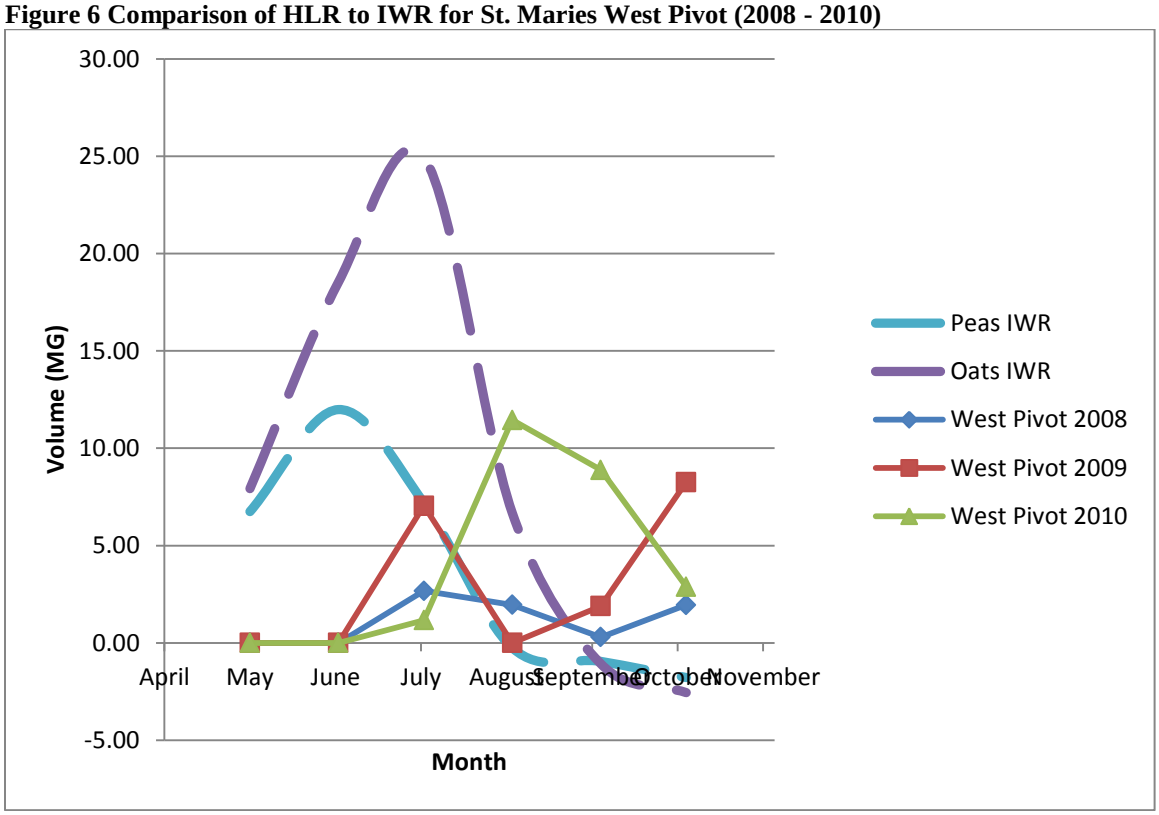


Figure 6 Comparison of HLR to IWR for St. Maries West Pivot (2008 - 2010)



4.5.2.3 COD Loading Rates

Wastewater reuse permits typically include a Chemical Oxygen Demand (COD) permit loading rate limit of 50 pounds/acre-day (lbs/ac-day) per season. The current permit does not include a COD limit. No nutrient monitoring for COD has been performed under the current reuse permit. Assuming an average effluent COD concentration of 43 mg/L, the average COD loading rate was approximately 0.41 lbs/acre-day for 2010, which is significantly less than 50 lbs/acre-day. Staff recommends that no COD loading limit be imposed in the draft permit.

4.5.2.4 Phosphorus Loading Rates

The current permit does not include a phosphorus-loading limit. Phosphorus loading rates are generally set based upon either groundwater or surface water concerns. With respect to groundwater concerns, DEQ does not usually set a phosphorus-loading limit where there is no ground water/surface water interconnection (i.e. where ground water down-gradient boundary from the irrigation site does not enter surface water). The depth to groundwater in the area is between 3 and 180 feet based on the static water level of surrounding well logs with the shallower wells to the north of the site along the north bank of the St. Joe River and the deeper wells found in the foothills to the south of the site and the highway. With the site elevation being just above that of the river, there is the potential for a connection between ground water and surface water in the area. As discussed in previous sections, Staff has recommended soil sampling and expanded recycled water and underdrain monitoring to establish data for the next permit cycle to characterize any connections. Phosphorous loading rates at the site have varied from 2.53 lbs/acre to 6.99 lbs/acre between 2006 and 2010 which is not excessive considering that hay requires about 4 lbs. of P/ton removed.

Staff recommends a runoff control plan be included as part of the O&M Manual update in Compliance Activity CA-012-01 of the draft permit and that no phosphorus-loading limit be imposed at this time. Soil data generated under this permit will be used to determine whether a loading limit is applicable by the next permit.

4.6 Buffer Zones and Site Management

It is proposed that the facility wastewater be classified as Class C. The *Recycled Water Rules* (IDAPA 58.01.17) list the uses of Class C recycled water and the disinfection requirements. In order to be considered Class C, "the median number of total coliform organisms does not exceed twenty-three (23) colony forming units (CFU) per one hundred (100) milliliters in any confirmed sample as determined from the bacteriological results of the last five (5) days for which analyses have been completed." As listed in the *Recycled Water Rules*, the following conditions apply: the point of compliance for Class C reclaimed water for total coliform compliance shall be at any point in the system following final treatment and disinfection contact time; and the total coliform analysis shall be based on weekly sampling during periods of application. The City disinfects using gaseous chlorine following treatment through the lagoons and the point of compliance is at the end of the chlorine contact chamber.

The buffer zones, as recommended in the *Recycled Water Rules* and Guidance are as follows for a median of 23 CFU/100 mL:

- 300 ft from reuse site and inhabited dwellings
- 50 ft from reuse site and areas accessible by the public
- 100 ft from reuse site and permanent and intermittent surface water
- 50 feet from reuse site and irrigation ditches and canals
- 500 feet from reuse site and private water supply wells
- 1000 feet from reuse site and public water supply wells
- Berms and other BMPs shall be used to protect the wellhead of on-site wells.

The operator is aware of the buffer zone requirements and has stated that the site and irrigation equipment are capable of meeting the setbacks. Appendix 7.3 includes a site map prepared by Welch-Comer Engineers which shows the buffer distances from the irrigation site.

4.7 Compliance Activities

The current permit does not include compliance activities.

4.7.1 Plan of Operation

It is understood that a Plan of Operation (also known as an Operations and Maintenance, or O&M Manual) is a living document and is modified as operations and regulatory requirements change. Staff recommends that in the draft permit, Section E, Compliance Activity Condition CA-012-01 requires the permittee to submit for DEQ review and approval, an updated Plan of Operation. The plan should address all of the applicable information in the latest revision of the Plan of Operation Checklist in the Reuse Program Guidance. It is also recommended that the permittee prepare a Runoff Management Plan (RMP) for inclusion in the Plan of Operation. The purpose of the RMP is to identify procedures and practices to avoid producing runoff from the site, including administrative procedures.

In addition, Staff recommends that the permittee prepare a Quality Assurance Project Plan (QAPP) for all monitoring activities required by this permit in order to avoid any inconsistencies in sample handling and data analysis. The intent of the QAPP is to provide consistent, written procedures for sample acquisition and handling to avoid problems with unreliable data. The QAPP is a vital part of the Plan of Operation and is included in this compliance activity.

4.7.2 Lagoon Seepage Testing

The Idaho Wastewater Rules (IDAPA 58.01.16.493.02.c), require all existing wastewater storage lagoons be seepage tested by a licensed professional engineer or licensed professional geologist by April 15, 2012 and every ten years thereafter. A lagoon seepage testing procedure plan was submitted to the Coeur d'Alene Regional Office on September 19, 2011 but the report is not complete. Additional evaluation of the seasonal variation in the depth to ground water relative to lagoon bottoms needs to be completed to determine the feasibility of seepage testing the lagoons. If the evaluation concludes that groundwater levels will render the seepage testing results inconclusive and invalid, a groundwater study will be completed to determine what, if any, impacts the lagoons may have on groundwater. This permit will not include a compliance

activity for the lagoon seepage testing due to the unknowns surrounding the ability of the lagoons to be adequately tested. Regional Office staff will continue to work with the permittee to find an effective solution for determining the condition of the lagoons.

4.7.3 Water Balance

As discussed in Section 4.5.1, the operator has included a brief discussion of the volumes of recycled water received by the treatment plant and discharged under the NPDES permit in addition to the volume used for crop irrigation in the last three years' annual reports. There appears to be substantial volumes of wastewater that is unaccounted for. Staff recommends in Section E of the draft permit, Compliance Activity CA-012-02, which requires the permittee within 6 months of permit issuance to prepare a "Water Balance Analysis Report" to determine the reason for the substantial volumes of unaccounted wastewater reported by the permittee. At a minimum, the report will evaluate the following: influent flows; effluent flows discharged to the St. Joe River and irrigated; precipitation into and evaporation out of the lagoons; lagoon volumes available for storage; influent and effluent flow meter accuracy; and lagoon seepage rates. The report will also evaluate the water balance for the projected flows for the five (5) year period covered by the new permit.

4.7.4 Permit Renewal

The *Recycled Water Rules* (IDAPA 58.01.17.300.01) require any permittee that intends to continue to operate as a recycled water facility to have a current permit issued by the Idaho Department of Environmental Quality (DEQ). Subsection 400.01 requires that a permit application be submitted to DEQ at least one hundred and eighty (180) days prior to the expiration of the facility's current permit. Proposed in Section E of the draft permit, Compliance Activity CA-012-03 requires that the permittee comply with this rule.

5.0 Conclusions

The following recommendations fall into three major areas. They include "Loading Rates", "Monitoring" and "Other Recommendations".

5.1 Loading Rate Recommendations

1. It is recommended that the nitrogen-loading limit be set at "150% of Typical Crop Uptake," as discussed in Section 4.5.2.1.

2. It is recommended that **no** COD loading limit be imposed by the draft permit, as discussed in Section 4.5.2.3.

3. It is recommended that **no** phosphorus-loading limit be imposed in the draft permit, as discussed in Section 4.5.2.4.

4. It is recommended that hydraulic loading rates be in accordance with crop irrigation water requirements (IWR) as discussed in Section 4.5.2.2

5.2 Monitoring Recommendations

1. It is recommended that soil sampling be implemented in the draft permit, as discussed in Section 4.1.

2. It is recommended that the permittee perform crop tissue analysis, as discussed in Section 4.5.2.1.

5.3 Other Recommendations

1. It is recommended that the draft permit be labeled as WRU M-0012-02, as discussed in Section 3.0.

2. It is recommended that irrigation only occur when the depth to ground water is a minimum of three (3) feet from the ground surface as measured in both of the piezometers for a HMU as discussed in Section 4.3. Weekly measurements will be required until there has been a minimum of three (3) consecutive measurements showing that the depth to ground water is a minimum of three (3) feet below the ground surface at both of the piezometers for the HMU.

3. It is recommended that the irrigation fields underdrain sampling location be monitored for total phosphorous, nitrate, nitrite, and Total Kjeldahl Nitrogen (TKN) once annually prior to starting irrigation and monthly when irrigating as discussed in Section 4.3.

4. It is recommended that the permittee completes the lagoon seepage testing process for the treatment and storage lagoons within 24 months of permit issuance, as discussed in Section 4.7.2.

5. It is recommended that the facility be classified as Class C with the buffer zones discussed in Section 4.6.

6. It is recommended that the following Compliance Activities, discussed in Section 4.7, be included in the draft permit:
   a. CA-012-01 – Update the existing Plan of Operation (O&M Manual) and prepare a Runoff Management Plan (RMP) and Quality Assurance Project Plan (QAPP).
   b. CA-012-02 – Complete a "Water Balance Analysis Report" to evaluate the reasons for the substantial volume of "unaccounted" wastewater.
   c. CA-012-03 – Submit a Recycled Water Permit Renewal Application at least 180 days prior to the permit expiration date.

7. It is recommended that the city of St. Maries Recycled Water Permit be issued for public comment.

6.0 References Cited

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C: WWRU Source File no. M-0012-02 (SO & CRO)
PDF: John Tindall, CRO
Chas Ariss, SO
Olga Cuzmanov, SO
Jennifer Wester, TS
TRIM: 2011AGH450

7.0 Appendices

7.1 IWR Formulation Methodology

The IWR values for St. Maries (Table 2) were derived from precipitation deficit (P_{def}) data available for "Grass Hay" from the ET_{Idaho} website (http://www.kimberly.uidaho.edu/ETIdaho/) for the Coeur d'Alene (#101956) and Saint Maries (#108062) stations. Table 1 summarizes the data taken from the ET_{Idaho} website for both stations. The irrigation water requirement is intended to serve as a guide for the application of water to the crop during the growing season. Actual application rates are expected to be substantially equal to these values, allowing for variations in yearly precipitation.

Table 1 Precipitation Deficit (P_{def}) Data

	Grass Hay			
	Coeur d'Alene 1E		Saint Maries	
	mm/day	in/month*	mm/day	in/month*
January	0.01	0.012	-0.16	-0.195
February	0.04	0.044	0.02	0.022
March	0.03	0.037	0.02	0.024
April	1.07	1.264	1.07	1.264
May	3.17	3.869	2.13	2.600
June	4.45	5.256	1.85	2.185
July	5.49	6.700	0.66	0.806
August	4.73	5.773	-0.03	-0.037
September	3.09	3.650	-0.35	-0.413
October	0.96	1.172	-0.80	-0.976
November	-0.64	-0.756	-2.95	-3.484
December	-0.06	-0.073	-1.36	-1.660

* Calculated value (ET_{Idaho} data in mm/day / 25.4 mm/in * # days in month)

The Saint Maries station P_{def} values are for non-irrigated crops while the Coeur d'Alene values are for irrigated ones. The irrigation site is located approximately 1 mile west by northwest of the City of St. Maries, but the crops grown on the site are irrigated; therefore the P_{def} values for the City are the average of the two stations as shown in Table 2

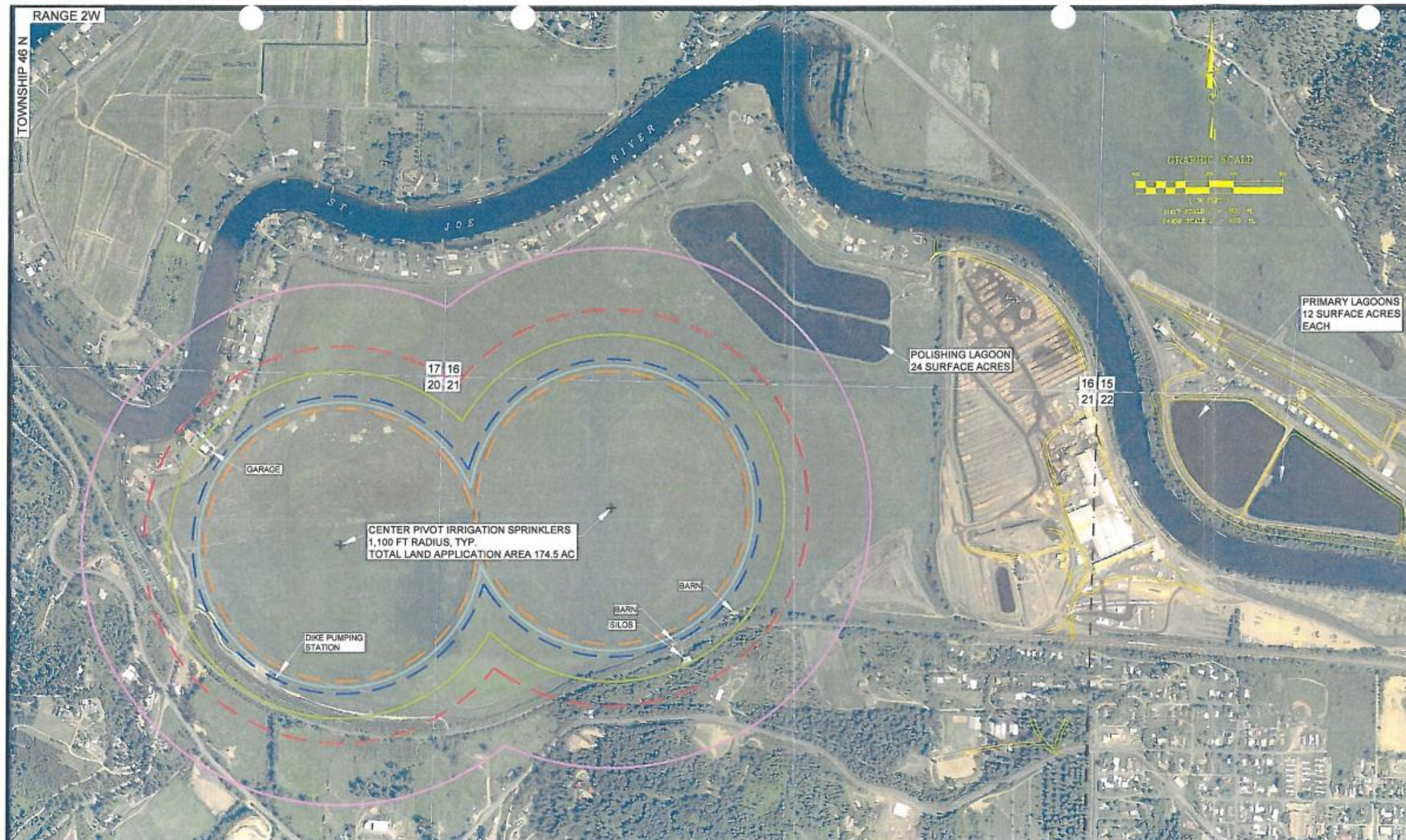
Table 2 St Maries Averaged Growing Season Irrigation Rate* (P_{def})

Month	Grass Hay
April	1.264
May	3.234
June	3.720
July	3.753
August	2.868
September	1.618
October	0.098

* Expressed in inches per month

From Table 4-12 of the Guidance (DEQ, 2007), the irrigation system efficiency was estimated to be 75% for low pressure center pivots. In order to represent the application system effectively, the values in Table 2 were divided by the efficiency of the distribution system and the resulting values are given in Table 3 in Section 4.5.2.2. The irrigation system is discussed in Section 4 of the Staff Analysis.

7.2 Site Map Showing Buffer Distances



LEGEND

- ST. MARIES CITY LIMITS
- 50' BUFFER FOR SURFACE WATER AND PUBLIC ACCESS
- 100' BUFFER TO PERMANENT SURFACE WATER
- 300' BUFFER FOR DWELLINGS
- 500' BUFFER FOR PRIVATE WELLS
- 1000' BUFFER FOR PUBLIC WELLS

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NO.	DATE	REVISION DESCRIPTION	BY

CITY OF ST. MARIES

VICINITY MAP AND LAND APPLICATION AREA BUFFERS

PROJECT NO.:	13820
DESIGNED BY:	PJO
DRAWN BY:	JAL
CHECKED BY:	
DWG NAME:	13820DS23.DWG
DATE:	04–02–09
SHEET NO:	

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7.3 2002 Staff Analysis Memo

July 19, 2002

M E M O R A N D U M

TO:	Roger Tinkey, Engineering Manager Coeur d'Alene Regional Office
FROM:	Gary Gaffney, Environmental Engineer, Coeur d'Alene Regional Office Doug Davidson, State Office of Technical Services
SUBJECT:	Staff Analysis of the City of St. Maries, Wastewater Land Application Permit Request, LA-000012-02 (Municipal Wastewater)

PURPOSE

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.700 for issuing wastewater land application permits.

PROCESS DESCRIPTION

The city of St. Maries operates a municipal wastewater treatment facility in St. Maries, Idaho approximately 27.5 miles southeast of Coeur d'Alene, Idaho. The design maximum flow of the facility is 1.0 million gallons (MG) per day. The maximum pumping rate to the wastewater land application site is 7.6 MG per week. The city finished an upgrade of its wastewater treatment facility in 1986. The treatment facility is located at two sites on the northeast side of the city. The raw wastewater is collected through the city sewer system and treated in two primary facultative lagoons on the north side of the St. Joe River. A transfer station to pump the wastewater across the river is built near the primary facultative lagoons. Facilities on the south side of the river include a settling/polishing pond, a chlorination contact chamber, a pump plant building, and an application field with two center pivot sprinkler systems. The effluent is disinfected with chlorine and used for slow rate land application through two center pivot sprinkler systems on 175 acres planted with alfalfa hay that is used as cattle feed. The city discharges wastewater to the river during the non-growing season and operates under National Pollutant Discharge Elimination System (NPDES) permit ID-002279-9. The permit expired in 1994, but the city of St. Maries is operating under the conditions of the permit (See Attachment A for permit details). The Environmental Protection Agency will issue a new NPDES permit for the city of St. Maries when the total maximum daily load (TMDL) is written for the St. Joe River (due this year).

SUMMARY OF EVENTS

The city of St. Maries received its original wastewater land application permit in 1988. The original permit was administratively extended through 1996. The city continues to operate under the conditions of the 1988 permit. In May 2001, Department of Environmental Quality (DEQ) personnel toured the facilities with Marla Schauls, the plant operator. DEQ received an application for permit renewal in January 2002.

DESCRIPTION OF WASTEWATER TREATMENT AND LAND APPLICATION SYSTEM

Raw wastewater is routed to two facultative lagoons (each with 24-acre surface area). The lagoon wastewater is pumped across the St. Joe River to a 24-acre settling/polishing pond. The water then moves into a chlorination chamber where chlorine gas is injected into the waste stream. Treated effluent from the storage lagoon is pumped to the land application site and applied to 175-acres of land using two center pivot sprinkler systems. It was stated during the site visit that only one of the center pivots is generally used during the season because the eastern pivot has a tendency to become stuck in specific areas. DEQ staff recommends that the city bury a geotextile fabric with gravel in the wet track areas or provide some other corrective measure to eliminate the potential of the pivot becoming stuck. Table 1 lists the land application capacity for the center pivot systems. As can be seen from the table, if only one pivot system is used, the largest flow that may be land applied to the land application site is 67.4 MG per year. This is far below the design maximum of 140.3 MG per year. However, the current flow rate to the land application site is approximately 33 MG per year; therefore one pivot currently provides sufficient treatment capacity. The city will need to operate both center pivot systems when the flow to the land application site becomes close to 67 MG per year.

During the non-growing season, the wastewater is stored at the two 24-acre ponds on the north side of the river. Wastewater has not historically been applied before July 1 of the growing season because of the potential of high ground water. That has caused some problems in dry years when water is needed for crop growth to prevent wilt damage. DEQ staff recommends that the application period be started at an earlier time period (May 1), but the actual start date be dependent upon the depth of the ground water as measured at the land application site. If ground water is greater than 3 feet below ground level, and the date is within the May-September growing season, then application may occur.

From the annual reports submitted to DEQ, application of wastewater to the site has been occurring to a large degree in the months of September and October. Based upon climatic data used in the development of this staff analysis and the accompanying permit, the irrigation water requirement starts to decline in September and becomes negative in October. DEQ staff recommends that the permit not allow wastewater application in October and that the application of wastewater be more evenly applied May through September, as conditions permit. The permit will specify the irrigation water requirements by month from May through September as permit limits.

Table 1. St. Maries Current and Design Maximum Conditions

Center Pivot Systems Available	**Daily Average Wastewater Flow, Million Gallons Per Day**	**Wastewater Land Applied, Million Gallons Annually**	**Wastewater Land Applied, Inches**	**Land Application Area Required, Acres**	**Land Application Area Available, Acres**
Current					
1	0.65	33	14.47	41	84
2	0.65	33	6.94	41	175
Design Maximum					
1	1.0	67.4	29.54	84	84
2	1.0	140.3	29.52	174.9	175

SITE CHARACTERISTICS

The land application site is nearly level with a slope of 0 to 2%. The soils in the land application area are classified as a "Ramsdell-DeVoignes" with 60% consisting of Ramsdell silt loam and 35% DeVoignes silt loam. Both soil types are deep and poorly drained with a tendency for seasonally high water tables. An organic (sapric) layer exists at the 9 to 24-inch depth, which has a much lower permeability (0.06 – 0.2 inch per hour) than the 0 to 9-inch depth, which has a permeability of 0.6 – 2.0 inch per hour. This factor should not be of concern in the application of the wastewater as long as the rate does not exceed the center pivot irrigation system maximum application rate of 1.1 inches per hour for an extended period of time. According to the original design parameters, the limiting factor of the irrigation system would be the pump's ability to supply water to the pivot system. The pump design maximum is listed at 7.6 MG per week if the pumps were run continuously.

If land managers implement drainage practices and protect the area from flooding, the soils in the land application area are suitable for agricultural activities. An underdrain exists on site; the water from the drain collects in Cherry Creek (Attachment B, Figure 2). This water is then pumped to the St. Joe River. This water was water quality sampled from 1989 through 2001 to assess the impact upon the river from the application of wastewater on this site. Samples from the wastewater treatment plant effluent are approximately 0.010 milligrams per liter (mg/L) total nitrogen and 2-3 mg/L for phosphorus. The level of nitrogen in under-drain water is similar, but phosphorus is consistently measured at a range one order of magnitude lower than in the effluent, near the level of 0.2 mg/l. This level for phosphorus may be still considered elevated if delivery to the river were to occur.

PROJECTED WASTEWATER QUALITY

The city currently produces a flow of approximately 650,000 gallons per day with a population of roughly 4,300 people. The design maximum flow is listed at 1MG per day. The design maximum of the pumps for the transport of the effluent from the plant to the land application site is 7.6 MG per week, if the pumps run continuously. The following table shows the wastewater maximum anticipated constituent contents and loading rates for chemical oxygen demand (COD), nitrogen, and phosphorus. These values were calculated using typical effluent wastewater values listed in the city's annual reports.

Table 2. Wastewater Quality

Constituent	Effluent (mg/L)	Ave. Loading Rates (existing) *	Ave. Loading Rates (maximum) **	Guideline Loading Rates
Chemical Oxygen Demand	102	1.05 (lbs./acre-day)	4.46 (lbs./acre-day)	50 (lbs./acre-day)
Total Nitrogen	4.70	7.4 (lbs./acre-day)	31.4 (lbs./acre-day)	125% of crop uptake
Total Phosphorus	2.23	3.5 (lbs./acre-year)	14.9 (lbs./acre-year)	125% of crop uptake

* The annual average existing loading rates for all constituents were calculated with the assumption that 33 MG of wastewater will be applied over 175 acres and that the loading rates occur over 153 days.

** The annual average maximum loading rates for all constituents were calculated with the assumption that 40.3 MG of wastewater will be applied over 175 acres and that the loading rates occur over 153 days.

As can be seen in Table 2, the amount of COD and nitrogen contained in the land-applied wastewater is well below the guideline loading rates. Typical crop uptake values for nitrogen and phosphorus are 250 and 30 pounds per acre-year, respectively. The values in Table 2 show that the wastewater loading rates for COD, nitrogen, and phosphorus are well below crop uptake values.

PROJECTED HYDRAULIC LOADING RATES

The growing season for this project should be from May 1 through September 30 (153 days). Wastewater should not be allowed when ground water is less than 3 feet below the ground surface. Ground water levels should be measured on the land application site to meet the 3-foot depth requirement. Piezometers of at least 4 feet in depth should be installed with water level readings occurring monthly before and during land application. Wastewater land application during the non-growing season should not be allowed under this permit. The number and location of piezometers will need to be determined and approved by DEQ prior to installation.

The following equation was used for the irrigation water requirement for the growing season:

$IWR = [Cu - (PPT_e + \text{carry over soil moisture}) + LR]/E_i$.

IWR is the irrigation water requirement or the hydraulic loading rate for the growing season
Cu is the crop consumptive use
PPT_e is the effective precipitation
LR is the leaching rate
E_i is the irrigation efficiency

For permit purposes, the carry-over soil moisture and the leaching rate are assumed to be zero in calculating the irrigation water requirement. The leaching rate of zero is used since soils in this area are not saline and need no additional hydraulic load for leaching. The maximum irrigation requirements listed in Table 3 were computed using values taken from the Kimberly Research Station climatic data.

Table 3. Maximum Irrigation Requirements for Alfalfa in North Idaho, by Month

7.3.1 Month	St. Maries Effective Precipitation*, Inches	Consumptive Use, Inches	Net Irrigation Water Requirements, Inches	Irrigation Water Requirements (Million Gallons)
May	1.53	5.48	5.26	25.01
June	1.42	5.94	6.03	28.64
July	0.69	7.36	8.89	42.24
August	0.80	5.36	6.08	28.89
September	0.90	3.37	3.28	15.61
Total	5.35	27.50	29.54	140.38

* www.kimberly.uidaho.edu/water/appndxet/index.shtml, Irrigation efficiency of 75% used

As shown in Table 4, the allowable irrigation water requirement for the growing season is 29.54 inches, or 140.38 MG on 175 acres. At the present rate of 33 MG per year, the hydraulic loading rate is at 6.94 inches, far below the application area maximum rates. If only one pivot is used, the hydraulic loading rate becomes 14.47 inches applied over 84 acres.

Table 4. Irrigation Water Requirements for Alfalfa Grown in North Idaho

CROP	CU (inches)	PPT_e (inches)	E_I (%)	IWR (inches)	IWR (MG)
Alfalfa	27.50	5.35	75	29.54	140.38

CONSTITUENT LOADING RATES

The COD rates of the wastewater are very low when compared to the 50 pounds per acre-day standard. DEQ staff recommends that the requirements for COD be eliminated from the current permit. Nitrogen and phosphorus loading rates shall be limited to 125% of crop uptake values. Crop uptake values are dependent upon soil test results and University of Idaho fertility guidelines and are estimated at 250 and 30 pounds per acre-year, respectively.

GROUND WATER CONSIDERATIONS

The land application site is located near the St. Joe River. The ground water in the area can be near the surface for extended periods of time. The land is also prone to flooding if levees and drainage ditches are not present. However, levees and drainage ditches are present at the application site. Wastewater application may not occur if ground water is closer than 3 feet to the surface. Piezometers should be installed to a depth of at least 4 feet to determine if ground water is below the established high water mark limit prior to the beginning land application.

Homes are located near the land application site. The city engineer determined distances from nearby homes to the application site. It was determined and detailed in the drawing listed in Attachment B, Figure 2 that no home is closer than 310 feet to the site. The closest ground water well is 0.25 mile from the site and that well is not used for drinking water.

BUFFER ZONES

Table 5 shows the buffer zone requirements for the specified disinfection level for the land application site.

Table 5. Disinfection and Buffer Zone Requirements

Buffer Object	Standard Municipal Permit (feet)	Actual Distance Provided
Public Access Area	50	50
Nearest Inhabited Dwelling	300	>300
Private Water Supply	500	>500
Public Water Supply	1,000	>1,000
Natural Surface Water	100	>250

The permit conditions require that the disinfecting system treat the effluent to a total coliform level of 23/100 milliliters total coliform or less during land application. With the use of a hypochlorite solution treatment, the reduction of total coliform to the 23/100 level should be attainable. Annual water quality reports submitted by the permittee demonstrate that the disinfection has at times not met this requirement. Daily chlorine residual measurements should be included in future monitoring requirements during periods when land application is in operation. DEQ staff recommends the 23/100 milliliters total coliform limit for a new permit. Compliance will be based on the median of the last five sample results with a rolling basis.

SITE SPECIFIC CONDITIONS

The site needs to plan for when both center pivot systems will be in operation on a full time basis. Steps need to be taken to ensure that the eastern pivot is working and will not become stuck. Wastewater can be applied when ground water is greater than 3 feet below ground surface as measured by piezometers that will be installed on site. Wastewater will be applied throughout the application season except when ground water is above 3 feet and the crop is being harvested.

RECOMMENDATION

DEQ staff recommends issuance of the attached draft permit. The city of St. Maries will need to provide close monitoring and reporting of all activities during the application period. The draft permit contains guideline loading limits for nitrogen and phosphorus and for growing season hydraulic loading rates. No wastewater application should be allowed outside of the growing season. Wastewater land application will need to be monitored to prevent ponding and run-off. Monitoring and reporting requirements to evaluate system performance and to determine permit compliance have been specified.

DD C:\WLAP\St. Maries\Staff analysis.DOC

cc: Marla Schauls, City of St. Maries, 602 College Avenue, St. Maries, ID 83861
Steve Cordes, Welch Comer Associates, Inc. 1626 Lincoln Way, Coeur d'Alene, ID 83814
Paul Wakagawa, DEQ State Office of Technical Services
Richard Huddleston, DEQ State Water Quality Office
WLAP Source File No. LA-000012-02
Technical Services Reading File

Attachment A

NPDES Permit
ID-002279-9

NPDES Permit ID-002279-9

Parameters of NPDES Permit for the City of St. Maries

Effluent Characteristics	Unit of Measurement	Monthly Average	Weekly Average	Daily Maximum
Biochemical Oxygen Demand (BOD_5)-five day	mg/L	45	65	--
Total Suspended Solids (TSS)	mg/L	70	105	--
Fecal Coliform Bacteria	Number/100 mls	50	100	--
Residual Chlorine	mg/L	--	--	2.0

Discharge to outfall(s) limited from November 1 through June 30.

The monthly average effluent loading should not exceed 35% of the monthly average influent loading for BOD_5.

Discharge to the river is not allowed:

- when the pH is less than 6.0 or greater than 9.0
- when flow is less than 1000 cubic feet per second
- when the water temperature is greater than 5.0 ^{0}C
- between July 1 and October 31

Attachment B

Figures of the St. Maries Wastewater Treatment Plant

St. Maries Wastewater Treatment Site

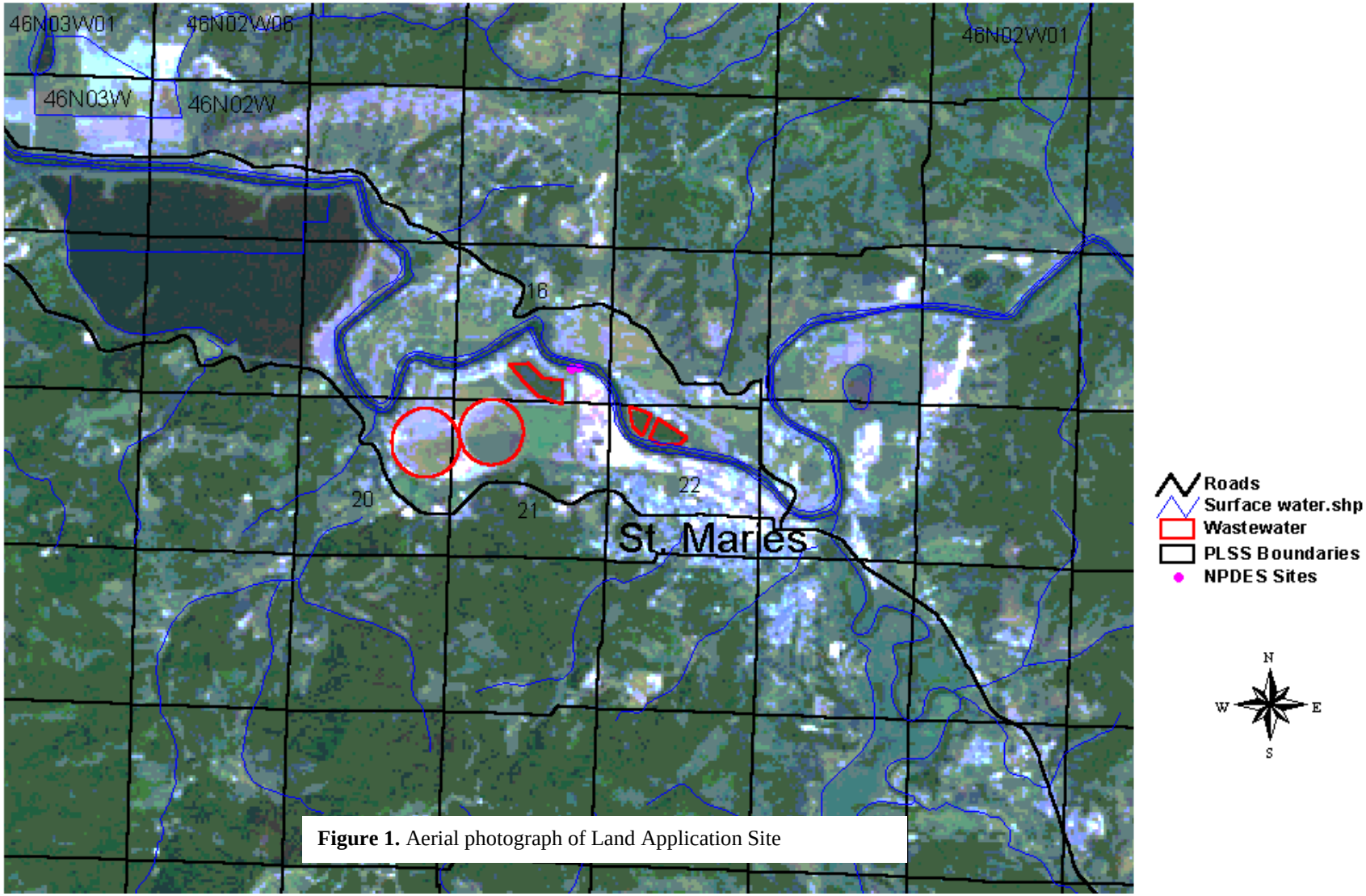
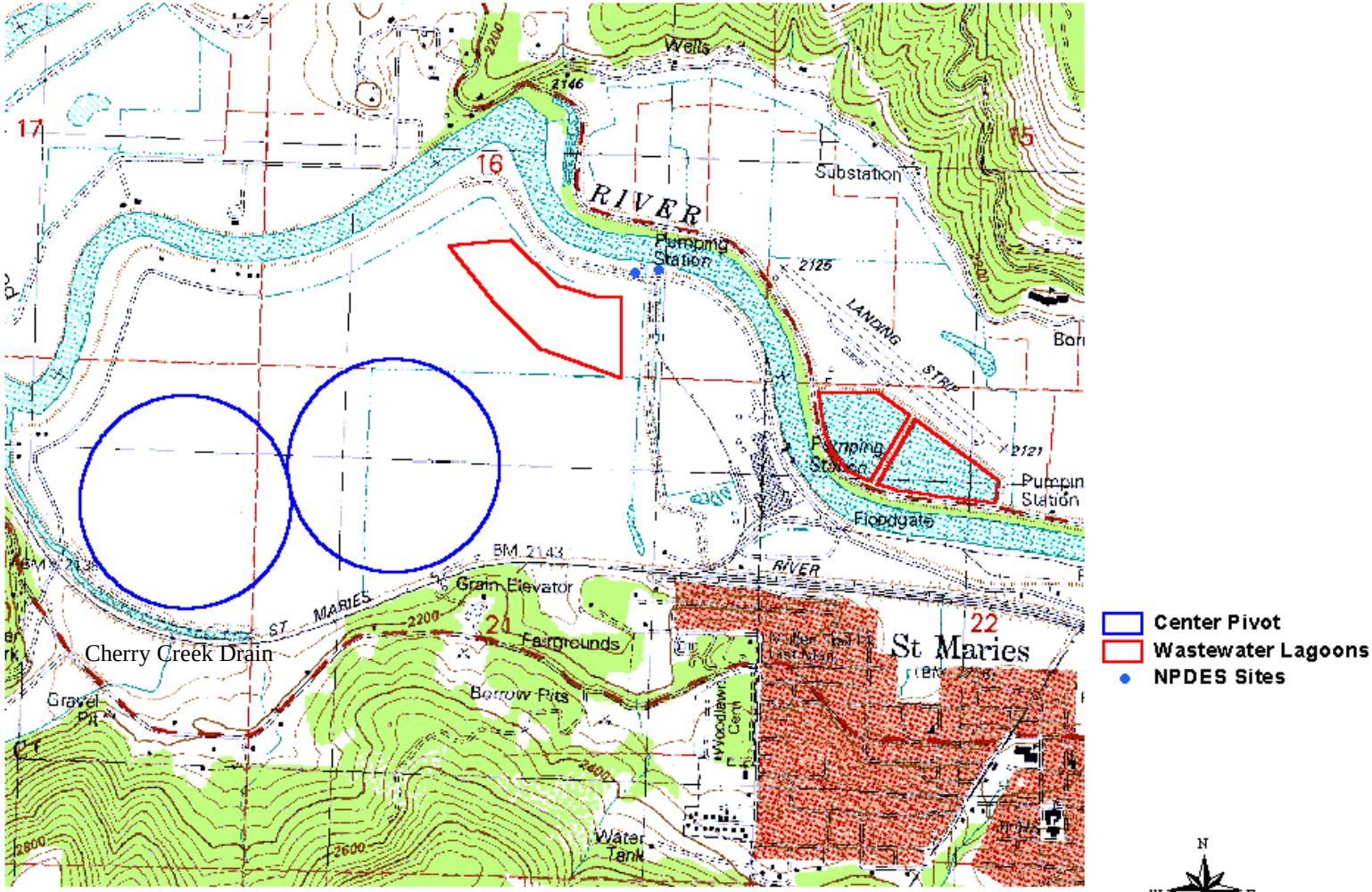


Figure 1. Aerial photograph of Land Application Site

St. Maries Wastewater Site



0.6 **Figure 2.** Topographic Map of Land Application Area 1.2 Miles