

Town of Ennis

Prepared For: Town of Ennis
Prepared By: Amy Deitchler, PE, Joel Pilcher, PE
Reviewed By: Collette Anderson, PE
Date: April 27, 2021
Project Number: 1-18184 TO 3
Revision No.:
Approved By: Dan McCauley, PE

1.0 Introduction

Given the anticipation of significant growth from new developments in and around the community, the Town of Ennis has contracted with Great West Engineering to evaluate the available capacity of its public water and sewer systems. This memorandum considers the existing water supply and wastewater treatment systems serving the Town of Ennis and excludes distribution and collection. To facilitate the analysis Great West has reviewed the following information: existing source water and water user meter data; water supply pumping capacity; wastewater influent and effluent flow data; and, the Town's MPDES discharge permit.

2.0 Wastewater Treatment System

2.1 Hydraulic Capacity

The wastewater treatment facility serving the Town of Ennis consists of a 3-cell, partially mixed, aerated lagoon system to provide treatment of domestic sewage generated by the municipality. The lagoon was designed for 2,300 people and an average design flow of 0.24 MGD.

The MPDES permit limit is a daily average of 0.24 million gallons per day. The Town is currently discharging a daily average of 0.11 million gallons per day and has the hydraulic capacity to accept an additional 0.13 million gallons per day.

DEQ Circular-2 recommends a per capita usage of 100 gpcd for collection systems in the absence of water meter data. Ennis does have water meter data, which indicates an average per capita per day use of 165 gpcd. Considering wintertime water use, when irrigation is not occurring, the average per capita per day use is between 80 and 100 gpcd. It is recommended to assume 100 gpcd for new sewer connections. Assuming there are 2.5 people/service connection and 100 gpcd, the wastewater treatment system has capacity for an additional 520 ($130,000 \text{ gpd} \div 250 \text{ gpd/service connection}$) new residential sewer connections.

2.2 Existing MPDES Permit

The current MPDES permit is expired and has been administratively extended by DEQ. Great West Engineering reached out to DEQ permitting, and they do not have a timeline for a new permit to be issued.

Below are the current parameters of the existing MPDES permit:

Pollutant	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
BOD ₅	mg/L	30	45	
	lb/day	25	90	
BOD ₅ Removal	%	85%		
TSS	mg/L	45	65	
	lb/day	83	130	
TSS Removal	%	65%		
E. coli	cfu/100mL	126	252	
E. coli	cfu/100mL	630	1260	
Ammonia	mg/L	30		42

2.2.1 BOD

The current permit requires the Town to meet the secondary standard for BOD₅. The future permit will not change this requirement. The load calculations in the current permit are based on the design flow of 0.24 MGD. Therefore, the permit includes the maximum load for BOD₅. The load is not anticipated to change in future permits.

The Town has received three concentration violations and two percent removal violations since 2018 for BOD₅. In 2020, there were no violations for BOD₅. Over the last three years, the system has averaged a BOD₅ load of 13 lb/day, a concentration of 13.5 mg/L, and 94.5% removal. These numbers indicate that the treatment system should continue to be capable of meeting the existing permit requirements with additional sewer service connections.

As the Town increases the sewer service connections for the system, permit limits may become more difficult to meet. We recommend the Town set requirements for influent BOD concentration requirements to ensure that only residential strength waste is accepted at the lagoons. If higher loads of BOD are accepted, treatment may suffer, and the Town may not be able to meet their discharge permit requirements.

2.2.2 TSS

The current permit requires the Town to meet treatment equivalent to secondary standards (TES) for TSS. Lagoons achieve significant reductions in TSS but might not consistently achieve the secondary treatment standards, so the EPA allows for less stringent permit limits. The load calculations in the current permit are based on the design flow of 0.24 MGD and TES concentrations. Therefore, the permit includes the maximum load for TSS at treatment equivalent to secondary standards. The Town will continue to be eligible for TES if the lagoons continue to meet the criterion of consistently exceeding secondary treatment standards and use of the lagoons for wastewater treatment continues.

The Town has received thirteen concentration violations and two percent removal violations since 2018. If the Town had secondary standards, they would have received an additional eight violations and nine additional percent removal violations. Over the last three years, the system has averaged a TSS load of 28 lb/day, a concentration of 32 mg/L, and 87% removal.

The system experiences times of algae bloom in the lagoon. During the summer, high nutrient loads, sunlight, and warm water temperatures lead to algae blooms.

The lagoon water remains in the pond system for longer than the design required because the influent flow is approximately ½ of the assumed rate. Additional flow into the lagoons will allow the water to move through the system closer to the design rate. If the influent flow rate is increased, the water may not produce as much algae.

2.2.3 Ammonia

The total ammonia limits are based on standards for a combination of pH and temperature of the receiving stream. The receiving stream for the Town of Ennis is the Madison River. In the existing

permit, the background ammonia level in the Madison River was unquantified. The ammonia limit was carried over from the previous permits, and reasonable potential was not calculated.

The Town currently averages effluent ammonia of 6.89 mg/L. The Town was also required to monitor the receiving stream and the effluent ammonia in the last permit cycle. All measurements have been completed and submitted to DEQ. This information will allow DEQ to calculate reasonable potential for ammonia in the next renewal. If they determine that the system has reasonable potential to cause or contribute above the State water quality standard, the permit limit may be lowered.

2.2.4 Nutrients

The TMDL for the Madison River, including the stretch that Ennis discharges to has been completed. The report was completed in February 2019. The TMDL references DEQ-12A and 12B for the Madison River. However, numeric nutrient standards 12A and 12B are being eliminated by Montana Senate Bill No. 358 due to a lawsuit. Rainie DeVaney, Montana DEQ Permit Section Supervisor has stated that they do not know how they will be implementing the nutrients in permits at this time. Senate Bill No. 358 does require the rulemaking process to be completed within one year. Rainie has stated that the Nutrient Workgroup will be integral to the rule making. Great West Engineering has members of staff on the Nutrient Workgroup and will be monitoring the rule making.

2.2.5 Metals

Arsenic, copper, and zinc have been detected in the Madison. In the last permit, limits did not have reasonable potential to exceed. As long as the Town does not accept wastewater that would raise these limits, we do not anticipate additional limits.

2.3 Wastewater Pretreatment

It is our understanding that the Town of Ennis does not currently have a pretreatment ordinance. Such a voluntary pretreatment program would not require EPA or State approval. An ordinance would outline the basis for what residential strength wastewater and the lagoon design are based on. If wastewater is discharged to the system outside of those parameters, the ordinance would protect the Town. For example, one of the proposed developments shows forty (40) RV spots. The pretreatment ordinance would give the Town and developer direction on wastewater strength expected from those RVs.

3.0 Water System

3.1 Water Demand

In Ennis, water pumped is metered at both of the wells, however, the data is not considered reliable as one of the flow meters had to be replaced recently. Each service connection on the system is metered and that data will be utilized in this analysis. Total water metered was 44,725,255 gallons in 2019 and 55,946,807 gallons in 2020. The higher usage in 2020 will be used in this capacity analysis. The average day demand of the system is 153,279 gpd (gallons per day). This is computed by dividing the total yearly water usage by 365 days. The average day demand equates to an average flow rate of 106 gpm (gallons per minute). Based on a population of 930 in 2020, the per capita usage is 165 gpcd (153,279gpd/930people). Tables 1 and 2 below summarize the water usage data.

Table 1 – 2019 Water Usage

Month	Total Water Pumped	Average Per Day (gpd)	Per Capita Per Day (gpcd – population of 930)
January	2,001,784	66,726	72
February	2,272,825	81,172	87
March	1,979,819	63,865	69
April	2,120,587	70,686	76
May	3,141,066	101,325	109
June	5,686,669	189,556	204
July	6,087,667	196,376	211
August	8,097,527	261,211	281
September	6,317,508	210,584	226
October	3,094,437	99,821	107
November	2,192,406	73,080	79
December	1,732,960	55,902	60
Total	44,725,255	122,535	132

Table 2 – 2020 Water Usage

Month	Total Water Pumped	Average Per Day (gpd)	Per Capita Per Day (gpcd – population of 930)
January	2,036,091	67,870	73
February	2,664,733	95,169	102
March	2,083,686	67,216	72
April	1,877,098	62,570	67
May	3,335,091	107,584	116
June	7,697,128	256,571	276
July	7,337,947	236,708	255
August	10,585,996	341,484	367
September	8,699,592	289,986	312
October	4,750,310	153,236	165
November	2,653,658	88,455	95
December	2,225,477	71,790	77
Total	55,946,807	153,279	165

Peak day demands or maximum day demands are important to consider as water usage varies throughout the day in addition to the month and year. Typically, a peaking factor is used to estimate the maximum day demand. The peaking factor is defined as the ratio of the maximum day demand to the average day demand.

Throughout the United States, Peaking factors range from 2 to 5. However, studies done throughout Montana and the Dakotas indicate peaking factors of 1.8 to 4 are most common. In general, the smaller the water supply system, the larger the peaking factor, though, metered systems typically see lower peaking factors due to a conscious effort by the users to conserve water. Peak days typically occur during the hottest days of the year when lawn watering is at a maximum.

The peak month usage during 2020 occurred in August, when 10,585,996 gallons were pumped. This averages out to 341,484 gallons per day which results in a peaking factor of 2.23, consistent with the range given above. Since this is an average over the entire month, it is likely that some daily usages are higher within the peak month and therefore a peaking factor of 2.5 will be used to be conservative. A maximum day demand of 383,198 gpd will be assumed. This equates to 266 gpm or 412 gpcd.

3.2 Water Supply

Ennis' existing water supply is obtained from groundwater via two wells. Supply Wells #2 and #3 were constructed in 1979 and 2014 respectively. Well #2 is located at the intersection of Armitage Street and Comely Way. This well pumps 350 gpm, which is the maximum flow rate allowed by the water right. Well #3 was constructed in 2014 and replaced Well #1 which had reached the end of its useful life. Well #1 was subsequently abandoned. The new well was test pumped at 350 gpm, which allows the Town to utilize the well at 235 gpm per DEQ standards. However, the water right for this well limits the flow rate to 200 gpm.

Montana Department of Environmental Quality Circular DEQ-1 has been adopted by the Montana Water Quality Division as its standard for Community Water Systems. DEQ-1, Section 3.2.1.2 states: "A minimum of two sources of groundwater must be provided." The Town currently meets this standard.

Based on the DEQ-1, Section 3.2.1.1: "The total developed groundwater source capacity for systems utilizing gravity storage or pumped storage, unless otherwise specified by MDEQ, must equal or exceed the design maximum day demand with the largest producing well out of service."

Ennis' current maximum day demand, as discussed above, is 266 gpm and 412 gpcd. With both wells in operation, a maximum flow rate of 550 gpm is available and a total of 792,000 gallons per day can be produced. This volume could provide the maximum day demand for a population of approximately 1,922 people (792,000 gpd/412 gpcd), an additional 992 people over the 2020 population of 930. Assuming 2.5 people/house, this equates to approximately 372 additional residential service connections.

When considering the DEQ standard of needing to meet maximum day demand with the largest producing well out of service, the Town's water supply capacity falls short. The system cannot meet the current maximum day demand (266 gpm) with the largest well out of service. The Town of Ennis has attempted to develop another supply well to supplement the two existing wells, but to date has been unsuccessful. The Town should continue to evaluate options to increase water supply.

3.3 Water Storage

Circular DEQ 1, Section 7.0.1 requires that "storage facilities must be sufficient, as determined from engineering studies, to supplement source capacity to satisfy all system demands occurring on the maximum day, plus fire flow demands, where fire protection is provided". The Town's water storage capacity of 530,000 gallons, when coupled with the water supply capacity of 792,000 gallons provides an available volume of 1,322,000 gallons. The needed fire flow in Ennis is 2,500 gpm which must be provided for a two-hour duration. This results in a fire flow volume of 300,000 gallons. Subtracting the needed fire flow volume of 300,000 gallons from the total available volume of 1,322,000 gallons results in

a remaining capacity of 1,022,000 gallons for domestic use. This remaining capacity would be sufficient to provide the maximum day demand for a population of approximately 2,480 people.

3.4 Water Distribution

While this analysis does not evaluate in detail the distribution system in Ennis, the Town of Ennis water distribution system consists of a series of mains and laterals that transport water to individual service lines. The distribution system is designed for fire flow capacity and is capable of providing minimum recommended fire flows. Domestic flows have minimal impacts on the flow capacity of the distribution system and therefore the distribution system is not a limiting factor of water system capacity.

4.0 Summary

In summary, it appears the Town's wastewater treatment and water supply systems currently have adequate capacity to accommodate some growth. It is estimated the wastewater treatment system has the hydraulic capacity for an additional 520 residential sewer service connections, or 130,000 gpd. While there are no immediate concerns with regards to continued treatment effectiveness, there may be some operational changes to improve TSS removal. As the new MPDES permit is developed, the Town may need start evaluating options to comply with more stringent permit limits. It is also recommended that the Town develop a pretreatment program to protect the existing lagoons.

The water supply system also has capacity to handle an estimated 372 additional residential service connections. However, the Town's water supply does not currently meet DEQ requirements regarding the ability to meet maximum day demands with the largest well out of service, and thus it is recommended the Town continue exploring options to increase its water supply.