Tumalo Wastewater System Feasibility Study


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December 2022

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Executive Summary

The Tumalo Wastewater Feasibility Study (study) provides an analysis of alternatives, evaluation of feasibility, and rough cost estimates[1] of providing sewer to a portion of the Tumalo Unincorporated Community (Study Area). The study originated, in part, through an interest from a portion of property and business owners in the Tumalo Unincorporated Community (2021 est. population 574), after experiencing issues with continued reliance on on-site septic systems for wastewater disposal. County data provides information on permitted septic systems in Tumalo as far back as 1971 and shows that the number of repair permits has increased over the past three decades. Although septic systems typically have a useful life of about 30 years, some of the septic systems in Tumalo are over 50 years old. Many systems have reached the end or are nearing the end of their useful life. Additionally, the smaller properties within the Tumalo Unincorporated Community boundary are limited by smaller lot sizes, and many property owners cannot obtain permits for repair or new installation. Finding solutions for these lots is challenging without a community wastewater solution. To understand the potential for providing sewer services to Tumalo, the project team analyzed existing conditions and land uses, future projected growth rates and types of development, as well as soils, topography, and other physical characteristics of the area, to develop three sewer system alternatives.

While the majority of Tumalo depends on on-site septic systems for wastewater disposal, there is a community wastewater system owned by Tumalo Property Owners Association (TPOA) that serves a portion of the unincorporated community west of Highway 20. This system serves 26 residential units, and a small number of commercial uses. The TPOA system is considered a Septic Tank Effluent Pumping (STEP) system which includes a small septic tank for each connection, a collection system, and a patented treatment system with associated drainfields, which are located on property owned by the Laidlaw Water District. Part of this study included evaluating the feasibility of expanding the TPOA system to serve the core area of Tumalo east of Highway 20.

Based on existing conditions and analysis of projected future flows, the CONSOR (formally Murraysmith) engineering team identified three alternatives for providing sewer service to Tumalo in this analysis:

1. Expanding the existing Tumalo Property Owners Association (TPOA) system (Orenco Advantex Treatment System).
2. Constructing a separate collection and treatment system within the Tumalo Unincorporated Community (Orenco AdvanTex Treatment System).
3. Installing a collection system with treatment and disposal via connection to the City of Bend's planned North Interceptor line at the Cooley Road/Highway 20 intersection (construction timelines for the North Interceptor are yet to be determined).

Each of these alternatives were analyzed, with a preliminary engineering design provided for each alternative, to estimate Class V capital construction costs and operating and maintenance for each alternative. Table 1 provides a summary of each alternative, with opportunities and challenges for each.

[1] Class IV cost estimates are also known as the rough order of magnitude (ROM) estimate for concept screening purposes. The accuracy for these estimates ranges from -50% on the low side to +100% on the high side. If a specific Alternative is chosen, those estimates will be refined through additional study and/or system design.

Table 1 | Summary of Sewer System Alternatives, Full Build Out

Alternative	Class V Cost Estimate- capital costs	Lifecycle Costs (NPV over 20 yr period)	Opportunities	Challenges
1. Expand TPOA System	$13,500,000	$4,634,000	Expansion of existing AdvanTex system can be phased If additional land for drain fields secured, expansion likely fastest alternative	Additional land needed is approximately 11 acres Governance structure may be complicated Each lot provides own onsite septic tank to remove bulk solids Potential pre-treatment for commercial uses Limited public funding for expansion due to private ownership
2. New STEP Collection/ Treatment System	$13,500,000	$4,634,000	Potential public funding options Can be phased	Siting of secondary treatment & drain fields Each lot provides own onsite septic tank to remove bulk solids Potential pre-treatment needs for commercial uses Redundancy challenges
3. Connect to City of Bend's North Interceptor	$8,000,000	$1,324,000	No local treatment system/ effluent disposal required Lowest Costs Potential public funding options Can be phased	Each lot provides own onsite septic tank to remove bulk solids Timing & Coordination w/ City of Bend Future fees/ rates uncertainties, including lifecycle costs that are part of City of Bend's Collection/ Treatment System, and are not factored in this analysis. North Interceptor construction timeline uncertain

Given Tumalo's relatively small population base, the costs of constructing and connecting to a public sewer system, were found to be prohibitively expensive for some property owners without grant funding, or other source to reduce the up-front costs. To estimate the potential rate impacts to Tumalo residents and businesses in the Study Area, and create a funding scenario that would be financially viable for participants in a sewer system, several variables were considered as part of this analysis, including:

The total up-front costs

The potential amount available through grant funding to reduce the up-front costs

Loan terms (length of loan) and interest rate

Ongoing operations and maintenance costs

The number of participants in the sewer district (evaluated as Equivalent Dwelling Units (EDUs)) per phase

As detailed in this report, the most feasible option for constructing and operating a public sewer system in Tumalo, for any of the three alternatives, assumed 50% of the project was funded through grants, with a $15,000 to $25,000 connection fee per EDU. In other words, to keep rates conceptually feasible—less than $100/month per EDU—securing 50% grant funding to reduce up-front costs and assessing a connection fee, once a sanitary sewer district is formed, will provide the most feasible monthly rates for the district participants.

To provide input to the County throughout the development of the study, an Advisory Committee representing a cross-section of community leaders was formed to provide input to the County on the three identified alternatives for serving Tumalo with sewer.

Their assignment was to:

• Evaluate and provide input on the engineering alternatives and associated costs for each alternative.

• Determine the best structure for implementing the preferred alternative.

• Consider the impacts of the various sewer alternatives in terms of cost, construction impacts, and long-term operations and maintenance.

• Recommend a preferred option to address the future of wastewater treatment in the community.

• Provide a roadmap for community implementation.

The Advisory Committee met three times during summer, 2022, to review and provide input on the sewer alternatives. The committee was comprised of a very diverse cross section of Tumalo residents as well as business owners and stakeholders. Based on strong opinions related to potential change to the community culture resulting from the addition of a sewer system, it became clear that consensus would be difficult to achieve.

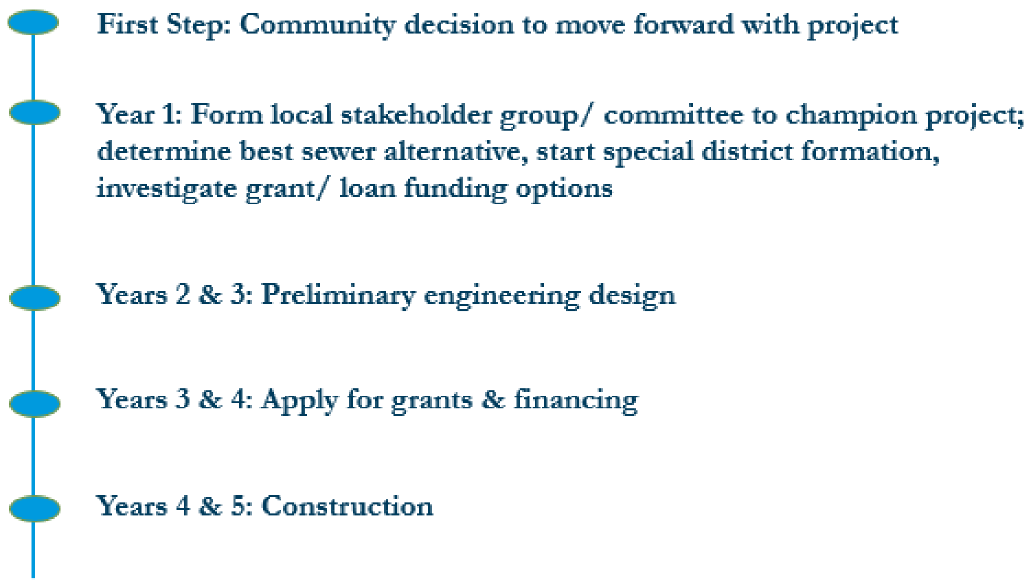
The committee was not asked to recommend a Preferred Option, rather interested stakeholders in Tumalo may decide to pursue a public sewer system option in the future, and this study provides high level costs and an implementation strategy to help with decision making.

Based on a clear differentiation of system need between commercial and residential property owners, the project team evaluated each of the sewer alternatives using a "Phase 1- Commercial Area only" approach, and a "Full Build-Out" approach. A Phase-1 Commercial only approach would enable the commercial area to connect to sewer, with the residential area connecting at a future time as needed, through a public sewer district or other mechanism. Please refer to the General Project Information Memo (Appendix A) to the Advisory Committee, dated July 22, 2022 for a description of the proposed Study Area and rationale, and page 10 of this memo for a map of Study Area phasing.

If the community within the Study Area (community) pursued the Phase 1 approach, the interested property owners would form a public sanitary sewer district in accordance with statutory regulations (See Utility Governance Considerations memo dated September 1, 2022, from Ellen Grover, BB&K, LLP in Appendix B) and could pursue public funding options.

This report will present the capital and lifecycle costs for each alternative with details for implementing a Phase 1 and "full build out" approach. Additionally, a "roadmap" or recommendations for next steps, if the community chooses to pursue a sewer alternative, are provided.

A general project timeline for all alternatives is shown below, with the community deciding to move forward with a sewer project being the first step in the process.



Introduction & Community Profile

Tumalo is a small rural community located approximately three miles northwest of Bend in central Deschutes County. Oregon Administrative Rules recognize communities such as Tumalo as a "Rural Unincorporated Community." Deschutes County regulates land uses and provides planning oversight for the community. Tumalo is recognized as a longstanding rural service center. Tumalo is comprised of residential neighborhoods, a small commercial node, the Tumalo Community School, which are located north of Highway 20 and west of the Deschutes River. Additional commercial and industrial properties are located on the south side of the highway. In recent years, Tumalo has become a destination for many, because of its location adjacent to U.S. Hwy. 20, local businesses, district offices, Tumalo Community School, and Tumalo State Park. Tumalo Community School, which is within the Redmond School District, provides education from kindergarten through 8th grade. The school's geographic area in addition to Tumalo extends to the outlying areas of Bend. The Tumalo community is comprised of approximately 361 tax lots, with a population of 574 (2021 estimate) people.[2]

With the County's update of the Tumalo Community Plan, population and potential build out projections indicate Tumalo is expected to grow consistent with County growth rates to the year 2040. According to the County, Tumalo's projected build-out population (*total population across all lots capable of supporting a dwelling at the time of full build-out) in the year 2040 is 772. This number does not assume build out if the entire community was served by a public sewer system.

In the area surrounding Tumalo, County data show an increase in land divisions, home occupations, marijuana/hemp production operations, and approvals of farm and nonfarm dwellings, primarily on Exclusive Farm Use-zoned properties. Tumalo's home values rose sharply during the period between 2010 and 2020, the percentage of housing stock valued at $500,000 or more increasing from approximately 11% in 2010 to roughly 72% in 2020. The population of Tumalo is predominantly white, although Tumalo has seen increases in Latino community members (3.3% in 2010 to 6.6% in 2020), and an associated decrease in "White alone" single-race community members (93.2% in 2010 to 88.5% in 2020).

As noted during the Tumalo Community Plan update, it is difficult to serve smaller lots (less than an acre) with standard septic systems within the Tumalo Unincorporated Community due to the soils conditions and the area needed for systems and repairs. In some cases, property owners can't obtain a septic system permit approval, and the County has been forced to deny permits for some parcels, leading to business closures.

Study Area Boundary

The project team worked with County staff to identify areas within the Tumalo Unincorporated Community boundary that made the most sense to evaluate for sewer feasibility. Based on a variety of factors, the area of study is focused on the Tumalo Commercial (TUC) area east of Highway 20 and west of the Deschutes River, the properties zoned Tumalo Residential (TUR) east of Highway 20 and west of the Deschutes River, and the properties zoned Tumalo Residential-5 (TUR-5) accessed from Beaver Lane.

Figure 1 shows the "Sewer Study Area" that is evaluated as part of this feasibility study. Limiting the size of the Study Area to higher-density areas reduces the initial capital costs while serving the greatest number of parcels. The project team worked with the County to define the Study Area considering these factors:

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[2] Source: Tumalo Community Plan Story Map (Copy) Tumalo Community Plan - Existing Conditions (arcgis.com), Deschutes County, Oregon.

- The properties within Tumalo's core area are constrained in terms of development potential due to limitations of their septic systems or inability to obtain septic approvals.

- Generally, the commercial properties west of Highway 20 that aren't connected to the TPOA system have enough space to locate on-site treatment facilities.

- The commercial properties west of Highway 20 that are not connected to the TPOA system would be inefficient to serve with sewer due to the distance between each property.

- Most of the residentially zoned properties east of the Deschutes River and west of Highway 20 (especially on the bluff above) are large enough to accommodate onsite treatment facilities. These properties have limited development or redevelopment potential due to existing zoning that limits the development to 5-acre minimum residential properties. Due to the size and spacing of these properties, extending sewers here would be inefficient.

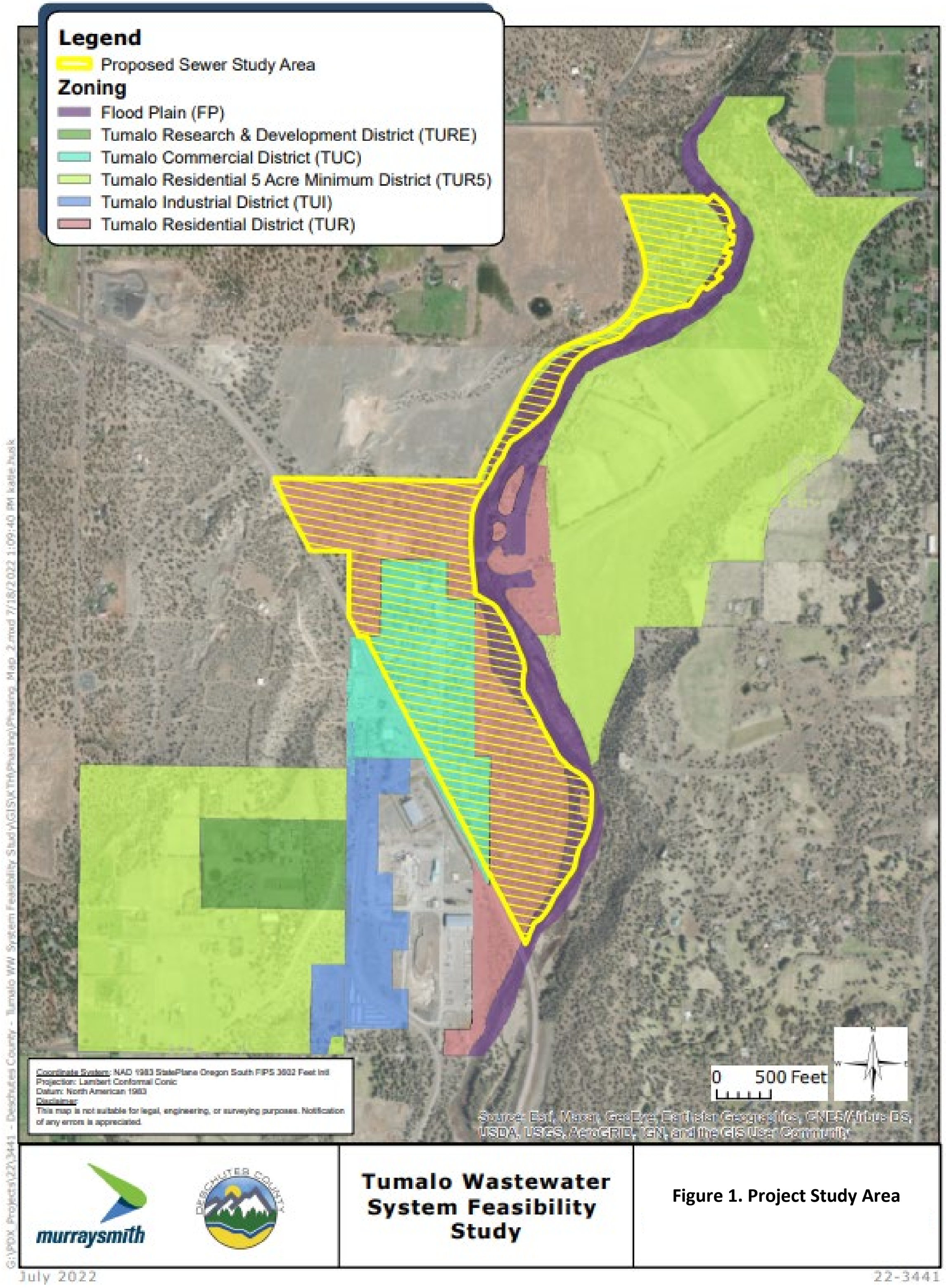

Figure 1. Project Study Area

The Study Area contains 233 lots in total. The TUC zoned properties within the Study Area total approximately 27 acres in size and contains 95 lots with an average lot size of 0.28 acres. The TUR zoned properties within the Study Area total approximately 57 acres contains 102 lots with an average lot size of 0.56 acres. The TUR5 zoned properties within the Study Area contains 36 lots with an average size of 0.59 acres. In total this entire area is roughly 21 acres in size. The TUC zoned and the TUR zoned areas within the Study Area are in close proximity to one another. The TUC5 zoned property within the Study Area is located approximately 2500 feet north of the northern extent of the TUR zoned property on the west side of the Deschutes River along Cline Falls Highway.

West of Highway 20, there is a community wastewater system owned by Tumalo Property Owners Association (TPOA) that serves a portion of the unincorporated community west of Highway 20. This system serves 26 residential units, the Tumalo Feed Company and Tumalo Junction (a small commercial building with Pisano's Woodfired Pizza, a home renovation company and Cline Falls Pool and Spa). The TPOA system is considered a Septic Tank Effluent Pumping (STEP) system which includes a small septic tank for each connection, a collection system, and a patented treatment system with associated drainfields, which are located on property owned by the Laidlaw Water District. The feasibility of expanding the TPOA system to serve additional properties within the Study Area is analyzed as part of this study.

Feasibility of Remaining on Septic Systems

As discussed in the General Project Information Memo (Appendix A) to the Advisory Committee, dated July 22, 2022, County records provide information on permitted septic systems in Tumalo as far back as 1971 and show that the number of repair permits has increased over the past three decades. Data shows that roughly 70 percent of Tumalo's onsite septic systems were installed during the period of 1971-1980. Deschutes County did not implement a septic permit program until 1974. Generally, any system installed prior to 1974 was not installed through a permit and/or inspection process. Figure 2 illustrates onsite septic system permit data for properties within the Tumalo Unincorporated Area boundary by year.

County records indicate that many owners are still using their original systems for wastewater disposal. Although septic systems typically have a useful life of about 30 years, some of the septic systems in Tumalo are over 50 years old. Many systems have reached or are nearing the end of their useful life, and some may be failing. However, Tumalo's graveled, course-textured soils allow wastewater to drain rapidly into the groundwater table or nearby water bodies. Under these circumstances, a failing septic system may not back up or provide visible evidence of failure.

Additionally, many property owners do not have space on their property for new drain fields. The average lot size in the residential core area of Tumalo is 0.56 acres, with a median lot size of 0.41 acres, based on Deschutes County GIS data. According to Deschutes County and the Department of Environmental Quality (DEQ), the minimum safe size for replacement or repair of an existing drain field is 0.5 acres. Typically, the County will work with property owners to find a solution, but a reasonable repair installation may not always meet minimum rule requirements. While circumstances vary based on specific lot configurations, system details, and other factors, if a septic system cannot be repaired or replaced, a home may be considered uninhabitable.

Table 2 illustrates the number of tax lots and average size by phase with the core and Beaver Lane residential areas presented separately. Generally, median lot sizes within the Study Area range from 0.20 to 0.44 acres, and many are limited in size to accommodate new drain fields or to repair existing systems.

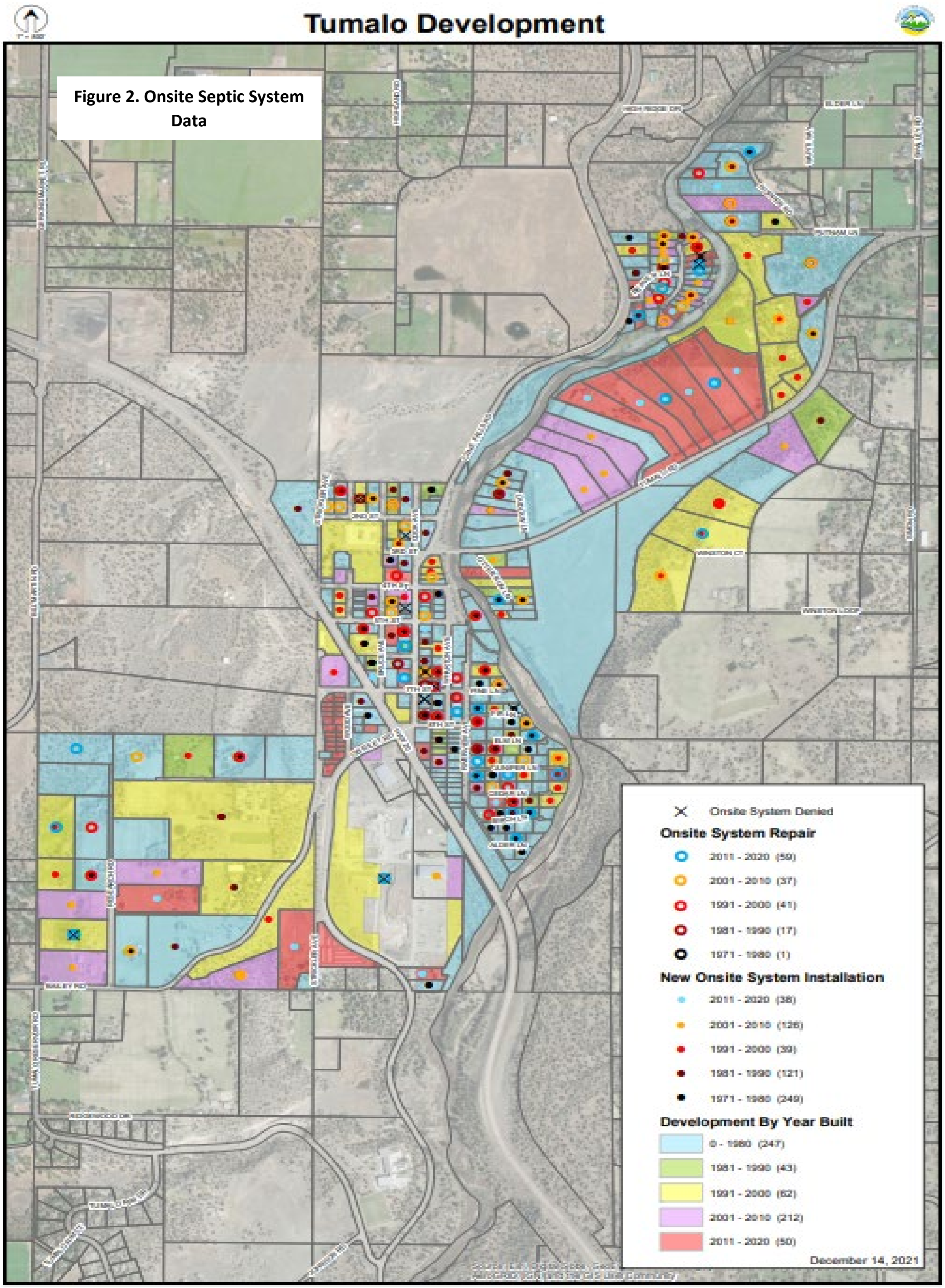

Figure 2. Onsite Septic System Data

Table 2 | Study Area Lot Characteristics

	Area Description	Number of Tax lots	Total Area of All Tax lots (Acres)	Average Tax lot Size (Acres)	Median Tax lot Size (Acres)
Phase 1	Commercial Area	95	26.90	0.28	0.20
Phase 2	Core Residential Area	102	57.32	0.56	0.41
	Beaver Lane Residential Area	36	21.13	0.59	0.44

Some parcels within the Study Area may be suitable for an Alternative Treatment Technology (ATT) system. However, the community's continued reliance on septic systems brings additional concerns, including:

Proximity to drinking water wells. Many households in Tumalo are reliant on wells for drinking water. In some cases, these private wells are not adequately separated from septic drain fields, increasing the risk of contamination and subsequent health risks.

Limits to remodels or expansion. Expansion or remodels to residences may not be feasible on current systems that are at capacity or failing; remaining on septic may limit additional bathrooms, bedrooms, or other remodels.

Limits to use of ATT systems. While a sand filter or other ATT system may be an acceptable solution for some properties, it may not be an adequate solution for every residential lot. Additionally, ATT systems are costly and may require annual maintenance agreements with 3rd party vendors.

Limitations of sand filters and ATT systems. Sand filters may treat pathogens but are not effective in removing nutrients such as nitrogen that are present in septic systems and can adversely affect the health and quality of nearby water bodies. Nutrient seepage into water bodies can accelerate growth of toxic algae and lead to blooms that affect the quality of habitat for native species and health of users.

Geographic limitations. Some of Tumalo's septic systems are located within the floodplain or within proximity of the Deschutes River which may present a risk of contaminating this resource with pathogens, nitrogen, and other waste biproducts. The Oregon DEQ is in the process of implementing pollution limitations for the Deschutes River, though details and timing are currently unknown.

Sewer System Alternatives Analysis

The entirety of the Study Area is estimated to generate up to roughly 45,000 gallons per day of sewage under current population and land use conditions. Based on population forecasts and engineering estimates for flows based on the zoning in the Study Area, full buildout of the Study Area would generate approximately 60,000 gallons per day of sewage flow. These assumed flows provide the basis for the collection and treatment system alternatives. To develop sewer system alternatives and Class V cost estimates for each, the project team identified six factors to assess feasibility of each alternative:

- Treatment level
- Effluent disposal (and land needs)
- Timing
- Long term operations and management
- Governance options
- Monthly rates

Alternatives Development and Selection

Based on existing conditions and analysis of projected future flows, in consultation with the County, the project team identified three alternatives for providing sewer service to the Tumalo Study Area:

1. Expanding the existing TPOA system (Orenco Advantex Treatment System).
2. Constructing a separate collection and treatment system within the Tumalo Unincorporated Community (Orenco Advantex Treatment System).
3. Installing a collection system with treatment and disposal via connection to the City of Bend's planned North Interceptor line at the Cooley Road/Highway 20 intersection (construction timelines for the North Interceptor are yet to be determined).

As part of the initial analysis, gravity collection and Membrane Bioreactor (MBR) treatment systems were considered. A review of geological records for the Study Area suggested that underlying bedrock is sufficiently deep that a gravity collection system, with its advantages for long-term resiliency, may be feasible. Similarly, advanced treatment systems like an MBR offer versatility in effluent disposal options that present specific long-term advantages for communities like Tumalo. Upon weighing the factors listed above to evaluate alternatives for sewer, the project team found both a gravity collection system and MBR treatment system to be cost-prohibitive and overly disruptive to the community because of construction impacts. Additionally, because of topographic limitations, lift stations would be required to serve properties in the low-lying areas east of Riverview Avenue, and a pump station and force main would be required to serve properties in the Beaver Lane area. Refer to Appendix C for additional information on the analysis of the gravity collection and MBR treatment systems.

Collection System

The project team focused on a collection system that consists of a series of pressurized force mains that collect septic tank effluent from each connection for treatment and disposal at a centralized location. This type of system, known as a Septic Tank Effluent Pump (STEP) system, is widely utilized in Central Oregon because it can be installed at relatively shallow depths that avoid underlying bedrock and is less reliant on intermediate lift stations for relatively minor topographic changes. The benefits of this approach include lower initial installation costs, less impactful construction for the community, and greater versatility for expansion of the system.

For each of the three alternatives, the fundamental operation of the system consists of primary treatment at each lot to remove bulk solids through settling in an onsite septic tank. Primary treated wastewater is then transferred via individual low-flow, high-head pumps located in each septic tank through a force main collection system for additional treatment at a central facility. Flow velocities are inherently low in a STEP system as primary treatment reduces the need for scouring. Under these circumstances, system capacity is represented by a much broader range than other force mains which allows for the system to be designed for greater expansion.

The collection system includes the pipes and pumps that move sewage from where it originates to where it is treated. For the entire Study Area collection system, roughly 22,000 linear feet of pipe is needed. Some businesses may require an additional method of pretreatment if the effluent produced is higher strength than domestic sewage. This may occur when wastewater from production processes, such as food and beverage, or other activities is discharged to the collection system that would require enhanced secondary treatment at the central facility. Figure 3 provides an illustration of a STEP Conveyance Pipe System for the Study Area.

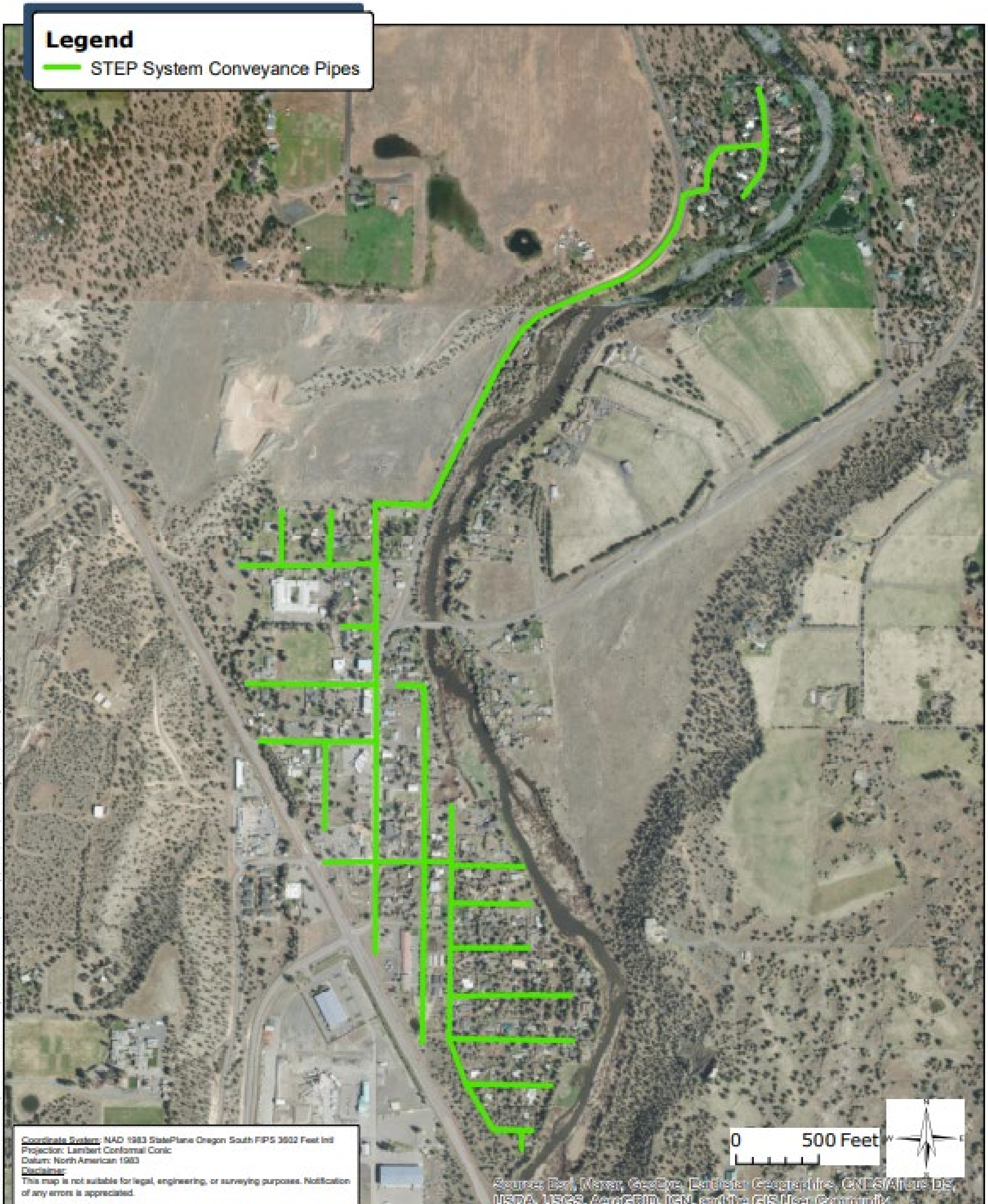

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Figure 3. STEP Conveyance Pipes System

August 2022 22-3441

Analysis of Sewer System Alternatives

Alternative 1 – TPOA Expansion

The existing TPOA System consists of a limited STEP collection system on the west side of Highway 20 and an Orenco Advantex treatment system with effluent disposal via drain fields. A lift station on Strickland Avenue transfers collected wastewater to the treatment system through an approximately 1,200-foot-long, 4-inch PVC force main with an elevation gain of approximately 115 feet.

Alternative 1 was analyzed based on expansion of the existing STEP collection system, lift station, Orenco AdvanTex treatment system, and drain fields. Flows collected from the Study Area would be conveyed via pressurized flow toward a central trunk running from the intersection of 7th Street and Cook Avenue to the west across Highway 20 toward Strickler Avenue.

The facility is permitted for a Maximum Daily Flow of 19,135 gallons and a Monthly Average Daily Flow of 9,567.5 gallons. Discharge Monitoring Reports (DMRs) from 2019 through 2021 were reviewed to evaluate available capacity of the existing system. Influent flows were reported as a daily average flow on a monthly basis with a maximum observed value of 12,972 gallons per day in August 2020 with flows during the summer months of 2019 and 2020 typically exceeding 11,000 gallons per day. The DMRs indicate that the level of treatment is adequate to meet permit limits.

Insufficient influent flow data is available to conclusively evaluate the available capacity of the system. If the limited data available represents the:

- Maximum Daily Flow, the system may be considered to have available capacity for less than 8,000 gallons per day of new flows under the existing permit.
- Monthly Average Daily Flow, the system may be considered to exceed its existing permitted capacity during the summer months.

Both scenarios represent insufficient capacity to accommodate the estimated 60,000 gpd of additional flows from the Study Area at full build out. The TPOA system would require significant expansion of the treatment systems and upgrades to both the existing lift station and force main. For this analysis, the required expansion is considered equivalent to construction of the new collection and treatment system under Alternative 2 which is presented below. The primary differentiator between Alternatives 1 and 2 is the funding and governance requirements, discussed beginning on page 20 of this study.

Alternative 2 – New Local Collection & Treatment System

The proposed new collection and treatment system consists of a STEP collection system with primary treatment at each lot, as previously described, with secondary treatment and final effluent disposal via drain field at a central location. Primary treated effluent would be conveyed by the STEP system across Highway 20 to a new lift station and force main for the final conveyance step out of the "bowl" of Tumalo with a presumed minimum elevation gain of approximately 150 feet over a distance of at least 1,000 feet depending on the final alignment of the force main and location of the secondary treatment system.

The major challenge with local treatment under Alternatives 1 and 2 is the land requirement. An estimated 11 acres of land is required to accommodate the secondary treatment system, active and reserve drain fields, operational/maintenance area(s), and setbacks at full buildout. The system should be located outside of the "bowl" of Tumalo due to the area's rapidly draining soils to prevent similar impacts to groundwater and surrounding water bodies as those associated with the existing septic systems. Additional analysis will be required during detailed design to determine the final requirements for a new system based on the specific conditions and characteristics of a selected site.

The Orenco AdvanTex treatment system is modular and expandable which enables it to be readily adapted to multiple capacity scenarios. Under both Alternatives 1 & 2, the system can be constructed in a phased approach to accommodate the commercial and residential areas separately. Similarly, the STEP collection system can also be constructed in phases though attention should be given to the central trunk and lift station sizing for planned future flows.

Alternative 3 – Pipeline to City of Bend's North Interceptor

Alternative 3 is based on transfer of wastewater from the Study Area to the City of Bend's wastewater collection system. No local treatment system or effluent disposal would be required for this option as treatment capacity would be provided by the City of Bend. This option also relies on a STEP collection system with primary treatment at each lot, as previously described. Primary treated water is collected to a central pump station and force main to the City of Bend's North Interceptor at the planned crossing of Highway 20 in the vicinity of Cooley Road.

STEP collection systems are capable of conveying flows for long distances with limited elevation gain due to the use of low-flow, high-head pumps. The proposed tie-in to the North Interceptor represents an approximate elevation gain of 300 feet over a 2.75-mile-long force main to transfer Tumalo's wastewater to the City of Bend's collection system. The head loss under these conditions is beyond the capabilities of standard pumps typically utilized in STEP systems which requires the assumption of transfer via pump station under this analysis.

The primary advantage of this alternative is that it represents a lower operations and maintenance requirement than local treatment and disposal. The City of Bend may require an out of district surcharge on top of the typical monthly sewer rate which could assist with maintenance of the collection system and pump station.

The primary challenge of this alternative is reliance on an outside entity for feasibility. The timing for construction of the North Interceptor has not been identified. Currently, the North Interceptor has been constructed across Highway 97 but has not proceeded west towards Highway 20 and crossing Highway 20 is part of Phase 3 of the project. Phase 3 is not listed on the City of Bend's five-year capital improvement program. According to City of Bend officials, it could be years before the extension of the line is constructed to Highway 20. This option also requires approval of the Bend City Council for such a connection. There would also need to be amendments to city planning documents. These factors introduce uncertainties for this alternative.

Like Alternatives 1 and 2, this alternative may also be implemented in phases. As previously discussed, the STEP collection system can be readily expanded to accommodate a phased approach. The pump station and force main must be constructed in the first phase and should be designed for buildout conditions.

Figure 4 illustrates the Study Area, broken into two phases, and Table 3 provides estimated Capital and Lifecycle Costs for each Alternative, by phase.

Table 3 | Estimated Capital & Lifecycle Costs by Commercial & Residential Project Phase

Phase		Alternative 1 Expand TPOA	Alternative 2: New STEP Treat/Coll Syst.	Alternative 3 North Interceptor
Phase 1 - Commercial Only	Capital Costs	$ 5,400,000	$ 5,400,000	$ 5,400,000
	Lifecycle Costs	$ 1,744,000	$ 1,744,000	$ 630,000
Phase 1 Totals		**$ 7,144,000**	**$ 7,144,000**	**$ 6,030,000**
Phase 2 - Residential Only	Capital Costs	$ 8,100,000	$ 8,100,000	$ 2,600,000
	Lifecycle Costs	$ 2,890,000	$ 2,890,000	$ 730,000
Phase 2 Totals		**$ 10,990,000**	**$ 10,990,000**	**$ 3,330,000**
Full Buildout, Capital + Lifecycle Costs		**$ 18,134,000**	**$ 18,134,000**	**$ 9,324,000**

As noted previously, Alternatives 1 and 2 would require approximately 11 acres of drainfield treatment area for the anticipated flow at full buildout. If the community wanted to move forward with providing sewer to only the commercial (Phase 1) portion of the Study Area, the estimated flows would require approximately 3 acres for treatment and disposal, reducing the costs for property acquisition or lease. This evaluation determined providing sewer to Phase 1 only has advantages because of the speed of implementation and reduced immediate cost impacts but may be problematic for addressing the long-term wastewater challenges for the residential community within the Study Area.

Alternative 3, directing flows to the City of Bend's North Interceptor, has the advantage of requiring a collection system and pump station only, as no new local treatment system would be required. This alternative has the lowest estimated lifecycle costs over the 20-year planning period. As noted previously, the timing and feasibility of Alternative 3, however, is contingent upon the construction of the North Interceptor by the City of Bend and approval of the connection. The North Interceptor is not included in Bend's 5-year Capital Improvement Plan and timing is uncertain. Additionally, future connection fees and utility rates are unknown at this time and therefore not included in this analysis.

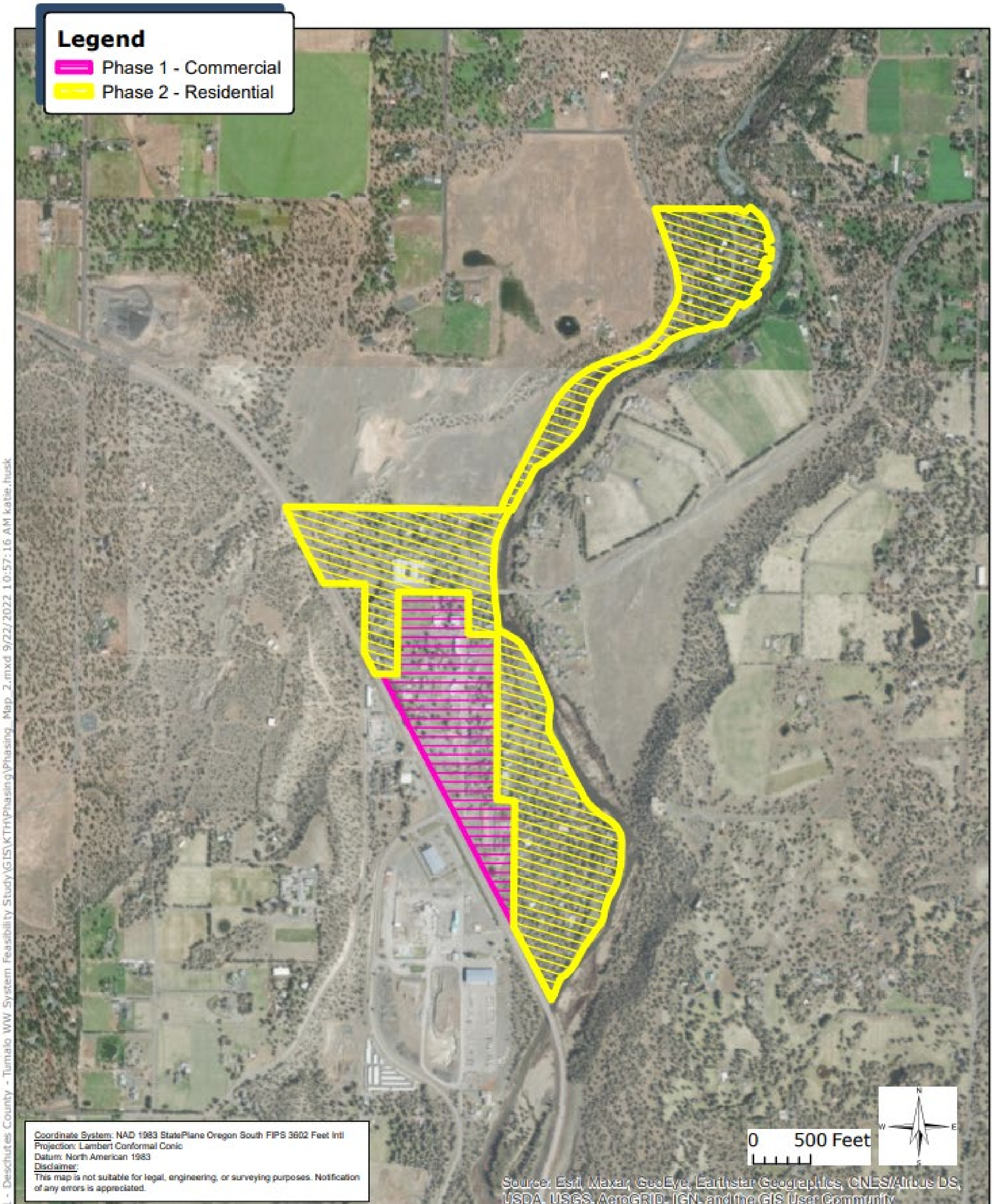

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Figure 4. Project Phasing

Monthly Rate Information

To estimate the potential monthly cost of connecting to a sewer system for each Tumalo household or commercial business, several factors need to be considered, as outlined below.

- Capital cost: How much does the sewer system cost?
- Operations and lifecycle cost: How much will it cost long-term to operate and maintain the system?
- How many potential ratepayers are there to help pay for the sewer system in terms of number of equivalent dwelling units (EDUs)?
- What is the interest rate and term of the loan (payback period) for the capital costs?
- Is there an opportunity for grant funding or loan forgiveness to help offset a portion of the capital costs?

Based on the current number of parcels within the Study Area, the number of potential ratepayers is assumed to be 95 commercial properties and 138 residential properties for the Study Area. In the future, the full build out of the Study Area, based on estimates in the Tumalo Community Plan, could support an additional 101 properties being developed by year 2040, adding to the potential ratepayer base for a sewer district.

If the community pursued construction of a sewer system to serve the Study Area, owners of commercial parcels will likely pay a higher portion of the capital and monthly lifecycle costs than single family residential, based on projected flows from typical commercial developments. However, without knowing the type of commercial development that could occur on each lot in the future, it is difficult to estimate specific flows. For example, a retail store will generate lower sanitary sewer flows than a restaurant. For this reason, the analysis assumes that each single-family residential lot will generate flows equal to 1.0 EDU, and commercial lots will generate average flows equal to 1.5 EDUs, although flows from restaurants, multi-family residential, or the existing school may be greater.

Table 4 illustrates a conceptual monthly rate analysis for each of the Study Area Phases. Several assumptions are incorporated in these scenarios, including the following:

- No inflation rates are factored into this analysis.
- An interest rate of 2% for a loan term of 30 years is included to reflect average probable loan terms for public financing options such as Water Infrastructure Finance and Innovation Act (WIFIA) or a Clean Water State Revolving Loan Fund loan.

Costs for septic to sewer conversions on private property may vary widely based on lot characteristics, so are not factored into this analysis. Additionally, because each sewer system alternative includes the use of an onsite septic tank on each parcel to remove bulk solids, there may be an opportunity for a property owner to use their existing septic tank, depending on the condition. This would reduce the private property costs for converting to sewer.

Table 4 | Estimate of Capital & Lifecycle Costs – Monthly Payment/ Rate Estimates

Key Financial Variables	**Full Buildout**		**Phase 1: Commercial Only**	
	Alt. 1-2 Treatment in Tumalo	Alt. 3 Connect to Bend	Alt. 1-2 Treatment in Tumalo	Alt. 3 Connect to Bend
Data is meant to illustrate the basic economics using ballpark estimates. This discounts the ramp-up period in connections. Does not include private property improvement requirements (septic tank pump system retrofits and connection).				
Key Variable: Up-front Costs				
Total Project Capital Cost				
New Facilities	$ 13,500,000	$ 8,000,000	$ 5,400,000	$ 5,400,000
Assumed City of Bend Treatment Capacity Charge	-	$ 1,590,000	-	$ 810,000
Total Up-Front Cost	$ 13,500,000	$ 9,590,000	$ 5,400,000	$ 6,210,000
Assumed Grant % (for illustration only)	10%	10%	10%	10%
Assumed Grant Funding	$ 1,350,000	$ 959,000	$ 540,000	$ 621,000
Local Share of Up-front Cost	$ 12,150,000	$ 8,631,000	$ 4,860,000	$ 5,589,000
Assumed Loan Terms:				
Length of Loan- 30 years				
Interest Rate- 2%/ year				
New Annual Debt Service	**$ 540,000**	**$ 390,000**	**$ 220,000**	**$ 250,000**
O&M Costs				
Maintenance	$ 232,000	$ 67,000	$ 87,000	$ 32,000
Wholesale Treatment Charge	-	$ 130,000	-	$ 70,000
Admin Cost (for illustration only)	$ 30,000	$ 30,000	$ 20,000	$ 20,000
Total Annual O&M Costs	**$ 262,000**	**$ 227,000**	**$ 107,000**	**$ 122,000**
Total Annual Cost	**$ 802,000**	**$ 617,000**	**$ 327,000**	**$ 372,000**
Potential Initial EDUs:				
Commercial lots	95	95	95	95
Residential lots	138	138	0	0
Assumed EDUs per commercial lot: 1.5				
Potential Initial EDUs	280.5 EDUs	280.5 EDUs	142.5 EDUs	142.5 EDUs
** If private TPOA system is expanded and remains a private utility, the project will likely not be eligible for public financing loans and/ or grants.*				

Key Variables: Estimating the Rate Impacts

To estimate the potential rate impacts to Tumalo residents and businesses in the Study Area, and create a funding scenario that will be financially viable for participants in a sewer system, several variables were considered as part of this analysis, including:

- The total up-front costs
- The potential amount available through grant funding to reduce the up-front costs
- Loan terms (length of loan) and interest rate
- Ongoing operations and maintenance costs
- The number of participants in the sewer district (evaluated as EDUs) per phase

Table 5 illustrates monthly rate scenarios based on some portion of the project being funded with grants, with potential revenues from varying connection (hookup) fees factored into the scenarios. Rates less than $100/month are shown in green, rates between $100 and $150/month are shown in orange, and rates more than $150/month are shown in red. Connection fees between $0 and $25,000 are shown (and are not inclusive of private, on-site improvements such as septic tank pump retrofits and other costs necessary to connect to the public system).

As illustrated, the scenarios are optimized for both a Phase 1 Commercial-only sewer service area, and a full build out scenario with 50% grant funding, and a $15,000 to $25,000 connection fee/ EDU. In other words, to keep rates relatively low—less than $100/month—attaining 50% grant funding to reduce up-front costs and a connection fee assessed by a future sewer district to make the district financially sustainable will be necessary.

Table 5 | Estimated Monthly Rates based on Varying Connection Fees and Assumed Grant Funding*

Hookup Fee	10% Grant Funding				30% Grant Funding				50% Grant Funding			
	Alternative 2		Alternative 3		Alternative 2		Alternative 3		Alternative 2		Alternative 3	
	Phase 1 Only	Full Build	Phase 1 Only	Full Build	Phase 1 Only	Full Build	Phase 1 Only	Full Build	Phase 1 Only	Full Build	Phase 1 Only	Full Build
$0	$191	$238	$218	$183	$162	$203	$182	$157	$133	$167	$153	$130
$5,000	$174	$220	$200	$163	$144	$185	$165	$139	$115	$149	$136	$112
$10,000	$150	$203	$182	$145	$127	$167	$147	$118	$98	$131	$118	$94
$15,000	$133	$182	$159	$127	$104	$146	$130	$100	$80	$111	$95	$76
$20,000	$115	$164	$142	$106	$86	$128	$112	$82	$57	$93	$77	$56
$25,000	$98	$146	$124	$88	$68	$111	$95	$64	$39	$75	$60	$38

*Red = >$150/month, Orange = $100 to $150/month, Green = <$100/month. Full buildout assumes 280.5 EDUs; Commercial only assumes 142.5 EDUs. Revenue from varying connection fees included in monthly estimates. Example monthly rates based on 1.0 EDU.

Implementation

This feasibility study has provided Class V cost estimates for three alternatives to provide sewer to the Study Area, along with a phased approach for initially serving only the commercial core. It is important for the residents and property owners within the Study Area to understand potential impacts of both the capital costs of the required infrastructure as well as the lifecycle costs that will be reflected in monthly rates over time. This is not intended to provide legal recommendations, but a summary of steps to move forward with a potential solution.

For all the Alternatives evaluated in this study, there is an advantage of approaching the project in two Phases: Phase 1 focusing on the Commercial properties only, and connection of the adjacent residential properties as needed. This approach allows the commercial property owners to establish a sanitary sewer special district, limiting the boundary to encompasses only the property within the Tumalo commercial core area. This approach would lessen the impact to the adjacent properties outside of the district boundary, as the properties would not have "legally available" sewer, and therefore not be required to connect to sewer under DEQ regulations.

According to OAR 340-071-0160(4)(f)(B) "Legal availability. A sewerage system is deemed legally available if the system is not under a DEQ connection permit moratorium and the sewerage system owner is willing or obligated to provide sewer service", legal availability can be defined by the owner of a sewer service or district, and the district may determine whether sewer is legally available to serve an adjacent property. In this manner, the residential property owners could potentially remain on existing septic systems until such a time that they were unable to achieve repair or replacement permits, and petition to annex to the sewer special district at such a time.

This strategy does not imply that remaining on septic systems will be an option for every lot in the future. Lot size limitations, potential pollution from effluent, and additional factors may limit the ability of the properties to accommodate septic, and authorization is subject to DEQ requirements. Connecting to a sewer system in the future may become the only feasible option for some property owners which would require annexation to the sanitary sewer district. The costs and feasibility for annexing at a future date are unknown at this time.

The following are recommendations for next steps if the community decides to pursue a sewer system in the future.

Alternative 1: Expansion of the existing TPOA System

Because the TPOA system is a private system, prior to a decision to pursue expansion and connection to the system, or acquisition of the entire system, it is recommended that the community consider a third party legal and engineering review of the system and governance documents. The project team has taken a high-level consideration of the capacity for expansion of the sewer system and has provided an overview of the TPOA governing documents is provided in Appendix B, Utility Governance Considerations memo (Governance Memo) dated September 1, 2022, from Ellen Grover, BB&K, LLP, summarized in the following sections of this study.

As noted in the Governance Memo, "Assuming TPOA can provide appropriate level of service to expanded areas, it is possible to voluntarily add property to the system and TPOA governance structure. A separate special service district—a local form of government established by the constituents in the district to meet specific service needs—could also be formed to serve areas outside of TPOA or incorporate the TPOA into the district boundary. There are several special district options. Depending on the service desired, there may be advantages of one service district type over another, however formation of each involves a public hearing and potential election process. We recommend further evaluation of this and encourage investigation into available resources at the Special Districts Association of Oregon." The Governance Memo notes that TPOA was incorporated with perpetual existence, as a nonprofit corporation. Members of TPOA are owners of any property that connects to the private community sewer system and as such, becomes a member of the Association subject to the Declaration.

The following potential risks for the community to consider are identified in the Governance Memo:

Risk of dissolution: "An unincorporated association has no structure or governance. While dissolution could be a remote risk, if it occurred, it could be costly to the members and difficult to develop a workable replacement structure".

Budgetary control risks: "Members do not have any specific process or substantive rights in budget setting, including capital budget needs. The budget is material to assessments charges and therefore Members have limited ability to protest assessment amounts".

Members' responsibility for connection fees: "There is no indication of the basis on which the connection fees are established".

Potential personal obligation: "All assessments are personal obligations and subject to suit for money judgement. Note: This enforcement right is limited by the ability of TPOA to recover such judgment from the owner or previous owner and would be subject to enforcement based on the judgement lien priority".

Debt financing restrictions: "The Declaration provides that TPOA acquired the system "using a loan from Declarant" and to borrow money from Declarant for expansions to add capacity. Declaration, section 4.2. Note. This could be construed to limit TPOA's authorities to refinance or seek financing other than from Declarant for the system and expansions even when such alternative financing may be in the best interest of TPOA. This issue should be clarified in the Bylaws".

These issues are discussed in full in the Governance Memo.

If the community does decide to pursue connection to the TPOA system, it is recommended that the system is evaluated further by a registered engineer, and that legal counsel is obtained. Full legal analysis of the TPOA system and bylaws are beyond the scope of this study. While the project team found limited capacity in the TPOA system to serve additional properties, there may be capacity to connect and serve a portion of the commercial properties as a first phase of a sewer system.

Next steps, if the community were to pursue connection to the TPOA system include:

Assessing the feasibility of establishing sanitary sewer district

- Begin conversations with Deschutes County about the steps necessary to form a special district
- Form a local committee to the manage process, likely hire legal counsel to assist.
- Procure a third-party engineering review of TPOA system capacity and legal review of TPOA governance documents.

Determining the district boundary.

- Work with the community to determine whether a Phase 1 approach for only the commercial area is feasible, or whether there is support from the entire Study Area to move forward.

- Determine the rate structure, begin steps to implement special district.

It is unclear whether the TPOA system could be acquired or expanded using public financing options, such as through Business Oregon, WIFIA, or DEQ/ State Revolving Loan program, because it was constructed as a private system. It is recommended that the community discuss the potential for public financing with Business Oregon.

If private extension of the TPOA system is proposed by TPOA or others, it is noted that TPOA will require a License Agreement with Deschutes County to locate a private sewer system in public road right-of-way. In consideration of this, the County will also want to consider that licensure of the TPOA system in public right-of-way may satisfy the State DEQ definition of Physical Availability (within 300 feet of a single-family residence and Legal Availability per OAR 340-071-0160(4)(f)(B)). The County may be unable to issue new or repair septic permits if a residential property if the TPOA system is both physically and legally available.

Alternative 2: Installation of a separate collection and treatment system

As discussed in the analysis of Alternative 1, if the community wanted to pursue construction of a separate collection and treatment system non-dependent of the TPOA system, similar steps would be taken for implementation.

Evaluate feasibility of establishing sanitary sewer district

- Begin conversations with Deschutes County about the steps necessary in forming a special district.
- Form a local committee to the manage process, likely hire legal counsel to assist.

Determine the district boundary.

- Work with the community to determine whether a Phase 1 approach for only the commercial area is feasible, or whether there is support from the entire Study Area to move forward. Similar to Alternative 1, Alternative 2 could be designed to support a Phase 1 approach and establish a sanitary sewer district to serve the commercial area only, which would limit the legal availability of sewer to the adjacent residential areas until warranted.
- Determine the rate structure, begin steps to implement special district.

Discuss funding opportunities with Business Oregon.

Set up a “One Stop” meeting for an overview of various public funding opportunities, including grants and loans.

Begin preliminary design and apply for funding.

Final design and construction.

Alternative 3: Installation of a collection system with treatment and disposal via connection to the City of Bend’s “north interceptor” line

Evaluate feasibility of establishing sanitary sewer district.

- Begin conversations with Deschutes County Board of Commissioners about the steps necessary to form a special district.

- Form a local committee to manage the process, likely hire legal counsel to assist.

Begin conversations with the City of Bend regarding the timing and potential for a connection to the City's North Interceptor in the future.

Coordinate with City of Bend and Deschutes County on the best path forward.

Determine the district boundary.

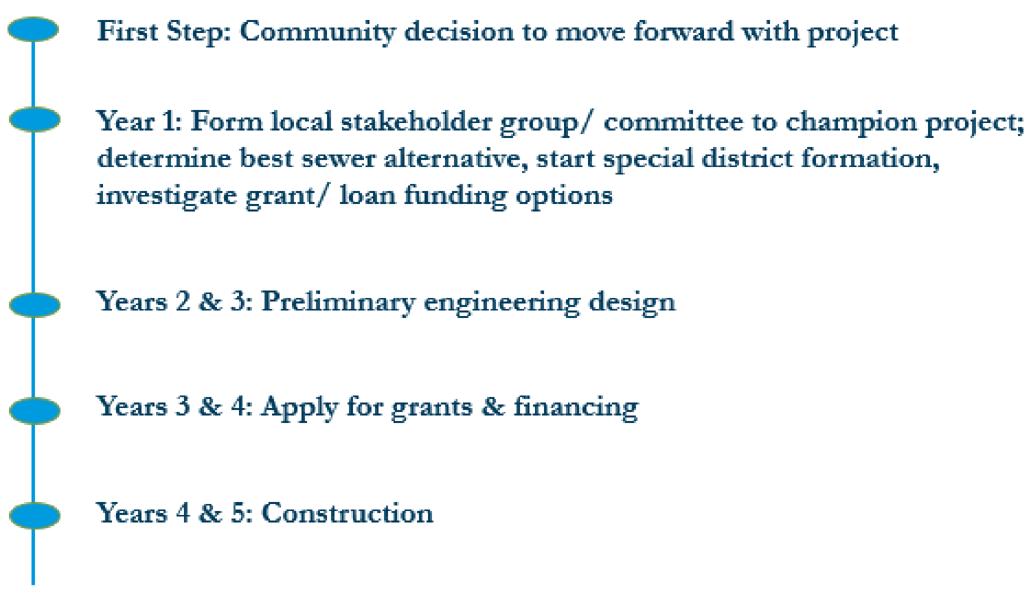
- Work with the community to determine whether a Phase 1 approach for only the commercial area is feasible, or whether there is support from the entire Study Area to move forward. Similar to Alternatives 1 and 2, Alternative 3 could be designed to support a Phase 1 approach and establish a sanitary sewer district to serve the commercial area only, which would limit the legal availability of sewer to the adjacent residential areas until warranted.

If there is support from the City of Bend, work to determine rate structure, scope of project, and design/engineering requirements.

Begin preliminary design and apply for funding.

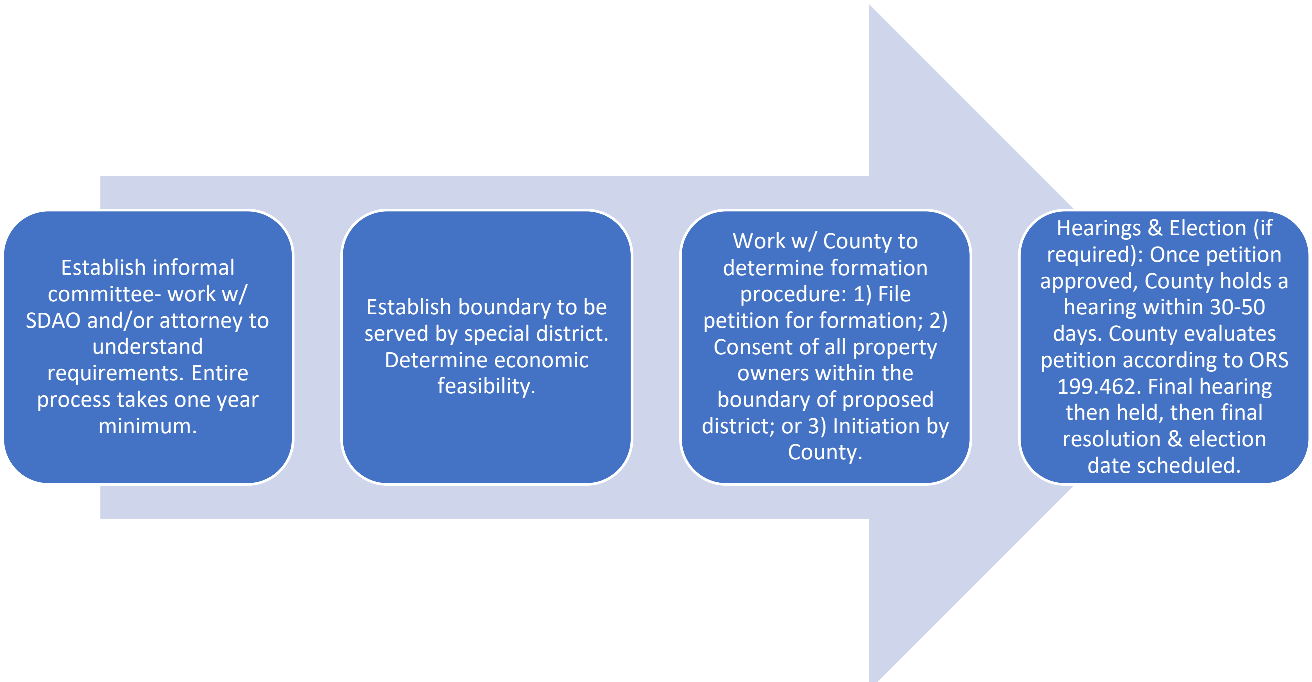
Final design and construction.

A general project timeline for all alternatives is shown below, with the community deciding to move forward with a sewer project being the first step in the process.



Special District Formation

Special districts in Oregon are governed by Oregon Revised Statutes (ORS) Chapter 198. Please refer to the memo provided by Ellen Grover, dated September 1, 2022 (Appendix B), for specific recommendations regarding establishing a district for the Tumalo Study Area for the specific purpose of providing sewer service, and an evaluation of the feasibility of expanding the TPOA system. In general, establishing a special district requires four essential steps, shown in the graphic below. If the community does want to pursue formation of a special district the Special Districts Association of Oregon (SDAO) and Deschutes County should be consulted on the specific actions required and the best path forward.



Resources:

The Special Districts Association of Oregon (SDAO) provides useful information regarding formation of a special district: https://www.sdao.com/what-is-a-special-district

Deschutes County provides an informational packet and instructions for communities interested in special district formation:

https://www.deschutes.org/sites/default/files/fileattachments/road/page/23051/formation_document_for_public_with_petition.pdf

Additional documents related to the Advisory Committee formation, roster, meeting notes, and presentations are included as Appendices D, E, F and G.

Appendices

A. General Project Information Memorandum
B. Utility Governance Considerations Memorandum
C. Collection & Treatment Alternatives Technical Memorandum
D. Advisory Committee Schedule & Participants
E. Advisory Committee Meeting #1 Materials
F. Advisory Committee Meeting #2 Materials
G. Advisory Committee Meeting #3 Materials

Tumalo Wastewater System Feasibility Study

Date: July 22, 2022

To: Tumalo Wastewater Feasibility Study Advisory Committee

From: Katie Husk, PE
Justin Moman, PE
Jon Skidmore
Susanna Julber

Re: General Project Information

Introduction

At the request of property and business owners within the community, Deschutes County[i] has commissioned a feasibility study to develop options for providing sewer services to the unincorporated community of Tumalo. An engineering team led by Murraysmith is developing the study. An Advisory Committee with a cross-section of community leaders will provide input to the County on the three identified alternatives for serving Tumalo with sewer. Their assignment:

- Evaluate and provide input on the engineering alternatives and associated costs for each alternative.
- Determine the best structure for implementing the preferred alternative.
- Consider the impacts of the various sewer alternatives in terms of cost, construction impacts, and long-term operations and maintenance.
- Recommend a preferred option to address the future of wastewater treatment in the community.
- Provide a roadmap for community implementation.

This memo provides a project overview for the Advisory Committee and other interested parties. It is meant to provide background information and highlight key items related to the study and the process.

Current Wastewater Conditions in Tumalo

The majority of Tumalo relies on private on-site septic systems for wastewater disposal. County data provides information on permitted septic systems in Tumalo as far back as 1971 and shows that the number of repair permits has increased over the past three decades, as illustrated in

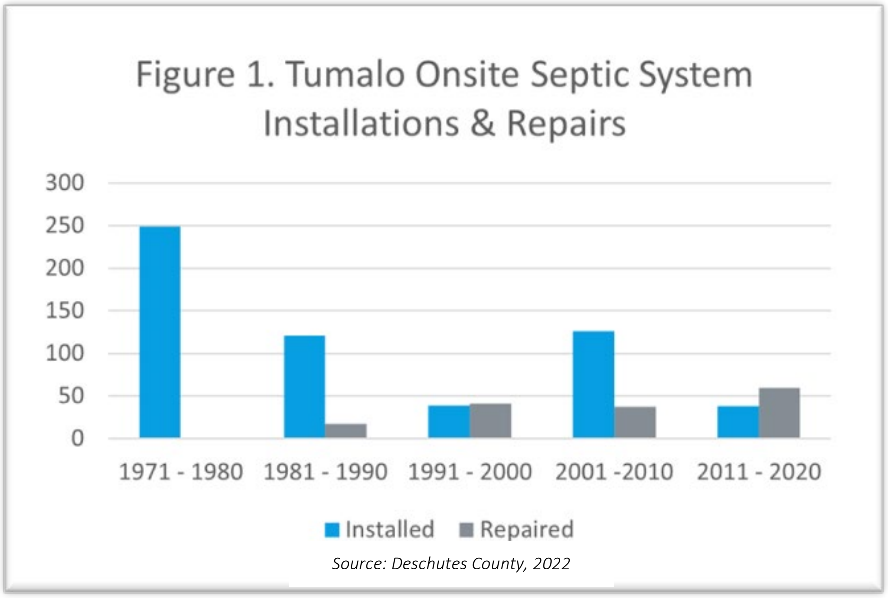


Figure 1. Although septic systems typically have a useful life of about 30 years, some of the septic systems in Tumalo are over 50 years old. Many systems have reached the end or are nearing the end of their useful life. Additionally, the smaller properties within the Tumalo Unincorporated Community boundary are limited by their smaller lot sizes, and many property owners cannot obtain permits for repair or new installation. Finding solutions for these lots is challenging without a community wastewater solution.

In addition to the individual onsite septic systems, there is a community wastewater system owned by Tumalo Property Owners Association (TPOA) that serves a portion of the unincorporated community west of Highway 20. This system serves 26 residential units, the Tumalo Feed Company and Tumalo Junction (a small commercial building with Pisano's Woodfired Pizza, a home renovation company and Cline Falls Pool and Spa). The TPOA system is considered a Septic Tank Effluent Pumping (STEP) system which includes a small septic tank for each connection, a collection system, and a patented treatment system with associated drainfields, which are located on property owned by the Laidlaw Water District.

Project Area

The project team has worked with County staff to identify areas within Tumalo that make the most sense to evaluate for sewer feasibility. Based on a variety of factors, the area of study for this effort is proposed to focus on the properties zoned Tumalo Commercial (TUC) east of Highway 20 and west of the Deschutes River, the properties zoned Tumalo Residential (TUR) east of Highway 20 and west of the Deschutes River, and the properties zoned Tumalo Residential-5 (TUR-5) accessed from Beaver Lane.

Figure 2 shows the "Sewer Study Area" that is proposed to be evaluated as part of the feasibility study. Limiting the size of the study area to higher-density areas reduces the initial capital costs while serving the greatest number of parcels. The project team worked with the County to define the Project Area considering these factors:

- Currently, the properties within Tumalo's core area are constrained in terms of development potential due to limitations of their septic systems or inability to obtain septic approvals.
- Generally, the commercial properties west of Highway 20 that aren't connected to the TPOA system have enough space to locate on-site treatment facilities.

- The commercial properties west of Highway 20 that are not connected to the TPOA system would be inefficient to serve with sewer due to the distance between each property.

Most of the residentially zoned properties east of the Deschutes River and west of Highway 20 (especially on the bluff above) are large enough to accommodate onsite treatment facilities. These properties have limited development or redevelopment potential due to existing zoning that limits the development to 5-acre minimum residential properties. Due to the size and spacing of these properties, extending sewers here would be inefficient. Therefore, this feasibility study is proposed to focus on the "Sewer Study Area" as depicted in Figure 2, subject to the concurrence of the Advisory Committee.

Sewer System Options to be Studied

The engineering team will review three options as part of the feasibility study to serve the properties in the Project Area:

1. Expansion of the existing TPOA system
2. Installation of a separate collection and treatment system within the Tumalo Unincorporated Community
3. Installation of a collection system with treatment and disposal via connection to the City of Bend's "north interceptor" line at the Cooley Road/Highway 20 intersection (construction timelines for the north interceptor are yet to be determined)

Funding Options & Governance Structure

The capital investments necessary for any type of community sewer system in Tumalo will be significant. Further, the ongoing maintenance and operational realities of a collection and treatment system will also require significant investment. As a result, the project team is exploring possible low interest loans and grants for the final wastewater solution. If the community of Tumalo decides to pursue a sewer option, property owners served by a sewer system will have monthly utility bills and ongoing operations and maintenance costs. It will be important for the community to understand these costs.

Each of the sewer system options considered may have separate legal governance and operating structures to consider as the group makes its recommendation. The engineering team will assist the Advisory Committee in evaluating the pros and cons of each of the finance/ governance structures to allow for informed recommendations.

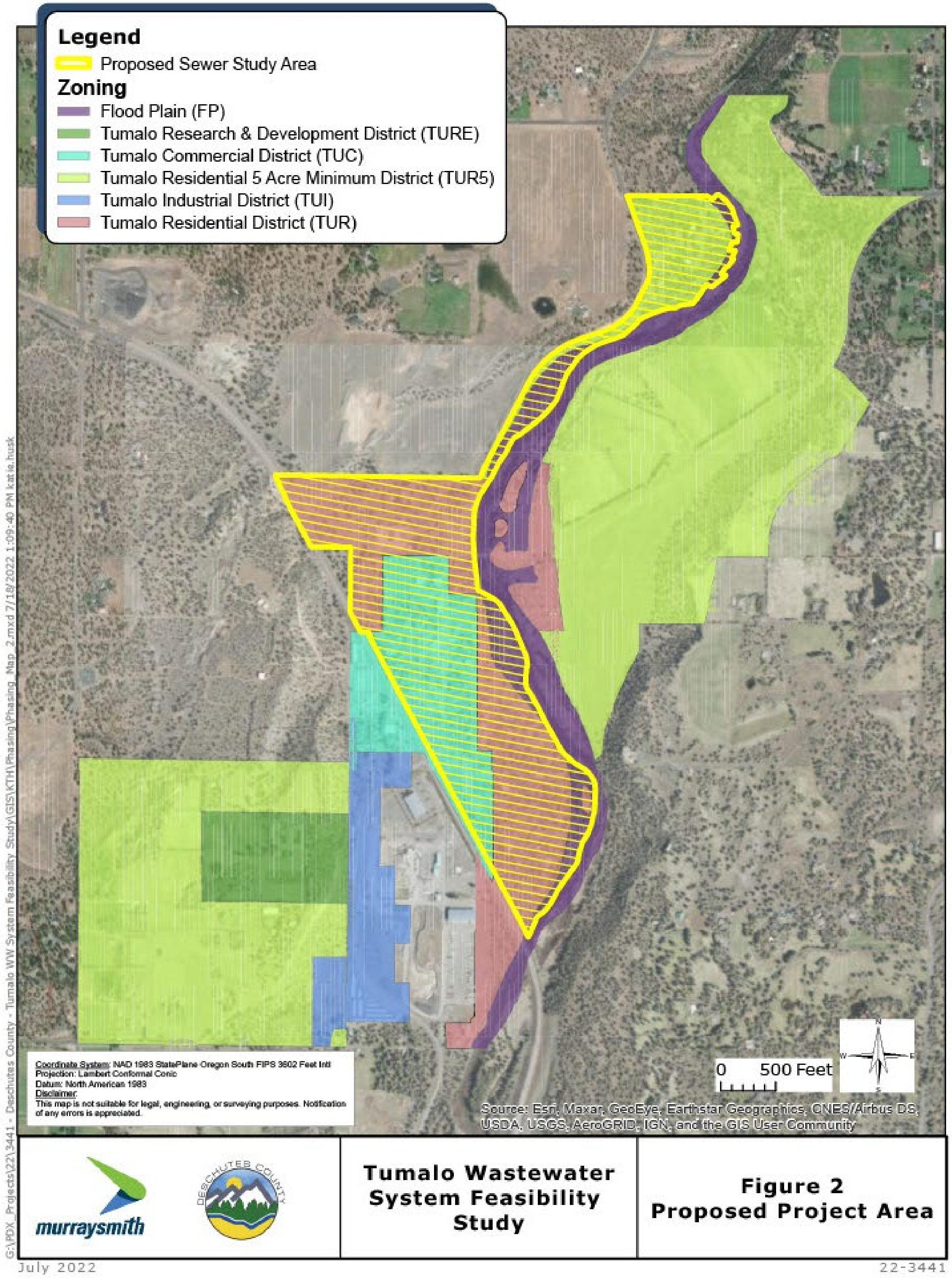
Learn More

The project team has created a website to post project news and Advisory Committee meeting information, which will be updated regularly: TumaloSewerOptions.org

Questions can be directed to:

- Susanna Julber – susannajulber@barneyandworth.com (458) 202-5746
- Jon Skidmore – Jon.Skidmore@murraysmith.us (541) 279-2465

[i] Note: Deschutes County is not a utility service provider and will not own or operate a future system within the community of Tumalo.


Legend
Proposed Sewer Study Area
Zoning
Flood Plain (FP)
Tumalo Research & Development District (TURE)
Tumalo Commercial District (TUC)
Tumalo Residential 5 Acre Minimum District (TUR5)
Tumalo Industrial District (TUI)
Tumalo Residential District (TUR)
Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet Intl
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer:
This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.
0 500 Feet
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
murraysmith
Tumalo Wastewater System Feasibility Study
Figure 2
Proposed Project Area
July 2022
22-3441

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Memorandum

To: Tumalo Wastewater Advisory Committee, Chris Doty, Deschutes County

From: Ellen Grover

Date: September 1, 2022

Re: Tumalo Wastewater System Feasibility Study—Utility Governance Considerations

1. Summary

This memorandum provides a high level review of governance considerations for potential sewer service options for the Tumalo Wastewater System Feasibility Study area. An existing private community sewer system is operating to serve a residential community located within a portion of the study area. It is owned, operated and governed, as provided through a recorded property declaration of covenants, conditions and restrictions, by the Tumalo Property Owners Association, LLC ("**TPOA**"). Assuming TPOA can provide appropriate level of service to expanded areas, it is possible to voluntarily add property to the system and TPOA governance structure. A separate special service district—a local form of government established by the constituents in the district to meet specific service needs—could also be formed to serve areas outside of TPOA or incorporate the TPOA into the district boundary. There are several special district options. Depending on the service desired, there may be advantages of one service district type over another, however formation of each involves a public hearing and election process. We recommend further evaluation of this and encourage investigation into available resources at the Special Districts Association of Oregon.

In considering available options, the following local governance considerations may be impactful:

- Durability of ownership and governance structure
- Local control over governance
- Financial controls
- Access to records and information
- Availability of financing options
- Enforcement of assessments

2. Private Community Sewer System.

2.1 Ownership: Tumalo Property Owners Association, LLC ("TPOA")

(a) Members of TPOA are owners of any property that connects to the private community sewer system and, thereby, becomes a member in the Association subject to the Declaration. It includes property within an initial development. Additional property may be connected upon Declarant/Board approval and provided the owner of the property agrees to be obligated under the provisions of the Declaration and record an acknowledgement to that effect.

(b) TPOA was incorporated with perpetual existence. The Declaration provides that in the event the Association is dissolved, whether inadvertently or deliberately, "it shall be automatically succeeded by an unincorporated association of all Owners of the same name" and that "all of the property, powers and obligations" shall "automatically vest in the successor unincorporated association." Note: *An unincorporated association has no structure or governance. While dissolution could be a remote risk, if it occurred, it could be costly to the members and difficult to develop a workable replacement structure*.

2.2 Governance Structure: Nonprofit Corporation (TPOA)[1]

(a) *Relevant Authority*: Oregon Revised Statutes Chapter 65, Declaration of Joint Use and Maintenance Obligations for Private Community Sewer System ("**Declaration**") recorded as instrument 2018-43964), Bylaws of Tumalo Property Owners Association, LLC ("**Bylaws**"), Articles of Incorporation ("**Articles**" as amended).

(b) *Control*

(i) Turnover. Declarant controlled until a) all loans Declarant provided to TPOA are repaid and b) until Declarant no longer owns any property subject to the Declaration. Declaration, Section 6.4 and Bylaws Section 2. Note: *This control structure is likely to remain in place for the foreseeable future assuming outstanding loans. There is no sunset term to force turnover nor ability for Members to cause turnover otherwise*.

(ii) Declarant is defined by the Declaration as Kine, LLC and Tumalo Investments, LLC.[2]

(iii) Board of Directors. Interim Board of Directors. Declarant appoints a three member interim Board of Directors prior to Turnover. After Turnover, member elected Board of Directors of 3-5 members.

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[1] The Declaration asserts that it is not a Planned Community Act Owners Association under ORS Chapter 94. This is likely due to the fact that the date of original subdivision platting was prior to January 1, 2002; however, further research into whether an owners association formed after this date is nevertheless still subject to ORS Chapter 94 exceeded the scope of this review. We assume for purposes of this review that ORS Chapter 94 does not apply except as provided in ORS 94.572

[2] The Bylaws identify Kine LLC as the only Declarant. This needs to be clarified. The Bylaws should also be reviewed for typographical errors.

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(1) Board exercises for TPOA "all powers, duties and authority vested in or delegated to the Association except those reserved to the Members in the Declaration, Articles of Incorporation or these Bylaws." Bylaws, Article IV, Section 3.

(2) Reserved Member Authority: Each Class A Member is entitled to one (1) vote per each Lot owned.

a. Elect and Remove Directors
b. Call special meetings
c. Propose amendments to Bylaws and approve with majority of quorum (defined as 20% of the votes entitled to be cast at any meeting)
d. Amend Declaration with 75% approval of total vots of each class of members eligible to vote.
e. Inspect books and records. Cause an audit (at Member's expense)
f. Enforce "all of the covenants, conditions, restrictions, reservations, easements, liens and charges now or hereinafter imposed by any provisions of this Declaration as may *appertain specifically* to such parties or Owners by any proceeding at law or in equity." Declaration, Section 8.3 (emphasis added).

(3) <u>Note</u>: *There is some risk that a court may construe the enforcement clause as requiring a heightened demonstration of standing; however the Declaration makes clear that TPOA has a trust responsibility to the Members to utilize the assessments only in a manner authorized by the Declaration. Declaration, section 7.2.1. Accordingly, it is assumed that any Member can enforce the fiduciary trust obligations*.

(c) *Meetings*. Annual Member Meetings required. Special meetings may be called by Declarant or a majority of the interim Board of Directors before Turnover, and after Turnover by 25% of the Members entitled to vote.

2.3 <u>Finance</u>.

(a) *Budgets*. Prepared and adopted by Board. Proforma operating statement of budget provided to Members containing: (i) estimated revenue and expenses on an accrual basis; (ii) the amount of the total cash reserves of the Association currently available for

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replacement or major repair of the Private Community Sewer System and for contingencies; (iii) an itemized estimate for the remaining life of, and the methods of funding to defray repair, replacement or additions to major components of such improvements as provided in Section 7.4.2; and (iv) a general statement setting forth the procedures used by the Board in the calculation and establishment of reserves to defray the costs of repair, replacement or additions to major components of Private Community Sewer System." Note: *Members do not have any specific process or substantive rights in budget setting, including capital budget needs. The budget is material to assessments charges and therefore Members have limited ability to protest assessment amounts.*

(b) *Assessments*. Assessments are determined annually. The total amount in the budget is "charged prorate based on EDU [equivalent dwelling unit] against all Lots or Parcels as annual assessments." Declaration, section 7.3 and 7.4.3. Special assessments are authorized for correcting deficits, addressing repairs or for special obligations of an Owner. Declaration 7.5. Assessments may only be used for the following purposes:

- Operating expenses of operating the Private Community Sewer System
- Regular maintenance of the system
- Repairs to the system components
- Reserves and/or replacement of components of the system and other capital improvements
- Administration and operation of TPOA
- Property and liability insurance.

(c) *Fees*.

(i) Connection Fees. Additional properties may connect provided such properties become subject to the Declaration and pay a connection fee. Fee is set by Declarant if outstanding loans and by Board otherwise. Note. *There is no indication of the basis on which the connection fees are established.*

(ii) Termination Fees. Owners in the Initial Development are subject to termination fees "based upon the anticipated revenues the Association would have received from the Lot or Parcel over a 15 year period of time accounting for the value of money at 3% per annum." Declaration, section 6.3. Note: *This appears intended to make TPOA whole for anticipated contributions to capital improvement costs but applies only to the Initial Development owners. This would not appear to apply to later capital expansion costs associated with expanded service territory—meaning system expansions triggered by service territory expansion could not charge a termination fee and the lost contributions would be reallocated among remaining owners*.

(d) *Enforcement*.

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(i) Personal Obligation. All assessments are personal obligations and subject to suit for money judgement. <u>Note</u>: *This enforcement right is limited by the ability of TPOA to recover such judgment from the owner or previous owner and would be subject to enforcement based on the judgement lien priority*. Declaration, section 7.7.1.

(ii) Association Lien. The Declaration provides that TPOA shall have a lien against each Lot or Parcel for any assessment or installment that is delinquent and that recording of the declaration constitutes record notice and perfection of the lien. <u>*Note*</u>*: TPOA is assumed to not be a Chapter 94 planned community. It is unknown without further research whether recording the declaration effects lien perfection.*

(e) *Debt Financing*. The Declaration provides that TPOA acquired the system "using a loan from Declarant" and to borrow money from Declarant for expansions to add capacity. Declaration, section 4.2. <u>*Note*</u>*. This could be construed to limit TPOA's authorities to refinance or seek financing other than from Declarant for the system and expansions even when such alternative financing may be in the best interest of TPOA. This issue should be clarified in the Bylaws*.

(f) *Audit*. There is no annual audit requirement.

3. Special District

3.1 <u>Ownership.</u>

(a) Special districts are local forms of government established by the constituents in the district to meet specific service needs. There are many kinds of districts—e.g., rural protection districts, water districts, recreation districts, etc. They can be large with permanent staff (like Bend Metro Parks District) or be small and volunteer only. The size, scope of services and budgets are determined through the petition process. https://www.sdao.com/what-is-a-special-district

(b) The service[3] could include:

(i) Construction and operation of a stand-alone community sewer treatment facility.

(ii) Acquisition and expansion of the TPOA system.[4]

[3] Please note that DEQ regulatory requirements are outside the scope of this memorandum.
[4] Another potential option is for a special district to contract with TPOA. Further research is required to determine whether special districts would have such authority. See e.g. ORS 450.075(3) authorizing joining with "any other public body, * * * a federal agency or another state in the joint establishment, maintenance and operation of such works * * *."

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(iii) Construction of facilities for interconnection to City of Bend north interceptor for treatment at the City sewer facilities.

(c) There are different kinds of districts that could potentially provide the appropriate service. The primary options are listed below. Once a sewer service option is selected, further analysis is required to determine whether a sanitary district, county service district or sanitary authority would be better suited to the needs of the community. To provide more information by way of example, formation, governance and finance information is provided in greater detail for a sanitary district.

(i) Sanitary District. The purpose is to provide sanitation facilities and services and sanitation districts are more fully described below. They are organized under ORS Chapter 450.005-.303 and formed pursuant to the procedures in ORS Chapter 198.

(ii) Sanitary Authority. The purpose is to provide a means to support cooperative and integrated efforts to address sewage disposal, drainage, insect control and related problems. ORS 450.705. A sanitary authority may be the preferred district form if the City north interceptor option is selected to facilitate City of Bend sewage services to the unincorporated County area of Tumalo.[5] These can be initiated in the same manner as sanitary districts. They can also be initiated by the County without petition and be initiated by a City and sanitary district (if a sanitary district is formed) by request to the County, each of which involves a hearing and election process under ORS chapter 198 described below. ORS 450.785 and .787.

(iii) A County Service District. County service districts can be established for the purpose of providing sewage works under ORS Chapter 451. County service districts are governed by the County Commission and formation may be initiated by the County Commission and follow the hearing and election procedures in ORS chapter 198 described below.

3.2 Formation of Sanitary District (ORS Chapter 450).

(a) *County Initiated Formation*. ORS 198.840 allows the County Board to initiate formation of a district by order citing the principal Act, the name and boundaries of the district, and date and time of the public hearing. The economic feasibility study (described below) would still be required for the permanent rate limitation approval.

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[5] These are governed by an elected board. The boundaries of a sanitary authority can include both incorporated and unincorporated areas. The cost of construction and operation of sewage facilities is born by the area directly benefitted from the system. The cost of other expenses such as planning, board expenses, conduct of elections and hearings are borne by the entire authority. It is governed by an elected board. New construction needs to be approved by the Oregon Health Authority and subject to public hearing and remonstrance procedures. Sewer service charges may be adopted by ordinance. Tax levies may be imposed to pay general expenses and general obligation bonds. General obligation and revenue bonds have to be approved by election and have the same debt limitation as sanitary districts. Local budget law applies to budgeting

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(b) *Petition Procedure*. If the County does not initiate the formation, it is by Petition under ORS Chapter 198.

(i) Pre-Formation Petition. Petitioner files with county clerk a prospective petition which must include a proposed boundary description. Petitioner must complete an economic feasibility statement which will form the basis for the proposed permanent rate limit for operating taxes required by ORS 198.750(1)(g). It must include a description of services and functions, analysis of relationship between those services and function and other existing or needed government service, and proposed first year line item operating budget and projected third year budget that demonstrate economic feasibility.

(ii) Formation Petition (ORS 198.750),

(1) Must contain, among other requirements, not more than 3 main petitioners, a boundary description (can be contiguous or non-contiguous), permanent rate limit for operating taxes sufficient to support the services and functions described in the economic feasibility report, identify whether signers are property owners or electors (or both) in the district.

(2) Must be signed by not less than a) 15% of electors or 100 electors whichever is greater, registered in the territory subject to the petition; or b) 15 owners of land or the owners of 10% of the acreage, whichever is greater, within the territory subject to the petition. Signatures must be gathered within 6 months of filing.

(3) Must be filed with the County Clerk within 180 days of the next May or November election if a permanent rate limit is included. Clerk will examine petition and signatures for certification for filing. Filing submitted to County Commission

(4) Security deposit: Bond or cash in the amount of $100 for each precinct in the affected district and territory to be included up to a maximum of $10,000. If the formation is not effected and the costs of the attempted formation exceed the deposit/bond, the chief petitioners must pay to the county treasurer the amount of the excess costs. If it is successful, the new district will bear the excess costs.

(iii) Public hearing within 30-50 days of filing. County Commission determines whether the area could be benefitted by the formation of the district. The County

Commission can adjust boundaries (to reduce if property will not be benefitted). The County can issue an order approving formation and setting time for a final hearing.

(iv) Elections. Assuming a permanent rate limit is included, the County must hold an election. In addition, if the County also approves a separate ad valorem tax for bonded indebtedness for capital construction, capital improvement or capital costs within the proposed district, the County shall hold an election on the question of incurring bonded indebtedness at the same time as the formation election. Elections must be held in May or November. Board member seats are also elected at this election.[6]

(v) Formation order entered. File notice of municipal corporate formation with the Secretary of State.

3.3 Governance.

(a) *Authority*. Principal Act governs each special district. ORS Chapter 450 governs sanitary districts. This is a public body subject to public meeting and record laws and public agency budget requirements, among other requirements to assure transparency and accountability.

(b) *Control*. District elected 3 to 5 member Board.

3.4 Finance

(a) *Budget*. Must prepare a budget in the form, manner and time prescribed in the local budget law. There is very specific funds accounting and investment requirements for public agencies. *Note. Operating budgets will be limited by the permanent rate limit approved in the formation process and capital expenditures via bonds are subject to approval by election and subject to separate debt limitations.*

(b) *Assessments and Bonds.*

(i) The district may issue general obligation bonds, revenue bonds among potentially other bond authority and potential limitations including debt limitation (viz., The total outstanding district bonds of all types shall at no time exceed in the aggregate 13 percent of the real market value of all taxable property within the district; and all general obligation and revenue bonds shall be paid within a period of 30 years)[7]. *Note: Bond issuances are subject to an approval election.*

(ii) It may also issue assessments directly against directly benefitted property, but doing so requires adoption of an ordinance pursuant to public notice and process.

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[6] The election may be dispensed with if 100% of the owners of the land within the district sign the petition. ORS 198.830.

[7] Detailed review and analysis of bonding and tax authorities are outside of the scope of this review.

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The ordinance must set forth general method of assessing the property directly benefited and of the recording of liens against the property directly benefited, and of making supplementary assessments and rebates.

(iii) The district may determine the rate of levy of taxes in the district, and fix sewer rentals, charges and assessments as provided in ORS 450.130 to 450.175

(c) *Fees*. The district may establish just and equitable rates or charges to be paid for the use of the disposal system by each person, firm or corporation whose premises are served thereby, or upon subsequent service thereto. ORS 454.255; see also ORS 450.130

(d) *Enforcement*

(i) Assessments are entered into a permanent lien docket, kept as part of the District records, which is a public record. For unpaid amounts, the board may proceed to foreclose the lien in any manner provided by law for the collection of liens by local governments as defined in ORS 174.116 and may provide by ordinance a general procedure for the collection of liens in any manner not inconsistent with law.

(ii) If the service charges so established are not paid when due, the amounts thereof, together with such penalties, interests and costs as may be provided by the governing body of the municipality may be recovered in an action at law, or if the municipality does not have the ability to collect sewerage disposal charges in connection with or as part of the charge for another service or utility that can be curtailed to secure collection, the charge may be certified and presented after July 15 and on or before the following July 15 to the tax assessor of the county in which the municipality is situated and be by the assessor assessed against the premises serviced on the next assessment and tax roll prepared after July 15. Once the service charges are certified and presented to the assessor, the payment for the service charges must be made to the tax collector pursuant to ORS 311.370. Such payment shall be made by the person responsible for the delinquent service charge or by the municipality who has received payment for the delinquent service charge. These charges shall thereupon be collected and paid over in the same manner as other taxes are certified, assessed, collected and paid over. ORS 454

(e) *Acquisition*. A sanitary district is authorized to among other powers to:

(i) Acquire, construct, reconstruct, alter, enlarge, renew, replace, operate and maintain such sewage collection and disposal systems as in the judgment of the board are necessary and proper for the area of the district. In the performance of these functions, either in or out of the district, it may join with any other public body as defined in ORS 174.109, a federal agency or another state in the joint establishment, maintenance and operation of such works, and may contract therefor within the limits of authority conferred by ORS 450.005 to 450.245.

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(ii) Acquire by purchase, gift, devise, condemnation proceedings or otherwise, such real and personal property and rights of way, either within or without the limits of the district, as in the judgment of the board are necessary or proper to the exercise of its powers, and to pay for and hold the same.

(f) *Audits*. Audits are required pursuant to the Municipal Audit Law, ORS 297.405 to 297.555.

EHG

Tumalo Wastewater System Feasibility Study

Date: August 15, 2022

To: Tumalo Wastewater Feasibility Study Advisory Committee

From: Katie Husk, PE
Susanna Julber
Justin Moman, PE
Jon Skidmore

Re: Collection & Treatment Options Technical Memo

Introduction

The Murraysmith engineering team has identified three wastewater treatment options to evaluate for the study area identified within the Tumalo unincorporated community listed below:

1. Expansion of the existing Tumalo Property Owners Association system (Orenco Advantex Treatment System).

2. Installation of a separate collection and treatment system within the Tumalo Unincorporated Community (Orenco Advantex Treatment System).

3. Installation of a collection system with treatment and disposal via connection to the City of Bend's "north interceptor" line at the Cooley Road/Highway 20 intersection (construction timelines for the north interceptor are yet to be determined)

This memo provides information on each of these options and provides a range of costs for each wastewater treatment option. These class 5 estimates are also known as the rough order of magnitude (ROM) estimate. The accuracy for these estimates ranges from -50% on the low side to +100% on the high side. If a specific option is chosen, those estimates will be refined through system design. The collection of information at this stage will help the advisory committee evaluate which option(s) to pursue for a community wastewater solution for Tumalo.

It is important to weigh the class 5 estimate costs in addition to other factors when considering which option(s) are most feasible. These factors include:

- Treatment level
- Effluent disposal (and land needs)

- Timing
- Long Term Operations and Management
- Governance Options
- Monthly Rates

This memo does not contain information on the governance options or monthly rates. Those items will be covered in more detail at the September meeting.

Based on feedback from the committee, the study area will be evaluated in three phases. Phase 1 consists of the area zoned Tumalo Commercial. Phase 2 consists of the area zoned Tumalo Residential east of the highway and west of the river. Phase 3 consists of the properties zoned Tumalo Residential-5 served from Beaver Lane. A map showing the three phases is provided at the end of this memo.

General Information for the Collection System

The collection system includes the pipes and pumps that move sewage from where it originates to where it is treated. For the entire study area collection system, roughly 22,000 linear feet of pipe is needed.

The consulting team examined different options for the type of collection system that would best serve the study area. The first option is referred to as a gravity system. With a gravity system, a series of pipes would be installed throughout Tumalo in a manner that allows the sewage to flow by gravity to pump stations. The pump stations would then pump the sewage to a chosen treatment option. These pipes would be installed primarily under the road surfaces throughout the community and require deep trenches for installation of larger diameter pipes to move the sewage. A gravity system would function in Phases 1 and 2 of the study area. Based on the topography of the area, a gravity solution would not work for Phase 3.

In review of the costs to excavate, the disruption that would be caused by excavation and the costs to reconstruct the roads, the consultant team recommends removing the gravity option from consideration. Although there are benefits to a gravity system (gravity never breaks), it is too expensive and disruptive based on the size of the study area and the number of potential rate payers.

Therefore, the consulting team is focusing on a collection system that consists of a series of pressurized force mains that move sewage. The benefits of this approach are that the initial installation costs are lower, and construction is much less impactful to the community. There may be some patchwork to repair streets after installation, but generally entire roads will not need to be reconstructed.

General Information Relating to Flows

Currently, the entirety of the study area is estimated to generate up to roughly 45,000 gallons per day of sewage. Based on population forecasts and engineering estimates for flows based on the zoning in the study area, “full buildout” would generate up to roughly 60,000 gallons per day of flow. These are the flows that the collection and treatment system options are built upon.

General Information Relating to Treatment Options

Two package treatment options were analyzed for Option 2 (the creation of a separate district): a package Septic Tank Effluent Pumping (STEP) system and a package Membrane Bioreactor (MBR) plant. The STEP System requires each property to have a septic tank on site which provides primary treatment. Treated wastewater is transferred through a pressurized collection system to a secondary treatment system -in this case, an Orenco AdvanTex system. Once the secondary treatment is complete, the effluent is then disposed of through use of drainfields. As will be described in more detail below, this is a relatively efficient method considering installation timing, cost, and treatment. The treatment isn’t of the highest level, but if the drainfield area can be sited in the right location, it is a viable option. In some cases, commercial property owners may need to invest in a pretreatment method for their businesses depending on the strength of the wastewater produced.

A package Membrane Bioreactor (MBR) option was also reviewed. The advantage of an MBR system is that it provides a high level of treatment and effluent that can be put to beneficial reuse, such as irrigation. However, the drawbacks of an MBR system is that they typically operate with a gravity collection system, increasing costs and disruption to the community. An MBR treatment facility is also mechanically intensive compared to the STEP system/Orenco Treatment option. Additionally, the operations and maintenance costs are significant, requiring a regular onsite operator, high energy consumption, solids treatment and management. Essentially, as illustrated in the table below, this adds up to an expensive system that is not feasible based on the relatively low number of potential rate payers. As a result, the consultant team recommends removing the MBR option from further consideration for Option 2.

MBR Option			
Phase	Conveyance Cost - Gravity	Treatment System Cost	Phase Total
1	$7,900,000	$5,500,000	$13,400,000
2	$8,000,000	-	$8,000,000
3	$2,400,000	-	$2,400,000
		Overall Cost Estimate	**$23,800,000**

Option 1 – Expansion of the Tumalo Property Owners Association System

Option 1 Overview

Option 1 is based on expansion of the Tumalo Property Owners Associate (TPOA) System utilizing a STEP collection system and the existing Orenco AdvanTex treatment system with effluent disposal via drainfield. The fundamental operation of the system consists of primary treatment at each lot, to remove bulk solids through settling in an onsite septic tank. Primary treated wastewater is then transferred through a force main collection system for secondary treatment (Orenco AdvanTex) prior to disposal in a drainfield. Some businesses may require a method of pretreatment if the effluent produced is high strength.

Generally, flows collected from the study area would be conveyed via pressurized flow toward a central location near the intersection of 7th Street and Cook Avenue. From there, flows would be conveyed to the west across Highway 20 through a pipeline toward Strickler Avenue, where a lift station would pump flows up the hill to an expanded Orenco AdvanTex treatment facility for additional treatment and eventual dispersion in an expanded drainfield area.

Pump Station Considerations:

The existing pump station on Stickler Avenue that currently transfers flows to the treatment facility and drainfields on property owned by the Laidlaw Water District. If this option is chosen, the existing pump station would likely require upgrades in order to handle the additional flows from the expanded system.

Treatment System Considerations:

The existing system is sized for a capacity of approximately 19,000 gallons per day (gpd) with a limited potential for expansion beyond its current capacity. Based on the estimated flow at full build out of approximately 60,000 gpd expansion, the TPOA system would require design and construction of a parallel system to accommodate the additional capacity. This would require additional treatment components. One key item to note with this option is that the expansion of the treatment components is scalable. If a phased approach to providing service throughout Tumalo is chosen, the treatment facility can be expanded incrementally.

Effluent Disposal Considerations:

Final effluent will be treated to a level sufficient to meet the existing TPOA permit limits and designed to be protective of groundwater with disposal via drainfields. The existing drainfields have a limited capacity for expansion of the system, and a significant increase to the total area will be required in order to accommodate the flows anticipated from full buildout of the study area. Current estimates of the total drainfield area required for the TPOA expansion to accommodate *current development* in the study area are approximately 8.6 acres for total required for active drainfield and reserve capacity, spacing for maintenance access, and setback requirements. *Full buildout* within the study area is estimated to require an additional 2.4 acres for a total of 11 acres for active drainfield and reserve capacity. Similar to the treatment facility, if a phased option is chosen, acreage needed for the drainfields can be incrementally obtained.

The TPOA has a lease with the Laidlaw Water District to operate the AdvanTex treatment system and drainfields on the property at 64670 Bill Martin Road. Additional acreage would need to be identified for the expanded drainfield. The neighbor directly south of the Laidlaw Water District property has been contacted and is open to for a conversation about the needed drainfield area.

Timing:

The existing TPOA system has some capacity to accommodate additional flows. While it is possible to utilize this capacity to begin near term expansion of the system into the unserved study area, additional infrastructure required to add users should be designed and constructed for the full planned expansion of the system. One key benefit of this system is that the expansion of the AdvanTex system can be done incrementally based on the volume of flow from the various phases. Generally, if additional room for the treatment system and drainfields can be obtained, expansion of this system could happen quickly. This assessment does not consider any timing issues that could be associated with the governance issues, which will be addressed later in this process.

Long term operations and maintenance issues:

Operation and maintenance of the central components of the TPOA system will be periodic as the system is largely automated.

- Operators will be required to conduct routine inspections and monitor performance of both the collection and treatment system monthly with quarterly sampling and semi-annual inspection of the drain fields.
- Maintenance of the treatment system is anticipated to be annual, consisting of filter bed cleaning and solids removal from treatment units as needed.
- Septic tanks at each lot will be inspected every three years with solids removed and hauled for disposal as needed depending on loading and usage.
- Collection system inspection and maintenance will be required periodically to address investigate/issues and make repairs.

Estimated Cost Range:

Orenco Option 1 & 2			
Phase	Conveyance Cost - STEP System	Treatment System Cost	Phase Total
1	$2,500,000	$4,700,000	$7,200,000
2	$3,700,000	$4,700,000	$8,400,000
3	$1,800,000	-	$1,800,000
		Overall Cost Estimate	$17,400,000

Option 2 – Installation of a separate collection and treatment system within the Tumalo Unincorporated Community

Installation of a separate collection and treatment system has basically the same requirements as Option 1, with the main differences being that the new system would not benefit from the capacity of the TPOA system and the treatment system and drainfield would need to be sited at a new location. Funding or governance requirements are not addressed at this stage, but those are major differentiators as well.

The advantages of Option 2 mirror those of the expansion of the TPOA system in terms of efficiency of construction of the collection system (pressurized force main), primary treatment with individual septic tanks, secondary treatment with an Orenco AdvanTex system and effluent disposal via drainfields.

One major challenge with this option is the required land needs for siting the Orenco AdvanTex system and drainfields. The secondary treatment and drainfields need to be located outside of the “bowl” of Tumalo due to the area’s rapidly draining soils. Likely, such drainfields would need to be located up on the shelf above Tumalo so that effluent is properly treated. Based on the calculations from Option 1, roughly 11 acres of land must be identified and acquired or leased long-term for the AdvanTex system and the drainfields.

As we will discuss in detail at the next meeting, the creation of a public sanitary district requires a number of additional costs and administrative items.

Based on the existence of the TPOA system, there may be options to consider such as contracting with the TPOA to provide secondary treatment through an expansion of its AdvanTex system on the Laidlaw property or the adjacent property. This reality also poses some efficiency questions. Expansion of an existing system could be more efficient than creating a new district and finding additional land for needed treatment facilities and drainfields.

Orenco Option 1 & 2			
Phase	Conveyance Cost - STEP System	Treatment System Cost	Phase Total
1	$2,500,000	$4,700,000	$7,200,000
2	$3,700,000	$4,700,000	$8,400,000
3	$1,800,000	-	$1,800,000
		Overall Cost Estimate	**$17,400,000**

Option 3– Installation of a collection system with treatment and disposal via connection to the City of Bend's "north interceptor" line at the Cooley Road/Highway 20 intersection

Option 3 Overview:
Option 3 is based on transfer of wastewater from the study area to the City of Bend's wastewater collection system via pipeline for treatment. This option also relies on the STEP system collection approach. Each property would have a septic tank to remove bulk solids and for primary treatment. Primary treated water is then transferred via a force main to a larger pump station to pump the effluent to the City of Bend's North Interceptor when it eventually crosses Highway 20 in the vicinity of Cooley Road. No local treatment system or effluent disposal would be required for this option as treatment capacity would be provided by the City of Bend.

One advantage of this option is that it likely represents the lowest operations and maintenance requirements of any of the options. The City might require an out of district surcharge on top of the typical monthly sewer rate which could assist with maintenance of the large pump station.

There are challenges to this option too. The timing of the construction of the North Interceptor has not been identified. Currently, the North Interceptor has been constructed across Highway 97 but has not proceeded west towards Highway 20 and crossing Highway 20 is part of Phase 3 of the project. Phase 3 is not listed on the City's five-year capital improvement program. According to city officials, it could be years before the extension of the line is constructed to Highway 20.

Further, this option also requires approval of the Bend City Council for such a connection. There would also need to be some amendments to city planning documents. These realities introduce time and uncertainty for this option.

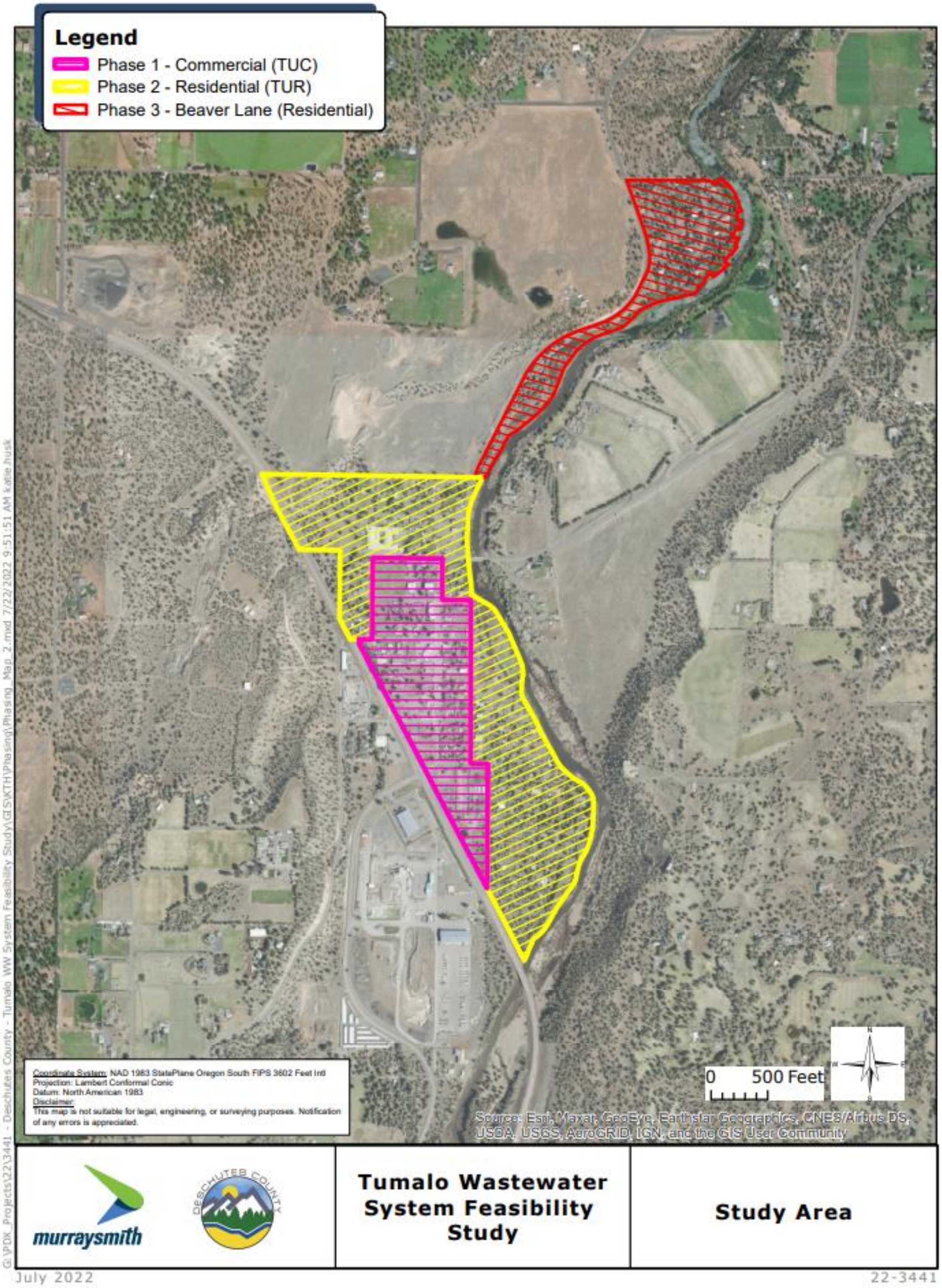
North Interceptor Option			
Phase	Conveyance Cost - STEP System	Pressure Pipe to North Interceptor	Phase Total
1	$2,500,000	$3,800,000	$6,300,000
2	$3,700,000	-	$3,700,000
3	$1,800,000	-	$1,800,000
		Overall Cost	$11,800,000

For the September 15 meeting, we will develop rate estimates based on these overall costs and we will discuss governance requirements and issues for each option. The intent for that meeting is to identify a preferred approach for a community wastewater solution for the study area within the Tumalo Unincorporated Community. Please reach out to Jon Skidmore or Susanna Julber if you have questions at any time.

jon.skidmore@murraysmith.us

SusannaJulber@barneyandworth.com

Phasing Map


Legend
Phase 1 - Commercial (TUC)
Phase 2 - Residential (TUR)
Phase 3 - Beaver Lane (Residential)
Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet Intl
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer:
This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.
0 500 Feet
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
murraysmith
DESCHUTES COUNTY
Tumalo Wastewater System Feasibility Study
Study Area
July 2022
22-3441

TumaloSewerOptions.org

Advisory Committee Schedule & Participants

Schedule

Meeting 1: Tuesday, July 26, 2022 – *Orientation*
Meeting 2: Tuesday, August 16, 2022 – *Evaluating Tumalo Sewer Options*
Meeting 3: Thursday, September 29, 2022 – *Results and Recommendations*

Participants

Name	Tumalo Affiliation
Gabe Coler	Tumalo property owner/ resident
Jim Crouch	Tumalo business owner
Andrew Davidson	Tumalo business owner
Jeanine Fraley	Tumalo resident
Jana Gisler	Tumalo property owner
Martha Gross/ Hall	Tumalo resident
Dale Peer	Laidlaw Water District
Kelly Roark	Tumalo business owner

Meeting Notes

Tumalo Wastewater Feasibility Study Advisory Committee

Meeting #1 – *Orientation*

Location:	Zoom/ Virtual Tumalo Wastewater Feasibility Study | Advisory Committee Meeting #1 on Vimeo	**Date:**	July 26, 2022
		Time:	4:30-6:30 p.m.

Committee Members:	Gabe Coler, Tumalo Resident, AC Member Jim Crouch, Heritage Brand, AC Member ***(Absent)*** Andrew Davidson, Dirty Hands Construction & Septic, AC Member ***(Arrived at 5:20 p.m.)***	Jeanine Fraley, Tumalo Resident, AC Member Jana Gisler, Tumalo Property Owner, AC Member Martha Gross, Tumalo Resident, AC Member	Dale Peer, Laidlaw Water District, AC Member Kelly Roark, Bend Cider Company, AC Member
Project Team:	Murraysmith, Inc.: Jon Skidmore, Justin Moman, PE, Katie Husk, PE	Barney & Worth: Susanna Julber, Clark Worth, Trisha Maxfield	Deschutes County: Chris Doty, Todd Cleveland, Peter Russell

The meeting convened at 4:34 p.m. through a virtual platform.

Murraysmith project manager, Jon Skidmore, opened the meeting and welcomed the group. Skidmore summarized the goals for the project: to develop a feasibility study that evaluates 3 options to serve the Tumalo area with sewer, with cost estimates and steps involved with implementation. The Advisory Committee is expected to meet three times, and this first meeting is focused on orientation and opportunity to introduce and discuss concepts. Skidmore explained that this meeting is high level, not a lot of detail on the sewer service options.

Skidmore explained that the project team is evaluating the unincorporated community of Tumalo, which is acknowledged in the county's comprehensive plan that's roughly 500 acres in size, for community wastewater service. We will not be looking outside of the incorporated community of Tumalo for sewer service. The consultant team proposed a specific project study area that is a smaller subset of the Tumalo UC boundary which will be detailed later in the meeting.

Skidmore explained that this is a feasibility study process- this project will not result in a full-blown design for a community wastewater system. The task is to evaluate questions like - What are the costs? What funding is available? How much will it cost everyone? Is there a financially feasible solution? Our charge is to identify a preferred solution based on a variety of factors and provide a roadmap for the group to work to realize that vision.

Susanna Julber, Barney & Worth, provided an overview of the agenda, and moved to introductions.

1. Introductions

Chris Doty, Deschutes County Road Dept. Supervisor, introduced himself and County staff- Todd Cleveland, Environmental Health Manager, and Peter Russell, Senior Planner. Doty noted the purpose of the study is a feasibility analysis, which will serve a Phase 1, and then Phase 2 would be implementation.

Doty explained that the County is implementing a similar project in Terrebonne. Interest for a wastewater system in Terrebonne began back in the 1990's and at least two feasibility studies have been conducted since then. The County is conducting this feasibility study for Tumalo because people have requested that the Board of County Commissioners look at the issue. There is a formal process to create a public sanitary district through the County. Yet, Doty noted that the County has no interest in becoming a wastewater utility, but will help the community evaluate options.

Todd Cleveland explained the situation with onsite septic systems in Tumalo. The Environmental Health Division reviews applications for permits and repairs, and determines whether a site can be served with an onsite system, noting that sometimes the County has to deny sites in Tumalo. Cleveland noted that there has been greater frequency of denials and costly repairs, which is driving some of the desire to look at a Tumalo community sewer system.

Senior Planner Peter Russell explained the focus of the Tumalo Community Plan Update, and how this process will play into the future development allowances for Tumalo. The plan has an infrastructure element, and once the sewer feasibility study is complete and an option recommended by the community, it will be incorporated into the Tumalo Community Plan.

The Advisory Committee members, then consultant team members introduced themselves.

2. Advisory Committee assignment

Julber discussed the assignment/ roles for the AC:

- Evaluate and provide input on the engineering alternatives and associated costs for each alternative.
- Determine the best structure for implementing the preferred alternative.
- Consider the impacts of the various sewer alternatives in terms of cost, construction impacts, and long-term operations and maintenance.
- Recommend a preferred option to address the future of wastewater treatment in the community.
- Provide a roadmap for community implementation.

Julber noted the quick project timeline and the plan to meet three times. Evaluating funding options such as State Revolving Loan Funds or WIFIA will be an important part of this, as is the governance structure for each of the options. Julber explained that a community survey will be launched in late August to get broader community input for those who can't attend Advisory Committee meetings. The committee will make recommendations in September, and then go to next steps.

3. Situation assessment

Katie Husk, PE with Murraysmith, provided an overview of the data related to the existing septic systems in Tumalo:

- Ages of the septic systems. Approximately 60% of the septic systems in Tumalo were built before 1990, and the life of the system is usually around 30 years, so that means that over half of the septic systems in Tumalo have already exceeded their expected service lives.
- Many of these properties are small, and don't have room for expanding, repairing or replacing their septic systems. This requires evaluation of other options to manage wastewater.
- The proximity of the river is problematic, and a lot of these septic systems are built within the flood plain. Tumalo has fast draining soils and septic systems that are starting to fail can cause environmental health concerns.

Skidmore noted that environmental concerns are captured in the existing Tumalo Community Plan with policies, and additionally, the plan provides guidance for housing and commercial growth, especially in the core area.

4. Proposed Project Area

Skidmore explained the rationale for the proposed project area boundaries. The proposed study area consists of the commercially zoned area (TUC) east of Highway 20, the residentially zoned property (TUR) west of the Deschutes River and east of Highway 20 and the residentially zoned property (TUR5) accessed from Beaver Lane.

The committee did not have additional changes or recommendations for varying the proposed boundary. Skidmore explained that we cannot study provision of sewer to areas outside of the Tumalo Unincorporated Community Boundary because of state land use planning rules. The project area was determined because of:

- Efficiencies: proximity of properties (densities)
- Areas that could have relatively intense level of development based on the zoning
- Areas that are experiencing most amount of septic failures/ difficulty in receiving permit approvals
- Areas that have expressed interest in being part of a sewer system

The committee members discussed the situation in Tumalo, providing examples of systems that have failed, and the need for some sort of solution. The financial impacts to residents are important to consider and may be too much to bear. Commercial property owners are more supportive of sewer. Residential property owners voiced concerns about the need for sewer service, especially if they have just installed a new septic system or done a repair.

The committee generally agreed with the proposed project boundaries.

5. Sewer options being evaluated

Justin Moman, PE, with Murraysmith explained at a high level, the 3 options for providing sewer that the team is evaluating, which will be discussed in greater detail at the next meeting.

- New sanitary district to include a collection and treatment/disposal system
- Expansion of the existing TPOA system to serve the proposed study area
- New collection system and pump station to connect to City of Bend's NE Interceptor for treatment and disposal

Moman clarified that one system (STEP) would require individual property owners to have a tank at their site prior to effluent entering the collection system, and with another system (MBR), the wastewater would go directly to a collection system and to a treatment facility. There may be difficulty providing gravity flow for certain areas of Tumalo. These details will be evaluated further for each of the 3 alternatives, along with cost, required governance structure, and timing for each.

Skidmore explained that connection to the City of Bend's system wil ultimately be a Bend City Council decision on whether to move forward. For now, the project team has approval to study the option, and there are a lot of steps required prior to any connection.

Skidmore explained that the evaluation criteria for each option includes:

- Timing
- Level of treatment (more intense uses will require greater level of treatment)
- Land considerations
- Cost/ funding/ rate impacts
- Ongoing operations and maintenance
- Governance Structure

Julber explained that the results of stakeholder interviews confirmed the evaluation criteria and added that those interviewed noted that a public utility, similar to the Laidlaw Water District, would be ideal. Further, the cost, timing, and overall feasibility of the system are important when evaluating sewer system option.

The committee did not have additional criteria to add.

6. Projecting future development and flows

Moman explained the process of predicting future flows- evaluating population projections and land uses. Further, there are various regulatory, historical, engineering, and best practices associated with forecasting future flows. Skidmore coordinated with Senior Planner Russell for guidance on population projections. The committee discussed a potential need for a higher rate for higher intensity uses- for example, a brewery, or other industrial waste.

7. Advisory Committee Questions/ Discussion

Julber summarized committee concerns and issues that had been mentioned:

- Potential phasing option for residential.
- Interim policy for those who have recently installed a septic system- evaluating what the physical and legal availability of having sewer nearby means, flexibility with forced hookups, what does it mean when someone is within 300 feet of a legally available sewer line?
- Physical feasibility, operations and maintenance, rates, cost implications of the design.
- Is there a way to have a pricing structure for new development as opposed to existing?

8. Public comment

A member of the public had a comment about Terrebonne and the large investment upfront and asked questions about comparing the two communities' feasibility studies.

> Chris Doty: Explained that Terrebonne is about two times the size of Tumalo with potential for more rate payers. The cost will be answered at the end of the study.

A member of the public posed a question in the chat: please explain the 230 taxlots in the 105 acre boundary… are these 230 platted lots or 230 taxlots? How is the 105 acre boundary calculated?

> Skidmore: we're looking at specific tax lots as identified in the County GIS system. We didn't break down the original platted lots in the Townsite of Laidlaw subdivision.

A member of the public made a request through the chat: Please show on your map the zoning and location of the Kine leach system and please upload to your website the Kine sewer system documentation.

A member of the public inquired about deliverable #5, which seems to be focused on the operator's point of view. But we should be analyzing the impact on the private homeowners. Need to know capital costs and investments for reaching the ROW- pretreatment, etc.

> Julber: we will be evaluating those costs for the homeowners- that is part of our scope. That is what FCS Group will be helping us with. Doty added our charge is to provide an unbiased comparison of options. Skidmore added that we'll be looking at grant and loan options to help with the initial capital outlay, which will likely be substantial.

A member of the public asked a question in the chat: What will sewer mean for future of Tumalo?

> Skidmore: our task is engineering, but the existence or absence of a sewer system will weigh into the update of the Tumalo Community Plan - this study is a key input into that plan. With sewer there will likely be additional growth.

A member of the public inquired about the unintended consequences of a community wastewater system. Do we really need a sewer system to support commercial? Trees have been removed, we're getting urban development, and land prices are increasing. This person mentioned concerns about urbanization and loss of rural character. The Kine/ TPOA documents- the county should take some ownership and responsibility for the process and the appeals. It is important to read and have those available for the public. Concerned about annexation discussion. Although she doesn't own property within the boundary, rural residents need to be heard throughout this process. We also need documentation for where water wells are located and hook them up to water service first- maybe it'd lessen the septic/ well pollution issues. Asked to upload the chat comments and any answers provided.

A committee member noted that the lack of sewer doesn't impede development in Tumalo, but it is expensive without sewer. That may still cause trees to be cut down. Sewer allows us to have more of a sanitary environment. Another committee member noted that sewer will bring development- lack of sewer is keeping development from happening.

Doty noted that this is a feasibility study and provide the community with a roadmap for the future.

A member of the public commented that TPOA doesn't represent Tumalo. Discussed a survey about sewer and most do not want sewer. Need to keep our rural plan, and the annexation is a concern. Housing usually means high density, and that is not consistent with the 2030 plan.

A couple committee members asked for a survey that was not only online, but ability to be mailed too. Julber will coordinate with that.

Skidmore noted that could be next steps- once we have specific information such as cost, the community can work with the County on next steps. The formation of a sanitary district has a very detailed, democratic approach.

9. Adjourn

The meeting was adjourned at 6:30 p.m.

Watch the meeting recording here: https://vimeo.com/734519354

TumaloSewerOptions.org

Tumalo Wastewater Feasibility Study Advisory Committee:

Meeting #2 – *Evaluating Sewer Options*

Location: Zoom [Meeting Registration - Zoom] **Date:** August 16, 2022

Time: 5:00-7:00 p.m.

Committee Members:	Gabe Coler, Tumalo Resident, AC Member Jim Crouch, Heritage Brand, AC Member Andrew Davidson, Dirty Hands Construction & Septic, AC Member	Jeanine Fraley, Tumalo Resident, AC Member Jana Gisler, Tumalo Property Owner, AC Member Martha Gross, Tumalo Resident, AC Member	Dale Peer, Laidlaw Water District, AC Member Kelly Roark, Bend Cider Company, AC Member
Project Team:	Murraysmith, Inc.: Jon Skidmore, Justin Moman, PE, Katie Husk, PE	Barney & Worth: Susanna Julber, Clark Worth, Trisha Maxfield	Deschutes County: Chris Doty, Todd Cleveland, Peter Russell

AGENDA

5:00 p.m. Welcome, introductions, agenda overview

5:15 Sewer options & discussion

- Expansion of TPOA system
- New collection and treatment/ disposal system
- Connect to Bend's North Interceptor

6:15 Estimated costs & finance options

6:30 Public Comment

6:50 Next steps

7:00 p.m. Adjourn- next meeting: September 15

Meeting Notes

Tumalo Wastewater Feasibility Study Advisory Committee

Meeting #2 – *Evaluating Sewer Options*

Location:	Zoom/ Virtual Meeting 2 video: https://vimeo.com/740234151	**Date:** **Time:**	August 16, 2022 5:00-7:00 p.m.

Committee Members:	Gabe Coler, Tumalo Resident, AC Member Jim Crouch, Heritage Brand, AC Member ***(Absent)*** Andrew Davidson, Dirty Hands Construction & Septic, AC Member	Jeanine Fraley, Tumalo Resident, AC Member Jana Gisler, Tumalo Property Owner, AC Member Martha Gross, Tumalo Resident, AC Member	Dale Peer, Laidlaw Water District, AC Member Kelly Roark, Bend Cider Company, AC Member ***(Absent)***
Project Team:	Murraysmith, Inc.: Jon Skidmore, Justin Moman, PE, Katie Husk, PE	Barney & Worth: Susanna Julber, Trisha Maxfield	Deschutes County: Chris Doty, Todd Cleveland, Peter Russell ***(Absent)***

The meeting convened at 5 p.m. through a virtual platform.

1. Welcome, introductions, agenda overview

Jon Skidmore, Murraysmith project manager, opened the meeting and welcomed the group. The main objective of this meeting was to review the three options for providing sewer to Tumalo in greater detail.

Chris Doty, Deschutes County Road Dept. Supervisor, gave opening remarks noting this project is primarily a sewer feasibility study that provides a roadmap of options for a community wastewater solution for the study area within the Tumalo Unincorporated Community. Susanna Julber, from Barney & Worth reviewed the advisory committee assignment, and explained the meeting ground rules.

2. Sewer options & discussion

Jon Skidmore noted that constructing a gravity collection system and membrane bioreactor (MBR) treatment system to Tumalo is too expensive and disruptive to be a feasible option. That option was ruled out for further consideration. The overall system requirements to serve Tumalo are:

- Roughly 22,000 linear feet of pipe is needed for the collection system.
- Collection system will be pressurized Septic Tank Effluent Pump (STEP) system.
- The existing study area is estimated to generate roughly 45,000 gallons per day of flow.
- The “full buildout” is estimated to generate roughly 60,000 gallons per day of flow.

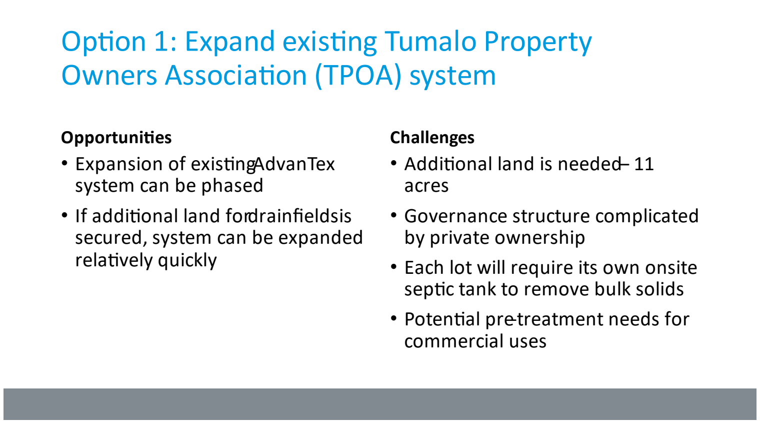
- The recommended Orenco AdvanTex treatment systems are scalable.

Justin Moman, PE, Murraysmith, and Katie Husk, PE, Murraysmith, provided an overview of the three sewer options:

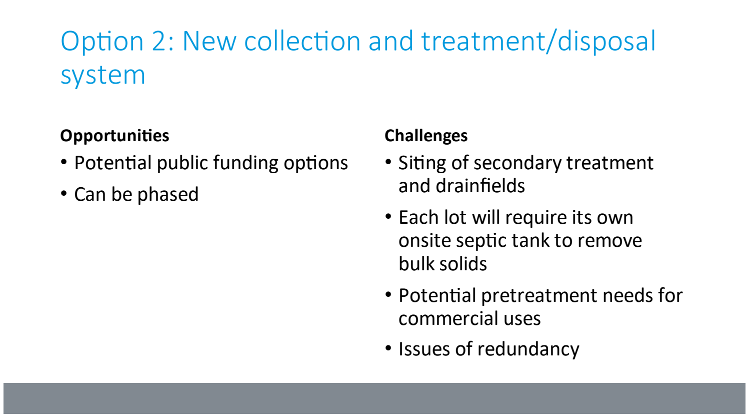
- Expansion of TPOA System
- New collection and treatment/ disposal system
- New collection system and connect to Bend’s North Interceptor for treatment and disposal

The consultant team evaluated the option of serving the project area in three phases—Phase 1 being the commercial core area, Phase 2 the residential within the core, and Phase 3 the area near Beaver Lane. Justin Moman clarified that each option would require individual property owners to have a tank at their site prior to effluent entering the collection system.

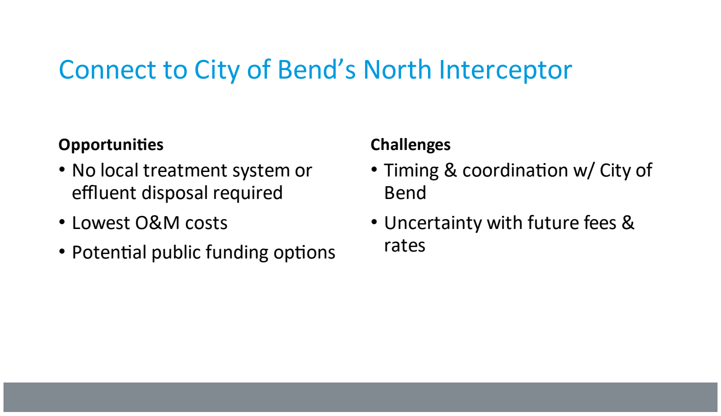
Options:



Option 1 consists of expanding the TPOA system to serve the identified study area. The existing TPOA system has additional capacity for a few additional homes. In order to treat the study area additional Orenco AdvanTex treatment facilities will be required and there would need to be additional acreage for drainfield areas. Governance may be complicated, because TPOA is a private system.



Option 2 consists of creation of a new sanitary district including construction of a STEP collection system and Orenco AdvanTex treatment system. would require additional property for secondary treatment and drain fields. Similar to Option 1, this option can be phased. Formation of a public sanitary district may have a less complicated governance structure and be eligible for public funding options.



Option 3 consists of connecting a collection system to the City of Bend's North Interceptor. It is the least expensive option, but also the most uncertain in terms of timing. Option 3 would not require a local treatment system or effluent disposal. It likely has the lowest O&M costs, and potential public funding options. This option contains a degree of uncertainty due to required coordination with the City of Bend, timing of the construction of the North Interceptor (it is not within Bend's 5-year plan now), and future fees and rates are challenges. The City Council is not required to permit such a connection.

Katie Husk, PE with Murraysmith, provided an overview of the Class 5 cost estimate for each alternative. Class 5 estimates for both **Options 1 and 2 total $17,400,000**. The Class 5 estimate for **Option 3 is $11,800,000**. It is important to note that Class 5 estimates are known as "rough order of magnitude" estimates—with variation of -50% to +100%. Future system design will refine these estimates. These cost estimates will be refined for meeting #3, with life cycle and O&M cost estimates as well.

Jon Skidmore explained that legal and financial consultants will be helping the team provide an overview of monthly costs/ potential rates, and recommended governance structures for each option.

3. Estimated costs & finance options

Susanna Julber provided an overview of public funding options that may be available for the project costs, including design and life cycle costs. These options include Clean Water State Revolving Loan Funds (through Oregon DEQ), the Water Infrastructure Finance and Innovation Act (WIFIA), Business Oregon Water/ Wastewater Financing Program, and USDA Rural Development. Susanna will provide a memo to the committee members detailing the specifics of each program prior to the next meeting.

4. Committee questions/ discussion

Committee members had questions about private septic tank maintenance, the cost estimates in general, and about expanding the TPOA system in terms of governance structures and feasibility.

5. Public comment

A member of the public had comments about the Option 1 feasibility, cost per household, and legal feasibility. Todd Cleveland was asked about the way the "300-foot rule" is measured – from property line or as the crow flies?

> Todd Cleveland explained (in the meeting chat) that normally, the 300-foot measurement is from the property line closest to the pipe.

A member of the public asked about providing sewer to the entire Tumalo Unincorporated Community boundary, and how adding more properties would reduce the cost per household for sewer.

> Jon Skidmore explained that the project area was determined by the advisory committee at the last meeting based on a variety of factors, and the estimated future flows are based on that.

A member of the public clarified details about the TPOA system, the financing, and the monthly rate the property owners pay. A portion of the monthly rate ($93/month) goes to maintenance of private tanks.

6. Adjourn- next meeting September 15

At the next meeting, the advisory committee will focus on results and recommendations. The project team will have refined cost estimates, including capital and life cycle costs, governance, and funding options for each option.

The meeting was adjourned at 7:00 p.m.

Watch the meeting here: https://vimeo.com/740234151

SEPTIC SYSTEM IMPACT ON SURFACE WATERS

A Review for the Inland Northwest



TABLE OF CONTENTS

June 2005

Septic System Impact on Surface Water is a publication of Tri-State Water Quality Council, which recognizes the following individuals for their valuable work in researching, drafting, editing, and/or compiling information, graphics, and photographs for this report and thanks them for making its publication possible:

Will McDowell
Chris Brick
Matt Clifford
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Jon Harvala
Karen Knudsen

TRI-STATE
WATER QUALITY COUNCIL

INTRODUCTION

Montana, Idaho, Washington, and Oregon have experienced tremendous population growth in the past 15 years, and this growth is expected to continue. To many people's surprise, a great deal of this growth is occurring in rural areas without centralized infrastructure, such as sewage treatment plants. This rural growth tends to be concentrated near rivers and lakes, where increased wastewater loads can threaten water quality. One of the biggest challenges facing state and local governments is how to deal with the increase in wastewater while protecting the water quality that is crucial to the natural beauty of these areas.

Septic systems, also known as "on-site wastewater treatment systems," are widely used in rural and suburban settings to dispose of wastewater. When operating properly, septic systems remove many pollutants and provide some measure of protection for human health and for the environment. But as rural populations grow and aquifers exhaust their ability to dilute wastes from ever-increasing numbers of septic tanks, water quality steadily deteriorates. Most state and local governments have regulations designed to protect public health from the worst contaminants from septic systems: water-borne pathogens and nitrates. But very few governments have created effective measures to address the increasing threat that septic tanks pose to the ecosystems of rivers and lakes.

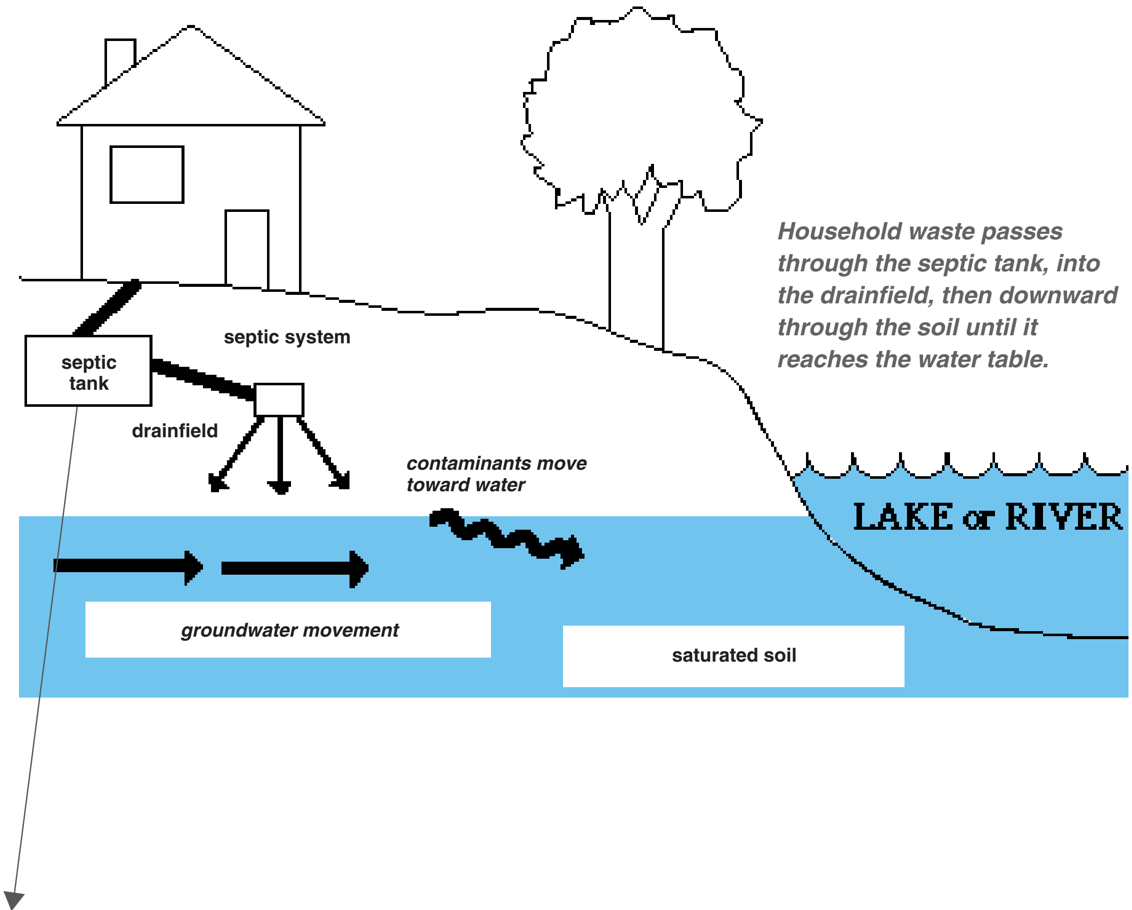
Why have communities not done more to prevent septic systems from harming our streams and lakes? Perhaps because in the past, when rural populations were lower, the impacts were minimal and there was little threat to our surface waters. Or it may be that the connection between groundwater and streams (or lakes) was simply not well understood. But scientists have demonstrated that septic wastes in groundwater do ultimately flow into rivers or lakes, and that in many areas these wastes are already degrading the quality of nearby waters. The goal of this paper is to discuss this issue by examining the technical background of the problem, clarifying the risks, and reviewing options for mitigation.

Through a review of scientific and policy studies, this paper will discuss the following questions:

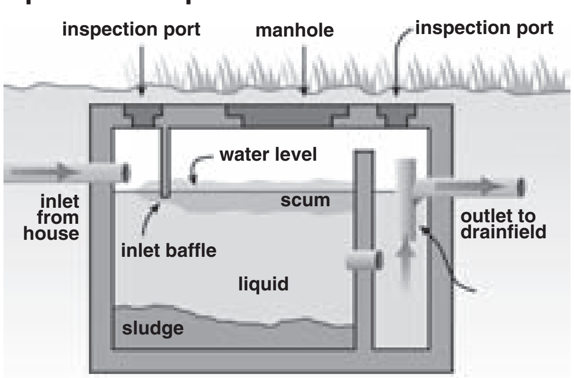
- What risk does septic effluent pose to streams and lakes?
- How do contaminants get from septic systems to groundwater?
- How do contaminants get from groundwater to streams and lakes?
- What are the wastewater treatment options when trying to achieve public health and resource protection goals?
- What are the existing policy and regulatory options for mitigating surface water impacts?

This paper is intended to give policymakers a broader appreciation of the risks that traditional septic systems pose to our surface waters, in the hope that this will lead them to develop strategies that maintain and improve the water quality of our lakes and rivers.

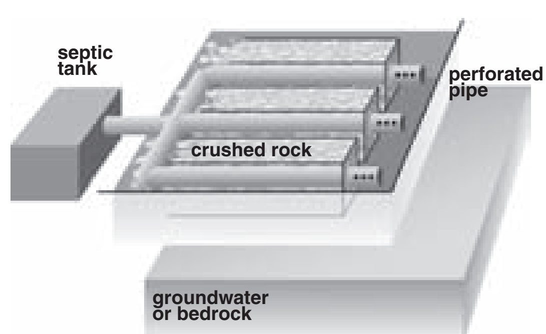
Waste's Journey from House to Water Table to Lakes and Streams



Up close: Septic Tank



Up close: Drainfield



SEPTIC EFFLUENT: What risk does it pose to streams and lakes?

Septic systems discharge a variety of contaminants which can affect surface waters, including nutrients, pathogens, organic matter and solids. Conventional septic tank and drainfield systems treat wastewater by settling solids and partly digesting the organic matter, allowing liquid effluent, which still contains nutrients and pathogens (bacteria, protozoa and viruses) to be discharged into the soil beneath the drainfield.

In the soil, biological processes, filtration, and adsorption remove most pathogens and some nutrients. However, conventional septic systems are not adequate for removing nitrate, and only partly remove phosphorus, certain pathogens, and certain other compounds, especially where soils or ground water conditions are marginally suitable, or where septic system densities are too high (EPA, 2002). Anything that is not removed by the soil under the drainfield will end up in groundwater.

Nutrient enrichment and its effect on lakes and rivers:

Septic systems are among the many sources of nutrients in groundwater and surface water—other major sources include agricultural fertilizers, livestock manure, air pollution, forest fires, eroded sediments, municipal wastewater, and storm-water runoff. Nutrient enrichment, or eutrophication, is the over-fertilization of surface waters by nitrogen and phosphorus, and is one of the leading causes of pollution of lakes, rivers, and coastal bays in the United States (EPA, 2004***).

Nutrient enrichment can cause a host of negative ecological effects on streams and lakes, including loss of water clarity, proliferation of aquatic weeds, algae blooms, and drop-offs in dissolved oxygen (a critical factor for fish and other aquatic life). Algae blooms can also make drinking water taste and smell bad, can release toxins (in the case of blue-green algae), and can contribute to the problem of carcinogenic tri-halomethanes formed by chlorination of drinking waters high in organic detritus (Carpenter, et.al., 1998, "Nonpoint Pollution of Surface Waters with N&P", Ecological Society of America, http://esa.sdsc.edu/).

Nitrogen, in its nitrate form, is also a direct risk to human and livestock health if it reaches high concentrations in drinking water (10 milligrams/Liter is the EPA maximum contaminant level for drinking water). However, the levels of nitrogen and phosphorus that cause ecological damage in lakes and rivers are far lower—usually more than 10 times lower—than the levels which are toxic to humans and livestock. Therefore, the precautions taken by communities to protect groundwater used for drinking are not sufficient to protect rivers and lakes from ecological impacts.

Septic systems can contribute nutrients to surface waters, especially nitrogen; while associated development activities—e.g., construction, roads, lawns—increase phosphorus. The combination threatens sensitive waters.

The issue of "limiting nutrients" in lakes and rivers:

Some state and local governments assume that phosphorus is the only nutrient of concern for surface water pollution, but this is not the case. In lakes and rivers a certain ratio of nitrogen to phosphorus is required to trigger an algal bloom or excessive growth of aquatic plants, and the nutrient which is in shortest supply is known as the "limiting nutrient." In freshwater systems, the limiting nutrient is often, but not always, phosphorus. In parts of the Clark Fork River, for example, nitrogen is the limiting nutrient.

Nitrogen from septic systems can cause nutrient enrichment in fresh water if:

1) complementary sources of phosphorus are available, or could become available, such as phosphorus associated with soil erosion, phosphorus associated with wildfires, phosphorus from municipal/industrial wastewaters; or phosphorus in urban and suburban storm runoff; and/or
2) septic-derived phosphorus can reach surface water, which is more likely when the septic system is very close to a stream or lake, as in a lake-front home. Note that many of these sources of phosphorus increase with development.

Rural and suburban regions experiencing growth near lakes and rivers:

Much of the northwestern United States has experienced accelerated growth rates in the last 15 years, including many formerly rural counties in Idaho, western Montana, Oregon and Washington. The growth in these areas was far higher than the national average from 1990 to 2000, as was growth in western Montana. Much of this growth is concentrated near well-known rivers and lakes or coastal waters. The counties listed in Table 1 below experienced growth rates that are more than ***double the national average*** of 13% between 1990 and 2000.

Table 1: Fast-Growing Counties in the Northwest USA

State/County	Growth Rate, 1990 - 2000	Key Surface Waters & Tributaries:
MT- Gallatin Co.	34%	Gallatin River and tributaries
MT- Ravalli Co.	44%	Bitterroot River and tributaries
MT- Lake Co.	26%	Flathead Lake and river
MT- Flathead Co.	26%	Flathead Lake, Swan Lake, Whitefish Lake, many others
ID- Kootenai Co.	56%	Spokane River, Coeur d'Alene & other lakes
ID- Bonner Co.	38%	Pend Oreille Lake
ID- Ada, Canyon, Elmore & Boise Cos.	37 - 90%	Boise River, Payette River, Snake River and reservoirs
ID- Teton Co	74%	Upper Snake River
OR- Crook, Deschutes, Jefferson Cos.	36% - 54%	Deschutes River and tributaries
OR- Yamhill & Washington Cos.	30% - 43%	Willamette and tributaries
WA- Whatcom, Skagit, Snohomish & Thurston	29% - 30%	Nooksak, Skagit, Skykomish, Stillaguamish rivers, lakes, Puget Sound
WA- Benton, Franklin, & Grant Cos.	27% - 36%	Yakima River, Columbia River, various lakes
WA- Stevens & Pend Oreille Cos.	27% - 32%	Spokane and Pend Oreille Rivers, Roosevelt Lake
WA- Chelan Co.	27%	Columbia tributaries & lakes

Source: U.S. Census Quickfacts

Of these high-growth counties, only a few are associated with major metropolitan areas; most are associated with smaller cities or small towns. In these rural and suburban counties, much of the development is in un-sewered areas on septic systems. The 1990 census indicated that between 29% and 37% of state residents in Montana, Idaho, Washington, and Oregon used septic systems (EPA, 2002, OWTS). It is likely that a much greater percentage of the new residents in rural counties are using septic systems.

Data from county health departments in rural areas (shown in Charts 1 and 2 below) illustrates the rapid growth in number of septic systems in the fast-growing counties of the inland northwest. These data illustrate the rapid growth of septics, many of which are located near the area's beautiful lakes and rivers, or are situated over alluvial aquifers closely connected to surface waters:

The question posed by this phenomenal growth in septic systems is this: Does the discharge of contaminants from these systems into shallow groundwater also impose a large additional load of nitrates and other contaminants on our rivers and lakes? This paper examines the question of how this growth in septic systems puts surface water quality at risk.

157,000 people in the Clark Fork basin of Montana use septic systems

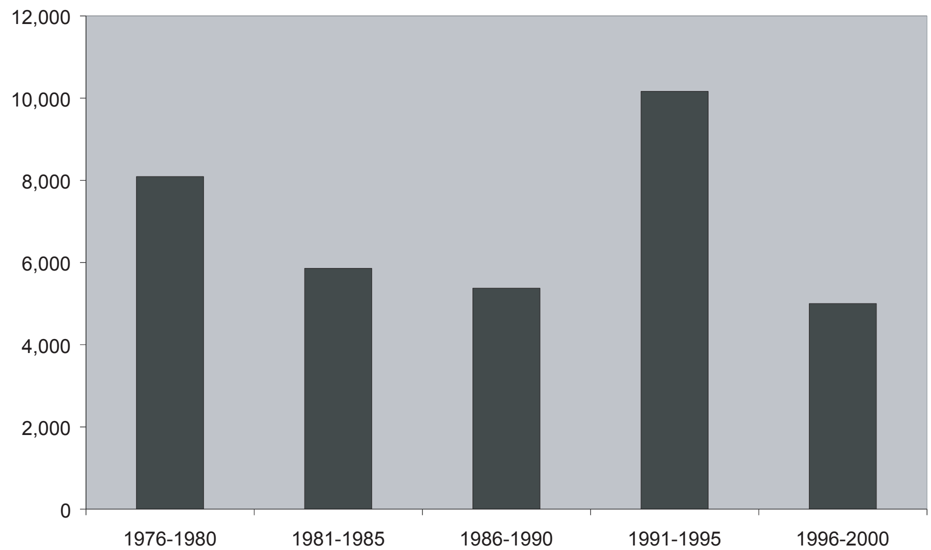
144,000 people in the Clark Fork basin are on sewer/wastewater treatment plants

52% of the people in the Clark Fork basin are on septics

—based on data from 10 counties

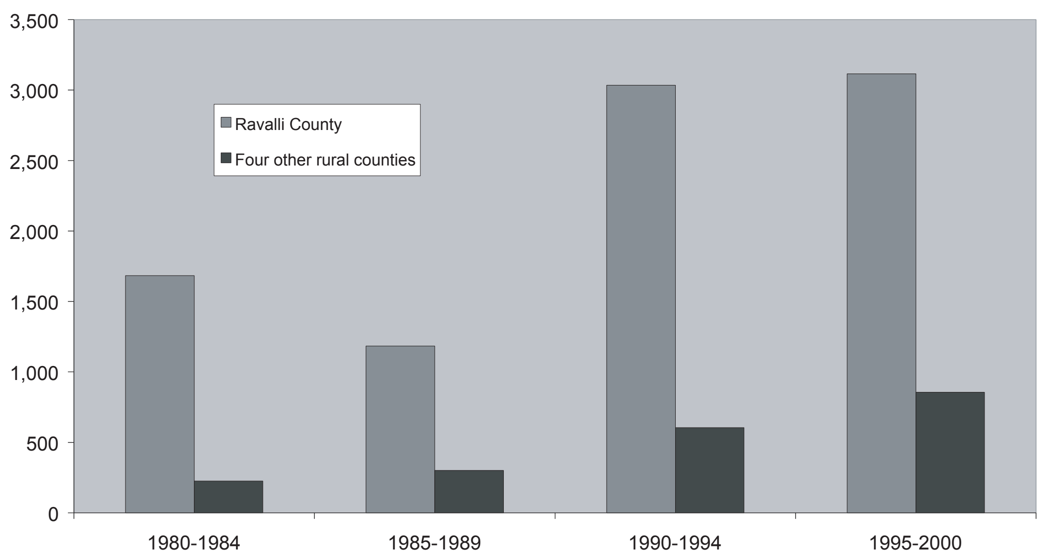
Chart 1: Number of Septic Systems Approved in Panhandle Health District, ID, 1976-2000

(includes Kootenai, Bonner, Benewah, Boundary, and Shoshone counties)



Source: D. Martindale, 2005, pers. comm.

Chart 2: Number of Septic System Approved in Rural Clark Fork Basin Counties, MT, 1980-2000*



Source: McDowell, W., 2001

* Missoula County approved a total of 5,185 septic systems from 1980-2000, but is now reducing the county's total number of septic systems by hooking them up to sewer.

Examples of waters with water quality issues related to septic systems:

A number of important water bodies in the Northwest already have nutrient enrichment problems, and in some cases septic systems have been identified as a significant source of those nutrients. Examples include:

- ***Clark Fork River, Missoula County, MT:*** The Missoula County Health Department and Missoula Valley Water Quality District have documented a large impact from septic systems discharging into the Missoula valley aquifer and then into the Bitterroot and Clark Fork rivers. The total load of nutrients (both nitrogen and phosphorus) discharged by groundwater in the Missoula valley is estimated to be approximately 40% of the TMDL nutrient load allocation for the Clark Fork River below the Bitterroot confluence (VNRP, 1998). Reducing this groundwater nutrient load by expanding sewers is a major goal of the Voluntary Nutrient Reduction Program for the Clark Fork (Missoula Valley Water Quality District, "Evaluation of Unsewered Areas in Missoula, MT", Missoula City-County Health Dept., 1996).

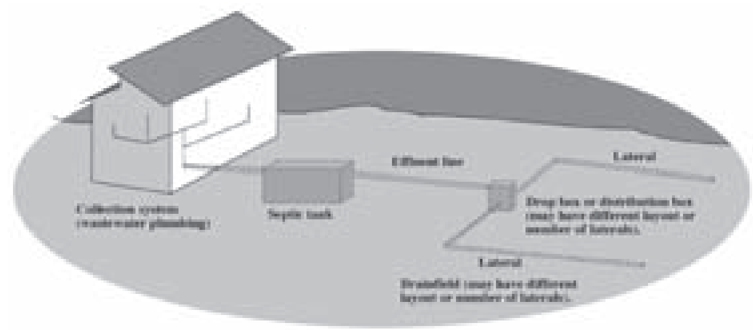
- ***Lake Pend Oreille, Bonner County, ID:*** Studies done by Idaho's Dept. of Environmental Quality have demonstrated that nutrient concentrations and resulting algae in the near-shore waters of Lake Pend Oreille are partly due to un-sewered lake-front properties leaking septic effluent into the Lake. Efforts are underway to sewer lake-front communities, and avoid discharging treated wastewater into the Lake (Idaho Division of Environmental Quality. Phase I Diagnostic and Feasibility Analysis: A Strategy for Managing the Water Quality of Pend Oreille Lake, Bonner and Kootenai Counties, ID. Coeur d'Alene, ID. 1993).

- ***Clackamas River, Clackamas County, OR:*** High algal biomass has been documented as a recent phenomena on the lower Clackamus River, a mostly forested watershed upstream from Portland, Oregon. The highest algal counts, as well as the highest N and P concentrations, were measured on Sieben Creek, the site of recent urbanization. It's likely that a combination of urban storm-water runoff and septic system inputs are responsible for a significant part of this problem (Carpenter, Kurt, 2003, USGS Water Resource Investigations Report 02-4189, "Water Quality and Algal Conditions in the Clackamas River Basin, Oregon, and their Relations to Land and Water Management").

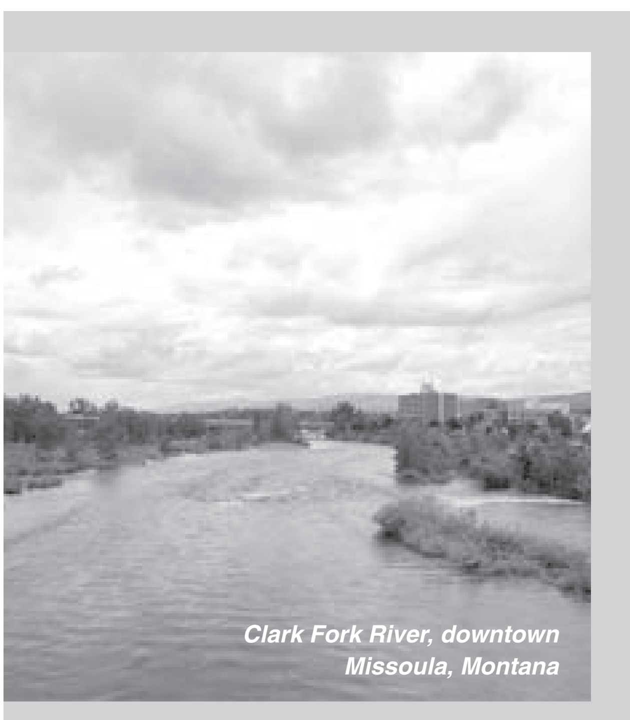
Septic system contamination of surface waters is a different, less well-known issue than the typical human health issue addressed by most current septic system regulation.

THE PATH OF CONTAMINATION:
How do contaminants get from septic systems to groundwater?

Wastewater leaving the drainfield of a septic system trickles first to unsaturated soil above the water table, and eventually to the water table below. All continuously operated septic systems are expected to discharge to groundwater eventually (Woessner in McDowell, 2001 newsletter). Where the depth to the water table is shallow and overlying soils are permeable, as is typical in valleys near streams, rivers, or lakes within the inland Northwest, recharge from septic systems to groundwater is relatively rapid. Although it is possible for wastewater to be absorbed by plant roots, in reality this should not happen because properly-designed drainfields are installed below the root zone of grasses and outside the rooting areas of trees. Therefore, most septic effluent reaches the water table. This water carries with it some of the soluble contaminants of effluent that are not absorbed by soil, including nitrogen, various bacteria and viruses.



Typical Onsite Wastewater Treatment System



Clark Fork River, downtown Missoula, Montana

Removal of Pollutants through Septic System Treatment of Wastewater:

Conventional septic systems consist of two primary components: the septic tank, which initially receives the wastewater, and the drainfield, which is the underground area that receives the outflow from the septic tank. The septic tank provides primary treatment to the wastewater by settling solids, and trapping greases, oils, and other floatable matter. Solid materials are partially converted to liquids by biological processes at the bottom of the tank. The liquid effluent is discharged into the drainfield. Further treatment occurs below the drainfield as the effluent percolates downward, in a micro-biologically active area known as a bio-mat. This area further treats the wastewater, trapping solids and metabolizing some nutrients and carbon. The bio-mat typically controls the infiltration rate in coarse or medium-textured soils, and treated effluent passes down through a partly-oxygenated unsaturated zone before reaching groundwater.

When a conventional septic system is properly designed, operated, and maintained, it is capable of nearly complete removal of suspended solids, bio-degradable organic compounds, and fecal coliforms. (EPA, 2002). However, conventional systems are not able to completely remove several of the constituents typically found in wastewater. Table 2 summarizes the effectiveness of typical septic tank and drainfield systems in removing common constituents.

is common for this process to remove 85-95% of phosphorous, and complete removal typically occurs long before effluent reaches surface water. However, this is not always the case—particularly where soils are coarse and distances to surface water are short. Significant phosphorus has been detected in groundwater below some drainfields, and phosphorus plumes have been measured moving down-gradient from septic drainfields in sandy shallow aquifers (Harman et.al. 1996, Ver Hey, 1987).

Conventional septic systems are also generally quite effective in removing pathogenic bacteria

Table 2: Wastewater Effluent Constituents and Treatment Efficiency in Soil

Constituent:	Effluent content (leaving tank): mg/L	Removal after percolation and treatment in a 3 - 5 foot vertical ìinfiltration zoneî
Biochemical Oxygen Demand	140 - 200	>90%
Nitrogen	40 - 100	10 - 20%
Phosphorus	5 - 15	0 - 100% (often 85 - 95%)
Fecal coliform bacteria	106 - 108	>99.99%
Organic chemicals (solvents, pesticides, etc.)	trace	>99%

Source: EPA, 2002 Tables 3-7 and 3-17 and 3-19

As the table makes clear, a major weakness of conventional septic systems is the inability to effectively treat nitrogen. Once septic effluent enters the soil profile below the drainfield, almost all the nitrogen is converted by nitrification to nitrate (NO3). Nitrate is a very soluble chemical, which is transported readily in dissolved form into and through the groundwater and ultimately to surface water. Thus it should come as no surprise that one of the biggest concerns in areas with large numbers of septic systems is high nitrogen levels in surface and groundwater.

On the other hand, one of the major strengths of septic systems in general is the ability to treat phosphorous. Phosphorus in wastewater effluent tends to attach itself, or sorb to soil particles in the unsaturated zone below septic drainfields. It

and viruses via infiltration and treatment below the drainfield. Once again, however, this treatment is not perfect. Outbreaks of groundwater borne pathogens linked to septic systems have been documented in several locations in the Northwest. Over 400 people were infected with gastroenteritis related to contaminated groundwater in Flathead County, Montana, in 1995; an outbreak of typhoid fever in Yakima County, Washington, 1981, was related to a septic system contaminating a shallow well; and a number of major outbreaks of gastroenteritis have been attributed to groundwater borne Norwalk-like virus in numerous states (Missoula Valley Water Quality District, 1996). Other pathogens of concern in wastewater effluent are protozoans like Cryptosporidium and Giardia. Improperly constructed drainfields, high water tables, or inappropriate geologic settings (fractured

OTHER CONSTITUTENTS OF WASTEWATER

Surfactants are chemicals which are used in laundry detergents and other cleaning products to decrease the surface tension of water, and they are present in septic system effluent. The most common surfactants in household laundry detergents are linear akylbenzenesulfonate (LAS) and akylbenzenesulfonate (ABS). Surfactants can be readily bio-degraded by micro-organisms in aerobic conditions and possibly in saturated sediments. Concerns with surfactants include their ability to decrease adsorption and even actively desorb organic pollutants like trichlorobenzene from soils, and their deleterious effects on soil structure and infiltration rates (EPA, 2002).

Various chemicals known as “endocrine disruptors” have been detected in domestic wastewater. These chemicals, including bisphenol A (BPA) which is widely used in dental materials and plastic food and beverage containers, can interfere with the natural sex hormones in the body of fish and amphibians. Estradiol, a synthetic estrogen used in birth-control pills, is often found in domestic wastewater, and has been shown to cause major alterations in the sexuality of fish at extremely low concentrations (Kidd, K., 2003, Canadian Freshwater Institute). It has not yet been established whether the most common endrocrine disruptors are retained in soil during septic effluent filtration and treatment.

bedrock or karst systems) can allow pathogenic bacteria and viruses to reach groundwater, where they can survive for days and travel up to 30 meters.

Wastewater flow rates:

To get an idea of the combined impacts that septic systems in an area might have on adjacent waters, one must first estimate the amount of effluent typically discharged by each system, and the typical concentration of nitrogen. These numbers allow one to calculate the total amount, or load of nitrogen that can potentially reach adjacent waters.

The load to soils below a typical septic drainfield is estimated to be 25 lbs of nitrate and 4 lbs of ortho-phosphate annually. Some of these nutrients—particularly phosphorous—are further removed by biological, geochemical, and physical filtering processes in the soil below the drainfield. This process is quite variable depending on the type of soil, depth to groundwater, loading rate, age of system and other factors. The performance of soil filtration in removing nutrients below septic drainfields ranges from 10 to 40 percent for total nitrogen and from 85 to 95 percent for total phosphorus. Using these numbers, one can reasonably estimate that a typical septic system discharges a total load of 19 lbs/year of nitrate and 0.4 lbs/year of orthophosphate to groundwater.

Not surprisingly, then, septic systems are the most frequently reported source of groundwater contamination in the U.S., and the single largest source, by volume, of wastewater discharged to groundwater. Nitrate is the primary contaminant that septic systems contribute to groundwater, and nitrate contamination in groundwater below septic drainfields is documented by an enormous literature. Studies have shown that groundwater nitrate loads and concentrations increase in areas with a high density of septic systems. In Helena, Montana, for example, a study has found that, between 1990 and 1994, average nitrate concentrations increased from an average of 1.25 mg/l to 1.70 mg/l as numbers of septic systems increased by 26% from 2,475 to 3,081.

SURFACE WATERS: How do contaminants get from groundwater to streams and lakes?

To understand how pollutants from septic systems can contaminate surface water, it is important to first understand the ways in which groundwater flows beneath the earth's surface and interacts with surface streams and lakes. Groundwater does not stay in one place, but flows from areas of higher water table elevation towards areas of lower water table elevation. Streams, rivers and lakes are usually low points in a watershed, and shallow groundwater within a watershed flows toward and discharges to these water bodies.

How Groundwater Flows

Groundwater flow paths vary greatly in length, depth, and travel time from points of recharge to points of discharge in the groundwater system.

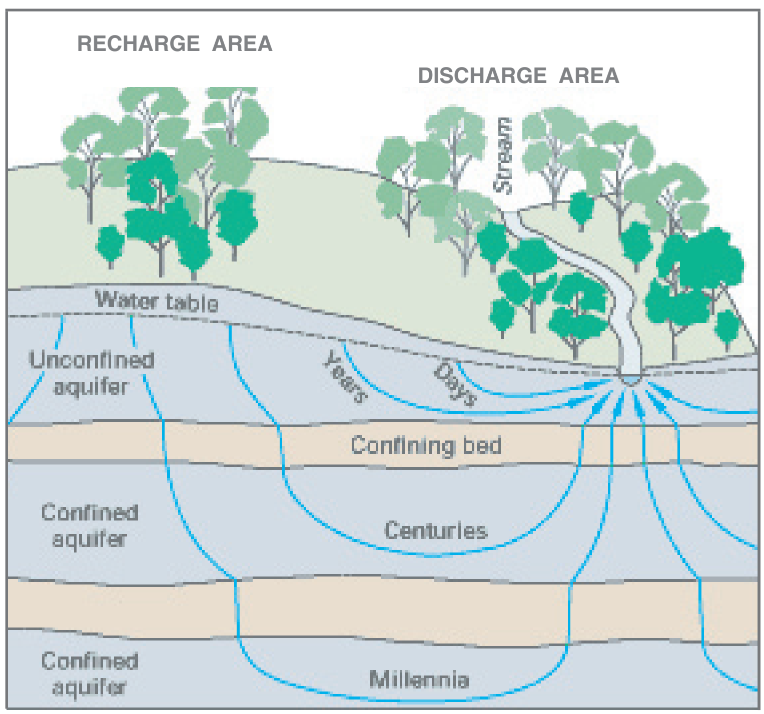


Figure from U.S. Geological Survey Circular 1139

Most of the broad inter-mountain valleys of western Montana, northern Idaho, and northeastern Washington are underlain by aquifers made up of silt, sand, gravel, and cobbles that were deposited by receding glaciers and the streams that flowed from them. These aquifers tend to be shallow, and produce abundant water for domestic, municipal and irrigation water supply wells. The high permeability of many of these aquifers permits relatively rapid infiltration of recharge waters from precipitation, flooding, irrigation, and septic systems. Examples include the Missoula valley aquifer, the Bitterroot valley aquifers, the Spokane River/Rathdrum Prairie aquifer near Couer d'Alene and Spokane, and aquifers in the Flathead valley, Mission Valley, Swan Valley, parts of the upper Blackfoot, and Deer Lodge valleys in Montana, and the Pend Oreille valley in Washington. (Glacial lake sediments, glacial till, and plutonic and volcanic rocks also are important aquifer materials in many areas of the inland Northwest, but are generally much less permeable than the Quaternary alluvial systems described above.)

Groundwater and surface water interact in complex and dynamic ways. The important concept is that surface water and groundwater are not separate, but rather consist of the same water circulating through the hydrologic system. Consequently, any impact to groundwater, such as the discharge from septic systems, will ultimately impact surface water. Managers of septic systems and other sources of groundwater contamination need to recognize that—in many of the geologic settings, such as basin-fill river valleys and lakeshores undergoing intense development pressure—groundwater contamination can have an impact on our surface waters, and vice versa.

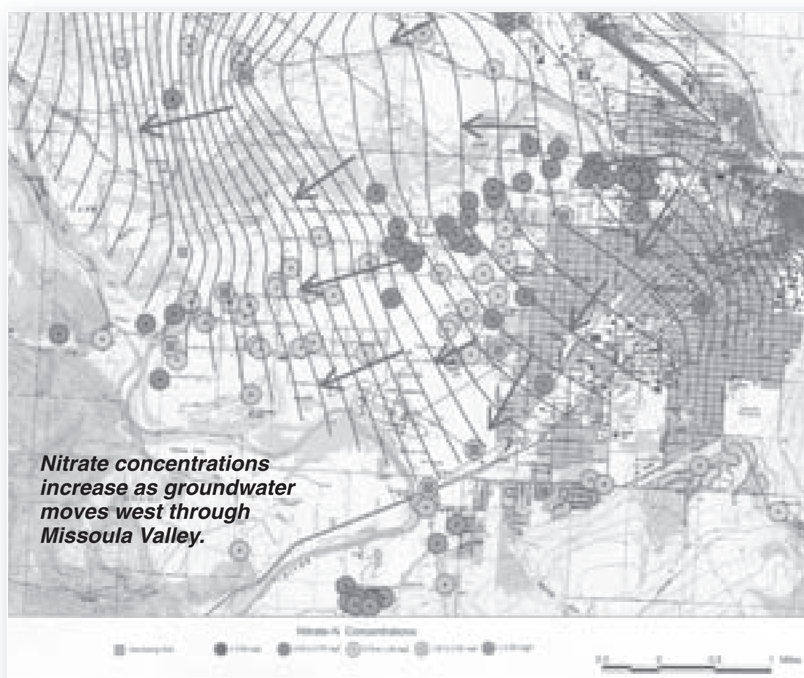
Shallow groundwater transport of nitrogen and phosphorus to surface waters:

The discussion above shows that septic systems deliver significant loads of nutrients—and particularly nitrogen—to groundwater. Moreover, we know that groundwater in most intermountain valleys of the Northwest generally flows toward surface water and ultimately discharges to streams, river and lakes. Thus, one would expect to find that, in some cases, septic systems are contributing significant amounts of nutrients to surface waters, and causing negative impacts to area waters. This indeed turns out to be the case. Below are examples where such impacts have been documented and linked to the cumulative load from individual septic systems.

- ***Missoula Valley, Montana:*** Groundwater enters the Missoula valley at its east end, flows west beneath the city and residential areas, and eventually discharges to the Clark Fork and Bitterroot Rivers on the west side of the valley. The east half of the valley is sewered, but the west side of the valley, which is experiencing significant population growth, is on individual septic systems. As groundwater flows from the sewered to the unsewered parts of the valley, nitrate concentrations increase above background levels. In general, nitrate concentrations increase by 0.5 to 2.5 mg/L as groundwater flows under the west valley toward the Bitterroot River (Land and Water, 1999).

Septic systems have the potential to contaminate surface water in geologic settings—alluvial river valleys and lake fronts—where most development is concentrated.

1996 Nitrate-N Concentrations: **Unsewered Missosula Area Study**



Source: "Evaluation of Unsewered Areas in Missoula, Montana," Missoula Valley Water Water Quality District, et al, March, 1996

Seeps and springs that discharge directly to the river have nitrate concentrations of 0.8 to 1.3 mg/L, which is significantly higher than normal concentrations in the river of 0.01 to 0.24 mg/L. The estimated flux of nitrate to the Clark Fork and Bitterroot Rivers is 120 tons of nitrate per year, and while the flux is seasonally variable, there are increases in nitrate concentration during summer months in the Bitterroot River as it flows past Missoula (Land and Water, 1999).

- ***Rattlesnake Valley, Missoula, Montana:*** A similar pattern occurs in Rattlesnake Creek in the Missoula area. Upstream of the developed and unsewered portions of the valley, nitrate concentrations in the stream during baseflow conditions are extremely low (2.5 to 7.6 micrograms/L, equal to 0.002 to 0.007 mg/L), while below un-sewered development, stream nitrate increases 4 to 10 fold above background (Missoula Water Quality District unpublished data). Nitrate concentrations in monitoring wells in the valley are also elevated over background conditions, and contain detectable levels of pharmaceutical chemicals, indicative of a septic system source (Godfrey, 2004).

- ***Butte, Montana:*** In the Summit Valley area of Butte, Montana, the Montana Bureau of Mines and Geology is investigating the impact of high nitrate in groundwater on surface drainages (LaFave, 2004). Out of about 150 recent and historic groundwater samples from the alluvial and bedrock aquifers, 64% have elevated nitrate concentrations (between 2 and 10 mg/L), and 15% exceed the drinking water standard of 10 mg/L. The nitrate-rich groundwater occurs below both sewered and unsewered parts of town, in both shallow and deep wells, and in areas not likely affected by past mining operations. The impact on local streams is obvious; upstream of populated areas, nitrate in Blacktail Creek is undetectable during base flow conditions (November 2001), but the concentration increases to over 1.0 mg/L over a 5-mile stretch through the most densely populated part of the valley. Analyses of nitrogen and oxygen isotopes in the contaminated groundwater point to an animal or septic waste source for the nitrate rather than fertilizer.

- ***Pine Lake, Washington:*** Studies of Pine Lake, a small natural lake situated in glacial till in the Puget Sound area of Washington, analyzed the potential for shoreline septic systems to discharge nutrients to the lake (Gilliom, RJ, and CR Patmont, 1983, "Lake Phosphorus Loading from Septic Systems by Seasonally Perched Groundwater," J.Water Poll.Control Fed., Vol. 55:10, p.1297-1305.) The authors concluded that septic effluent was moving through perched groundwater toward the lake, and that 11% of the shallow groundwater from monitoring wells below residences near the lake was actually wastewater effluent. A small amount of phosphorus (less than

Mouth of the Clark Fork River and Lake Pend Oreille, Idaho

1 percent of the septic P load) was shown to be moving in the effluent towards the lake, and in a few cases where older septic systems were situated in saturated soils, a larger portion of the phosphorus was reaching the lake, either through shallow groundwater, or by surfacing of effluent which then passed into the lake as overland flow.

- ***Crystal Lake, Michigan:*** In a classic study of septic wastewater influence on a clear-water, low-nutrient lake, Kerfoot and Skinner (1981) showed that both nitrogen and small quantities of phosphorus were being discharged into the lake where shallow groundwater was flowing rapidly towards the lake through lakefront developments. Septic effluent entered the lake by: 1) erupting plumes of effluent coming through the near-shore lake-bottom; 2) by "dormant" or passive plumes coming through the lake bottom; and 3) and by surface flow into the lake, at small streams that received septic effluent upstream of the lake.

These authors measured background levels of phosphorus in the lake and unaffected lakeshore groundwater at 0.004 mg/L, while shallow groundwater in septic effluent plumes along the lake was 0.017 mg/L dissolved phosphorus on average. They noted that this increase in concentration in phosphorus, although still low-level, was sufficient to cause impressive blooms of nuisance Cladophora green algae in the near-shore areas around the erupting septic plumes. They concluded that most of the septic effluent phosphorus had been retained by soil treatment, but that the small proportion (slightly less than 1%) which made it to the lake (called phosphorus "breakthrough") was sufficient to cause localized noxious algae blooms, but not sufficient to cause a change in the generalized lake level of phosphorus. They also verified that some coliform bacteria as well as UV light-sensitive detergent compounds were present in the septic discharge plumes entering the lake through shallow groundwater, and that the septic plumes could be easily detected with UV-sensitive equipment.

BACKGROUND NUTRIENT CONCENTRATIONS IN GROUNDWATER

To understand the potential impact of septic systems on shallow groundwater and on surface water, it is important to know the natural condition of the groundwater discharging into streams. Views on this subject have evolved in recent years.

Although earlier studies from the U.S.Geological Survey (USGS) defined concentrations of nitrate in groundwater exceeding 2 mg/L or even exceeding 3 mg/L as the levels indicating human impact on aquifer water quality (Madison and Burnett, 1985, Mueller et.al., 1995), newer studies have shown that natural nitrate concentrations are generally far lower .

In 2003, new USGS studies based on the National Water Quality Assessment (NAWQA) program for the continental U.S. concluded that, "Mean concentrations of nitrate in NAWQA land use studies showed 2.8 mg/L in agricultural areas, 1.45 mg/L in urban areas, and 0.06 mg/L in undeveloped areas." (Nolan and Hitte, 2003.) In relatively undeveloped areas, the median groundwater nitrate levels were 0.1 mg/L. These values are similar to data from similar land uses in Montana, Idaho, and Washington.

From the perspective of surface water contamination, the elevation of nitrate in alluvial groundwater to even the 1-3 mg/L level typical of urban and agricultural land uses, can be significant if groundwater is a major contributor to surface water flows. This is because typical levels of nitrate in natural streams, rivers, and lakes of the inland Northwest/Northern Rockies are 5 - 10 times lower than that level. (EPA, 2000, "Ambient Water Quality Criteria Recommendations-Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion II, EPA Office of Water, Office of Science and Technology, Washington, DC; Clark Fork VNRP, Tri-State Water Quality Council, 1998). Therefore, nutrient-sensitive surface waters can experience significant excess nutrient loading from groundwater typical of agricultural or urban landscapes.

Mitigation of Nutrient Discharge from Septics to Surface Waters:

The previous sections discussed how significant quantities of nutrients from septic tanks can reach groundwater, and how that contaminated groundwater can reach streams and lakes and contribute to harmful nutrient enrichment. However, not all of the nutrients that reach groundwater necessarily make it to surface water. As we have seen, most or all phosphorous from septic systems usually sorbs onto soil particles long before reaching a stream or lake. Moreover, there are two processes that can eliminate at least some of the nitrogen from groundwater: plant uptake and denitrification. These two processes can reduce, but not always eliminate, impacts to surface water.

Plants will uptake nitrate from groundwater if their roots reach the water table. Plants incorporate nitrate into their tissues, where it remains until it is released back to the soil when plants die and decay. Thus, vegetation does not remove nitrogen from the ecosystem, but temporarily decreases its mobility. Nutrient uptake by vegetation occurs only during parts of the year when plants are growing; this precludes about half the year in western Montana.

Apart from uptake by plants, denitrification is the only other natural process that potentially removes nitrate from groundwater. Denitrification is a microbially mediated reaction in which nitrate in groundwater is reduced to nitrogen gas which diffuses to the atmosphere, effectively removing nitrogen from the terrestrial environment. The denitrification reaction requires a low-oxygen environment and a source of energy for the microbes. Typically the energy source is the dissolved organic carbon found in fertile, organic soils, but denitrification can also occur in the presence of ferrous iron, sulfide, or methane (Postma et al., 1991; Korom, 1992; Böhlke and Denver, 1995; Star and Gillham, 1993; Böhlke et al., 2002). Consequently, denitrification is most likely to occur in water-logged soils, in shallow groundwater overlain by rich organic soil, in organic-rich riparian areas where groundwater is close to the surface, and in aquifers containing trace amounts of iron sulfide (pyrite). Denitrification can occur anywhere in an aquifer if conditions are right: up-gradient from streams, in riparian areas, in the zone of groundwater-stream mixing, and in the benthic environment of the stream itself (Böttcher et al., 1990; Smith et al., 1991; Postma et al, 1991; Vogel et al., 1981).

Denitrification also requires a flow regime that brings groundwater into contact with reactive substrates for a sufficient amount of time to allow the reaction to occur. For example, shallow groundwater that discharges rapidly to a stream, or deep groundwater that discharges vertically to the stream bottom is less likely to undergo denitrification (Böhlke and Denver, 1995). Likewise, groundwater flow that discharges to ditches or drains will bypass the riparian zone and is less likely to be denitrified (Puckett, 2004). Denitrification is also less likely to occur where groundwater moves rapidly through coarse, gravelly, alluvial material (Pinay et al., 2003). A review of numerous studies of groundwater in riparian areas shows highly varying efficiencies of nitrate removal from groundwater, ranging from 0% to over 90% (Peterjohn and Correll, 1984; Lowrance et al., 1984; Jacobs and Gilliam, 1985; Lowrance, 1992; Korom, 1992; Puckett, 2004). As a mechanism of nitrate removal, denitrification may be very important in some areas, and completely negligible in others.

Regional examples demonstrate the conditions under which denitrification occurs. In the Upper Snake River basin of Idaho and western

Wyoming, areas with rapidly drained soils correlate with high-nitrate groundwater while areas with poorly drained soils contain groundwater with the lowest nitrate concentrations (Rupert, 1997). Out of 61 groundwater samples collected from wells in western Montana, northern Idaho, and eastern Washington, the USGS found no correlation between nitrate concentration and well depth or depth of the water table, but there was a strong correlation with dissolved oxygen; groundwater with undetectable nitrate also had very low dissolved oxygen concentrations, possibly indicating that denitrification was removing nitrate from groundwater (Caldwell et al, 2004).

In the Missoula valley, soil and groundwater sampling immediately beneath and down-gradient from septic systems demonstrates different mechanisms of nitrate dilution and potential attenuation in the aquifer. In the Orchard Homes area, nitrate was not removed in the soils below two separate drain fields, but dilution in groundwater was responsible for reducing nitrate to background concentrations (Ver Hey, 1987). Subsequent studies indicate that nitrate may be attenuated by factors other than dilution. By comparing ratios of nitrate to the non-reactive chloride ion, King (1987) found that nitrate decreased faster than chloride with increasing distance from drain fields, up to a threshold value, at which point the ratios remained constant. The reduction of nitrate concentrations in the aquifer could result from denitrification, or possibly from uptake by native bacteria in the aquifer.

Clark Fork River flowing west through Missoula, Montana

WASTEWATER TREATMENT:
What are the options when trying to achieve public health and resource protection goals?

Every community must find ways to treat its wastewater to levels that protect public health and water quality in streams, lakes, and aquifers. Communities in rural areas can often meet these goals using conventional septic systems, thanks to low population density and large lot sizes. Larger communities are often able to meet the same goals using centralized sewage treatment plants, thanks to their larger capital base. Caught in the middle are fast-growing suburban and semi-rural areas, which present the most difficult challenges for effective wastewater management. These communities often cannot use centralized sewer systems due to limitations on available capital. At the same time, the resources these communities must protect are often particularly sensitive to impacts, since residents typically rely on individual wells for drinking water, and residential development in the Northwest often occurs near rivers and streams that are sensitive to nutrient enrichment.

When a community must choose among various systems for treating its wastewater – on-site septic systems, centralized sewage plants with sewers, or smaller-scale collective treatment systems serving individual subdivisions – it should carefully weigh the inherent strengths and weaknesses of each. Each type of system poses risks to public health and aquatic environments, and must be managed with the various types of risks in mind.

Centralized systems offer several distinct advantages: they can provide the most nitrogen removal if they are fitted with biological nutrient removal (BNR) or other advanced treatment systems. Moreover, they centralize an entire community's discharge in one place where it can be easily monitored, where any problems can be readily detected, and where treatment upgrades can be installed with relative ease if found to be necessary in the future. On the other hand, centralized systems generally do not provide the same level of phosphorous treatment as on-site systems, at least when they discharge directly into a river and therefore do not get the benefit of treatment in the soil. Centralized systems can sometimes overcome this disadvantage by discharging to constructed wetlands or land-applying effluent to agricultural fields, but these solutions present additional design and operational challenges.

On-site septic systems treat phosphorous well. Although conventional on-site systems remove very little nitrogen, advanced septic designs are now available that can provide levels of nitrogen removal comparable to BNR at centralized systems, if they are maintained and operated properly. But ensuring proper maintenance and operation of these systems is a challenge. Their nutrient removal components can fail without showing any trouble signs to alert the homeowner to the failure. Moreover, these systems effectively disperse wastewater treatment at hundreds or thousands of individual home sites, rendering effective monitoring, inspection, and enforcement virtually impossible. In addition, advanced systems are expensive.

Collective treatment systems – in which wastewater at the subdivision level (from several dozen to a few hundred homes (??)) is routed to a single on-site system – offer some of the advantages of both centralized and individual systems. Like individual systems, they allow for ample treatment of phosphorous in the soil before effluent reaches surface water. And like centralized systems, they route individual waste streams to a central point where monitoring, maintenance, and upgrades in treatment are much more feasible. In addition, collective treatment systems generally are required to obtain groundwater discharge permits, which provide a way of ensuring that the systems are being properly monitored and maintained so that treatment is meeting design standards.

Comparison of Alternative Wastewater Treatment Systems in Nutrient Removal:

Table 3 below shows the nitrogen and phosphorous concentrations in wastewater effluent from different sources. It also illustrates the dangers of directly comparing effluent concentrations from different types of systems without considering the additional treatment provided in soil between the discharge and surface water.

Table 3: Comparison of Nutrient Concentrations Discharged from Various Types of Wastewater Treatment

Wastewater Treatment Technology (examples)	Total Nitrogen	Total Phosphorus
1. Lolo Conventional Secondary Wastewater Treatment 2. Missoula WWTP in 1992 – Secondary Treatment	22.0 mg/l 21.9 mg/l	3.8 mg/l 3.5 mg/l
3. Kalispell Biological Nutrient Removal WWTP - 2001 4. Missoula Biological Nutrient Removal (Design Goals)	9.4 mg/l 10.0 mg/l	0.11 mg/l 1.0 mg/l
5. Conventional on-site septic tank (EPA 2002).	40 - 100 mg/l	5 - 15 mg/l
6. Estimated Removal by Drainfield Soil Treatment (conventional septic system): (EPA, 2002, Table 3.17)** 7. Estimated Remaining Nutrients Discharged to Ground Water (based on #6 above) :	10 - 40% 30 - 45mg/ l	85 - 95% 0.5 - 1.6 mg/l
8. Montana Level 2 Nitrogen Removal Systems*	24 mg/l	10.6 mg/l (0.5 - 1.6 mg/l after soil treatment)

**Only three approved Level 2 systems exist for Montana*
***Montana assumes residences discharge 50 mg/L nitrate to groundwater*

REDUCING THE IMPACTS:
What are the existing policy and regulatory options for mitigating the impacts to surface waters?

As described in preceding sections of this paper, there is now a good deal of data establishing that septic tanks can, and often do, have significant effects on the water quality of streams and lakes, especially in regards to nutrients. To date, however, the potential for septic systems to degrade surface water quality has gone largely unrecognized in the federal, state, and local laws that are designed to protect surface water quality. As a result, many thousands of septic tanks are being permitted and installed in the Northwest each year with little or no analysis of their cumulative impacts on surface lakes and streams.

The following section describes the existing regulatory scheme that one state, Montana, uses for permitting septic tanks and other private sewage treatment systems. This discussion will focus on the ways in which that permitting scheme addresses—and fails to address—potential impacts to surface water. Montana was chosen as an example not only because it is most familiar to the authors of this paper, but also because it appears to have done more than any other state in the region to address surface water impacts from private wastewater systems. The Montana example then serves as the basis for a discussion of different alternatives for expanding existing laws and policies in ways that would recognize and mitigate these impacts.

Prescriptive versus performance-based approaches to wastewater management:

The various Montana laws governing wastewater systems use one of two general approaches to regulate impacts. The prescriptive approach focuses on the source of pollutants—the septic system itself—and sets forth minimum requirements for septic system design, siting and installation. An example of such requirements would be minimum setback distances from drinking water wells, surface water, and groundwater. In contrast, the performance-based approach focuses on the waters potentially at risk from pollution. This approach identifies the lakes, streams, or aquifers at risk, then attempts to calculate whether the these waters can assimilate the pollutant load from the wastewater system or systems in question without degrading water below acceptable levels (usually defined by ambient water quality standards). If not, the design approach requires alternatives such as advanced treatment, different siting, or not allowing the system to be installed at all. (EPA 2002).

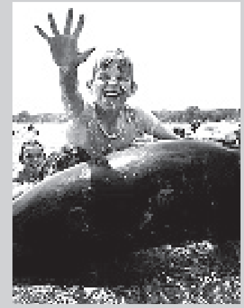
At present, Montana regulates septic systems primarily by the design approach. Although Montana does not generally apply the design approach to prevent septic system impacts to surface waters, it does have the legal framework in place to impose such controls if it were deemed necessary to do so.

Prescriptive-based laws and regulations:

- ***State and local septic system regulations:*** As mandated by statute, the Montana Department of Environmental Quality (MDEQ) has enacted minimum standards for the design, installation, and maintenance of conventional septic systems. These regulations generally ensure the systems will provide the level of treatment described in Chapter 3 of this paper – i.e., removal of most pathogens and the nutrient phosphorous. Recently, MDEQ enacted a set of minimum standards for advanced septic systems that can remove significant levels of nitrogen as well. These systems, designated Level II systems, are available for use when conventional systems are unable to meet minimum water quality standards required by performance-based laws discussed in section 6.3, below.

State law requires local boards of health to enact and enforce septic system regulations that are at least as stringent as the MDEQ standards discussed above.[1] Local boards may also, under certain conditions, enact septic regulations that go beyond state standards. These may be used to restrict or prohibit septic systems in certain areas due to local conditions. For example, the Missoula City-County Health Board has established three separate districts where new or enhanced treatment is required. In one case the district was established because an area has high existing groundwater nitrate concentrations, and in another case because the area has high groundwater elevations. The third district comprises the entire service area of the Missoula municipal wastewater treatment plant, where the policy is to encourage new development to connect to the sewer system as soon as it is practical to do so.

■ ***State subdivision regulations:*** Montana's subdivision laws contain density limitations or minimum lot area requirements for septic systems, which are primarily intended to mitigate impacts to human health. These regulations require a minimum lot size of one acre for each on-site wastewater system and well in a proposed subdivision. If a community water supply or wastewater system will serve the subdivision, the minimum lot size is decreased to 20,000 square feet. If both a community water supply and a community wastewater system are provided, lot sizes can be smaller. (Montana ARM 17.36.340). The intent of these regulations is to protect human health by providing adequate buffers between septic systems and drinking water wells to allow adequate treatment of pathogens and other harmful substances. However, these regulations may provide incidental benefits to surface waters to the extent they limit the total number of homes that can be built in an area, thereby limiting the total nutrient load.



Regulatory systems designed to protect groundwater will *NOT* protect surface water adequately.

Performance-based laws and regulations:

■ ***Nondegradation policy:*** The primary performance-based Montana law protecting surface water quality is the state nondegradation policy, codified at MCA 75-5-303, which implements the substantive requirements of the federal Clean Water Act.[2] The nondegradation policy makes it illegal to engage in any activity that will cause significant degradation of high-quality waters, which include the vast majority of natural surface waters in the state.[3] Both the statute and related administrative rules contain extensive provisions describing activities that, by definition, are not legally significant degradation.[4]

In order to obtain a permit for a septic or other private wastewater system, one must establish that any deterioration in water quality caused by the system will fit within one of the recognized definitions of nonsignificant degradation. Since most systems are permitted in the context of proposed subdivisions of land, this nondegradation analysis is usually done by the developer as a condition of receiving final

Blackfoot River, Montana

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[1] MCA § 50-2-116(1)(h)(i).

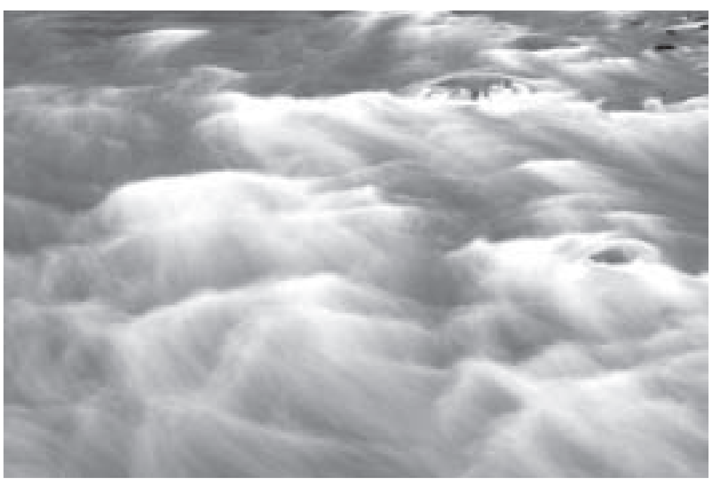
[2] *See* 40 CFR § 131.12.

[3] *See* MCA §§ 75-5-303(2), -301(5)(c).

[4] *See* MCA §§ 75-5-301(5)(c), -301(5)(d), and -317; ARM §§ 17.30.715 and -716.

approval for the subdivision from the local government authority.[5] The developer does this by submitting site-specific sampling data and analysis, which is reviewed by specialists at the state Department of Environmental Quality (MDEQ) or, in some cases, by local specialists certified by MDEQ.[6] In the case of sewage systems, the analysis focuses on nitrogen and phosphorous, the two relevant pollutants for which the state has adopted water quality standards.[7]

The nondegradation rules provide several ways to establish that a discharge of nitrogen and phosphorous will not significantly degrade surface water. In the case of nitrogen, most domestic sewage systems are not required to undergo any surface water nondegradation analysis at all. The only exceptions are those systems that are close enough to a lake or stream to be considered "adjacent" to surface water, a determination that MDEQ makes on a case-by-case basis. In these cases, the permitee must submit site-specific data and modeling to establish either (1) that the discharge will not cause the surface water concentration of nitrogen to increase by more than the trigger value for nitrogen (.01ppm), or (2) that the discharge will not violate the narrative standard prohibiting any "measurable changes in aquatic life or ecological integrity."[8]



In the case of phosphorous, the vast majority of discharges are found to be nonsignificant by the submission of a "phosphorous breakthrough analysis" that analyzes the adsorption capacity of the local soil. A discharge is considered not to cause a significant degradation of surface water if the breakthrough analysis shows that no phosphorous from the system will reach surface water for at least 50 years.[9] In the rare cases where a site fails to pass the breakthrough analysis, the permitee can establish that the discharge is nonsignificant using the trigger value approach described above (except that the trigger value for phosphorous is .001 ppm), or by showing the discharge will not have a measurable impact on aquatic life or ecological integrity.[10]

A weakness of the trigger value and narrative standard approaches is that they do not consider cumulative impacts. That is, the question in each case is whether the individual development being reviewed will cause the trigger value or narrative standard to be exceeded, without regard to the impacts of existing or future development.[11] As a practical matter, the discharge from a single small subdivision, much less a single septic system, is seldom if ever sufficient to cause a .01 mg/l increase in nitrogen in a river or lake, especially considering that compliance is not measured where the discharge to surface water occurs, but rather at the end of a potentially lengthy mixing zone. As a result, the trigger value approach has had little or no effect on the permitting of domestic wastewater systems, even in areas of the Clark Fork and lower Bitterroot

5 *See* MCA §§ 76-3-504(1)(f)(3) and -76-3-604.

6 The permitee need not submit a site-specific nondegradation analysis if site-specific data show that the site qualifies for one of the categorical exemptions spelled out in the rule. These exemptions are based on considerations such as soil type, depth to groundwater, and distance to surface water. See ARM 17.30.716(2).

7 *See generally,* "How to Perform a Nondegradayion Analysis for Subsurface Wastewater Treatment Systems," MDEQ handbook, March 2005.

8 This section of the rule applies where only narrative standards for nutrients exist. On the Clark Fork River between Warm Springs Ponds and the Flathead River, where numeric standards for nitrogen and phosphorous has been adopted, the permitee would have to show that the predicted in-stream concentration after the discharge is mixed in-stream was less than 15% of the numeric standard in order for the discharge to be considered nonsignificant.

9 ARM § 17.30.715(1)(e).

10 ARM §§ 17.30.715(1)(c) and -715(1)(g). Trigger values are found in DEQ Circular WQB-7 (numeric water quality standards).

11 *See* "How to Perform a Nondegradation Analysis," p. 45. However, multiple phases of a single development proposal are considered to be a single development and are reviewed together for trigger value compliance. Id.

valleys where data suggest that the cumulative load from these systems far exceeds the trigger value, and is likely a significant contributor to algae growth as well.

In addition to the above provisions related to surface water, Montana's nondegradation rules contain other, far more extensive provisions regulating the concentration of nitrogen in groundwater.[12] These groundwater regulations are driven primarily by the need to keep levels of nitrogen from approaching the 10 mg/l human health standard for groundwater. In actual practice, compliance with groundwater standards—which is highly dependent on local factors such as, lot sizes, alignment of drainfields, and dispersion rates—dominates the nondegradation analysis for most proposed subdivisions. Surface water concerns play only a minor role.

- ***Surface water discharge permit regulations:*** Montana regulates point-source discharges to surface water under the Montana Point Source Discharge Elimination System, or MPDES program. All wastewater systems, including septic tanks, technically qualify as point sources under the MPDES regulations, which define that term as "any discernible, confined, or discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, [or] conduit . . . from which pollutants are or may be discharged."[13] Despite this, however, MDEQ does not require privately-owned sewage systems to obtain MPDES permits, even when they discharge pollutants to surface water via hydrologically-connected groundwater. The legal reason for this is not clear.[14] MDEQ does require point-source discharges to hydrologically-connected groundwater in other contexts, such as mining, to obtain MPDES permits. Therefore, MDEQ does have the legal authority to regulate septic systems that have the potential to discharge nutrients to surface water under the MPDES program, should MDEQ choose to exercise that authority.

There are several potential ways the MPDES system could fit into an overall scheme to control cumulative nutrient impacts from septic tanks and other sewage systems. For example, while it would obviously be unmanageable to require every septic tank that discharges to alluvial aquifers in a river basin to get an MPDES permit, the state could prepare a general permit setting forth specific requirements for geographical areas within basins where nutrients are known to be a problem. Such requirements could include the use of level II treatment systems where appropriate. In the case of collective systems, it might be desirable to require individual MPDES permits, not only to require advanced nutrient treatment, but also as a way to implement monitoring requirements to insure that nutrient removal is functioning effectively and to provide information about the load these sources are contributing to surface water. Such information could help to equitably allocate cumulative loads among various dischargers, as discussed in more detail below.

- ***Groundwater discharge permit regulations:*** Montana regulates discharges of pollutants to groundwater under the Montana Groundwater Pollution Control System (the MGWPCS program). Due to a series of statutory and regulatory exclusions, privately-owned sewage systems are not required to obtain MGWPCS permits unless they have a design capacity of greater than 5,000 gallons per day (equivalent to about 25

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[12] *See* ARM §§ 17.30.715(1)(d) and -716(2); see generally "How to Perform a Nondegradation Analysis."

[13] ARM § 17.30.1304(41).

residences).[14] In many cases, these exemptions allow developments to avoid being regulated by the MGWPCS system by installing two or more smaller-capacity collective systems instead of a single large system, or by installing individual septic tanks. As noted in Chapter 5, centralized, permitted systems offer several advantages over individualized systems because they route sewage to a single collection point and treatment system, greatly simplifying the tasks of monitoring, maintenance, and inspection. In addition, the effluent limits and ambient monitoring requirements imposed by MGWPCS permits could provide important information that could be used for equitable load allocation.[15]

- ***Total Maximum Daily Load provisions:*** The Montana Water Quality Act contains a process for reducing pollutants such as nitrogen and phosphorous to allowable levels in a stream or lake where they currently fail to meet water quality standards. This process, which is set forth in the federal Clean Water Act, is known as the Total Maximum Daily Load, or TMDL program.[16] The basic concept behind the TMDL process is relatively simple. In basic terms, the process consists of determining the total load of a pollutant that can be discharged into a waterbody while still meeting standards, allocating equitable portions of that load to each of the identified sources of that pollutant, and then implementing controls on each source to ensure it does not exceed its allowable load.[17]

In reality, the process of developing a TMDL is very complex to say the least. In practical terms, the process is complicated by variables such as flow rates, discharge rates, and in-stream attenuation, each of which can be highly variable across time and space. In legal terms, the process is complicated by the fact that regulators may impose mandatory restrictions only on point sources, while all controls on non-point sources are voluntary. Therefore, if there is a general increase in loading from non-point sources over time, point sources tend to suffer, since they are the only sources on which regulators can impose mandatory restrictions to meet standards.

Despite the complications, Montana has developed a TMDL for nitrogen and phosphorous in one 200-mile long reach of river, the Clark Fork River between Warm Springs Ponds and the Flathead River confluence. This TMDL is based on a computer model that considers the discharges from the four largest point sources on this reach (three municipalities and one paper mill), an estimated cumulative

Bitterroot River, Montana

[14] *See* MCA § 75-5-401(5)(h); ARM § 17.30.1022(c) through (f).

[15] *See* ARM § 17.30.1031(5).

[16] *See* 33 U.S.C. § 1313(d)(1)(C); 40 CFR § 130.7; MCA § 75-5-03.

[17] *See* 40 CFR §§ 130.7(c) and 130.2.

discharge from over 6,000 septic systems in the Missoula valley, the inputs from each major tributary, and a calculated allowance for the total non-point discharge for each designated sub-reach of river. Measures were then developed to reduce the discharge from each of the four major point sources, and one concentrated group of septic systems in Missoula, and, using the model, a prediction was made that if the point sources implemented these measures the river would comply with numeric standards for nitrogen and phosphorous. These numeric standards were developed for this particular reach of river based on many years of monitoring data for both nutrients and algae.

A weakness of the Clark Fork River TMDL is that it does not allocate nitrogen and phosphorous loads to point sources other than the four major dischargers. Although plans exist to bring smaller point-sources that discharge directly to surface water into the TMDL in the next few years as their MPDES permits are renewed, there currently are no plans to allocate loads to sources such as sewage systems that discharge nutrients to surface water indirectly via hydrologically-connected groundwater. Instead, the TMDL treats these discharges as non-point source pollution. Therefore, the TMDL presently contains no mechanism to prevent the increasing load from septic tanks and privately-owned collective sewage treatment systems from "eating into" the load that is presently allocated to point sources that discharge to surface water directly.

It is possible to assign load allocations to groundwater dischargers in a surface water TMDL. Collective sewage systems with capacities greater than 5,000 gpd already have MGWPCS permits, with calculated limits on the maximum load they may discharge to groundwater. Where adequate aquifer data exist, rough estimates could be made of the amount of their load that reaches surface water, and this load could be incorporated into the TMDL. Where systems discharge in close proximity to the river, it might make sense to conservatively estimate that 100% of the load goes directly to surface water, while in the case of more-distant dischargers, some fraction of the load might be more appropriate. Although smaller systems such as septic tanks would provide a greater challenge due to their sheer numbers, estimates of their surface water load could still be made in many cases. Local governments have data on the location of most if not all septic permits within their jurisdictions, and standard assumptions could be used regarding the average daily load generated by a residential septic system. Although the surface water loading calculations for all groundwater dischargers would necessarily be inexact, they might represent a significant improvement over the alternative of simply ignoring these point sources in a nutrient TMDL.

Discussion of policy alternatives:

It is clear that the existing legal framework in Montana already provides the tools that could be used in concert to mitigate and prevent surface water quality impacts from septic systems. These tools include both prescriptive and performance-based approaches. Montana's water quality-based standards and non-degradation policy could be used to identify waters that are impaired or at risk from excessive nutrients. The non-degradation policy could be used—provided some way were developed to account for cumulative impacts—to identify development projects that threaten to cause unacceptable degrees of degradation. Point-source regulations and design standards could then be used in conjunction with land use regulations to control the size of cumulative nutrient loads, both by requiring higher levels of treatment and limiting the number of systems allowed in a given area. The TMDL system could provide a way of allocating cumulative nutrient loads between different areas, and between point and non-point sources. Finally, local governments could identify areas within their boundaries that are particularly sensitive to nutrient impacts—as Missoula County has already done—and apply higher levels of protection to those areas by requiring advanced treatment, collective on-site systems, or connection to a municipal sewer system.

CONCLUSIONS

- Rapid development of valleys and property near streams and lakes in rural counties of the inland Northwest highlights the potential for septic systems to contaminate surface waters—a different issue than the typical human health focus of septic system regulation.
- Septic system effluent is discharged to shallow groundwater, which moves along flow lines and eventually carries soluble constituents like nitrate nitrogen toward surface water.
- Other constituents of septic effluent, such as phosphorus, pathogenic organisms, and some household products, are mostly removed during the soil treatment process, but have also been detected in groundwater near septic systems.
- Shallow groundwater affected by septic effluent discharges into streams, rivers, and lakes in many geologic settings. Alluvial basin-fill valleys and lakeshore areas where shallow groundwater flows towards waterfront are prime areas for septic nutrients—especially nitrates, but sometimes small quantities of phosphorus—to be discharged through the groundwater into surface water.
- As nutrients from septic effluent are transported in ground water, partial mitigation by chemical denitrification or biological uptake may occur, but is not assured.
- Levels of nitrate nitrogen in shallow groundwater under developing areas are often far higher than background concentrations, and far higher than their concentrations in healthy surface waters. Phosphorus concentrations in groundwater, even when low, are often higher than levels in clean streams and lakes. This means that shallow groundwater flowing into streams, rivers and lakes from developed areas is expected to increase nutrients, especially nitrates, in these surface waters.
- In settings where septic-contaminated groundwater inflow makes up a significant portion of surface water flows, surface water nutrient loading from septic effluent will occur, and can be a significant portion of total nutrient loads to sensitive waters.
- In lake-front settings, septic systems have been documented to discharge not only nitrogen but also phosphorus to the lakes via a shallow groundwater aquifer, causing near-shore noxious algae blooms.
- In general, septic systems are a significant source of nutrients, especially nitrates, to groundwater and surface water in rural areas experiencing rapid growth. New septic systems inexorably add nitrates to the cumulative nutrient loads in surface waters. Other factors common to land development (e.g. construction sediments, road runoff, fertilizers, industrial projects) also typically increase phosphorus loading to surface waters. This combination of nitrate and phosphorus loading is highly detrimental to fresh water lakes and streams.
- Technical options for reducing the septic nutrient load to surface waters include various alternative septic systems, but management of septic system impact will require attention to cumulative effects at a watershed level, not just technical options.
- In some cases, using new nutrient-reduction septic systems actually encourages further development in sensitive watershed areas that would not have been built out with traditional septic systems. For nutrient-sensitive surface waters, this could result in a net loss of water quality.
- Subdivision-scale collective treatment systems may offer the best way to control wastewater nutrients in suburban and semi-rural settings, combining some advantages of both centralized sewers and individual septic systems.
- Some states address the possibility of phosphorus "breakthrough" into surface waters from older septic systems. Other states ignore this possibility.
- Some states currently require analysis of septic nutrient loading to surface waters, including phosphorus "breakthrough" as septic systems age. Other states do not address this issue.
- It is unclear to what extent TMDL implementation will address the cumulative nutrient load issues of septic systems in rapidly growing rural areas.

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TumaloSewerOptions.org

Tumalo Wastewater Feasibility Study

Advisory Committee Meeting #2 – *Sewer Options*

August 16, 2022 · 5:00-7:00 p.m. · Zoom Meeting

Purpose & Agenda

Meeting Purpose:

5:00 p.m.	Welcome, introductions, overview
5:15	Sewer options
	• Expand TPOA System
	• New collection and treatment/disposal system
	• Connect to Bend's North Interceptor
6:15	Estimated costs & finance options
6:20	Committee questions/ discussion
6:45	Public Comment
7:00 p.m.	Adjourn - next meeting: September 15

Advisory Committee assignment

- Evaluate and provide input on the engineering alternatives and associated costs for each alternative.
- Determine the best structure for implementing the preferred alternative.
- Consider the impacts of the various sewer alternatives in terms of cost, construction impacts, and long-term operations and maintenance.
- Recommend a preferred option to address the future of wastewater treatment in the community.
- Provide a roadmap for community implementation.

Meeting Guidelines

Meetings will be facilitated to provide all Advisory Group members opportunities to ask questions and provide feedback. These meeting guidelines will maximize participants' time and efforts:

- ✓ Limit speaking to only one person at a time.
- ✓ Listen carefully; keep an open mind.
- ✓ Keep remarks brief and on point. Be mindful of the group and the importance of all members having the chance to express their views.
- ✓ Express your own views or those of constituents. Refrain from characterizing the opinions, interests, motivations, positions or values of other Advisory Group members or the project team.

Sewer Options

Sewer options

1 Expand existing TPOA System

2 New collection & treatment/disposal system

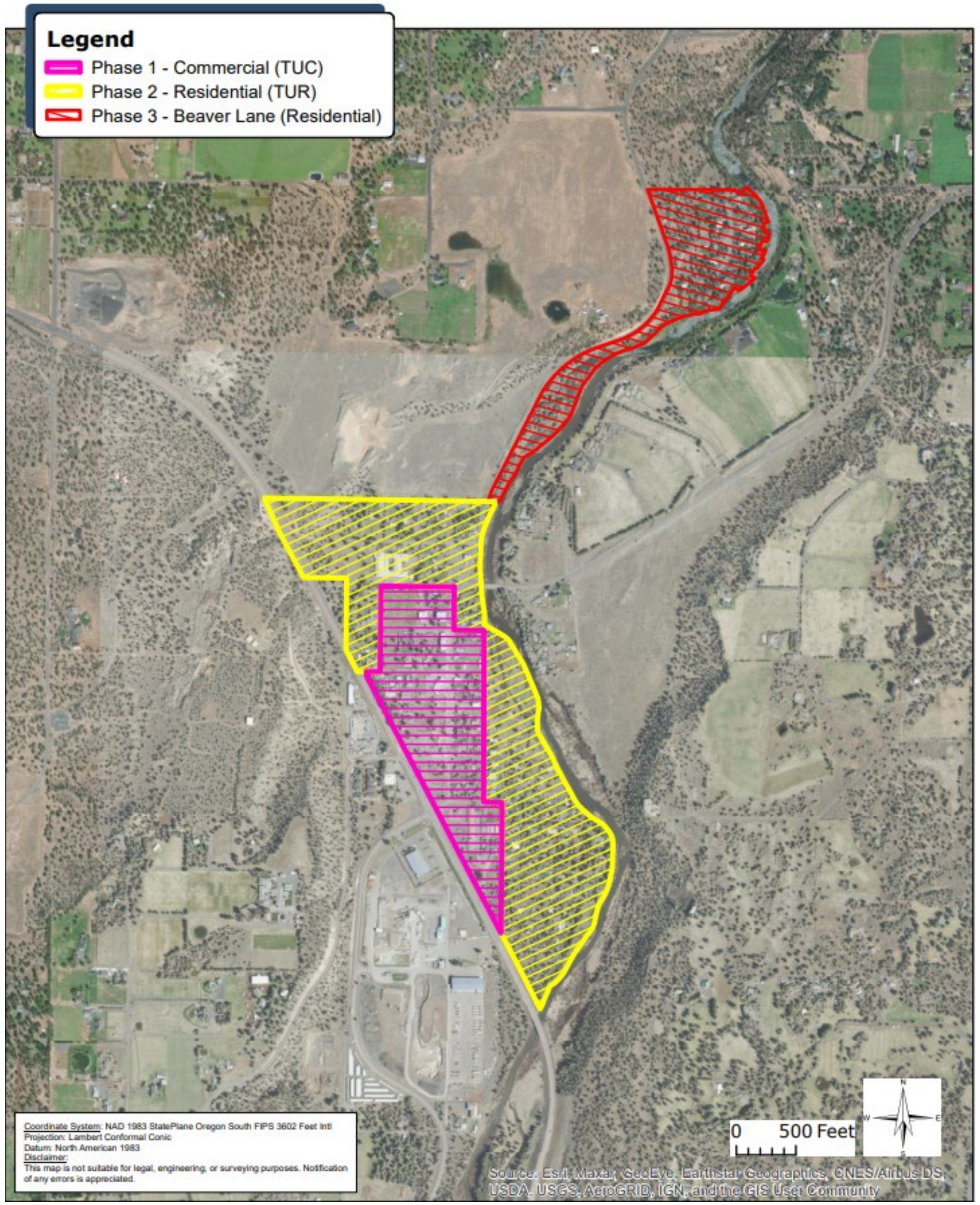
3 New collection system & connect to City of Bend's NE Interceptor for treatment & disposal

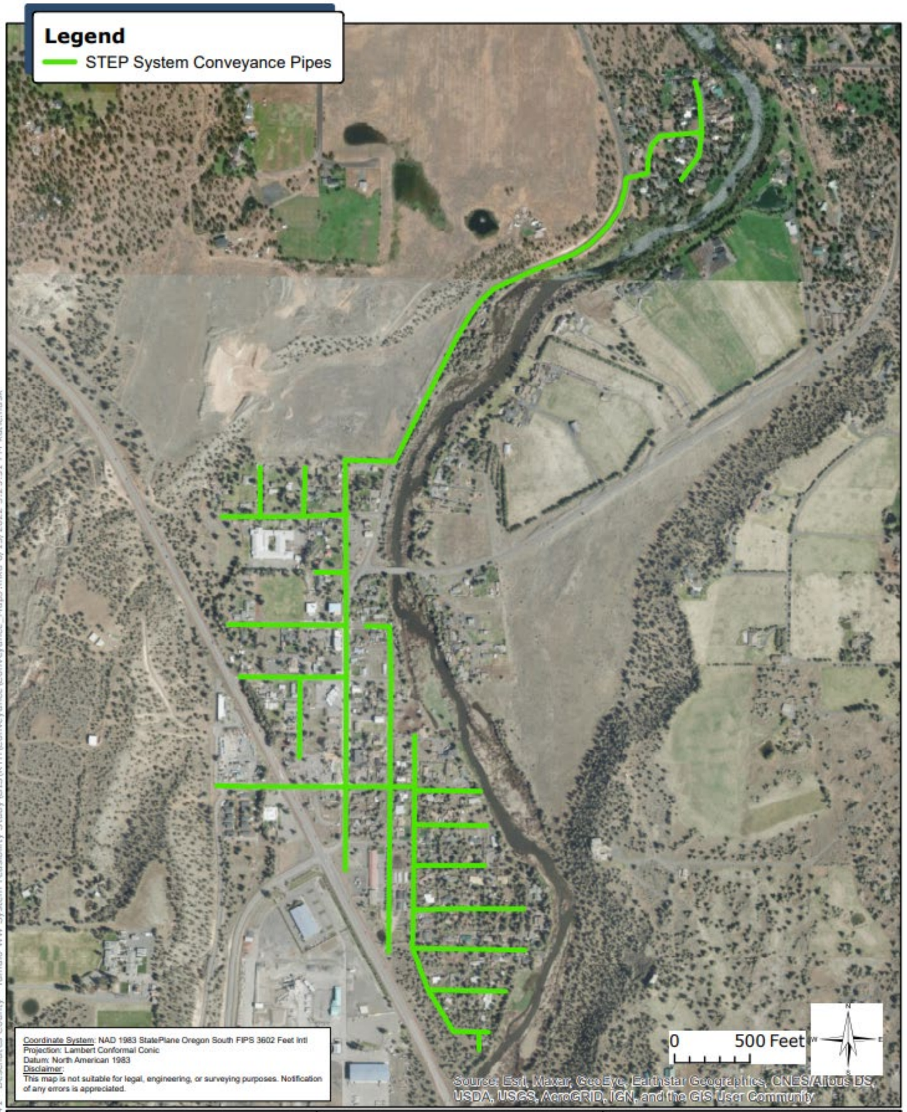
Ideas Considered & Eliminated

- Gravity collection system- too disruptive for community and too expensive based on number of potential rate payers.
- Membrane Bioreactor (MBR) system - too expensive.

Overall system considerations

- Roughly 22,000 linear feet of pipe is needed for the collection system.
- Collection system will be pressurized Septic Tank Effluent Pump (STEP) system.
- The existing study area is estimated to generate roughly 45,000 gallons per day of flow.
- The “full buildout” is estimated to generate roughly 60,000 gallons per day of flow.
- Orenco AdvanTex treatment systems are scalable.





murraysmith

Tumalo Wastewater System Feasibility Study

STEP Conveyance Pipes

August 2022

22-3441

Option 1: Expand existing Tumalo Property Owners Association (TPOA) system

Opportunities

- Expansion of existing AdvanTex system can be phased
- If additional land for drainfields is secured, system can be expanded relatively quickly

Challenges

- Additional land is needed – 11 acres
- Governance structure complicated by private ownership
- Each lot will require its own onsite septic tank to remove bulk solids
- Potential pre-treatment needs for commercial uses

Option 1: Expand existing TPOA system

Orenco Option 1 and 2			
Phase	Conveyance Cost - STEP System	Treatment System Cost	Phase Total
1	$2,500,000	$4,700,000	$7,200,000
2	$3,700,000	$4,700,000	$8,400,000
3	$1,800,000	-	$1,800,000
		Class 5 Cost Estimate*	$17,400,000

**Class 5 estimates are known as “rough order magnitude” estimates- with variation of -50% to +100%. Future system design will refine these estimates. Additionally: System Development Charges, fees TBD.*

Option 2: New collection and treatment/disposal system

Opportunities

- Potential public funding options
- Can be phased

Challenges

- Siting of secondary treatment and drainfields
- Each lot will require its own onsite septic tank to remove bulk solids
- Potential pretreatment needs for commercial uses
- Issues of redundancy

Option 2: New collection and treatment/disposal system

Orenco Option 1 and 2			
Phase	Conveyance Cost - STEP System	Treatment System Cost	Phase Total
1	$2,500,000	$4,700,000	$7,200,000
2	$3,700,000	$4,700,000	$8,400,000
3	$1,800,000	-	$1,800,000
		Class 5 Cost Estimate	$17,400,000

**Class 5 estimates are known as "rough order magnitude" estimates- with variation of -50% to +100%. Future system design will refine these estimates. Additionally: System Development Charges, fees TBD.*

Connect to City of Bend's North Interceptor

Opportunities

- No local treatment system or effluent disposal required
- Lowest O&M costs
- Potential public funding options

Challenges

- Timing & coordination w/ City of Bend
- Uncertainty with future fees & rates

Option 3: Connect to City of Bend's North Interceptor

North Interceptor Option			
Phase	Conveyance Cost – STEP System	Pressure Pipe to North Interceptor	Phase Total
1	$2,500,000	$3,800,000	$6,300,000
2	$3,700,000	-	$3,700,000
3	$1,800,000	-	$1,800,000
		Class 5* Cost Estimate	$11,800,000

**Class 5 estimates are known as "rough order magnitude" estimates- with variation of -50% to +100%. Future system design will refine these estimates. Additionally: System Development Charges, fees TBD.*

Funding Sources

- State Revolving Loan Funds
- Water Infrastructure Finance and Innovation Act (WIFIA)
- Business Oregon Water/ Wastewater Financing Program
- USDA Rural Development

*May include capital costs, monthly rates, hookup fees, SDCs.

Funding Round Table

- Monthly meeting
- Determine best funding path forward

business oregon

INFRASTRUCTURE FINANCE:
One-Stop Financing Roundtable

Bringing together all parties to efficiently find funding solutions for community projects and helping move them from concepts to reality...

Do you need financing for your public works project?
Business Oregon facilitates a monthly meeting to quickly and efficiently find funding solutions for communities. One-stop meeting locations can vary depending on the topic, project or the community requesting the meeting.

WHO CAN REQUEST A ONE-STOP?
Any stakeholder (City Manager, Engineer, Elected Official, etc.) working on a potential project or working on behalf of the community.

WHY SHOULD YOU REQUEST A ONE-STOP?
One-stop participants will benefit from the combined experience of participants and gain valuable contacts. As a result of the one-stop, participants will walk away with an understanding of the next steps needed for the project and be provided a variety of funding scenarios.

WHAT SHOULD YOU BRING TO A ONE-STOP?
Decision maker, engineer, and staff from the community requesting the funding, a project plan, budget, financials.

FUNDING PARTNERS:
Clean Water State Revolving Fund
USDA Rural Development — Committed to the future of rural communities.
Drinking Water State Revolving Fund — Protect Our Health from Source to Tap
DEQ State of Oregon Department of Environmental Quality

www.oregon4biz.com

Business Oregon's infrastructure finance programs assist communities to build infrastructure capacity to address public health safety and compliance issues as well as support their ability to attract, retain and expand businesses. We strive to coordinate the delivery of infrastructure financing to Oregon communities and to better collaborate with local partners.

TO REQUEST A ONE-STOP:
Contact the Regional Development Officer covering your area. List can be found on oregon4biz.com.

BUSINESS OREGON
Main Office:
775 Summer St., NE, Suite 200
Salem, OR 97301
www.oregon4biz.com
Ph: 503-986-0123
business.oregon@oregon.gov
Business Oregon is an agency of the state of Oregon.

Advisory Committee questions/ discussion

Public Comment- limited to 3 minutes per person

What's next?

August

Advisory Committee meeting August 16 - Evaluating Tumalo Sewer Options

Engineering team presents general cost & feasibility of each alternative

September

Advisory Committee meeting September 15 - Results & Recommendations

Refined cost- capital & life cycle, governance, & funding options for each alternative

Advisory Committee recommendations

October

Implementation Plan and presentations

Thank you!

Stay connected:
TumaloSewerOptions.org

TumaloSewerOptions.org

Meeting Notes

Tumalo Wastewater Feasibility Study Advisory Committee

Meeting #2 – *Evaluating Sewer Options*

Location:	Zoom/ Virtual Meeting 2 video: https://vimeo.com/740234151	**Date:** **Time:**	August 16, 2022 5:00-7:00 p.m.

Committee Members:	Gabe Coler, Tumalo Resident, AC Member Jim Crouch, Heritage Brand, AC Member ***(Absent)*** Andrew Davidson, Dirty Hands Construction & Septic, AC Member	Jeanine Fraley, Tumalo Resident, AC Member Jana Gisler, Tumalo Property Owner, AC Member Martha Gross, Tumalo Resident, AC Member	Dale Peer, Laidlaw Water District, AC Member Kelly Roark, Bend Cider Company, AC Member ***(Absent)***
Project Team:	Murraysmith, Inc.: Jon Skidmore, Justin Moman, PE, Katie Husk, PE	Barney & Worth: Susanna Julber, Trisha Maxfield	Deschutes County: Chris Doty, Todd Cleveland, Peter Russell ***(Absent)***

The meeting convened at 5 p.m. through a virtual platform.

1. Welcome, introductions, agenda overview

Jon Skidmore, Murraysmith project manager, opened the meeting and welcomed the group. The main objective of this meeting was to review the three options for providing sewer to Tumalo in greater detail.

Chris Doty, Deschutes County Road Dept. Supervisor, gave opening remarks noting this project is primarily a sewer feasibility study that provides a roadmap of options for a community wastewater solution for the study area within the Tumalo Unincorporated Community. Susanna Julber, from Barney & Worth reviewed the advisory committee assignment, and explained the meeting ground rules.

2. Sewer options & discussion

Jon Skidmore noted that constructing a gravity collection system and membrane bioreactor (MBR) treatment system to Tumalo is too expensive and disruptive to be a feasible option. That option was ruled out for further consideration. The overall system requirements to serve Tumalo are:

- Roughly 22,000 linear feet of pipe is needed for the collection system.
- Collection system will be pressurized Septic Tank Effluent Pump (STEP) system.
- The existing study area is estimated to generate roughly 45,000 gallons per day of flow.
- The “full buildout” is estimated to generate roughly 60,000 gallons per day of flow.

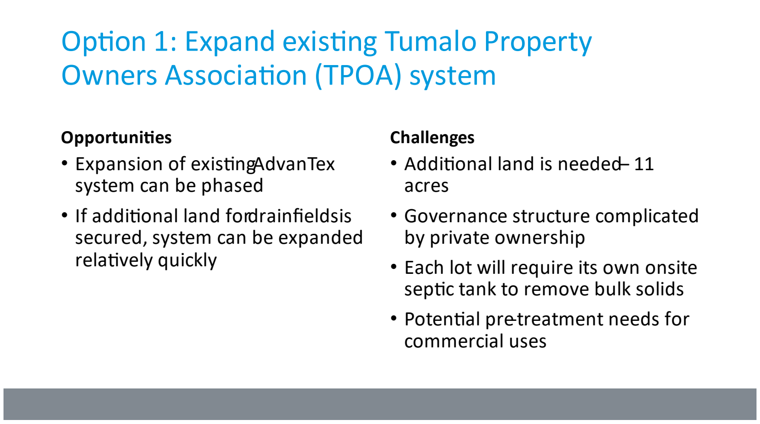
- The recommended Orenco AdvanTex treatment systems are scalable.

Justin Moman, PE, Murraysmith, and Katie Husk, PE, Murraysmith, provided an overview of the three sewer options:

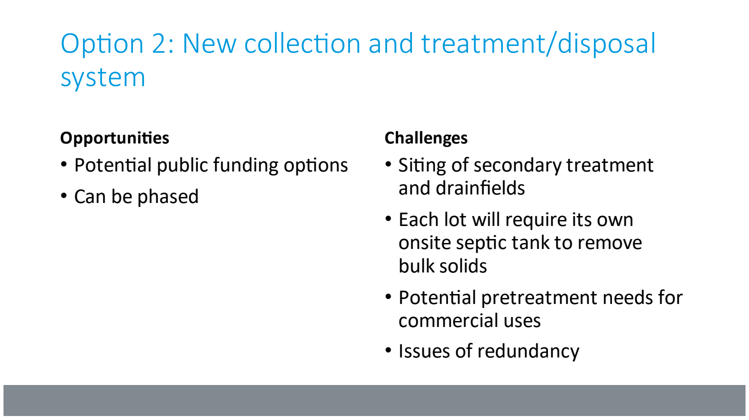
- Expansion of TPOA System
- New collection and treatment/ disposal system
- New collection system and connect to Bend's North Interceptor for treatment and disposal

The consultant team evaluated the option of serving the project area in three phases—Phase 1 being the commercial core area, Phase 2 the residential within the core, and Phase 3 the area near Beaver Lane. Justin Moman clarified that each option would require individual property owners to have a tank at their site prior to effluent entering the collection system.

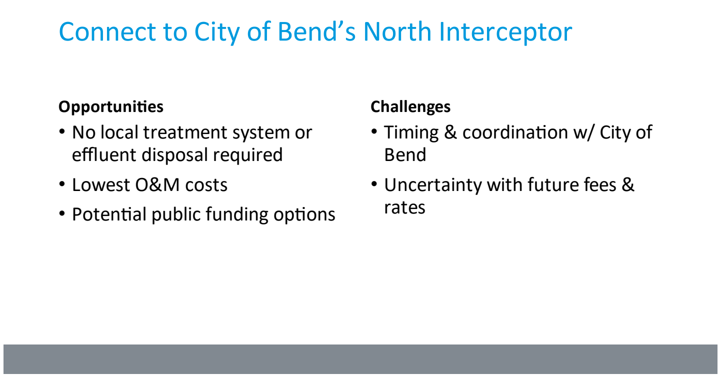
Options:



Option 1 consists of expanding the TPOA system to serve the identified study area. The existing TPOA system has additional capacity for a few additional homes. In order to treat the study area additional Orenco AdvanTex treatment facilities will be required and there would need to be additional acreage for drainfield areas. Governance may be complicated, because TPOA is a private system.



Option 2 consists of creation of a new sanitary district including construction of a STEP collection system and Orenco AdvanTex treatment system. would require additional property for secondary treatment and drain fields. Similar to Option 1, this option can be phased. Formation of a public sanitary district may have a less complicated governance structure and be eligible for public funding options.



Option 3 consists of connecting a collection system to the City of Bend's North Interceptor. It is the least expensive option, but also the most uncertain in terms of timing. Option 3 would not require a local treatment system or effluent disposal. It likely has the lowest O&M costs, and potential public funding options. This option contains a degree of uncertainty due to required coordination with the City of Bend, timing of the construction of the North Interceptor (it is not within Bend's 5-year plan now), and future fees and rates are challenges. The City Council is not required to permit such a connection.

Katie Husk, PE with Murraysmith, provided an overview of the Class 5 cost estimate for each alternative. Class 5 estimates for both **Options 1 and 2 total $17,400,000**. The Class 5 estimate for **Option 3 is $11,800,000**. It is important to note that Class 5 estimates are known as "rough order of magnitude" estimates—with variation of -50% to +100%. Future system design will refine these estimates. These cost estimates will be refined for meeting #3, with life cycle and O&M cost estimates as well.

Jon Skidmore explained that legal and financial consultants will be helping the team provide an overview of monthly costs/ potential rates, and recommended governance structures for each option.

3. Estimated costs & finance options

Susanna Julber provided an overview of public funding options that may be available for the project costs, including design and life cycle costs. These options include Clean Water State Revolving Loan Funds (through Oregon DEQ), the Water Infrastructure Finance and Innovation Act (WIFIA), Business Oregon Water/ Wastewater Financing Program, and USDA Rural Development. Susanna will provide a memo to the committee members detailing the specifics of each program prior to the next meeting.

4. Committee questions/ discussion

Committee members had questions about private septic tank maintenance, the cost estimates in general, and about expanding the TPOA system in terms of governance structures and feasibility.

5. Public comment

A member of the public had comments about the Option 1 feasibility, cost per household, and legal feasibility. Todd Cleveland was asked about the way the "300-foot rule" is measured – from property line or as the crow flies?

> Todd Cleveland explained (in the meeting chat) that normally, the 300-foot measurement is from the property line closest to the pipe.

A member of the public asked about providing sewer to the entire Tumalo Unincorporated Community boundary, and how adding more properties would reduce the cost per household for sewer.

> Jon Skidmore explained that the project area was determined by the advisory committee at the last meeting based on a variety of factors, and the estimated future flows are based on that.

A member of the public clarified details about the TPOA system, the financing, and the monthly rate the property owners pay. A portion of the monthly rate ($93/month) goes to maintenance of private tanks.

6. Adjourn- next meeting September 15

At the next meeting, the advisory committee will focus on results and recommendations. The project team will have refined cost estimates, including capital and life cycle costs, governance, and funding options for each option.

The meeting was adjourned at 7:00 p.m.

Watch the meeting here: https://vimeo.com/740234151

Tumalo Wastewater Feasibility Study Advisory Committee:

Meeting #3 – Funding & Governance

Location:	Zoom Meeting Registration Link	**Date:**	September 29, 2022
		Time:	5:00-7:00 p.m.

Advisory Committee Members:	Gabe Coler, Tumalo Resident Jim Crouch, Heritage Brand Andrew Davidson, Dirty Hands Construction & Septic	Jeanine Fraley, Tumalo Resident Jana Gisler, Tumalo Property Owner Martha Gross, Tumalo Resident	Dale Peer, Laidlaw Water District Kelly Roark, Bend Cider Company
Project Team:	Murraysmith, Inc.: Justin Moman, PE, Katie Husk, PE, Anna Messing, Engineering Designer	Barney & Worth: Susanna Julber, Clark Worth, Trisha Maxfield	Deschutes County: Chris Doty, Todd Cleveland, Peter Russell

AGENDA

5:00 p.m.	Welcome, introductions, agenda overview
5:15	Review sewer options and refined costs
5:30	Phasing- impacts
5:40	Funding and rate estimates
6:10	Governance structure / requirements
6:20	Next steps: roadmap for implementation
6:30	Discussion
6:45	Public comment
7:00 p.m.	Adjourn

TumaloSewerOptions.org

Tumalo Wastewater Feasibility Study

Advisory Committee Meeting #3 – *Funding & Governance*

September 29, 2022 · 5:00-7:00 p.m. · Zoom Meeting

Purpose & Agenda

Meeting Purpose: Review, discuss funding scenarios, estimated monthly rates, governance structure overview

5:00 p.m.	Welcome, introductions, overview
5:15	Review sewer options and refined costs
5:30	Funding and rate estimates
5:55	Governance structure / requirements
6:20	Next steps: roadmap for implementation
6:30	Discussion
6:45	Public Comment
7:00 p.m.	Adjourn

Photo: Deschutes County

Advisory Committee assignment

- Evaluate and provide input on the engineering alternatives and associated costs for each alternative.
- Determine the best structure for implementing the preferred alternative.
- Consider the impacts of the various sewer alternatives in terms of cost, construction impacts, and long-term operations and maintenance.
- Recommend a preferred option to address the future of wastewater treatment in the community.
- Provide a roadmap for community implementation.

Meeting Guidelines

Meetings will be facilitated to provide all Advisory Group members opportunities to ask questions and provide feedback. These meeting guidelines will maximize participants' time and efforts:

- ✓ Limit speaking to only one person at a time.
- ✓ Listen carefully; keep an open mind.
- ✓ Keep remarks brief and on point. Be mindful of the group and the importance of all members having the chance to express their views.
- ✓ Express your own views or those of constituents. Refrain from characterizing the opinions, interests, motivations, positions or values of other Advisory Group members or the project team.

Sewer Options & Refined Costs

Review: Sewer Alternatives

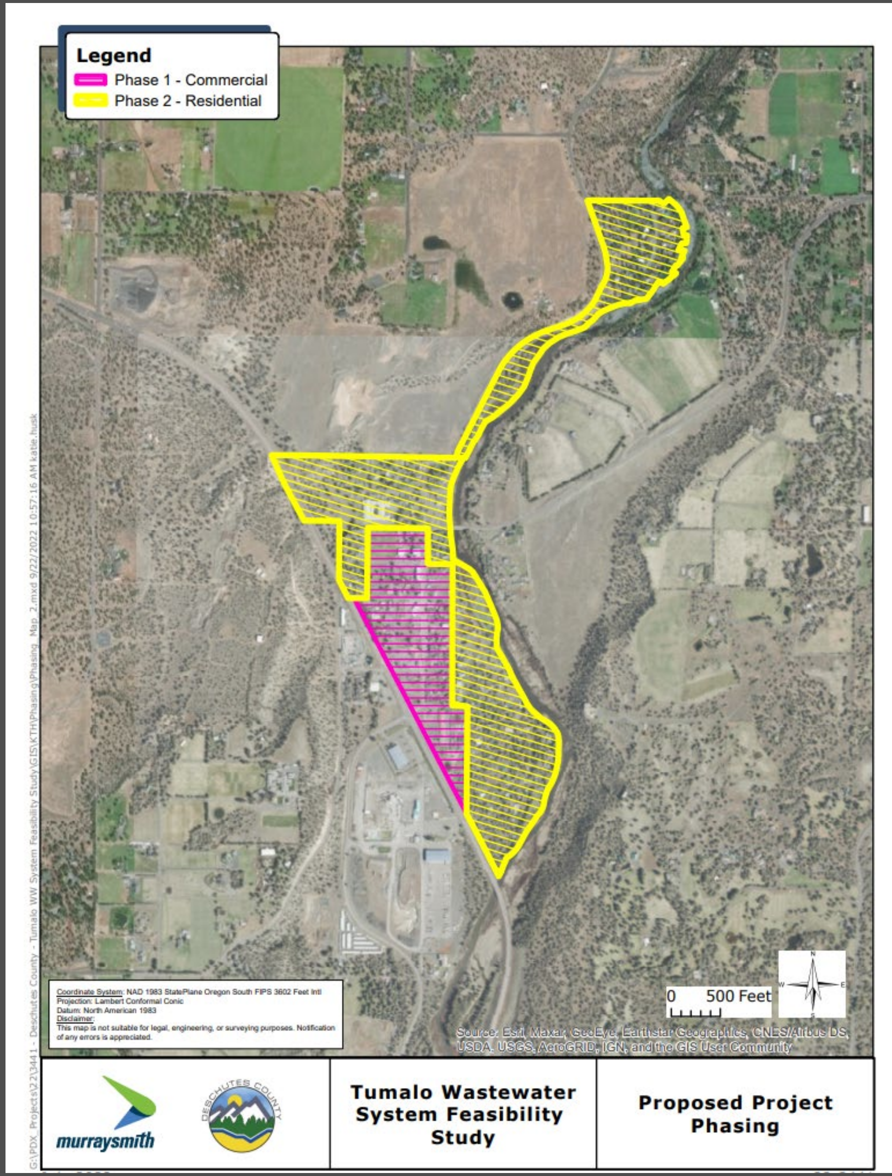
1 Expand existing TPOA System

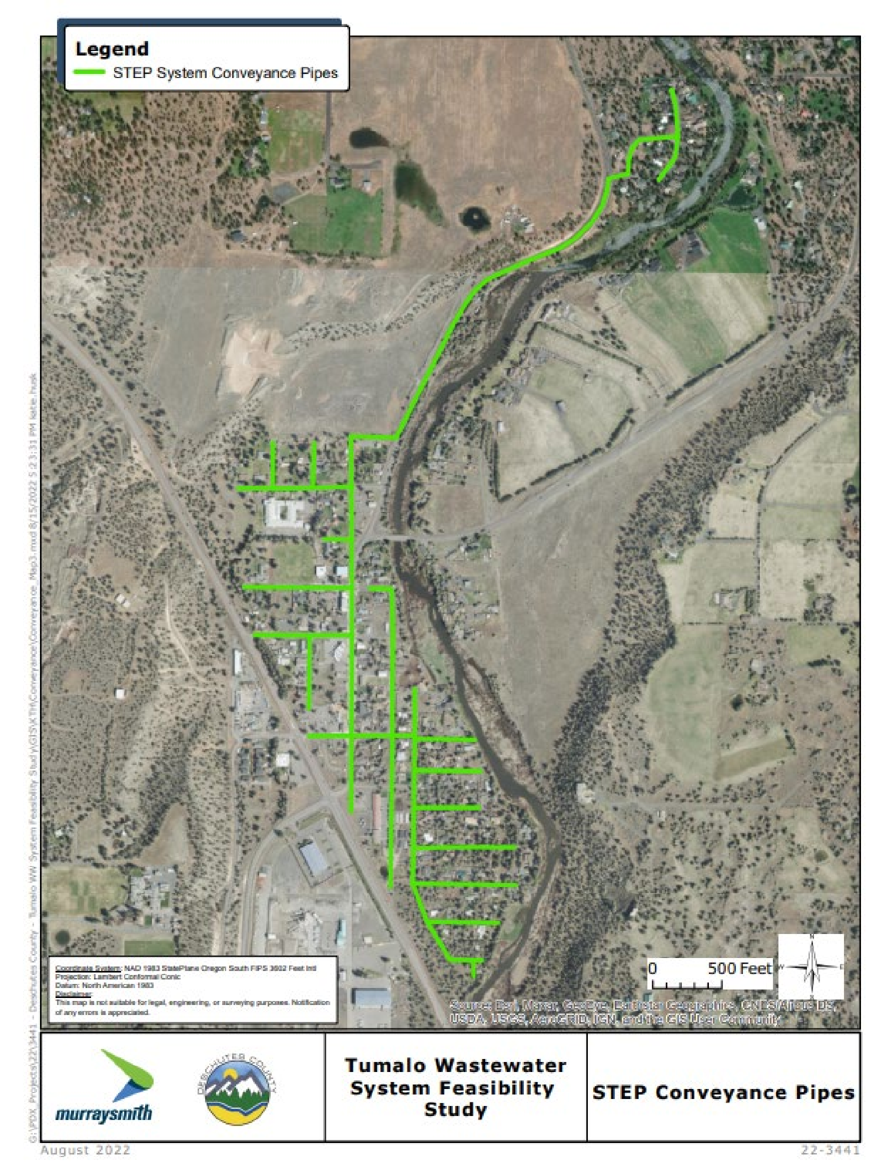
2 New collection & treatment/disposal system

3 New collection system & connect to City of Bend's NE Interceptor for treatment & disposal

Overall system considerations

- Roughly 22,000 linear feet of pipe is needed for the collection system.
- Collection system will be pressurized Septic Tank Effluent Pump (STEP) system.
- The existing study area is estimated to generate roughly 45,000 gallons per day of flow.
- The “full buildout” is estimated to generate roughly 60,000 gallons per day of flow.
- Orenco AdvanTex treatment systems and North Interceptor pipeline alternatives are scalable.


Legend
Phase 1 - Commercial
Phase 2 - Residential
Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet Intl
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer:
This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.
0 500 Feet
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
murraysmith
Tumalo Wastewater System Feasibility Study
Proposed Project Phasing


Legend
STEP System Conveyance Pipes
Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet Intl
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Tumalo Wastewater System Feasibility Study
STEP Conveyance Pipes
August 2022
22-3441

Updated Costs- Capital & Lifecycle- Full Buildout

Alternative	Class 5 Cost Estimate- capital costs	Lifecycle Costs (NPV over 20 yr period)	Total Cost
1. Expand TPOA System	$13,500,000	$4,634,000	$18,134,000
2. New Sewer District	$13,500,000	$4,634,000	$18,134,000
3. Connect to City of Bend's North Interceptor	$8,00,000	$1,324,000	$9,324,000

**Class 5 estimates are known as "rough order magnitude" estimates- with variation of -50% to +100%. Future system design will refine these estimates. Additionally: System Development Charges, connection and/or other fees TBD, as well as private property costs to convert from septic systems to a public sewer system.*

Funding & Rate Estimates

Sample of Costs- Moving from Septic to Public Sewer System (assuming new sanitary sewer district is formed)

***Key Factor for Community Support:** keeping costs of converting to sewer = or < installing new septic system.*

Connection fees and System Development Charges (SDCs). These range from a combined total of between $3,300 to $15,000 per connection, depending on jurisdiction.

Monthly Utility Fee. Sewer District participants will be charged a monthly utility fee.

Private property costs for converting. Based on local comparisons, the cost for a property owner can range from +/- $5,000-$25,000 for converting to sewer.

Overview	
Connection Fee and/or SDC	$$
Monthly utility fee- to pay capital & O&M Costs	$
Private property costs to convert	$ - $$$

Key Variables in Estimating the Rate Impact

- What are the total up-front costs?
- How much might be paid by someone else, so you don’t have to pay it back? (“Launch aid” from Federal, State or County government?)
- What would the loan terms be? Loan length and interest rate?
- What would be ongoing maintenance and administration costs?
- How many people are there to help pay the ongoing bills? (Number of equivalent dwelling units, or EDUs)
  - Now? In the future?

Illustrative Numbers – Up-front Capital Costs*

Key Variable: Up-front Costs	Alternative 2 Commercial Only- Treatment in Tumalo	Alternative 3 Commercial Area Only- Connect to Bend	Alternative 2 Treatment in Tumalo	Alternative 3 Connect to Bend
Total Project Capital Cost	$ 5,400,000	$ 5,400,000	$ 13,500,000	$ 8,000,000
Assumed Treatment Capacity Charge- City of Bend	-	$810,000	-	$ 1,590,000
Total Up-Front Cost	$ 5,400,000	$ 6,210,000	$ 13,500,000	$ 9,590,000
Assumed Grant 10 % (for illustration only)	10%	10%	10%	10%
Assumed Grant Funding	$ 540,000	$ 621,000	$ 1,350,000	$ 959,000
Local Share of Up-front Cost	**$ 4,860,000**	**$ 5,589,000**	**$ 12,150,000**	**$ 8,631,000**

** Does not include ramp-up period in connections, and potential revenues from connection fees and monthly rates. Does not include private property improvement requirements, SDCs, or connection fees. If private TPOA system is expanded and remains a private utility, the project will likely not be eligible for public financing loans and/ or grants, so only Alts 2 & 3 scenarios are shown.*

Illustrative Numbers – Ongoing Costs*

Key Variable: Up-front Costs	Alternative 2 Commercial Only- Treatment in Tumalo	Alternative 3 Commercial Only- Connect to Bend	Alternative 2 Treatment in Tumalo	Alternative 3 Connect to Bend
Local Share of Up-front Cost	$ 4,860,000	$ 5,589,000	$ 12,150,000	$ 8,631,000
New Annual Debt Service	$ 220,000	$ 250,000	$ 540,000	$ 390,000
O&M Costs (Annual)				
Maintenance	$ 87,000	$ 32,000	$ 232,000	$ 67,000
Wholesale Treatment Charge	-	$ 70,000	-	$ 130,000
Admin Cost (for illustration only)	$ 20,000	$ 20,000	$ 30,000	$ 30,000
Total Annual O&M Costs	$ 107,000	$ 122,000	$ 262,000	$ 227,000
Total Annual Costs	**$ 327,000**	**$ 372,000**	**$ 802,000**	**$ 617,000**

*Terms of Loan: 2% interest and 30 years

Illustrative Numbers – Customer Base & Rates*

Key Variable: Up-front Costs	Alternative 2 Commercial Only- Treatment in Tumalo	Alternative 3 Commercial Only- Connect to Bend	Alternative 2 Treatment in Tumalo	Alternative 3 Connect to Bend
Total Annual Cost (Capital and O&M)	$ 327,000	$ 372,000	$ 802,000	$ 617,000
Potential Initial EDUs:				
Commercial lots	95	95	95	95
Residential lots	0	0	138	138
Assumed EDUs per commercial lot: 1.5				
Potential Initial EDUs	142.5 EDUs	142.5 EDUs	280.5 EDUs	280.5 EDUs
Average Monthly Cost per EDU (Assuming 10% grant funding)	$ 191	$ 218	$238	$ 183

** Does not include ramp-up period in connections, and potential revenues from connection fees and monthly rates. Does not include private property improvement requirements, SDCs, or connection fees. If private TPOA system is expanded and remains private, the project will likely not be eligible for public financing loans and/ or grants, so only Alts 2 & 3 scenarios are shown.*

How do grant funding & varying connection fees impact monthly rates?*

Hookup Fee	10% Grant Funding				30% Grant Funding				50% Grant Funding			
	Alt 2		Alt 3		Alt 2		Alt 3		Alt 2		Alt 3	
	Commer-cial	Full Build	Commer-cial	Full Build	Commer-cial	Full Build	Commer-cial	Full Build	Commer-cial	Full Build	Commer-cial	Full Build
$ 5,000	$ 174	$ 220	$ 200	$ 163	$ 144	$ 185	$ 165	$ 139	$ 115	$ 149	$ 136	$ 112
$ 10,000	$ 150	$ 203	$ 182	$ 145	$ 127	$ 167	$ 147	$ 118	$ 98	$ 131	$ 118	$ 94
$ 15,000	$ 133	$ 182	$ 159	$ 127	$ 104	$ 146	$ 130	$ 100	$ 80	$ 111	$ 95	$ 76
$ 20,000	$ 115	$ 164	$ 142	$ 106	$ 86	$ 128	$ 112	$ 82	$ 57	$ 93	$ 77	$ 56
$ 25,000	$ 98	$ 146	$ 124	$ 88	$ 68	$ 111	$ 95	$ 64	$ 39	$ 75	$ 60	$ 38

***Red = >$150/mo, Orange = $100 to $150/mo, Green = <$100/mo**

Full buildout assumes 280.5 EDUs; Commercial only assumes 142.5 EDUs.
Revenue from varying connection fees included in monthly estimates. Example monthly rates based on 1.0 EDU.

What if? Project at 50% Grant Funding- Phase 1

Phase 1 Commercial Only	Alternative 2	Alternative 3
Total Capital Costs	$5,400,000	$6,210,000
EDUs (Commercial=1.5 EDUs, Residential=1)	142.5	142.5
Ideal Monthly Sewer rate/ EDU	$75-$95	$75-$95
Monthly O&M Costs	$8,917	$10,167
Monthly Debt Service- towards capital costs	$7,500	$11,667
Max. Loan Balance	$2,700,000	$3,105,000
Needed Grant Funding (50%)	$2,700,000	$3,105,000
Example: Commercial Property Owner		
Connection Fee (Based on EDU, to Tumalo Sanitary Sewer District)	$15,000	$15,000
Private Property costs to convert	$5,000-$25,000	$5,000-$25,000

**Costs based on Class 5 analysis*
Based on 2022/23 dollars with no inflation factor.
Based on 2022/23 City of Bend SDCs – likely to be higher in future, and possibly additional fees.

What if? Project at 50% Grant Funding- Full Build Out

Phases 1 & 2: Commercial & Residential	Alternative 2	Alternative 3
Total Capital Costs	$ 13,500,000	$ 9,590,000
EDUs (Commercial=1.5 EDUs, Residential=1)	280	280
Ideal Monthly Sewer rate/ EDU	$75-95	$75-$95
Monthly O&M Costs	$21,833	$18,917
Monthly Debt Service	$20,000	$17,500
Max. Loan Balance	$6,750,000	$4,795,000
Needed Grant Funding (50%)	$6,750,000	$4,795,000
Example: Residential Property Owner		
Connection Fee (Based on EDU, to Tumalo Sanitary Sewer District)	$20,000	$15,000
Private Property costs to convert	$5,000-$25,000	$5,000-$25,000

**Costs based on Class 5 analysis*
Based on 2022/23 dollars with no inflation factor.
Based on 2022/23 City of Bend SDCs – likely to be higher in future, and possibly additional fees.

Review: Funding Sources

- State Revolving Loan Funds
- Water Infrastructure Finance and Innovation Act (WIFIA)
- Business Oregon Water/ Wastewater Financing Program
- USDA Rural Development

*May include capital costs, monthly rates, hookup fees, SDCs.

Governance Structure / Requirements

Governance Structure / Requirements

1. Establish informal committee- work w/ SDAO and/or attorney to understand requirements. Entire process takes one year minimum.
2. Establish boundary to be served by special district Determine economic feasibility.
3. Work w/ County to determine formation procedure: 1) File petition for formation; 2) Consent of all property owners within the boundary of proposed district; or 3) Initiation by County.
4. Hearings & Election: Once petition approved, County holds a hearing within 30-50 days. County evaluates petition according to ORS 199.462. Final hearing then held, then final resolution & election date scheduled.

The Special Districts Association of Oregon (SDAO): https://www.sdao.com/what-is-a-special-district

Deschutes County provides an informational packet on special district formation:

https://www.deschutes.org/sites/default/files/fileattachments/road/page/23051/formation_document_for_public_with_petition.pdf

TPOA System Considerations

- Important to identify risks, opportunities, and impacts to community
- OAR 340-071-0160(4)(f)(B) *Legal availability: A sewerage system is deemed legally available if the system is not under a DEQ connection permit moratorium and the sewerage system owner is willing or obligated to provide sewer service.*
- TPOA rates: need to verify with owner-greater connection fee and comparable monthly rates to sewer district analysis
- Engineering analysis has shown limited capacity for new connections to existing system
- Not likely eligible for public infrastructure grants or financing

Roadmap for Implementation

Community decision to move forward with project

Year 1

- Form local stakeholder group/ committee to champion project
- Determine best sewer alternative, start special district formation
- Investigate grant/ loan funding options

Years 2 & 3

- Preliminary engineering design

Years 3 & 4

- Apply for grants & financing, final engineering design

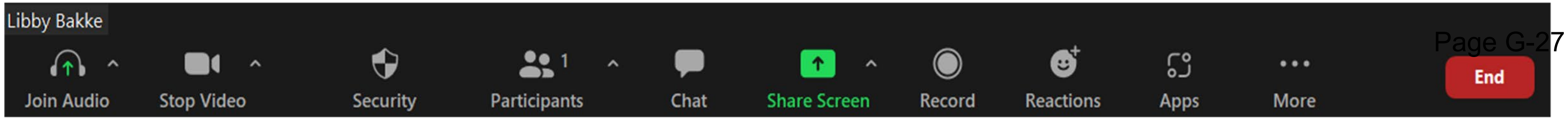
Years 4 & 5

- Construction

Advisory Committee questions/ discussion

Public Comment- time limit based on number of speakers

Raising Your Hand



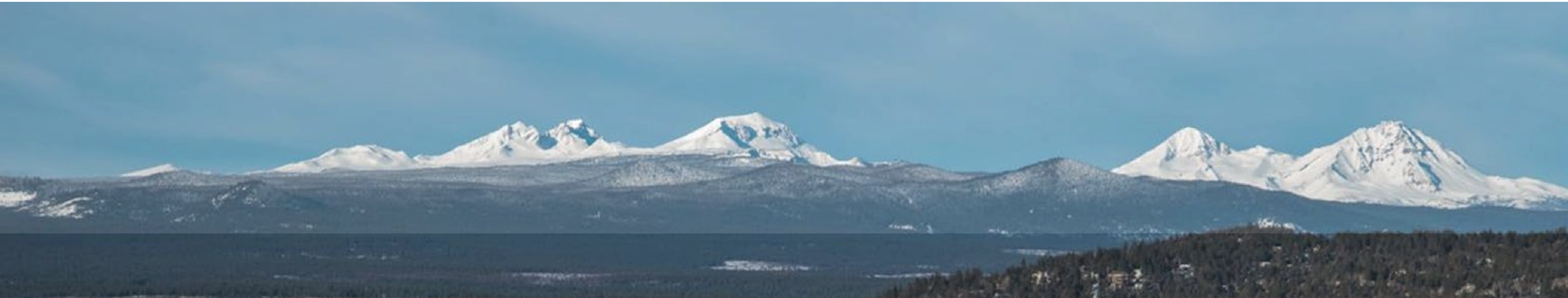
What's next?

October – November

Completion of Study & presentation to Board of County Commissioners

Following

Community/ commercial area property owners evaluate options & level of support to form public sanitary sewer district



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Meeting Notes

Tumalo Wastewater Feasibility Study Advisory Committee

Meeting #3 – *Funding & Governance*

Location:	Zoom/ Virtual Meeting 3 video: https://vimeo.com/755591012	**Date:**	September 29, 2022
		Time:	5:00-7:00 p.m.

Committee Members:	Gabe Coler, Tumalo Resident, AC Member Jim Crouch, Heritage Brand, AC Member ***(Absent)*** Andrew Davidson, Dirty Hands Construction & Septic, AC Member	Jeanine Fraley, Tumalo Resident, AC Member Jana Gisler, Tumalo Property Owner, AC Member Martha Gross, Tumalo Resident, AC Member	Dale Peer, Laidlaw Water District, AC Member Kelly Roark, Bend Cider Company, AC Member ***(Absent)***
Project Team:	Murraysmith, Inc.: Jon Skidmore, Justin Moman, PE, Katie Husk, PE	Barney & Worth: Susanna Julber, Trisha Maxfield	Deschutes County: Chris Doty, Todd Cleveland, Peter Russell

The meeting convened at 5 p.m. through a virtual platform.

1. Welcome, introductions, agenda overview

Susanna Julber, Barney & Worth project manager, opened the meeting and welcomed the group. The main objective of this meeting is to review updated cost estimates, discuss funding scenarios, estimated monthly rates, and provide a governance structure overview.

Chris Doty, Deschutes County Road Dept. Supervisor, gave opening remarks noting this project really is a sewer feasibility study that provides a roadmap for the future. Julber reviewed the advisory committee assignment, and meeting ground rules.

2. Sewer options and refined costs

Justin Moman, Murraysmith Project Engineer, provided an overview of the refined Class 5 cost estimates for each option. The main factor that reduced the overall cost estimates was removing the assumed costs for converting from septic to sewer on private properties, which can vary substantially, from +- $5,000 to $25,000 depending on private property characteristics.

3. Phasing impacts

Katie Husk, Murraysmith Project Engineer, discussed cost impacts for full build out and Phase 1 – commercial only – options. Moman discussed rationale for restructuring the phases into just a commercial phase and a residential phase, because of the small numbers of residential equivalent dwelling units (EDUs) in Phase 3, which would make developing Phase 3 unfeasible on its own.

4. Funding and rate estimates

Moman and Julber reviewed the estimated monthly rates and fees for Alternatives 2 and 3 (creation of a public sewer district and new collection and treatment system, or connecting to City of Bend), based on an assumption of varying grant funding to reduce up-front costs, and varying connection fees for hooking up to a public system. Key variables in rate estimates include:

- The total up-front costs- How much might be paid by someone else, so you don't have to pay it back? ("Launch aid" from Federal, State or County government?)
- Loan terms and interest rate
- Ongoing maintenance and administration costs
- Number of people to help pay ongoing bills (EDUs) now- and in the future

Assuming a 50% grant contribution for alternatives 2 and 3, and a $15,000-$20,000 hookup fee per connection, the project could be feasible for both a Phase 1 commercial only option and/or a full build out option. The 50% grant contribution would be necessary to keep monthly rates less than $100 per EDU. Moman discussed the detailed assumptions that went into the funding scenarios. For Alternatives 2 and 3, a loan term of 30 years and interest rate of 2% were assumed. Alternative 1, expanding the existing private Tumalo Property Owners Association (TPOA) system, would likely not be eligible for public financing options so was not considered in the analysis.

5. Governance structure / requirements

Julber explained options for forming a special sanitary sewer district, and referred the group to two resources:

- The Special Districts Association of Oregon (SDAO):
  - https://www.sdao.com/what-is-a-special-district
- Deschutes County informational packet on special district formation:
  - https://www.deschutes.org/sites/default/files/fileattachments/road/page/23051/formation_document_for_public_with_petition.pdf

Julber referred the group to a legal memo provided by attorney Ellen Grover, which outlines the steps necessary for special sanitary district formation and details some of the factors with expansion of the TPOA private system.

6. Next steps: roadmap for implementation

Julber explained the possible roadmap for implementation:

- Year 0:
  - Community Decision to Move Forward with Project
- Year 1:
  - Form local stakeholder group/ committee to champion project
  - Determine best sewer alternative
  - Start special district formation

  - Investigate grant/loan funding options
- Years 2 and 3:
  - Preliminary engineering design
- Years 3 and 4:
  - Apply for grants and financing, final engineering design
- Years 4 and 5:
  - Construction

7. Discussion

A member of the committee expressed concern around what inaction would look like if Tumalo decided not to move forward with creating a special district. They worry the private system would trigger a requirement for residents to connect to it or make it more expensive down the road for the residential area to establish a public system outside of the private system.

> The project team noted the analysis of rates in Phase 2 of Alternatives 2 and 3 do hinge upon the assumption that Phase 1 would be developed first as a public system, as that is when the backbone of the infrastructure would be established.

A committee member asked how duplexes would be assessed for hookup fees.

> The project team noted that it will depend on how the district structured their EDUs.

A member of the committee expressed their interest in the option of connecting to Bend, noting it may take longer, but overall may be the best option in terms of price for the commercial area.

A committee member noted they are looking at what Tumalo could be 20 years from now as their children grow up in Tumalo.

8. Public comment

A member of the public noted the figures provided could fluctuate by 50-100% and shared they would have liked to see the numbers more refined along with a risk assessment. They also note doing nothing would be the cheapest option.

> The project team responded by letting the member of the public know the scope of the project was to do a broad overview of requirements, and that further refinement of costs is a next step. They highlight that the community now at least has more information about options if they do decide they'd like to move forward with a project.

A member of the public sought clarification on the role of the Public Utility Commission (PUC) and how that relates to the Tumalo Property Owners Association (TPOA) option.

> The project team will include updated information on the PUC in the final report.

9. Adjourn

The meeting was adjourned at 7:00 p.m.

Watch the meeting here: https://vimeo.com/755591012