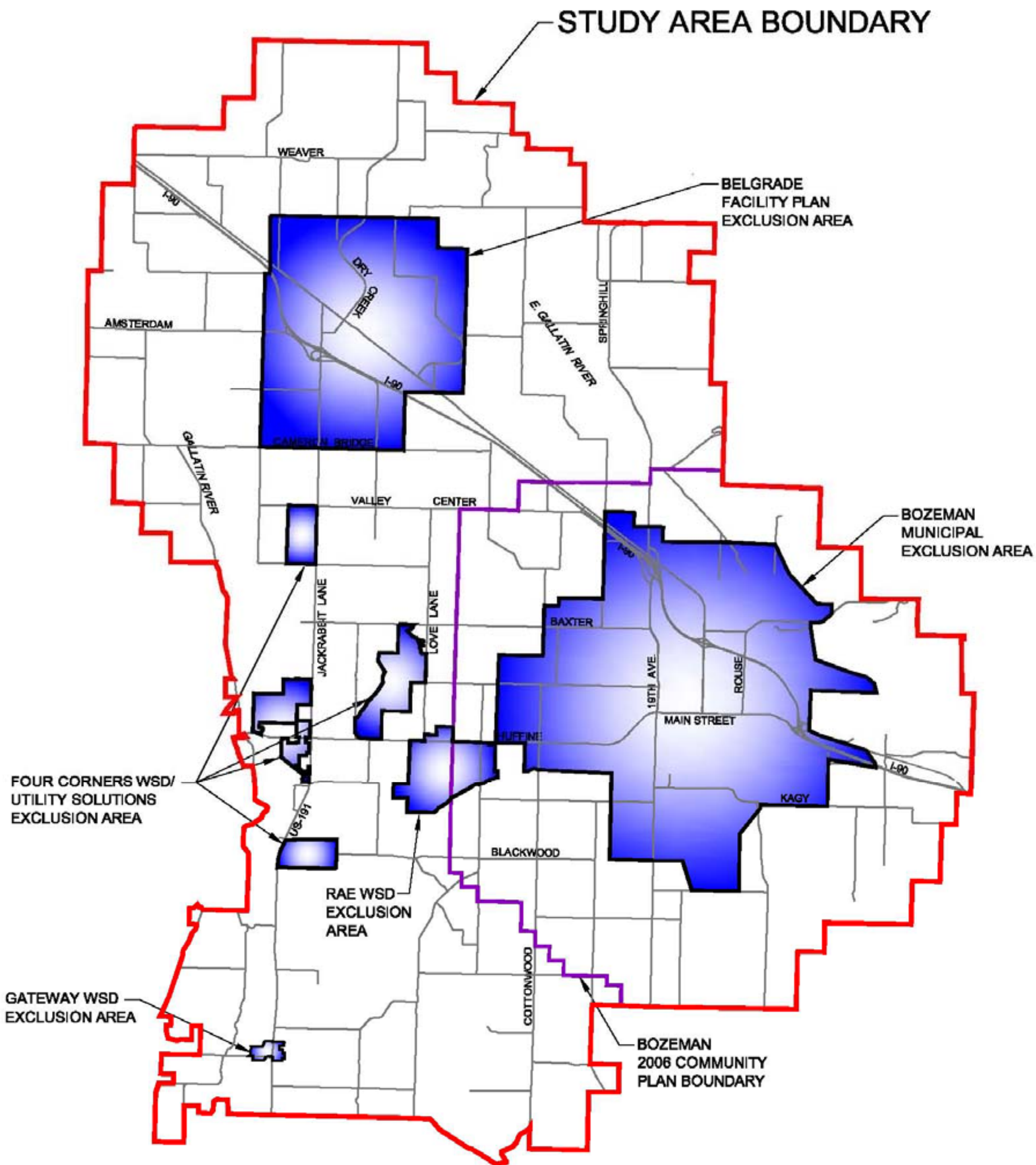
Gallatin County
Regional Wastewater Management System
Feasibility Study - Phase II

Working Draft Report—9/17/2010



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Gallatin County Regional Wastewater Management System Feasibility Study Phase II Project

Working Draft Report

9/17/2010

Prepared For:

Gallatin County Commission
Gallatin County Planning Board
Water and Wastewater Subcommittee

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1. INTRODUCTION

Gallatin County Regional Wastewater Feasibility Study Phase 2 Report was prepared by Stahly Engineering & Associates, Inc at the request of, and with the assistance and funding by, the Gallatin County Planning Board Water & Wastewater Subcommittee. This report examines centralized wastewater management technologies, economics, and strategies for portions of rural Gallatin County as selected by the subcommittee.

This study is the result of community and agency (Gallatin Local Water Quality District [GLWQD]) concerns over high levels of expected growth, and a county wastewater management policy that universally favors a decentralized network of on site and small community type systems. A key concern is that the combination of high future densities and a decentralized approach may eventually threaten local groundwater quality. Given that scenario, certain areas may be better served by a centralized approach to wastewater collection, treatment, and disposal. Accordingly, this study evaluates population and density projections reflecting recent planning and zoning activities undertaken by the Commission and, based on those projections, identifies the general characteristics and locations of centralized collection, treatment and disposal facilities. In all, ten different alternatives for centralized service are evaluated.
In addition to examining various central treatment alternatives, this study presents additional information intended to assist the County in evaluating the adequacy of its current wastewater management policy including:

- estimates for near term and long term population growth and density by specific location within the study area,
- an economic comparison of decentralized and centralized approaches to wastewater management,
- an overview of available wastewater treatment technologies and performance including a description of what other Montana communities are doing,
- an examination of important centralized treatment constraints including water rights, permitting restrictions, subsurface and surface water discharge considerations, and physical constraints including soil and groundwater characteristics, and,
- spreadsheet tools that can be used by county staff for the evaluation of additional alternatives.

2. BACKGROUND

Prior to the current recession, Gallatin County experienced a sustained period of rapid population growth. According to published data, the County's population increased from 50,463 in 1990 to an estimated 87,359 in 2007 (U.S. Census Bureau 2007). This growth rate equates to a 42 percent increase over the last 17 years. Based on data provided by the GLWQD, approximately 22,000 persons (59 percent of new growth) located in rural areas; this new growth was supported with onsite wastewater systems.

A detailed review of the existing county planning and zoning classifications indicates that substantial rural area growth may continue for many years. The study area examined for this report (See Section 3, Figure 3A-1) is expected to grow from about 30,000 persons to 60,000 persons by the year 2030.

> Note: Existing planning and zoning designations allow for as many as 260,000 persons within the study area boundaries.

At the present time, unincorporated areas of Gallatin County rely upon a de-centralized network of individual and/or community on-site wastewater treatment systems. For the most part, implementation of these systems uses an approval process centered on existing DEQ regulations - if a proposed system meets DEQ design standards it's usually approved by the County. According to the GLWQD, these systems are often approved independently of each other with little follow-up to evaluate important parameters such as cumulative groundwater impacts and ongoing system maintenance and performance.

Gallatin County contains 135 different public (serving 15 or more connections) wastewater treatment systems not including major systems serving cities and towns. About 90 percent of these systems are un-permitted. These systems are thought to discharge a total of about 500,000 gallons of wastewater per day into the groundwater. Together with the approximately 13,000 privately owned systems, the total effluent flowrate discharged by these systems is estimated at 3.5 million gallons per day. When these combined flows are compared to other major effluent sources, they represent the second largest source next to the City of Bozeman treatment facility which discharges approximately 5 million gallons per day.

The GLWQD has studied many of these systems concluding that lack of routine monitoring; unknown physical condition and effluent treatment performance; and the un-permitted discharge of treated effluent to the subsurface are all significant concerns. As rural growth continues, the GLWQD and many residents are concerned that the continued reliance on individual and community on-site systems will produce cumulative effects that may someday degrade local groundwater quality. A good example of this potential is the River Rock subdivision wastewater facility that has allegedly polluted down gradient drinking water wells.

Although the GLWQD has limited resources for the investigation of the hundreds of individual and community systems, Gallatin County cannot conclude that groundwater quality degradation is not a problem. If the experiences of other Montana communities such as Missoula County and the unincorporated community of Lockwood (adjacent to Billings) are any sort of guide, then the expectation for additional future groundwater contamination should be the rule and not the exception. Both of these communities have been working for several years to remedy nitrate contaminated groundwater resulting from the long term over-reliance on decentralized wastewater technologies.

The continued reliance on de-centralized systems is beginning to have significant repercussions within our community. For example, the author is aware of several commercial facilities with older on site systems that no longer function correctly. In most of these cases, the combination of new regulations and poor site (soils and groundwater) conditions are preventing system upgrades. Without viable long term alternatives for sewage treatment, some of these businesses may be forced to unnecessarily relocate (or possibly close) causing economic disruption to both the owners and employees.

3. STUDY METHODS

The study area population and density projections form the basis of this work. With the majority of the study area either planned and/or zoned, it's possible to more accurately project future populations and densities within the study area. Overall growth rates were determined using a three (3) percent net growth rate multiplied by the total population within the study area including excluded areas. This method accounts for the fact that growth occurring in excluded areas, such as Bozeman, impacts nearby unincorporated areas. The Gallatin County geographical information systems (GIS) database was then used to distribute the growth across the study area according to the planning and zoning characteristics of each land parcel within the study area. As a result, areas that are zoned for growth were allocated a higher proportion of growth than areas with lower densities.

The project team also developed spreadsheet models for estimating the characteristics, size, and cost of various types of wastewater collection, treatment, and disposal systems. The spreadsheets use population and service area as primary inputs. Outputs include collection, treatment, and disposal system sizes, land requirements, capital, and operating costs. When used in conjunction with the County's GIS database and population distributions, the spreadsheets facilitate rapid analysis of multiple wastewater management scenarios.

These spreadsheet models were also used to determine the economics for many of the decentralized system types now in use within the study area. The objective in doing this was to compare the life cycle costs of decentralized technologies to centralized system costs and to estimate the cost impact of future discharge regulations on the owners of decentralized systems.

With the population distributions and general facility characteristics known, the project team identified possible locations of these facilities. Potential sewer routes were based on factors such as topography and proximity to population centers and suitable effluent disposal sites. Treatment and disposal sites were identified by screening the GIS database to exclude areas with unsuitable characteristics by considering the location of surface waters, depth to groundwater, soil type, and physical interferences such as roads, structures, conservation easements, et cetera. Both the suitable and unsuitable sites were marked on the constraints maps providing a valuable planning tool useful for future related county activities. Administrative and legal constraints affecting various centralized treatment and disposal alternatives, such as water rights restrictions, were also identified and discussed where appropriate.

4. STUDY CONCLUSIONS

Major study conclusions are presented below. The conclusions are organized according to the originating section of the report.

Part 3A Study Area Definition

- Part 3A of this study presents the methods for projecting future populations within the study area. As discussed there, the Gallatin County GIS database, and existing planning and zoning designations, were used to distribute estimated future population growth according to zoning. This method is more precise than conventional methods that assume areas with high existing populations will continue to grow at high rates. In fact, in areas zoned for growth, the population tends to grow faster than in more mature areas. This effect is quite evident in rural Gallatin County where more than half of recent growth occurred outside population centers served by central sewer systems.

- A three (3) percent growth rate was applied to the entire existing population within the study area boundary. This allows for the fact that growth created by Bozeman and other excluded areas affects the growth of nearby unincorporated areas many of which are within the study area. (These projections are summarized in Tables 3A-2 and 3A-3 of the report.). Due to recent planning and zoning efforts, the study area 2030 population will be approximately 60,000 with about 36 percent or 22,000 located in portions of the study area having growth favored zoning.

- Similarly, the study area build out population will be approximately 260,000 with about 77,000 located in portions of the study area having growth favored zoning.

- The corresponding year 2030 densities in certain study area sub-regions will range from about 0.8 to 1.4 persons per acre increasing to between 3 to 6 persons/acre at build out. (Note: As a point of reference, Lockwood, Montana implemented a regional collection and treatment program at a current density of approximately one (1) person per acre.)

- Much of the land within the study area is zoned at densities that are unlikely to support centralized treatment. However, there are several key sub-regions within the study area where centralized treatment concepts are plausible. As a result, much of the study focused on the following six sub-regions:

  West Belgrade Area
  Belgrade Facility Plan Area (Outside the city limits)
  Valley Center Area
  Jackrabbit Area
  Four Corners Area
  Northwest Bozeman Community Plan Area

- Localized growth and infill rates within these sub-regions could be much higher than the overall study area population growth rate of 3 percent. This suggests that economical densities may be more rapidly attained than earlier engineers had thought. For example, Table 1-1 below indicates that the 20 year growth rates of certain sub-regions could exceed 100 percent. The corresponding densities are provided in Table 1-2 and show that by 2030, several sub-regions could meet or exceed densities of at least one (1) person/acre.

Table 1-1
Study Area Sub-Region Growth Rates

	Overall Population Change Year 2030	Overall Population Percent Change Year 2030
Sub-Region		
West Belgrade	+1435	+24
Belgrade Facility Plan Boundary Outside City Limits	+5600	+73
Valley Center	+3821	+165
Jackrabbit	+1525	+700
Four Corners WSD and areas served by Utility Solutions	+3618	+100
Northwest Bozeman	+2303	+650

Table 1-2
Study Area Sub-Region Density Information

	Projected Density (persons/acre) 2030	Zoned Density
Sub-Region		
West Belgrade	1.4	2.9
Belgrade Facility Plan Boundary Outside City Limits	1.1	3.0
Valley Center	0.90	4.0
Jackrabbit	0.80	4.3
Four Corners WSD and areas served by Utility Solutions	1.1	4.0
Northwest Bozeman	1.1	6.0

Part 3B Constraints Analysis

- Part 3B of this study evaluated a variety of constraints that could complicate the implementation of a centralized collection, treatment, and disposal facility. Of the many constraints identified, water rights could have significant impacts on the scope and location of any centralized facility. Essentially, the collection and disposal of wastewater is considered a diversion that may require mitigation. Because mitigation is only required for new water rights obtained after 2003, this issue would primarily affect recently established and planned future growth unless served by existing water rights that are free of mitigation provisions. The operator of a centralized wastewater facility may be able to mitigate any constraints through a variety of avenues including the acquisition of a mitigating water right or by using a wastewater disposal location located close to the fresh water source.

- Study area physical constraints such as depth to groundwater, soil type, and surface water locations are mapped in Figure 3B-1 of this report. This map suggests that a limited amount of land is suitable for locating and successfully operating a centralized wastewater treatment and ground water disposal facility. As much of this land is located in or near prime development corridors, the quantity of well located land with the required soil and groundwater conditions will continue to diminish over time. A good example of this trend is the Gallatin Heights subdivision, on Jackrabbit Lane, that was built on a site having excellent characteristics for a regional wastewater disposal facility.

- The lack of a central collection and treatment system will not prevent development within the study area. This is because state agencies are familiar with many decentralized technologies and will readily approve them. As a result, land development projects will continue without consideration for the need to preserve sites for possible future centralized facilities.

- Surface water discharge options are severely limited by a variety of discharge standards, most notably the non-significance trigger values for nitrogen and phosphorous. Examples of these restrictions can be found in Figures 3B-2 and 3B-3 of this report. These restrictions may be reduced if a credit for the removal of existing on site systems can be negotiated with Montana Department of Quality (DEQ). In this case, the higher removal efficiencies of a central facility would allow for it to serve more people with an equal or lower impact to the receiving water. Such an arrangement would require case by case negotiations with DEQ.

Part 3C & 3D Overview of Decentralized & Centralized Wastewater Treatment Technologies and Economics

- Part 3C and 3D of this study examine the treatment performance and economics of decentralized and centralized wastewater facilities. An economic comparison shows that over the long run, central treatment is more economical than individual on-site systems. For example, the ownership cost of decentralized (on-site) wastewater treatment systems ranges between about $2,000 and $4,000 per connection per year. In comparison, the cost of the centralized collection, treatment, and disposal facilities evaluated for the highest density sub-regions ranged from about $1,000 to $1,500 per connection per year.

- In addition to lower long term costs, centralized systems can produce an effluent significantly lower in conventional pollutants, nitrogen, and phosphorous than decentralized systems. In the case of new or more stringent effluent quality regulations, a centralized system is more easily upgraded than hundreds of individual systems.

- Because the cost of decentralized systems is typically included in the price of a home or commercial building, many people incorrectly assume that these systems have no cost. They are often unaware that wear and tear and depreciation are also significant long term costs. The true cost of these systems is often not apparent until a system fails and must be replaced. Some business owners along the Jackrabbit corridor are currently facing unaffordable upgrades to their older, failing on-site systems. As mentioned before, some of these owners are faced with the possible relocation or closure of their facilities because alternatives to on-site disposal are not available at this time.

Part 3E Spreadsheet Tools

- The cost of centralized wastewater collection, treatment, and disposal facilities is affected by a variety of factors each of which is discussed in Part 3E of this report. Of all the factors, the collection system cost has the largest effect on overall costs. Because the study area contains large tracts of undeveloped land, it's unlikely that sewer service to these areas would be 100 percent publically financed. More likely, developers would finance and install neighborhood sewers (defined as 12-inches or less) in grass roots developments with subsequent connection to a publically financed central trunk sewer. To account for this implementation method and the resulting range of collection system financing possibilities, the analysis spreadsheets include public financing factors that can be varied from 30 percent to 100 percent.

Part 4 Screening of Alternatives 1 Through 6

Part 4 conceptually evaluates collection, treatment, and disposal systems for several individual sub-regions selected from within the study area. These sub-regions, relative to the overall study area, are projected to contain the highest future densities and may represent the best opportunities to someday establish economical centralized collection, treatment, and disposal systems. The sub-regions are listed below and are also shown on Figure 4A-1.

Alternative 1. West Belgrade Central Collection & Treatment (CCT)
Alternative 2. Belgrade Facility Plan Area CCT
Alternative 3. Jackrabbit CCT
Alternative 4. Valley Center CCT
Alternative 5. Northwest Bozeman Community Plan CCT
Alternative 6. Four Corners CCT

- Because of higher current densities, the central treatment system economics for Alternatives 1, 2, or 4 are initially more favorable than for Alternatives 3, 5, or 6. If a centralized system was pursued by the County, the starting point should include one or more of the service areas identified in Alternatives 1, 2, or 4. Over the next 20 years, densities in all of these areas should produce central system costs in the range of $1,000 to $1,500 per connection per year.

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- A centralized treatment strategy that initially includes portions of the West Belgrade and Valley Center sub-regions, and possibly other (interested) adjacent areas, has the highest chance for success due to its current population density, favorable elevation for gravity sewers, and proximity to potential groundwater disposal areas. Such a system could be expanded to the south to incorporate additional sub-regions as their density increases and conditions permit. This concept is explored in more detail in Alternative 10 (Part 6 and below).

Part 5 Screening of Alternatives 7 Through 9

Part 5 conceptually evaluates collection, treatment, and disposal systems for larger portions of the study area. Each of these alternatives is briefly described below along with the corresponding conclusions.

- Alternative 7 considers a fully regional system serving the entire study area; in this alternative, average study area densities are assumed and then used to determine the overall system economics. This alternative is not feasible. Much of the land within the study area is zoned at densities that are unlikely to support centralized treatment. Serving these low density areas is uneconomical because the necessary collection system costs are too large and the rate payer base too small. If a centralized system serving the entire study area was constructed, an average density of at least 4 persons per acre would be necessary to achieve a reasonable cost structure. As the overall study area is planned and/or zoned at an average density of 2.8 people per acre, a fully regional system is not considered feasible.

- Alternative 8 explores the possibility of treated effluent hydropower generation with disposal in the Missouri River near Trident, Montana. In this case, a pressure pipeline is used to connect a treatment facility located northwest of Belgrade to a hydropower generation and effluent discharge facility located near Trident, Montana. This alternative has a variety of technical problems that most importantly include Missouri River non-degradation significance trigger levels that are difficult and expensive to meet and that also limit the amount of flow to the facility. Unfortunately, the power generation potential of this idea is miniscule when compared to the overall project costs. Lastly, the analysis shows that the cost of a pipeline to Trident, approximately 22 miles, is significantly more than the cost of groundwater disposal facility near Belgrade.

- Alternative 9 is identical in scope to Alternative 8 except that the Missouri River discharge option is replaced with a groundwater disposal system also located northwest of Belgrade, Montana. Using previously established methods, the annualized cost range for this alternative is about $1,200 to $1,700 per connection per year depending on which modeling assumptions are used.

Part 6 Screening of Alternative10

- In this alternative, the economics of a hypothetical system serving the West Belgrade and Valley Center sub-regions is explored in three (3) phases over a 20-year time horizon. This alternative is different from other alternatives in that it examines a project at several points during its duration. Initial costs of around $600 per connection per year are required during the initial phase where both central trunk sewers and neighborhood sewers are constructed to service the existing populations. As was the case with the Lockwood, Montana project, sewers are built first followed by a second phase where the treatment and disposal facilities are constructed and immediately commissioned. At this point, costs would rise to around $1,500 per connection per year. Phase 3 represents a time period 20 years from the project start. At this point, the debt from Phase 1 has been paid off resulting in a substantial lowering of costs to around $1,000 per connection per year.

- The presence of a central system is likely to stimulate growth and development beyond existing estimates. As a result, the cost structures shown for this alternative are likely conservative.

- Of all the alternatives considered, alternative 10 appears to be the best. This alternative has many positive attributes including: proximity to current and future growth areas; ability to serve most areas by gravity flow; higher chances for redevelopment and infill leading to lower user costs; proximity to many possible groundwater disposal sites; and, being centered near Belgrade, is well positioned for expansion to the southern portion of the study area as future conditions require.

Additional Conclusions

- During the next 50 to 100 years, additional restrictions on groundwater discharge and water diversions will likely require that regional treatment facilities incorporate reuse technologies such as ultra filtration or reverse osmosis followed by indirect reuse of effluent. Indirect reuse would be accomplished by pumping treated effluent up-gradient and injection into the groundwater. This possibility must be considered in the design of any centralized treatment facilities.

5. RECOMMENDATIONS

1. Because the study area is planned and zoned for 60,000 persons by 2030 and eventually up to 265,000 persons, the County, in consultation with the GLWQD, should review its current (decentralized) wastewater management policy to assess if another 500 to 1,000 small to medium sized treatment systems represents the most efficient and reliable way to preserve and protect local water quality.

2. Given the many benefits of centralized treatment including cost effectiveness, higher pollutant removals, and ease of upgrade and expansion for future conditions, the County should review its current wastewater management policy to determine if a properly located and implemented central system can aid in the preservation of local water quality.

3. In the event that such a policy shift is needed or is simply of interest, the County should then evaluate the legal and administrative requirements necessary for the County, or for a county encouraged entity, to provide and/or facilitate centralized service to portions of the study area.

4. Pending a shift in its wastewater management policies, the County should also consider acquiring or otherwise preserving for the public benefit, certain lands that could be used for future wastewater treatment and disposal facilities. The identification of such lands should follow the guidelines contained in this study and should be confirmed by the engineer prior to making any commitments.

5. Further, the County should consider enhancing the subdivision review process so that potential routes of regional sewer trunk lines are preserved and that approved community systems contain provisions for the possible future connection to a central system.