Gallatin County

Regional Wastewater Study

January 2007

Submitted to:

Gallatin County Planning Board and Commissioners

Submitted by:

GreatWest engineering

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Prepared for:

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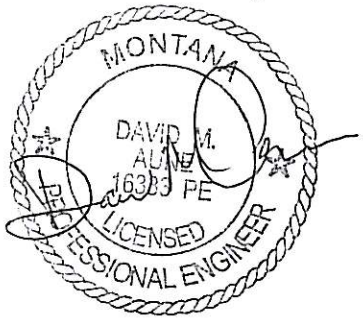
Prepared by:

Dave Aune, PE



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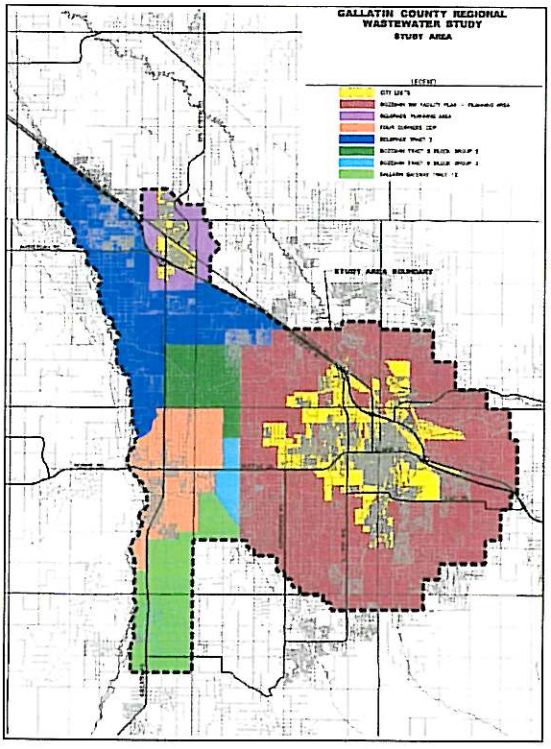
Executive Summary

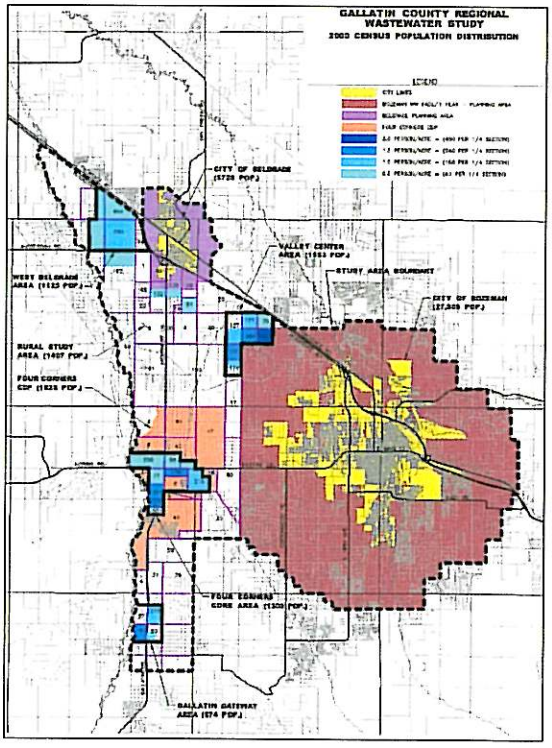
EXECUTIVE SUMMARY

Purpose: The purpose of this study is to investigate, on a reconnaissance level, the feasibility of various regional wastewater management concepts. It is not the intent to select a detailed alternative in this phase of the study, but rather to narrow the field to a few preferred concepts that would be evaluated in more detail in a later phase of the study effort. This study will allow a more informed discussion of wastewater management and guide pubic input and discussion with the hope of building consensus on a preferred wastewater management concept.

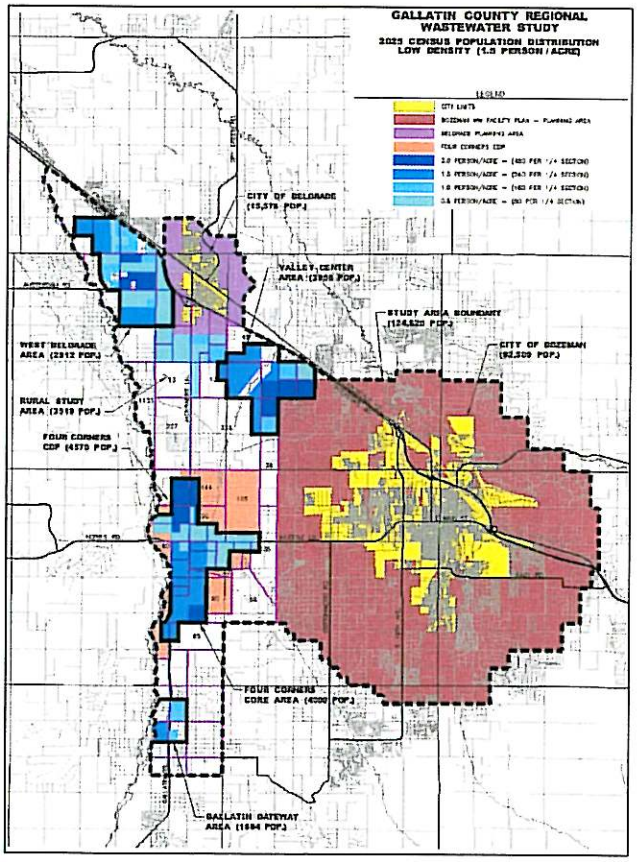
Study Area and Current Population Distribution: The study area is presented in Figure 2 on page 4 and shown in reduced scale on this page. This study area was developed with input from the Gallatin County Planning Board and the County Commissioners. Based on a detailed evaluation of 2000 census data; the distribution of existing population within the study area was developed as presented in Figure 4 on page 6 and also presented in an insert on this page. The results of this population analysis clearly demonstrate that two municipal (Belgrade and Bozeman) and four non-municipal population centers exist within the study area. The non-municipal population centers are listed below:

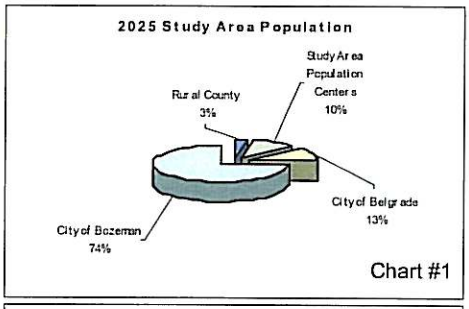
- The Four Corners Area
- The Gallatin Gateway Area
- The Valley Center Area
- The West Belgrade Area

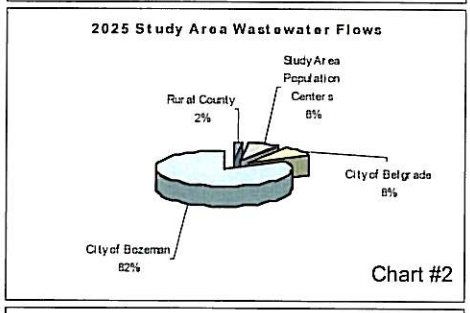


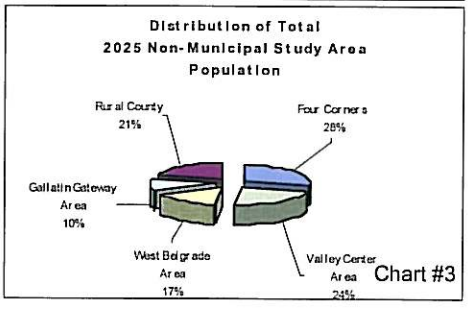


Future Population Distribution and Density: Based on recent subdivision proposals, discussions with developers and projections of census data; the future distribution of population was also developed and is presented in Figure 6 on page 12 and a smaller scale insert on this page. The actual population projection for each municipality and population center is presented in Table 1 on page 7. The relative distribution of future (2025) population and wastewater flow for each municipality and population center as a percentage of the total study area population or flow is presented in Charts 1 and 2 on this page. The relative population of each non-municipal population center (Valley Center, etc.) as a percentage of the total non-municipal study area population is presented in Chart 3 on this page. The remaining rural population as presented in these charts is that population that is not included in either a population center or one of the two municipalities.









A detailed understanding of existing and future population and the distribution of that population is essential to wastewater management planning and is presented herein for that purpose. The City of Bozeman is by far the largest population center in the study area and will continue to be so well into the future. The City of Belgrade, based on its current planning area, represents approximately 13 percent of the future population (year 2025) and the four population centers are estimated to represent 10% of the future population. The remaining rural areas are estimated to represent 3% of the population.

The City of Belgrade's current city limits is approximately 1500 acres in size with a population of nearly 8000 persons for an approximate average density of slightly greater than 5 persons per acre. Bozeman's current city limits include approximately 11,000 acres with a population of nearly 35,000 persons, resulting in an average density of greater than 3 persons per acre. These are average densities; the density within each city varies, with the higher densities in city centers and progressively lower densities in the outer portions of each city. The current density in the Valley Center area and the suburban area west of Belgrade is in the range of 1.5 to 3 persons/acre. Based on the above analysis and for the purposes of this study, urban densities were considered to be 3 persons/acre and higher and suburban densities between 1.5 and 3 persons/acre.

The entire study area consists of over 77,000 acres, of which 47,000 acres are within the Bozeman (43,000 acres) and Belgrade (4000 acres) planning areas. This of course, leaves 30,000 acres for the non-municipal study area. The 2025 population projection for the currently proposed Bozeman planning area is 92,500 persons (Table 1 on page 7) resulting in a future population density of approximately 2 persons per acre. It does not appear that the proposed Bozeman planning area will achieve urban densities as defined previously. In other words, the Bozeman planning area will not likely achieve complete infill by 2025.

The City of Belgrade's planning area, as currently defined, consists of 4000 acres with a future population projection of nearly 16,000 persons resulting in a 2025 population density of nearly 4 persons per acre. The current City of Belgrade planning area will likely achieve urban density in the next 20 years, pressuring the City to expand its boundaries.

The 2025 population projection for the non-municipal population centers and rural area is approximately 16,500 persons distributed over 30,000 acres for an estimated 2025 population density slightly less than 0.5 persons per acre. The non-municipal area is estimated to not achieve urban or suburban densities in the next 20 years, resulting in remaining lower density rural areas with higher density areas clustered around existing municipal and non-municipal population centers.

The projected population of the total study area in 2025 is approximately 124,500 persons resulting in an average population density of approximately1.5 person/acre. To achieve urban type densities, the population of the entire study area would have to approach 250,000 persons. This would require more than 30 years of growth at a sustained 5% annual rate.

Based on the above analysis and the population distribution map presented previously in Figure 6 on page 12; the Bozeman area, Four Corners area and the Belgrade area will remain somewhat separated in the next 20 years. However, the City of Belgrade, Valley Center and West Belgrade areas will tend to grow in to each other.

Existing Study Area Wastewater Management: Existing wastewater management in the study area ranges from simple septic systems to large complex mechanical wastewater treatment plants. Approximately 85% of the service population in the study

area is served by central wastewater systems. Central systems include the Cities of Bozeman and Belgrade, the Four Corners Sewer District (served by a private utility - Utility Solutions) and approximately a half dozen large subdivisions and mobile home parks. Approximately 7500 persons in the study area are served by individual septic systems with the highest concentration being in Four Corners, Rainbow Subdivision, Gallatin Gateway, Cobblestone and Valley Center area. Many of these areas have shallow groundwater and are overlain with coarse material, making the area susceptible to groundwater contamination.

The existing wastewater treatment plant for the City of Bozeman cannot meet future capacity and regulatory permit limits and must be upgraded. The City completed a detailed study in 2006 that established a service area for Bozeman through the year 2025 and identified a phased program for wastewater plant improvements. The first phase of improvements is projected to cost $33 million followed by a $34 million phase 2 and $9 million phase 3. Phase 1 is currently being designed and phases 2 and 3 will be implemented as population and regulations dictate. Because of the significant capital investment required and the complex nature of the regulatory limits established for discharge, it is the current policy of the City of Bozeman to not expand its service area beyond that established in the 2006 study. The projected service population for the City of Bozeman's proposed service area is 92,500 persons and the wastewater plant is proposed to be expanded to a capacity of approximately 14 mgd.

The City of Belgrade completed a detailed study of the wastewater system in 1998 and wastewater system improvements were completed in 2004. The new facilities have a capacity up to 10,500 persons or 0.9 million gallons per day (mgd) and this capacity is likely to be reached in the next 5 to 6 years at current growth rates. The City intends to complete a new wastewater study in early 2007. To service the existing City of Belgrade planning area through the year 2025, the City's plant capacity would have to be expanded to approximately 1.3 mgd. To service Belgrade, Valley Center and the West Belgrade area, the City's plant would have to be expanded to between 1.7 mgd and 2.5 mgd; depending on how many persons who are now served by septic systems are included in the final system design. Most of the growth would be new development.

Utility Solutions is a private utility with a wastewater treatment plant located in the Four Corners area. The utility intends to service the Four Corners area north to Cameron Bridge Road as presented in Figure 7 on page 17. The utility does not have capacity to service this area, but has a well developed and feasible plan to add capacity as needs dictate. The Utility Services completed a detailed study in 2006 that outlines a plan to upgrade plant capacity in three phases with phase 1 upgrading to a capacity of 0.15 mgd, phase 2 to a capacity of 0.3 mgd and phase 3 to a capacity of 0.7 mgd. As needed, a second plant could be added to bring the total utility capacity to 1.5 mgd.

Wastewater Management Alternatives Evaluation: Based on the projected population distribution, eleven wastewater management concepts were developed. A description and figure is presented for each alternative starting on page 26. The capital, operation and maintenance cost for each alternative is presented in Table 3 on page 23. The alternatives considered fall into four primary groups as presented below:

- Full Regionalization
- Partial Regionalization
- Population Center Areas
- Hydropower Alternative

In the full regionalization concepts, the entire study area is served by one large regional treatment plant and collection system. The full regional collection system would require between 150 and 200 miles of sewer pipe ranging in size from 8 inches to 36 inches in diameter. Two full regionalization alternatives were developed and are presented in Figures 8, 9 and 10. Alternative 1 envisions a 17 mgd regional treatment facility located north of Belgrade that serves the entire study area. Alternative 1 would cost $121 million with an additional collection system cost of $93 million and is not technically achievable or financially affordable. Alternative 2 considers pumping wastewater from Belgrade and the non-municipal population centers back to the Bozeman Wastewater Treatment Plant. Alternative 2 is estimated to cost approximately $65 million for treatment and another $91 million for collection. Alternative 2 does not appear to be financially affordable and would require multiple points of disposal to be technically achievable. Alternatives 1 and 2 do not appear to be viable and should not be considered further.

The partial regionalization concepts include the majority of the study area population in one regional system. Those systems not included in the partial regional system will develop their own wastewater system. Four partial regionalization alternatives (#3, 4, 5 and 6) were developed and are presented in Figures 11 through 14. Alternative 3 is similar to Alternative 2, but is a partial regional solution because it excludes Four Corners. Alternative 3 should not be considered further for technical and financial reasons.

Alternative 4 would serve the entire study area (3 mgd) except Bozeman. The cost is estimated to be $44 million for treatment and $80 million for collection. Partial regionalization Alternative 5 would serve Belgrade, Valley Center and West Belgrade with a 2.5 mgd plant. It would cost $40 million for treatment and $49 million for collection. The collection system costs for Alternative 5 are lower than the other alternatives because it does not include the Four Corners area, reducing the length of pipe required. Alternative 6 would service the four population centers; Valley Center, West Belgrade, Four Corners and Gallatin Gateway and would require a 1.7 mgd plant. The treatment plant cost is estimated to be $30 million and the collection system is estimated to cost $77 million. Discharge to the East Gallatin or Gallatin River is not technically feasible for partial regional Alternatives 4, 5 and 6. Groundwater discharge is feasible for each of these alternatives.

Finally, Alternatives 7, 8, 9 and 10 outline wastewater collection and treatment facilities for each of the four non-municipal population centers. These concepts are presented in Figures 15 through 18. Alternatives 7, 8, 9 and 10 are technically feasible for both discharge to the Gallatin River and groundwater. Treatment costs for these alternatives range between $2.5 and 6.0 million and $4.0 to $30 million for collection.

The hydropower concept presented in Alternative 11 considers the feasibility of cost effectively generating hydropower from a regional wastewater system. Figure 19 presents this alternative. This alternative is not economically viable and should not be considered further.

Primary Study Conclusions:

1. Large regional collection systems require high densities to be cost effective, and as discussed previously, such densities are not likely in the next 20 years. The significant expense, regulatory feasibility and the political and jurisdictional complexities associated with the large regional concepts as outlined in Alternatives 1 through 3, suggest a focus on more practical localized wastewater management solutions as outlined in Alternatives 4 through 10. Ultimately, as future growth and density dictate, localized systems could be combined into a larger regional system serving the entire study area. Full regional systems, serving the entire study area, are not likely to be feasible for another 30 to 40 years and should not be evaluated further.
2. An alternative (Alternative 11) to generate hydropower from wastewater flows was evaluated. This alternative does not generate sufficient hydropower revenue to offset the additional cost. This alternative should not be considered further.
3. Four Corners and Gallatin Gateway will continue to be somewhat separated from the other population centers that currently exist. Also, as demonstrated in Alternatives 4 and 6, collection systems costs are much higher when Four Corners is included in the partial regional alternatives when compared to partial regional Alternative 5. The geographic separation and high collection system cost suggests wastewater management facilities for the Four Corners area should be planned and developed separately from the other population centers in the study area. Concept Alternative 7-Four Corners and Gallatin Gateway Wastewater Facilities should be evaluated further.
4. Population growth and distribution projections suggest the Valley Center, West Belgrade and City of Belgrade population centers will expand into each other in the next 20 to 30 years. Partial regional Alternative 5 should be evaluated in more detail to address this growth. Because Alternative 5 will likely be developed in an ongoing basis over the planning period, it may be necessary to develop interim wastewater facilities for the population centers as outlined in Alternatives 8 and 9 (Valley Center central system and West Belgrade central system).
5. Utility Solutions, a private utility, appears to have a technically viable wastewater plan to serve the Four Corners area up to Cameron Bridge Road and should be incorporated into the more detailed evaluation of Alternatives. However, the service areas for Utility Solutions and Belgrade may overlap in the valley center area in the future and this should be addressed to ensure efficient delivery of services.

6. The capital costs of the alternatives evaluated are high. The funding strategy should include both traditional state and federal grant programs as well as the pursuit of direct congressional appropriations to offset these costs. To maximize the use of grant funding, each project may have to be divided into several stand alone phases and implemented through several state legislative and US congressional sessions.

Implementation Recommendations:

1. Complete a detailed wastewater master planning study that evaluates the following:
    a. Alternative 5 – Partial regional wastewater treatment plant serving Belgrade, Valley Center, West Belgrade and the general vicinity of Belgrade. The study should address the complex political, legal and financial constraints to connecting the West Belgrade and Valley Center areas to the City of Belgrade's wastewater facilities. If annexation is a condition of connection, it could occur in an ongoing and phased manner as density dictates. The County should work closely with the City of Belgrade to address planning and wastewater connection issues.
    b. Alternative 7 - Central wastewater facilities serving Four Corners and Gallatin Gateway. This evaluation should build on the planning study prepared by Utility Solutions. This evaluation should also consider procedures to facilitate centralize wastewater management for the existing higher density subdivisions currently utilizing individual septic systems.
    c. Alternatives 8 and 9 Combined – Central wastewater facilities serving both the Valley Center and West Belgrade area. This alternative should be evaluated if the analysis determines Alternative 5 is not viable or it is necessary to develop a central system for these areas as an interim implementation step to realizing the longer term wastewater management goal outlined in Alternative 5.
    d. Alternative 8 – Central wastewater facilities serving the Valley Center Area. This alternative should be evaluated if the analysis determines Alternative 5 is not viable or it is necessary to develop a central system for this area as an interim implementation step to realizing the longer term wastewater management goal outlined in Alternative 5.
    e. Alternative 9 – Central wastewater facilities serving the West Belgrade Area. This alternative should be evaluated if the analysis determines Alternative 5 is not viable or it is necessary to develop a central system for this area as an interim implementation step to realizing the longer term wastewater management goal outlined in Alternative 5.
2. Wastewater planning should consider overall community needs and services and be closely coordinated with other infrastructure such as water, streets, storm drain and solid waste.

3. Study efforts should consider Growth Policy goals and other planning documents and considerations; including neighborhood plans, zoning efforts and subdivision regulation. Wastewater study recommendations should include specific County subdivision review policies and regulations necessary to accomplish recommended wastewater master plan.

Part 1

Study Area Characteristics

PART 1. STUDY AREA CHARACTERISTICS

Study Purpose

The purpose of this report is to investigate the feasibility of various regional wastewater management concepts. When preparing a feasibility study of this nature, the County has two choices:

1. Identify all possible alternatives and evaluate them in much detail. This approach will reduce the uncertainty associated with the analysis, but will cost several hundred thousand dollars because each alternative is evaluated in detail.

2. Identify alternatives and evaluate them on a reconnaissance level with the intent of identifying those alternatives that appear most viable. Then, in a second phase of the study effort, prepare a more detailed analysis of the most viable alternatives. This study approach is more cost effective.

The County has selected the latter approach and therefore, a reconnaissance level of detail is presented in this analysis. Further, it is not the intent to recommend a final solution, but rather to narrow the field to a few preferred concepts that would be evaluated in more detail in a later study. In terms of actually realizing progress towards better infrastructure management, the process of completing the study and soliciting public input is as important, or probably more important, than the study itself. Accordingly, this study has been delivered to several key stakeholders with a request to comment on the primary conclusions of the report. These comments will be reported to the County and included in this report. Public hearings and news articles completed to date are included in Appendix A.

This study was prepared for the Gallatin County Planning Board and the Gallatin County Commission.

Study Area Development

To initiate the study, the Planning Board and Commission generally defined the study area as that area encircled by Bozeman, Belgrade and Four Corners.

The study area was further developed by utilizing the 2000 census tracts, block groups, census designated places and municipal planning boundaries as presented in Figure 1. The Belgrade, Bozeman and Utility Solutions planning boundaries are taken from recently completed wastewater facility plans prepared by each of these entities. However, due to rapid growth, Belgrade is soon to initiate a new water and wastewater facility planning process that may consider expanding the Belgrade service area. The timing of Belgrade's new facility plan is not known and it is therefore not possible to incorporate the new facility plan into this study. In a follow up phase to this study, it would be important to adjust the study area presented herein to incorporate a possibly expanding Belgrade service area.

Insert Figure 1

The census tracts and block group approach was selected to allow future evaluation of population and distribution projections. This may be performed by simply updating spreadsheets and tables with new census information. This allows the report to be used as a proactive tool to gauge success in meeting planning goals.

Based on the census data in Figure 1, overlapping census areas and blocks were eliminated to allow accurate estimates of census 2000 populations for each service area or population center. This study area boundary was then presented to the Planning Board and Commission for further comment. The Planning Board requested the study area extend to just south of Gallatin Gateway and this change was made. The final study area boundary was then developed and is presented in Figure 2.

Using the boundary in Figure 2 and pertinent census blocks (the lowest delineation of population statistics), the study area was further divided into study area zones, as presented in Figure 3. This was done to predict the population density and distribution in the year 2000 and to use this information to predict future population distributions. Population density and distribution are essential to the layout of the wastewater collection system and the evaluation of regional wastewater alternatives. Each study area zone is assigned a number as shown in Figure 3 and specific data for that particular study area zone number is kept in a spreadsheet to organize available information and allow ready retrieval and future comparison. Again, this will allow the report to be utilized as a planning tool as well as a source of information.

Figure 3 also presents the planning area for Utility Solutions, a private utility. Utility Solutions is currently providing water and sewer service to the Four Corners area and intends to expand its service to that area presented in Figure 3.

Current and Future Population Distribution

Using the census data outlined previously, the actual distribution of population within the study area for the year 2000 was determined and is presented in Figure 4. The number in the center of each individual study zone presented in Figure 4 represents the 2000 population for that study zone. Table 1 presents current and future population projections for each of the population centers presented in Figure 4.

The results of this population analysis clearly demonstrate that two municipal (Belgrade and Bozeman) and four non-municipal population centers exist within the study area. The non-municipal population centers are listed below and presented in Figure 4:

- The Four Corners Area
- The Gallatin Gateway Area
- The Valley Center Area
- The West Belgrade Area

The Four Corners Area is a Census Designated Place (CDP), which is a special census designation allowing the census bureau to collect information specific to this area much as is done for municipalities. The core population of the Four Corners Area is much

Insert Figure 2

Insert Figure 3

Insert Figure 4

Table 1
Population Estimates

Population Area	2000 Census	2000 Census Adjusted[1]	2005 Census[2]	2025 Projected[3]
Rural, Low Density County Population				
Belgrade Division Tract 2	4,163	1,180	1,475	2,950
Bozeman Tract 5 Block Group 2	2,079	167	209	418
Bozeman Tract 5 Block Group 3	1,481	60	75	150
Rural County Subtotal	7,723	1,407	1,759	3,518
Non-municipal, Moderate Density County Population Centers				
Four Corners CDP	1,828	1,828	2,285	4,570
Valley Center Area	1,583	1,583	1,978	3,958
West Belgrade Area	1,125	1,125	1,406	2,812
Gallatin Gateway Area	674	674	842	1,684
Moderate Density County Subtotal	5,210	5,210	6,511	13,024
Moderate and Low Density Rural County Total	N/A	6,617	8,270	16,542
Municipal Population				
City of Belgrade	5,728	6,050	7,789 [4]	15,578 [5]
City of Bozeman	27,509	27,509	34,900	92,500
Municipal Total	33,237	33,559	42,689	108,078
Total Regional Area Population	N/A	40,176	50,959	124,620

[1] Subtracted population of census blocks within municipality, CDP planning areas, and identified population centers as presented in Figure 2.

[2] Data from Census Bureau projections where available or projected forward at 5% per year growth rate.

[3] Projected at 5% growth rate.

[4] Per Census Bureau growth from 2000 to 2004 was 23% or 5.75%/year and is used to project 2005 population.

[5] Exceeds planning area population density as predicted by zoning and presented in 2003 Belgrade Wastewater Facility Plan. Prediction includes area to the south of Belgrade.

Table 2
Wastewater Flows

Population Area	2000 Census	2000 Flows	2025 Census	2025 Flows
Rural, Low Density County Population				
Belgrade Division Tract 2	1,475	147,500	2,950	295,000
Bozeman Tract 5 Block Group 2	209	20,900	418	41,800
Bozeman Tract 5 Block Group 3	75	7,500	150	15,000
Rural County Subtotal	1,759	175,900	3,518	351,800
Non-municipal, Moderate Density County Population Centers				
Four Corners CDP	2,285	228,500	4,570	457,000
Valley Center Area	1,978	197,800	3,958	395,800
West Belgrade Area	1,406	140,600	2,812	281,200
Gallatin Gateway Area	842	84,200	1,684	168,400
Moderate Density County Subtotal	6,511	651,100	13,024	1,302,400
Moderate and Low Density Rural County Total	8,270	827,000	16,542	1,654,200
Municipal Population				
City of Belgrade	7,789	669,850	15,578	1,339,700
City of Bozeman	34,900	5,200,000	92,500	13,900,000
Municipal Total	42,689	5,869,850	108,078	15,239,700
Total Regional Area Population	50,959	6,696,850	124,620	16,893,900

more concentrated than the CDP and the analysis in this report differentiates between this core area and the CDP as noted in Figure 4. Future wastewater management alternatives will focus on the needs of the core area, not the CDP.

The existing and future population and wastewater flows are presented for each population center and municipality in Tables 1 and 2. Wastewater loads for these same population centers and municipalities are presented in similar tables in Appendix B. These flows and loads are the basis of design for each of the wastewater alternatives evaluated in this report.

Population projections were made for 2005 and for 2025. As noted in Table 1, the 2005 population for non-municipals was projected based on an average population growth of 5% per year. For the municipalities and the CDP, Census Bureau population estimates for 2005 are available and are presented in Table 1. The 2025 population growth was based on an average annual population growth of 5% between 2005 and 2025.

The City of Bozeman currently makes up 68 % of the study area population and generates 77% of the study area flows and is projected make up 74% of the population in 2025 and generates 82% of the wastewater flow. The reason that the Bozeman's percentage of wastewater flows exceeds its relative contribution to the population of the study area is because the surrounding population works, recreates and shops in Bozeman thereby, utilizing Bozeman's wastewater facilities. Growth within the City of Bozeman is likely to grow at a similar rate as the rest of the study area. The conclusion is the City of Bozeman will continue to be the largest generator of wastewater within the study area well into the future.

The City of Belgrade makes up 15% of the population, but generates 10% of the current study area wastewater flows. In 2025, Belgrade will make up 12% of the study area population and generate 7.9 % of the wastewater flow. If the service area for Belgrade expands, which will be discussed later in this report, the City's percentage of population relative to the study area total population will increase.

Currently, the four non-urban population centers make up 13 % of the study area population and generate 9.7% of the wastewater flows. In the future (2025), this group will make up 10% of the study area population and generate 7.8 % of the wastewater flow. The rural portion of the study area outside of the population centers is projected to make up just 2.8% of the study area population and generate 2.0% of the wastewater flow in 2025.

A comparison of the relative population and wastewater flows for each of the major population centers within the study area concludes that the relative contribution of each will not change drastically in the future because each area is experiencing a similar rate of growth. The population, wastewater flows and wastewater loads presented in the tables and pie charts in this report and Appendix B will be used as the basis of design for evaluating the alternatives presented in Part 2 of this report.

Belgrade's current city limit is approximately 1500 acres in size with a population of nearly 8000 persons for an approximate average density of slightly greater than 5 persons per acre. Bozeman's current city limits include approximately 11,000 acres with a population of nearly 35,000 persons, resulting in an average density of greater than 3 persons per acre. These are average densities; the density within each city varies, with the higher densities in city centers and progressively lower densities in the outer portions of each city. The current density in the Valley Center area and the suburban area west of Belgrade is in the range of 1.5 to 3 persons/acre. Based on the above analysis and for the purposes of this study, urban densities were considered to be higher than 3 persons/acre and suburban densities between 1.5 and 3 persons/acre.

Figures 5 and 6 on pages 11 and 12, predict graphically how the projected populations may distribute and expand around the existing population centers. Census block groups were used to predict this expansion combined with knowledge of transportation routes, physical limitations and discussions with persons knowledgeable of local conditions and current development plans. In preparing the maps in Figures 5 and 6, when the projection for each study area zone reached the designated population density (upper suburban density range for Figure 5 and lower suburban density for Figure 6) for that zone, the population was distributed to the next section or other sections more suitable for development or where plans were known to exist.

The projections of population distribution are speculative, but are based on the best available information and seem to reflect recent development plans presented to the County. It is important that land use planning, zoning, natural resource limitations, transportation, and growth policy goals be incorporated into these projections before they are used as a planning tool for future wastewater studies.

The entire study area consists of over 77,000 acres, of which 47,000 acres are within the Bozeman (43,000 acres) and Belgrade (4000 acres) planning areas. This of course, leaves 30,000 acres for the non-municipal study area. The 2025 population projection for the currently proposed Bozeman planning area is 92,500 persons (Table 1 on page 7) resulting in a future population density of approximately 2 persons per acre. It does not appear that the proposed Bozeman planning area will achieve urban densities as defined previously. In other words, the Bozeman planning area will not likely achieve complete infill by 2025.

The City of Belgrade's planning area, as currently defined, consists of 4000 acres with a future population projection of nearly 16,000 persons resulting in a 2025 population density of nearly 4 persons per acre. The current City of Belgrade planning area will likely achieve urban density in the next 20 years, pressuring the City to expand its boundaries.

The 2025 population projection for the non-municipal population centers and rural area is approximately 16,500 persons distributed over 30,000 acres for an estimated 2025 population density slightly less than 0.5 persons per acre. The non-municipal area is estimated to not achieve urban or suburban densities in the next 20 years, resulting in considerable remaining open space.

Insert Figure 5

Insert Figure 6

The projected population of the total study area in 2025 is approximately 124,500 persons resulting in an average population density of approximately1.5 person/acre. To achieve urban type densities, that are commonly associated with cost effective regional collection systems, the population of the entire study area would have to approach 250,000 persons. This would require more than 30 years of growth at a sustained 5% annual rate.

Based on the above analysis and the population distribution map presented previously in Figure 6 on page 12; the Bozeman area, Four Corners area and the Belgrade area will remain somewhat separated in the next 20 years. However, the City of Belgrade, Valley Center and West Belgrade areas will tend to grow in to each other.

Conclusions

Based on the population distributions presented in Figures 5 and 6 and the projected population growths presented in the tables, the following conclusions are made:

1. The study area will not achieve urban or suburban densities in the next 20 years or, in other words, it is unlikely that the study area will completely fill in. Significant open space will continue to exist into 2025.
2. The planning area for the City of Bozeman will not achieve urban densities in the next 20 years. The planning area for the City of Belgrade will achieve urban densities in the next 20 years, pressuring Belgrade to expand.
3. Four Corners and Gallatin Gateway will continue to be somewhat separated from the other population centers that currently exist. This suggests that for well into the future, wastewater management facilities and other infrastructure for the Four Corners area may be planned and developed separately from the other population centers in the study area.
4. Population growth and distribution projections suggest that the Valley Center, West Belgrade and City of Belgrade population centers will expand into each other in the next 20 to 30 years. Planning and development of wastewater management and other infrastructure for these areas should be coordinated to ensure the most efficient development of this area.

Existing Wastewater Management

Existing wastewater management within the study area ranges from very simple individual septic tank and drainfield systems to large and complex mechanical wastewater treatment plants. The Cities of Bozeman and Belgrade make up 83 % of the population and this, combined with the fact that many subdivisions also have central collection and treatment facilities, demonstrates that most of the service population (approximately 85%) within the study area is served by central wastewater systems. Areas currently served by central wastewater collection and treatment systems include the following entities:

- The City of Bozeman
- The City of Belgrade
- The Four Corners Water and Sewer District
- Elk Grove Subdivision
- Valley Grove Phase IV
- Four Dot Meadows
- Forest Grove Mobile Home Park
- Lexley Acres Mobile Home Park

The remaining population (approximately 7500 persons) in the study area is served by individual septic tanks and drainfields. The highest concentration of individual septic tanks is in the Four Corners, Rainbow Subdivision, Gallatin Gateway, Cobblestone and Valley Center Area. The existing individual septic systems are likely the cause of the elevated nitrate levels in the Four Corners area. Groundwater in the area is shallow and overlain by coarse material resulting in an area susceptible to groundwater contamination. A brief description of the major wastewater facilities serving the study area are presented in the remainder of this Part.

City of Bozeman Existing Wastewater Facilities: The City of Bozeman is serviced by 150 miles of gravity sewer main, 3300 manholes, six lift stations and a 5.8 million gallon per day (mgd) conventional activated sludge mechanical wastewater treatment plant. Few capacity problems have been identified for the collection system. Some problems with the maintenance and the physical condition of the collection system include excessive root cutting and clay pipe maintenance, groundwater infiltration is some areas and sump pump connections. The primary collection system needs for the future include addressing maintenance issues and expanding the system to serve a larger area.

The wastewater treatment plant is a secondary treatment facility. Such facilities are designed to remove secondary contaminants such as BOD and TSS and not nutrients such as nitrogen and phosphorous. The original plant was constructed in 1970 and has been expanded or modified five times. Flows into the plant in 2005 were approximately 5.0 mgd which is approximately 86 % of the available hydraulic capacity. BOD and TSS loads to the plant have exceeded the design capacity by 4 to 16 %. The aeration system and bio-solids treatment and disposal system also have capacity limitations. The existing plant also has a number of equipment items that are older than 20 years and must be replaced. The plant must be upgraded and expanded to satisfy the immediate hydraulic capacity, load capacity and equipment needs.

In addition, non-degradation regulations will limit the nitrogen load to 1010 lbs/day and phosphorous loads to 252 lbs/day. For the 2025 flow and load estimates outlined in Tables B-1 through B-3 in Appendix B; the treatment plant must achieve effluent concentrations of 9 mg/l for nitrogen and 2.3 mg/l for phosphorous. The existing secondary treatment plant is not capable of satisfying these nutrient limits and as such the plant will need to be converted to a Biological Nutrient Removal (BNR) facility. Total Maximum Daily Load (TMDL) regulations will likely result in even more stringent nitrogen and phosphorous limits, further demonstrating the need to convert to a BNR plant.

To further define the previously discussed wastewater management issues in Bozeman, the City of Bozeman prepared a detailed facilities plan in 2006. The Bozeman facility plan was reviewed in detail by Great West Engineering and the results incorporated into this report. The study area for the City of Bozeman was initially based on the planning area boundary presented in 2020 Plan (County Comprehensive Plan), but was expanded to address the higher growth rates and development trends experienced since the preparation of the 2020 Plan. Also, Gallatin County encourages annexation to the City of Bozeman for any development within the Gallatin County/City of Bozeman Zoning District. Accordingly, the Zoning District was included in the new study area developed in the Wastewater Facility Plan. Topographical and other physical constraints were also considered in developing the City of Bozeman wastewater service area. The proposed City of Bozeman service area was reviewed and approved by the Bozeman City Commission as part of the 2006 wastewater facility planning process.

Population within the City of Bozeman service area is projected to be 92,500 by 2025 based on an annual growth rate of 5%. The current population is estimated to be 34,900 people. Because of the regulatory restrictions, physical limitations and other considerations; City officials have stated that it is not likely that the City of Bozeman will expand service to areas outside the service area identified in the 2006 wastewater facility plan.

The facility plan recommended that improvements be implemented in three phases, with the first phase addressing immediate capacity needs and initiating the conversion to a BNR plant. The cost of this first phase is projected to be $33 million. The second phase provides additional capacity to meet future growth and future regulatory requirements. The project cost for Phase 2 is $34 million. Phase 3 would make the final improvements needed to satisfy 2025 system demands. Phase 3 costs are estimated to be $9.0 million. The first phase will be implemented immediately with subsequent phases being developed as population and regulatory needs dictate.

City of Belgrade Existing Wastewater Facilities: Most of the gravity collection system serving the City of Belgrade is less than 25 years old and is reported to be in good condition. The older section of the City does have some old clay tile pipe which was installed at the turn of the century. This pipe is becoming a maintenance problem due to root intrusion and blockages. Groundwater depths are in the 20 ft range and the per capita flow is 86 gallons per day suggesting groundwater infiltration is not a problem for the collection system.

A four cell non-aerated facultative pond system was constructed in 1973 to service the City of Belgrade. This system experienced excessive seepage and did not have sufficient surface area for system BOD loading. To address these issues, the City of Belgrade completed a wastewater facility plan in 1998 that recommended converting two of the facultative cells to mechanically aerated ponds and the converting the other two ponds to a single storage pond for irrigation. The facility plan also recommended constructing 7 new rapid infiltration (RI) ponds for groundwater disposal. Purchasing land for irrigation of treated wastewater on crops was also recommended. The facility plan was

based on a design population of 7500 persons and a flow of 0.64 mgd. This facility plan identified the service area for the City of Belgrade as presented in Figure 4 on page 6.

From 2001 to 2004 the City of Belgrade implemented many of the recommended wastewater improvements. As a result, the existing wastewater system serving Belgrade consists of two mechanically aerated ponds, one 90 day storage pond for irrigation and 10 rapid infiltration (RI) ponds. The RI ponds have a DEQ groundwater permit capacity for total nitrogen of 144 lbs/day. The design memorandum prepared for these facilities suggests this provides a hydraulic capacity of 0.63 mgd based on an effluent quality for nitrogen of 19 mg/l. This capacity could be improved with the lower effluent nutrient concentrations provided by Biological Nutrient Removal (BNR) treatment plants. In addition, the existing system has sufficient storage capacity to allow an additional 0.26 mgd of effluent to be disposed of by irrigation. When evaporation is accounted for, the existing wastewater treatment and disposal facilities serving Belgrade have a capacity of approximately 0.9 mgd and are able to serve 10,500 persons.

The current population of Belgrade is estimated to be approximately 7789 people. This is 74 % of the 10,500 design population for the existing wastewater treatment facilities. At the current growth rates for Belgrade, the capacity of the treatment facilities will likely be reached within the next 5 to 6 years. Because the system is rapidly reaching capacity and a new, very large, subdivision is being developed north of Belgrade; the City is procuring engineering services to perform additional facility planning. In addition, several developers have approached the City regarding water and sewer service for developments south of Belgrade in the general area of Valley Center Road. On November 2, 2006, the City conducted an open meeting with several landowners to discuss providing service to the south. Great West Engineering attended this meeting and presented the draft results of this report. A similar meeting was conducted on January 4, 2007. The County should participate in the current Belgrade facility planning process to encourage broader based planning that would include the Valley Center and West Belgrade areas.

Utility Solutions: Utility Solutions is a private utility offering water and sewer service to properties located in the area bounded by Gallatin Gateway on the south (Blackwood Road) to Cameron Bridge Road to the north and from the Gallatin River on the West to Love Lane on the East. The proposed service area is shown in Figure 3. The service area appears to have been developed to provide central water and sewer service to those areas that are not likely to be serviced by the existing municipalities and districts (Belgrade, Bozeman and the RAE Water and Sewer District).

Utility Solutions currently serves the Four Corners Water and Sewer District, which includes the Northstar subdivision, the Galactic Park subdivision, Bozeman Hot Springs subdivision, and various Rainbow subdivision properties as shown in Figure 7. The Elk Grove subdivision is also serviced by Utility Solutions. Commitments have been received from other properties including the Cok property, District Tier 1 Annexation and the Horace Brailsford property. The total build out wastewater flow for the on-line and committed properties is 0.353 mgd. Properties that have "will serve" letters include the Future Galactic Park, Bozeman Hot Springs, Brookshire, Black Bull, Middle Creek

Insert Figure 7

and Gallatin Heights subdivisions. The total projected build out wastewater flow for these subdivisions is 0.30 mgd. With the exception of the Gallatin Heights subdivision, all of these subdivisions are located in the immediate vicinity of Four Corners (see Figure 7). Utility Solutions has also had preliminary discussions with three subdivisions located along Valley Center Road and Love Lane. The total buildout flow for these properties is approximately 0. 3 mgd. The total wastewater flow of all of the potential subdivisions discussed above is nearly 1.0 mgd.

Each of the subdivisions currently served by Utility Solutions have gravity collection systems that deliver wastewater to a lift station that then pump the wastewater to the Utility Solutions treatment plant located on Lot UL-3 on the Elk Grove Subdivision (See Figure 7.) There are currently five lift stations delivering wastewater to the treatment plant. Each lift station is relatively new (except the Elk Grove station), and is equipped with back up power and SCADA communications.

The existing wastewater treatment plant owned by Utility Services is an oxidation ditch mechanical treatment plant. Oxidation ditches are extended aeration, activated sludge processes designed for secondary treatment, i.e. BOD and TSS removal. The systems can be modified for nutrient removal, which will be necessary for Utility Solutions to satisfy groundwater disposal permit limits. The treatment process also includes secondary clarifiers for further treatment of the liquid stream and aerobic digesters for sludge conditioning. The treated liquid stream is currently discharged to groundwater using Infiltrator/Percolation cells. The existing plant operates under Montana Ground Water Pollution Control System Discharge Permits issued by DEQ.

The existing wastewater treatment plant was constructed in 2001 and became operational in 2002 to service the Elk Grove subdivision. The existing oxidation ditch has a capacity of 0.3 mgd, but other components of the treatment process are more limited in capacity. In particular the aerobic digester has capacity of 0.075 mgd and the secondary clarifier has a capacity of 0.15 mgd. The existing plant is permitted up to 80,000 gpd for a discharge of 30 mg/l total nitrogen and 3 mg/l for total phosphorous. The current discharge facilities have a hydraulic capacity of 100,000 gpd. Utility Solutions has sufficient capacity to service currently contracted users and intends to add capacity as growth occurs and new developments sign service contracts.

Utility Solutions completed a detailed facility plan in 2006 to outline a plan for accomplishing its goals. In general, Utility Services intends to upgrade the Elk Grove Plant through three phases of 0.15 mgd, 0.3 mgd and finally 0.7 mgd. Utility Solutions also plans to add a second plant with a capacity of 0.8 mgd at Lot C-1 of Rainbow subdivision. This will provide the utility with a total treatment capacity of 1.5 mgd. The facility plan documents adequate space for treatment at these two sites, but additional space will be needed for groundwater disposal. Utility Solutions already has groundwater permits for up to 0.635 mgd and irrigation disposal for 0.10 mgd. Outfall #1 is located at the Elk Grove site and is permitted to 0.10 mgd. Outfall #2 and #3 are located in the area of Lot C-1 (see Figure 7.) and have a permitted capacity of 0.535 mgd. To achieve the ultimate capacity goal of 1.5 mgd, additional permits and disposal sites will need to be obtained. Costs for these expansions are estimated as follows;

- Phase 1 (0.15 mgd) = $1,043,000
- Phase 2 (0.30 mgd) = $1,612,000
- Phase 3 (0.70 mgd) = $5,428,000
- Phase 4 (1.50 mgd) = $10,624,000

As part of this study effort, Great West Engineering, Inc. performed a detailed review of the facility plan prepared by Utility Solutions. The facility plan for Utility Services was prepared by a qualified engineering firm following standard practice of the industry. The technical approach for wastewater management outlined by the facility plan is technically viable and feasible from a regulatory perspective, at least up to the currently permitted capacity (0.735 mgd). The difficulty obtaining additional permitted disposal sites is uncertain. This is true for all new plant proposals for any entity, whether public or private. The system proposed is very reliant on lift stations because the wastewater treatment plant is located up gradient of the proposed service area. While this is not a desirable feature of the proposed system it is feasible.

Wastewater service provided by Utility Solutions appears to be appropriate for the Four Corners area and is technically feasible for the area north to Cameron Bridge Road. Utility Solutions may be a practical solution for the Four Corners area because this area will likely remain separated from other population centers for the next 20 years and is not likely to form a municipality. Therefore, most other infrastructure and services will be provided by the County and provision of wastewater and water service through a separate water and sewer district is typical in such instances. However, service up to Cameron Bridge Road includes an area that may ultimately be within the Belgrade service area as discussed earlier in this report. Utility Solutions providing service as far north as Cameron Bridge Road should be closely scrutinized. In the long run this may lead to multiple entities (Belgrade and Utility Solutions) providing infrastructure and services to the area and result in coordination difficulties and infrastructure inefficiencies. This issue should be investigated further and closely coordinated with Utility Solutions and the City of Belgrade.

It is also important to consider that Utility Solutions will tend to service new development and not existing subdivisions. Existing subdivisions that are currently utilizing individual septic systems in the Four Corners area are likely causing groundwater pollution and this problem will not be corrected until these systems are connected to a central system. The County should facilitate the development of a water and sewer district to finance a central collection system for existing subdivisions in the Four Corners area. State and federal grants should be utilized for such an effort. Such a district could contract with Utility Solutions for treatment.

Great West Engineering, Inc. did not review the water services planned by Utility Solutions and therefore, cannot comment on the technical viability, water rights or other legal issues surrounding the ability of Utility Solutions to also provide water service to the study area. In addition, we have not reviewed a business plan or other information that would allow assessment of the capacity of Utility Solutions to finance capital,

operation and maintenance costs. These are issues that must also be reviewed when assessing the overall viability of Utility Solutions to service the area.

Valley Grove Phase IV Subdivision: The wastewater system serving this subdivision consists of central sewer collection with treatment by an SBR with disposal to underground tanks.

Four Dot Meadows Subdivision: The wastewater system serving this subdivision consists of central collection with recirculating sand filter for treatment and effluent disposal by a community drainfield.

Forest Grove Mobile Home Park and Lexley Acres Mobile Home Park: Detailed information on these systems is not readily available; however, they are most likely a community drainfield type of system or a cluster of community drainfields.

Conclusions

Based on the previously discussed population distribution, the status of existing wastewater management in the study area and the discussion in various facility plans prepared by wastewater utilities, the following conclusions may be drawn:

1. The City of Bozeman, has clearly established its planning area in numerous planning documents including the 2006 wastewater facility plan. Given the complex political, regulatory and financial constraints of expanding wastewater service beyond the currently identified planning boundary, it is very unlikely that the City of Bozeman will expand wastewater service within the 20 year planning period beyond the currently defined Boundary.
2. The existing capacity of Belgrade's wastewater treatment facilities is 0.9 mgd and the City is likely to reach these flows in the next 5 to 6 years. The 20 year capacity needs for Belgrade with the current service boundary are likely to be 1.3 mgd.
3. It is projected that the Valley Center, West Belgrade and City of Belgrade population centers will grow together. If it is determined that the City of Belgrade should service these areas it would be necessary to expand the existing wastewater treatment plant to approximately 1.70 mgd if only new development is considered and 2.5 mgd if existing septic users are also added (See Table 2 on page 8 for wastewater flows). In discussions with the City of Belgrade, the City appears willing to consider expansion beyond what is currently planned. The City of Belgrade is justifiably concerned with the political, financial and legal complexities of further expanding its service area.
4. From a purely wastewater perspective, Utility Solutions, a private utility, appears to have a technically viable wastewater plan to serve north to Cameron Bridge Road. The 20 year plan developed by Utility Solutions will build to a wastewaters treatment and disposal capacity of 1.5 mgd as service needs

dictate. The 1.5 mgd build out capacity proposed is consistent with population and flow projections for the area presented in Tables 1 and 2 of this report.

5. In the future, it is likely that the service areas for Utility Solutions and the City of Belgrade will overlap in the Valley Center area. This would lead to services being provided by two entities and that may lead to infrastructure management inefficiencies and problems. This issue should be addressed to prevent future problems. The County should work closely with the City of Belgrade and Utility Solutions to overcome the complex political, legal and financial constraints and develop a management plan that either provides for single jurisdiction in this area or defines procedures that facilitate coordination between entities in the provision services.

Part 2

Wastewater Management Concepts

PART 2. WASTEWATER MANAGEMENT CONCEPTS

Alternatives Evaluated

Utilizing the population distribution projections presented previously, eleven alternatives were evaluated. A separate detail sheet and figure is presented for each alternative starting on page 26. These alternatives fall into four primary groups as presented below:

- Full Regionalization
- Partial Regionalization
- Population Center Areas
- Hydropower Alternative

In the full regionalization concepts the entire study area is served by one large regional treatment plant and collection system. Two full regionalization alternatives were developed and are presented in Figures 8, 9 and 10.

The partial regionalization concepts include multiple systems, but the majority of the study area population is serviced by one large regional system. In the partial regionalization concepts, those systems not included in the partial regional system will develop their own wastewater system as outlined in the population center area alternatives discussed later. Four partial regionalization alternatives were developed and are presented in Figures 11 through 14.

The population center area concepts service only the individual population centers as defined previously and depicted in Figure 4. These concepts are presented in Figures 15 through 18.

The hydropower alternative considers the feasibility of cost effectively generating hydropower from a regional wastewater system. Figure 19 presented presents this alternative.

Reconnaissance level costs are presented in Table 3 on the next page. These costs include capital costs and annual operation and maintenance costs. Separate capital costs were prepared for each municipality and population center to allow the capital cost to be distributed to those users that benefit from the specific improvements. Table 4 presents the collection system costs for each entity. Treatment costs were generally assumed to be equally shared by all users that benefit from each concept alternative evaluated, however collection system costs were distributed based on the actual entity served. The capital costs are broken down into annual costs based on amortizing a loan at 4% for 20 years. This annual capital cost was then added to operation and maintenance costs to determine the total annual cost for each municipality and population center. The total annual cost was divided by the number persons in each municipality and population center to develop the annual cost per person for comparison between alternatives. A work sheet is presented in Appendix C to demonstrate how costs were distributed between the various entities.

Table 3
Alternatives Comparison

Alternative	Treatment Capital Cost	Collection Capital Cost	Total Annual Capital Cost	Treatment Annual O&M Cost	Collection Annual O&M Cost	Persons Served	Annual Cost per Person
Alternative 1 Full Regionalization w/new Regional Plant	$126,000,000	$93,000,000	$16,118,400	$4,000,000	$2,800,000	49,200	$1,500 [1] $300 [2] $290 [3]
Alternative 2 Full Regionalization w/New Lift Station and Bozeman Plant	$65,000,000	$91,000,000	$11,481,600	$4,200,000	$2,800,000	49,200	$1,600 [1] $173 [2] $240 [3]
Alternative 3 Partial Regionalization w/New Lift Station and Bozeman Plant (Excludes Four Corners)	$65,000,000	$64,000,000	$9,494,400	$4,150,000	$2,400,000	46,073	$2,200 [1] $190 [2] $260 [3]
Alternative 4 Partial Regionalization w/New Regional Plant Serving Belgrade & County	$44,000,000	$80,000,000	$9,126,400	$1,000,000	$2,000,000	14,300	$1,485 [1] $315 [3]
Alternative 5 Partial Regionalizstion w/ New Regional Plant Serving Belgrade & County (Excludes Four Corners)	$40,000,000	$49,000,000	$6,550,400	$900,000	$1,500,000	11,173	$1,000 [1] $295 [3]
Alternative 6 Partial Regionalization w/New Regional Plant Serving Poulation Centers & County	$30,000,000	$77,000,000	$7,875,200	$700,000	$2,000,000	6,511	$1,625 [1]
Alternative 7 Four Corners CDP Wastewater System	$6,000,000	$30,000,000	$2,649,600	$250,000	$425,000	3,127	$1,063 [1]
Alternative 8 Valley Center Wastewater System	$5,500,000	$18,000,000	$1,729,600	$225,000	$300,000	1,978	$1,139 [1]
Alternative 9 West Belgrade Wastewater System	$3,800,000	$27,000,000	$2,266,880	$175,000	$400,000	1,406	$2,021 [1]
Alternative 10 Gallatin Gateway Wastewater System	$2,500,000	$4,400,000	$507,840	$100,000	$100,000	842	$840 [1]

[1] Cost to non municiple county users
[2] Cost to City of Bozeman users in addition to current costs
[3] Cost to City of Belgrade users in addition to current costs

Table 4. Collection System Costs

Pipe Size	West Belgrade	Valley Center	Four Corners	Gallatin Gateway	Belgrade	Bozeman	Regional
8 inch diameter	275000	150000	200000	36000	15000		676000
Capital Cost	$11,275,000	$6,600,000	$9,600,000	$1,620,000	$600,000	$0	$29,695,000
10 inch diameter			23000				23000
Capital Cost	$0	$0	$1,219,000	$0	$0	$0	$1,219,000
12 inch diameter							0
Capital Cost	$0	$0	$0	$0	$0	$0	$0
15 inch diameter	9000	24000	26000				59000
Capital Cost	$504,000	$1,416,000	$1,638,000	$0	$0	$0	$3,558,000
18 inch diameter	20000						20000
Capital Cost	$1,260,000	$0	$0	$0	$0	$0	$1,260,000
21 inch diameter							0
Capital Cost	$0	$0	$0	$0	$0	$0	$0
24 inch diameter	25000					18000	25000
Capital Cost	$2,075,000	$0	$0	$0	$0	$1,476,000	$3,551,000
36 inch diameter						$64,000	0
Capital Cost	$0	$0	$0	$0	$0	$7,680,000	$7,680,000
Manholes	904.75	478.5	684.75	99	41.25	200	2208.25
Manhole Cost	$1,809,500	$957,000	$1,369,500	$198,000	$82,500	$400,000	$4,816,500
Services	700	1000	1150	400	150		
Capital Cost	$1,750,000	$2,500,000	$2,875,000	$1,000,000	$375,000	$0	$8,500,000
24 inch boring	200	300		300			
Capital Cost	$90,000	$135,000	$0	$135,000	$0	$0	$360,000
30 inch boring	400	100	300				
Capital Cost	$220,000	$55,000	$165,000	$0	$0	$0	$440,000
Gravel Replacement	30000	15000	25000	2000			
Capital Cost	$600,000	$300,000	$500,000	$40,000	$0	$0	$1,440,000
Highway Replacement	30000	15000	25000	2000			
Capital Cost	$1,200,000	$600,000	$1,000,000	$80,000	$0	$0	$2,880,000
Stream Crossing		200	100	100			
Capital Cost	$0	$110,000	$55,000	$55,000	$0	$0	$220,000
Construction Subtotal	$20,783,500	$12,673,000	$18,421,500	$3,128,000	$1,057,500	$9,556,000	$65,619,500
Mobilization	$2,078,350	$1,267,300	$1,842,150	$312,800	$105,750	$955,600	$6,561,950
Contingency	$2,078,350	$1,267,300	$1,842,150	$312,800	$105,750	$955,600	$6,561,950
Adm/Legal/Engineering	$4,156,700	$2,534,600	$3,684,300	$625,600	$211,500	$1,911,200	$13,123,900
Right of Way/Permits	$415,670	$253,460	$368,430	$62,560	$21,150	$191,120	$1,312,390
Total Cost	**$29,512,570**	**$17,995,660**	**$26,158,530**	**$4,441,760**	**$1,501,650**	**$13,569,520**	**$93,179,690**

Each alternative evaluated is outlined in detail in the following portion of this Part. The evaluation includes a description of the alternative, design specifications based on the specific needs of the service area for each alternative, important considerations for determination of feasibility, regulatory requirements and supporting design calculations.

Alternative 1: Full Regionalization
New Regional Plant Relocated In Belgrade Area

Description:

This alternative would serve the entire study area by locating a 17 million gallons per day (mgd) Biological Nutrient Removal (BNR) wastewater treatment plant north of Belgrade as presented in Figure 8. A biological nutrient removal plant is necessary to reduce the concentrations of nitrogen and phosphorous prior to discharge to either the East Gallatin River or the Gallatin River. The existing wastewater treatment plant serving Bozeman would be abandoned and reclaimed. Design specifications were developed for discharge to each river based the flows and loads presented in Part 1 and the specific regulatory requirements that are applicable to each river. Both current and future regulatory requirements were considered including nondegradation, total maximum daily loads (TMDL's), secondary standards, sludge regulations and instream water quality standards. Treatment specifications and supporting calculations are listed following this description and form the basis for treatment assumptions and cost estimates.

Wastewater that is currently delivered to the City of Bozeman's existing treatment plant will need to be redirected to the new location north of Belgrade through approximately 12 miles of gravity sewer main along a gently sloping route. The proposed route is mostly in public right of way and is presented in Figure 8. A 36 inch diameter sewer main would be required. This wastewater alternative would also require the construction of approximately 175 miles of wastewater collection pipe to serve the entire study area. A map of a conceptual collection system is presented in Figure 9. This concept collection system makes a few assumptions on where future growth might occur and is therefore speculative in nature. This collection system would consist of sewer pipe diameters ranging from 8 inches to 36 inches and includes over 2000 manholes.

The collection system capital cost is $93 million, most of which is attributable to serving the non-municipal county population centers. Therefore, most of the capital cost of the collection system is applied to the users within the four population centers of Valley Center, West Belgrade, Four Corners and Gallatin Gateway. The cities of Bozeman and Belgrade already have collection systems to service their users. The collection system operation and maintenance (O&M) costs are estimated to be $2.8 million. As mentioned previously, Table 4 and Appendix C present how the collection system costs were distributed to the various entities served by the regional system. Future alternatives evaluated in this report will use the cost breakdown for each entity as presented in Table 4.

The overall capital cost for the treatment facilities is $126 million with an annual operation and maintenance cost of $4.0 million (See Table 3 on page 5). These costs are based on similarly sized wastewater treatment and collection systems and currently available bid tabulations. Treatment costs are distributed equally among the users (two municipalities and four county population centers).

Insert Figure 8

Insert Figure 9

Based on the distribution of capital and O&M costs, the annual cost per person for the county non-municipal population centers is $1500. The annual cost per person for the City of Bozeman would be $300 and for the City of Belgrade $290. The costs per person presented in Table 3 are intended to only be used for comparison to other alternatives to determine relative cost effectiveness. The actual cost would be dependent on several other detailed issues such as capital distribution among potential users, number of residential and commercial users, funding strategies, bond rates, rate structures and most importantly, more detailed cost estimates and funding strategies. For Bozeman and Belgrade these costs would be in addition to those already assessed for their existing collection system.

A fully regional wastewater system raises several complex jurisdictional issues because it would serve two municipalities and likely several sewer districts. The City of Bozeman and the City of Belgrade currently require annexation to provide water and sewer service. Annexation would likely be unpopular for current valley residents and politically difficult to achieve. Annexation may be politically achievable for new developments because it would be decided by the developer. The City of Bozeman is resistant to expanding its service area beyond that already outlined in their recently completed wastewater facility plan. The City of Bozeman's resistance is because of the very stringent regulations for discharge to surface water being imposed on the City. The City of Belgrade has expressed similar concerns. Wastewater loads already grandfathered to these cities under current nondegradation rules make it difficult for these cities to abandon their existing plant locations and effluent disposal method. While multi-jurisdictional regional wastewater treatment plants have been developed in other parts of the country, they are very complex from a political, legal, regulatory, technical and financial perspective.

Design Specifications:

- Biological Nutrient Removal followed by filtration
- Average Annual Flow = 17 mgd
- Maximum Month Flow = 21 mgd
- Peak Flow = 25 mgd
- Phosphorous Limit = 1.75 mg/l based on an annual average load of 252 lbs/day
- Nitrogen Limit = 7 mg/l based on an annual average load of 1010 lbs/day
- Ammonia Plant Effluent Required for the East Gallatin River= 6 mg/l based on 7/10Q low flow of 14.9 mgd and instream limit of 3.7 mg/l. An ammonia limit for discharge to the Gallatin River is not needed.
- CBOD limit = 7.6 mg/l based on an annual average load of 1072 lbs/day
- TSS limit = 7.6 mg/l based on an annual average load of 1083 lbs/day (filtration required to meet this limit)
- Fecal Coliform Limit = 200/400 (April – September); 1000/2000 rest of year
- Total Residual Chlorine = .011 mg/l
- TMDL-East Gallatin is on the EPA 303d list as nutrient impaired. The most likely instream limit is 0.02 to 0.03 mg/l total P and 0.30 to 0.40 mg/l total N.

- New permit will be issued in late July or early August for Bozeman and will include nutrient cap equal to approximately 70% of the nondegradation load.

Considerations:

- Environmental impacts of new WWTP site and new outfall line are significant
- Right of way and land acquisition will be difficult
- Shared O&M and management is an advantage
- Annexation and public acceptance of annexation is difficult to achieve
- Larger projects more difficult to implement and finance

Conclusions:

1. The City of Bozeman currently has non-degradation load limits based on historical use. Moving the plant point of discharge as envisioned in Alternative 1 would void these grandfathered limits and require the City of Bozeman to treat to levels below the nondegradation significance trigger limits (DEQ discussions). This would result in a total P permit effluent limit of 0.002 mg/l and 0.02 mg/l for total N in the East Gallatin River. These limits are not achievable with best available technology. It is not feasible to move the Bozeman WWTP to the Belgrade location and discharge to the East Gallatin River.
2. The dilution ratio in the East Gallatin River is 1:1 so a future TMDL permit load is likely much more stringent than the load limit established by the current non-degradation rule. The TMDL permit limits most likely to be issued by DEQ, like the non-degradation requirements, are not achievable with available technology.
3. Changing the point of discharge to the Gallatin River is also not feasible. The effluent limits necessary to avoid exceeding the nondegradation trigger limits are 0.012 mg/l for total P and 0.12 mg/l for total N. The nitrogen limit is not reliably achievable with best available technology.
4. The volume of wastewater that would have to be discharged (17 mgd) to groundwater would require a very large surface area and be very difficult to locate without a major disruption of nearby land uses. Large storage ponds would have to be constructed to provide temporary storage during periods when groundwater disposal was not possible. The storage and infiltration needs would require several hundred acres of land. Because of the volume of wastewater to be discharged to groundwater, biological nutrient removal would be required for treatment. These considerations make groundwater disposal through infiltration ponds impractical.
5. This alternative is not technically achievable for surface water discharge based on current and proposed regulations, would be impractical from a land use perspective for groundwater disposal and is very difficult from a political, legal and financial perspective and therefore, should not be considered further.

Alternative 2: Full Regionalization
New Lift Station and Expansion of Bozeman Plant

Description:

Like Alternative 1, this alternative would serve the entire study area, but will rehabilitate and expand the City of Bozeman's existing wastewater treatment plant rather than build a new plant. Bozeman's existing plant would be expanded to a capacity of 17 million gallons per day (mgd) and converted to a Biological Nutrient Removal (BNR) wastewater treatment plant as presented in Figure 10. A biological nutrient removal plant is necessary to reduce the concentrations of nitrogen and phosphorous prior to discharge to the East Gallatin River. Design specifications were developed for discharge to the East Gallatin River based the flows and loads presented in Part 1 and the specific regulatory requirements. Both current and future regulatory requirements were considered including nondegradation, total maximum daily loads (TMDL's), secondary standards, sludge regulations and instream water quality standards. Again, these design specifications are listed below.

To deliver wastewater from Belgrade and the four county population centers, a 3 mgd lift station would be constructed to pump wastewater to the improved Bozeman wastewater treatment plant. This lift station could be located northwest of Belgrade as shown in Figure 10. Approximately 12 miles of forcemain would be required to pump wastewater to Bozeman. The proposed route is also presented in Figure 10. This wastewater alternative would require the construction of approximately 175 miles of wastewater collection pipeline as previously outlined in Alternative 1.

The collection system capital cost is $91 million, most of which is attributable to serving the county population centers. The overall cost is slightly lower because the cost of the forcemain to Bozeman is less than a new gravity main from Bozeman as required in Alternative 1. However, a greater burden of this cost is placed on the population centers and Belgrade because they are responsible for the cost of the lift station and forcemain. The City of Bozeman and Belgrade already have collection systems to service their users. The collection system operation and maintenance (O&M) costs are estimated to be $2.8 million as presented in Alternative 1. As mentioned previously, Table 4 and Appendix C present how the collection system costs were distributed to the various entities served by the regional system.

The overall capital cost for the treatment facilities is $65 million with an annual operation and maintenance cost of $4.2 million (See Table 3 on page 5). The treatment cost is lower than Alternative 1 because this alternative is able to re-use much of the existing treatment infrastructure in Bozeman. The O&M cost is slightly higher due to the energy cost associated with pumping to the City of Bozeman's wastewater treatment plant.

Based on the distribution of capital and O&M costs, the annual cost per person for the county population centers is $1600. The annual cost per person for the City of Bozeman

Insert Figure 10

would be $178 and for the City of Belgrade $240. For Bozeman and Belgrade these costs would be in addition to those already assessed for their existing collection system. A fully regional wastewater system raises several complex issues as discussed in Alternative 1. This alternative is different that Alternative 1 in that it does not require the relocation of the Bozeman wastewater treatment plant and that significantly simplifies the concept and reduces capital costs.

Design Specifications:

- 3 mgd (average annual) lift station located northwest of the City of Belgrade
- Lift station peak flow = 6mgd
- Surface Water Discharge to East Gallatin River using Bozeman WWTP
- Treatment:
  - Biological Nutrient Removal followed by filtration
  - Average Annual Flow = 17 mgd
  - Maximum Month Flow = 21 mgd
  - Peak Flow = 25 mgd
  - Phosphorous Limit = 1.75 mg/l based on an annual average load of 252 lbs/day
  - Nitrogen Limit = 7 mg/l based on an annual average load of 1010 lbs/day
  - Ammonia Plant Effluent Required for East Gallatin River = 6 mg/l based on 7/10Q low flow of 14.9 mgd and instream limit of 3.7 mg/l. An ammonia limit for discharge to the Gallatin River is not needed.
  - CBOD limit = 7.6 mg/l based on an annual average load of 1072 lbs/day
  - TSS limit = 7.6 mg/l based on an annual average load of 1083 lbs/day (filtration required to meet this limit)
  - Fecal Coliform Limit = 200/400 (April – September); 1000/2000 rest of year
  - Total Residual Chlorine = .011 mg/l
  - TMDL-East Gallatin River is on EPA 303d list as nutrient impaired. The most likely instream limit is 0.02 to 0.03 mg/l total P and 0.30 to 0.40 mg/l total N.
- 12 miles of forcemain required to pump to the Bozeman treatment plant

Considerations:

- Reduced land use and environmental impacts because of continued use of existing WWTP site. New lift station site required, but much less land is impacted.
- Shared O&M and management
- Annexation is required for sewer hookup to the City WWTP
- Public acceptance of annexation is difficult to achieve
- Larger projects more difficult to implement and finance

Conclusions:

1. Increased flows to Bozeman WWTP from regional sources represent a small percent of total flows and are manageable from a nondegradation perspective, but not from a TMDL perspective.
2. The dilution ratio in the East Gallatin River is 1:1 so the future TMDL permit load is likely much more stringent than the current non-degradation regulation and will drive the design of the plant. The TMDL permit limits most likely to be issued are not achievable with available technology and will require the City to reduce wastewater discharge flows to the river leading to multiple points of discharge, such as ground water, surface water and irrigation. Since multiple points of discharge will be necessary, concentrating wastewater flows in a regional plant is not desirable because those same wastewater flows will then have to be spread out again for disposal.
3. Alternative 2 is more cost effective than other alternatives evaluated from a treatment perspective, but not for collection.
4. This alternative is not technically achievable for surface water discharge based on current and proposed regulations, not practical for multiple points of discharge and very difficult from a political, legal and financial perspective and should not be considered further.

Alternative 3: Partial Regionalization
New Lift Station and Expansion of Bozeman WWTP Serving Bozeman, Belgrade, Valley Center, West Belgrade and Immediate Vicinity of Belgrade (Excludes Four Corners and Gallatin Gateway).

Description:

This alternative is very similar to Alternative 2, except it only accomplishes partial regionalization because Four Corners and Gallatin Gateway are excluded. Like Alternative 2, this alternative would rehabilitate and expand the City of Bozeman's existing wastewater treatment plant rather than build a new plant. Bozeman's existing plant would be expanded to a capacity of 16.5 million gallons per day (mgd) and converted to a Biological Nutrient Removal (BNR) wastewater treatment plant as presented in Figure 11. A biological nutrient removal plant is necessary to reduce the concentrations of nitrogen and phosphorous prior to discharge to the East Gallatin River. The regulatory requirements are very nearly same as those outlined for Alternatives 1 and 2. The permit limits are only marginally reduced by the slightly lower flow.

To deliver wastewater generated by Belgrade and the two non-municipal population centers, a 2.5 mgd lift station would be constructed to pump wastewater to the improved Bozeman wastewater treatment plant. This lift station could be located northwest of Belgrade as shown in Figure 11. Approximately 12 mile of forcemain would be required to pump to Bozeman as outlined in Alternative 2. With the exclusion of Four Corners and Gallatin Gateway, this wastewater alternative would also require the construction of less miles of wastewater collection pipeline than outlined for Alternative 1 & 2 previously.

The collection system capital and O&M costs are less at $64 million and $2.4 million respectively because Four Corners and Gallatin Gateway are excluded. As mentioned previously, Table 4 and Appendix C present how the collection system costs were distributed to the various entities served by the regional system.

The overall capital cost for the treatment facilities is $65 million with an annual operation and maintenance cost of $4.15 million as outlined for Alternative 2 previously (See Table 3 on page 5). The treatment cost doesn't change significantly when compared to Alternative 2 because the flows are only slightly reduced.

Based on the distribution of capital and O&M costs, the annual cost per person for the county population centers is $2200. The annual cost per person for the City of Bozeman would be $190 and for the City of Belgrade $260. For Bozeman and Belgrade these costs would be in addition to those already assessed for their existing collection system.

A large partial regional wastewater system raises several complex issues as was discussed in Alternative 2 and apply similarly to Alternative 3.

Insert Figure 11

Design Specifications:

- Surface Water Discharge to East Gallatin River using Bozeman WWTP
- Treatment:
  - Average Annual Flow = 16.5 mgd
  - Maximum Month Flow = 20.5 mgd
  - Peak Flow = 24 mgd
  - Biological Nutrient Removal followed by filtration
  - Phosphorous Limit = 1.75 mg/l based on an annual average load of 252 lbs/day
  - Nitrogen Limit = 7 mg/l based on an annual average load of 1010 lbs/day
  - Ammonia Plant Effluent Required = 6 mg/l based on 7/10Q low flow of 14.9 mgd and instream limit of 3.7 mg/l
  - CBOD limit = 7.6 mg/l based on an annual average load of 1072 lbs/day
  - TSS limit = 7.6 mg/l based on an annual average load of 1083 lbs/day (filtration required to meet this limit)
  - Fecal Coliform Limit = 200/400 (April – September); 1000/2000 rest of year
  - Total Residual Chlorine = .011 mg/l
  - TMDL-East Gallatin River is on EPA 303d list as nutrient impaired. The most likely instream limit is 0.02 to 0.03 mg/l total P and 0.30 to 0.40 mg/l total N.
  - New permit will be issued in late July, early August for Bozeman and will include nutrient cap-approximately 70% of nondegradation load.
- 12 miles of forcemain required to pump back to Bozeman WWTP

Considerations:

- Reduced collection piping by excluding Four Corners, Gallatin Gateway and rural area.
- Four Corners would develop its own central facility and low density rural areas would remain on septic systems.
- Reduced land use and environmental impacts because of continued use of existing WWTP site. New lift station site required, but much less land is impacted.
- Shared O&M and management
- Annexation is required for sewer hookup to the City WWTP
- Public acceptance of annexation
- Larger projects more difficult to implement and finance

Conclusions:

1. Increased flows to Bozeman WWTP from regional sources represent a small percent of total flows and are manageable from a nondegradation perspective, but not from a TMDL perspective.
2. The dilution ratio in the East Gallatin River is 1:1 so the future TMDL permit load is likely much more stringent than the current non-degradation regulation and will drive the design of the plant. The TMDL permit limits most likely to be issued are not achievable with available technology and will require the City to reduce wastewater discharge flows to the river leading to multiple points of discharge, such as ground water, surface water and irrigation. Since multiple points of discharge will be necessary, concentrating wastewater flows in a regional plant is not desirable because those same wastewater flows will then have to be spread out again for disposal.
3. Alternative 2 is more cost effective than other alternatives evaluated from a treatment perspective.
4. This alternative is not technically achievable for surface water discharge based on current and proposed regulations, not practical for multiple points of discharge and very difficult from a political, legal and financial perspective and should not be considered further.

Alternative 4: Partial Regionalization
New Regional Plant Serving Belgrade and the County Population Centers of Four Corners, Gallatin Gateway, Valley Center and West Belgrade (Excludes Bozeman).

Description:

Because this alternative excludes Bozeman, its total flows are much smaller than the previous three alternatives and therefore, make disposal to surface waters more manageable. This alternative is a partial regionalization concept because it serves all four population centers and the City of Belgrade, but excludes the City of Bozeman. This alternative would provide treatment by locating a Biological Nutrient Removal (BNR) wastewater treatment plant northwest of Belgrade as presented in Figure 12. A biological nutrient removal plant is necessary to reduce the concentrations of nitrogen and phosphorous prior to discharge to either the East Gallatin River or the Gallatin River. The treatment capacity required is 3 mgd.

This wastewater alternative would also require the construction of approximately 175 miles of wastewater collection pipeline to serve the entire study area as outlined in Alternative 1.

The overall capital cost for the treatment facilities is $44 million with an annual operation and maintenance cost of $1.0 million. The collection system capital and O&M cost is similar to Alternative 1 but does not include Bozeman and therefore does not include the large gravity sewer outfall from Bozeman. The collection system cost is $80 million. The annual collection system O&M cost is $2.0 million. Based on the distribution of capital and O&M costs, the annual cost per person for the county population centers is $1485. The annual cost per person for the City of Belgrade is $315. For Belgrade these costs would be in addition to those already assessed for their existing collection system.

A large partial regional wastewater system raises several complex issues as was discussed in Alternatives 1, 2 and 3 and these apply to Alternative 4 as well.

Design Specifications:

- Surface Water Discharge to the Gallatin or East Gallatin River
- Treatment:
  - Biological Nutrient Removal
  - Average Annual Flow = 3 mgd
  - Maximum Month Flow = 4 mgd
  - Peak Flow = 6 mgd
  - Phosphorous Limit = 0.004 to 0.05 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P in either East Gallatin or Gallatin River

Insert Figure 12

- Nitrogen Limit = 0.04 to 0.5 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen in either the East Gallatin or Gallatin River
- Ammonia Plant Effluent Required = 22 mg/l based on 7/10Q low flow of 14.9 mgd and instream limit of 3.7 mg/l in East Gallatin River. No limit is necessary for discharge to the Gallatin River. These permit limits are very achievable
- CBOD limit = 30 mg/l
- TSS limit = 30 mg/l
- TMDL limits for Alternatives 1, 2 & 3 apply the same to this alternative for discharge to the East Gallatin River
- Effluent discharge by groundwater or irrigation
    - Groundwater Limit for Nitrogen = 7.5 mg/l
    - Groundwater Limit for Phosphorous = 2.5 mg/l (dependent on location relative to surface water)

Considerations:

- Environmental impacts of new WWTP site and outfall line
- Right of way and land acquisition will be difficult
- Shared O&M and management
- Annexation is required for sewer hookup to the City WWTP
- Public acceptance of annexation for existing county users will be difficult
- Larger projects more difficult to implement and finance

Conclusions:

1. Nondegradation and TMDL based discharge permit limits are expected to be very stringent for discharge to the East Gallatin. Also, nondegradation based permit limits for nitrogen is expected to be very stringent for discharge to the Gallatin River. Accordingly, the expected permit limits for surface water discharge to either the East Gallatin of Gallatin Rivers are not achievable with the best available treatment technology (BNR).
2. Expected permit limits for groundwater discharge are achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation. Site specific analysis is required to establish the feasibility of groundwater discharge.

Alternative 5: Partial Regionalization
New Regional Plant Serving Belgrade and County Population Centers of Valley Center and West Belgrade and Immediate Vicinity of Belgrade (Excludes Bozeman, Four Corners and Gallatin Gateway).

Description:

This alternative is a partial regionalization concept that serves two of the non-municipal population centers (Valley Center and West Belgrade) and the City of Belgrade. It excludes the City of Bozeman, Four Corners and Gallatin Gateway. This alternative essentially expands the existing service area for Belgrade in both a south and west direction by including Valley Center and West Belgrade. The total wastewater capacity needed for this alternative is 2.5 mgd; very similar to the wastewater flow of 3.0 mgd for Alternative 4. Accordingly, many of the same treatment conclusions may be made for Alternative 5 as were made for Alternative 4. The capacity required for this alternative would be only 1.7 mgd if only new development in the Valley Center and West Belgrade were included. The difference between these two capacities is the existing population that is already on septic systems in these suburban areas.

This alternative would provide treatment by locating a Biological Nutrient Removal (BNR) wastewater treatment plant northwest of Belgrade as presented in Figure 13. A biological nutrient removal plant is necessary to reduce the concentrations of nitrogen and phosphorous prior to discharge to either the East Gallatin River or the Gallatin River.

This wastewater alternative would also require the construction of approximately 100 miles of wastewater collection pipeline ranging in size from 8 inches in diameter to 24 inches in diameter. The collection system cost is $49 million. The annual collection system O&M cost is $1.5 million. The collection system capital and O&M cost are significantly reduced when compared to Alternative 4 because of the exclusion of Four Corners and Gallatin Gateway.

The overall capital cost for the treatment facilities is $40 million with an annual operation and maintenance cost of $900,000. This is one of the lowest collection system costs for the non-municipal population centers. Based on the distribution of capital and O&M costs, the annual cost per person for the county population centers is approximately $1000. The annual cost per person for the City of Belgrade is $295. For Belgrade these costs would be in addition to those already assessed for their existing collection system. Overall, this alternative is the most cost effective of all of the regional and partial regional alternatives considered.

A large partial regional wastewater system raises several complex issues as was discussed in previous regional alternatives and these apply to Alternative 5 as well. One important issue for Alternative 5 is whether the Valley Center area is better served by the City of Belgrade, a separate sewer district or Utility Solutions. As mentioned previously in Part 1, the Valley Center suburban area, West Belgrade suburban area and the City of

Insert Figure 13

Belgrade are likely to grow together in the next 20 years. This growth may result in the City of Belgrade providing service to this area in the future. Utility Solutions offers service north to Cameron Bridge Road, which includes the Valley Center suburban area. If the area is ultimately annexed by the City of Belgrade, the result will be overlapping service areas where overall infrastructure needs and community services will be provided by the City, but possibly not all sewer service. Considering overall infrastructure needs and community services, it seems the area may be better served by the City of Belgrade and this should be evaluated in more detail. The timing of service by the City of Belgrade is difficult to predict. Interim solutions may be necessary, which could include a separate sewer district, service by Utility Solutions or a master plan concept and associated subdivision regulations that simply pave the way for building to city standards in this area.

Design Specifications:

- Surface Water Discharge to the Gallatin or East Gallatin River
- Treatment:
  - Biological Nutrient Removal
  - Average Annual Flow = 2.5 mgd
  - Maximum Month Flow = 3.8 mgd
  - Peak Flow = 6 mgd
  - Phosphorous Limit = 0.007 to 0.08 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P in either East Gallatin or Gallatin River
  - Nitrogen Limit = 0.07 to 0.8 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen in either the East Gallatin or Gallatin River
  - Ammonia Plant Effluent Required = 26 mg/l based on 7/10Q low flow of 14.9 mgd and instream limit of 3.7 mg/l in East Gallatin River. A limit is not necessary for discharge to the Gallatin River.
  - CBOD limit = 30 mg/l
  - TSS limit = 30 mg/l
  - TMDL limits for East Gallatin River same as previously discussed
  - Effluent discharge by groundwater or irrigation
    - Groundwater Limit for Nitrogen = 7.5 mg/l
    - Groundwater Limit for Phosphorous = 2.5 mg/l (dependent on location relative to surface water)

Considerations:

- Environmental impacts of a new WWTP site
- Right of way and land acquisition will be difficult.
- Low density rural areas will not be served by regional collection system
- Annexation may be difficult for existing users, but more likely for new development.

- Smaller project is easier to implement and finance than larger regional and partial regional concepts presented in Alternatives 1, 2, 3 and 4.
- Shared O&M and management
- Most cost effective regional and partial regional concept

Conclusions:

1. Nondegradation and TMDL based discharge permit limits are expected to be very stringent for discharge to the East Gallatin. Also, nondegradation based permit limits for nitrogen is expected to be very stringent for discharge to the Gallatin River. Accordingly, the expected permit limits for surface water discharge to either the East Gallatin of Gallatin Rivers are not achievable with the best available treatment technology (BNR).
2. Expected permit limits for groundwater discharge are achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation regulations. Site specific analysis is required to establish the feasibility of groundwater discharge.
3. The existing capacity of Belgrade's wastewater treatment facilities is 0.9 mgd and the City is likely to reach these flows in the next 5 to 6 years. The 20 year capacity needs for Belgrade within the current service boundary are likely to be 1.3 mgd. Extending service to the south and west, as described previously and outlined above, would require expansion of the existing wastewater treatment plant to approximately 1.70 mgd if only new development is considered and 2.5 mgd if existing users are also added (See Table 2 on page 4 for wastewater flows). Based on discussions with the City of Belgrade, the City appears willing to consider expansion beyond what is currently planned. The City of Belgrade is justifiably concerned with the political, financial, regulatory and legal complexities of further expanding its service area. Alternative 5 should be evaluated in more detail.
4. Issues associated with potentially overlapping wastewater service areas in the Valley Center area (the City of Belgrade and Utility Solutions) should be evaluated with consideration for overall infrastructure and community service needs.
5. Future planning efforts should address the complex political, legal and financial constraints to connecting the West Belgrade and Valley Center areas to the City of Belgrade's wastewater facilities. If annexation is a condition of connection, it could occur in an ongoing and phased manner as density dictates. The County should work closely with the City of Belgrade to address planning and wastewater connection issues.
6. Growth rates are difficult to predict and there are many political, financial and legal issues associated with realizing the overall goals of Alternative 5. Achieving these goals may require the development of interim solutions such as separate sewer service for each population center during an interim period or master planning concepts that guide wastewater management in the area until growth justifies connection to the City.

Alternative 6: Partial Regionalization
New Regional Plant Serving Four Corners, Gallatin Gateway, Valley Center and West Belgrade Population Centers (Excludes Belgrade and Bozeman).

Description:

This alternative is a partial regionalization concept that serves the four population centers; Valley Center, West Belgrade, Four Corners and Gallatin Gateway. It excludes the City of Bozeman and Belgrade. The total wastewater capacity needed for this alternative is 1.7 mgd. While the wastewater flows for this alternative are much lower than the other alternatives considered so far, they are still large enough to make it difficult to satisfy the nutrient permit limits likely required for discharge to the East Gallatin and Gallatin River. Accordingly, many of the same treatment conclusions may be made for Alternative 6 as were made for Alternatives 4 & 5.

This alternative would provide treatment by locating a Biological Nutrient Removal (BNR) wastewater treatment plant northwest of Belgrade as presented in Figure 14. A biological nutrient removal plant is necessary to reduce the concentrations of nitrogen and phosphorous prior to discharge to either the East Gallatin River or the Gallatin River.

This wastewater alternative would also require the construction of approximately 150 miles of wastewater collection pipeline ranging in size from 8 inches in diameter to 24 inches in diameter. The wastewater system would include nearly 2000 manholes. The overall capital cost for the treatment facilities is $30 million with an annual operation and maintenance cost of $700,000. The collection system costs are similar to Alternative 4 because it includes all four county population centers. The collection capital cost is $77 million and the O&M cost is $2.0 million. Based on the distribution of capital and O&M costs, the annual cost per person for the county population centers is approximately $1625.

This alternative does not include either of the municipalities and therefore is not complicated by annexation issues.

As mentioned previously in Part 1, the Valley Center, West Belgrade and the City of Belgrade are likely to grow together in the next 20 years and Four Corners and Gallatin Gateway will remain separated from the other population centers. Therefore, because of the population distribution that is most likely to occur in the next 20 years and the wastewater systems currently in place, it is unlikely that the wastewater concept outlined in Alternative 6 will be cost effective when compared to the development of each of these areas separately as outlined in Alternatives 7 through 10.

Insert Figure 14

Design Specifications:

- Surface water discharge to either East Gallatin or Gallatin rivers
- Average Annual Flow = 1.7 mgd
- Maximum Month Flow = 2 mgd
- Peak Flow = 4 mgd
- Phosphorous Limit = .01 to 0.1 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P for discharge to the East Gallatin or Gallatin River
- Nitrogen Limit = 0.1 to 1.0 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen in either river
- Ammonia Plant Effluent Required is 36 mg/l based on 7/10Q low flow of 14.9 mgd and instream limit of 3.7 mg/l for the East Gallatin River. Ammonia limit is not required for discharge to the Gallatin river
- CBOD limit = 30 mg/l
- TSS limit = 30/mg/l
- TMDL limits for East Gallatin River same as previously discussed
- Effluent discharge by groundwater or irrigation
  - Groundwater Limit for Nitrogen = 7.5 mg/l
  - Groundwater Limit for Phosphorous = 2.5 mg/l (dependent on location relative to surface water)

Considerations:

- Environmental impacts of new WWTP site
- Right of way and land acquisition will be difficult.
- Eliminates Belgrade and Bozeman annexation issues
- Water and Sewer District formation may be difficult for existing users, but more likely for new development.
- Bond Debt election for capital cost may be difficult to pass.
- Smaller project easier to implement and finance than larger regional and partial regional concepts presented in Alternatives 1, 2, 3 and 4.
- Shared O&M and management

Conclusions:

1. Nondegradation and TMDL based discharge permit limits are expected to be very stringent for discharge to the East Gallatin. Also, nondegradation based permit limits for nitrogen is expected to be very stringent for discharge to the Gallatin River. Accordingly, the expected permit limits for surface water discharge to either the East Gallatin of Gallatin Rivers are not achievable with the best available treatment technology (BNR).

2. Expected permit limits for groundwater discharge are achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation requirements. Site specific analysis is required to establish the feasibility of groundwater discharge.
3. It is more desirable to include the City of Belgrade in the regional concepts and therefore, Alternative 6 should not be pursued unless it is not possible to include the City of Belgrade. Even if it is concluded that Belgrade will not be part of regionalization, it may not be best to pursue Alternative 6 over Alternatives 7 through 10. Because the non-municipal portion of the study area is not likely to experience complete infill, it is likely more cost effective to sewer each of the non-municipal population centers separately as outlined in Alternatives 7 through 10.

Alternative 7: Four Corners CDP and Gallatin Gateway Wastewater System

Description:

This alternative is a population center concept that serves the Four Corner and Gallatin Gateway areas. The total wastewater capacity needed for this alternative is 0.46 mgd. Because of this lower flow, discharge to either the Gallatin River or groundwater is feasible. However, the predicted nutrient permit limits are still low enough to require biological nutrient removal (BNR) processes for wastewater treatment.

This alternative could be satisfied by locating a Biological Nutrient Removal (BNR) wastewater treatment plant north of Four Corners as presented in Figure 15 or connecting all future development and existing development to the wastewater treatment system proposed by Utility Solutions. As part of this study effort, Great West Engineering studied the Wastewater Facility Plan prepared by Morrison and Maierle for Utility Solutions and concluded that the system proposed appears technically viable and is achievable from a regulatory perspective, especially for the Four Corners area. It is also important to understand that the scope of this study did not include a detailed review of Utility Solutions' water system or overall business plan and financial capacity. Our conclusion is limited to Utility Solutions' viability as a private wastewater utility.

This wastewater alternative would also require the construction of approximately 55 miles of wastewater collection pipeline ranging in size from 8 inches in diameter to 18 inches in diameter. The wastewater system would include approximately 800 manholes.

The overall capital cost for the treatment facilities is approximately $7.5 million with an annual operation and maintenance cost of $350,000 (includes Four Corners and Gallatin Gateway as presented in Table 3). The collection system costs include a capital cost of approximately $35 million and an O&M cost of $425,000. Based on these capital and O&M costs, the annual cost per person for the county population centers is approximately $1063. This cost per person should only be used for comparison to other alternatives to determine relative cost effectiveness of the various alternatives considered. As mentioned in Alternative 1, the actual cost would be dependent on several other detailed issues such as capital distribution among potential users, number of residential and commercial users, funding strategies, bond rates, rate structures and finally, more detailed cost estimates.

This alternative does not include either of the municipalities and therefore is not complicated by annexation issues.

Design Specifications:

- Average Annual Flow = 0.46 mgd
- Maximum Month Flow = 0.56 mgd
- Peak Flow = 1.6 mgd

Insert Figure 15

- Phosphorous Limit = 0.40 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P for the West Gallatin River
- Nitrogen Limit = 4.0 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen
- Ammonia Plant Effluent Required is very high based on 7/10Q low flow of 200 mgd and instream limit of 3.7 mg/l and is not an issue
- CBOD limit = 30 mg/l
- TSS limit = 30 mg/l
- Effluent discharge by groundwater or irrigation
  - Groundwater Limit for Nitrogen = 7.5 mg/l
  - Groundwater Limit for Phosphorous = 2.5 mg/l (dependent on location relative to surface water)

Considerations:

- Right of way and land acquisition will be difficult.
- The low density rural areas will not be served by regional collection system
- Eliminates Belgrade and Bozeman annexation issues
- Water and Sewer District formation may be difficult for existing users, but more likely for new development.
- Bond Debt election for capital cost may be difficult to pass.
- Smaller project easier to implement and finance than larger regional and partial regional concepts presented in Alternatives 1 through 6.

Conclusions:

1. The expected permit limits for surface water discharge are achievable with BNR treatment processes.
2. Expected permit limits for groundwater discharge are also achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation requirements. Site specific analysis is required to establish the feasibility of groundwater discharge.
3. It is likely that Four Corners and Gallatin Gateway will remain separated from the other population centers in the next 20 years and may be better served by a separate system such as that provided by Utility Solutions.
4. The County should develop a plan to encourage existing high density subdivisions to convert from on-site systems to a central wastewater collection and treatment system.

Alternative 8: Valley Center Wastewater System

Description:

This alternative is a population center concept that serves the Valley Center area. The total wastewater capacity needed for this alternative is 0.40 mgd. Because of this lower flow, discharge to either the Gallatin River or groundwater is feasible. However, the predicted nutrient permit limits are still low enough to require biological nutrient removal (BNR) processes for wastewater treatment.

This alternative could be satisfied by locating a Biological Nutrient Removal (BNR) wastewater treatment plant northwest of Valley Center as presented in Figure 16. This wastewater alternative would also require the construction of approximately 33 miles of wastewater collection pipeline ranging in size from 8 inches in diameter to 18 inches in diameter. The wastewater system would include approximately 500 manholes.

The overall capital cost for the treatment facilities is approximately $5.5 million with an annual operation and maintenance cost of $225,000. The collection system costs include a capital cost of approximately $18 million and an O&M cost of $300,000. Based on these capital and O&M costs, the annual cost per person for the county population centers is approximately $1139.

This alternative does not include either of the municipalities and therefore is not complicated by annexation issues. This alternative could also be an interim or phased solution to Alternative 5. In other words, centralized wastewater facilities could be developed for the Valley Center area that would ultimately be integrated into the City of Belgrade facilities when population densities dictate.

Design Specifications:

- Average Annual Flow = 0.40 mgd
- Maximum Month Flow = 0.50 mgd
- Peak Flow = 1.4 mgd
- Phosphorous Limit = 0.03 to 0.4 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P for discharge to either the East Gallatin or Gallatin River
- Nitrogen Limit = 0.30 mg/l to 4.0 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen in either river
- Ammonia Plant Effluent Required = 140 mg/l
- CBOD limit & TSS limit = 30 mg/l
- Effluent discharge by groundwater or irrigation
  - Groundwater Limit for Nitrogen = 7.5 mg/l
  - Groundwater Limit for Phosphorous = 2.5 mg/l (dependent on location relative to surface water)

Insert Figure 16

Consideration:

- Environmental impacts of new WWTP site
- Right of way and land acquisition will be difficult.
- Low density rural areas will not be served by regional collection system
- Eliminates Belgrade and Bozeman annexation issues
- Water and Sewer District formation may be difficult for existing users, but more likely for a new development.
- Bond Debt election for capital cost may be difficult to pass.
- Smaller project easier to implement and finance than larger regional and partial regional concepts presented in Alternatives 1 through 6.

Conclusions:

1. The expected permit limits for surface water discharge are achievable with BNR treatment processes.
2. Expected permit limits for groundwater discharge are also achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation requirements. Site specific analysis is required to establish the feasibility of groundwater discharge.
3. The County should develop a plan to encourage existing high density subdivisions to convert from on-site systems to a central wastewater collection and treatment system.

Alternative 9: West Belgrade Wastewater System

Description:

This alternative is a population center concept that serves the West Belgrade area. The total wastewater capacity needed for this alternative is 0.28 mgd. Because of this lower flow, discharge to either the Gallatin River or groundwater is feasible. However, the predicted nutrient permit limits are still low enough to require biological nutrient removal (BNR) processes for wastewater treatment.

This alternative could be satisfied by locating a Biological Nutrient Removal (BNR) wastewater treatment plant northwest of Belgrade as presented in Figure 17. This wastewater alternative would also require the construction of approximately 62 miles of wastewater collection pipeline with approximately 1000 manholes.

The overall capital cost for the treatment facilities is approximately $3.8 million with an annual operation and maintenance cost of $175,000. The collection system costs include a capital cost of approximately $27 million and an O&M cost of $400,000. The collection system is somewhat lower than that presented in Table 4 on page 6 because it is possible to reduce the size of some of interceptors when West Belgrade is not part of a larger regional concept. The collection system for West Belgrade tends to be higher than other similar population center alternatives because it requires borings under the interstate, significant pavement replacement and other complexities. Based on these capital and O&M costs, the annual cost per person for the county population centers is approximately $2021.

This alternative does not include either of the municipalities and therefore is not complicated by annexation issues. This alternative could also be an interim or phased solution to Alternative 5. In other words, centralized wastewater facilities could be developed for the West Belgrade area that would ultimately be integrated into the City of Belgrade facilities when population densities dictate.

Design Specifications:

- Average Annual Flow = 0.28 mgd
- Maximum Month Flow = 0.35 mgd
- Peak Flow = 1.0 mgd
- Phosphorous Limit =0.055 to 0.7 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P for the East Gallatin and Gallatin rivers
- Nitrogen Limit = 0.55 to 7.0 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen
- Ammonia Plant Effluent Required is very high based on 7/10Q low flow for both rivers
- CBOD and TSS limit = 30 mg/l

Insert Figure 17

Considerations

- Environmental impacts of new WWTP site
- Right of way and land acquisition will be difficult.
- Rural low density area will not be served by regional collection system
- Eliminates Belgrade and Bozeman annexation issues
- Water and Sewer District formation may be difficult for existing users, but more likely for new development.
- Bond Debt election for capital cost may be difficult to pass.
- Smaller project easier to implement and finance than larger regional and partial regional concepts presented in Alternatives 1 through 6.

Conclusion:

1. The expected permit limits for surface water discharge are achievable with BNR treatment processes.
2. Expected permit limits for groundwater discharge are also achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation requirements. Site specific analysis is required to establish the feasibility of groundwater discharge.
3. The County should develop a plan to encourage existing high density subdivisions to convert from on-site systems to a central wastewater collection and treatment system.

Alternative 10: Gallatin Gateway Wastewater System

Description:

This alternative is a population center concept that serves the Gallatin Gateway area. The total wastewater capacity needed for this alternative is 0.17 mgd. Because of this lower flow, discharge to either the Gallatin River or groundwater is feasible. However, the predicted nutrient permit limits are still low enough to require biological nutrient removal (BNR) processes for wastewater treatment.

This alternative could be satisfied by locating a Biological Nutrient Removal (BNR) wastewater treatment plant north of Gallatin Gateway as presented in Figure 18 or connecting all future development and existing development to the wastewater system proposed by Utility Solutions.

This wastewater alternative would also require the construction of approximately 7 miles of 8 inch diameter wastewater collection pipe with approximately 100 manholes.

The overall capital cost for the treatment facilities is approximately $2.5 million with an annual operation and maintenance cost of $100,000. The collection system costs include a capital cost of approximately $4.4 million and an O&M cost of $100,000. Based on these capital and O&M costs, the annual cost per person for the county population centers is approximately $840.

This alternative does not include either of the municipalities and therefore is not complicated by annexation issues. This area should be combined with Four Corners as described in Alternative 7.

Design Specifications:

- Average Annual Flow = 0.17 mgd
- Maximum Month Flow = 0.24 mgd
- Peak Flow = 0.68 mgd
- Phosphorous Limit = 0.9 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P for discharge to the Gallatin River
- Nitrogen Limit = 9.0 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen for discharge to the Gallatin River
- Ammonia Plant Effluent Required is very high based on 7/10Q low flow and is not a problem
- CBOD limit = 30 mg/l
- TSS limit = 30 mg/l

Insert Figure 18

Considerations:

- Environmental impacts of new WWTP site
- Right of way and land acquisition will be difficult.
- Rural low density area will not be served by regional collection system
- Eliminates Belgrade and Bozeman annexation issues
- Water and Sewer District formation may be difficult for existing users, but more likely for new development.
- Bond Debt election for capital cost may be difficult to pass.
- Smaller project easier to implement and finance than larger regional and partial regional concepts presented in Alternatives 1, 2, 3 and 4.

Conclusion:

1. The expected permit limits for surface water discharge are achievable with BNR treatment processes.
2. Expected permit limits for groundwater discharge are also achievable with available technology. A BNR plant would likely be necessary to satisfy nondegradation requirements. Site specific analysis is required to establish the feasibility of groundwater discharge.
3. It is likely that Four Corners and Gallatin Gateway will remain separated from the other population centers in the next 20 years and may be better served by a separate system such as that provided by Utility Solutions.
4. The County should develop a plan to encourage existing high density subdivisions to convert from on-site systems to a central wastewater collection and treatment system.

Alternative 11: Hydropower Wastewater System

This concept was brought to the County Commission and Planning Board by members of the general public. The concept is to generate hydropower from wastewater generated at Four Corners and Bozeman and delivered to a regional wastewater plant located in Belgrade. Four Corners is approximately 300 ft higher than Belgrade and Bozeman is approximately 231 feet higher. This concept would require the wastewater to be collected at each respective location and be transported in a pressurized pipeline to Belgrade as presented in Figure 19.

The need for a pressure pipe to maintain available head, does not allow downstream users to utilize the system and thereby undermining the regional value of the system. To deliver wastewater to the pressurized pipe from a downstream location would require the use of booster pumps at each home or lift stations for whole subdivisions, largely negating the energy savings. Some have suggested the use of venturi pipes along the pressure main to avoid pumping and allow downstream use. While we can understand this may seem like free energy; it is not because it consumes hydraulic energy to perform work. For a venturi to create vacuum or low pressure area, it must create a pressure loss across the venturi, and thereby consume available head that is otherwise intended for hydropower generation. This would significantly reduce head (pressure energy) available for hydropower generation.

Further, as the supporting cost analysis below indicates, there is not sufficient flow to generate enough hydropower revenue to pay for the required infrastructure. The concept is not economically feasible. While it is understandable that the concept would have appeal, practical considerations such as piping limitations, hydraulics, and economics render the concept infeasible. Economically feasible hydropower sites typically have higher flows and steeper slopes which reduce pipeline length to generating equipment and thereby significantly reduce capital costs. The proposed Belgrade and Bozeman sites have long gently sloping terrains which require long pipe lengths and high capital costs.

There are several problems with this concept that render it impractical and it should not be considered further.

Design Specifications:

- Average Annual Flow = 0.46 mgd (0.70 cfs) + 13.9 mgd (8.0 cfs)
- Available Head = 300 ft for Four Corners; 231 ft for Bozeman
- Generating Power Available = 15KW for Four Corners; 350 KW for Bozeman
- Phosphorous Limit = 0.03 mg/l based on not exceeding an instream non-significance trigger limit of 0.001 mg/l total P
- Nitrogen Limit = 0.30 mg/l based on not exceeding an instream non-significance trigger limit of 0.01 mg/l total Nitrogen
- CBOD & TSS limits = 30 mg/l

Insert Figure 19

Conclusions:

1. Full regionalization alternatives when combined with this alternative would require separate trunk and interceptors to the treatment plant or lift station to pump into pressurized hydropower line.
2. Revenue generated from hydropower for the Four Corners Area is $3,900/yr before O&M expenses and would be able to amortize a debt of $53,000 for 20 yrs at SRF rates of 4% and is therefore unable to pay for the additional expense of a pipeline to Belgrade.
3. Revenue generated from hydropower for the Bozeman Planning Area is $92,000/yr before O&M expenses and would be able to amortize a debt of $1,250,000 for 20 years at SRF rates of 4% and is therefore unable to pay for the additional expense of a pipeline to Belgrade.
4. This alternative is not economically or technically viable and should not be considered further.

Supporting Calculations:

Four Corners Generating Power

Generating Power = 0.70 cfs * 130 lbs/sq in * 144 sq in/sq ft = 13,000 ft-lb/sec
= (13,000 ft-lb/s) / (550 ft-lb/sec/Hp) = 24 Hp = 18 KW

Less Efficiency Loss = 27KW * .85 = 15 KW

Total Available Power = 15 KW * 24hrs = 360 KW-hrs/day
= 131,000 KW-hr/yr

Annual Power Revenue = 131,000 KW-hr * 0.03 = $3,900 before expenses

Debt Service Capacity at 4% for 20 yrs (SRF Loan) = $53,000

Debt Service Capacity is much less than the cost of the pipeline to Belgrade.

Bozeman Planning Area Generating Power

Generating Power = 21 cfs * 100 lbs/sq in * 144 sq in/sq ft = 302,400 ft-lb/sec
= (115,000 ft-lb/s) / (550 ft-lb/sec/Hp) = 549 Hp = 412 KW

Less Efficiency Loss = 412KW * .85 = 350 KW

Total Available Power = 350 KW * 24hrs = 8412 KW-hrs/day
= 3,070,000 KW-hr/yr

Annual Power Revenue = 3,070,000 KW-hr * 0.03 = $92,100 before expenses

Debt Service Capacity at 4% for 20 years (SRF) = $1,250,000 before expenses

Debt Service Capacity is much less than the cost of a new pipeline to Belgrade and orders of magnitude less than additional cost of moving the WWTP.

Part 3

Summary Conclusions and Recommendations

PART 3. SUMMARY CONCLUSIONS AND RECOMMENDATIONS

1. The proposed study area includes several Census Bureau tracts and block groups as presented in Figure 2 on page 4.
2. The primary population centers in the study area include two municipalities, Belgrade and Bozeman, and four non-municipal population centers. The non-municipal population centers include the Valley Center area, West Belgrade area, Four Corners area and the Gallatin Gateway area (See Figure 4).
3. The Bozeman planning area population is currently 68% of the total study area population and projected to be 74% of the future study area population. Belgrade's population represents 15% of the 2025 population currently and 13% in 2025. The remaining four population centers are home to 12% of the current population and projected to be 13% of the 2025 study area population (See Table 1 on page 7).
4. The Bozeman planning area currently generates 82% of the wastewater flow in the study area. Belgrade generates 7.9% of the wastewater and the four population centers of Four Corners, Valley Center, West Belgrade and Gallatin Gateway generate 7.8%. The remaining rural areas are generating 2.1% of the study area wastewater (See Table 2 on page 8). The fact that Bozeman's wastewater flow contribution is a higher percent than its population percentage demonstrates that it serves as regional work and commercial hub for the area.
5. The City of Belgrade's current average density is slightly greater than 5 persons per acre. Bozeman's current average density is slightly greater than 3 persons per acre. The current density in the Valley Center area and the suburban area west of Belgrade is in the range of 1.5 to 3 persons/acre. For the purposes of this study, urban densities were considered to be 3 persons/acre and higher and suburban densities between 1.5 and 3 persons/acre.
6. The total study area consists of 77,000 acres, of which, the Bozeman and Belgrade planning areas represent 43,000 acres and 4,000 acres respectfully. The remaining non-municipal surface area consists of 30,000 acres.
7. The 2025 population projections presented in Table 1 on page 7 suggest a future population density of approximately 2 persons per acre. The Bozeman planning area will not achieve urban densities as defined previously, that is, the Bozeman planning area will not likely achieve complete infill by 2025.
8. The City of Belgrade's planning area will achieve a population density of nearly 4 persons per acre by 2025. The City of Belgrade's planning area will likely achieve urban density in the next 20 years, pressuring the City to expand its boundaries.
9. The 2025 population estimate for the non-municipal population centers predict a population density of slightly less than 0.5 persons per acre. The non-municipal portion of the study area is not likely to achieve urban or suburban densities in the next 20 years. In other words, low density rural areas will remain with higher density areas clustered generally around the current population centers.

10. The projected population of the total study area in 2025 is approximately 124,500 persons; resulting in an average population density for the combination of municipal and non-municipal areas of approximately 1.5 person/acre. To achieve urban type densities (3 persons/acre), that are commonly associated with cost effective regional collection systems, the population of the entire study area would have to approach 250,000 persons. This would require more than 30 years of growth at a sustained 5% annual rate.

11. Based on the above analysis, complete infill for the study area is not likely in the next 20 years, but may occur in the next 40 years. Assuming growth will be concentrated around the population centers, Four Corners and Gallatin Gateway will tend to remain separate from the other areas, but Valley Center, West Belgrade and the City of Belgrade with tend to grow together other as presented in Figures 5 and 6 on pages 11 and 12.

12. For the regionalization concepts considered in this report, the regional collection system would be built to primarily serve the non-municipal population centers and the cost would be assigned to only those users. A concept regional collection system is presented in Figure 9 on page 28. The cost of the regional collection system is very high for the non-municipal users as presented in Table 3 on page 23 and Table 4 on page 24. The regional collection system would require between 150 and 200 miles of sewer pipe ranging in size from 8 inches to 36 inches in diameter. The City of Bozeman and Belgrade already have a collection system and would share in the new outfall sewers only.

13. A new regional treatment facility, as outlined in Alternatives 1 through 3, is not technically feasible for surface water discharge and not practical for groundwater discharge. In addition, large regional collection systems require high densities to be cost effective, and as discussed previously, such densities are not likely to develop in the next 20 years. The significant expense, regulatory feasibility and the political and jurisdictional complexities associated with the large regional concepts as outlined in Alternatives 1 through 3, suggest a focus on more practical localized wastewater management solutions. Ultimately, as future growth and density dictate, these localized systems could be combined into a larger regional system serving the entire study area. Large regional systems as outlined in Alternative 1, 2 and 3 are not likely to be feasible for another 30 to 40 years and should not be evaluated further.

14. Discharge to the East Gallatin or Gallatin River is not technically feasible for partial regional Alternatives 4, 5 and 6. Groundwater discharge is feasible for each of these alternatives.

15. Population growth and distribution projections suggest the Valley Center, West Belgrade and City of Belgrade population centers will expand into each other in the next 20 to 30 years. To address this growth, partial regional Alternative 5 should be evaluated in more detail.

16. The existing capacity of Belgrade's wastewater treatment facilities is 0.9 mgd and the City is likely to reach these flows in the next 5 to 6 years. The 20 year capacity needs for Belgrade within the current service boundary are likely to be

1.3 mgd. Extending service to the south and west, as described previously and outlined in Alternative 5, would require expansion of the existing wastewater treatment plant to approximately 1.70 mgd if only new development is considered and 2.5 mgd if existing users are also added (See Table 2 on page 8 for wastewater flows). In discussions with the City of Belgrade, the City appears willing to consider expansion beyond what is currently planned. The City of Belgrade is justifiably concerned with the political, financial, regulatory and legal complexities of further expanding its service area.

17. If annexation is a condition of connection to the City of Belgrade, it could occur in an ongoing and phased manner as density dictates. The County should work closely with the City of Belgrade to address planning and wastewater connection issues.

18. Four Corners and Gallatin Gateway will continue to be somewhat separated from the other population centers that currently exist. Also, as demonstrated in Alternatives 4 and 6, collection systems costs are much higher when Four Corners is included in the partial regional alternatives when compared to partial regional Alternative 5. The geographic separation and high collection system cost suggests wastewater management facilities and other infrastructure for the Four Corners area should be planned and developed separately from the other population centers in the study area. Alternatives 4 and 6 should not be evaluated further because they include Four Corners in larger regional concepts. Concept Alternative 7 considers a separate wastewater facility serving Four Corners and Gallatin Gateway and should be evaluated further.

19. From a purely wastewater perspective, Utility Solutions, a private utility, appears to have a technically viable wastewater plan to serve north to Cameron Bridge Road. The 20 year plan developed by Utility Solutions proposes to construct to a wastewaters treatment and disposal capacity of 1.5 mgd. The necessary expansion will occur as service needs dictate. In the valley center area (Cameron Bridge/Valley Center roads), Utility Solutions and the City of Belgrade may have overlapping service areas in the next 20 years. The viability of overlapping service needs to be evaluated and specific planning recommendations made.

20. Alternatives 7, 8, 9 and 10 outline wastewater collection and treatment facilities for each of the four non-municipal population centers. These alternatives are feasible for both discharge to the Gallatin River and groundwater. These alternatives should be evaluated in more detail. The more detailed evaluation should include existing and new development and should provide the tools and recommendations to encourage existing county users in the identified population centers to connect to a central facility. In particular, the formation of water and sewer districts and funding strategies need to be prepared.

21. An alternative (Alternative 11) to generate hydropower from wastewater flows was evaluated. It was determined that this alternative does not generate sufficient hydropower revenue to offset the additional cost. This alternative should not be evaluated further. This is not to say that it would not be feasible to utilize methane gas from any of the proposed wastewater treatment plants to generate electric power. This is commonly done throughout the country and has

merit, but such facilities generally produce only enough power to run the wastewater treatment plant at which the power is being generated. The analysis of the feasibility of utilizing methane gas for power will not impact the comparison of the concept alternatives evaluated for this report. Methane gas power is most appropriately evaluated at the preliminary design phase for any of the concept alternatives considered in this report.

22. It is recommended that the County complete a detailed wastewater master planning study that evaluates the following:

    a. Alternative 5 – Partial regional wastewater treatment plant serving Belgrade, Valley Center, West Belgrade and the general vicinity of Belgrade. The study should address the complex political, legal and financial constraints to connecting the West Belgrade and Valley Center areas to the City of Belgrade's wastewater facilities. If annexation is a condition of connection, it could occur in an ongoing and phased manner as density dictates. The County should work closely with the City of Belgrade to address planning and wastewater connection issues.

    b. Alternative 7 - Central wastewater facilities serving Four Corners and Gallatin Gateway. This evaluation should build on the planning study prepared by Utility Solutions. This evaluation should also consider procedures to facilitate centralize wastewater management for the existing higher density subdivisions currently utilizing individual septic systems.

    c. Alternatives 8 and 9 Combined – Central wastewater facilities serving both the Valley Center and West Belgrade area. This alternative should be evaluated if the analysis determines Alternative 5 is not viable or it is necessary to develop a central system for these areas as an interim implementation step to realizing the longer term wastewater management goal outlined in Alternative 5.

    d. Alternative 8 – Central wastewater facilities serving the Valley Center Area. This alternative should be evaluated if the analysis determines Alternative 5 is not viable or it is necessary to develop a central system for this area as an interim implementation step to realizing the longer term wastewater management goal outlined in Alternative 5.

    e. Alternative 9 – Central wastewater facilities serving the West Belgrade Area. This alternative should be evaluated if the analysis determines Alternative 5 is not viable or it is necessary to develop a central system for this area as an interim implementation step to realizing the longer term wastewater management goal outlined in Alternative 5.

23. The capital costs of the alternatives evaluated are high. The funding strategy should include both traditional state and federal grant programs as well as the

pursuit of direct congressional appropriations to offset these costs. To maximize the use of grant funding, each project may have to be divided into several stand alone phases and implemented through several state legislative and US congressional sessions.

24. Wastewater planning should consider overall community needs and services and be closely coordinated with other infrastructure such as water, streets, storm drain and solid waste.
25. Study efforts should consider Growth Policy goals and other planning documents and considerations; including neighborhood plans, zoning efforts and subdivision regulation. Wastewater study recommendations should include specific County subdivision review policies and regulations necessary to accomplish the recommended wastewater master plan.
26. In follow up analysis, develop population distribution estimates in greater detail considering planned land use, physical limitations, environmental constraints, growth policy goals, transportation plans as well as water and wastewater feasibility.

APPENDIX A

Public Information

Gallatin County, Montana
311 West Main Street, Bozeman, MT 59715
Phone (406) 582-3000

Planning Board August 8 Meeting Minutes

Description Gallatin County Planning Board August 8, 2006
Date 08/08/2006 Location Planning Board

Time Speaker Note
2:07:26 PM Chairman Gene Krebsbach Called to Order. Gallatin County Planning Board Members Present: Eugene Krebsbach, Kerry White, Gail Richardson, Rick Holscher, Donald Seifert, C.B. Dormire and Michael Milmine. Board Members Absent: Deb Kimball-Robinson, Mary Jacobs, Matt Flikkema and Martha Hopkins-Biel. Gallatin County Planning Staff Present: Planning Director Jennifer Madgic, Planner Warren Vaughan, Planner Victoria C. Drummond, Deputy County Attorney Greg Sullivan, Environmental Health Director Tim Roark, Grants Administrator Larry Watson and Recording Secretary Crystal Turner.
2:07:37 PM Chairman Gene Krebsbach Approval of July 11th, 2006 meeting minutes
2:07:49 PM No corrections or edits to the minutes. Minutes stand approved as written.
2:07:53 PM There was no public comment on matters within the Board's jurisdiction that was not on the agenda.
2:08:48 PM Closed public comment.
2:08:52 PM Chairman Gene Krebsbach Great West Engineering Presentation
2:09:27 PM Dave Aune, Great West Engineering Presentation
2:31:57 PM Board questions and discussion with Dave Aune. Gail Richardson asked if it would make sense, environmentally, to have one system rather than a bunch of smaller systems. C.B. Dormire questions and discussion with Dave Aune requesting that he speculate on what might be the considerations, and their effect, using the population density figures he has. Board questions regarding the Four Corner's private systems that is in operation now and how they relate to the options. Board questions to verify that Great West Engineering was aware that Utility Solutions has a plant in the Four Corner's area. Yes, he is aware and thinks Four Corner's should be centralized. Comes down to, "What's the most cost effective way to do that?" Gene Krebsbach questions for clarification that even though there is a private entity servicing the area, that does not significantly change Great West's recommendations as far as continuing to look at alternatives in that area. Dave answers at a minimum you need to look at a centralized wastewater treatment facilities at an individual subdivision level that encourages advanced treatment. When you go to the next level, what do you do with a particular population center, in consideration of both public and private utilities, you need to study it. Gail Richardson questions about using the treated water to irrigate. Dave answered regulations govern what you can and cannot do with treated water.
2:47:10 PM Public Comment Clinton Caine
3:01:04 PM Board discussion. Kerry White was disappointed with the timeline; stated in the contract between the County and Great West Engineering. Timeline shows that a preliminary plan should have been presented by January 2006. He was also disappointed that Alternative #11 (Hydropower) did not have a cost analysis accompanying it. Michael Milmine commented regarding having funding available for this plan to go forward. Would like to get this going. Disagrees with Kerry White's comments. Commented that the feasability study request was for a broad study, and he felt that is what the engineers provided. It may not have been as detailed as we would have liked to see, but it was what the County requested. Asks that if there are names of financial institutions willing to provide funding, to please present that to the Board.
3:07:42 PM Clinton Caine Comments to Board on available money, but no names were given.
3:08:47 PM Discussion between Clinton Caine and Michael Milmine. Clinton Caine gave the names of Pam Higgins, Paul Torck, Josh Keller, Conrad Burns and Rehberg and ask those people to give names of folks that could fund it.
3:10:13 PM Gail Richardson Asks if Dave Aune has any comments on Kerry White's comments. She felt very educated after reading the report. Thought Great West Engineering did an excellent job in what they presented.
3:10:45 PM Dave Aune, Great West Engineering They are on schedule. Advised the Planning Board many times that they postponed presenting the study until Bozeman was complete (and gave Great West information) with their rigorous wastewater facility plan. Starting to work with Department of Environmental Quality. There was no cost analysis done for the Hydropower alternative because it is simply not feasible to create. We can only generate $96,000 a year from treatment, and the least expensive cost analysis (not for Hydropower) was for $1.7 million to lay 12 miles of pipe (which is the amount given for another alternative and not a realistic to today's market costs). Hydropower would not generate enough money to pay for itself; it does not have enough flow or drop.
3:13:18 PM C.B. Dormire echoes Mike Milmine's comments. His impression is that this is exactly what the Board asked to see. He thanked Dave Aune and Great West for doing this. We had to start somewhere. Hopes we keep going.
3:13:47 PM Dave Aune comments on regionalization: regulatory, annexation, plans, and political constraints. Kerry White asked at what step is Great West currently at in their timeline. Dave Aune answered that their intent was to get comment from the Planning Board and now he has that. He needs to put a narrative to this draft and feels one month's time is adequate to be complete. Then Great West would be right on schedule with their original timeline.
3:17:36 PM Chairman Gene Krebsbach Other Business: Receipt of Draft Subdivision Regulations with Legislative Changes
3:18:05 PM County Planner Victoria C. Drummond Passed out a copy of the draft subdivision regulation/legislative changes. Included a coversheet, it will be noticed in the paper this week that the Planning Board and County Commission will be considering it. Resolution of Intent and Resolution to Adopt will also be in that notice. Subdivison subcommittee has already reviewed.
3:20:43 PM Chairman Gene Krebsbach I strongly recommend members of the Board contact Victoria C. Drummond before August 22nd so we can have a reasonable discussion at the meeting. Request that Victoria C. Drummond contact the members not present today and discuss.
3:21:25 PM Michael Milmine asks if there is an electronic copy on the web page. Victoria C. Drummond answered that it is not yet, but will be once the notice is published for the agendas.
3:21:43 PM Chairman Gene Krebsbach Planning Director's Report
3:21:47 PM Planning Director Jennifer Madgic Distributed Planning Director's Report to Board. MAP conference, if you are interested

in attending, let the Planning Department know. Remember you can claim mileage as you go to the County Outreach Meetings.
3:22:07 PM Chairman Gene Krebsbach Consideration and Recommendation for Preliminary Plat Approval for the Longview Estates Major Subdivision
3:22:40 PM Recess.
3:27:22 PM Chairman Gene Krebsbach Reconvened meeting.
3:27:28 PM County Planner Warren Vaughan Staff report. Handed out addendum to the staff report, which was amendment to conditions 35, 37, 38 and 39 (changes are underlined). #35: "...western boundary of the canal maintenance easement (on subdivision property, not canal easement), referred..." and, "...between lots 13 and 14 large enough for vehicular access and maintenance equipment ," and, "...area having jurisdiction, and the Board of Directors of the Farmer's Canal ." #37: "The Property Owner's Association shall carry general liability insurance in the commercially reasonable amounts, naming the Farmer's Canal Company of Gallatin County as an additional insured. The subdivider shall provide a copy of said certificate of insurance to the Gallatin County Attorney's Office, prior to final plat approval." #38: "...north side of Blackwood acceptable to the Board of Directors of the Farmer's Canal . The subdivider shall reclaim old point of diversion so that it does not leak and cannot be used in the future ." #39: "...require the Property Owners Association to construct Canal fence and maintain all..."
3:40:14 PM Terry Threlkheld, Innovative Engineering Presentation on behalf of applicants Jerry and Shirley Long.
3:54:04 PM Board questions and discussion with Terry Threlkheld regarding acceptable conditions that staff has presented today. Gail Richardson questioned why the applicants have not opted to create smaller clustered lots to accommodate central water and sewer. Rick Holscher asks about the spring-fed wetlands and the lot and road placement on them. Donald Seifert questions on the dry creek bed referenced on plat. Gail Richardson asks if the applicant has talked with the large surrounding landowners and received consensus on neighboring approval.
4:02:47 PM Public Comment Barbara Campbell for Utility Solutions, Al Lien for Farmer's Canal, County Road Engineer George Durkin
4:20:06 PM Chairman Gene Krebsbach Closed public comment.
4:20:11 PM Terry Threlkheld, Innovative Engineering Rebuttal and comments on behalf of applicants Jerry and Shirley Long. Suggests to the following conditions: Condition #8b: delete the second sentence. They will enter into and agreement (MOU) with the ditch company and get that wording straightened out. Condition #13, delete the last part of the last sentence, "...at least 300 linear feet apart and constructed to County standards or a variance shall be approved." Condition #15, delete, "Gooch Hill Road," and applicant will voluntarily pave to the Blackwood "y". Condition #26 delete the words, "and site plans." Condition #34, would like to encourage that the ditch company accept the minimum 45-feet around lots 13, 14, and 15, but would remain the requested 60-feet in other areas. Condition #36, strike this condition or maybe delete the second sentence. Applicant will work with the ditch company for correct language. Condition #38, requests to strike this. Will try to work something out with the Morgan's, but don't want to say they can achieve drainage of the ditch/wetland if they cannot.
4:26:21 PM Board discussion with Terry Threlkheld on ditch company's easement. Comments on road accesses being close together.
4:30:50 PM County Planner Warren Vaughan Comments on conversation with Allen Steinly with the Army Corps of Engineers regarding moving the ditch. He did not feel it would be a big deal. Cautions Board on editing the ditch conditions too much. Staff and ditch company held six meetings to work them out, the Deputy County Attorney has reviewed them, and just wants to caution the Board. Comments on road accesses and conditions for the paving of Blackwood Road.
4:34:08 PM Board discussion. Rick Holscher comments on soils information on page 5 of staff report that points out safety issues. According to the Growth Policy, this isn't where we want to see growth necessarily: property with this type of landscape, and that is surrounded by agricultural land. Michael Milmine disagrees. Feels the project is where we want to see growth: near Four Corner's and Elk Grove subdivision. Also would like to encourage central water and sewer, especially after hearing the fire department's concerns for fire mitigation. C.B. Dormire agrees this density is acceptable for the area. However, this piece of property, and this layout, is questionable due to the ditch, wetlands and topography.
4:45:18 PM Kerry White I make a motion that we approve the request for Longview Estates Major Subdivision, as it complies with Montana Subdivision and Platting Act and the Gallatin County Subdivision Regulation, and I believe follows the Gallatin County Growth Policy, with the attached conditions supplied by the Planning Staff, all 43 conditions.
4:45:59 PM Donald Seifert Second
4:46:05 PM Board clarification on variance. Kerry White will make a separate motion for the variance. Michael Milmine clarified that this motion includes requiring the pavement of Blackwood Road.
4:46:49 PM Board discussion. Kerry White concerned about paving Blackwood Road, and the $1,000,000 [insurance coverage] liability from the ditch company is insufficient. Gail Richardson does not feel this application meets the criteria of the Growth Policy for residential use, promoting residential use adjacent to existing developed land, encouraging multi-user public water and waste water systems, preserve production farm and ranch-lands, promote development adjacent to or within cities/unincorporated communities, etc. Feels very strongly about the cumulative effects of water drawdown. There are other subdivisions in this area about to be proposed, and without accumulative effect's analysis she could not support this subdivision. Donald Seifert addresses the access: if you put a fence around the entire subdivision, and a fire happens, you virtually have no way out. Concerning fires again, if you are on electric pumps for sprinkler systems you could have problems. Gene Krebsbach addresses that this has an impact on agriculture and agricultural water. Agrees with Gail Richardson that there are insufficiencies with the application meeting Growth Policy criteria.
4:52:25 PM Motion failed 6:1. Kerry White, Gail Richardson, Eugene Krebsbach, Rick Holscher, Donald Seifert and C.B. Dormire opposed.
4:52:52 PM This item will be before the Commission on August 22nd, 2006.
4:53:00 PM Meeting adjourned.

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http://www.gallatin.mt.gov/Public_Documents/GallatinCoMT_PlanNews/S00A68F80-00A6902A

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Four Corners sewer system focus of study

By WALT WILLIAMS Chronicle Staff Writer

Gallatin County has contracted with a Helena engineering firm to study the feasibility of setting up a sewer system to service the fast-growing Four Corners area and beyond.

The first phase of the wastewater management feasibility study will review what options are available to the county and their costs.

"The primary purpose is to provide a basis for informed discussion of wastewater management,"**Dave Aune** of Great West Engineering of Helena said Thursday.

The county will pay Great West $30,000 under a contract recently approved by both the Gallatin County Planning Board and Gallatin County Commission.

The Four Corners area is one of the fastest growing in the state,with perhaps as many as 5,000 homes being built between Belgrade and Bozeman in coming years.

"We're looking at the growth needs for that entire corridor" for water treatment,Gallatin County Grants Coordinator Larry Watson said.

One of the goals will be to protect the nearby Gallatin River.

The study will consider the feasibility of a system that would connect the developments to a treatment facility near Belgrade,a location chosen because it would allow the waste to flow downhill.

The study also will consider the areas adjacent to U.S. Highway 191 between Four Corners and Gallatin Gateway, and north along Jackrabbit Lane to Cameron Bridge Road.

The study may explore as many six or seven alternatives for sewer services.

The scope of work will include population and growth projections,basic wastewater design criteria and regulatory requirements,evaluation and consideration of existing systems and a conceptual evaluation of management alternatives.

The feasibility of hydropower from the flow of waste and methane energy conversion also is under consideration.

Walt Williams is at wwilliams@dailychronicle.com

APPENDIX B

Wastewater Loads

Table B-1
Wastewater BOD Loads

Population Area	2000 Census	2000 BOD Load (lbs/day) [1]	2025 Census	2025 BOD Load (lbs/day) [1]
Rural, Low Density County Population				
Belgrade Division Tract 2	1,475	295	2,950	590
Bozeman Tract 5 Block Group 2	209	42	418	84
Bozeman Tract 5 Block Group 3	75	15	150	30
Rural County Subtotal	1,759	352	3,518	704
Non-municipal, Moderate Density County Population Centers				
Four Corners CDP	2,285	457	4,570	914
Valley Center Area	1,978	395	3,958	792
West Belgrade Area	1,406	281	2,812	562
Gallatin Gateway Area	842	168	1,684	337
Moderate Density County Subtotal	6,511	1,301	13,024	2,605
Moderate and Low Density Rural County Total	8,270	1,653	16,542	3,309
Municipal Population				
City of Belgrade	7,789	1,558	15,578	3,115
City of Bozeman [2]	34,900	9,423	92,500	18,500
Municipal Total	42,689	10,981	108,078	21,615
Total Regional Area Population	50,959	12,634	124,620	24,924

[1] Based on .20 lbs/day/capita for all areas other than Bozeman

[2] Bozeman loads based on .27 lbs/day/capita

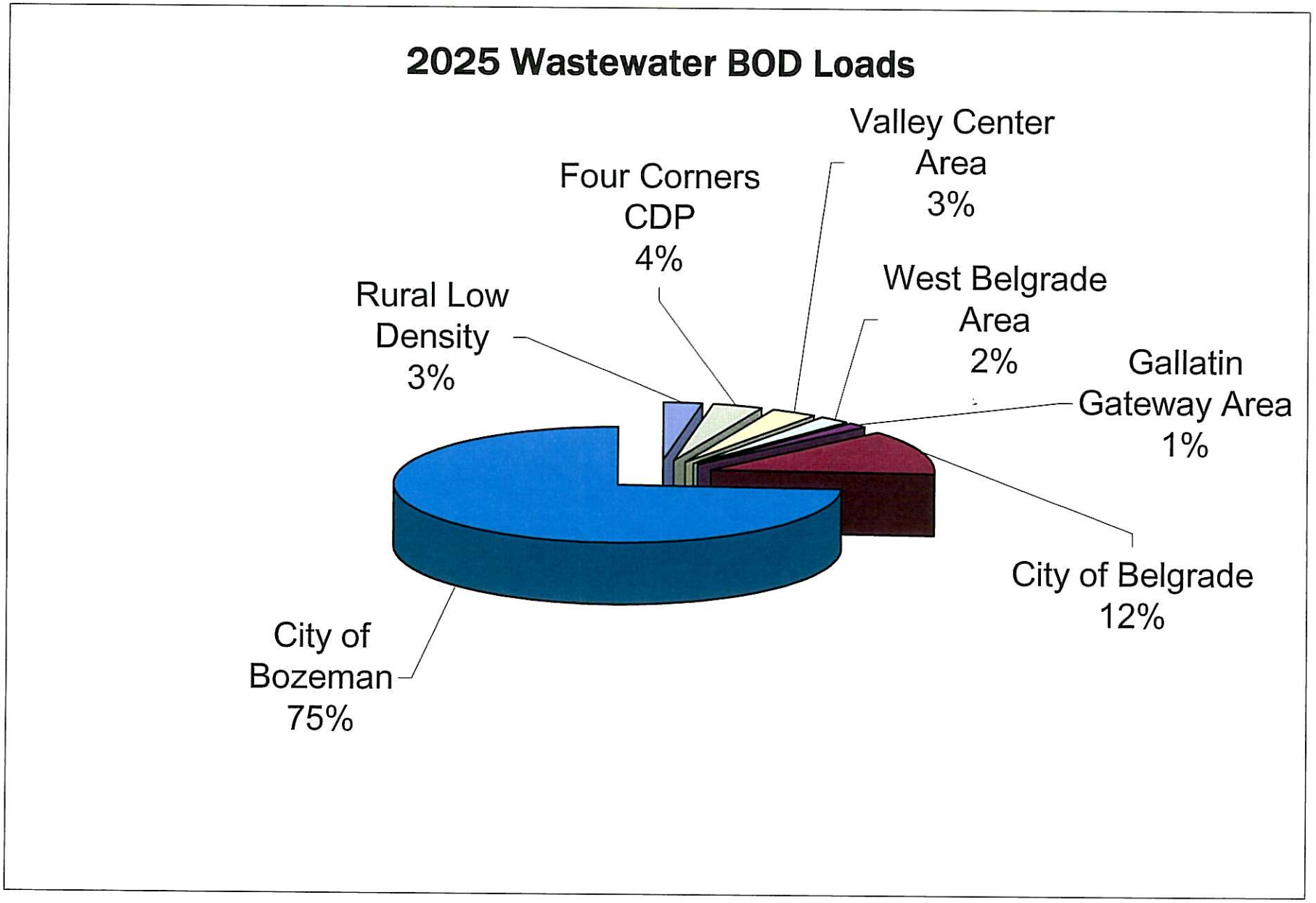

2025 Wastewater BOD Loads
Valley Center Area 3%
Four Corners CDP 4%
West Belgrade Area 2%
Rural Low Density 3%
Gallatin Gateway Area 1%
City of Belgrade 12%
City of Bozeman 75%

Table B-2
Wastewater Total Nitrogen Loads

Population Area	2000 Census	2000 Total Nitrogen Load (lbs/day) [1]	2025 Census	2025 Total Nitrogen Load (lbs/day) [1]
Rural, Low Density County Population				
Belgrade Division Tract 2	1,475	41	2,950	83
Bozeman Tract 5 Block Group 2	209	6	418	12
Bozeman Tract 5 Block Group 3	75	2	150	4
Rural County Subtotal	1,759	49	3,518	99
Non-municipal, Moderate Density County Population Centers				
Four Corners CDP	2,285	64	4,570	128
Valley Center Area	1,978	55	3,958	111
West Belgrade Area	1,406	39	2,812	79
Gallatin Gateway Area	842	24	1,684	47
Moderate Density County Subtotal	6,511	182	13,024	365
Moderate and Low Density Rural County Total	8,270	232	16,542	463
Municipal Population				
City of Belgrade	7,789	218	15,578	436
City of Bozeman	34,900	977	92,500	2,590
Municipal Total	42,689	1,195	108,078	3,026
Total Regional Area Population	50,959	1,427	124,620	3,489

[1] Based on a per capita load of 0.028 lbs/day

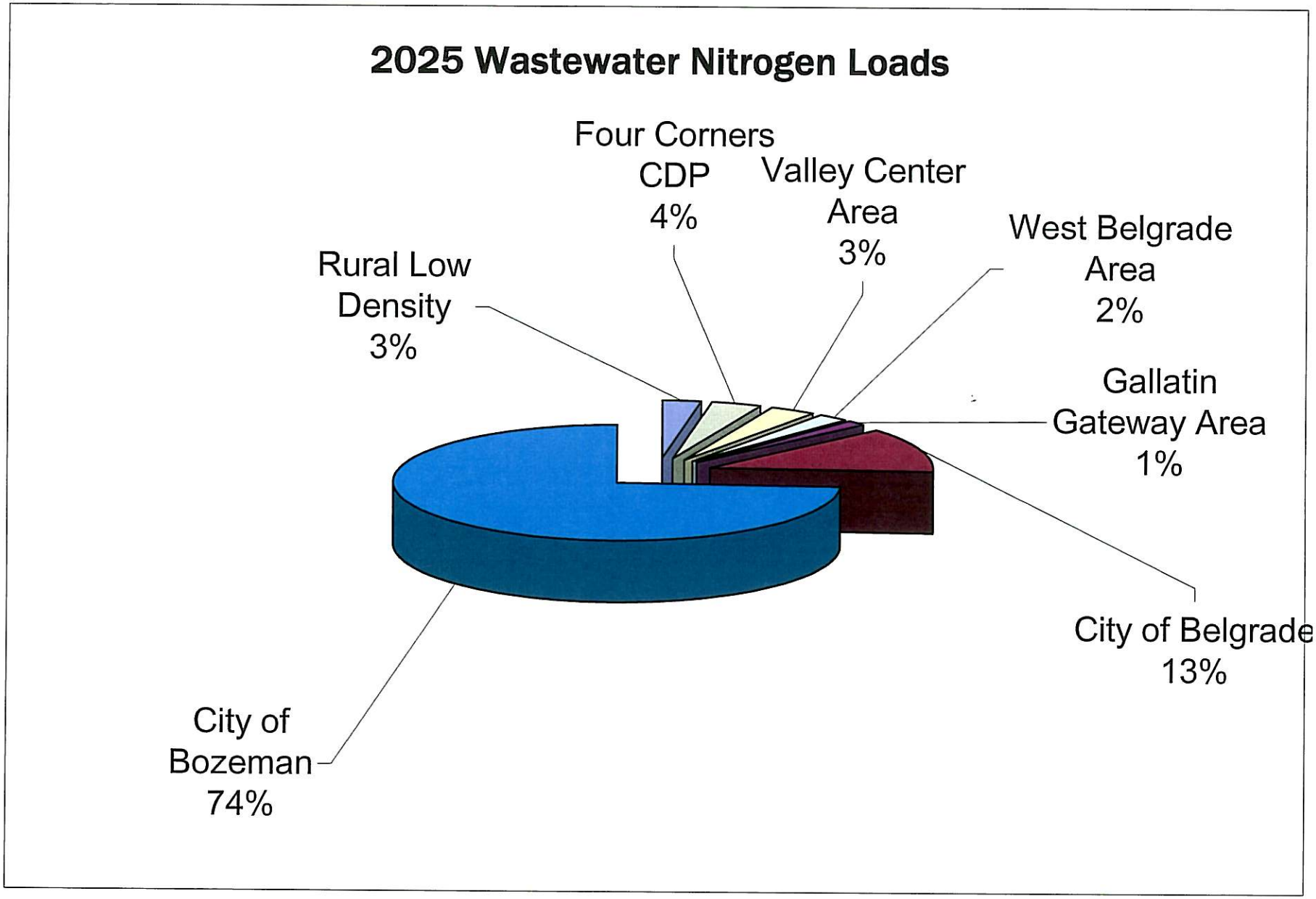
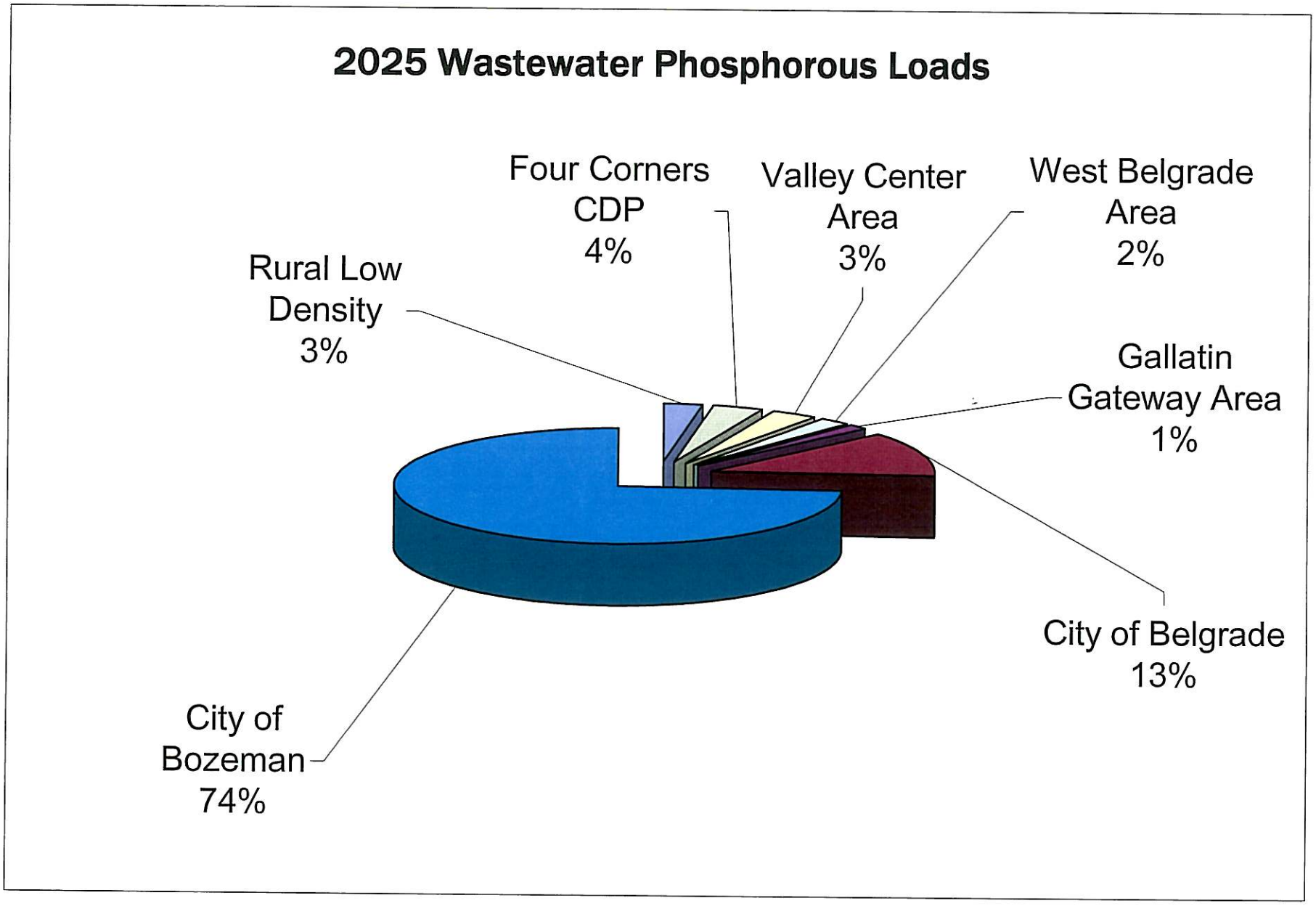

2025 Wastewater Nitrogen Loads
Four Corners CDP 4%
Valley Center Area 3%
West Belgrade Area 2%
Rural Low Density 3%
Gallatin Gateway Area 1%
City of Belgrade 13%
City of Bozeman 74%

Table B-3
Wastewater Total Phosphorous Loads

Population Area	2000 Census	2000 Total Phosphorous Load (lbs/day) [1]	2025 Census	2025 Total Phosphorous Load (lbs/day) [1]
Rural, Low Density County Population				
Belgrade Division Tract 2	1,475	10	2,950	21
Bozeman Tract 5 Block Group 2	209	1	418	3
Bozeman Tract 5 Block Group 3	75	1	150	1
Rural County Subtotal	1,759	12	3,518	25
Non-municipal, Moderate Density County Population Centers				
Four Corners CDP	2,285	16	4,570	32
Valley Center Area	1,978	14	3,958	28
West Belgrade Area	1,406	10	2,812	20
Gallatin Gateway Area	842	6	1,684	12
Moderate Density County Subtotal	6,511	46	13,024	91
Moderate and Low Density Rural County Total	8,270	58	16,542	116
Municipal Population				
City of Belgrade	7,789	55	15,578	109
City of Bozeman	34,900	244	92,500	648
Municipal Total	42,689	299	108,078	757
Total Regional Area Population	50,959	357	124,620	872

[1] Based on a per capita load of 0.007 lbs/day


2025 Wastewater Phosphorous Loads
Four Corners CDP 4%
Valley Center Area 3%
West Belgrade Area 2%
Rural Low Density 3%
Gallatin Gateway Area 1%
City of Belgrade 13%
City of Bozeman 74%

APPENDIX C

Cost Distribution Worksheet

ALTERNATIVE	Users	Annual Treatment Cost	Capital Collection cost	Coll annual Cap Cost	Treatment O&M	Collection O&M	Total Annual Cost	Total monthly cost/person
Alternative 1 County	6,511	188.4878049	77931000	880.9279066	81.30081301	360.3608781	1511.077403	125.9231169
Alternative 1 Bozeman	34900	188.4878049	13569000	28.61542693	81.30081301	8.361216379	306.7652612	25.56377177
Alternative 1 Belgrade	7789	188.4878049	1500000	14.1738349	81.30081301	5.798085803	289.7605386	24.14671155
Alternative 2 County	6,511	97.23577236	89000000	1006.051298	95.28682699	420.5900074	1619.163905	134.9303254
Alternative2 Bozeman	34900	97.23577236	0	0	81.30081301	0	178.5365854	14.87804878
Alternative 2 Belgrade	7789	97.23577236	3,500,000	33.07228142	95.28682699	13.82620461	239.4210854	19.95175712
Alterantive 3-County	3384	103.835218	60500000	1315.839243	104.7190395	670.4343972	2194.827898	182.9023249
Alternative 3-Bozeman	34900	103.835218	0	0	86.81874417	0	190.6539622	15.88783018
Alterantive 3-Belgrade	7789	103.835218	3500000	33.07228142	104.7190395	16.85068687	258.4772258	21.53976882
Alternative 4-County	6511	226.4615385	78500000	887.3598526	69.93006993	301.4129934	1485.164454	123.7637045
Alternative 4-Bozeman	0	0	0	0	0	0	0	0
Alterantive 4-Belgrade	7789	226.4615385	1500000	14.1738349	69.93006993	4.814481962	315.3799252	26.28166044
							0	0
Alternative 5-County	6511	205.8741259	51000000	576.5013055	62.93706294	221.6857973	1066.998292	88.9165243
Alternative 5-Belgrade	7789	205.8741259	2000000	18.89844653	62.93706294	7.267142584	294.9767779	24.58139816
							0	0
Alternative 6-County	6511	339.118415	77000000	870.4039318	107.5103671	307.1724773	1624.205191	135.3504326
							0	0
Alternative 7-Four Corners	3127	141.2216182	30000000	706.1080908	79.94883275	135.9130157	1063.191557	88.59929645
Alternative 8-Valley Center	1978	204.6511628	18000000	669.7674419	113.7512639	151.6683519	1139.83822	94.98651837
Alternative 9-West Belgrade	1406	198.9189189	27000000	1413.371266	124.4665718	284.4950213	2021.251778	168.4376482
Alternative 10-Gallatin Gateway	842	218.5273159	4,400,000	384.608076	118.7648456	118.7648456	840.6650831	70.05542359