Preliminary Engineering Report
Wastewater System Improvements Project
for the
Bosque Loop Area
Sandoval County, New Mexico

July 2014

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1. PROJECT PLANNING

Souder, Miller and Associates (SMA) was contracted by Sandoval County to complete a Preliminary Engineering Report (PER) for wastewater system improvements within the "Bosque Loop" area of Sandoval County. This report is intended to provide Sandoval County and the residents of the Bosque Loop area with information regarding potential engineering solutions, probable costs, and a recommended solution for the wastewater improvement project.

A. Location

The Project Planning area, commonly referred to as the "Bosque Loop Area" is located within Sandoval County, New Mexico. The project planning area is bounded by the Rio Grande River on the west, the Town of Bernalillo to the North and East, and Sandia Pueblo to the south. The project planning area is approximately 250 acres in size, including a 40 acre parcel that is owned by the Pueblo of Sandia. Figure 1 shows the project planning area outlined in red. Exhibit 1 in Appendix A provides a vicinity map which shows the location of the Bosque Loop area within the State of New Mexico.

Figure 1: Project Planning Area Boundary

B. Environmental Resources Present

Farmland

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) provides detailed soil maps and identifies soils as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland as a part of the National Cooperative Soil Survey (NCSS). Approximately 27% of the land within the project planning area is comprised of soils that are considered to be prime farmland if irrigated. A NRCS Soils

map is included as Exhibit 2 in Appendix A. The complete NRCS custom soil report and maps are included in Appendix B.

Rangeland
The majority of the soils within the project planning area (~87%) are considered bottomland. There are currently no free roaming herds within the project planning area. A Rangeland soils map is include in the NRCS custom soil report in Appendix B.

Forestland
There are no forestland soils within the project planning area. A Forestland soils map is include in the NRCS custom soil report in Appendix B.

Wetlands
There are no wetlands within the project planning area. A wetlands map of the area from the U.S. Fish and Wildlife Service is included in Appendix A as Exhibit 3.

100/500 Year Floodplains
The majority of the project planning area is designated as Zone A by the Federal Emergency Management Agency (FEMA). A map of the project planning area showing the FEMA flood hazard areas is included in Appendix A as Exhibit 4. Zone A designation is subject to the 1% annual chance of flooding. FEMA also references that a hydraulic study has not been done so no Base Flood Elevations (BFE) or flood depths are given. The remaining portion of the project planning area is designated Zone D by FEMA. Zone D designation indicates that the area has a possible but undetermined flood hazard based on a lack of analysis of the area.

Historic Sites
SMA communicated with the New Mexico State Historic Preservation Office (SHPO) to identify any historic sites within the project planning area. At the time of this report there were no documented historic sites within the project planning area, although a recent survey by the Bureau of Indian Affairs in the area had indicated an archeological site in the area. Details of the site and location were not yet reported to the SHPO therefore an archeological survey of the project planning area is recommended prior to project design and construction.

C. Population Trends

According to the 2010 United States Census the area encompassing the project planning area has an average population density of 2.86 persons per household. The project planning area contains 126 homes indicating an estimated population of 360 people in 2010.

Population projections were calculated using the growth rates published in the 2007 report "2030 Socioeconomic Forecasts by Data Analysis Subzones for the Mid-Region Council of Governments (MRCOG) Region". Table 1 summarizes the reports annual growth rate projections for Sandoval County from 2010 through 2030. The complete MRCOG report is included in Appendix C of this report. The growth rate from 2030 to the end of the planning period is assumed to be the same as for the period from 2025 to 2030.

Table 1: MRCOG Population Growth Rate Projections

Projected Annual Population Growth Rate				
2011 - 2015	**2016 - 2020**	**2021 – 2025**	**2026 - 2030**	**2031 - 2035**
2.86%	2.50%	2.17%	1.91%	1.91%

The estimated population, using the MRCOG annual population growth rate from Table 1, for 2014 is 403 people and the projected population is estimated to be 619 people at the end of the 20-year planning period. Table 2 shows the population projections for the project planning area at five years intervals through the end of the planning period.

Table 2: Population Projections for Project Planning Area 20-year Period

2010 Population Estimate	2014 Population Estimate	2019 Population Estimate	2024 Population Estimate	2029 Population Estimate	2034 Population Estimate
360	403	458	511	563	619

D. Community Engagement

Sandoval County is the lead government agency for this Preliminary Engineering Report (PER). All community engagement activities related to the proposed project will be held in and staffed by Sandoval County.

The Town of Bernalillo is a key partner for this proposed project however the Town of Bernalillo is not responsible the project or any decisions arising from this PER.

2. EXISTING FACILITIES

A. Location Map

The Project Planning Area is located to the southwest of the Town of Bernalillo in Sandoval County, New Mexico. There is currently no public wastewater infrastructure within the project planning area. Exhibit 1 of Appendix A is a location map of the project planning area. Figure 2 below demonstrates the lack of wastewater facilities within the planning area and shows the existing sewer infrastructure in the surrounding populated area.

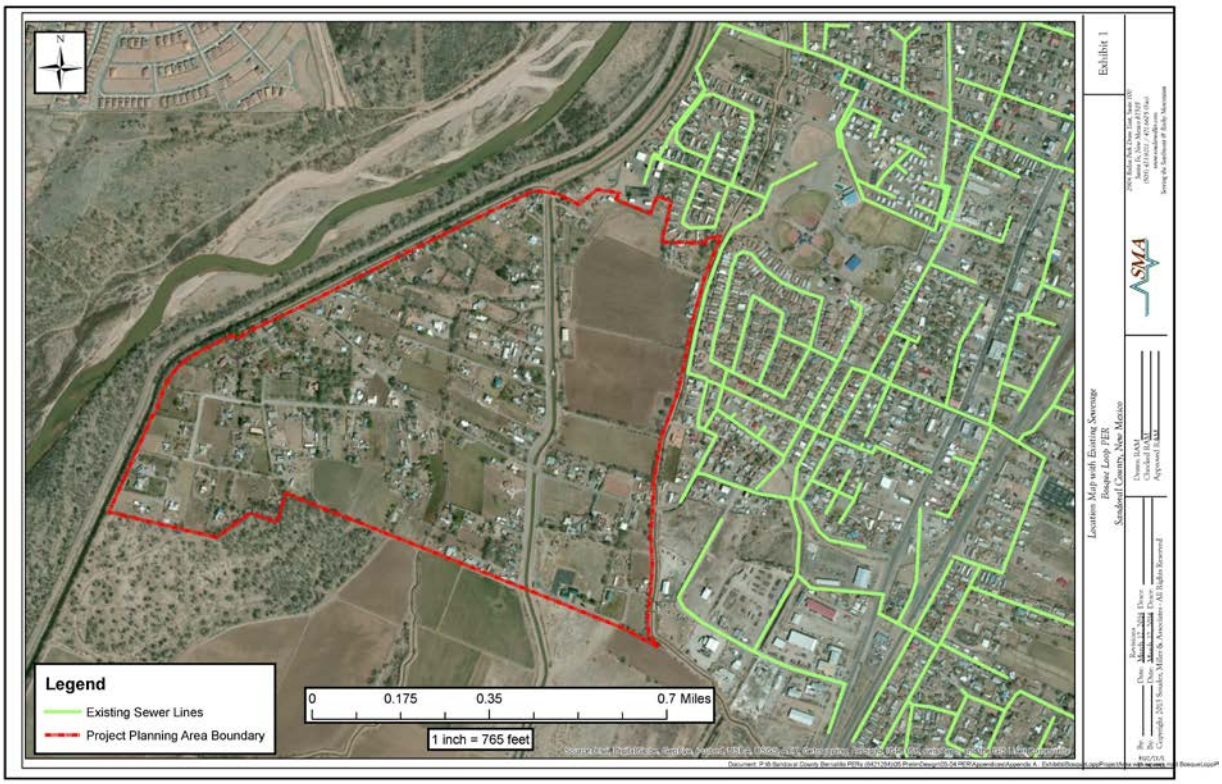

Figure 2: Existing Facilities

B. History

The project planning area is currently served by individual private septic tanks and leach field systems serving 126 existing homes on 165 parcels. These systems have been installed by private owners as needed.

C. Condition of Existing Facilities

The condition of the existing facilities is not fully known at this time. New Mexico Environment Department (NMED) is responsible for regulating wastewater systems in the state. NMED has only 89 permitted onsite septic systems in the project planning area for 126 existing homes. The rest of the onsite septic systems are assumed to have been installed prior to the 1970's when the NMED began requiring permits for residential onsite wastewater systems.

The systems within the area are assumed to be operational although their efficacy is unknown. The systems that have been permitted by NMED have generally been mound type, or elevated, drain fields within the project planning area, due to elevated ground water levels.

The Town of Bernalillo's wastewater system consists of collection lines, interceptors, lift stations, wastewater treatment, and disposal. The Town of Bernalillo's wastewater treatment plant (WWTP) is an extended aeration, activated sludge process with a capacity of 1.2 million gallons per day (mgd). The WWTP currently treats an average of 600,000 gpd of wastewater. The existing system has approximately 600,000 gpd of excess capacity. The WWTP is currently capable of treating the projected wastewater flows from the Bosque Loop area. Appendix D includes data and information on the existing Town of Bernalillo system.

D. Financial Status of any Existing Facilities

There is no public entity responsible for the wastewater systems within the project planning area. This report is intended to provide a proposed project that will enable the residents of the project planning area to connect to a new collection system that will be operated by the Town of Bernalillo. The most recent financial information for the Town of Bernalillo is provided in section 6F of this report.

E. Water/Energy/Waste Audits

At the time of this report the Town of Bernalillo did not have a water audit, energy audit, or waste audit.

3. NEED FOR PROJECT

A. Health, Sanitation, and Security

Residents, businesses and institutions in the planning area rely on on-site septic systems. Even with regular maintenance, septic systems can pollute local groundwater supplies, especially in areas with high groundwater and poor soils. Septic systems that do not receive regular, proper maintenance are an even greater risk to groundwater. Groundwater within the planning area ranges from about 8' to more than 25' below the surface according to NM OSE records. It is well documented that even properly functioning septic systems can contaminate groundwater supplies with nitrates which pose a significant health risk, especially to infants; while poorly functioning systems are a significant source of groundwater contamination from bacteria, protozoa and viruses which can cause numerous diseases including cholera, hepatitis A, and typhoid. Continued reliance on on-site septic systems and shallow domestic wells, without disinfection or other treatment, poses an increased health risk to residents, especially those that still rely on domestic wells for household water.

Based on the fact that homes with existing systems have requested the installation of replacement systems it is safe to assume that other systems in the area are either failing or will fail in the near future. Failing on-site systems present an even greater risk of contamination of the groundwater aquifer due to untreated human waste entering the groundwater.

The majority of the homes within the project planning area are connected to the Town of Bernalillo water system, but there are still domestic water wells in use at individual homes. According to the New Mexico Office of the State Engineer (NMOSE) records there are currently 36 active domestic wells within the project planning area. There are 125 current connections to the Town of Bernalillo water system and it is assumed that some of these properties also have working domestic wells. The homeowners that are not connected to the Town of Bernalillo water system are at the greatest risk from contaminated drinking water caused by septic systems in the area. Establishing a centralized wastewater collection and treatment system for the area would significantly reduce the health risks to the residents that still rely on domestic wells for their drinking water.

B. Aging Infrastructure

There are approximately 126 on-site wastewater treatment and disposal systems within the project planning area. It is assumed that approximately 37 of these systems were originally installed prior to the implementation of NMED septic tank permitting requirements which indicates that many of these systems are more than 35 years old. These systems are not routinely inspected meaning that a failing system may go unnoticed for an extended period of time before the homeowner notices a problem and initiates a repair. It is reasonable to believe that some systems within the planning area are regularly discharging untreated, or poorly treated, wastewater into the soils. The high groundwater in the area is very susceptible to contamination from these periodic system failures. In the Bosque Loop area some of the septic systems are being replaced. As they are replaced they are required to meet NMED regulations for irrigated conditions. There are approximately 200 acres according the Middle Rio Grande Conservancy District (MRGCD) that are irrigated within the project planning area. The older systems within the project planning area will continue to contribute to soil and groundwater contamination until they are replaced.

C. Reasonable Growth

There are approximately 403 people who currently live in the Project Planning Area and the projected population in the year 2034 will increase to an estimated 619. The purpose of this report is to develop a project that will connect the existing and future additional users to the Town of Bernalillo WWTP. These new users will pay for their individual use of the system based on the Town of Bernalillo wastewater rate structure. These new users will represent approximately $3,450 of additional monthly revenue for the Town of Bernalillo system in the beginning. This revenue will grow to a projected $5,920 per month at the end of the planning period based on projected growth and the current rate structure. Section 6, subheading I of this report provides a breakdown of all sources of income including a proposed rate schedule.

4. ALTERNATIVES CONSIDERED

The alternatives evaluated for the project planning area are:

1. No action
2. Pressure sewer system with connection to the Town of Bernalillo WWTP
3. Gravity sewer system with lift stations and connection to the Town of Bernalillo WWTP
4. Vacuum sewer system with connection to Town of Bernalillo WWTP

Each alternative is described in detail in the following sections.

A. Alternative #1 – No Action

i. Description

For this alternative no action would be taken to change, improve, or expand wastewater systems within the project planning area. System management, maintenance and operation would continue to be the responsibility of the individual homeowners within the project planning area and the probable groundwater contamination would remain.

ii. Design Criteria

There are no design criteria for this alternative.

iii. Map

A map of the project planning area is provided in Appendix A as Exhibit 1.

iv. Environmental Impacts

The most likely environmental impacts for this alternative are related to the continued use of on-site wastewater treatment and disposal systems. Septic systems and disposal fields commonly transmit pathogens, nitrates and other contaminants into groundwater causing concern for human health in the area. The area has high ground water levels, between 7 and 25 feet below ground surface (bgs), which can be easily contaminated by septic systems.

v. Land Requirements

There will be no land requirements with this alternative.

vi. Potential Construction Problems

There is no construction for this alternative.

vii. Sustainability Considerations

The current individual septic systems are not a sustainable method of disposing of sewage since the continued contamination of groundwater will increase the probability of causing health issues for residents in the area.

a. Water and Energy Efficiency

Not applicable

b. Green Infrastructure

Not applicable.

c. Other

This alternative promotes sustainability by continuing to use the existing system which eliminates the need to manufacture and install new sewer collection lines within the area. Initially this alternative will require much less energy and material than any alternative that requires new construction. As systems fail and are replaced, the differential will be less pronounced.

viii. Cost Estimates

Not applicable

B. Alternative #2 – Pressure Sewer System

i. Description

This alternative consists of a pressure sewer system with a connection to the Town of Bernalillo WWTP. The pressure sewer system would consist of grinder pump stations located at each residence, pressure sewer lines, and a connection to the existing Town of Bernalillo system. The grinder pumps for each service connection will be connected to the homeowner's power system and the cost of operating and maintaining these pumps will be the responsibility of the homeowner. There will be two tie-in points to the existing system. One tie in will be into an existing manhole directly adjacent to the Waste Water Treatment plant that will gather the majority of the sewage. The other connection will be into a manhole on Calle Laguna to meet the needs of the small area on the north east corner of the Project Planning area.

Each grinder pump station would collect the wastewater flow from the residence, grind the sewage, and pump the slurry into the service lines that would discharge into a main collection line. The combined pressure from the grinder pump stations would force wastewater flows through the collection lines, which would flow generally north, and discharge into a manhole near the existing Town of Bernalillo WWTP. This alternative includes approximately 19,000 linear feet to 2 to 4 inch piping and approximately 216 grinder pump stations to serve the area at the end of the 20-year planning period. The system also includes approximately 3,300 feet of pressurized transmission line that would extend north along the Albuquerque Main Canal to a connection at the Town of Bernalillo's WWTP.

ii. Design Criteria

Pressure sewers generally use smaller pipe diameters than conventional gravity sewers and are operated by small pumps instead of gravity flows. Pressure sewer systems can be considered a practical option for providing sewer service for low density rural areas. They are typically used in areas of hilly terrain, high water table, and congestion areas where gravity sewer lines my not be practical. Excavation and line costs are lower for pressure sewers due to the small diameter pipes and the shallow depths at which they can be buried. Pressure sewers are typically constructed in trenches that follow the natural grade of the terrain. The collection lines typically range from 2-4 inches in diameter and are typically buried 4 feet below the ground surface. Table 3 provides a summary of the design criteria for this alternative.

Table 3: Design Criteria for Alternative #2

System Element/Condition	Criteria
Minimum Pipe Diameter	2-4 inches
Minimum Velocity	3-7 fps
Minimum slope	Natural slope of existing topography
Minimum Desired Depth of Cover	4 feet, typically below frost line
Acceptable Pipe Materials	Poly Vinyl Chloride (PVC) or High Density Polyethylene (HDPE)

iii. Map

Exhibit 5 in Appendix A shows the conceptual layout of Alternative 2.

iv. Environmental Impacts

The environmental impacts of this alternative would primarily consist of the disruption and disturbance of the existing roadways. The area is already developed and most construction would be within existing right of ways and previously disturbed areas. Construction taking place

along the canal will need to take measures to prevent erosion and runoff into the canals or Rio Grande River channel.

v. Land Requirements

The land required for this alternative would be minimal. Small diameter sewer lines would be constructed under the existing roadways and are in shallow and narrow trenches that follow the existing topography. Grinder pumps would be installed on private property requiring easements from each homeowner. In some cases, adjacent homes may need access from neighbors land.

vi. Potential Construction Problems

Due to the high ground water within the project planning area some portions of construction may encounter groundwater during excavation and construction. Construction activities, noise and traffic, can cause a disturbance to homeowners in the area and will need to be monitored and planned to minimize the negative impact. Construction within the roadways may impact traffic flows on some of the narrow residential roadways win the area and the costs for asphalt replacement can be a significant factor. Access during construction could be limited due to area confinements and minimal roadway and driveway widths and lengths.

vii. Sustainability Considerations

a. Water and Energy Efficiency

This alternative is less energy efficient than other alternatives considered.

b. Green Infrastructure

Not applicable

c. Other

Not Applicable

viii. Cost Estimates

The total capital cost for Alternative #2 is estimated at $ 4,307,651. A summary of the cost estimate is shown in Table 4. Appendix E includes the capital and operational costs for this alternative.

Annual operation and maintenance costs are estimated for this alternative based on the Town of Bernalillo managing the proposed system and treating the wastewater. The annual operation and maintenance costs are estimated to be approximately $19,150 per year for the utility. Each homeowner will also be responsible for the power costs for operating the grinder pump for their residence which is estimated at $420 per year.

Table 4: Budget Estimate for Alternative #2

Item	Cost Estimate
Construction Costs	$ 3,076,894
Non-Construction Costs	$ 1,230,758
Total Estimated Project Cost	$ 4,307,651

C. Alternative #3 – Gravity Sewer System with Lift Station

i. Description

This alternative includes gravity sewer lines flowing into centrally located lift stations that pump the wastewater through a force main to discharge into the Town of Bernalillo WWTP.

The gravity collection system for this alternative would consist of 8 inch collection lines, two lift stations, and 4 inch force main that would discharge into a manhole located just north of the planning area. The system includes approximately 30,000 linear feet of 8 inch gravity sewer line, 5,000 linear feet of force main sewer line, 92 manholes, two lift stations and approximately 19,000 linear feet of 4 inch service lines.

ii. Design Criteria

Table 5 describes the system element and the criteria for each item[1].

Table 5: Design Criteria for Alternative #3

System Element/Condition	Criteria
Minimum Pipe Diameter	8 inches
Minimum velocity	2 fps at Average Daily Flow
Slope Between manholes	Sewers shall be laid with uniform slope between manholes
Design Flow Depth	½ Pipe Diameter
Steep Slope Protection	Sewers on 20% slopes or great shall be anchored securely with concrete, or equal
Minimum Pipe Slope for 8 inch pipe (ft. /100 ft.)	0.40
Minimum Service lateral Diameter	4 inch
Minimum Service Lateral Slope	1.5%
Minimum Desired Depth of cover	4 feet
Maximum Depth of cover	Depending on soil and loading and pipe field strength
Acceptable Pipe materials	Polyvinylchloride (PVC) HDPE high density polyethylene
Manholes-minimum diameter	4 feet

iii. Map

Exhibit 6 in Appendix A provides a conceptual layout of this alternative.

iv. Environmental Impacts

The environmental impacts of this alternative would primarily consist of the disruption and disturbance of the existing roadways. The area is already developed and most construction would be within existing right of ways and previously disturbed areas. There will be temporary disruptions to property owner's land to install gravity service connections to each home. Construction taking place along the canal will need to take measures to prevent erosion and runoff into the canals or Rio Grande River channel.

v. Land Requirements

The land required for this alternative would be minimal. Sewer lines would be constructed in the center of the roadways with manholes spaced approximately 400 feet apart and at intersections.

[1] New Mexico Environment Department Construction Programs Bureau, *Recommended Standards for Wastewater Facilities*, 2003

The land required for the lift station would consist of approximately 700 square feet that could be obtained through an easement from the Town of Bernalillo, MRGCD, or a private land owner.

vi. Potential Construction Problems

Due to the high ground water within the project planning area some portions of construction may encounter groundwater during excavation and construction that will need to be mitigated. Construction activities, noise and traffic, can cause a disturbance to homeowners in the area and will need to be monitored and planned to minimize the negative impact. Construction within the roadways may impact traffic flows on some of the narrow residential roadways win the area. Access while in construction could be limited due to area confinements and minimal roadway and driveway widths and lengths. The possibility of sandy soil conditions may require wider trenches for worker safety which would increase the cost of the project.

vii. Sustainability Considerations

a. Water and Energy Efficiency

This alternative relies on gravity for much of the wastewater flow into the two lift stations. This alternative is more energy efficient than other alternatives considered.

b. Green Infrastructure

Not applicable.

c. Other

Not applicable

viii. Cost Estimates

Total capital costs for this alternative are estimated at $ 7,865,368. A summary of the cost estimate is shown on Table 6. Appendix E contains the detailed cost estimate for this alternative.

Annual operation and maintenance costs are estimated for this alternative based on the Town of Bernalillo managing the proposed system and treating the wastewater. The annual operation and maintenance costs are estimated to be approximately $22,750.

Table 6: Budget Estimates for Alternative #3

Item	Cost Estimate
Construction Costs	$ 5,618,120
Non-Construction Costs	$ 2,247,248
Total Estimated Project Cost	$ 7,865,368

D. Alternative #4 – Vacuum Sewer System

i. Description

This alternative considers the construction of a vacuum sewer system to serve the area. A vacuum sewer system is comprised of gravity lines from each residence that connect to a vacuum valve pit. The valve pits are often designed to receive the sewage from more than one residence and do not require power to operate. The valve pit is connected to vacuum sewer mains that transport the sewage by a combination of gravity and vacuum suction to a central vacuum station. The vacuum station includes a vacuum pump, a storage tank and sewage pumps that transmit the sewage via a force main. The sewage would be delivered to an influent manhole located within the Town of Bernalillo WWTP site.

Vacuum sewers use a combination of gravity flow and vacuum suction to transport waste from individual homes to the WWTP. Wastewater is captured as it exits the home and flows by gravity to a small vacuum-valve pit that would be shared with nearby residences. When the pit reaches a specified level the valve would open and vacuum from the main lines would pull the waste from the pit and into the main lines moving towards the WWTP. The main sewer lines have vacuum applied from a vacuum station located along the main lines. The main lines are laid in a saw-tooth pattern where wastewater will flow by gravity for a length and then reach a small vertical lift where the vacuum system will lift the sewage into another gravity flow section. The vacuum applied to the main line will lift the wastewater through incremental vertical rises until it reaches the vacuum station. The sewage is collected at the vacuum station before being pumped from the station to the WWTP through an 8-inch force main.

One of the major advantages to a vacuum system is the ability to keep wastewater lines relatively shallow to avoid problems associated with constructing pipes in areas with shallow groundwater tables. The depth of the wastewater lines is dependent on the length of gravity flow pipe between lifts; the greater the distance between lifts, the fewer lifts needed but the deeper the wastewater lines need to be buried to maintain slope between the lifts. By installing more lifts, the pipes can be laid at shallower depths saving on construction cost for the piping, but this would result in increased capital and operating costs for the additional vacuum stations.

ii. Design Criteria

The project planning area is relatively flat, with elevation differences between areas typically being less than 10 feet. The canal that flows north to south and divides the planning area near the eastern portion of Bosque Loop creates an additional challenge for the layout of the system.

Table 7 provides a summary of the design criteria considered for this alternative.

Table 7: Design Criteria for Alternative #4

System Element/Condition	Criteria
Design Flow Depth	½ Pipe Diameter
Minimum Pipe Slope (ft. /ft.)	0.2%
Minimum Service lateral Diameter	4 inch
Minimum Desired Depth of cover	4 feet
Maximum Depth of cover	Depending on soil loading and pipe field strength
Preferred Pipe materials	SDR 21 PVC
Vacuum stations	1

iii. Map

Exhibit 7 in Appendix A provides a conceptual layout of this alternative.

iv. Environmental Impacts

This alternative is designed specifically for high groundwater and a flat terrain which is appropriate for the Project Planning area. There are no wetlands, endangered species or any documented historical or archaeological sites within the project area.

v. Land Requirements

Homeowner easements and land requirements for construction would be needed for the construction of the vacuum stations, and in some cases for the vacuum valve pits, and would be imperative for the project to be completed. Most of the construction would take place within existing roadways and right-of-ways. Homeowner cooperation would be needed for services to be connected from homes to the collection lines that would be appropriately installed in the roads or right of ways.

vi. Potential Construction Problems

Due to the high ground water within the project planning area some portions of construction may encounter groundwater during excavation and construction. Although mitigated to some extent by the vacuum system, it will likely be an issue for the construction of the vacuum stations. Construction activities, noise and traffic, can cause a disturbance to homeowners in the area and will need to be monitored and planned to minimize the negative impact. Construction within the narrow roadways may impact traffic flows on some of the narrow residential roadways within the area. Access while in construction could be limited due to area confinements and minimal roadway and driveway widths and lengths.

vii. Sustainability Considerations

a. Water and Energy Efficiency

This alternative relies on gravity for the major portions of the system, but due to the inherent inefficiency of vacuum systems will result in increased energy costs over other alternatives.

A study was performed by Daniel G. Burden P.E. on the efficiency of vacuum sewers. [2] The area of study was one square mile in the state of Florida. The area is similar to the Project Planning area in size and population. What was discovered was that vacuum systems were not as efficient as other alternatives and specifies that one traditional hydraulic lift station could be operated at a fraction of the cost of one vacuum lift station. The benefits of a vacuum system become apparent when each vacuum station can eliminate more than four or five traditional lift stations.

b. Green Infrastructure

Not applicable

c. Other

Not applicable

viii. Cost Estimates

[2] Daniel G. Burden, P.E., Public Works Magazine, September 2013, Energy Costs: gravity vs. vacuum sewers

Total capital costs for this alternative are estimated at $ 6,575,454. A summary of the cost estimate is shown on Table 8, and a detailed cost estimate is included in Appendix E of this report.

Annual operation and maintenance costs are estimated for this alternative based on the Town of Bernalillo managing the proposed system and treating the wastewater. The annual operation and maintenance costs are estimated to be approximately $39,600.

Table 8: Budget Estimates for Alternative #4

Item	Cost Estimate
Construction Costs	$ 4,696,753
Non-Construction Costs	$ 1,878,701
Total Estimated Project Cost	$ 6,575,454

5. SELECTION OF AN ALTERNATIVE

This section evaluates each of the alternatives based on both monetary and non-monetary factors.

A. Life Cycle Cost Analysis

The life cycles costs for each alternative evaluated are summarized in Table 9. Detailed cost estimates are included in Appendix E of this report.

Table 9: Summary of Life Cycle Costs

Category	Alternative 1 No Action	Alternative 2 Grinder	Alternative 3 Gravity	Alternative 4 Vacuum
Planning Period in Years	20			
20-Year Discount Rate	0.8%			
Present Value of Capital Cost (C)	$ 0	$ 4,307,651	$ 7,865,368	$ 6,575,454
Present Value of Total Annual O&M Costs (O&M)	$ 0	$ 352,470	$ 418,965	$ 729,216
Present Value of Salvage Value (S)	$ 0	$ 2,600,637	$ 5,313,192	$ 4,342,548
Net Present Value (NPV)	$ 0	$ 2,059,484	$ 2,971,141	$ 2,962,122

B. Non-Monetary Factors

i. Suitability

Each alternative considered is evaluated against the stated goals and objectives of Sandoval County, the Town of Bernalillo and the residents of the project planning area. The alternative that most completely addresses the stakeholders' objectives, including addressing public health and safety concerns, was assigned a rank of 4 and other alternatives are ranked from 3 to 1 according to their suitability.

ii. Ease of O&M

Each alternative considered has different O&M requirements. The alternatives considered are ranked against each other with the alternative requiring the least amount of O&M receiving a score of 4 and the alternative requiring the most receiving a score of 1.

iii. Operator Training Requirements

The Town of Bernalillo wastewater utility staff are currently trained to operate and maintain the existing system. Each of the alternatives considered are evaluated against the need to provide the existing staff with additional training for the operations and maintenance of the specific alternative. If no additional training is required the alternative received a score of 4. If the alternative considered would require additional training the alternative was ranked against other alternatives that would also require training, with the alternative requiring the least amount of training receiving a lower score.

A selection matrix was developed to evaluate each of the proposed alternatives and assist determining a recommended solution. The matrix includes the net present value of each alternative and the following non-monetary criteria:

- Suitability
- Ease of O&M
- Operator Training Requirements

The selection matrix in Table 10 scores each alternative from 1 to 4 against the 4 criteria with a score of 4 being the best. Each criterion is assigned a weighting factor to reflect the importance of that factor relative to the other criteria. The assigned weight for each of the criteria is then multiplied by its respective score, which returns a weighted score (WS). The weighted scores for each of the criteria under its respective alternative are then summed, which produces a final weighted score for each alternative considered. Each alternative is then ranked according to the weighted score.

Table 10: Selection Matrix

	Life Cycle Costs (4)	**Suitability (3)**	**Operations & Maintenance (2)**	**Training Requirements (1)**	**Raw Score**	**Weighted Score**	**Overall Rank**
Alternative 1 No Action	4	1	1	1	7	22	4
Alternative 2 Grinder	3	3	2	3	10	25	2
Alternative 3 Gravity	1	4	4	4	13	28	**1**
Alternative 4 Vacuum	2	2	3	2	9	25	2

The selection matrix indicates that Alternative 3, gravity sewer with lift stations, is the preferred alternative.

6. PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

The recommended alternative is to install a gravity sewer system with lift stations to serve the residents of the project planning area. A conceptual layout is provided in Appendix A as Exhibit 6.

A. Preliminary Project Design

i. Collection System/Reclaimed Water System Layout

The project will install new sewer lines throughout the project planning area. Lines will be placed within the roadway wherever possible to minimize environmental impacts, easements and other concerns related to disturbing previously untouched areas.

The proposed project will include approximately 30,000 linear feet of 8-inch PVC gravity sewer lines installed within the roadways. Gravity sewer lines will discharge into two lift stations (described in the next section). 48-inch diameter circular, precast concrete manholes will be installed at all sewer line intersections and along straight sections at intervals of approximately 400 feet. The project will include approximately 91 Manholes. The new system will connect to the existing Town of Bernalillo collection lines either at existing manholes, or a new manhole installed as part of the project, at two points.

Approximately 5,000 linear feet of 4-inch PVC force main sewer line will be installed from the lift stations to discharge manholes shown on the layout. The force mains will be installed within the existing roadways.

In addition the project will require the installation of approximately 19,000 linear feet of 4-inch PVC line for individual service connections. The alignment for each service connection line will be determined during the design phase in conjunction with the design engineers, the Town of Bernalillo and individual property owners.

ii. Pumping Stations

The project will include two new lift stations. The first lift station will be located near the intersection of Camino Del Bosque and Calle Dominguez. This lift station will handle the wastewater generated by the western portion of the project planning area. The second lift station will be located along the Bosque Loop approximately 400 feet north of Camino Del Bosque. This lift station will handle the wastewater for the majority of the remainder of the project planning area. The proposed locations for these lift stations are based on preliminary engineering design. SMA recommends that full consideration of all stakeholders be considered prior to the final lift station location to avoid, if possible, future disputed with landowners in the area. The proposed locations are also dependent upon the ability of the County to reach an agreement with a landowner regarding an easement. Homes in the extreme north-east portion of the project planning area will have their wastewater diverted directly into the Town of Bernalillo system by gravity.

The lift stations will be precast coated concrete wet-wells consisting of a circular basin, minimum of 4 feet in diameter and an approximate depth of 16 to 20 feet. Overhead power lines are present in both proposed lift station locations. The proposed lift stations would be secured by an 8’ tall perimeter fence.

The pump bases should be as specified by the pump manufacturer and have minimum 4" ductile iron (Class 200) discharge pipes, which run through the valve vault. There should be provided stainless steel lifting chains and floats for control of the pumps as called for and as recommended by the pump manufacturer. Floats should be provided for the control of the pumps and alarms.

iii. Storage

Not Applicable

iv. Treatment

Not Applicable

B. Project Schedule

The proposed project schedule is dependent on Sandoval County and the Town of Bernalillo priorities and funding availability. Estimated dates are not available at the time of this report. For scheduling purposes it is estimated that once the project implementation begins the design phase of the project will require approximately 6 months and the construction phase may take between 12 and 24 months depending on the amount of dewatering required and the weather conditions during construction.

C. Permit Requirements

Town of Bernalillo, MRGCD, NMED, Sandoval County

D. Sustainability Considerations

i. Water and Energy Efficiency

The proposed project makes use of gravity sewers to collect wastewater at the proposed lift stations thereby minimizing the energy required to operate the system. The proposed project is the most energy efficient of the alternatives considered.

ii. Green Infrastructure

Not applicable

iii. Other

The proposed project uses familiar technology that is currently in use by the Town of Bernalillo and therefore provides a level of operational sustainability that the other alternatives considered could not match.

As sewer service becomes more readily available, the opportunity to subdivide existing parcels will increase the density in the area. This increased density will increase the flow and potential revenue generated from the area. An analysis of the potential impact on the wastewater treatment plant indicated that the impact on the wastewater treatment plan will vary depending on how the area develops. Potential developed flows for the area were calculated based on information provided by Sandoval County, regarding potential lot densities. A value of 375 gpd per connection was used to predict flows, and the potential total wastewater flow from the area for each lot size is included in Table 11 below.

Table 11; Flow Estimate Based on Lot Size

Acreage	Quantity of lots in area	Gallons per day projected
1 acre	266 lots	99,750 gpd
.75 acres	286 lots	107,250 gpd
.5 acres	328 lots	123,000 gpd
.25 acres	453 lots	169,875 gpd

The wastewater treatment plant was designed for 1.2 million gallons per day and is currently operating at half capacity (approximately 600,000 gpd). Based on the table above, if the area were to develop at the highest possible density, the additional flows would not exceed the treatment capacity within the treatment plan. In addition the proposed system would only require an upgrade to the lift stations in order to handle the additional flow from future development. The proposed pipe sizes are sufficient for the possible future flow.

Based on this information, it is recommended that the lift station be designed with the capacity to either increase the pump sizes or the number of pumps to accommodate the additional flow, and the wet well be sized accordingly.

E. Total Project Cost Estimate

Project costs are estimated in detail in Table 12.

Table 12: Proposed Project Cost Estimate

Item	Description	Unit	QTY	Unit Price	Amount
1	Connect new 4 inch service line to owner's home, complete in place, including double cleanout, trenching, backfilling and testing	EA	126	$ 250	$ 31,500
2	4 inch service line, complete in place, including trenching, backfilling and testing	LF	19,000	$ 25	$ 475,000
3	Connect new 4 inch service line to sewer main complete in place, including trenching, backfilling and testing	EA	126	$ 250	$ 31,500
4	6 inch C-900 PVC sewer force main, complete in place, including trenching, backfilling and testing	LF	5,000	$ 25	$ 125,000
5	8 inch gravity SDR 35 sewer line including, trenching, backfill, compaction, and all appurtenances, CIP	LF	30,000	$ 40	$ 1,200,000
6	Jack and Bore/Directional Drill 18 inch Diameter and 1/2 inch thick Under MRGCD canals (including all material, labor, 8 inch SDR 35 carrier pipe, with restraints, end seals, casing spacers, fittings, bore pipe excavation, tracer wire, backfill, sheeting, shoring, location and temporary support of existing utilities, and other temporary measures as necessary for site protection and restoration including MRGCD provisions), CIP	LF	250	$ 400	$ 100,000
7	4' diameter Type E precast concrete manhole, cover, collar, tracer wire port , and connection of new sewer line for manholes (incl. materials, labor, excavation, backfill and site restoration), CIP	EA	91	$ 4,850	$ 441,350
8	Rehabilitate Existing Manhole at WWTP including all material, labor, and appurtenances. CIP	LS	1	$ 3,000	$ 3,000
9	Fiberglass packaged sewer lift station, including manhole, concrete/fencing/bollards, interior piping, valve vault, pumps, electrical & controls, electrical service riser, concrete slab, backfill, compaction, testing, including connections, CIP	LS	2	$ 225,000	$ 450,000
10	Electrical service for lift station, including power drop/pole, load center, meter box w/ meter, all conduit, wiring, switches, lights, outlets, concrete slab, backfill, compaction, testing, including connections, etc. CIP	LS	2	$ 25,000	$ 50,000
11	Waterline Crossing	EA	150	$ 300	$ 45,000
12	Dewatering for sewer line, up to 4’ drawdown, CIP	LF	11,000	$ 50	$ 550,000
13	Dewatering for sewer line, 4’ to 8' drawdown, CIP	LF	1,500	$ 60	$ 90,000
14	Dewatering for structure, up to 4’ drawdown, CIP	EA	48	$ 8,000	$ 384,000
15	Dewatering for structure, 4’ to 8’ drawdown, CIP	EA	12	$ 9,000	$ 108,000
16	Dewatering for structure, more than 8’ drawdown, CIP	EA	2	$ 10,000	$ 20,000
17	Abandon existing septic tank, including salvaging all equipment to owner, filling existing tank with sand, removing any above-ground equipment.	EA	126	$ 750	$ 94,500
18	Asphalt removal and replacement	SY	16,000	$ 35	$ 560,000
19	Chain Link Fence (8' tall) with 6' gate at each lift station site	LF	300	$ 40	$ 12,000
20	Purchase Easement for lift station placement	EA	2	$ 20,000	$ 40,000
21	Post Construction CCTV inspection of all sewer lines	LF	30,000	$ 2.50	$ 75,000
22	Provide, implement, and maintain Storm water Prevention Plan (SWPPP)	LS	1	$ 10,000	$ 10,000
23	Testing Allowance	LS	1	$ 25,000	$ 25,000
24	Construction Staking	LS	1	$ 30,000	$ 30,000
25	Traffic Control	LS	1	$ 75,000	$ 75,000
26	Potholing/ private line locating	HR	40	$ 250	$ 10,000
27	Mobilization/Demobilization	LS	1	$ 251,793	$ 251,793
	Construction Subtotal				$ 5,287,643
	NMGRT @ 6.25%				$ 330,477
	Construction Total				$ 5,618,120
	Construction Contingency @ 20%				$ 1,123,624
	Professional Services @ 15%				$ 842,718
	Private Property Access Mitigation @ 5%				$ 280,906
	Non-Construction Total				$ 2,247,248
	Total Project Cost				**$ 7,865,368**

F. Annual Operating Budget

The proposed project will be funded through Sandoval County and other funding agencies. The Town of Bernalillo will not provide funding, nor will they incur costs to implement the proposed project. The costs will be shared among the residents of the Project Planning Area and Sandoval County.

i. Income

The Town of Bernalillo Ordinance Number 159 establishes the current sewer system connection fees for the wastewater system and is included in the Appendix D of this report. The connection fee is based on the size of the customer's water meter and ranges from $1,200 for a customer with a ¾" water meter to $14,600 for a customer with a 4" water meter. The project planning area contains single family residences that are assumed to have 3/4" water meters resulting in a $1,200 connection fee for every new customer that the project connects. Assuming all 126 homes choose to connect to the system at the time of project construction the Town of Bernalillo would receive $151,200 in new user connection fees.

The Town of Bernalillo Ordinance Number 210 governing wastewater user rates is included in Appendix D of this report. The minimum residential user rate is set at $21.93 per month for anyone using 4,000 gallons of water or less per month. Each additional 1,000 gallons is charged at a rate of $3.38 during the winter months (based on the average water meter reading from the months of December, January and February), or at the user's 3-month average during the summer months. The ordinance notes a 25% surcharge on accounts that are outside of the Town limits. The project planning area is not within the Town limits and users would be subject to the 25% surcharge on wastewater rates.

Assuming the 126 new connections pay the minimum service fees, based on using less than 4,000 gallons of water per month, the Town of Bernalillo would receive approximately $3,500 per month in additional revenue upon project completion.

ii. Annual O&M Costs

The annual O&M costs of the proposed project are primarily estimated based on a general cost of pipeline maintenance, energy required to operate the lift stations, and the costs of maintaining the short-lived assets such as pumps and motors. The limited size of the project, when compared to the existing Town of Bernalillo system, indicate that the additional O&M costs are minimal in relation to the overall system.

The 2014 O&M budget for the Town of Bernalillo wastewater department is approximately $778,000. The proposed project is estimated by multiplying the 20 year present worth of $418,965 by the 20 year capital recovery factor of 0.054306 to increase the annual O&M costs by approximately $22,750, or approximately 3.5%. This expense will be more than offset by the expected increase in revenue from the new customers. The O&M Projections spreadsheet is located in Appendix E

iii. Debt Repayments

The Town of Bernalillo Wastewater Department has a current annual budget (2014) of approximately $778,000. A detailed budget breakdown for the fiscal year that ended on June 30, 2013 is included in Appendix D of this report.

The Town of Bernalillo provided information indicating the Town currently has three separate debt obligations tied to its public utilities. The debts are summarized in Table 13. More detailed information about the debts, including the reserve requirements, were not provided to SMA at the time of this report.

Table 13: Town of Bernalillo Utilities Debt Summary

Debt Issue Date	Principal	Annual Debt Service	Debt Retirement Date
2005	$ 2,938,111	$ 361,000	2015
2006	$ 3,280,329	$ 256,750	2027
2007	$ 8,815,000	$ 654,000	2028

The proposed project would require approximately $7.234 million to complete. For the purpose of this report it is assumed that the project would be funded by a combination loan financing and partial payment from municipal reserves. This report considers a loan for 90% of the project cost, or approximately $6.51 million in debt financing. A 20-year loan term for $6.51 million at an estimated interest rate of 3%[3] the annual debt service would be approximately $435,000.

iv. Reserves

- Debt Service Reserve – The debt reserve requirements for this project are conservatively estimated to be equal to 1 annual payment, or approximately $435,000. If this fund is to be established over the course of 1 year the Town of Bernalillo would be required to deposit approximately $36,000 per month for the first year of the loan.

- Short-Lived Asset Reserve - The proposed project short lived assets are shown in Table 14. The establishment of a reserve account for these assets would require an estimated $12,650 per month to be set aside for replacement and repair costs.

Table 14: Short Lived Assets

Short-Lived Asset	Expected Useful Life (years)	Estimated Replacement Cost (Current $)	Annual Reserve Required (Current $)
Pumps (6)	10	$ 46,500	$ 4,650
Pump Controls (2)	10	$ 20,000	$ 2,000
Pump Motors (6)	10	$ 60,000	$ 6,000
Totals		$ 126,500	$ 12,650

[3] 2014 NMFA Clean Water State Revolving Loan Fund Guidelines

7. CONCLUSIONS AND RECOMMENDATIONS

The residents of the project planning area are at risk of negative health consequences from the continued reliance on individual on-site wastewater treatment and disposal systems. The proposed project provides an opportunity for these residents to eliminate these health risks by connecting to a centralized wastewater collection and treatment system. The system is operated and managed by professional staff that are properly trained and regulated by various agencies to ensure that the system is operated in a safe and effective manner.

The proposed project will need to gain acceptance among residents within the project planning area, and secure funding in order to be realized, but these are minor obstacles when compared to the long-term benefits to the residents of the area, and the environment. Once the initial obstacles are overcome the design process is estimated to take 6 months. Once the design is completed construction can begin and the new collection system can be expected to be operational within 12 months of the start of construction.

This report considers the project to be a single project, but the area can easily be divided into smaller sections with construction being phased over a longer period to minimize the impact to the area and distribute the amount of funding needed over a longer time period. The possibilities of project phasing should be addressed during the design phase of the project with input from all of the project stake-holders and the project engineer.

It is the County's view that while a wastewater system will require participation from all active County properties in the Bosque plan area and that this will also require the closure and elimination of septic systems, this process will not require that all Bosque area residents connect to the Town water system and will not require residents to discontinue using a well for their water supply. The current levels of toxicity in the Bosque area soil, even with the approval, construction, and operation of a wastewater system, will take some time to resolve. It is important that Bosque residents are aware of this and that they have the Town water system option available to them to secure a safe water supply should they choose.

APPENDIX A

Exhibits

APPENDIX B

Environmental Resources Present

APPENDIX C

Population and Growth Data

APPENDIX D

Town of Bernalillo Documents

APPENDIX E

Cost Estimates

Alternative #2
Grinder Pumps and Pressure Sewer

Item	Description	Unit	QTY	Unit Price	Amount
1	Installation of Grinder Pumps including electrical connection to home, including all appurtenances CIP	EA	126	$ 2,500.00	$ 315,000.00
2	Electrical service for grinder pumps including temporary pole, conduit, panel, electrical drop from PNM, or connection to existing, concrete pad, CIP	LS	126	$ 1,500.00	$ 189,000.00
3	4" service connections with pigging ports, including all materials, trenching, backfill, compaction, CIP	EA	126	$ 1,000.00	$ 126,000.00
4	Connections to existing homes	EA	126	$ 500.00	$ 63,000.00
5	4 inch sewer service line including trenching, backfill, compaction, CIP	LF	17,100	$ 25.00	$ 427,500.00
6	4 inch C900 sewer force main including, trenching, backfill, compaction, CIP	LF	33,100	$ 25.00	$ 827,500.00
7	Jack and Bore/Directional Drill 8 inch Diameter and 1/2 inch thick Under MRGCD canals (including all material, labor, 4 inch C900 carrier pipe, with restraints, end seals, casing spacers, fittings, bore pipe excavation, Tracer wire, backfill, sheeting, shoring, location and temporary support of existing utilities, and other temporary measures as necessary for site protection and restoration including MRGCD provisions), CIP	LF	150	$ 200.00	$ 30,000.00
8	Double Cleanout, complete in place, including fittings, concrete pad, blocking, and dewatering if necessary	EA	83	$ 2,500.00	$ 207,500.00
9	Rehabilitate Existing Manhole at WWTP including all material, labor, and appurtenances. CIP	LS	1	$ 3,000.00	$ 3,000.00
10	Abandon existing septic tank, including salvaging all equipment to owner, filling existing tank with sand, removing any above-ground equipment.	EA	126	$ 750.00	$ 94,500.00
11	Waterline Crossing	EA	150	$ 300.00	$ 45,000.00
12	Asphalt removal and replacement	SY	8,000	$ 35.00	$ 280,000.00
13	Provide, implement, and maintain Storm water Prevention Plan (SWPPP)	LS	1	$ 10,000.00	$ 10,000.00
14	Testing Allowance	LS	1	$ 25,000.00	$ 25,000.00
15	Construction Staking	LS	1	$ 30,000.00	$ 30,000.00
16	Traffic Control	LS	1	$ 75,000.00	$ 75,000.00
17	Potholing/ private line locating	HR	40	$ 250.00	$ 10,000.00
18	Mobilization/Demobilization	LS	1	$ 137,900.00	$ 137,900.00
				Construction Subtotal	$ 2,895,900.00
				NMGRT @ 6.25%	$ 180,993.75
				Construction Total	$ 3,076,893.75
				Construction Contingency @ 20%	$ 615,378.75
				Professional Services @ 15%	$ 461,534.06
				Private Property Access Mitigation @ 5%	$ 153,844.69
				Non-Construction Total	$ 1,230,757.50
				Total Project Cost	$ 4,307,651.25

Alternative #3
Gravity Sewer with Lift Stations

Item	Description	Unit	QTY	Unit Price	Amount
1	Connect new 4 inch service line to owner's home, complete in place, including double cleanout, trenching, backfilling and testing	EA	126	$ 250.00	$ 31,500.00
2	4 inch service line, complete in place, including trenching, backfilling and testing	LF	19,000	$ 25.00	$ 475,000.00
3	Connect new 4 inch service line to sewer main complete in place, including trenching, backfilling and testing	EA	126	$ 250.00	$ 31,500.00
4	6 inch C-900 PVC sewer force main, complete in place, including trenching, backfilling and testing	LF	5,000	$ 25.00	$ 125,000.00
5	8 inch gravity SDR 35 sewer line including, trenching, backfill, compaction, and all appurtenances, CIP	LF	30,000	$ 40.00	$ 1,200,000.00
6	Jack and Bore/Directional Drill 18 inch Diameter and 1/2 inch thick Under MRGCD canals (including all material, labor, 8 inch SDR 35 carrier pipe, with restraints, end seals, casing spacers, fittings, bore pipe excavation, tracer wire, backfill, sheeting, shoring, location and temporary support of existing utilities, and other temporary measures as necessary for site protection and restoration including MRGCD provisions), CIP	LF	250	$ 400.00	$ 100,000.00
7	4' diameter Type E precast concrete manhole, cover, collar, tracer wire port , and connection of new sewer line, (incl. materials, labor, excavation, backfill and site restoration), CIP	EA	91	$ 4,850.00	$ 441,350.00
8	Rehabilitate Existing Manhole at WWTP including all material, labor, and appurtenances. CIP	LS	1	$ 3,000.00	$ 3,000.00
9	Precast Concrete sewer lift station, including manhole, concrete/fencing/bollards, interior piping, valve vault, pumps, electrical & controls, electrical service riser, concrete slab, backfill, compaction, testing, including connections, CIP	LS	2	$ 225,000.00	$ 450,000.00
10	Electrical service for lift station, including power drop/pole, load center, meter box w/ meter, all conduit, wiring, switches, lights, outlets, concrete slab, backfill, compaction, testing, including connections, etc. CIP	LS	2	$ 25,000.00	$ 50,000.00
11	Waterline Crossing	EA	150	$ 300.00	$ 45,000.00
12	Dewatering for sewer line, up to 4’ drawdown, CIP	LF	11,000	$ 50.00	$ 550,000.00
13	Dewatering for sewer line, 4’ to 8' drawdown, CIP	LF	1,500	$ 60.00	$ 90,000.00
14	Dewatering for structure, up to 4’ drawdown, CIP	EA	48	$ 8,000.00	$ 384,000.00
15	Dewatering for structure, 4’ to 8’ drawdown, CIP	EA	12	$ 9,000.00	$ 108,000.00
16	Dewatering for structure, more than 8’ drawdown, CIP	EA	2	$ 10,000.00	$ 20,000.00
17	Abandon existing septic tank, including salvaging all equipment to owner, filling existing tank with sand, removing any above-ground equipment.	EA	126	$ 750.00	$ 94,500.00
18	Asphalt removal and replacement	SY	16,000	$ 35.00	$ 560,000.00
19	Chain Link Fence (8' tall) with 6' gate at each lift station site	LF	300	$ 40.00	$ 12,000.00
20	Purchase Easement for lift station placement	EA	2	$ 20,000.00	$ 40,000.00
21	Post Construction CCTV inspection of all sewer lines	LF	30,000	$ 2.50	$ 75,000.00
22	Provide, implement, and maintain Storm water Prevention Plan (SWPPP)	LS	1	$ 10,000.00	$ 10,000.00
23	Testing Allowance	LS	1	$ 25,000.00	$ 25,000.00
24	Construction Staking	LS	1	$ 30,000.00	$ 30,000.00
25	Traffic Control	LS	1	$ 75,000.00	$ 75,000.00
26	Potholing/ private line locating	HR	40	$ 250.00	$ 10,000.00
27	Mobilization/Demobilization	LS	1	$ 251,792.50	$ 251,792.50
				Construction Subtotal	$ 5,287,642.50
				NMGRT @ 6.25%	$ 330,477.66
				Construction Total	$ 5,618,120.16
				Construction Contingency @ 20%	$ 1,123,624.03
				Professional Services @ 15%	$ 842,718.02
				Private Property Access Mitigation @ 5%	$ 280,906.01
				Non-Construction Total	$ 2,247,248.06
				Total Project Cost	$ 7,865,368.22

Alternative #4
Vacuum Sewer System

Item	Description	Unit	QTY	Unit Price	Amount
1	Furnish and Install Valve Pit – 8-foot model (incl. physical barrier, breather, cover, air intake and all other related appurtenances not included separately on Bid Form), CIP	EA	63	$ 5,500.00	$ 346,500.00
2	Furnish and Install Air-Terminal (incl. PVC pipe, connection to valve pit, fittings, and all other related appurtenances not included separately on Bid Form), CIP	EA	126	$ 350.00	$ 44,100.00
3	Furnish and Install 4-inch diameter sanitary sewer service line to connect to existing line or to home(incl. trenching, backfill, compaction, SCH-40 pipe, cleanouts) CIP	EA	126	$ 500.00	$ 63,000.00
4	Furnish and Install 6-inch vacuum sewer pipe (incl. trenching, backfill, compaction, pipe testing, Schedule 40 PVC pipe, fittings, bends, caps, wyes, reducers, warning tape, tracer wire, and all other related appurtenances not included separately on Bid Form), CIP	LF	35,000	$ 30.00	$ 1,050,000.00
5	Furnish and Install 6-inch Division Valve (incl. valve box, valve collar, key, and all other related appurtenances not included separately on Bid Form) CIP	EA	35	$ 1,750.00	$ 61,250.00
6	Furnish and Install 8-inch vacuum sewer pipe (incl. trenching, backfill, compaction, pipe testing, Schedule 40 PVC pipe, fittings, bends, caps, wyes, reducers, warning tape, tracer wire, and all other related appurtenances not included separately on Bid form), CIP	LF	5,000	$ 35.00	$ 175,000.00
7	Furnish and Install 8-inch Division Valve (incl. valve box, valve collar, key, and all other related appurtenances not included separately on Bid Form), CIP	EA	5	$ 2,000.00	$ 10,000.00
8	Furnish and Install 8-inch force main sewer pipe (incl. trenching, backfill, compaction, pipe testing, fittings, bends, caps, warning tape, tracer wire, and all other related appurtenances not included separately on Bid Form), (CIP)	LF	7,750	$ 35.00	$ 271,250.00
9	Jack and Bore/Directional Drill 18 inch Diameter and 1/2 inch thick Under MRGCD canals (including all material, labor, 8 inch SDR 35 carrier pipe, with restraints, end seals, casing spacers, fittings, bore pipe excavation, tracer wire, backfill, sheeting, shoring, location and temporary support of existing utilities, and other temporary measures as necessary for site protection and restoration including MRGCD provisions), CIP	LF	150	$ 400.00	$ 60,000.00
10	Electric Services for New Vacuum Station Building (incl. extension of 3-phase power and all other related appurtenances not included separately on Bid Form), CIP	EA	2	$ 25,000.00	$ 50,000.00
11	New Vacuum Station Building (incl. excavation, compaction, structural fill, slab, walls, roofing, electrical, plumbing, mechanical, all piping inside and within 10 feet of the building, etc.), As Shown On Plans, CIP	LS	2	$ 350,000.00	$ 700,000.00
12	Furnish and Install Vacuum Pump Station/Equipment (incl. vacuums, collection tank, booster pumps, control panels, piping, Bio-Mass Filter Bed and all related	LS	2	$ 350,000.00	$ 700,000.00
13	Chain Link Fence (8' tall) with 6' gate at each lift station site	LF	1,000	$ 40.00	$ 40,000.00
14	Dewatering for structure, up to 4’ drawdown, CIP	EA	1	$ 8,000.00	$ 8,000.00
15	Dewatering for structure, 4’ to 8’ drawdown, CIP	EA	1	$ 10,000.00	$ 10,000.00
16	Dewatering for structure, more than 8’ drawdown, CIP	EA	1	$ 12,000.00	$ 12,000.00
17	Asphalt remove and replace (incl. base course, compaction, and all other related appurtenances not included separately on Bid Form), CIP	SY	8,000	$ 35.00	$ 280,000.00
18	Abandon existing septic tank, including salvaging all equipment to owner, filling existing tank with sand, removing any above-ground equipment.	EA	126	$ 750.00	$ 94,500.00
19	Purchase Easement for Vacuum Station placement	EA	2	$ 10,000.00	$ 20,000.00
20	Waterline Crossing	EA	150	$ 300.00	$ 45,000.00
21	Provide, implement, and maintain Storm water Prevention Plan (SWPPP)	LS	1	$ 10,000.00	$ 10,000.00
22	Testing Allowance	LS	1	$ 25,000.00	$ 25,000.00
23	Construction Staking	LS	1	$ 30,000.00	$ 30,000.00
24	Traffic Control	LS	1	$ 75,000.00	$ 75,000.00
25	Potholing/ private line locating	HR	40	$ 250.00	$ 10,000.00
26	Post Construction CCTV inspection of all sewer lines	LF	7,750	$ 2.50	$ 19,375.00
27	Mobilization/Demobilization	LS	1	$ 210,498.75	$ 210,498.75
				Construction Subtotal	$ 4,420,473.75
				NMGRT @ 6.25%	$ 276,279.61
				Construction Total	$ 4,696,753.36
				Construction Contingency @ 20%	$ 939,350.67
				Professional Services @ 15%	$ 704,513.00
				Private Property Access Mitigation @ 5%	$ 234,837.67
				Non-Construction Total	$ 1,878,701.34
				Total Project Cost	$ 6,575,454.70

Life Cycle Cost Calculations

	Alternate 2 Grinder Pumps	Alternate 3 Gravity Sewers	Alternate 4 Vacuum Sewers
Total Capital Cost (Construction & Non-construction)	$ 4,307,651.00	$ 7,865,368.00	$ 6,575,454.00
Present Value of Capital Cost (C)	$ 4,307,651.00	$ 7,865,368.00	$ 6,575,454.00
Annual O&M Costs	$ 19,141.23	$ 22,752.33	$ 39,600.80
Present Value of Total Annual O&M Costs (O&M)	$ 352,469.88	$ 418,965.37	$ 729,215.99
Salvage Value	$ 3,049,920.80	$ 6,231,094.40	$ 5,092,763.20
Present Value of Salvage Value (S)	$ 2,600,636.97	$ 5,313,191.88	$ 4,342,548.25
Net Present Value (NPV)	$ 2,059,483.91	$ 2,971,141.48	$ 2,962,121.74

Discount Rate 20-year (%)	0.8
Planning Period (years)	20

Proposed Project
O&M Calculations

Lift Station Maintenance

	Replacement Cost	Useful Life	Quantity	PWF	Annual Replacement Costs
Sewage Pumps	7750	10	6	0.9234	$ 4,294
Control Panel	10000	10	2	0.9234	$ 1,847
Miscelaneous Equipment	5000	10	2	0.9234	$ 923
				Total Annual	**$ 7,064**

Lift Pumping Stations Power Costs

year	flow	estimated annual cost	PWF	PW of Annual Power Costs
1		$ 5,240.00	0.9921	$ 5,198.60
2		$ 5,240.00	0.9842	$ 5,157.21
3		$ 5,240.00	0.9764	$ 5,116.34
4		$ 5,240.00	0.9686	$ 5,075.46
5		$ 5,240.00	0.9609	$ 5,035.12
6		$ 5,240.00	0.9533	$ 4,995.29
7		$ 5,240.00	0.9457	$ 4,955.47
8		$ 5,240.00	0.9382	$ 4,916.17
9		$ 5,240.00	0.9308	$ 4,877.39
10		$ 5,240.00	0.9234	$ 4,838.62
11		$ 5,240.00	0.9161	$ 4,800.36
12		$ 5,240.00	0.9088	$ 4,762.11
13		$ 5,240.00	0.9016	$ 4,724.38
14		$ 5,240.00	0.8944	$ 4,686.66
15		$ 5,240.00	0.8873	$ 4,649.45
16		$ 5,240.00	0.8803	$ 4,612.77
17		$ 5,240.00	0.8733	$ 4,576.09
18		$ 5,240.00	0.8664	$ 4,539.94
19		$ 5,240.00	0.8595	$ 4,503.78
20		$ 5,240.00	0.8527	$ 4,468.15
		$ 104,800.00	**Total**	**$ 96,489.36**

Pipeline Maintenance

Item	Unit Price	Length of Pipe	Annual Pipe O&M	20-year Pipe O&M NPV
Maintenance	$ 0.10	35,000	$ 3,500.00	**$ 64,449**

Treatment Costs

item	Annual Cost	PWF	NPV
Chemicals	$ -	0.9207	$ -
Power	$ 5,240.00	0.9207	$ 96,489.36
Testing	$ 8,400.00	0.9207	$ 154,677.60
Total			**$ 251,166.96**

Total O&M Costs

20 year present worth O&M		$ 419,169.33
20 year capital recovery factor		0.054306
annual cost of O&M		$ 22,763.41