Wastewater Pumping Station Feasibility Report

for

The Pagosa Springs Sanitation General Improvement District

Bartlett & West, Inc.
1200 SW Executive Dr.
Topeka, Kansas 66615

W.O. 17856.001
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1 Executive Summary

In 2010, a Preliminary Engineering Report (PER) was prepared for the Pagosa Springs Sanitation General Improvement District (PSSGID) that addressed the treatment and disposal of the Town's wastewater. The PER concluded that the best option was to build a new mechanical type treatment plant. The project was subsequently designed and due to a variety of situations including bid results well in excess of the budgeted amount and subsequent additional construction costs to protect the facility from the 500 year flood has caused PSSGID to reassess their options. Recent discussions between PSSGID and the Pagosa Area Water and Sanitation District (PAWSD) has initiated a more thorough review of constructing a wastewater conveyance system consisting of sewage pump station(s) and force main(s) to deliver PSSGID's wastewater to PAWSD's Vista WWTP for treatment and disposal. This wastewater conveyance system from PSSGID to PAWSD is the focus of this Preliminary Engineering Report.

Currently the Town's sewage, which has averaged 0.239 million gallons per day (MGD), is treated by a three cell aerated lagoon system. The facility is no longer capable of treating the wastewater to acceptable levels within the currently permitted effluent limits. To compound the situation, the effluent is discharged into the San Juan River that is used for recreational and a raw water supply source for PAWSD's Water Treatment Plant (WTP).

The need for this project is to provide a viable economic and environmental solution for the proper treatment and disposal of PSSGID's wastewater.

To determine the best overall solution to this situation, the overall project was divided into two components; the force main(s) and pumping station(s). Three alternatives for each were reviewed and analyzed to determine the selected alternative for each component.

2 Growth Areas and Population Trends

The first step is to determine the estimated population for the 20 year design period. Assuming that the current economic recovery continues, planning for a 2.3% growth rate is appropriate. At the 2.3% growth rate, and projecting out 20 years, the projected population is 2,848. This population number will be rounded up approximately 5% to add a conservative buffer. Based on this, the project will be designed for a service population of 3,000.

3 Wastewater Flow Forecasts

As indicated in the previous WWTP PER, commercial wastewater flow contributions were estimated at a conservative annual contribution of 20 percent or 0.18 MGD. A 3x peaking factor was used which is consistent with this size community and 50% more than the maximum calculated monthly peak of 2.01 for the last 10 years. Based on a combination of the commercial flows and residential flows, the selected alternative will be designed for a total flow of 1.08 MGD or 750 gallons per minute.

4 Force Main Pipe Material

The preferred alternative for this project is PVC. The roughness coefficient is comparable with HDPE while also having a much larger internal diameter than HDPE, although not as large as DIP. This makes it the optimal choice in regards to head loss. PVC is also less costly than DIP in the same pipe size, and would be less costly than HDPE when considering that HDPE would have to increase a pipe size due to the smaller internal diameter.

5 Force Main Size

Much like the pipe material, pipe size affects each of the alternatives. The design flow rate of 750 GPM can be conveyed by either an 8" diameter or 10" diameter. Obviously, the 10" pipe size provides the most capacity for future growth, however that future capacity comes with some distinct disadvantages. The minimum flow rate that is recommended in a 10" line is 750 GPM which equates to a velocity of just over 3 feet per second (fps). This means that the pump's flow rate cannot be reduced to more closely match the current and foreseeable future flows.

Compared to a 10" diameter force main, the 8" diameter is a better fit for this situation. The smaller size will allow the pumps to be slowed down and pump 500 GPM, which equates to a velocity of 3 fps. This flow will better match existing flows and will provide reduced electrical power from the lower speed. While the smaller line size will not provide the ultimate capacity that a 10" would, an 8" force main would be able to convey up to 1,250 gallons per minutes, which would exceed the flow projections for the next 20 years. In addition, by reducing the pumping rate, the actual horsepower used will be reduced as well as lowering energy costs which the 10-inch size will not provide.

Based on the above information each alternative assumes the use of 8-inch PVC pipe.

6 Force Main Route Alternates

Three force main alignments were considered; Alternate No. 1 - the Trails Route, Alternate No. 2 - South Pagosa Route and Alternate No. 3 - the Meadows Route. All three force main routes are almost identical in length with only 282 feet difference between the shortest and longest. The Meadows Route is approximately 36,208 feet, the Trails Route force main is approximately 36,482 feet long and the South Pagosa Route is about 36,490. Each route alignment along with the associated pump station location is provided as **Figure 1**.

In addition, each force main will virtually see the same static head, pumping from a ground elevation of approximately 7010 to elevation 7610+ where it crosses Put Hill or the southerly extension of Put Hill for the other two force main routes.

The estimated construction costs for each of the three force main alternates is as follows:

- Alternate No. 1 – Trails Route: $2,214,944
- Alternate No. 2 – South Pagosa Route: $2,193,272
- Alternate No. 3 – Meadows Route: $2,177,648

The force main alternate selected was No. 3, the Meadows Route for a number of reasons. This route results in the least amount of disruption during construction, utilizes the existing PAWSD's LS 18 site and hydraulically the route maximizes the use of down gradient sections thereby reducing energy costs. It is also the lowest cost alternative and minimizes the environmental impacts by maximizing the use of existing easements and road right-of-way.

The alignment as well as a preliminary profile of the selected Meadows Route is shown on **Figure 2**.

7 Pump Station Alternates

Similar to the force main routes, there are three Pump Station Alternates; Alternate No. 1 – Progressive Cavity Pump Station, Alternate No. 2 – Dry Mounted Pump Station and Alternate No. 3 – Submersible Pump Station.

Given the 36,000 feet of length and over 600 feet of vertical rise, there are no pumps available that are capable of pumping raw sewage all the way from PSSGID's WWTP to PAWSD's Vista WWTP. Therefore two pump stations are required.

The following items describe the criteria used to analyze the viability of the three pumping alternatives and to develop preliminary cost estimates.

8" FORCE MAIN						
Design Condition	Pump Station No. 1			Pump Station No. 2		
	Flow	Static Head	TDH	Flow	Static Head	TDH
1	750	345	452	850	344	452
2	500	345	381	600	344	387

Progressive Cavity pumps are the only type capable of pumping to halfway with only one pump. The Dry Mount and Submersibles require two pumps in series for the same condition.

Each type of pump station was reviewed for a variety of parameters including their operational and construction requirements. The estimated construction costs for each of the three pump station alternates are as follows:

- Alternate No. 1 – Progressive Cavity Pump Station: $2,733,000
- Alternate No. 2 – Dry Mounted Pump Station: $2,670,000
- Alternate No. 3 – Submersible Pump Station: $2,210,000

The pump station alternate selected was again No. 3, the Submersible Pump Station. The submersible pump station alternative does not require an auxiliary system such as a vacuum prime system for the station to operate as a dry mounted pump set up does and it is capable of handling larger solids up to 3-inches and does not require a comminutor as the progressive cavity set up does. All four pumps at each station can be the same, which standardizes the pumps and reduces the inventory of spare parts as well as being the lowest cost alternative.

8 Environmental Benefits

The largest positive impact this project has is the total elimination of wastewater effluent discharge into the San Juan River and the negative impacts that has on the river's overall health and recreational aspects as well as impacting the downstream raw water source for the PAWSD's WTP.

The Meadows Route maximizes the use of existing easements and right-of-way to minimize any potential environmental impacts.

Pump Station No. 1 will be sited at the southwest corner of PSSGID's existing WWTP site at the southwest corner of the previously decommissioned and abandoned lagoon cell. The area required will be filled in and built up so the station is above both the 100 and 500 year flood elevations.

Pump Station No. 2 will be sited at the current location of PAWSD's existing Lift Station 18. This site is not within either the 100 or 500 year flood plain.

Both pump station sites were disturbed by either the previous lagoon construction or the existing lift station construction.

9 Cost Estimate

Cost estimate for the selected route and pump station are broken down by force main and pump station with Force Main 1 grouped with Pump Station No. 1 and similarly for No. 2. Tables 1 and 2 provide the costs associated with Pump Station and Force Main 1 and 2 respectively along with contingencies, engineering and construction administration. Table 3 combines them for a total estimated project cost.

Table 1 Force Main #1 & PS#1 Cost Estimate

Item		Cost (in 2012 $)
Force Main		$296,400
Rock Excavation		$374,400
Pipe Bedding		$109,200
Backfill & Compaction		$93,600
Air Release Valves		$60,000
	Subtotal Force Main #1 Construction	**$933,600**
	Construction Contingency	$140,040
	Engineering and Construction Administration Costs	$93,360
Force Main #1 Capital Costs		**$1,167,000**
Pumps		$235,000
Piping		$75,000
Wet Well		$75,000
Building		$210,000
Electrical		$300,000
Standby Generator		$100,000
Yard Piping		$275,000
Site Work		$40,000
	Subtotal PS#1 Construction	**$1,310,000**
	Construction Contingency	$196,500
	Engineering and Construction Administration Costs	$131,000
PS#1 Capital Costs		**$1,637,500**
	Subtotal Construction Force Main #1 & PS#1	**$2,243,600**
	Construction Contingency	$336,540
	Engineering and Construction Administration Costs	$224,360
Total Capital Costs		**$2,804,500**

Table 2 Force Main #2 & PS#2 Cost Estimate		
Item		**Cost (in 2012 $)**
Force Main		$391,552
Rock Excavation		$494,592
Pipe Bedding		$144,256
Backfill & Compaction		$123,648
Air Release Valves		$90,000
	Subtotal Force Main #2 Construction	**$1,244,048**
	Construction Contingency	$186,607
	Engineering and Construction Administration Costs	$124,405
Force Main #2 Capital Costs		**$1,555,060**
Pumps		$235,000
Piping		$75,000
Wet Well		$75,000
Building		$210,000
Electrical		$170,000
Standby Generator		$100,000
Yard Piping		$20,000
Site Work		$15,000
	Subtotal PS#2 Construction	**$900,000**
	Construction Contingency	$135,000
	Engineering and Construction Administration Costs	$90,000
PS#2 Capital Costs		**$1,125,000**
	Subtotal Construction Force Main #2 & PS#2	**$2,144,048**
	Construction Contingency	$321,607
	Engineering and Construction Administration Costs	$214,405
Total Capital Costs		**$2,680,060**

Table 3 Total Cost Estimate		
Total Construction Costs		**$4,387,648**
	Construction Contingency	$658,147
	Engineering and Construction Administration Costs	$438,765
Total Capital Costs		**$5,484,560**