

COMPARISON OF CENTRALIZED AND DECENTRALIZED WASTEWATER MANAGEMENT STRATEGIES

AS PART OF

DECENTRALIZED WASTEWATER MANAGEMENT FACILITY PLAN

FOR

CANAAN VALLEY, TUCKER COUNTY, WV



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Submitted to:

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1. INTRODUCTION

Lombardo Associates, Inc. (LAI) has been retained to develop a Canaan Valley decentralized wastewater management facilities plan (WWMP), which meets the water quality standards and is protective of public health and safety. A Facilities Plan was previously developed by Thrasher Engineering that proposed a centralized WWMP. LAI has developed a Preferred Plan that proposes a decentralized approach to achieve water quality standards in Canaan Valley. The purpose of this report is to compare the decentralized approach to the centralized approach.

2. CENTRALIZED WWMP SUMMARY

The November 2001 Amendment to the Facilities Plan developed by Thrasher Engineering proposed a centralized wastewater management system that would connect all the existing collection systems to a centralized wastewater treatment facility (WWTF). This proposed collection system has the following components:

- 115 manholes
- 35,500 LF of 4" – 8" gravity sewers
- 88,150 LF of 1-½" – 8" force mains
- 10 simplex grinder pump stations
- 17 duplex grinder pump stations
- 7 major non-clog pump stations
- 2 wetwell aeration systems
- 2 odor control systems

The proposed treatment system has the following components:

- Headworks with bar screen and grit removal equipment
- O&M building
- Triple loop oxidation ditch
- 1 final and 2 secondary clarifiers
- Aerated sludge holding system
- Sludge press system
- UV Disinfection
- Dissolved oxygen basin
- Discharge system

The proposed discharge system has the following components:

- 1 duplex non-clog pump station
- 13,000 LF of 12" force main
- Flow meter

The system proposed would take flow from each of the existing collection systems in Canaan Valley and convey it to the centralized facility. The orbal ditch treatment process selected does not require tertiary filtration to meet effluent requirements. One advantage to combining facilities is a reduction in the peaking factor of the influent flow. This ensures a base level of flow to maintain the biological processes necessary for treatment. Another advantage of the centralized option is that public sewers will be available for private residences that may wish to abandon their septic systems and connect to the sewer. This would help facilitate a reduction in the non-point sources of pollution, especially in areas with poor soils.

3. DECENTRALIZED WWMP SUMMARY

The decentralized WWMP developed by LAI is summarized in the 2006 Facility Plan Report. The option selected was Scenario I, where all WWTFs are proposed to be replaced at their existing location with new

- Timberline and Canaan Valley State Park Lodge - use of MBR treatment systems
- For all other WWTFs, use of the RMF treatment systems. These systems have the advantage of simplicity of operations, low sludge production, reliability under highly variable wastewater flows and low operating costs.

Total capital, O&M and life cycle costs were developed for each of the proposed replacement systems.

Scenario I costs were initially developed for participating facilities only. For the purposes of comparing the decentralized plan to the centralized plan, the costs for non-participating facilities were prorated based on flow from similarly sized participating facilities for which detailed cost estimates were performed. Detailed cost estimates were prepared for MBR facilities at the CVSP Lodge and Timberline. The costs for these systems and the other non-participating facilities were added to the Scenario I costs to determine the total cost of a decentralized system with all facilities participating. The life cycle cost analysis for the full decentralized system is presented in Table 4-1.

4. COST COMPARISON OF CENTRALIZED AND DECENTRALIZED WWMP

4.1. Present Worth Comparison

The costs for the centralized system were presented in Amendment No. 1 of the Thrasher Facility Plan. The ENR Construction Cost Index was used to update the construction costs from 2001 to 2006. The development and O&M costs were inflated at a rate of 3% per year over the same period. The updated cost of the centralized system is as follows:

| Construction Cost Adjustment | |
|--|---------------------|
| 2001 Centralized Plan Construction Costs | \$13,400,000 |
| Jan. 2005 ENR index / Jan. 2001 ENR index | 0.842 |
| Jan. 2005 ENR index | 7295.5 |
| Jan. 2006 ENR index | 7660.29 |
| 2006 Centralized Plan Construction Costs | \$16,710,246 |
| Development Costs Adjustment | |
| 2001 Development Costs | \$2,450,000 |
| Inflation Rate | 3% |
| # of years | 5 |
| 2006 Project Costs | \$2,840,221 |
| 2006 Centralized Plan Total Capital Costs | \$19,550,468 |
| O&M Costs Adjustment | |
| 2001 O&M Costs | \$387,093 |
| Inflation Rate | 3% |
| # of years | 5 |
| 2006 Centralized Plan Total O&M Costs | \$448,747 |

Table 4-1 presents the results of a total life cycle cost comparison for the decentralized and centralized plans. A depreciation fund in the amount of 1% of construction costs was included in the O&M costs for the decentralized system. This cost was not included in the centralized plan O&M costs. To accurately compare the two systems, the fund was deducted from the O&M costs of the decentralized system.

TABLE 4-1: LIFE CYCLE COST COMPARISON OF CENTRALIZED AND DECENTRALIZED WWMP

| Facility Name | Total Life Cycle Costs | | | | | | |
|------------------------------------|------------------------|-----------------------------------|--------------------------------|------------------------|---|--------------------------------|-----------------------|
| | Total Capital Cost | Net Annual O&M Costs ¹ | Depreciation Fund ² | Gross Annual O&M Costs | Present Worth of O&M Costs (20 yrs. @ 5.875%) | Present Worth of Salvage Value | Total Life Cycle Cost |
| Beaver Ridge | \$997,000 | \$36,000 | \$7,700 | \$43,700 | \$420,000 | \$178,000 | \$1,239,000 |
| Black Bear | \$707,000 | \$33,000 | \$5,500 | \$38,500 | \$390,000 | \$115,000 | \$982,000 |
| Blackwater Center | \$371,000 | \$30,000 | \$2,900 | \$32,900 | \$350,000 | \$64,000 | \$657,000 |
| Canaan Village | \$1,330,000 | \$48,000 | \$10,300 | \$58,300 | \$560,000 | \$240,000 | \$1,650,000 |
| C.V. Nat. Wildlife Refuge | \$428,000 | \$30,000 | \$3,300 | \$33,300 | \$350,000 | \$60,000 | \$718,000 |
| CVSP - Cabins | \$371,000 | \$25,000 | \$2,900 | \$27,900 | \$290,000 | \$64,000 | \$597,000 |
| CVSP - Ski Area | \$612,000 | \$42,000 | \$4,800 | \$46,800 | \$490,000 | \$320,000 | \$782,000 |
| CVSP - Lodge | \$1,920,000 | \$135,000 | \$14,800 | \$149,800 | \$1,570,000 | \$370,000 | \$3,120,000 |
| CVSP - Campground | \$371,000 | \$25,000 | \$2,900 | \$27,900 | \$290,000 | \$64,000 | \$597,000 |
| CVSP - Clubhouse | \$371,000 | \$25,000 | \$2,900 | \$27,900 | \$290,000 | \$64,000 | \$597,000 |
| Deerfield Village | \$961,000 | \$36,000 | \$7,400 | \$43,400 | \$420,000 | \$180,000 | \$1,201,000 |
| LOCHOA | \$833,000 | \$35,000 | \$6,500 | \$41,500 | \$410,000 | \$135,000 | \$1,108,000 |
| North Point / North Lake | \$1,314,000 | \$39,000 | \$10,200 | \$49,200 | \$460,000 | \$252,000 | \$1,522,000 |
| Timberline | \$2,030,000 | \$141,000 | \$15,700 | \$156,700 | \$1,640,000 | \$390,000 | \$3,280,000 |
| Windwood and Talheim | \$1,640,000 | \$44,000 | \$12,700 | \$56,700 | \$510,000 | \$216,000 | \$1,934,000 |
| Total Decentralized Plan | \$14,256,000 | \$724,000 | \$110,500 | \$834,500 | \$8,440,000 | \$2,712,000 | \$19,984,000 |
| Total Centralized Plan | \$19,190,000 | \$449,000 | \$0 | \$449,000 | \$5,200,000 | \$3,680,000 | \$20,710,000 |
| Centralized - Decentralized | \$4,934,000 | -\$275,000 | | -\$385,500 | | | \$726,000 |

¹The Decentralized Plan included a 1% Depreciation Fund for all facilities in the annual O&M costs that was not included in the Centralized Plan. This number does not include the fund.

²The gross annual O&M costs were calculated by adding the depreciation fund to the net annual O&M costs.

4.2. Potential Savings Associated with the Decentralized System

Due to the uncertainty surrounding which facilities would be participating, the costs for each individual system were estimated for the participating facilities. No savings were credited for the economies of scale associated with one entity owning and operating all the WWTFs in Canaan Valley. There are savings associated with combining the inspections and maintenance visits. By having one entity secure all sampling and O&M services, the economies of scale will result in lower costs than the ones used in cost estimates for the decentralized option's WWTFs. The decentralized approach also offers the possibility of phasing construction to save on initial capital costs.

There are many factors that will affect the ability to realize the potential savings associated with the Decentralized Plan. The management entity will ultimately decide how to proceed. Table 4-2 shows the potential savings, on a present worth basis, associated with phasing construction and taking advantage of the economies of scale discussed above. Table 4-3 shows how this will impact life-cycle costs.

TABLE 4-2: POTENTIAL SAVINGS WITH DECENTRALIZED PLAN

| Potential Savings - Decentralized Plan | Present Worth of Savings |
|---|--------------------------|
| Phased construction for facilities where near term flows are significantly lower than current permitted flows | \$1,000,000 |
| Reduced Administrative Costs | \$230,000 |
| Reduced Labor Costs | \$290,000 |
| Economies of Scale for Sampling Costs | \$70,000 |
| Total | \$1,590,000 |

TABLE 4-3: IMPACT OF POTENTIAL SAVINGS ON LIFE CYCLE COSTS

| Plan | Total Life Cycle Costs | |
|--|------------------------|-------------|
| Centralized Plan | \$20,710,000 | |
| Decentralized Plan | \$19,984,000 | |
| Decentralized Plan with Potential Savings | \$18,394,000 | |
| Centralized - Decentralized (with Potential Savings) | | \$2,316,000 |
| Savings as a % of Centralized System Cost | | 11% |

4.3. Non-Economic Factors

The total life cycle cost analysis of the centralized and decentralized systems demonstrated that nearly \$5,000,000 would be saved in initial capital costs using the decentralized option. This capital cost savings is somewhat offset by the higher O&M costs associated with operating multiple facilities. The total life cycle costs for the decentralized system over a 20 year planning period are up to \$2,316,000 lower than that of the centralized system, with potential savings being realized. This represents a

small savings, suggesting that non-economic factors will have considerable weight in the decision making process for plan selection.

The centralized plan requires 100 percent volunteer participation from existing wastewater facilities. From an implementation perspective, this would be very difficult to achieve. In addition, this plan proposes discharging directly into the most sensitive area for dissolved oxygen in the upper reaches of the Blackwater River. By spreading out the effluent discharge, the impact of a potential process upsets is minimized. The decentralized plan costs also include constructed wetlands as a buffer between the WWTF discharges and the receiving streams.

The environmental sensitivity and dispersed development of Canaan Valley lends itself to a more decentralized approach. The decentralize approach avoids construction along public roadways, stream crossings and other construction activities within environmentally sensitive areas. No new land needs to be procured to site the replacement facilities.

A decentralized wastewater management plan also allows for “smart” future growth. The excess capacity in the existing wastewater treatment systems can be utilized. The implementation of drip irrigation or beneficial reuse systems can help reduce the pollutant load from additional wastewater associated with new growth.

In summary, LAI feels that decentralized systems are technically viable, economically competitive and thereby are the most appropriate approach for Canaan Valley. Also, the decentralized approach allows maximum flexibility in planning for future growth.