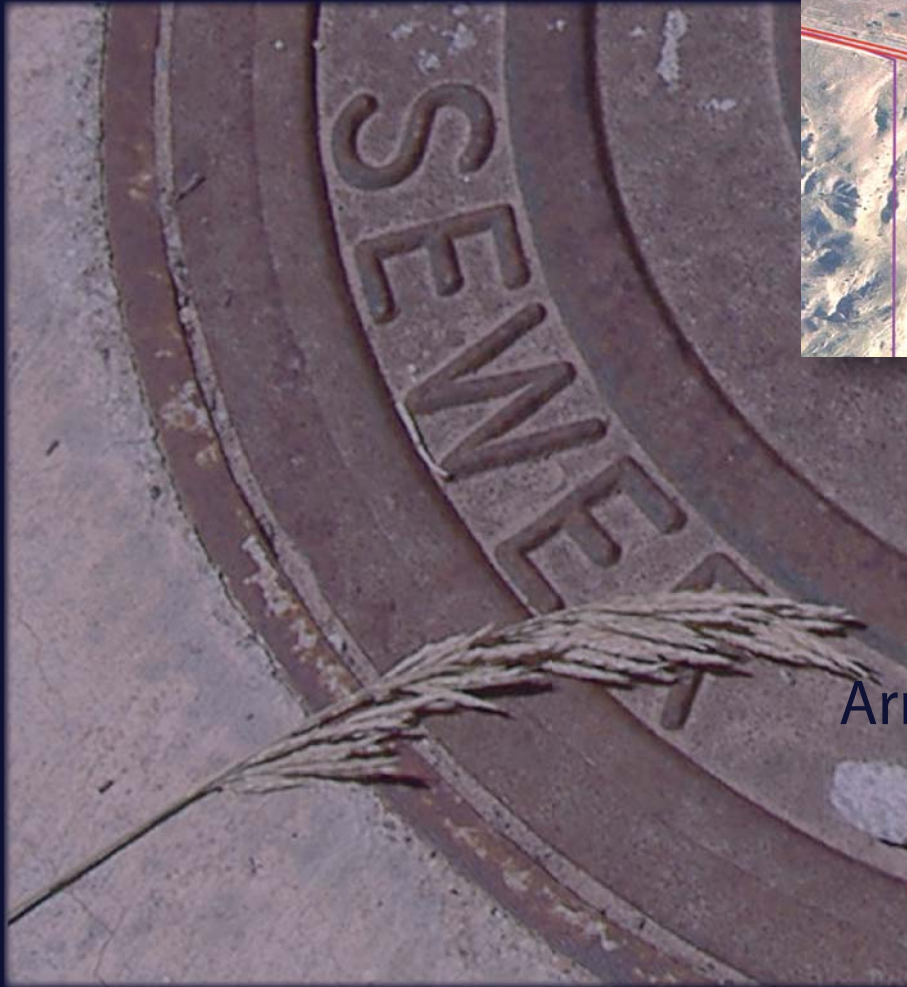


Revision No. 2
FINAL DRAFT



Sombrillo



Arroyo Seco



Santa Fe County

Preliminary Engineering Report

Wastewater Facilities for
Communities of Sombrillo & Arroyo Seco
Santa Fe County, New Mexico

February 2009



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**Revision No. 2 Final Draft
Preliminary Engineering Report
Wastewater System Improvements Project
Communities of Sombrillo and El Valle de Arroyo Seco, NM
Santa Fe County, New Mexico
February 2009**

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This Preliminary Engineering Report (PER) was prepared by Souder, Miller & Associates as per U.S. Department of Agriculture Rural Utilities Services (RUS) Bulletin 1780-3: "Preliminary Engineering Report—Wastewater Facilities" and the Scope of Services Requirements in the Contract



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Listed and Sensitive Species in Santa Fe County, New Mexico

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I. GENERAL

The community of Sombrillo is located adjacent to the City of Española, New Mexico at coordinate's 35°58'53" N 106°02'18" W. The community of El Valle de Arroyo Seco (Arroyo Seco) is located south of Sombrillo at coordinate's 35°57'57" N 106°02'00" W. The communities were settled as early as the 1600's by Spanish settlers. As of the year 2000 the community of Sombrillo has a population of 492 and the community of Arroyo Seco has a population of 1,147 (U.S. Census 2000). The communities are a part of the Cuatro Villas Mutual Domestic Water Consumers Association, but there is currently no established wastewater association.

This Preliminary Engineering Report (PER) is being written to evaluate existing community wastewater systems and to evaluate alternatives for providing new community-wide wastewater collection, treatment, and disposal systems.

The wastewater issues identified in this PER as potentially posing problems for the communities of Sombrillo and Arroyo Seco are:

- There is currently no public wastewater system
- Existing septic tank leach fields are potentially contaminating groundwater that is utilized by residential drinking water wells.

Santa Fe County is considering constructing a wastewater system to ensure all current and future residents of the Sombrillo and Arroyo Seco communities have a safe and reliable wastewater disposal system that is protective of groundwater.

Souder, Miller, and Associates (SMA) inspected and evaluated the communities for multiple options available for construction of wastewater collection, treatment, and disposal systems. After assessing the needs of the communities of Sombrillo and Arroyo Seco related to a wastewater system over a 20-year design period, SMA developed design alternatives for construction of a wastewater system. Each alternative presented in this PER includes a study of the feasibility of implementing each option, as well as a cost analysis to estimate the total cost of construction and operation and maintenance (O&M) costs.

The final sections of this report include a comparative analysis of the alternatives given, a more detailed presentation of the recommended alternative (proposed project), and conclusions and recommendations. A final cost estimate of the recommended alternative is also included to identify the funding that will likely be required to implement the proposed project.

The selected alternative for the proposed project is to construct a combination septic tank effluent pressure (STEP) and septic tank effluent gravity (STEG) collection system and connecting to the Santa Clara Development Corporation wastewater treatment plant (WWTP) to treat and dispose of the effluent.

This PER is funded by the County of Santa Fe through Special Appropriations Programs (SAP) administered by the New Mexico Environment Department (NMED) Construction Programs Bureau (CPB).

This report was prepared by SMA according to the guidelines established in RUS Bulletin 1780-3, "Rural Utilities Service (RUS) Preliminary Engineering Report - Wastewater Facilities," and the scope of work required in the services contract.



II. PROJECT PLANNING AREA

A. Location

The communities of Sombrillo and Arroyo Seco are located just south of the City of Española (See Appendix A-Figure 1). The communities are located within Township 20N Range 8E and are shown on USGS Española Quadrangles, 1:24,000 map. Sombrillo lies within the Santa Cruz River Valley. The Santa Cruz River Valley is rich in fertile land which is used for both agriculture and ranching. Arroyo Seco lies within the Rio Grande Valley.

Sombrillo has an area of approximately 1 square mile and elevations in the community range between 5,630 and 5,850 feet above mean sea level (AMSL). A large part of the community is within the Santa Cruz Grant. The community boundary of Sombrillo is bounded on the north by Santa Clara Pueblo land, private land and the community of Cuarteles, and on the east by BLM land, on the south by BLM and private land, and on the west by the Santa Clara Pueblo.

Arroyo Seco has an area of approximately 5.2 square miles, with elevations in the community ranging between 5,630 and 6,000 ft AMSL (Appendix A-Figure 1). The community is bounded on the north by private and BLM land, on the east by State and BLM land, on the south by Pojoaque Pueblo land, and on the west by State lands and the Santa Clara Pueblo.

The project planning area is defined as the entire Sombrillo area as well as the portion of Arroyo Seco north of Sections 24, 19, and 20. This study area was defined and directed by Santa Fe County.

B. Environmental Resources Present

Farmland

Both Arroyo Seco and Sombrillo have significant portions of High-Quality farmland as identified by America's Farmland Trust. Appendix A-Figure 3 contains maps indicating the farmland locations. The Santa Cruz Irrigation District (SCID) manages approximately 709 acre-feet of surface water rights from the Santa Cruz River. Agricultural practice in Sombrillo and Arroyo Seco has long standing historical, political, and cultural significance for the current residents of the Santa Cruz Valley. All project work is planned to occur on land previously impacted by previous infrastructure projects or outside of from the farmland locations.

Wetlands

Sombrillo has wetlands in the vicinity of the Santa Cruz River Wetlands. Wetland areas were not observed in the Arroyo Seco Study Area. Appendix A-Figure 3 contains maps indicating the wetland locations. All project work will occur on land previously impacted by previous infrastructure projects or away from the wetland locations.

Rangeland

The Bureau of Land Management (BLM) manages approximately 30,000 acres surrounding the Sombrillo and Arroyo Seco planning area. With the establishment of the Federal Land Policy and Management Act of 1976, BLM land is now available for multiple use and allows for the BLM to manage rights-of-way. Right-of-way (ROW) grants for proposed infrastructure facilities must be obtained prior to construction if BLM land is utilized. ROW grants will also be necessary where land is owned and managed by Santa Clara Pueblo for any proposed infrastructure.



Forestland

No land within the area within Sombrillo or Arroyo Seco is considered forestland.

100/500 Year Floodplains

The Federal Emergency Management Agency (FEMA) map 35049C0135D contains the Sombrillo and Arroyo Seco area. It is observed that several residences within Sombrillo adjacent to the Santa Cruz River is subject to intermittent flooding episodes and has had base flood elevations determined with respect to 100-year flood levels. See FEMA Flood Insurance Rate Map (FIRM) located in Appendix A-Figure 4. All proposed construction would be located in areas outside of these designated flood areas.

Historic Sites

A list of New Mexico Registered Cultural Properties in Santa Fe County is provided at the website <http://www.nmhistoricpreservation.org/documents/PropertiesByCounty.pdf>. It is observed that there are no historic properties listed in the registry. Once the project scope is defined and approved, and a funding agency is identified, it may be necessary to contact the State Historic Preservation Office (SHPO) to obtain official archaeological clearance for any proposed construction.

Endangered Species/Critical Habitats

To identify critical habitats, SMA utilized the Biota Information System of New Mexico (BISON-M) website (<http://www.bison-m.org>). BISON-M contains accounts for all vertebrate and invertebrate species occurring in New Mexico and Arizona. From the list of threatened, endangered, candidate species, and species of concern received from the Fish and Wildlife Service, the BISON-M website showed no findings in the proposed project area.

A list of threatened and endangered species and species of concern that exist in Santa Fe County is included in Appendix B. However, it is not anticipated that any of the work required to construct the proposed improvements will have any effect on endangered species or critical habitats.

Areas of Growth and Population Trends

According to the 2000 Census, the Sombrillo community contains 179 households with a total population of 492 (2.74 persons per household). Sombrillo also has a school, church, and veterinarian's office for commercial properties. The Arroyo Seco community contains 407 households with a total population of 1,147 and 17 commercial properties (2.82 persons per household). For this study it is assumed that the population density is uniform and that the study population for Arroyo Seco is determined by the percentage of the area. The study area consists of 100% of Sombrillo and approximately 66% of the Arroyo Seco area. At 66% of the area, the study population for Arroyo Seco is 757 with 269 households.

To evaluate the growth potential of Sombrillo and Arroyo Seco, growth trends of Santa Fe County and the Jemez y Sangre Water Planning Council growth were evaluated. The Santa Cruz sub-basin of the Jemez y Sangre Water Planning district encompasses an area of about 200 square miles to the east of Española in the northeastern part of Santa Fe County and Southeastern part of Rio Arriba County. The Santa Cruz sub-basin is east of the city of Española, bounded on the west by the Rio Grande, on the north by the Velarde sub-basin, on the east by the crest of the Sangre de Cristo Mountains, and on the south by the Pojoaque-Nambe sub-basin. The Santa Cruz sub-basin is projected to double in population within the next 60 years. The Santa Fe County population is projected to grow from its currently population of 129,292 to 230,915 by the year 2030 based on projections by the Business Bureau of Economic Research (BBER) at the University of New Mexico (UNM). The growth rate is determined to be 2.68% for the Santa Cruz sub-basin.



Based on these projections and assuming that Sombrillo and Arroyo Seco follow the same trends, the population of Sombrillo at the end of the 20-year planning period (2028) is estimated to be 835, Arroyo Seco is estimated to be 1,947, and the studied portion of Arroyo Seco to be 1,285. Population projections for 5, 10, and 20 years are summarized in Table 1.

It is important to note that construction of wastewater facilities for these communities could allow for subdivision of properties smaller than 3/4-acre lots, the minimum lot size required by NMED for use of a conventional septic tank system. In Arroyo Seco, with larger tracts of land and proximity to the City of Santa Fe, population projections could increase at a rate faster than 2.68% over the next 20 years.

Table 1: 20-year Population Projections for Sombrillo and Arroyo Seco

Residential						
	Population			Households		
	Sombrillo	Arroyo Seco (total)	Arroyo Seco (Study Area)	Sombrillo	Arroyo Seco (total)	Arroyo Seco (Study Area)
2008	608	1,417	935	221	503	332
2013	694	1,618	1,068	252	574	379
2018	792	1,846	1,219	288	655	432
2028	1,032	2,405	1,587	375	853	563

III. EXISTING FACILITIES

A. Location Map

The location of the project planning area is provided in Appendix A-Figure 6. There are currently no municipal wastewater facilities in the communities of Sombrillo or Arroyo Seco. The project scope is limited to the Sombrillo community and the northern portion of the Arroyo Seco community.

B. History

Sombrillo and Arroyo Seco were both first settled by early Spanish settlers during the 1600's. Both communities have culture rich in agriculture and ranching, due to the fertile land and the Santa Cruz River. Sombrillo and Arroyo Seco are a part of the Cuatro Villas Mutual Domestic Water Users Association, formed in 2000. Currently there is no wastewater association formed. All properties are served by individual systems. The individual systems are assumed to be conventional septic tanks, although cesspools may still be used in some locations.

C. Condition of Existing Facilities

Currently the communities of Sombrillo and Arroyo Seco rely on individual septic tanks, and possibly cesspools, for treatment and disposal of wastewater. There are currently no municipal wastewater facilities in either of the communities. For any alternative considered for wastewater treatment, the total loading will have to be determined.

The Tony Quintana Elementary School in Sombrillo is equipped with a 12,000 GPD STM Aerotor™ wastewater treatment system as well as four 2,000 gallon septic tanks, in series. Currently there are no other tertiary wastewater treatment systems in the study area.

D. Financial Status of Existing Facilities

Users

There is currently no municipal wastewater system or association. The median household income in the Census Designated Place (CDP) for Sombrillo is \$47,000. The median household income in the CDP for Arroyo Seco is \$33,056

Existing Debts and Required Reserve Accounts

There is currently no municipal wastewater system or association to incur debts or to establish a reserve account.

E. Analysis of Existing and Future Conditions

1. Expected Domestic Wastewater loading

Industry design standards indicate an average of approximately 75% of the total water supplied for residential use is disposed of as wastewater. According to NMED CPB standard estimates for domestic use of water in New Mexico is 80 gallons per capita-day (gpcd). Wastewater loading for the two communities is based on 60 gallons-per-day (gpd) per capita, or 75% of the estimated 80 gpcd domestic use. Wastewater current loading and future loading rates for the study area are shown in Table 2:

Table 2: Projected Domestic Wastewater Loading

	Population		Loading (GPD)		Total Loading (GPD)
	Sombrillo	Arroyo Seco	Sombrillo	Arroyo Seco	
2008	608	935	36,476	56,124	92,599
2013	694	1,068	41,633	64,058	105,691
2018	792	1,219	47,518	73,115	120,633
2028	1,032	1,587	61,904	95,249	157,154

2. Expected Commercial and Industrial Wastewater loading

Established liquid waste design flow rates for assorted commercial occupancies are listed in Table 201.1 of the "NMED September 2005- Liquid Waste Disposal and Treatment" regulations. These design flow rates were used for each commercial and industrial facility located in the proposed project area. Projected loading rates were determined using the residential growth rate (2.68%) as determined in section II.c of this report. Wastewater current loading and future loading rates are shown in Table 3:

Table 3: Projected Non-Residential Wastewater Loading

	Loading (GPD)		Total Loading (GPD)
	Sombrillo	Arroyo Seco	
2008	3,370	5,940	9,310
2013	3,849	6,783	10,632
2018	4,388	7,734	12,122
2028	5,719	10,080	15,799

3. Total Wastewater Loading

Table 4: Total Projected Wastewater Loading

		Population		Loading (GPD)		Total Loading (GPD)	Combined Loading from Both Communities (GPD)
		Sombrillo	Arroyo Seco	Sombrillo	Arroyo Seco		
2008	Residential	608	935	36,476	56,124	92,599	101,909
	Commercial	NA	NA	3,370	5,940	9,310	-----
2013	Residential	694	1,068	41,633	64,058	105,691	116,323
	Commercial	NA	NA	3,849	6,783	10,632	-----
2018	Residential	792	1,219	47,518	73,115	120,633	132,755
	Commercial	NA	NA	4,388	7,734	12,122	-----
2028	Residential	1,032	1,587	61,904	95,249	157,154	172,953
	Commercial	NA	NA	5,719	10,080	15,799	-----

4. Other Areas and Facilities of Possible Service

Other areas of possible service are the southern portions of Arroyo Seco as well as the community of Cuarteles. However, these areas of wastewater treatment and disposal facilities are located nearby at the City of Española. These boundaries are not included as part of this study, as directed by Santa Fe County.

5. Wastewater Characteristics and Composition

Wastewater characteristics, shown in Table 5, are estimated using Table 3-15-“Wastewater Engineering,” Metcalf-Eddy, 2003. The wastewater strength for Arroyo Seco and Sombrillo is expected to be “Medium strength.”

Table 5: Typical Composition of Untreated Domestic Wastewater

Contaminants	Unit	Concentration		
		Low Strength	Medium Strength	High Strength
Solids, total (TS)	mg/L	390	720	1230
Dissolved, Total (TDS)	mg/L	270	500	860
Fixed	mg/L	160	300	520
Volatile	mg/L	110	200	340
Suspended solids, Total (TSS)	mg/L	120	210	400
Fixed	mg/L	25	50	85
Volatile	mg/L	95	160	315
Settleable Solids	mg/L	5	10	20
Biochemical Oxygen demand				
5-d, 20C (BOD, 20C)	mg/L	110	190	350
Total Organic Carbon (TOC)	mg/L	80	140	260
Chemical Oxygen demand (COD)	mg/L	250	430	800
Nitrogen (Total as N)	mg/L	20	40	70
Organic	mg/L	8	15	25
Free ammonia	mg/L	12	25	45
Nitrites	mg/L	0	0	0
Nitrates	mg/L	0	0	0
Phosphorus (Total as P)	mg/L	4	7	12
Organic	mg/L	1	2	4
Inorganic	mg/L	3	5	8
Chlorides	mg/L	30	50	90
Sulfate	mg/L	20	30	50
Oil and Grease	mg/L	50	90	100
Volatile organic compounds (VOCs)	ug/L	<100	100-400	>400
Total coliform	NO./100mL	10 ⁶ -10 ⁸	10⁷-10⁹	10 ⁷ -10 ¹⁰
Fecal coliform	NO./100mL	10 ³ -10 ⁵	10⁴-10⁶	10 ⁵ -10 ⁸

IV. NEED FOR PROJECT

A. Health, Sanitation, and Security

Groundwater nitrate contamination due to the presence and density of septic tank leach fields is the major concern for the communities of Sombrillo and Arroyo Seco. Groundwater levels in Sombrillo range between 6 to 100 ft depths which results in a high probability of groundwater contamination from septic drain fields.

B. System O&M

The Sombrillo and Arroyo Seco community currently do not have any issues regarding the current operations and maintenance of the existing wastewater system as there are no wastewater systems.

C. Growth

Sombrillo and Arroyo Seco are located adjacent to the City of Española and are subject to urban growth. Due to the land requirements, Sombrillo and Arroyo Seco may be unable to subdivide or grow unless the land plats are subdivided into smaller portions for development. Currently the land cannot be subdivided to less than the 0.75 acre minimum required (NMED Liquid Waste Regulations) land size for septic tank use.

V. ALTERNATIVES CONSIDERED

The following alternatives were considered for the Sombrillo/Arroyo Seco communities Wastewater System Improvements project:

A. Collection Systems

1. No Action
2. Conventional Gravity/Force Main System
3. Septic Tank Effluent Pressure (STEP) and Septic Tank Effluent Gravity (STEG) System
4. Vacuum System

B. Treatment Systems

1. No Action – Septic Tanks
2. Advanced Treatment Units
3. Connection with the City of Española Wastewater System
4. Connection with the Pueblo of Santa Clara Wastewater System
5. Centralized Treatment Facility(s)
 - a) Sequencing Batch Reactor (SBR)
 - b) Integrated Fixed Film/Activated Sludge (IFAS)
 - c) Membrane Biological Reactor (MBR)

C. Disposal Systems

1. Surface Effluent Disposal to River/Arroyo
2. Surface Effluent Disposal by Irrigation
3. Subsurface Disposal by Aquifer Injection
4. Subsurface Effluent Disposal by Infiltration
5. Biosolids Management

A. Collection System Alternatives

1. No Action

Description – No action will force the communities of Sombrillo and Arroyo Seco to continue to rely on septic tank systems. Due to increasing densities of septic tanks and the depth of groundwater less than 100 ft in the area, there is potential for the septic tank leach fields to contaminate the groundwater supply with nitrates. Nitrate levels above the EPA maximum contaminant level (MCL) of 10 mg/L are known to cause methemoglobinemia in infants. This alternative is not recommended for long range wastewater collection planning and should not be considered for further study.

2. Conventional Gravity/Force Main Collection System

Description – This alternative entails the use of a 12-inch gravity main with 8-inch gravity laterals (the minimum size allowable by NMED and Santa Fe County), 6-inch force mains, 3 major lift stations, and 6 minor lift stations (see Appendix A-Figures 9 and 10). The topography of the Sombrillo and Arroyo Seco are described as rolling with a large number of variations in elevations between 5,700 and 5,800 ft AMSL as shown in Appendix A-Figure 6.



It should be noted that due to the rolling topography in some areas, final design of a conventional gravity sewer system will require some trench depths in limited areas to be 16 feet in depth to maintain minimum grades of 0.60% for 8-inch gravity pipe and 0.24% for 12-inch gravity pipe for wastewater flow (slopes as per Santa Fe County design standards). In some areas lift stations will be required to serve only a few homes where grade is insufficient when having to connect with the remainder of the collection system. Additionally, groundwater levels in the vicinity of Sombrillo and Arroyo Seco range between 6 ft. to 100 ft. depths, which may pose some problems during design and/or construction in high groundwater areas. It is possible that the area in the northernmost portion of Sombrillo, adjacent to the Santa Cruz river, will encounter shallow groundwater and dewatering may be required. It is assumed that all placements of gravity and force mains will be underneath road right-of-ways.

The total amount of collection line for each community is summarized below:

Table 6: Material Quantities for Sombrillo and Arroyo Seco Gravity Collection System

Sombrillo		
Collection System Items	Quantity	Units
8-inch Gravity Main	24,920	LF
12-inch Gravity Main	3071	LF
6-inch Force Main	12,200	LF
Minor Lift Stations	5	EA
Major Lift Stations	1	EA
Manholes	62	EA
Arroyo Seco		
Collection System Items	Quantity	Units
8-inch Gravity Main	48,986	LF
12-inch Gravity Main	16,051	LF
6-inch Force Main	6,524	LF
Minor Lift Stations	1	EA
Major Lift Stations	2	EA
Manholes	145	EA

Design Criteria – The design parameters used for evaluation purposes includes the 2003 “New Mexico Environment Department Construction Programs Bureau Recommended Standards for Wastewater Facilities” and conventional gravity collection system design parameters from “Small and Decentralized Wastewater Management Systems” (Crites and Tchobanoglous, 1998).

Construction Problems – Potential construction problems include construction within areas of high groundwater and significant traffic control required for construction within highway right-of-ways.

Costs of Alternative – The estimated costs for a conventional gravity and force main wastewater collection system for each community is shown in the table below:

Table 7: Sombrillo/Arroyo Seco Conventional Gravity / Force Main System Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Conventional Gravity/Force Main Collection System					
Item	Description	Unit	Quantity	Unit Cost	Total
Sombrillo Gravity Collection System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 266,650	\$ 266,650
2	6-in PVC Force Main Pipe (Backfill, Compaction), CIP	LF	7300	\$ 25	\$ 182,500
3	8-in PVC Gravity Main Pipe (Backfill, Compaction), CIP	LF	24920	\$ 30	\$ 747,600
4	12-in PVC Gravity (Backfill, Compaction), CIP	LF	3071	\$ 35	\$ 107,485
5	Manhole, 4' dia., Type C or E, 6-10' depth	EA	145	\$ 5,000	\$ 725,000
6	Pressure Cleanout, CIP	EA	3.071	\$ 6,000	\$ 18,426
7	Minor Lift Station, CIP	EA	5	\$ 100,000	\$ 500,000
8	2-in Pavement Removal & Replacement, Subgrade, CIP (10-ft width)	SY	20968	\$ 16	\$ 335,488
9	Traffic Control	LS	1	\$ 50,000	\$ 50,000
Sombrillo Gravity Collection System Subtotal:					\$ 2,933,149
Arroyo Seco Gravity Collection System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 397,459	\$ 397,459
2	6-in PVC Force Main Pipe (Backfill, Compaction), CIP	LF	6524	\$ 25	\$ 163,100
3	8-in PVC Gravity Main Pipe (Backfill, Compaction), CIP	LF	48986	\$ 30	\$ 1,469,580
4	12-in PVC Gravity/Force Main (Backfill, Compaction), CIP	LF	16051	\$ 35	\$ 561,785
5	Manhole, 4' dia., Type C or E, 6-10' depth	EA	145	\$ 5,000	\$ 725,000
6	Pressure Cleanout, CIP	EA	16.051	\$ 6,000	\$ 96,306
7	Major Lift Station, CIP	EA	2	\$ 200,000	\$ 400,000
8	Minor Lift Station, CIP	EA	1	\$ 100,000	\$ 100,000
9	2-in Pavement Removal & Replacement, Subgrade, CIP (10-ft width)	SY	22426	\$ 16	\$ 358,816
10	Traffic Control	LS	1	\$ 100,000	\$ 100,000
11	Wash Crossings	LS	2	\$ 50,000	\$ 100,000
Arroyo Seco Gravity Collection System Subtotal:					\$ 4,472,046
Construction Subtotal:					\$ 7,405,195
Contingency 20%				\$ 1,481,039	
NMGRT (Santa Fe Cty) 6.6250%				\$ 490,594	
Total for Construction:					\$ 9,376,828
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction Costs Est.	LS	1	\$ 1,965,206	\$ 1,965,206
2	Geotechnical Report	LS	1	\$ 25,000	\$ 25,000
Non-construction Subtotal:					\$ 1,990,206
Contingency 20%				\$ 398,041	
NMGRT (Santa Fe Cty) 6.6250%				\$ 131,851	
Total for Non-Construction:					\$ 2,520,098

Total Collection System Project Cost: \$ 11,896,926

Advantages – The advantages of this alternative is that homeowners and businesses would not have to maintain septic tank systems. Additionally, potential long term groundwater impacts from use of septic tanks would be alleviated which is protective of the sustainability of the local groundwater aquifer. As an added benefit, land lots could be subdivided into lots smaller than 0.75 acre lots and help promote economic development in the area.

Disadvantages – The disadvantages of this alternative is that the cost is extremely high to implement particularly for the demolition and replacement of asphalt pavement. Funding for the entire system may require multiple phases, long term project commitment and high monthly user rates. Additionally, there will be significant time required for construction and public and business disruption. Also, there is a potential risk for groundwater infiltration in areas of high groundwater.

3. Septic Tank Effluent Pressure (STEP) and Septic Tank Effluent Gravity (STEG) System

Description – This alternative utilizes the home/business owner’s existing septic tank system. A STEG system collects effluent from individual septic tanks and utilizes gravity to carry the effluent to a main collection line, lift station, or treatment plant. A STEP system also collects septic tank effluent, but uses a small pump to send effluent to a collection main, lift station, or treatment plant. To send the effluent to its final destination point, in the case of Arroyo Seco and Sombrillo, it is necessary to utilize both STEP and STEG systems. Since STEP/STEG systems do not carry large solids, the line diameters are smaller than conventional wastewater lines. Additionally, home/business owners remain responsible for maintenance of their septic tank systems. A proposed STEP/STEG system for both communities is shown in Appendix A – Figures 9 and 10.

**Table 8: Material Quantities for Sombrillo and Arroyo Seco
STEP/STEG Collection System**

Sombrillo		
Collection System Items	Quantity	Units
4-inch Collector	24920	LF
8-inch Gravity Main	3071	LF
6-inch Force Main	12200	LF
STEP units	6	LF
STEG units	218	EA
Cleanouts	9	EA
Major Lift Stations	0	EA
Major Lift Stations	3	EA
Arroyo Seco		
Collection System Items	Quantity	Units
4-inch Collector	48986	LF
6-inch Gravity Main	16051	LF
6-inch Force Main	6524	LF
STEP units	12	LF
STEG units	336	EA
Cleanouts	10	EA
Major Lift Stations	2	EA
Major Lift Stations	1	EA

Design Criteria – The design parameters used for evaluation purposes includes the 2003 “New Mexico Environment Department Construction Programs Bureau Recommended Standards for Wastewater Facilities” and STEP/STEG design parameters from “Small and Decentralized Wastewater Management Systems” (Crites and Tchobanoglous, 1998).

Construction Problems – Construction within owner’s properties require access agreements. Construction in public rights-of-way within paved areas, require traffic control and will cause some disruption to the communities.

Costs of Alternative

Table 9: Sombrillo/Arroyo Seco STEP/STEG Collection System Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project STEP/STEG Collection System					
Item	Description	Unit	Quantity	Unit Cost	Total
Sombrillo Collection System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 199,607	\$ 199,607
2	4-in PVC Collector Main Pipe (Backfill, Compaction), CIP	LF	24920	\$ 23	\$ 560,700
3	8-in PVC Gravity/Force Main Pipe (Backfill, Compaction), CIP	LF	15271	\$ 25	\$ 381,775
4	STEP pump kit, CIP	EA	6	\$ 5,000	\$ 30,000
5	STEG kit, CIP	EA	218	\$ 2,500	\$ 545,000
6	Pressure Cleanout, CIP	EA	9	\$ 6,000	\$ 54,000
7	Minor Lift Station, CIP	EA	3	\$ 100,000	\$ 300,000
8	2-in Pavement Removal & Replacement, Subgrade, CIP (3-ft width)	SY	4662.156	\$ 16	\$ 74,594
9	Traffic Control	LS	1	\$ 50,000	\$ 50,000
Subtotal for Sombrillo STEP/STEG:					\$ 2,195,676
Arroyo Seco Collection System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 336,046	\$ 336,046
2	4-in PVC Collector Main Pipe (Backfill, Compaction), CIP	LF	48986	\$ 23	\$ 1,102,185
3	6-in PVC Gravity/Force Main Pipe (Backfill, Compaction), CIP	LF	22575	\$ 25	\$ 564,375
4	STEP pump kit, CIP	EA	12	\$ 5,000	\$ 60,000
5	STEG kit, CIP	EA	336	\$ 2,500	\$ 840,000
6	Pressure Cleanout, CIP	EA	10	\$ 6,000	\$ 60,000
7	Major Lift Station, CIP	EA	2	\$ 200,000	\$ 400,000
8	Minor Lift Station, CIP	EA	1	\$ 100,000	\$ 100,000
9	2-in Pavement Removal & Replacement, Subgrade, CIP (3-ft width)	SY	8368.844	\$ 16	\$ 133,902
10	Traffic Control	LS	1	\$ 100,000	\$ 100,000
Subtotal for Arroyo Seco STEP/STEG:					\$ 3,696,508
Construction Subtotal:					\$ 5,892,184
Contingency 20%					\$ 1,178,437
NMGRT (Santa Fe Cty) 6.6250%					\$ 390,357
Total for Construction:					\$ 7,460,978

Item	Description	Unit	Quantity	Unit Cost	Total
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction Costs Est.	LS	1	\$ 1,492,196	\$ 1,492,196
2	Geotechnical Report	LS	1	\$ 5,000	\$ 5,000
Non-construction Subtotal:					\$ 1,497,196
Contingency 20%					\$ 299,439
NMGR (Santa Fe Cty) 6.6250%					\$ 99,189
Total for Non-Construction:					\$ 1,895,824
Total Collection System Project Cost: \$ 9,356,802					

Advantages

- Infiltration is not an issue because the system is watertight.
- Ability to handle a wide divergence of flow rates from initial to ultimate flow rates resulting from system expansion or increases in population.
- Systems can be designed or programmed to alternate doses when maximum capacity is approached.
- Require lower scour velocity than conventional systems.
- Use smaller diameter pipe than gravity systems.
- Ease of construction.
- Less impact to community during construction.
- Use of existing septic tanks or new grinder pumps.
- Does not typically require a significant number of lift stations.
- Smaller trench width than conventional systems.

Disadvantages

- Requires periodic septic tank maintenance and pumping of septic tanks.
- Requires addition of effluent filter and individual or shared effluent or grinder pump.
- Requires a higher level of design than conventional systems.
- Maintenance of system pumps can be larger scale than conventional systems.

4. Vacuum System

Description – Vacuum systems are used in areas that have low-lying, flat, high groundwater, shallow bedrock, or sensitive ecosystems. Vacuum sewer systems utilize the suction of a vacuum, created by a vacuum station, to collect and transport wastewater. The main components of a vacuum sewer system are the valve pit, the sewer main, and the vacuum station. Wastewater from each property is collected in the valve pit. Valve pits of varying sizes can serve one home or up to six homes; larger valve pits (buffer tanks) may be used to collect larger flows. When the wastewater in the valve pit reaches a certain level, a valve opens and the wastewater is sucked into the sewer main. The vacuum sewer mains are typically 4-inch, 6-inch, 8-inch, or 10-inch PVC pipes that have a “sawtooth” profile, allowing for vertical profile changes (lifts) and shallow burial. The sewage is conveyed through the sewer mains to the vacuum station by vacuum suction created by a vacuum pump. The vacuum station functions similarly to a lift station with the addition of the vacuum pumping system. The vacuum station contains a collection tank, vacuum pumps, sewage pumps, and electrical controls. When the collection tank fills to a certain level, the sewage pump conveys the sewage to the treatment facility.

Due to the high capital cost of a vacuum system, the rolling topography of the Arroyo Seco and Sombrillo area, and the small flat land areas that might be best served by a vacuum system, it is not considered the best technology or cost effective for the study area. This alternative is not recommended and will not be considered for further study.

B. Wastewater Treatment Alternatives

1. No Action

Description – No action will require the communities of Sombrillo and Arroyo Seco to continue relying on septic tank systems. The wastewater treatment within the communities would still be by conventional septic tank systems with leachfields.

NMED currently requires a minimum of 0.75 acres for the use of a conventional septic tank (NMED Liquid Waste Disposal and Treatment, 20.7.3 NMAC). Any property transfers require inspection of the existing septic tank system by NMED. NMED does not allow replacement of conventional septic tanks on properties that do not meet the minimum size requirement of 0.75 acre.

As discussed previously in the Need for Project section, there is the potential for septic tanks in the communities to cause groundwater contamination. The effects of total nitrogen contaminants to the aquifer by septic tank discharge in the communities, is unknown.

This treatment alternative is not recommended for continued long term use by the communities.

Advantages

- Simple, low cost and easily maintained.
- Long life if properly maintained.

Disadvantages

- Poor performance if not maintained.
- Treatment of wastewater may not be adequate for areas of high groundwater, poor soils, or rocky areas.
- Improperly functioning systems can introduce contaminants into groundwater and surrounding area.
- Regulatory setbacks for water supply, property lines, etc.
- Effluent not capable of being reused.

2. Advanced Treatment Units (ATU)

Description – The use of ATUs in the communities to upgrade or replace existing conventional septic tank systems would enable a much higher quality of effluent to be produced. This could result in more positive effects on the groundwater aquifer as compared to conventional septic tank systems.

It would also enable owners to reuse the effluent for subsurface irrigation, if desired and if the effluent meets the required quality standards (20.7.3 NMAC). The reduction of biochemical oxygen demand (BOD) in the effluent by an ATU also causes reduction of the layer of bacteria (biomat) that grows beneath the existing system's leachfield. The reduction in biomat allows a higher rate of permeability, which can be beneficial for poor

draining soils, as may be the case in some parts of the communities.

The use of ATUs, are regulated by NMED Liquid Waste Program, as per 20.7.3 NMAC. NMED also uses the terminology “ATS” in place of “ATU.” The regulation also requires scheduled maintenance of ATUs as per manufacturer’s recommendations. Periodic effluent sampling and analysis is required for mandatory (by NMED) installation of an ATU. Voluntary installation of an ATU does not require sampling and analysis, although it is recommended by NMED to do so.

NMED Liquid Waste Program has approved 20 vendors of ATUs. It is important to note that not all NMED-approved ATU vendors can meet the capacity or quality of effluent that should be required for the communities. ATUs used in the communities should meet the secondary treatment standard of 30 mg/L total suspended solids (TSS) and 30 mg/L BOD and the tertiary treatment standard of 20 mg/L total nitrogen. It is also recommended that ATUs should also be certified by both American National Standards Institute (ANSI) and National Sanitation Foundation (NSF).

Several statements regarding the history of ATUs in New Mexico are of particular concern. They are:

- “Fluctuations in effluent quality and episodes of poor treatment were believed to result largely from lack of maintenance”
- “There was a lack of availability of qualified maintenance service providers in the state. Some ATS distributors/installers were unwilling to provide maintenance and effluent sampling services. In other cases, ATS manufacturers had either gone out of business or no longer did business in New Mexico”

NMED has addressed some of the historical issues with ATUs. “[ATUs] whose manufacturers fail to provide qualified service providers, and to comply with the requirements of 20.7.3.903 NMAC, are being removed from the list of wastewater products approved for use in the State of New Mexico”.

The NMED report compares effluent quality and consistency of three manufacturers of ATU’s. It states, “It is somewhat encouraging that three different brands of ATSSs, each with multiple installation locations, consistently produce effluent with total nitrogen at or less than the TAC (sic - Technical Advisory Committee) treatment standard of 20 mg/L total nitrogen”.

The estimated cost to install an ATU within an existing septic tank or between an existing septic tank and leachfield is \$3,500 to \$5,000, including the required NMED permit fee of \$150. When installing an ATU as part of an existing system it may be found that the existing septic tank is leaking and needs to be replaced. This would add an estimated additional \$5,000 to the cost, for a total of as much as \$10,000. The cost to install an ATU new, or as total replacement of a septic tank, is estimated to be \$15,000 to \$20,000, including the NMED permit fee. O&M costs would be the cost of electricity to run blower and/or pump, periodic maintenance inspection and effluent sampling. O&M of an ATU is estimated to be \$800 per year, or \$67/month. It is assumed that all costs would be incurred by property owners. The total cost for the estimated current 572 septic tanks conversion to ATUs, for both options, is shown in the following table.

Table 10: Estimated Cost of Communities Septic Tanks Conversion to ATUs

Option	Number Septic Tanks	Unit Cost (Low to High Range)	Total Cost (Low to High Range)
Modify Existing Septic Tank	572	\$3,500	\$2,002,000
Install Replacement ATU	572	\$20,000	\$11,440,000

If the County provides operations and maintenance services of the ATUs, it would need to hire or subcontract services to monitor and enforce the operation of ATUs. This is provided to some degree by NMED. The County may also desire to solicit proposals and quantity costing for equipment, maintenance, and sampling in order to pass potential costs savings to property owners.

Advantages

- High quality effluent that will reduce contaminant load on aquifer.
- Can be implemented in existing systems with little disturbance to property.
- Does not require easements or access agreements.
- Collection, treatment and disposal occur on individual properties.
- Effluent may be reused by individuals.
- Aids disposal in poorly draining soils.
- Helps the community maintain a rural atmosphere.
- Lower costs than municipal centralized or decentralized systems.
- Larger scale systems can be shared by adjoining lots when utilizing legal sharing agreements.
- For Community wide use, costs are equally shared within the community.

Disadvantages

- Higher capital and O&M cost than conventional septic tank system.
- Periodic maintenance and inspections.
- Periodic sampling and analysis, if required.
- May require higher level of monitoring required to ensure proper operation.

3. Connection with the City of Española Wastewater System

Description – This alternative involves collection of wastewater from the communities and transmission of raw sewage or septic tank effluent to the City of Española Wastewater Treatment Plant (WWTP). The City of Española has a total capacity of 3 MGD. Currently, only approximately 1 MGD is used and can accommodate the 180,000 gpd of estimated wastewater flow from both the communities of Sombrillo and Arroyo Seco. The shortest route to the Española WWTP is through lands owned by the Pueblo of Santa Clara located in the northeast corner of Sombrillo. Due to the expected time required to obtain easement through Pueblo land, the wastewater from both communities could be more easily routed by force main across the Santa Cruz River Bridge and west on Santa Cruz road approximately one mile west of the County Road 106/76 intersection. This alternative would require addition of a force main line between the communities, lift stations, and bridge crossing. The connection to the Española WWTP is shown in Appendix A – Figure 11.

Costs of Alternative

Table 11: Connection with the City of Española WWTP Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Connection with the City of Espanola WWTP					
Item	Description	Unit	Quantity	Unit Cost	Total
Capital Costs					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 30,000	\$ 30,000
2	12-in PVC Gravity (Backfill, Compaction), CIP	LF	3565	\$ 35	\$ 124,775
3	Bridge Crossing	LS	1	\$ 100,000	\$ 100,000
4	Arroyo Seco Connection to Sombrillo 6-inch PVC Force Main, CIP	LF	2700	\$ 25	\$ 67,500
5	Arroyo Seco Major Lift Station	LS	1	\$ 75,000	\$ 75,000
6	Lift Station for SE Portion of Arroyo Seco	LS	1	\$ 200,000	\$ 200,000
				Construction Subtotal:	\$ 597,275
				Contingency 20%	\$ 119,455
				NMGRT (Santa Fe Cty) 6.6250%	\$ 39,569
				Total for Construction:	\$ 756,299
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 151,260	\$ 151,260
				Non-construction Subtotal:	\$ 151,260
				Contingency 20%	\$ 30,252
				NMGRT (Santa Fe Cty) 6.6250%	\$ 10,021
				Total for Non-Construction:	\$ 191,533

Total Connection System Project Cost: \$ 947,832

Advantages

- Does not require operations or maintenance from either community.
- Does not require any additional capital cost for treatment.
- Both communities can be served immediately after completion of collection system.

Disadvantages

- Rates may increase in the future as required by the City of Española public works in order to maintain municipal operations.
- City of Española public works in the future could apply wastewater loading limits in quality and quantity on users, restricting the amount and quality of wastewater coming from the communities.
- Requires City of Española to obtain an easement from Santa Clara Pueblo which could cause delays due to the required lengthy process with the Pueblo, and possibly the Bureau of Indian Affairs (BIA).

4. Connection with the Santa Clara Development Corporation (SCDC) Wastewater Treatment Plant

Description – This alternative involves routing collected wastewater to the SCDC WWTP. The SCDC WWTP is located approximately 3,400 ft west of Sombrillo on HWY 399. The SCDC WWTP has a current capacity of 80,000 GPD. The treatment system is currently not in use but is ready to start-up when wastewater collection systems are constructed. The SCDC WWTP would have to be expanded to accommodate the estimated 102,000 GPD year 2008 flow from Sombrillo and Arroyo Seco and the estimated flow of 173,000 GPD (nominal 180,000 GPD) in year 2028. As the collection systems are constructed and connections are made it could take several or more years to obtain a flow of 102,000 GPD. The existing SCDC WWTP 80,000 GPD would suffice for a period of time. The expansion to 180,000 GPD (to accommodate the estimated year 2028 flow would require an expansion of 100,000 GPD. Parts of the existing SCDC WWTP may be utilized for an expansion of 100,000 GPD. Review of the SCDC WWTP as-builts appears to indicate that the existing sludge storage tank, sludge pump, polymer system, centrifuge, surge tank, filtration pumps, sand filters, and UV disinfection can be utilized for expansion to 180,000 GPD. The 100,000 GPD expansion we would require an influent lift station, headworks, SBRs, sludge pump, building with electrical and HVAC, piping connections to existing WWTP and sewer, and standby generator.

If considered a viable alternative otherwise, the collection system for Sombrillo would connect with the SCDC Wastewater System at the first manhole point (MH1 on Appendix A – Figure 12) located 1,700 LF west of Highway 84/285 on County Road 399. The collection system for Arroyo Seco will require a 1.7 mile long 12-inch gravity main traveling northwest along the north side of the Arroyo Seco ephemeral streambed to route wastewater directly to the SCDC WWTP located on the east side of the arroyo south of CR-399.

Costs of Alternative

Table 12: Connection with SCDC WWTP Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project					
Connection with SCDC WWTP					
Item	Description	Unit	Quantity	Unit Cost	Total
Capital Costs					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	12-in PVC Gravity Main (Backfill, Compaction), CIP	LF	8,923	\$ 35	\$ 312,312
3	6-in PVC Force Main (Backfill, Compaction), CIP	LF	940	\$ 25	\$ 23,500
4	Major Lift Station	EA	1	\$ 100,000	\$ 100,000
				Construction Subtotal:	\$ 465,812
				Contingency 20%	\$ 93,162
				NMGRT (Santa Fe Cty) 6.6250%	\$ 30,860
				Total for Construction:	\$ 589,834
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 117,967	\$ 117,967
				Non-construction Subtotal:	\$ 117,967
				Contingency 20%	\$ 23,593
				NMGRT (Santa Fe Cty) 6.6250%	\$ 7,815
				Total for Non-Construction:	\$ 149,376

Total Connection System Project Cost: \$ 739,210

Advantages

- Does not require operations or maintenance from either community.
- Does not require any additional capital cost for treatment.
- Both communities can be served immediately after completion of collection system.
- Project may qualify for grant funds from the Water Trust Board (WTB) if the treated effluent is reused.

Disadvantages

- Current SCDC WWTP will need to be expanded to accommodate the anticipated year 2008 102,000 GPD flow and the year 2008 173,000 GPD flow.
- Rates may vary as the Pueblo of Santa Clara public works is required to maintain operations unless rates are absorbed by Santa Fe County.

The estimated cost to expand the SCDC WWTP from the current 80,000 GPD capacity to 180,000 GPD capacity for "stick built" or packaged system is shown in the following table.

Table 13: Expansion of SCDC WWTP Capacity Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project 100,000 GPD Expansion of SCDC WWTP - "Stick Built" SBR					
Item	Description	Unit	Qty	Unit Cost	Total
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 153,000	\$ 153,000
2	Influent Lift Station	LS	1	\$ 150,000	\$ 150,000
3	Headworks Screen & Wash System	LS	1	\$ 80,000	\$ 80,000
4	100,000 gpd, 2 concrete basins	LS	1	\$ 250,000	\$ 250,000
5	SBR Equipment	LS	1	\$ 470,000	\$ 470,000
6	Misc. Electrical and Controls, Standby Generator	LS	1	\$ 290,000	\$ 290,000
7	Misc. Mechanical	LS	1	\$ 70,000	\$ 70,000
8	Sludge pump	LS	1	\$ 50,000	\$ 50,000
9	Yard piping connections to existing WWTP	LS	1	\$ 30,000	\$ 30,000
10	HVAC	LS	1	\$ 50,000	\$ 50,000
11	Pre-engineered Metal Building	LS	1	\$ 100,000	\$ 100,000
				Subtotal:	\$1,693,000.00
				Contingency 20%	\$338,600.00
				Subtotal	\$2,031,600.00
				NMGRT 6.6250%	\$134,593.50
				Total for Construction:	\$2,166,193.50
Non-Construction Costs					
1	Basic Engineering Services (Design, Bidding, Construction Inspection, etc.) 15% of Construction	LS	1	\$ 253,950	\$ 253,950
				Non-construction Subtotal:	\$ 253,950
				Contingency 20%	\$ 50,790
				Subtotal	\$ 304,740
				NMGRT 6.6250%	\$ 20,189
				Total for Non-Construction:	\$ 324,929
				Total Cost:	\$ 2,491,123

Table 13 (cont'd.)

Sombrillo and Arroyo Seco Wastewater System Project 100,000 GPD Expansion of SCDC WWTP - Packaged SBRs					
Item	Description	Unit	Qty	Unit Cost	Total
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 115,000	\$ 115,000
2	Influent Lift Station	LS	1	\$ 150,000	\$ 150,000
3	Headworks Screen & Wash System	LS	1	\$ 80,000	\$ 80,000
4	50,000 GPD Packaged SBR	LS	2	\$ 248,000	\$ 496,000
5	Misc. Electrical & Standby Generator	LS	1	\$ 150,000	\$ 150,000
6	Misc. Mechanical	LS	1	\$ 20,000	\$ 20,000
7	Sludge pump	LS	1	\$ 50,000	\$ 50,000
8	Yard piping connections to existing WWTP	LS	1	\$ 30,000	\$ 30,000
9	HVAC	LS	1	\$ 50,000	\$ 50,000
10	Pre-engineered Metal Building	LS	1	\$ 100,000	\$ 100,000
				Subtotal:	\$1,241,000
				Contingency 20%	\$ 248,200
				Subtotal	\$1,489,200
				NMGRT (Santa Fe Cty) 6.6250%	\$ 98,660
				Total for Construction:	\$1,587,860
Non-Construction Costs					
1	Basic Engineering Services (Design, Bidding, Construction Inspection, etc.) 10% of Construction	LS	1	\$ 124,100	\$ 124,100
				Non-construction Subtotal:	\$ 124,100
				Contingency 20%	\$ 24,820
				Subtotal	\$ 148,920
				NMGRT (Santa Fe Cty) 6.6250%	\$ 9,866
				Total for Non-Construction:	\$ 158,786
				Total Cost:	\$ 1,746,645

5. Centralized Wastewater Treatment Facility

A centralized wastewater treatment facility or a central facility for each community is considered as an alternative.

a) Sequencing Batch Reactor (SBR)

Description – The SBR is an activated sludge system for wastewater treatment. SBR treatment systems have the following sequence of operations:

- Fill
- React (aeration)
- Settle (sedimentation/clarification)
- Draw (decant)
- Idle

A typical SBR will have two flow-through reactor basins on a common inlet. While one reactor basin is filling and aerating, the other settles and decants. Aeration is accomplished by addition of air through the use of floating aerators and pumps or a perforated membranes fixed to the tank floor. Aeration allows for biological growth to reduce the organic content in the wastewater. During the settle operation, the aeration is turned off and biosolids are allowed to settle and fall out of suspension in the wastewater, resulting in a

clarified supernatant. The other reactor basin then fills and aerates during the settle and decant phase. An SBR will provide for Class 1A effluent quality for wastewater reuse.



Photograph 1: Sequencing Batch Reactor Facility (Fluidyne)

Table 14: SBR WWTP Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project					
Sequencing Batch Reactor WWTP Alternative					
Item	Description	Unit	Quantity	Unit Cost	Total
Wastewater Treatment System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 343,480	\$ 343,480
2	SBR WWTP (180,000 GPD) CIP	LS	1	\$2,083,000	\$ 2,083,000
3	Misc Electrical and Controls	LS	1	\$1,176,000	\$ 1,176,000
4	Misc Plumbing	LS	1	\$ 100,800	\$ 100,800
5	Land purchase	AC	0.75	\$ 100,000	\$ 75,000
				Subtotal:	\$ 3,434,800
				Contingency 20%	\$ 686,960
				NMGRT (Santa Fe Cty) 6.6250%	\$ 227,556
				Total for Construction:	\$ 4,349,316
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 869,863	\$ 869,863
2	Geotechnical Report	LS	1	\$ 25,000	\$ 25,000
				Non-construction Subtotal:	\$ 894,863
				Contingency 20%	\$ 178,973
				NMGRT (Santa Fe Cty) 6.6250%	\$ 59,285
				Total for Non-Construction:	\$ 1,133,120
				Total SBR Cost:	\$ 5,482,436
Operational Costs					
1	Electrical	LS	1	\$ 54,000	\$ 54,000
2	Operator	LS	1	\$ 50,000	\$ 50,000
3	Parts and Equipment	LS	1	\$ 15,000	\$ 15,000
				Annual Total Cost:	\$ 119,000
				Interest Rate	3%
				Operational Years	20
				20-Year Lifecycle Costs:	\$ 1,770,420

b) Integrated Fixed Film / Activated Sludge System (IFAS)- STM Aerotor™

Description – The STM-Aerotor™ treatment system is a hybrid activated sludge system similar to a rotating biological contactor (RBC) that combines aeration and biological nutrient removal processes in a single reactor basin. This process integrates activated biosolids and fixed film processes. The operation of the STM-Aerotor™ system is dependent on the creation of both aerobic and anoxic zones within the reactor basin. A rotating drum assembly is used for the aeration zone. The drum assembly is made of open-faced disks, which serve to entrain air as the drum rotates. The entrained air provides the aeration necessary to the treatment process while also providing the mixing action required to suspend the biological growth in the basin. The disks also provide area for fixed film growth for biological nutrient removal. The depth of the reactor basin allows for creation of an anaerobic zone for biosolids digestion. Solids settling is achieved by this process. A clarifier is used to remove any additional suspended solids and biomasses from the effluent stream prior to discharge. The STM-Aerotor™ provides Class 1B quality wastewater reuse. This equipment uses a dissolved oxygen meter to control a variable frequency drive motor that turns the drum. A recycle pump returns activated sludge to the reactor basin. This system is easily operated and has very low power use. The estimated cost of this system is provided in Table 15.



Photograph 2: STM-Aerotor™ Wastewater Treatment System

c) Membrane Biological Reactor (MBR)

Description – MBR systems consist of utilizing a biological reactor (bioreactor) and microfiltration as a one unit process, thereby eliminating the need for secondary clarification prior to effluent discharge. The microfiltration membrane is immersed inside or placed outside the activated biosolids reactor. The membranes are mounted in modules (cassettes) that can be easily maintained. The membranes are subjected to a vacuum that draws water through the membrane while retaining solids in the reactor. To maintain



Photograph 3: Membrane Bioreactor Plant (Kubota)

suspended biomass in the bioreactor and to clean the exterior of the membranes, compressed air is introduced through the distribution manifold at the base of the membrane module. As the air bubbles rise to the surface, the membrane surface is scoured and the air provides oxygen to maintain aerobic conditions. The MBR provides Class 1A effluent quality for reuse. This system is controlled by a PLC and requires significant power use for aeration and to prevent membrane fouling. The estimated cost of this system is shown in Table 16.

Table 15: Aerotor WWTP Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project STM Aerotor™ Wastewater Treatment System					
Item	Description	Unit	Quantity	Unit Cost	Total
Wastewater Treatment System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 58,250	\$ 58,250
2	Aerotor Packaged Wastewater Treatment System	LS	1	\$ 350,000	\$ 350,000
3	Misc Electrical and Controls	LS	1	\$ 105,000	\$ 105,000
4	Misc Plumbing	LS	1	\$ 52,500	\$ 52,500
5	Land purchase	AC	0.75	\$ 100,000	\$ 75,000
				Subtotal:	\$ 582,500
				Contingency 20%	\$ 116,500
				NMGRT (Santa Fe Cty) 6.6250%	\$ 38,591
				Total for Construction:	\$ 737,591
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 147,518	\$ 147,518
2	Geotechnical Report	LS	1	\$ 25,000	\$ 25,000
				Non-construction Subtotal:	\$ 172,518
				Contingency 20%	\$ 34,504
				NMGRT (Santa Fe Cty) 6.6250%	\$ 11,429
				Total for Non-Construction:	\$ 218,451
				Total Aerotor Cost:	\$ 956,042
Operational Costs					
1	Electrical	LS	1	\$ 10,800	\$ 10,800
2	Operator	LS	1	\$ 40,000	\$ 40,000
3	Parts and Equipment	LS	1	\$ 5,000	\$ 5,000
				Annual Total Cost:	\$ 55,800
				Interest Rate	3%
				Operational Years	20
				20-Year Lifecycle Costs:	\$830,163.10
Item	Description	Unit	Quantity	Unit Cost	Total
Operational Costs					
1	Electrical	LS	1	\$ 20,000	\$ 20,000
2	Operator	LS	1	\$ 80,000	\$ 80,000
3	Parts and Equipment	LS	1	\$ 7,500	\$ 7,500
				Annual Total Cost:	\$ 107,500
				Interest Rate	3%
				Operational Years	20
				20-Year Lifecycle Costs:	\$1,599,329

Table 16: MBR WWTP Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Membrane Bio Reactor Wastewater Treatment System					
Item	Description	Unit	Quantity	Unit Cost	Total
Wastewater Treatment System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 307,500	\$ 307,500
2	MBR Wastewater Treatment System (180,000 GPD), Building, Basins, CIP	LS	1	\$ 1,860,000	\$ 1,860,000
3	Misc Electrical and Controls	LS	1	\$ 1,050,000	\$ 1,050,000
4	Misc Plumbing	LS	1	\$ 90,000	\$ 90,000
5	Land purchase	AC	0.75	\$ 100,000	\$ 75,000
				Subtotal:	\$ 3,382,500
				Contingency 20%	\$ 676,500
				NMGRT (Santa Fe Cty) 6.6250%	\$ 224,091
				Total for Construction:	\$ 4,283,091
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 856,618	\$ 856,618
2	Geotechnical Report	LS	1	\$ 5,000	\$ 5,000
				Non-construction Subtotal:	\$ 861,618
				Contingency 20%	\$ 172,324
				NMGRT (Santa Fe Cty) 6.6250%	\$ 57,082
				Total for Non-Construction:	\$ 1,091,024
				Total MBR Cost:	\$ 5,374,115
Item	Description	Unit	Quantity	Unit Cost	Total
Additional Cost for Centralization					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 8,157	\$ 8,157
2	6-in PVC Force Main Pipe (Backfill, Compaction), CIP	LF	1700	\$ 25	\$ 42,500
3	Manhole, 4' dia., Type C or E, 6-10' depth	EA	4	\$ 5,000	\$ 20,000
4	2-in Pavement Removal & Replacement, Subgrade, CIP (10-ft width)	SY	566.6667	\$ 16	\$ 9,067
5	Traffic Control	LS	1	\$ 10,000	\$ 10,000
6	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 17,945	\$ 17,945
				Subtotal:	\$ 107,668
				Contingency 20%	\$ 21,534
				NMGRT (Santa Fe Cty) 6.6250%	\$ 7,133
				Total:	\$ 136,335
Operational Costs					
1	Electrical	LS	1	\$ 50,400	\$ 50,400
2	Operator	LS	1	\$ 50,000	\$ 50,000
3	Parts and Equipment	LS	1	\$ 28,800	\$ 28,800
				Annual Total Cost:	\$ 129,200
				Interest Rate	3%
				Operational Years	20
				20-Year Lifecycle Costs:	\$1,922,169.75

If a centralized WWTP were utilized it is expected to be more easily sited in Arroyo Seco. An additional cost of \$135,335 would be required to route the major lift station force main to Arroyo Seco.

Treatment System Selection

The four treatment systems (ATU, SBR, IFAS, MBR) were evaluated based on the following criteria: Construction cost, operational cost, biosolids generation, operational complexity, effluent quality, and odor. Only biological and clarification/filtration parts of the systems are considered in the cost estimates. Energy and equipment replacement costs are considered in the operational costs.

Biosolids Generation

ATU – Solids collected in septic tank.

SBR - The yield or pounds of solids per pound of BOD is approximately 0.8.

STM-Aerotor™ - The yield or pounds of solids per pound of BOD is approximately 0.8.

MBR - The yield or pounds of solids per pound of BOD is approximately 0.5.

Operational Complexity

ATU - The ATU has simple operations as it is entirely self-controlled.

SBR - The SBR involves a fairly complex process that requires close monitoring and operator attention. Extended aerated biosolids can be difficult to settle and the biosolids age must be monitored. A scum layer normally builds up and is often difficult to remove. The system requires a considerable amount of maintenance for the automated valves and decanting operation.

STM-Aerotor™ - The STM-Aerotor™ requires less operator attention as there are fewer moving parts and processes. Good settling biosolids are achieved in this process. The dissolved oxygen is easy to control by changing the drives on the Aerotors. The anaerobic zone allows for effective denitrification and biosolids digestion.

MBR - The MBR is computer operated by a programmable logic controller (PLC) and requires minimal attention, other than sampling and monitoring. The operator must have a Class 4 certification as well as operational training. Membranes must be cleaned every six months; however, this process is also automated.

Effluent Quality

ATU- This system will meet Class 1B reuse requirements.

SBR – This system will meet Class 1A reuse requirements.

STM-Aerotor™ – This system will meet Class 1B reuse requirements.

MBR – This system will meet Class 1A reuse requirements.

Odors

ATU- The system produces no odor as it is entirely enclosed.

SBR – Proper operation of this system will insure that there will be little or no odors.
Odors can be produced with the build-up of scum.

STM-Aerotor™ – Proper operation of this system will insure that there will be little or no odors.

MBR - Proper operation of this system will insure that there will be little or no odors.

The following table is a matrix used to evaluate the treatment systems considered. The evaluation parameters are assigned a score from 1 to 4, with 4 being the highest rating. Based on the three treatment systems evaluated as compared to each other, the highest total score is the preferred system.

Table 17: Treatment System Comparison Matrix

Parameter	Score			
	SBR	Aerotor	MBR	ATU
Construction Cost	1	3	1	4
Operational Cost	1	3	2	4
Biosolids Generation	3	3	4	2
Operational Complexity	1	2	3	4
Effluent Quality	4	3	4	3
Odors	4	4	4	4
Land Required	1	3	2	4
Total	15	21	20	25

Based on the analysis above, the ATU scores the highest of the treatment systems. However, the ATU is an individual residential type system and individual residential and commercial systems may require a more complicated monitoring program to ensure proper operation. The ATU alternative also requires a higher initial capital cost to each residence and business. Funding availability to offset residential and commercial costs may be limited whereas funding for a centralized WWTP for both communities would be more easily obtained as a regional wastewater systems improvements project.

The STM-Aerotor ranks highest of the large scale mechanical type treatment systems.

Advantages

- Provides safe and effective wastewater treatment for the entire community.
- Only one location required for WWTP site operations minimizes land costs.
- Wastewater treatment managed by one responsible party.

Disadvantages

- Requires land purchase for facility.
- Requires certified operator.
- Requires permitting and compliance and yearly sampling O&M costs.
- Requires effluent and biosolids disposal.
- High potential for “not in my back yard” (NIMBY) syndrome from neighboring properties.
- The Community will be required to create and provide wastewater operations, management, and administration and will be required to assume all responsibilities to meet the necessary regulatory compliance.

Individual Wastewater Treatment Facilities

Description – This alternative entails construction of two wastewater treatment plants one for each community. The proposed locations of two treatment systems are shown in Appendix A, Figure 12. The treatment system as selected in the previous section, would be the STM-Aerotor™ system. The plant sizes for Sombrillo and Arroyo Seco are each expected to handle approximately 80,000 gpd each.

Costs of Alternative

Table 18: Individual Aerotor WWTP Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Aerotor Wastewater Treatment System					
Item	Description	Unit	Quantity	Unit Cost	Total
Wastewater Treatment System					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 99,000	\$ 99,000
2	Aerotor Packaged Wastewater Treatment System (80,000 GPD), CIP	LS	2	\$ 300,000	\$ 600,000
3	Misc Electrical and Controls	LS	1	\$ 180,000	\$ 180,000
4	Misc Plumbing	LS	1	\$ 60,000	\$ 60,000
5	Land plot	AC	1.5	\$ 100,000	\$ 150,000
				Subtotal:	\$ 990,000
				Contingency 20%	\$ 198,000
				NMGRT (Santa Fe Cty) 6.6250%	\$ 65,588
				Total for Construction:	\$ 1,253,588
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 250,718	\$ 250,718
2	Geotechnical Report	LS	1	\$ 5,000	\$ 5,000
				Non-construction Subtotal:	\$ 255,718
				Contingency 20%	\$ 51,144
				NMGRT (Santa Fe Cty) 6.6250%	\$ 16,941
				Total for Non-Construction:	\$ 323,802
				Total Aerotor Cost:	\$ 1,577,390
Operational Costs					
1	Electrical	LS	1	\$ 20,000	\$ 20,000
2	Operator	LS	1	\$ 80,000	\$ 80,000
3	Parts and Equipment	LS	1	\$ 7,500	\$ 7,500
				Annual Total Cost:	\$ 107,500
				Interest Rate	3%
				Operational Years	20
				20-Year Lifecycle Costs:	\$1,599,329

Advantages

- Provides safe and effective wastewater treatment for the entire community.
- Smaller scale WWTP site operations.
- Wastewater treatment managed by one responsible party.
- Can be phased easier as per needs due to smaller size and locations.

Disadvantages

- Requires certified operator for each community or shared operator.
- Requires multiple permitting and compliance and yearly sampling O&M costs.
- Requires multiple effluent and biosolids disposal.
- Higher cost of capital improvements and annual O&M costs for two systems.
- Potential "Not in my back yard" (NIMBY) syndrome from neighboring properties.
- Ideal location in each community is in residential areas.

C. Effluent Disposal Alternatives

1. Surface Effluent Disposal to River/Arroyo

Description – Disposal of treated wastewater effluent can be discharged to the Santa Cruz River or to the ephemeral Arroyo Seco. A National Pollutant Discharge Elimination System (NPDES) permit from EPA is required for surface discharge to these water bodies. Discharges less than 100,000 gpd are easily permitted and cost approximately \$6,000, such as the case for the individual community WWTP alternative. Discharges greater than 100,000, such as the case for a single centralized WWTP, are much more timely and costly. This estimated cost, assuming extensive public meetings regarding discharge to the Middle Rio Grande, is \$70,000. Due to the fact that the Santa Cruz River and Arroyo Seco directly feeds into the Rio Grande River, there could be significant public opposition outside of the communities for disposal to the Rio Grande basin. Discharge to the Rio Grande is regulated by NMED, 20.6.4 NMAC – Water Quality Standards for Interstate and Intrastate Surface Waters. Section 114 of 20.6.4 NMAC, contains the specific discharge quality required for the section of the Rio Grande upstream of the Cochiti reservoir headwaters to Rio Pueblo de Taos. This current discharge quality is summarized in the following table.

Table 19: Required Water Quality Discharge to Rio Grande Basin

Parameter	Standard
Dissolved Oxygen	>5.0 mg/L
pH	6.6 to 9.0
Turbidity	50 NTU
Temperature	<22°C(<71.6°F)
E. Coli (monthly geometric mean)	≤ 126 CFU/100 mL
E. Coli (single sample)	≤ 416 CFU/100 mL
TDS (mean monthly)	≤ 500 mg/L
Sulfate (mean monthly)	≤ 150 mg/L
Chloride (mean monthly)	≤ 25 mg/L

The State of New Mexico is in the process of establishing total maximum daily loads (TMDLs) for water bodies in the state. A fecal coliform TMDL has been established for the portion of the Rio Grande in the Albuquerque area. It is possible that new, more stringent TMDLs will be established in the future for the Santa Cruz River and the Rio Grande basin.

The NPDES permit will require periodic sampling and analysis for affect on aquatic life. There are only a few laboratories in the U.S. that perform this analysis and the cost can be several thousand dollars per sampling event.

The current discharge standards should be easily obtained by any of the mechanical wastewater treatment technologies evaluated. All surface disposal of wastewater requires disinfection. If chlorine disinfection is used the effluent must be de-chlorinated, typically using sulfate salts, prior to water surface disposal. In present day designs, ultra-violet light is more commonly used for high quality effluent producing WWTPs in order to eliminate the need and costs of dechlorination.

Costs of Alternative

Table 20: Individual Facilities NPDES Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Individual Facilities - NPDES Surface Water Discharge					
Item	Description	Unit	Quantity	Unit Cost	Total
Sombrillo Surface Discharge					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	Testing Allowance	LS	1	\$ 10,000	\$ 10,000
3	8-inch SDR 26 HDPE pipe	LF	421	\$ 40	\$ 16,840
4	8-inch DIP w/ Flap Valve and outfall	LS	1	\$ 5,000	\$ 5,000
5	2-in Pavement Removal & Replacement, Subgrade, CIP	SY	155.77	\$ 16	\$ 2,492
Arroyo Seco Surface Discharge					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	Testing Allowance	LS	1	\$ 10,000	\$ 10,000
3	8-inch SDR 26 HDPE pipe	LF	635	\$ 40	\$ 25,400
4	8-inch DIP w/ Flap Valve and outfall	LS	1	\$ 5,000	\$ 5,000
5	2-in Pavement Removal & Replacement, Subgrade, CIP	SY	234.95	\$ 16	\$ 3,759
Construction Subtotal:				\$	138,492
Contingency 20%				\$	27,698
NMGRT (Santa Fe Cty) 6.6250%				\$	9,175
Total for Construction:				\$	175,365
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 35,073	\$ 35,073
2	NPDES Permit	LS	2	\$ 6,000	\$ 12,000
Non-construction Subtotal:				\$	35,073
Contingency 20%				\$	7,015
NMGRT (Santa Fe Cty) 6.6250%				\$	2,324
Total for Non-Construction:				\$	44,411
Total Surface Discharge Cost:				\$	219,776

Advantages

- Requires no additional land.
- Guaranteed disposal of daily flow.
- Cost effective alternative.
- Minimal intrusion to surrounding land use.
- Potential water use credit available from Office of the State Engineer (OSE).

Disadvantages

- Additional permitting and compliance.
- Potential for regulatory standards to become more restrictive in the future.
- Costs associated with monitoring and reporting.

Table 20 (cont'd.)

Sombrillo and Arroyo Seco Wastewater System Project Central Facility - NPDES Surface Water Discharge					
Item	Description	Unit	Quantity	Unit Cost	Total
	Arroyo Seco Surface Discharge				
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	Testing Allowance	LS	1	\$ 10,000	\$ 10,000
3	8-inch SDR 26 HDPE pipe	LF	635	\$ 40	\$ 25,400
4	8-inch DIP w/ Flap Valve and outfall	LS	1	\$ 5,000	\$ 5,000
5	2-in Pavement Removal & Replacement, Subgrade, CIP	SY	234.95	\$ 16	\$ 3,759
Construction Subtotal:					\$ 74,159
Contingency 20%					\$ 14,832
NMGRT (Santa Fe Cty) 6.6250%					\$ 4,913
Total for Construction:					\$ 93,904
	Non-Construction Costs				
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 18,781	\$ 18,781
2	NPDES Permit	LS	1	\$ 6,000	\$ 6,000
Non-construction Subtotal:					\$ 18,781
Contingency 20%					\$ 3,756
NMGRT (Santa Fe Cty) 6.6250%					\$ 1,244
Total for Non-Construction:					\$ 23,781
Total Surface Discharge Cost:					\$ 117,685

2. Surface Effluent Disposal by Irrigation

Description – Disposal of treated wastewater to the surface via irrigation is not allowed for conventional septic tanks or residential ATUs. Surface disposal requires disinfection. Disinfection may be by chlorination or UV light. Chlorination does not typically harm vegetation. NMED GWQB requires monitoring and reporting of irrigated disposal of treated wastewater. A standard of a maximum of 200 pounds of nitrogen per acre per year is allowed. The amount of nitrogen in effluent, typically <10 ppm, from advanced type treatment plants can easily meet this requirement.

There are portions of Sombrillo that contain agricultural crops for non-human consumption, such as alfalfa, that might be utilized for surface disposal. Additionally, reclaimed wastewater can be used for landscape irrigation. Wastewater irrigation systems are usually sized for the type of plant that is to be irrigated and the evapotranspiration requirement (ET_c) of the plant. Alfalfa is a popular plant for wastewater irrigation as it has high water requirements, has a low to medium-high sensitivity to water supply, and is a commodity with agricultural value. Alfalfa requires an average of 48 inches of water for a 7-month growing season. The remaining 5 months of winter season is a fallow period and would require either storage of the daily effluent in a lined pond or disposal by other methods cited in this report. Other crops could be irrigated but typically has less water uptake and require larger areas of land application for disposal. Considering disposal of the 180,000 gpd wastewater flows for the communities of Sombrillo and Arroyo Seco, to an irrigated alfalfa field, approximately 101 acres is required for application of the 48 inches of water over the 210 day growing season.

Table 21: Land Size Requirement for Reuse Irrigation

Daily Flow	180,000	gpd
Total Annual Production	65,700,000	gallons
	202.2	acre-ft
Alfalfa Applied Land	50.55	acres

A formal agreement would be required to be implemented for acceptance and use by a farmer(s). There would have to be some type of contingency in place should the farmer(s) eventually decide to not accept the effluent. There may not be enough users or land to be utilized for other purposes if used as an alfalfa field for treated wastewater disposal. The County could possibly negotiate a legal agreement with local farmers to accept the treated wastewater, however, the crop type and daily acceptance are critical items of this type of agreement. Farmed areas in the communities are not very large. The required land area for surface irrigation of alfalfa for each of the treatment alternatives is summarized in the following table. There should be some type of contingency in place in case the farmers decide not to accept the effluent in the future. A distribution system will have to be constructed for the users of the reclaimed wastewater. Assuming a WWTP located in Sombrillo with a distribution system to the agricultural area located on the eastern portion of the community the estimated cost for reclaimed wastewater distribution is shown in the Table below:

Costs of Alternative

Table 22: Sombrillo and Arroyo Seco Surface Water Irrigation Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Surface Water Irrigation					
Item	Description	Unit	Quantity	Unit Cost	Total
Capital Costs					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	4-inch PVC, CIP	LF	6506	\$ 20	\$ 130,120
3	Water Storage Ponds	LS	1	\$ 100,000	\$ 100,000
4	Booster Pump	LS	1	\$ 10,000	\$ 10,000
Construction Subtotal:					\$ 270,120
Contingency 20%					\$ 54,024
NMGR (Santa Fe Cty) 6.6250%					\$ 17,895
Total for Construction:					\$ 342,039
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 68,408	\$ 68,408
Non-construction Subtotal:					\$ 68,408
Contingency 20%					\$ 13,682
NMGR (Santa Fe Cty) 6.6250%					\$ 4,532
Total for Non-Construction:					\$ 86,621
Total Surface Irrigation Project Cost:					\$ 428,661

Advantages

- Can be used locally to produce a commercial commodity for local use, i.e., alfalfa.
- Widely accepted disposal method.

Disadvantages

- Requires substantial area of land.
- Is restricted to growing seasons.
- Will require storage ponds or other methods of disposal during winter months.
- Requires additional monitoring and reporting.
- Requires additional O&M.
- Would require formal agreement with farmer(s) for disposal contingency if not used by farmer(s).

Another alternative for surface disposal by irrigation would be the use of reclaimed wastewater from the SCDC WWTP, should the collected wastewater from the communities be sent there. The SCDC WWTP is capable of providing Class 1A reclaimed wastewater, as defined by NMED. There are a number of different surface disposal locations available in the area and could satisfy regional needs for irrigation. These disposal locations include former sports fields located just east of the SCDC WWTP, the undeveloped commercial site on Pueblo of Santa Clara lands located at the northwest corner of the Hwy. 399 and US 84/285, the Tony E. Quintana Sombrillo Elementary School, and the Black Mesa Golf Course located south of the SCDC WWTP on lands of the Pueblo of Santa Clara. All of these potential disposal locations are shown in Figure 15.

The SCDC WWTP is equipped with a pumping system for delivery of reclaimed wastewater to the Black Mesa Golf Course pond (see Figure 15). Assuming a design flow of 160,000 GPD over an 8-hour period results in a flow of 333 GPM. The calculated total dynamic head (TDH), using the Darcy-Weisbach equation, to provide the 333 GPM for the estimated 5,200 LF to the ponds is 133 ft. A 6-inch PVC pipe would be required to provide this flow. The distances and calculated TDH for each of the four regional reuse locations is as follows:

• Black Mesa Golf Course Pond	5,200 LF	TDH = 133 ft.
• Sports Fields	970 LF	TDH = 27 ft.
• Commercial Site	3,500 LF	TDH = 130 ft.
• Elementary School	5,900 LF	TDH = 155 ft.

It is possible that the SCDC reuse pump is not capable of providing a flow of 333 GPM at a TDH of 155 ft. if the reclaimed wastewater would be sent for reuse to the elementary school. The estimated cost to design and construct the piping to transport the reclaimed wastewater for regional reuse to the four locations is shown in the following table.

Table 23: SCDC WWTP Reuse Water Transmission Piping Cost Estimates

Sombrillo and Arroyo Seco Wastewater System Project SCDC Reclaimed Wastewater Reuse Alternatives					
Item	Description	Unit	Quantity	Unit Cost	Total
SCDC WWTP to Sports Fields Piping					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 3,410	\$ 3,410
2	6-in. C900 Class 100, CIP	LF	970	\$ 30	\$ 29,100
3	Valving	LS	1	\$ 5,000	\$ 5,000
				Subtotal:	\$ 37,510
				Contingency 20%	\$ 7,502
				NMGRT (Santa Fe Cty) 6.6250%	\$ 2,485
				Total for Construction:	\$ 47,497
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 9,499	\$ 9,499
				Non-construction Subtotal:	\$ 9,499
				Contingency 20%	\$ 1,900
				NMGRT (Santa Fe Cty) 6.6250%	\$ 629
				Total for Non-Construction:	\$ 12,029
				Total Cost:	\$ 59,526
SCDC WWTP to Commercial Land Site					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 11,500	\$ 11,500
2	6-in. C900 Class 100, CIP	LF	3500	\$ 30	\$ 105,000
3	Valving	LS	1	\$ 10,000	\$ 10,000
				Subtotal:	\$ 126,500
				Contingency 20%	\$ 25,300
				NMGRT (Santa Fe Cty) 6.6250%	\$ 8,381
				Total for Construction:	\$ 160,181
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 32,036	\$ 32,036
				Non-construction Subtotal:	\$ 32,036
				Contingency 20%	\$ 6,407
				NMGRT (Santa Fe Cty) 6.6250%	\$ 2,122
				Total for Non-Construction:	\$ 40,566
				Total Cost:	\$ 200,746
SCDC WWTP to Elementary School					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 19,200	\$ 19,200
2	6-in. C900 Class 100, CIP	LF	5900	\$ 30	\$ 177,000
3	Valving	LS	1	\$ 15,000	\$ 15,000
				Subtotal:	\$ 211,200
				Contingency 20%	\$ 42,240
				NMGRT (Santa Fe Cty) 6.6250%	\$ 13,992
				Total for Construction:	\$ 267,432

Item	Description	Unit	Quantity	Unit Cost	Total
	Non-Construction Costs				
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 53,486	\$ 53,486
Non-construction Subtotal:					\$ 53,486
Contingency 20%					\$ 10,697
NMGRT (Santa Fe Cty) 6.6250%					\$ 3,543
Total for Non-Construction:					\$ 67,727
Total Cost:					\$ 335,159

Item	Description	Unit	Quantity	Unit Cost	Total
	SCDC WWTP to Golf Course Pond				
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 16,600	\$ 16,600
2	6-in. C900 Class 100, CIP	LF	5200	\$ 30	\$ 156,000
3	Valving	LS	1	\$ 10,000	\$ 10,000
Subtotal:					\$ 182,600
Contingency 20%					\$ 36,520
NMGRT (Santa Fe Cty) 6.6250%					\$ 12,097
Total for Construction:					\$ 231,217
	Non-Construction Costs				
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) 20% of Construction	LS	1	\$ 46,243	\$ 46,243
Non-construction Subtotal:					\$ 46,243
Contingency 20%					\$ 9,249
NMGRT (Santa Fe Cty) 6.6250%					\$ 3,064
Total for Non-Construction:					\$ 58,556
Total Cost:					\$ 289,773

Only the Black Mesa Golf Course site is currently ready and able to receive and reuse the reclaimed wastewater. All three other sites would require development of an irrigation system to disperse the reclaimed wastewater.

Assuming reuse for surface irrigation of grass, such as fescue, a yearly demand of 60 inches per year, and the capability of year round irrigation, a total of 36 acres would be required to reuse a daily WWTP output of 160,000 GPD. The cost to design and construct a 36 acre irrigation system is summarized in the following table.

Regional reuse of Class 1A reclaimed wastewater from the SCDC WWTP for surface irrigation has the following advantages and disadvantages.

Advantages

- Regional reuse offsets some of the need to use potable groundwater for irrigation use.
- Provides a cost effective disposal solution.

Disadvantages

- Requires a substantial area of land that is only available at the Black Mesa Golf Course.
- Requires design and construction of an irrigation system at all locations other than the Black Mesa Golf Course.
- Requires design and construction of transmission piping.

Table 24: SCDC WWTP Reuse Surface Water Irrigation Site Development Cost Estimate

160,000 GPD 36 Acre Surface Irrigation System					
Construction Cost					
Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Mobilization/Demobilization	LS	1	\$ 33,940	\$ 33,940
2	Testing Allowance	LS	1	\$ 10,000	\$ 10,000
3	Irrigation nozzles,inc. pipe	EA	415	\$ 600	\$ 249,000
4	Irrigation pumping system	LS	1	\$ 50,000	\$ 50,000
5	Electrical	LS	1	\$ 25,000	\$ 25,000
6	Seeding	AC	36	\$ 150	\$ 5,400
Subtotal					\$ 373,340
Contingency 20%					\$ 74,668
Subtotal					\$ 448,008
NMGRT (Santa Fe Cty) 6.6250%					\$ 29,681
Construction Cost Total					\$ 477,689
Non-Construction Cost					
1	Engineering & Construction Inspection Services (20% of Construction)	LS	1	\$ 89,602	\$ 89,602
NMGRT (Santa Fe Cty) 6.6250%					\$ 5,936
Non-Construction Cost Total					\$ 95,538
Total System Cost					\$ 573,226

3. Subsurface Effluent Disposal by Aquifer Injection

Description – The use of reclaimed wastewater for aquifer injection and recharge has become more prevalent with the advent of treatment systems capable of providing a very high quality of effluent. This reuse alternative has not yet been used to any extent in New Mexico, even though it is more commonplace in the states of Arizona, Florida and Texas. The hydrogeology of an aquifer injection area is of great importance when considering this alternative. A number of issues must be addressed when considering this alternative, such as depth to groundwater, ability of the aquifer to accept an induced additional quantity of water, distance to private and public water supply wells, etc. Permits are required from both the OSE and NMED. As is the case for the communities with numerous private wells and shallow depth to groundwater in some locations, the injected reclaimed wastewater would be required to meet NMED drinking water standards. While this should not be problematic with the advanced types of wastewater treatment systems, the system must be correctly maintained and operated to prevent any effluent discharges that do not meet standards. Aquifer injection is not an easy or inexpensive process. A rough rule of thumb is that it takes twice as much energy and effort to put the water back into the aquifer as it does to take it out.

Of particular importance concerning the communities for this alternative is the mounding effect that occurs when injecting water. With the high groundwater that exists in some locations in the communities, it would be possible for the mounding to cause the water to come to the land surface and it could also be disruptive for building foundations. Groundwater modeling would be required to effectively address this concern and injection wells should be located in open areas away from structures.

Additional land would have to be accessed or purchased for this alternative as the wells require adequate spacing so as not to influence each other. This distance and area would

have to be calculated based on the required groundwater modeling for this alternative. A yearly O&M program would be required for each of the wells in order to maintain capacity.

Costs of Alternative

See the following table.

Advantages

- Low cost alternative for very small systems.
- Water use credit from OSE.

Disadvantages

- High risk alternative due to the number of private wells in the area.
- Land use requirements for large scale system.
- Extensive monitoring and control required for large scale systems.
- Annual injection well operational costs.

Table 25: Subsurface Water Injection Cost Estimate

Sombrillo and Arroyo Seco Wastewater System Project Subsurface Water Injection					
Item	Description	Unit	Quantity	Unit Cost	Total
Capital Costs					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	100-ft Injection Well	EA	6	\$ 60,000	\$ 360,000
3	20 GPM Pump	LS	6	\$ 25,000	\$ 150,000
4	Electrical	LS	1	\$ 10,000	\$ 10,000
5	Well testing	LS	1	\$ 60,000	\$ 60,000
6	Land (qty estimated)	AC	3	\$ 150,000	\$ 450,000
				Construction Subtotal:	\$1,060,000
				Contingency 20%	\$ 212,000
				NMGRT (Santa Fe Cty) 6.6250%	\$ 70,225
				Total for Construction:	\$1,342,225
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 268,445	\$ 268,445
				Non-construction Subtotal:	\$ 268,445
				Contingency 20%	\$ 53,689
				NMGRT (Santa Fe Cty) 6.6250%	\$ 17,784
				Total for Non-Construction:	\$ 339,918

Total Groundwater Injection Project Cost: \$1,682,143

4. Subsurface Effluent Disposal by Infiltration

Description-- Treated wastewater effluent by ATU or by advanced municipal WWTPs can be used for subsurface irrigation or disposal. Subsurface disposal does not require disinfection. Residential and small commercial flows can be disposed subsurface using drip irrigation systems. Filtering of effluent is typically required so as not to clog drip irrigators.

Larger scale disposal systems, such as that proposed for the communities, most efficiently use large scale infiltration systems utilizing manufactured infiltration chambers. Design of an infiltration system is in accordance with NMED Liquid Waste Disposal and Treatment, 20.7.3 NMAC and is based on soil types and daily flow. A 30 percent reduction factor is used for the application rate (gal./SF/day) whenever a secondary treatment system, a tertiary treatment systems or infiltration chamber type disposal system is used.

Cost Estimates

Table 26: Subsurface Effluent Disposal Cost Estimate
Sombrillo and Arroyo Seco Wastewater System Project
Subsurface Effluent Disposal

Item	Description	Unit	Quantity	Unit Cost	Total
Capital Costs					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	Testing allowance	LS	1	\$ 10,000	\$ 10,000
3	Earthwork	CY	2600	\$ 3	\$ 7,800
4	Infiltration Chambers	EA	2700	\$ 50	\$ 135,000
5	Dosing Piping	LF	10800	\$ 5	\$ 54,000
6	Dosing Pump	LS	2	\$ 15,000	\$ 30,000
7	Select Backfill	CY	7020	\$ 10	\$ 70,200
8	Electrical	LS	1	\$ 50,000	\$ 50,000
Construction Subtotal:					\$ 387,000
Contingency 20%					\$ 77,400
NMGRT (Santa Fe Cty) 6.6250%					\$ 25,639
Total for Construction:					\$ 490,039
Item	Description	Unit	Quantity	Unit Cost	Total
Non-Construction Costs					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 98,008	\$ 98,008
Non-construction Subtotal:					\$ 98,008
Contingency 20%					\$ 19,602
NMGRT (Santa Fe Cty) 6.6250%					\$ 6,493
Total for Non-Construction:					\$ 124,102

Total Subsurface System Project Cost: \$ 614,141

Advantages

- Do not require effluent disinfection unless depth to groundwater is <4 ft.
- Can be used by individual households and municipal systems.
- Beneficial use for gardening and farming.
- When operated correctly, require little O&M.
- Viable alternative when other alternatives are limited.

Disadvantages

- Large municipal systems require extensive land area.
- High capital cost of large scale systems.

5. Biosolids Processing and Disposal/Reuse

Biosolids processing also requires permitting by NMED and must be performed in accordance with EPA regulations, 40 CFR Part 503 – *Standards for the Use or Disposal of Sewage Sludge*. The State of New Mexico considers sewage sludge a special waste and only certain landfills are allowed to accept it for disposal. The closest landfill to the communities that accepts sewage sludge for disposal is City of Rio Rancho Landfill.

For small scale WWTPs, such as the proposed 180,000 gpd for both communities, it is more cost effective to utilize a local septage hauler several times a month. Estimated costs using this method for this size of facility are estimated to be \$8,400 per year. This is equivalent to a 20-year present worth (at 2.8 percent interest) of \$127,313.

VI. SELECTION OF AN ALTERNATIVE

The above collection, treatment and disposal alternatives can be ranked using various selection criteria to select specific alternatives. The criteria is based upon standard wastewater project assessment criteria, cost estimates, estimated user rates, etc. as shown below. This ranking and selection process can be done in matrix form. Each alternative is compared to others in the category and given a ranking number, from 1 to 5, for each of the selection criteria. The highest scoring alternative is that best suited for selection.

A. Collection System Alternative Selection

A summary of the collection system alternatives and estimated costs is shown in the following table:

Table 27: Collection System Alternatives Cost Analysis Summary

Alternatives	Construction Cost	Non-Construction Cost	Total Cost
Conventional Gravity/Force Main Sewer	\$9,376,828	\$2,520,098	\$11,896,926
STEP/STEG System	\$7,460,978	\$1,895,824	\$ 9,356,802

Table 28: Collection System Alternatives Selection Matrix

Criteria	Conventional Gravity/Force Main	Low pressure STEP/STEG
Ease of design	5	3
Capital cost	3	5
Construction depth	3	5
High groundwater impact	3	5
Infiltration potential	3	5
Traffic control	3	3
Community disruption	3	3
Easement/Access	3	3
Expandability	5	3
O&M	4	3
Capital cost	3	4
Total Score	38	42

As the collection system matrix shows, the STEP/STEG sewer system is the highest ranked community-wide collection system alternative. The STEP/STEG collection system also has the lowest capital cost.

B. Treatment System Alternative Selection

A summary of the municipal treatment system alternatives and estimated costs is shown in the following table.

Table 29: Treatment System Alternatives Cost Analysis Summary

Alternatives	Construction Cost	Non-Construction Cost	Total Cost
Advanced Treatment Units (High cost)	\$ 11,440,000	\$ 2,288,000	\$ 13,728,000
Connect to the City of Española WWTP	\$ 756,299	\$ 191,533	\$ 947,832
Connect to the SCDC WWTP	\$ 589,834	\$ 149,376	\$ 739,210
Sequencing Batch Reactor	\$ 4,349,316	\$ 1,133,120	\$ 5,482,436
IFAS (STM - Aerotor™)	\$ 737,591	\$ 218,451	\$ 956,042
Membrane Biological Reactor	\$ 4,283,091	\$ 861,618	\$ 5,144,709
Individual Wastewater Treatment Facilities	\$ 1,253,588	\$ 323,802	\$ 1,577,390
Packaged SBR Expansion of SCDC WWTP	\$ 1,587,860	\$ 158,786	\$ 1,746,645

The lowest cost treatment system alternative is to interconnect with the SCDC WWTP located on Hwy 399 and to expand the SCDC WWTP , using a packaged system, to meet the flow requirements.

Table 30: Treatment System Alternatives Selection Matrix

Criteria	Connection to SCDC WWTP	Connection to Española WWTP	Single Centralized Treatment System	Individual Community Treatment Systems
Additional Collection System Cost	3	2	4	5
Ease of Design	5	5	3	3
Capital Cost	5	4	2	1
O&M Cost	5	5	2	2
Ease of Operation	5	5	2	1
Footprint	5	5	2	1
Effluent Quality (Reuse)	1	1	5	5
Biosolids Production	5	5	2	2
Operator Classification	5	5	2	2
Odor	5	5	3	3
Noise	5	5	3	3
Single Responsible Party	5	5	5	4
Required Level of Management	5	5	2	1
User rates	5	4	2	1
Total Score	64	61	38	34

Connection with the SCDC WWTP is the recommended treatment system for the communities of Sombrillo and Arroyo Seco.

C. Effluent Disposal Selection

A summary of the effluent disposal alternatives for treatment system alternatives and estimated costs is shown in the following table.

Table 31: Effluent Disposal Alternatives Cost Estimates

Alternatives	Construction Cost	Non-Construction Cost	Total Cost
Surface Effluent Disposal (Individual WWTPs)	\$ 175,365	\$ 44,411	\$ 219,776
Surface Effluent Disposal (Centralized WWTP)	\$ 93,904	\$ 23,781	\$ 117,685
Subsurface Effluent Aquifer Injection	\$ 1,342,225	\$ 339,918	\$ 1,682,143
Community Surface Effluent Irrigation	\$ 342,039	\$ 86,621	\$ 428,661
Subsurface Effluent Disposal	\$ 490,039	\$ 124,102	\$ 614,141
Resue Piping System to Sports Fields	\$ 47,497	\$ 12,029	\$ 59,526
Reuse Piping System to Commercial Site	\$ 160,181	\$ 40,566	\$ 200,746
Reuse Piping System to Elementary School	\$ 267,432	\$ 67,727	\$ 335,159
Reuse Piping System to Golf Course Pond	\$ 231,217	\$ 58,556	\$ 289,773
36 Ac. Reuse Surface Irrigation System	\$ 477,689	\$ 95,538	\$ 573,226

Table 32: Effluent Disposal Alternatives Selection Matrix

Criteria	Surface River/Arroyo	Subsurface Aquifer Injection	Surface Irrigation	Subsurface Irrigation
Land requirements	5	2	1	1
Formal agreements	3	3	1	1
Reuse of effluent	1	3	5	5
Year-round acceptance	5	4	1	1
Capital Cost	5	1	2	2
Operational Cost	2	2	5	3
Total Score	21	20	18	16

The selected treatment alternative is to connect to the SCDC WWTP with regional reuse of the Class 1A reclaimed wastewater at the Black Mesa Golf Course. However, if on-site treatment is desired in lieu of connection, the recommended effluent disposal is to discharge to the Santa Cruz River and the ephemeral Arroyo Seco.

D. Biosolids Removal

The most cost effective method for disposal of the expected low monthly volumes of biosolids is to use a septage hauler to haul collected biosolids to the City of Santa Fe WWTP for disposal. However, the selected treatment alternative is to connect to the SCDC WWTP so biosolids disposal will not be required by the communities.

VII. PROPOSED PROJECT (Recommended Alternative)

The proposed project is required to meet the immediate and future wastewater needs of the communities.

The total project can be broken down into five distinct phases based on available funding.

A. Project Design

- Phase 1: Sombrillo STEP/STEG wastewater collection system design.
- Phase 2: Sombrillo wastewater collection system construction.
- Phase 3: Sombrillo wastewater interconnection to SCDC WWTP.
- Phase 4: SCDC WWTP regional reuse piping system to Black Mesa Golf Course pond design and construction.
- Phase 5: Arroyo Seco wastewater collection system design.
- Phase 6: Arroyo Seco wastewater collection system construction.
- Phase 7: SCDC WWTP packaged SBR expansion design and construction.

The proposed wastewater project is a STEP/STEG collection system with lift stations and force mains to send the collected wastewater to the SCDC WWTP. The SCDC WWTP would be expanded and regional reuse piping would be constructed to the Black Mesa Golf Course pond for irrigation of the golf course. The project would include:

- Purchase land or acquire easements for construction of the proposed major and minor lift stations.
- Construct connections to SCDC WWTP.
- Designation of STEP or STEG for each land parcel and size effluent pumps.
- Install STEP/STEG connections and pumps at all commercial and residential septic tanks.
- Expansion of the SCDC WWTP utilizing a packaged system.
- Construct reuse piping to golf course.

B. Total Project Cost Estimate

An itemized estimate of the total project cost of \$12,481,554 is provided in the following table.

Table 33: Sombrillo/Arroyo Seco Wastewater System Improvements Project Costs

Sombrillo and Arroyo Seco Wastewater System Project STEP/STEG Collection System, Connection to SCDC WWTP, Regional Reuse at Golf Course					
Item	Description	Unit	Quantity	Unit Cost	Total
Phase 1: Sombrillo Collection System Design					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 611,770	\$ 611,770
2	Geotechnical Report	LS	1	\$ 2,500	\$ 2,500
Sombrillo Non-Construction Subtotal:				\$	614,270
Contingency 20%				\$	122,854
NMGRT (Santa Fe County) 6.6250%				\$	40,695
Total for Non-Construction:				\$	777,819

Item	Description	Unit	Quantity	Unit Cost	Total
Phase 2: Sombrillo Collection System Construction					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 219,607	\$ 219,607
2	4-in PVC Collector Main Pipe (Backfill, Compaction), CIP	LF	24920	\$ 23	\$ 560,700
3	6-in PVC Gravity/Force Main Pipe (Backfill, Compaction), CIP	LF	15271	\$ 25	\$ 381,775
4	STEP pump kit, CIP	EA	6	\$ 5,000	\$ 30,000
5	STEG kit, CIP	EA	218	\$ 2,500	\$ 545,000
6	Pressure Cleanout, CIP	EA	9	\$ 6,000	\$ 54,000
7	Major Lift Station, CIP	EA	1	\$ 200,000	\$ 200,000
8	Minor Lift Station, CIP	EA	3	\$ 100,000	\$ 300,000
9	2-in Pavement Removal & Replacement, Subgrade, CIP (3-ft width)	SY	4662.156	\$ 16	\$ 74,594
10	Traffic Control	LS	1	\$ 50,000	\$ 50,000
Sombrillo Construction Subtotal:					\$ 2,415,676
				Contingency 20%	\$ 483,135
				NMGRT (Santa Fe County) 6.6250%	\$ 160,039
Total for Sombrillo STEP/STEG Construction:					\$ 3,058,850
Phase 3: Connect to SCDC WWTP Construction					
1	Mobilization/Demobilization	LS	1	\$ 30,000	\$ 30,000
2	12-in PVC Gravity Main (Backfill, Compaction), CIP	LF	8923.2	\$ 35	\$ 312,312
3	6-in PVC Force Main (Backfill, Compaction), CIP	LF	940	\$ 25	\$ 23,500
4	Major Lift Station	EA	1	\$ 100,000	\$ 100,000
Sub-total for Connection to SCDC WWTP:					\$ 465,812
				Contingency 20%	\$ 93,162
				NMGRT (Santa Fe County) 6.6250%	\$ 30,860
Total for Construction:					\$ 589,834
Phase 4: SCDC WWTP Reuse Piping to Golf Course Design & Construction					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$ 46,243	\$ 46,243
2	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 16,600	\$ 16,600
3	6-in. C900 Class 100, CIP	LF	5200	\$ 30	\$ 156,000
4	Valving	LS	1	\$ 10,000	\$ 10,000
Non-Construction & Construction Subtotal:					\$ 228,843
				Contingency 20%	\$ 45,769
				NMGRT (Santa Fe County) 6.6250%	\$ 15,161
Total for SCDC Reuse Piping:					\$ 289,772
Phase 5: Arroyo Seco Collection System Design					
1	Basic Engineering Design Services (Design, Bidding, Permitting, ROW, Surveying, Construction Inspection, etc.) (20% of Construction)	LS	1	\$1,054,107	\$ 1,054,107
2	Geotechnical Report	LS	1	\$ 2,500	\$ 2,500
Arroyo Seco Non-Construction Subtotal:					\$ 1,056,607
				Contingency 20%	\$ 211,321
				NMGRT (Santa Fe County) 6.6250%	\$ 70,000
Total for Non-Construction:					\$ 1,337,929

Item	Description	Unit	Quantity	Unit Cost	Total
Phase 6: Arroyo Seco Collection System Construction					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 336,046	\$ 336,046
2	4-in PVC Collector Main Pipe (Backfill, Compaction), CIP	LF	48986	\$ 23	\$ 1,102,185
3	6-in PVC Gravity/Force Main Pipe (Backfill, Compaction), CIP	LF	22575	\$ 25	\$ 564,375
4	STEP pump kit, CIP	EA	12	\$ 5,000	\$ 60,000
5	STEG kit, CIP	EA	336	\$ 2,500	\$ 840,000
6	Pressure Cleanout, CIP	EA	10	\$ 6,000	\$ 60,000
7	Major Lift Station, CIP	EA	2	\$ 200,000	\$ 400,000
8	Minor Lift Station, CIP	EA	1	\$ 100,000	\$ 100,000
9	2-in Pavement Removal & Replacement, Subgrade, CIP (3-ft width)	SY	8368.844	\$ 16	\$ 133,902
10	Traffic Control	LS	1	\$ 100,000	\$ 100,000
Arroyo Seco Construction Subtotal:					\$ 3,696,508
Contingency 20%				\$ 739,302	
NMGR (Santa Fe County) 6.6250%				\$ 244,894	
Total for Arroyo Seco STEP/STEG Construction:					\$ 4,680,703
Phase 7: SCDC WWTP Packaged SBR Expansion Design & Construction					
1	Mobilization/Demobilization (10% of Construction)	LS	1	\$ 115,000	\$ 115,000
2	Influent Lift Station	LS	1	\$ 150,000	\$ 150,000
3	Headworks Screen & Wash System	LS	1	\$ 80,000	\$ 80,000
4	50,000 GPD Packaged SBR	LS	2	\$ 248,000	\$ 496,000
5	Misc. Electrical & Standby Generator	LS	1	\$ 150,000	\$ 150,000
6	Misc. Mechanical	LS	1	\$ 20,000	\$ 20,000
7	Sludge pump	LS	1	\$ 50,000	\$ 50,000
8	Yard piping connections to existing WWTP	LS	1	\$ 30,000	\$ 30,000
9	HVAC	LS	1	\$ 50,000	\$ 50,000
10	Pre-engineered Metal Building	LS	1	\$ 100,000	\$ 100,000
11	Basic Engineering Services	LS	1	\$ 124,100	\$ 124,100
Non-Construction & Construction Subtotal:					\$ 1,365,100
Contingency 20%				\$ 273,020	
NMGR (Santa Fe County) 6.6250%				\$ 108,525	
Total for SCDC WWTP Expansion:					\$ 1,746,645

C. Annual Operating Budget

The communities of Sombrillo and Arroyo Seco do not have operating budgets for a wastewater system as there is no municipal association formed, Santa Fe County will operate the wastewater system.

1. Income

The median household income of the residences of Sombrillo and Arroyo Seco, as per a NMFA survey, is \$50,400/year as of 2005. For informational purposes, the following table shows user rates required to cover the capital costs. Various loan and grant scenarios are shown in the table below using 554 residential and 19 commercial meters over the 20-year planning period. Loan amortization tables are provided in Appendix C.

The following table shows rates that would be required for each connection to cover the entire capital costs of the project. The table also shows rates required for different grant/loan scenarios. As Santa Fe County is expected to apply current non-water use wastewater rates for this project, the table is for informational purposes only.

The current Santa Fe County wastewater rates that would be utilized for these communities is shown in the following Operations and Maintenance section.

Table 34: Rate Schedule Required for Capital Expenses

Residential Connections: 554	Commercial Connections: 19						
	Loan %	Loan Monthly Payment	Meter Monthly Rate				
\$10,445,000	100%	\$63,295.47	\$110.46				
	75%	\$47,471.60		\$82.85			
	50%	\$31,647.74			\$55.23		
	25%	\$15,823.87				\$27.62	
	10%	\$6,329.55					\$11.05
	Proposed Project Rate Totals		\$110.46	\$82.85	\$55.23	\$27.62	\$11.05
Future Base Rates		Loan %	100%	75%	50%	25%	10%
		Connection	\$110.46	\$82.85	\$55.23	\$27.62	\$11.05
NMFA survey of per capita income: \$50,400							
Yearly future residential base rate as % of per capita yearly income:			2.63%	1.97%	1.32%	0.66%	0.26%

Note: Assumed loan rate 4% interest for 20 years, no additional consumers

2. Operations and Maintenance

Additional O&M costs attributed to the proposed project would consist primarily of electricity to power the lift stations, STEP pumps, and possibly fixing leaking septic tanks. Santa Fe County will own and operate the proposed STEP/STEG collection system. Current non-water use wastewater rates for Santa Fe County are \$6.54 per month base charge and a commodity charge of \$3.50 per thousand gallons.

3. Debt repayments

Financing for the proposed project must come from loans or grants, or a combination thereof. A breakdown of various loan/grant scenarios for the two phases of the proposed project is summarized in the following table.

Table 35: Proposed Project Loan Scenarios

Estimated Cost	Loan Ratio				
	100%	75%	50%	25%	10%
\$10,445,136	\$15,190,913	\$11,393,185	\$7,595,456	\$3,797,728	\$1,519,091
Totals	\$15,190,913	\$11,393,185	\$7,595,456	\$3,797,728	\$1,519,091
Annual Loan Payment	\$ 759,546	\$ 569,659	\$ 379,773	\$ 189,886	\$ 75,955

Note: Based on loan at 4.00% interest for 20 years

4. Reserves

The Debt Service Reserve of one-tenth (1/10) of the annual debt payment for each of the loan ratios in the table above, is shown in the table below.

Table 36: Required Debt Service Reserve for Loans

Estimated Cost	Loan Ratio				
	100%	75%	50%	25%	10%
\$10,445,136	\$15,190,913	\$11,393,185	\$7,595,456	\$3,797,728	\$1,519,091
Totals	\$15,190,913	\$11,393,185	\$7,595,456	\$3,797,728	\$1,519,091
Annual Loan Payment	\$ 759,546	\$ 569,659	\$ 379,773	\$ 189,886	\$ 75,955
Debt Service Reserve	\$ 75,955	\$ 56,966	\$ 37,977	\$ 18,989	\$ 7,595

Note: Based on loan at 4.00% interest for 20 years

A Short-Lived Asset Reserve is a deposit reserved for replacement of pumps, paint, and small equipment not covered under O&M. As the proposed project includes replacement of items that would fall under this category and these items are expected to have a life of at least 20 years, it is assumed that a Short-Lived Asset Reserve is not required for the proposed project.

VIII. CONCLUSIONS AND RECOMMENDATIONS

The proposed wastewater system improvements presented in this report represent the recommended improvements to ensure the communities of Sombrillo and Arroyo Seco has a safe and reliable wastewater system that does not impact the groundwater quality for the next 20-years.

The proposed project is a STEP/STEG collection system with connection to the SCDC WWTP for wastewater treatment. The total estimated project cost of \$12,481,554 might be too great to cover for one funding source, and in one funding cycle, and may require the project to be split into multiple phases.

A proposed phase breakdown for this project is:

- Phase 1: Sombrillo STEP/STEG wastewater collection system design - \$777,819
- Phase 2: Sombrillo wastewater collection system construction - \$3,058,850
- Phase 3: Sombrillo wastewater interconnection to SCDC WWTP - \$589,834
- Phase 4: SCDC WWTP regional reuse piping system to Black Mesa Golf Course pond design and construction - \$289,772
- Phase 5: Arroyo Seco wastewater collection system design - \$1,337,929
- Phase 6: Arroyo Seco wastewater collection system construction - \$4,680,703
- Phase 7: SCDC WWTP packaged SBR expansion design and construction - \$1,746,645

APPENDIX A

Figures

- Figure 1: Location Map**
- Figure 2: Sombrillo and Arroyo Seco Wetlands**
- Figure 3: Watercourses and Wetlands Map**
- Figure 4: Flood Insurance Map**
- Figure 5: Land Status Map**
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- Figure 7: Sombrillo Conventional Gravity Collection System**
- Figure 8: Arroyo Seco Conventional Gravity Collection System**
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- Figure 11: Sombrillo/Arroyo Seco Connections to Santa Clara WWTP and City of Española WWTP**
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- Figure 13: Sombrillo/Arroyo Seco Individual WWTP Alternative**
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- Figure 15: SCDC WWTP Reclaimed Wastewater Reuse Alternatives**

APPENDIX B

Environmental Resources Present

Listed and Sensitive Species in Santa Fe County, New Mexico

APPENDIX C

Loan Amortization Tables