Regional Facility Plan

Monticello Regional Facility Plan

City of Monticello, Kentucky

September 2011

STATE OF KENTUCKY
DAVID F. SCHRADER
20981
10/18/11
LICENSED
PROFESSIONAL ENGINEER

bell engineering

Monticello Regional Facility Plan

September 2011

As required by 401 KAR 5:006

TABLE OF CONTENTS

.

Section 1: Regional Facility Plan Summary

1. PURPOSE OF THE PLAN

33 U.S.C. 1288 requires the governor of the state or local officials to designate a boundary for areas within the state and a single representative organization within each area to develop a wastewater treatment management plan applicable to all wastewater generated within an area. 40 C.F.R. 130.6 requires the state and areawide agencies to update the plans as needed to reflect changing water quality conditions, results of implementation actions, and new requirements, or to remove conditions in prior conditional or partial plan approvals. This administrative regulation establishes Kentucky's regional facility planning process for publicly-owned wastewater treatment works that are, or result in, point sources of water pollution in designated planning areas.

2. INTRODUCTION

The City of Monticello, herein referenced as the City, is the seat of Wayne County and is located in the Lake Cumberland region of south central Kentucky. According to the U.S. Census Bureau and the Kentucky Data Center at the University of Louisville, the population of Monticello is estimated at approximately 5,981 residents as of the 2000 survey. Wayne County, which covers a land area of 484 square miles, has a population of about 21,000.

The City owns and operates the Monticello Wastewater Treatment Plant. The purpose of this report is to provide preliminary design criteria and opinions of probable cost for the proposed Monticello Wastewater Treatment Plant Expansion. This report will analyze various alternatives and expound upon the recommended alternative. The City is proposing to construct improvements to their existing 0.7 MGD water treatment plant and increase capacity to 1.4 MGD.

3. PROJECT PLANNING AREA

A. Location

The City is located 101 miles south of Lexington, Kentucky; 92 miles northwest of Knoxville, Tennessee; and 153 miles southeast of Louisville, Kentucky. The project planning area lies entirely within Wayne County. It extends from Lake Cumberland in the north to Sulfur Springs Mountain which is a few miles south of Monticello in the south and from High Rock Hill in the east to Colletts Hill in the west as shown as shown on the map in Appendix A.

4. SELECTION OF AN ALTERNATIVE

A. Present Worth

A present worth and life cycle cost analysis was conducted for each alternative at a discount rate of 6 percent. Below in Table 1-1 is a summary of the present worth calculations with the capital costs adjusted for 2009 dollars. Alternative No. 4 is not shown since it is the do nothing alternative which does not have any costs associated with it.

Table 1-1
Present Worth

Present Worth Item	Alternative No. 1	Alternative No. 2	Alternative No. 3
Capital Cost	$3,410,000	$6,778,000	$8,530,000
Equipment Replacement	$568,100	$729,400	$729,400
Operation and Maintenance	$6,658,700	$7,956,500	$7,956,500
Salvage Value	$75,500	$93,000	$93,000
Total Present Worth	$10,712,300	$15,556,900	$17,122,900
Ranking	**3**	**2**	**1**

3=Most Favorable; 1=Least Favorable

B. Evaluation of Non-Monetary Values

A matrix system was developed to facilitate the selection process by evaluating non-monetary factors which could influence the selection process.

Table 1-2
Evaluation Matrix

Factor	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
Reliability	2	3	3	1
Phosphorus Removal	2	3	3	1
Ability to Upgrade	2	2	2	1
Ability to Expand	2	2	3	1
Generation of Odors	2	3	2	1
Sludge Handling	2	3	3	1
Ability to Meet Permit	2	3	3	1
Constructability	1	1	2	3
Ranking	**15**	**20**	**21**	**10**

3=Most Favorable; 1=Least Favorable

5. PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

A. Project Design

During the facilities planning four alternatives were evaluated for the expansion and upgrading of the wastewater treatment facilities. Alternative No. 2 was chosen as the most cost effective and practical alternative. Alternative No. 2 proposes to renovate the existing WWTP and add additional treatment units to ensure compliance with current and future regulatory requirements. This recommendation differs from the findings of the 2005 Regional facilities Plan in regard to waiting till year 6 to expand the treatment capacity and regarding the reuse of the single grit chamber and the addition of biological nutrient removal systems. We recommend removing this unit from service and installing a new grit removal system in conjunction with the new headworks facility. The existing influent pump station will be rehabilitated and remain in service. The headworks will include grit removal, and mechanical bar screens. To meet the new KPDES permit that has been issued for phosphorus removal to 1 mg/l phosphorus the facilities will include a new chemical feed facilities. An additional oxidation ditch and two new final clarifiers will be constructed to increase capacity of the secondary system to 1.4 MGD. The existing chlorine contact basin will be taken out of service and a new ultraviolet disinfection system installed. Two additional sludge holding basins will be constructed to improve solids handling. A second belt filter press and additional sludge storage should be constructed to improve sludge handling. A new ultraviolet disinfection system would replace the chlorination and dechlorination systems.

B. Proposed Funding for this Project:

• USDA Rural Development Grant	$2,000,000
• USDA Rural Development Loan	$4,620,000
• EDA Grant	$2,000,000
• Total Funding	**$8,620,000**

C. IMPLEMENTATION SCHEDULE

The proposed schedule is as follows:

Item Description	Completion Date / Status
1. Final Design	Complete
2. Bid Opening	8/26/2011
3. Begin Construction	10/20/2011
4. End of Construction	10/20/2013
5. Project Closeout	11/20/2013

Section 2: Statement of Purpose and Need

1. Health, Sanitation, and Security

When the plant's current Kentucky Pollution Discharge Elimination System permit (KPDES) expires in 2012 the Kentucky Division of Water will add a phosphorus limit to the requirements of the new discharge permit. The addition of this limit will require process changes along with chemical feed additions in order to ensure the plant can meets its new discharge permit limits.

The existing plant uses highly hazardous chlorine gas for disinfection of the treated effluent which requires additional safety precautions especially with the plants proximity to town. Changing disinfection to something like UV light or sodium hypochlorite would allow the utility to eliminate the use of hazardous chlorine gas.

There are a number of residences around the planning area which use septic tanks or straight pipes. Some portion of these may be contributing to the fact that the 2008 Kentucky Division of Water Report to Congress on the state's water resources indicated that Elk Spring Creek does not support Aquatic Life Use. One of these areas is the Colonial Estates Subdivision which lies upstream of nearly the entire corporate area of Monticello. Any waste streams in this area that are not properly treated would likely flow through subsurface waterways and eventually reach the surface of the Elk Spring Creek drainage area. Expanding the wastewater treatment capacity would increase the number of residences with failing septic systems or straight pipes that could be connected to the community treatment system, improving Elk Spring Creek's water quality.

2. System O&M

Other than routine maintenance no improvements have been made to this plant since its initial operation in 1987 and the only addition has been a belt filter press for sludge handling and disposal. As a result many of the systems need improvements as the standard life expectancy for equipment is around 20 years. Major upgrades or replacement of equipment should extend the various unit processes' life another 20 years or so.

The plant currently has a higher level of solids in its primary treatment process, the extended air oxidation ditch, due to inadequate sludge handling capability. These elevated solids levels can be partially washed out, possibly to the receiving stream, should wet weather flows approach the plant capacity. This can be solved with additional solids storage and handling facilities.

3. Growth

Based on the 2005 Regional Facilities Plan (the Plan) the planning area was broken down into 3 areas: the 0-2 year planning period which included the corporate limits which will be referred to as Area 1; the 3-10 planning period which included a section along Route 90 north of its intersection with Main Street (Route 1275), along Route 1275 north of the city to Lake Cumberland and a section south of the city around Route 167 and Missouri Hollow to Wray Gap which will be referred to as Area 2 and; the 11-20 planning area which included all other areas outside the city as previously mentioned which will be referred to as Area 3.

The plan also noted an average number of persons per household of 2.49; an average growth rate of 0.5 percent for area 1 and 1.14 percent for areas 2 and 3; the total number of existing households in area 1 not on the city sewer system as 225 (174 plus 51 from an immediate connection project); and the number of existing customers in area 2 as of 2004 as 1,244 (1,033 from the 2000 census plus 211 from 10 years of growth), none of which are currently connected to the sewer system. Area 1's anticipated growth rate was noted to be less than areas 2 and 3 due to its limited availability of land for development.

Using the above information and a base year of 2004 the plan was adding 481 customers new customers from area one; 674 new customers from area 2 and 2,808 new customers from area 3. The plan assumed that all existing non-sewered customers in areas 1, 2 and 3 along with all new customers would be added to the city sewer system by the end of the 20 design period. This is very optimistic as many of the customers are in remote areas relative to existing sewer lines and the wastewater treatment plant and thus it would be very expensive to add all of them to the sewer system in the next 20 years.

The corresponding increase in wastewater flows as proposed in the plan over this time period can be seen in Table 7-3. The actual average daily flow that entered the wastewater treatment plant during 2007 was measured to be 0.406 MGD. The design average daily flow of the existing plant is 0.700 MGD resulting in a current used capacity of approximately 58 percent for 2007. This flow may be lower than that projected below because of the repair work being done on the Lake Cumberland dam necessitated lowering of the lake's water level which in turn reduced lake use by tourists which has resulted in lower wastewater flows and because one or more businesses have closed since the 2005 Regional Facilities Plans was done. Once the repairs to the dam are completed in 2012-2014 the rate of increased wastewater flows may come closer to expected levels.

Section 3: Physical Characteristics of the Planning Area

The City is located 101 miles south of Lexington, Kentucky; 92 miles northwest of Knoxville, Tennessee; and 153 miles southeast of Louisville, Kentucky. The project planning area lies entirely within Wayne County. It extends from Lake Cumberland in the north to Sulfur Springs Mountain which is a few miles south of Monticello in the south and from High Rock Hill in the east to Colletts

The Planning Area is divided into three elements. The first element is the 0-2 year Planning Area and generally covers the existing city limits. The second element is the 3-10 year Planning Area where sanitary sewer extensions are likely to occur over the next 10 years. This area consists of the corridor along the bypass (KY 90) and an area locally referred to as the Missouri-Hollow area. The area along the Bypass has experienced some commercial and residential growth due to its proximity to the City of Somerset. The Missouri-Hollow areas growth is due to the dense population in the area. The third area in the 10-20 year Planning Area is the Steubenville area north of the corporate boundary. This area is located along the main artery into the city (KY 90). The final area located in the 10-20 year planning area boundary is the highway corridor that starts at the northern portion of the City limits and extends to the Lake Cumberland Reservoir near Conley Bottom Resort. The last element is the 10 – 20 year expansion area. Sanitary sewer extensions in these areas are likely to occur due to the addition of new subdivisions and vacation cabins around Lake Cumberland. This area encompasses the central portion of Wayne County with Lake Cumberland Reservoir as its northern boundary. The eastern boundary for this area lies along Harmon Creek following KY90 west to its intersection with KY 858. The southern boundary of this area extends to Elk Ridge. A seven and one-half minute USGS topographic map showing the planning area boundary is located in Appendix A. A map showing the Monticello sewer system is located in Appendix B. A 7.5 minute USGS topographic map is located in Appendix C. A flood plain map delineating the 100-year floodplain relative to the planning area is shown in Appendix D.

Section 4: Socioeconomic Characteristics of the Planning Area

1. HUMAN ENVIRONMENT

As previously stated the population of Monticello is approximately 5,981. The following information was obtained from the Kentucky Data Center at the University of Louisville. The figures are estimates based on the results gathered during the 2000 Census.

<u>Sex</u>
Male (44%) – 2,815
Female (56%) – 3,166

<u>Marital Status(Population 15 and over)</u>
Married – 52.6%
Never Married, Divorced,
Widowed -47.4%

<u>Race</u>
White Non-Hispanic – 94.6%
Black – 2.4%
Asian– 0.4%
American Indian – 0.4%
Other – 2.2%

<u>Age</u>
Median Age – 36.5 years

<u>Income</u>
Median Household Income - $17,423

<u>Population Change (1990-2000 Wayne County)</u>
Increase – 2,455 residents (14.1%)

<u>Education (25 years and over)</u>
Population – 3,900
High School or Equivalence – 33.2%
Bachelors – 5.4%
Graduate or Professional – 4.8%

2. GROWTH AREA AND POPULATION TRENDS

The estimated population of Wayne County was 20,813 in 2010, representing an increase of about 4.5% over the 2000 census population of 19,923. The population for the City of Monticello in 2010 was 6,188, representing a 3.5% increase from the census population in 2000 of 5,981. These population trends are representative of the project area. Population trends of the City show it continues to grow at a reasonable rate. The continued growth and the City's aggressive stance on promoting responsible development demands the infrastructure of the region continue to grow as the population does. The proposed project follows the lines of responsible development and not only provides a great environmental service to the area but it also represents the city's commitment to the area.

The planning area that is served by the WWTP is expected to see a significant growth pattern due to the recent designation of Clinton County and portions of Wayne County as Federal Empowerment Zones. This designation should encourage investment in the area and encourage the growth of industrial and commercial developments. This growth along with the anticipated residential growth will increase wastewater flow to the treatment plant.

Without an expansion of the existing wastewater treatment plant, the City of Monticello will not able to add additional commercial growth from industries that have shown interest in relocating to the area.

Table 4-1
Population Projections[1]
Wayne County & City of Monticello

Year	**2000**	**2010**	**2015**	**2020**	**2025**	**2030**
Wayne County	19,923	20,813	21,532	22,128	22,542	22,728
% Increase	-	4.47	3.45	2.77	1.87	0.83
City of Monticello	5,981	6,188	6,401	6,578	6,701	6,757
% Increase	-	3.46	3.45	2.77	1.87	0.83

Notes: 1. Data obtained from the Kentucky State Data Center, and U.S. Census Bureau, Census 2010.

3. RESIDENTIAL GROWTH

Based on the population projections above and the existing number of customers, the table below represent population projection for the planning areas. According to a recent survey, there are approximately 175 unserved customers within the current city limits. It is estimated that these customers will be served over the planning period at a rate of about 9 homes per year until all of these customers are served, and that the city will experience growth at the rates shown above. Growth in the 0-2 year planning area is expected to increase at a rate equal to the population projections. The population in 2010 was 6,188 for an increase of 207 people since the year 2000. Assuming this remains fairly constant during the 0-2 year planning period, using an average of 2.40 people per household (207/2.4) equals approximately 9 additional connections per year between 2000 and 2010. Assuming this trend continues and adding the 9 homes per year of unserved customers results in 18 additional customers per year over the next 20 years in the 0-2 year planning area.

The 3-10 year planning period includes a population of approximately 1,200 people. Population projections for the county indicate that the overall population in Wayne County over the next 20 Years will average 2.68%. Using this average increase and applying it to the population of the 3-10 year planning area it is assumed that the population will increase at a rate of 93.5 people per year resulting in (93.5/2.4) 39 customers per year.

The 11-20 planning area growth will be similar to the 3-10 year growth rate of approximately 39 customers per year.

Table 4-2
Expected Additional Customers
Planning Area

	Planning Period			
	0-2 Year	3-10 year	11-20 Year	Total Planning Area
End of Year 2	36	0	0	36
End of Year 10	144	312	0	456
End of Year 20	144	312	780	1,236
Total	320	624	780	1,724

Section 5: Existing Environment in the Planning Area

1. ENVIRONMENTAL RESOURCES PRESENT

The information contained herein briefly describes the planning area topography/geology, groundwater conditions, human environment, climatology, and culture resources.

Topography/Geology – Wayne County is located in both the Pennyrile region and the Eastern Kentucky Coal Field region of the state. The elevation of Wayne County ranges from 723 feet to 1,780 feet above mean sea level. The elevation of Monticello is approximately 923 feet above mean sea level. Western Wayne County is in the Mississippian Plateaus Region of south-central Kentucky. The topography of the region is generally classified as rolling to flat terrain karst areas frequent throughout the region. Sinkholes and springs are abundant in the karst area and have dramatic effects on the quality of groundwater in the region. The southern and eastern portions of the county are considered in the Eastern Kentucky Coal Field physiographic region of the state. This region is a higher plateau of the county and dissected by normal stream erosion. Moderate to steep elevation reliefs exist in abundance in this region and the highest points in the county are found in this region.

Groundwater Conditions – According to the Kentucky Geological Service, water obtained from drilled wells in the region was classified as hard. Salt and hydrogen sulfide were the two most commonly occurring natural pollutants. The Kentucky Division of Water, Groundwater Branch, considers ground water in urban areas of Wayne County to be sensitive to pollutants generated by human activities and unsafe for human consumption or domestic use. Maximum ground water flows occur in late winter, minimum flows in early fall. Groundwater conditions in the region will not be affected by the proposed project.

Climatology – Monticello has a moderate climate, characterized by warm moist conditions. Monthly average temperatures range from high 80 degrees F to lows of 23 degrees F. Weather patterns are influenced by weather trends in the Gulf of Mexico. Monticello is located in the path of several storm systems. Storms occur year around; however, most occur between the months of March and September. Average annual precipitation for the area is approximately 44 inches.

Cultural Resources – Established in 1802, Monticello is historically deeply rooted in the culture of south central Kentucky. The first known settlement of the region stems back to the summer of 1770 at the site which would later become Mills Springs State Park. A few of the cultural sites of the county include: The Brown-Lanier House, The West-Metcalfe House, Mills Springs, and the Wayne County Museum located near the original "Raccoon" John Smith Cabin Site. No cultural resources will be affected by the proposed project.

Biological Resources – Wayne County is known for its' biological diversity in plant and animal communities. Below is a list of endangered species listed in the following report; 'Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities for Wayne County:

Taxonomic Group	Common Names
Vascular Plants –	Southern Maidenhair Fern, Spreading False Foxglove, Yellow Wild Indigo, Summer Sedge, Crawe's Sedge, Prarie Root, Sharp-Scaled Manna-Grass, Short's Hedgehyssop, Grassleaf Mud-Plantain, Plains Muhly Conjurer's-Nut, Canby's Mountain Lover, Illinois Pondweed, Water Oak, Tall Beaked Rush, Shinning Ladies-Tresses, and Eelgrass.
Freshwater Mussels -	Tennessee Clubshell, Fluted Kidneyshell.
Crustaceans -	Cumberland Platau Cave Crayfish.
Fishes -	Mountain Brook Lamprey, Palezone Shiner, Sawfine Shiner.
Breeding Birds -	Henslow's Sparrow.
Mammals -	Rafinesque's Big-Eared Bat, Indiana Bat.

This project is fully contained on the existing fenced-in property site and it is not anticipated that any endangered species will be harmed as a result of this project.

Section 6: Existing Wastewater System

1. HISTORY

The area is currently served with a wastewater system that consists of a conventional gravity collection system operated in conjunction with a conventional extended aeration wastewater treatment facility.

The gravity collection system consists of gravity sewer lines, twelve lift stations and their associated force mains and one large lift station located adjacent to the treatment plant. According to the Monticello Utility Commission, the sewer system consists of over 220,000 feet of 8-inch, approximately 6,600 feet of 10-inch and 6,400 feet of 12-inch of sewer lines. In addition, over 625 manholes are known to exist. Most of the collection lines were initially constructed during the 1950's. Additions to the collection system have periodically been occurring since then. Due to the Karst topography and the associated sinkholes, individual areas of the sewer system drain toward depression areas which are served by lift stations. The service area terrain follows a northeast to southwest path, which is aligned with the Elk Creek drainage basin. A large portion of the sewer system follows this pattern via a gravity sewer without the need for lift stations.

The earlier sewer lines are constructed of vitrified clay pipe with mortar and lead type joints. Beginning in the 1970's, sewer lines were made of PVC plastic with bell and spigot type joints. The older manholes are made of brick and concrete mortar and the newer manholes are made of precast concrete. Nearly all of the manholes were constructed with access steps.

The wastewater treatment plant has been in operation since 1987 and currently operates at a capacity of approximately 58 percent based on the average daily flows for the year 2007. The City has maintained the operation of the sewer collection and treatment system within compliance of all applicable rules and regulations during the test period of this report which is the 2007 annual period.

D. Condition of Existing Facilities

The purpose of this section is to evaluate the components of the unit processes. It will include a description of the physical characteristics, and the condition of the existing facilities. In addition, we will evaluate its present capability and future use.

1. Preliminary Treatment

Influent Pumping

a. Description

The influent pumping station at the Monticello WWTP is equipped with four pumps with the following capacity:

Duty Pumps

Two 100 Hp submersible centrifugal pumps rated at 800 gallons per minute.

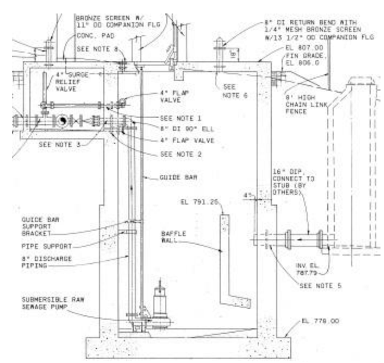
Jockey Pumps

Two 50 Hp submersible centrifugal pumps rated at 350 gallons per minute.

The submersible pumps are housed in a wet well sized to prevent air from reaching the impeller. The sump layout is typical of the Flygt sump design criteria with a front – high level entry intake structure. The front entry design allows for the flow to enter the wet well and be directed towards the pumps without inducting horizontal rotation in the sump. The flow from the inlet strikes a baffle wall and flows into the inlet chamber through a slot in the baffle. This slot distributes the flow evenly toward all of the pump inlets. When flow reaches the pump inlet the sewage is lifted to preliminary treatment units using centrifugal forces and differential pressure.

b. Evaluation

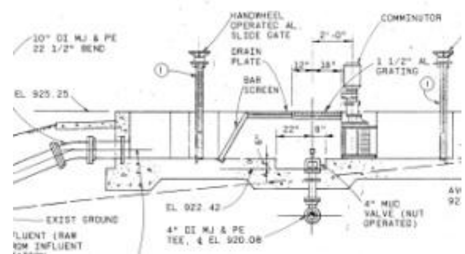
The influent pumping station sump well is 16 ft wide, 15 ft long, and approximately 28 ft deep resulting in a volume of approximately 1,800 gallons per foot of elevation. The top of the baffle wall is located 13 ft from the bottom slab. Assuming a minimum submergence of 3 ft this design allows for 18,000 gallons of storage before the sewage overflows the baffle wall. Emergency storage available during power outages or pumping system malfunctions is calculated using the peak inflow of 2.175 MGD. This allows for approximately 12 minutes of emergency storage. This does not meet 10-state requirements for emergency storage and thus an emergency generator is required. Future capacity will also require the use of a generator.



The vertical discharge piping is 8-inch ductile iron pipe. The hydraulic institute recommends a velocity of 5-8 ft/s in the vertical discharge column to prevent the settling of solids. The vertical discharge pipes for the jockey pumps are also 8-inches in diameter. This was likely done to allow for two additional duty pumps for future flows. The current pipes are oversized for the jockey pump discharge of 350 gpm. The resulting vertical velocity would be around 2 ft/s which is well below the recommended velocity. This is likely resulting in poor solids transport during low flow conditions. The duty pumps are rated at 800 gpm and the resulting velocity is 4.47 ft/s.

Screening

a. Description



The Monticello WWTP is equipped with a coarse manual bar screen followed by a comminutor with an overflow to a fine manual bypass screen. The coarse screen has clear spacing between the ¼ - inch thick bars of 1 – inch. The channel for the coarse bar screen is 1 – foot wide and 2.33 feet deep. Allowing for freeboard of 18 – inches reduces the allowable depth to 0.83 feet. Screenings are manually removed from the screens and deposited on a drain plate. The screenings are then manually removed from the drain plate and placed into a screenings container for final disposal to the landfill. A comminutor is located downstream of the coarse bar screens to reduce particle size.

The bypass channel is equipped with a fine screen to remove screenings from the wastewater should the primary channel be out of service or blinded.

b. Evaluation

At normal operating conditions, the minimum approach velocities to the coarse screen should be 1.25 ft/s to prevent material from settling, but not greater than 3.0 ft/s to prevent forcing the material through the openings.

At the current design flow of 0.700 MGD the approach velocity is approximately 1.3 ft/s. At the present design peak flow of 2.175 MGD, the approach velocity is approximately 4.1 ft/s. At the future peak flow of 4.35 MGD, the approach velocities would theoretically be approximately 8.1 ft/s. However, the channel would overflow long before these velocities are achieved.

Operating personnel at the Monticello WWTP have reported that the comminutor frequently clogs with rags. It is possible that the instantaneous high flows could carry rags into the comminutor.

Grit Removal

a. Description

A grit chamber 10.35 feet deep, 10 feet wide, and 10 feet long, follows the screening system to remove grit from the treatment system. The basin has a total volume of 1,346 cubic feet resulting in a detention time of approximately 6.7 minutes at a peak hourly flow of 1,510 gallons per minute. Grit is allowed to settle in the tank and is removed from the bottom hopper using a fluidizing line to lift the girt into a grit-washing system. The grit is washed to remove organics prior to discharge into a self dumping grit hopper.

b. Evaluation

The grit chamber is not functioning and has not been operational for many years resulting in grit buildup that requires frequent cleaning. The fluidizing line does not operate properly and clogs with grit when it does function. The structural steel is deteriorating and in poor condition creating a potential safety hazard.

Parshall Flume

a. Description

A parshall Flume is located downstream of the grit removal system. The parshall flume has a throat width of 9 – inch, and a depth of 0.88 ft. The flume is equipped with an electronic level transducer. A unit of this size is designed to measure flows from 0.59 MGD to a maximum measurable flow of 5.73 MGD.

b. Evaluation

The parshall flume appears to be in good condition and operational.

2. Secondary Treatment

Oxidation Ditch

a. Description

The secondary treatment unit consists of a single oxidation ditch with two surface aerators. The tank is approximately 214 feet long, 60 feet wide, and the water depth is approximately 8 feet deep. Total volume of the oxidation ditch is 696,100 gallons resulting in a hydraulic detention time of approximately 23.9 hours at a design flow of 486 gallons per minute.

b. Evaluation

The average influent BOD and SS concentrations for 2007 were 290 mg/l and 285 mg/l respectively. The 2007 yearly average BOD and SS concentrations for the effluent discharge from the secondary clarifiers were 3 mg/l and 8.6 mg/l respectively. This represents a 99% removal efficiency for BOD and 97% reduction in SS through the secondary treatment system. Also, records show that the plant influent ammonia-nitrogen (NH3-N) concentration was approximately 35 mg/l while the effluent concentration was about 0.4 mg/l resulting in a reduction of 98.9%. The concrete tanks appear to be in good condition. The surface aerators provide adequate aeration for treatment but the effluent weir is not functioning resulting in wasted energy. The depth of the liquid in the ditch cannot be adjusted. The design does not provide redundancy in the aeration basins and therefore the basin cannot be taken out of service for maintenance. Since the grit system is not functioning it is likely that the basin is accumulating grit and needs to be cleaned to maintain efficiencies.

Final Clarifiers

a. Description

Following the oxidation ditch are two 38 foot diameter circular clarifiers fitted with a rotating sludge collection system. Sludge is directed to the center of the basin for wasting activated sludge or returning sludge to the aeration basin. The clarifier side water depth is 12 feet and a surface area of approximately 1,134 ft^2 each resulting in an overflow rate of 1,918 gpd/ft^2 at a design peak hourly flow of 2.175 million gallons per day with one clarifier out of service. The overflow rate at the design flow of 0.700 MGD is approximately 617 gdp/ft^2.

b. Evaluation

The typical design parameter for solids loading rate to the final clarifiers at average daily flow is 25 lbs./day/ft^2. The City of Monticello WWTP records indicate that the mixed liquor suspended solids (MLSS) concentration in the oxidation ditch is approximately 4,770 mg/l. Typical MLSS for an oxidation ditch is in the range of 1,500 to 5,000 mg/l. It is not recommended to operate this facility in the upper range for extended periods. The high loading in the oxidation ditches indicate a need to increase sludge wasting.

The sludge scraping mechanisms in the final clarifiers are about 20-years old and should be replaced with the expansion of the WWTP.

Activated Sludge Pumping

a. Description

The WWTP is currently equipped with the following activated sludge pumps:

Waste Activated Sludge Pumps

Two centrifugal Pumps – 150 gpm.

Return Activated Sludge Pumps

Three centrifugal Pumps – 150-730 gpm.

The centrifugal pumps are housed in the lower floor of the administration building. Waste activated sludge is discharged to aerated sludge digesters. Return activated sludge is pumped to the oxidation ditch.

b. Evaluation

This pump room is poorly ventilated and methane buildup is a concern. The pipe gallery layout requires operators to use a hand truck to move heavy equipment to a removal hatch located in the ceiling of the pump room. The stators on the progressive cavity pumps experienced frequent failure and became too costly to maintain. The original progressive cavity pumps have been replaced with screw augurs. Sludge is drawn off the clarifiers with the screw auger and discharged into two aerated sludge digesters or wasted to the belt filter press for dewatering.

3. Disinfection

Chlorination Equipment

a. Description

Disinfection is achieved using 100 pound gaseous chlorination cylinders that feed chlorine to the effluent. This system is conveniently located adjacent to the chlorine contact basin and seems to function properly.

b. Evaluation

Plant records indicate that the present average chlorine feed is approximately 3.4 mg/l, and that an average chlorine residual of less than 0.01 mg/l is in the effluent. The monthly average coliform count is 14.7 colonies per 100 ml.

The existing chlorinators are reported to be in reasonably good condition. Additional chlorinators would be required for a plant expansion if chlorine is the favored disinfection alternative for the expanded facility.

Chlorine Contact Tanks

a. Description

The Monticello WWTP has two chlorine contact tanks. The chlorine contact tanks have a total volume of 29,156 gallons. Each tank is 12 ft. wide, 29 ft. long, and the average water depth is 5.6 ft. Each tank contains three baffle walls to ensure detention times are maintained without short-circuiting.

b. Evaluation

Chlorine contact chambers should be capable of providing a minimum of 30 minutes detention time at average flow and 15 minutes detention time at peak flow rate. The present system capacity is capable of providing 60 minutes detention time at the average daily flow of 0.700 MGD. At a peak flow of 2.175 MGD the current system is capable of 20 minutes detention time. At a future average daily flow of 1.4 MGD the detention time would be 30 minutes. The detention time at a peak flow of 4.35 MGD the system would be capable of providing 9.7 minutes. Future detention time would need to be accomplished with means to facilitate cleaning of the basin while continuing to disinfect.

De-Chlorination Equipment

a. Description

Disinfection is achieved using 100 pound gaseous sulfur dioxide cylinders that feed sulfur dioxide to the effluent. This system is located between the laboratory and the oxidation ditch and seems to function properly. Sulfur dioxide systems should be designed to provide at least

30 seconds of detention time for mixing and dechlorination. In addition, feed systems should be capable of adequate turndown capability to avoid depleting dissolved oxygen in the effluent.

b. Evaluation

Plant records indicate that the present average sulfur dioxide feed is approximately 3.5 mg/l. This system is located between the laboratory and the oxidation ditch. The location results in a long chemical feed run to the chlorine contact basin. The length of this line results in frequent clogging. The existing sulfonators are reported to be in reasonably good condition. Additional sulfonators would be required for a plant expansion if chlorine is the favored disinfection alternative for the expanded facility. The existing system should be relocated closer to the feed point to reduce the chances of clogging the system.

Parshall Flume

a. Description

A parshall Flume is located downstream of the final clarifiers prior to the chlorination system. The parshall flume has a throat width of 9 – inch, and a depth of 0.88 ft. The flume is equipped with an electronic level transducer. A unit of this size is designed to measure flows from 0.59 MGD to a maximum measurable flow of 5.73 MGD.

b. Evaluation

The parshall flume appears to be in good condition and operational.

4. Solids Processing

The existing solids handling system at the Monticello WWTP consists of the following processes:

Aerobic Sludge Holding Tanks

Sludge Conditioning

Sludge Dewatering

Sludge Disposal

The sludge is drawn off of the final clarifiers using the sludge pumps located in the basement of the administration building. Sludge removed from the final clarifiers is pumped to the aerated holding tanks.

Sludge Holding

a. Description

The Monticello WWTP has two aerated holding tanks that have a total volume of approximately 60,000 gallons. Each tank is 20 ft. wide, 30.5 ft. long, and the average water surface elevation is 14.25 ft. Sludge is pumped to the holding tanks and aerated to keep it fresh and provide some digestion of solids.

b. Evaluation

According to operations staff the sludge holding tanks currently operate on a 15 day holding cycle to provide some digestion prior to dewatering. As flow and loading increase these units will not provide adequate detention to digest the sludge. It is recommended that two additional units of equal size be installed for additional sludge storage and conditioning.

Sludge Dewatering

a. Description

Sludge is dewatered using a single belt filter press. Filtrate is returned to the head works pumping station. Dewatered sludge is transferred to a holding pad for ultimate disposal by a screw conveyor.

b. Evaluation

The belt filter press is in good condition and should provide many years of service if properly maintained. However, it is recommended that an additional belt filter press be installed to provide redundancy.

Sludge Disposal

a. Description

Sludge is deposited on a concrete slab next to the belt filter press building and stored until land farming requirements allow disposal.

b. Evaluation

The concrete holding pad is in good condition but lacks adequate space for storage and removal of solids. It is recommended that additional storage space be provided for sludge. The exiting sand drying beds next to the exiting solids processing building should be modified for sludge storage.

Section 7: Forecasts of Flows and Waste Loads in the Planning Area

1. FORECASTS OF FLOWS

Based on the 2005 Regional Facilities Plan (the Plan) the planning area was broken down into 3 areas: the 0-2 year planning period which included the corporate limits which will be referred to as Area 1; the 3-10 planning period which included a section along Route 90 north of its intersection with Main Street (Route 1275), along Route 1275 north of the city to Lake Cumberland and a section south of the city around Route 167 and Missouri Hollow to Wray Gap which will be referred to as Area 2 and; the 11-20 planning area which included all other areas outside the city as previously mentioned which will be referred to as Area 3.

A. Residential Flows

Residential flows for new construction were generated using a wastewater flow rate of 288 gpd/household, the typical residential dry weather flow of the Planning Area. This is based on 120 gpcd for an average household of 2.4 persons.

Table 7-1
Expected Additional Domestic Flow
Planning Area

	Planning Period (GPD)			
	Area 1	Area 2	Area 3	Total Planning Area
End of Year 2	10,368	0	0	10,368
End of Year 10	41,472	89,856	0	131,328
End of Year 20	41,472	89,856	224,640	355,968
Total	93,312	179,712	224,640	497,664

B. Industrial and Commercial Flows

Monticello has two industrial parks within the planning area. One is located near downtown and the other is located along Highway 90. The downtown industrial park consists of approximately 50 acres. The Empowerment Zone Industrial Park consists of 99 acres. Utilizing planning data and commercial and industrial water consumption records, an average flow of 1,500 gpd/acre was developed to apply to all new commercial and industrial sites within the downtown industrial park, which is considered light Industry. The Empowerment Zone industrial Park is actively pursuing medium industrial users and this requires 3,000 gpd/acre. The industrial parks are expected to develop over the next 20 years and the flow will be evenly distributed over that time frame. Applying these flow estimates to the industrial park acreage and applying the expected development phases the following table of expected flows was developed:

Table 7-2
Industrial and Commercial Flow Projections
Planning Area

	EZ Industrial Park	Downtown Industrial Park	Total Planning Area
End of Year 2	29,700	3,750	33,450
End of Year 10	118,800	30,000	148,800
End of Year 20	148,500	37,500	186,000
Total	297,000	75,000	372,000

Table 7-3 20 Year Average Daily Flow Projections Monticello Wastewater Treatment Plant					
Planning Period	Current Residential Flow (gpd)	Current Non Residential Flow (gpd)	Future Residential Flow Increase (gpd)	Future Nonresidential Flow Increase (gpd)	Total Flow (gpd)
2010	275,500	199,500	0	0	475,000
End of Year 2	275,500	199,500	10,368	37,200	522,568
End of Year 3	275,500	199,500	26,784	55,800	557,584
End of Year 4	275,500	199,500	43,200	74,400	592,600
End of Year 5	275,500	199,500	59,616	93,000	627,616
End of Year 6	275,500	199,500	76,032	111,600	627,418
End of Year 7	275,500	199,500	92,448	130,200	697,648
End of Year 8	275,500	199,500	108,864	148,800	732,664
End of Year 9	275,500	199,500	125,280	167,400	767,680
End of Year 10	275,500	199,500	141,696	186,000	802,696
End of Year 11	275,500	199,500	177,293	204,600	856,893
End of Year 12	275,500	199,500	212,890	223,200	911,090
End of Year 13	275,500	199,500	248,486	241,800	965,286
End of Year 14	275,500	199,500	284,083	260,400	1,019,483
End of Year 15	275,500	199,500	319,680	279,000	1,073,680
End of Year 16	275,500	199,500	355,277	297,600	1,127,877
End of Year 17	275,500	199,500	390,874	316,200	1,182,074
End of Year 18	275,500	199,500	426,470	334,800	1,236,270
End of Year 19	275,500	199,500	462,067	353,400	1,290,467
2030	275,500	199,500	497,664	372,000	1,344,664

Adding a 5% factor of safety brings to the design capacity of 1,400,000 gallons per day.

C. Waste Load Projections

Residential/Commercial/Industrial Projected Waste Loadings are based on the following influent average concentration at the existing wastewater treatment plant:

BOD_5	210 mg/l
Total Suspended Solids	305 mg/l
Total Phosphorus	10 mg/l
Ammonia Nitrogen	30 mg/l
Total Nitrogen	40 mg/l

The wasteload projections for year 2030 using a wastewater flow of 1.4 million gallons per day are presented in Table 7-4.

Table 7-4
Total Projected Dry Weather Loading
Planning Area

	Lbs/day
BOD_5	2,452
Total Suspended Solids	3,561
Total Phosphorus	117
Ammonia Nitrogen	350
Total Nitrogen	467

Section 8: Evaluation of Alternatives

1. ALTERNATIVES CONSIDERED

A. Description

1. Wastewater Treatment Facilities

Four alternatives for the development of an improved wastewater treatment plant were evaluated. Each alternative considered the requirements for compliance with the reliability and redundancy requirements. They are as outlined below:

a) Alternative No. 1 - Renovate the existing facility and maintain the current capacity of 700,000 gallons per day during the 3-10 year planning period.

b) Alternative No. 2 - Renovate the existing facility and construct an expanded facility with a capacity of 1,400,000 gallons per day.

c) Alternative No. 3 - Abandon the existing facility and construct a new treatment plant at the site of the existing facility with a capacity of 1,400,000, gallons per day.

d) Alternative No. 4 - Do nothing.

B. Alternatives

1. Alternative No. 1

Alternative No. 1 consists of renovating the existing facility and adding the components necessary to meet the regulations primarily those regarding reliability and redundancy. The portions of the existing facility that would remain basically unchanged are the influent pump station, single unit grit chamber, single unit oxidation ditch, dual secondary clarifiers, dual chlorine contact chambers, and all of the sludge handling facilities. The existing influent pump station would remain as is and a new headworks facility would be constructed. An additional oxidation ditch and two additional secondary clarifiers would be constructed parallel to the existing units. In addition, the chlorine contact chamber would be enlarged to meet the current detention time requirements. Additional sludge digesters would be built and the belt filter press would continue as the primary sludge dewatering system with the sand drying beds serving as the backup system. *Table 8-1* outlines the preliminary opinion of probable construction cost for all of the improvements and the total opinion of probable construction cost for Alternative No. 1 not including contingencies has been estimated to be $3,410,000.

TABLE 8-1
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE NO 1 – RENOVATED FACILITY

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
1	Site Work		
	A. Grading	1 L.S.	$100,000
	B. Remove Existing Facilities	1 L.S.	$30,000
	C. Fencing	1 L.S.	$80,000
	D. Pavement & Roadways	1 L.S.	$100,000
			$310,000
2	Concrete		
	A. Headworks	1 L.S.	$300,000
	B. Oxidation Ditch	1 L.S.	$300,000
	C. Secondary clarifiers	1 L.S.	$150,000
	D. Chlorine Contact Chamber	1 L.S.	$100,000
	E. Sludge Digesters	1 L.S.	$90,000
	F. Miscellaneous	1 L.S.	$100,000
			$940,000
3	Process Piping		
	A. Exterior Yard	1 L.S.	$140,000
	B. Interior	1 L.S.	$90,000
			$230,000
4	Mechanical Equipment		
	A. Mechanical Screen	1 L.S.	$150,000
	B. Grit Collection System	1 L.S.	$100,000
	C. Oxidation Ditch Equipment	1 L.S.	$180,000
	D. Secondary Clarifier Units	1 L.S.	$200,000

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
	E. Sludge Digester Equipment	1 L.S.	$80,000
	F. Sludge Pumps	1 L.S.	$100,000
	G. Recirculation Lift Station	1 L.S.	$90,000
	H. Instrumentation	1 L.S.	$50,000
	I. Break Tank	1 L.S.	$70,000
	J. Laboratory Equipment	1 L.S.	$50,000
			$1,070,000
5	Chemical System		
	A. Chlorine Feed System	1 L.S.	$40,000
	B. Sulfur Dioxide System	1 L.S.	$40,000
			$80,000
6	Buildings		
	A. Main Control Building	1 L.S.	$50,000
	B. Maintenance Building	1 L.S.	$50,000
			100,000
7	Coatings		
	A. Concrete	1 L.S.	$60,000
	B. Exposed Piping	1 L.S.	$50,000
	C. Buildings	1 L.S.	$40,000
	D. Metals & machinery	1 L.S.	$40,000
			$190,000
8	Mechanical	1 L.S.	$80,000
9	Electrical		
	A. Yard/Mechanical Equipment	1 L.S.	$100,000
	B. Auxiliary power Generator	1 L.S.	$200,000
	C. Raw Sewage Pumps	1 L.S.	$50,000
	D. Control Building	1 L.S.	$30,000
	E. Return Lift Station	1 L.S.	$30,000
			$410,000
	Subtotal		$3,410,000
	Contingency		$341,000
	Total construction Cost		$3,751,000

Alternative No. 2

Alternative No. 2 consists of building a new treatment plant located on the site of the existing plant. This option would consist of renovating all of the existing usable units and adding additional similar units in parallel to each process. The existing facility would remain in operation until the new facility was completely built and at that time would be upgraded to meet the current regulatory requirements. The design average plant capacity would be increased to 1,400,000 gallons per day. The facility would have two process trains each capable of treating 1,400,000 gallons per day, or twice the current capacity, but due to the additional phosphorus removal requirements the additional units would not be constructed until the needed capacity exceeds 1,000,000 gallons per day. The treatment plant would be designed considering future treatment needs. The treatment method would be the same as that in Alternate No.1 and it would consist of influent pumping, headworks consisting of screening, grit removal, and flow measurement, twin reactor basins and secondary clarifiers, a tertiary clarifier, and sludge handling and conditioning by new digesters, the existing filter belt press system, and new sludge drying beds. *Table 8-2* outlines the preliminary opinion of probable construction cost of Alternative No.2, and the total opinion of probable construction cost not including contingencies has been estimated to be $6,778,000.

TABLE 8-2
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE NO 2 – EXPANDED & UPGRADED FACILITY

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
1	Site Work		
	A. Grading	1 L.S.	$200,000
	B. Remove Existing Facilities	1 L.S.	$50,000
	C. Fencing	1 L.S.	$80,000
	D. Pavement & Roadways	1 L.S.	$150,000
			$480,000
2	Concrete		
	A. Raw Sewage Pump Station	1 L.S.	$320,000

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
	B. Anaerobic Selector Basins	1 L.S.	$150,000
	C. Headworks	1 L.S.	$400,000
	D. Oxidation Ditch	1 L.S.	$500,000
	E. Secondary clarifiers	1 L.S.	$150,000
	F. Chlorine Contact Chamber	1 L.S.	$100,000
	G. Sludge Digesters	1 L.S.	$160,000
	H. U.V. Disinfection / Re-aeration	1 L.S.	$300,000
	G. Buildings	1 L.S.	$50,000
	F. Miscellaneous	1 L.S.	$200,000
			$2,330,000
3	Process Piping		
	A. Exterior Yard	1 L.S.	$308,000
	B. Interior	1 L.S.	$170,000
			$478,000
4	Mechanical Equipment		
	A. Raw Sewage Pumps	1 L.S.	$150,000
	B. Anaerobic Mixers	1 L.S.	$50,000
	C. Mechanical Screen	1 L.S.	$180,000
	D. Grit Collection System	1 L.S.	$120,000
	E. Oxidation Ditch Equipment	1 L.S.	$300,000
	F. Secondary Clarifier Units	1 L.S.	$200,000
	G. Sludge Digester Equipment	1 L.S.	$140,000
	H. Sludge Pumps	1 L.S.	$100,000
	I. Recirculation Lift Station	1 L.S.	$90,000
	J. Instrumentation	1 L.S.	$200,000
	K. Break Tank	1 L.S.	$100,000
	L. U.V. Disinfection / Re-Aeration	1 L.S.	$250,000
	M. Laboratory Equipment	1 L.S.	$50,000
			$1,930,000
5	Chemical Systems		
	A. Alum & Polymer Feed System	1 L.S.	$80,000
			$80,000
6	Buildings		
	A. Main Control Building	1 L.S.	$150,000
	B. Chemical Feed Building	1 L.S.	$150,000
	C. Maintenance Building	1 L.S.	$180,000
			$480,000
7	Coatings		

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
	A. Concrete	1 L.S.	$60,000
	B. Exposed Piping	1 L.S.	$50,000
	C. Buildings	1 L.S.	$40,000
	D. Metals & machinery	1 L.S.	$40,000
			$190,000
8	Mechanical		$150,000
9	Electrical		
	A. Yard/Mechanical Equipment	1 L.S.	$200,000
	B. Auxiliary power Generator	1 L.S.	$300,000
	C. Raw Sewage Pumps	1 L.S.	$50,000
	D. Control Building	1 L.S.	$30,000
	E. Return Lift Station	1 L.S.	$30,000
	F. Misc. Electrical	1 L.S.	$50,000
			$660,000
	Subtotal		$6,778,000
	Contingency		$678,000
	Total construction Cost		$7,456,000

2. Alternative No.3

Alternative No. 3 is the same as Alternative No.2 but all of the existing treatment units would be removed and replaced with new treatment units. The new facility would use two parallel trains and be equipped with two tertiary clarifiers and a phosphorus treatment and removal system. The sludge handling and treatment system would be sized to use alum and polymers to remove the excess phosphorus. The preliminary opinion of probable construction cost not including contingencies of Alternative No.3 is estimated to be $8,530,000 and it is outlined in *Table 8-3.*

TABLE 8-3
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE NO 3 – NEW 1.4 MGD FACILITY

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
1	Site Work		
	A. Grading	1 L.S.	$340,000
	B. Remove Existing Facilities	1 L.S.	$350,000
	C. Fencing	1 L.S.	$80,000
	D. Pavement & Roadways	1 L.S.	$150,000
			$920,000
2	Concrete		
	A. Raw Sewage Pump Station	1 L.S.	$320,000
	B. Headworks	1 L.S.	$400,000
	C. Oxidation Ditch	1 L.S.	$800,000
	D. Secondary clarifiers	1 L.S.	$280,000
	E. Chlorine Contact Chamber	1 L.S.	$100,000
	F. Sludge Digesters	1 L.S.	$320,000
	G. Buildings	1 L.S.	$200,000
	F. Miscellaneous	1 L.S.	$200,000
			$2,420,000
3	Process Piping		
	A. Exterior Yard	1 L.S.	$420,000
	B. Interior	1 L.S.	$340,000
			$760,000
4	Mechanical Equipment		
	A. Raw Sewage Pumps	1 L.S.	$140,000
	B. Mechanical Screen	1 L.S.	$180,000
	C. Grit Collection System	1 L.S.	$160,000
	D. Oxidation Ditch Equipment	1 L.S.	$400,000
	E. Secondary Clarifier Units	1 L.S.	$310,000
	F. Sludge Digester Equipment	1 L.S.	$250,000
	G. Sludge Pumps	1 L.S.	$300,000
	H. Recirculation Lift Station	1 L.S.	$90,000
	I. Instrumentation	1 L.S.	$200,000
	J. Break Tank	1 L.S.	$100,000
	J. Laboratory Equipment	1 L.S.	$50,000
			$2,180,000

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
5	Chemical System		
	A. Chlorine Feed System	1 L.S.	$80,000
	B. Sulfur Dioxide System	1 L.S.	$80,000
			$160,000
6	Buildings		
	A. Main Control Building	1 L.S.	$450,000
	B. Maintenance Building	1 L.S.	$180,000
			$630,000
7	Coatings		
	A. Concrete	1 L.S.	$100,000
	B. Exposed Piping	1 L.S.	$80,000
	C. Buildings	1 L.S.	$60,000
	D. Metals & machinery	1 L.S.	$60,000
			$300,000
8	Mechanical		$300,000
9	Electrical		
	A. Yard/Mechanical Equipment	1 L.S.	$400,000
	B. Auxiliary power Generator	1 L.S.	$300,000
	C. Raw Sewage Pumps	1 L.S.	$50,000
	D. Control Building	1 L.S.	$80,000
	E. Return Lift Station	1 L.S.	$30,000
			$860,000
	Subtotal		$8,530,000
	Contingency		$853,000
	Total construction Cost		$9,383,000

4. Alternative No. 4 is to do nothing.

B. Evaluation of Alternatives

Evaluation of the alternatives resulted in the following conclusions. The primary factors in determining the best alternative were project costs, existing treatment condition and efficiency, required capacity, and type of treatment process.

Based on the existing treatment plant capacity of 700,000 gallons per day, the current usage of approximately 409,000 gallons per day and the resulting available capacity of 42 percent, there is enough existing capacity to serve the expected residential growth for the next few years but possibly not enough should a large nonresidential user need to be considered. Based on the expected growth of the service area, expansion of the treatment plant would not be needed until year 6. However, due to the age and condition of the facility upgrades should be made now to keep the plant operating without the fear of system failure.

City officials have expressed a desire to keep the location any treatment plant at the current site due to its proximity to the City and its inconspicuous location.

It is desirable to use a treatment process with a long detention time, such as the current extended aeration process due to the built in peaking capacity and treatment forgiveness. This type of treatment is common in Kentucky because it allows for the convenient sharing of information regarding treatment practices, and problem solving among operators that reside in close proximity to each other. Based on these factors, the City wanted considered alternatives to be based on this type of treatment process.

Alternative No.3 was the least desirable alternative based on the total cost. The proposed cost of this alternative was estimated to be $9,383,000 which is greater than the amount the city felt they could handle at this time.

Alternative No.1 does not allow for additional growth in the planning area, while Alternative No. 2 doubles the current capacity. Due to economic growth and new industrial development, Alternative No. 2 is the most attractive alternative.

In selecting the best choice for the treatment plant, each alternative consists of the same method of treatment but Alternate No. 2 is based on twice the current capacity.

Discussions with City officials indicated their desire to continue to own and operate the treatment plant at its current location and to continue to operate the components of the plant that are usable. Expansion at the existing site would minimize the environmental impact upon the area negating the need to develop another site. Therefore, based on these factors, Alternative No. 2 was selected as the best alternative for improving the existing facility while positioning it for a future expansion. This two phased approach would allow the City of Monticello to utilize grant funds in which the City is eligible for in each phase therefore reducing the loan amount.

C. Design Criteria

The design criteria are based on the requirements of the Kentucky Division of Water and the Recommended Standards for Wastewater Facilities (10 States Standards) which have been incorporated into the standards by reference.

The expanded and upgraded wastewater treatment plant will be designed for an average daily flow of 1.4 million gallons per day (MGD) and a peak hydraulic flow of 4.35 MGD. The influent pump station will be designed for a design average flow of 1.4 MGD and to handle the peak hydraulic flow. The firm capacity of the pump station will be 5 MGD with one of the pumps out of service. New mechanical bar screens and grit removal facilities will be located in a new headworks facility to remove any material that could damage the pumps or other equipment. Anaerobic biological selector basins will be provided to promote the growth of phosphorus accumulating microorganisms and reduce the possibility of filamentous growth. Chemicals will be provided as a backup means of phosphorus removal. The occasionally high biochemical oxygen demand (BOD) and low total Kjeldahl nitrogen (TKN) generally requires processes with large basin volumes and high mixing/aeration energy that an extended aeration process can provide.

The biological system design is based on providing a solids retention time adequate for nitrification/de-nitrification. Aeration equipment will be sized to provide enough oxygen with one unit out of service.

Following biological treatment will be clarifiers sized to handle the peak flow. Polymer and aluminum sulfate will be introduced prior to the clarifiers as needed for chemical phosphorus removal and to enhance settling. An ultraviolet (UV) disinfection system will be used and designed to handle the peak flow with one bank out of service. Supplemental aeration will be provided following disinfection to maintain a minimum dissolved oxygen level of 7.0 milligrams per liter. Waste biosolids will be pumped from the clarifiers to aerobic sludge digesters for further degradation prior to dewatering and disposal by the belt filter press (BFP) system. The BFP will dewater the solids to approximately 16 percent solids for disposal in a landfill or land farm. A schematic layout of the proposed system is shown in Attachment D.

E. Advantages/Disadvantages

Alternative No. 4, do nothing, is the least costly alternative but because of the plants age relative to when improvements were last made creates a facility where treatment units could begin to fail at any time, would not meet current requirements for redundancy and reliability and would limit long term community growth. Alternative No. 1 has the next lowest cost but like Alternative No. 4 has the disadvantage of limiting long term community growth. It does however address the reliability and redundancy requirements. Alternative No. 2 has a mid range cost more than Alternative No. 1, and like Alternative No. 1 provides the required redundancy and reliability but unlike Alternative No. 1 adds additional treatment capacity to the system allowing long term system growth. Finally Alternative No. 3 is the most expensive option, which while it does provide for the greatest increase in capacity it does it at a cost the City would be hard pressed to handle. And much of the increased capacity is not expected to be needed till year 20 or beyond.

2. SELECTION OF AN ALTERNATIVE

A. Present Worth

A present worth and life cycle cost analysis was conducted for each alternative at a discount rate of 6 percent. Below is a summary of the present worth calculations with the capital costs adjusted for 2009 dollars. Alternative No. 4 is not shown since it is the do nothing alternative which does not have any costs associated with it.

Present Worth Item	Alternative No. 1	Alternative No. 2	Alternative No. 3
Capital Cost	$3,410,000	$6,778,000	$8,530,000
Equipment Replacement	$568,100	$729,400	$729,400
Operation and Maintenance	$6,658,700	$7,956,500	$7,956,500
Salvage Value	$75,500	$93,000	$93,000
Total Present Worth	$10,712,300	$15,556,900	$17,122,900
Ranking	**3**	**2**	**1**

3=Most Favorable; 1=Least Favorable

B. Evaluation of Non-Monetary Values

A matrix system was developed to facilitate the selection process by evaluating non-monetary factors which could influence the selection process.

Factor	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
Reliability	2	3	3	1
Phosphorus Removal	2	3	3	1
Ability to Upgrade	2	2	2	1
Ability to Expand	2	2	3	1
Generation of Odors	2	3	2	1
Sludge Handling	2	3	3	1
Ability to Meet Permit	2	3	3	1
Constructability	1	1	2	3
Ranking	**15**	**20**	**21**	**10**

3=Most Favorable; 1=Least Favorable

3. PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

A. Project Design

During the facilities planning four alternatives were evaluated for the expansion and upgrading of the wastewater treatment facilities. Alternative No. 2 was chosen as the most cost effective and practical alternative. Alternative No. 2 proposes to renovate the existing WWTP and add additional treatment units to ensure compliance with current and future regulatory requirements. This recommendation differs from the findings of the 2005 Regional Facilities Plan in regard to waiting till year 6 to expand the treatment capacity and regarding the reuse of the single grit chamber and the addition of biological nutrient removal systems. We recommend removing this unit from service and installing a new grit removal system in conjunction with the new headworks facility. The existing influent pump station will be rehabilitated and remain in service. The headworks will include grit removal, and mechanical bar screens. To meet the new KPDES permit that has been issued for phosphorus removal to 1 mg/l phosphorus the facilities will include a new chemical feed facilities. An additional oxidation ditch and two new final clarifiers will be constructed to increase capacity of the secondary system to 1.4 MGD. The existing chlorine contact basin will be taken out of service and a new ultraviolet disinfection system installed. Two additional sludge holding basins will be constructed to improve solids handling. A second belt filter press and additional sludge storage should be constructed to improve sludge handling. A new ultraviolet disinfection system would replace the chlorination and dechlorination systems.

Noted below is a summary of the system after the proposed changes have been made.

B. Critical Design Values

Minimum Wastewater Temperature 10^{o}C

The first step in determining the overall volume of the aeration basin is to establish the minimum anticipated temperature of the wastewater.

Solids Retention Time (SRT) 20 Days

Since the concentration of carbonaceous organic content in typical wastewater is significantly higher than the concentration of nitrogen, the design SRT must be developed based on the growth rate of nitrifying organisms. This was determined to be approximately 20 days. A factor of safety was applied to account for variations in dissolved oxygen and system pH.

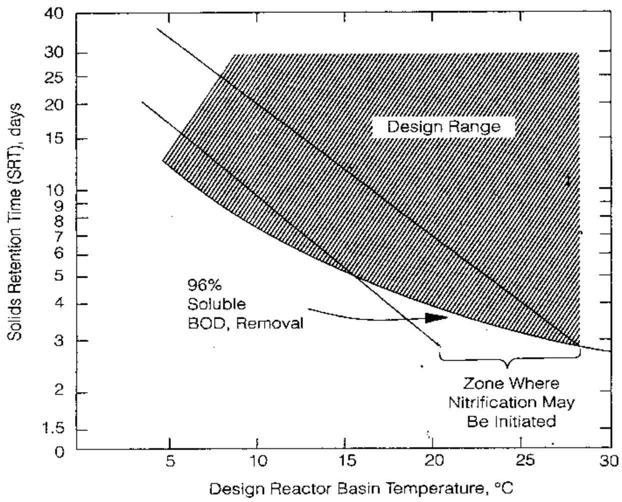


Figure 1

Design Solids retention Time for Carbonaceous biochemical oxygen demand removal. *Design of Municipal Wastewater Treatment Plants, MOP 8, 4th Edition, 1998.*

Mixed Liquor Suspended Solids (MLSS) 4,000 mg/L

Typical design values for MLSS used to determine oxidation ditch sizing range between 1,500 mg/L and 5,000 mg/L. A conservative value of 4,000 mg/L was used for this project. A higher mixed liquor value could be used to reduce aeration basin volume.

C. Design Assumptions

Dissolved Oxygen Concentration 2.0 mg/L

A typical value for dissolved oxygen concentration in the aeration basin for an oxidation ditch is 2.0 mg/L.

Maximum Wastewater Temperature 26° C

Elevation 922 ft.

The elevation above mean sea level for the proposed wastewater treatment plant is approximately 922 ft. The elevation of the facility is used to approximate the oxygen saturation coefficient at the maximum expected wastewater temperature of 25°C.

Carbonaceous Oxygen Coefficient 1.1 lb. O_2/ lb. BOD removed

A conservative value for the carbonaceous oxygen coefficient is 1.3 lb. O_2/ lb BOD removed, for determining actual $CBOD_5$ oxygen coefficient requirements.

Nitrogenous Oxygen Coefficient 4.6 lb. O_2/ lb. TKN removed

A conservative value for nitrogenous oxygen coefficient is 4.6 lb. O_2/ lb TKN removed. Values as low as 4.57 lb. O_2/ lb. TKN removed could be used to reduce aeration horsepower requirements.

Section 9: Cross-Cutter Correspondence and Mitigation

1. KENTUCKY STATE CLEARINGHOUSE

A. The Kentucky State Clearinghouse, which has been officially designated as the Commonwealth's Single Point of Contact (SPOC) pursuant to Presidential Executive Order 12372, has completed its evaluation of the project SAI# KY20090817-1575. The clearinghouse review has indicated that there are no identifiable conflicts with any state or local plan, goal or objective. The State Clearinghouse has recommended that this project be approved for assistance by the contingent federal agency. A copy of the letter can be found in Appendix E. The following comments pertain to Environmental impact of the proposed project:

i. The Transportation Cabinet had no comment.

ii. Natural Resources included the following comments:

a) All solid waste generated by this project must be disposed at a permitted facility.

b) There Water Infrastructure Branch had no objections to the project.

c) A preliminary engineering report will be required.

d) Final plans and specifications will be required.

e) Proper permits for floodplain construction, stream crossings, stormwater discharge, etc will be required.

f) Best management practices shall be used to reduce runoff from the project into adjacent streams.

g) If construction disturbs an area greater than 1 acre a KPDES Permit will be required.

iii. The Housing, Building, and Construction had no comment.

iv. Kentucky Heritage Council, State Historic Preservation Office (SHIPO) indicated that if the project remains confined to the existing footprint of the treatment plant, no further work is necessary. However, plant expansion outside the existing plant site boundaries will require an archaeological survey.

v. The Labor Cabinet had the following advisory:

PW RATES MAY APPLY-CONTACT KY LABOR CABINET AT 1-502-564-3534.

vi. The Kentucky Housing Corporation had no comments.

vii. The Lake Cumberland ADD had no comments.

viii. The Office of the State Budget Director had no comments.

ix. The Kentucky Housing Corporation had no comments.

Section 10: Evaluation of Recommended Regional Facility Plan

1. ENVIRONMENTAL IMPACTS

   There are no known negative environmental impacts from the proposed project alternatives as the proposed projects would be located on the existing wastewater treatment plant property.

2. INSTITUTIONAL STRUCTURE

   The City of Monticello adopted a resolution on March 28, 2011, endorsing this Planning Document and all of its contents, including the boundary of the Planning Area. A copy of this resolution is contained in Appendix F.

3. FUNDING PLAN

MONTICELLO WWTP IMPROVEMENTS
PROPOSED BUDGET
SEPTEMBER, 2011

1	Administrative and Legal Expenses	$100,000
2	Land, Appraisals, Easements	$20,000
3	Interest During Construction	$230,000
4	Other Engineering Fees	$70,000
5	Engineering Fees	$477,000
6	Engineering Fees - Inspection	$297,000
7	Construction	$6,778,000
8	Contingency (10% of Construction)	$678,000
9	Additional Engineering Fees	
	Additional Feasibility Study	$10,000
	Final Plan of Operation	$10,000
	O&M Manual	$40,000
	Startup Services	$10,000
	Subtotal	$70,000
	TOTAL	**$8,620,000**

Proposed Funding for this Project:

• USDA Rural Development Grant	$2,000,000
• USDA Rural Development Loan	$4,620,000
• EDA Grant	$2,000,000
• Total Funding	**$8,620,000**

Proposed User Rate:

Sewer Rate Schedule
Residential – Inside City Limits

First	2,500 gallons @	$12.90 Minimum Bill
Next	7,500 gallons @	$3.15 per 1,000 gallons
Next	20,000 gallons @	$2.98 per 1,000 gallons
Next	30,000 gallons @	$2.78 per 1,000 gallons
Next	40,000 gallons @	$2.67 per 1,000 gallons
All Over	100,000 gallons @	$2.61 per 1,000 gallons

Sewer Rate Schedule
Commercial/Industrial – Outside City Limits

First	2,500 gallons @	$16.77 Minimum Bill
Next	7,500 gallons @	$4.10 per 1,000 gallons
Next	20,000 gallons @	$3.87 per 1,000 gallons
Next	30,000 gallons @	$3.61 per 1,000 gallons
Next	40,000 gallons @	$3.47 per 1,000 gallons
All Over	100,000 gallons @	$3.39 per 1,000 gallons

A copy of this ordinance is located in Appendix E.

4. IMPLEMENTATION SCHEDULE

The proposed schedule is as follows:

Item Description	Completion Date / Status
1. Final Design	Complete
2. Bid Opening	8/26/2011
3. Begin Construction	10/20/2011
4. End of Construction	10/20/2013
5. Project Closeout	11/20/2013

Section 11: Documentation of Public Participation

Requirements: This section shall include;

1. A copy of the newspaper advertisement
2. Measures taken to solicit public participation
3. A summary report presented to the public during the public meeting
4. Public meeting attendance sheet
5. Public Comments

Recommendations: As indicated throughout this guidance document, the public should participate from the beginning in regional facility planning so that interests and potential conflicts may be identified early and considered. The importance of building a consensus among citizens and stakeholders is extremely critical, as the fate of many planning efforts is decided by the willingness of the public to accept the plan and take action to appropriate the necessary funds for design and construction of facilities. Therefore, it is recommended to hold one public meeting to discuss the draft alternatives and environmental impacts prior to the required public meeting.

The regional planning agency should define issues and analyze information so that the public will clearly understand the costs and benefits of alternatives considered during the planning process. Efforts should be made to ensure that the interests of a broad spectrum of the public are represented in the planning process. Projects that are complex or controversial may require a more substantial public outreach. The public can be informed and their input solicited through a variety of means, including the following: Advisory groups, depositions, information contacts, liaison with citizen groups, mailings, news media, polls, public meetings, speeches, surveys, task forces, correspondence, exhibitions, workshops, interviews, newsletters, seminars.

Section 12: Regional Facility Plan Completeness Checklist and Forms

Regional Planning Agency Name: **City of Monticello**

Date: **September 2011**

		PAGE #
SECTION 1		
REGIONAL FACILITY PLAN SUMMARY- This section shall provide a brief summary of the information provided in the facility plan, including the following:		
1.	Purpose of the plan and major problems evaluated in the plan.	3
2.	Recommended alternative chosen to remediate or correct the problems and/or serve the area of need identified in the plan. Also, include any institutional arrangements necessary to implement the recommended alternative(s).	5
3.	Estimated cost of implementing the proposed plan (including user fees) and the proposed funding method to be used.	5
4.	Planning agency commitments necessary to implement the plan.	N/A
5.	Schedule of implementation for projects.	6
SECTION 2		
STATEMENT OF PURPOSE AND NEED- This section shall contain a brief description of the purpose and need for a submitting the facility plan.		7
SECTION 3		
PHYSICAL CHARACTERISTICS OF THE PLANNING AREA- This section shall delineate the planning area boundaries and describe key topographic, geographic and pertinent natural or man-made features of the area. Digital or electronic submission of the planning area boundary shapefile in a standard GIS format shall also be included. This section shall also include the following maps:		
1.	One (1) up-to-date map, suitable for photocopying, indicate the planning area boundary, service area boundary, watershed boundaries, county lines, populated places, cities and/or towns and project areas or proposed planning period phases.	Appendix A
2.	One (1) up-to-date map, suitable for photocopying, include locations of wastewater treatment facilities (including package treatment plants), discharge location(s), collection lines (gravity, force main, interceptors), pump stations, public drinking water intake points and groundwater supply areas [Source Water Area Protection Plans (SWAPP) and/or Wellhead Protection Areas (WHPA)].	Appendix B
3.	One (1) seven and one-half (7 ½) minute USGS topographic map including the location of wetlands, delineation of the 100-year floodplain, surface water(s), and topography.	Appendix C,D
4.	If available, a local planning and zoning land use map.	N/A
SECTION 4		
SOCIOECONOMIC CHARACTERISTICS OF THE PLANNING AREA- The following characteristics of the planning area shall be discussed:		

1.	Historical, current, and projected population in the planning area including wastewater contributions from industrial and commercial sources.	11
2.	Current and projected population in the existing service area and unsewered parts of the planning area	12
3.	Economic or social benefit to the affected community	12
SECTION 5		
EXISTING ENVIRONMENT IN THE PLANNING AREA- Describe existing physical, biological, cultural, and other resource features within the planning area with an emphasis on those that may be impacted by the proposed plan or projects, including the following:		
1.	Physical features such as surface and groundwater quality, water sources and supply, wetlands, lakes, streams, air pollution, floodplains, soils, geology, and topography	14
2.	Biological: Identify plant and animal communities in the planning area with an emphasis upon endangered and threatened species likely to be impacted	15
3.	Cultural: Describe archaeological and historical resources that may be affected by the proposed project	15
4.	Other Resource Features such as national and state parks, recreational areas, USDA Designated Important Farmland, and any other applicable environmentally sensitive areas	15
SECTION 6		
EXISTING WASTEWATER SYSTEM- This section shall be prepared by a Professional Engineer licensed in Kentucky. A description of the existing facilities within the planning area shall include the following:		16
1.	On-site systems in the planning area	16
2.	Physical condition of the existing wastewater treatment plant(s) including the type, age, design capacity, process units, peak and average wastewater flows, current discharge permit limits, schematic layout of treatment plant. Include a narrative description of the capacity of the treatment plant to meet reliability and redundancy requirements as outlined in regulation 401 KAR 5:005, Section 13.	16
3.	Existing collection and conveyance system and its condition	27
4.	Existing biosolids disposal method	16-27
5.	Existing operation, maintenance and compliance issues	
SECTION 7		
FORECASTS OF FLOWS AND WASTE LOADS IN THE PLANNING AREA- This section shall be prepared by a professional engineer licensed in Kentucky and shall include:		
1.	Current and projected commercial, industrial and residential growth for the proposed planning period	28-29
2.	A copy of the waste load allocation (WLA) issued by the DOW for new or expanded treatment plant projects	Appendix E
SECTION 8		
EVALUATION OF ALTERNATIVES- This section shall be prepared by a professional engineer licensed in Kentucky and include an assessment of alternatives to determine the appropriate facilities that will meet the wastewater needs of the planning area and provide benefits that are cost-effective and environmentally sound. The section shall include:		

1.	No-action alternative	32
2.	Optimization of existing facilities	32
3.	Regionalization	32
4.	Other alternatives	32
5.	Detailed cost analysis along with 20 year present worth analysis for each alternative	32-43
6.	Recommended alternative	43
SECTION 9		
CROSS-CUTTER CORRESPONDENCE AND MITIGATION- Each facility plan shall include cross-cutter correspondences to and from each agency related to the following four environmental and cultural concerns:		
1.	Threatened and Endangered Species: The U.S. Fish and Wildlife Service- Kentucky Ecological Services Field Station and the Kentucky Department of Fish and Wildlife Resources	47, Appendix E
2.	Historical Resources: The Kentucky Heritage Council State Historic Preservation Office	47,App. E
3.	Aquatic Resources: The US. Army Corps of Engineers (Louisville, Nashville, or Huntington Districts).	47, Appendix E
4.	Agricultural Resources: The local office of the Natural Resources Conservation Service (NRCS) or USDA Service Center	
SECTION 10		
EVAULATION OF RECOMMENDED REGIONAL FACILITY PLAN- This section of the facility plan shall summarize the critical components of the recommended plan.		
1.	Environmental impacts	49
2.	Institutional structure	49
3.	Funding plan	49
4.	Current and projected residential user charge rate based on 4,000 gallon usage per month	50
5.	Implementation schedule	51
SECTION 11		
DOCUMENTATION OF PUBLIC PARTICIPATION- The section shall include a copy of the newspaper advertisement/proof of publication, attendance sheet, and public comments.		Appendix G

Unit Process Design Criteria Form

Unit Process	Number of Units[1]	Flow per Unit (MGD)	Design Criteria[2]
Influent Pumping	4	2.42 / I Unit, 4.35/ 3 Units	4.35 MGD with largest unit out of service
Screening	1 – Manual, 1 Automatic	4.35 / Unit	¼" Bar Spacing
Grit Removal	1	4.35 / Unit	85% Removal, 70 Mesh
Primary Clarification	N/A	N/A	N/A
Biological Process	2	0.7 MGD each	100% Peak Air each Unit
Chemical Phosphorus Removal	1	1.4 MGD	11 lbs. / lb of Phosphorus removed
Final Clarification	4	2 @ 0.35 MGD, 2 @ 0.49 MGD	< 1,000 gpd overflow rate, < 35 lb/day/sf Solids Loading Rate
Disinfection	2	4.35 MGD / Unit	> 65% Transmittance @ Q peak
RAS/WAS Pumping	2 – RAS, 1 - WAS	1,458 gpm / Unit 486 gpm / Unit	RAS – 0 - 150% ADF WAS – 50% ADF
Sludge Treatment	4	4 @ 59,324 gallons each	32.7 days storage @ 4% solids @ ADF
Sludge Dewatering	2	2 channel rotary fan press, 106 gpm each, backup existing BFP	4% solids feed – 4.75 hrs/day runtime

1*The number of units shall be in accordance with the reliability/redundancy checklist
2*The design criteria shall be in accordance with 401 KAR 5:005 including Ten States Standards

Note: This is a suggested format only. The process listed here will not fit every project and will therefore need to be revised accordingly.

Design Flow and Concentration Form

Design Flows and Organic Concentrations	Flows MGD	BOD_5 mg/l	BOD_5 lb/day	SS mg/l	SS lb/day	NH_3-N mg/l	NH_3-N lb/day	TKN mg/l	TKN lb/day	P mg/l	P lb/day
Average Daily											
Domestic Portion	0.8	210	1,401	305	2,035	30	200	40	267	10	67
Industrial Portion	0.6	210	1,051	305	1,526	30	150	40	200	10	50
Total	1.4	210	2,452	305	3,561	30	350	40	467	10	117
Population Equivalent	11,667										
Peak Hourly											
Domestic Portion	2.49	67.5	1,401	98	2,035	9.6	200	13	267	3.2	67
Industrial Portion	1.86	67.5	1,051	98	1,526	9.6	150	13	200	3.2	50
Total	4.35	67.5	2,452	98	3,561	9.6	350	13	467	3.2	117
Peak Daily	4.35	Maximum Pumping Rate									
Peak Instantaneous	4.35										