1 Executive Summary

1.1 Background

Since 1937, the Emerald Coast Utilities Authority's (ECUA's) Main Street Wastewater Treatment Plant (MSWWTP) has been operated in downtown Pensacola, Florida, on an 18-acre site approximately one block from Pensacola Bay. The plant is designed for an average daily flow (ADF) of 20 million gallons per day (MGD), and is the workhorse of our entire region's wastewater treatment capability. The plant serves the majority of Escambia County south of Cantonment, and also functions as a biosolids processor for several of the area's other treatment plants. The service provided by this plant is critical to the health of the area and to the local economy. However, due to its advanced age and the limitations of the relatively small site, the plant has been unable to consistently treat the incoming wastewater to the level required by the Florida Department of Environmental Protection (FDEP), has been a financial burden to ECUA and to the community, and has been nearly a constant source of foul odor for years. Based primarily on continuing FDEP rule violations and mounting costs of maintaining the plant, the ECUA directed its consulting engineers to conduct a feasibility study in 2003 to determine the most cost-effective options for rebuilding or replacing the MSWWTP.

The feasibility study revealed that replacing the plant with a modern facility in a more central location offered the best solution for ECUA, its ratepayers and the citizens of Pensacola and Escambia County. The importance of replacing the MSWWTP was emphasized when Hurricane Ivan struck Pensacola in September 2004, rendering the plant inoperable for three days and causing the release of raw sewage into the streets of Pensacola. Hurricane Ivan, with its wind-driven saltwater, aged the already outdated plant by approximately 10 years. The need to replace and relocate the plant shifted in much of the public's opinion from a good idea to an urgent priority.

Toward that end, ECUA has tasked its engineering team, Baskerville-Donovan, Inc., and Hatch-Mott MacDonald, to develop a Facilities Plan that would serve as the guiding document to take the new plant from "concept to concrete." This document will advance the MSWWTP replacement alternative (as presented in the 2003 Feasibility Study) by detailing the evaluation and selection process undertaken to recommend the location of the replacement plant, the treatment processes to be incorporated into the new plant, the transmission systems to bring wastewater to the new plant and carry reclaimed water away from the plant, and the alternatives for the reuse of reclaimed water produced by the plant. Additionally, the Facilities Plan includes cost estimates for construction and operation of the replacement system, and will serve as the basis for the detailed design, permitting and financing of the replacement of the MSWWTP.

Due to the ongoing efforts to obtain grant funds for the plant replacement (over $150 million currently secured), the funding aspect of the project is not currently included in the Facilities Plan. As the funding elements are solidified, this component will be added to the Facilities Plan as the Capital Financing Plan prior to the commitment of funds for construction.

As indicated, the Facilities Plan includes several major components as appropriate to investigate each aspect of the project. These are as follows:

- Replacement Plant Site Selection
- Flow Determination
- Raw Wastewater Transmission System
- Treatment Process Alternatives
- Treatment Plant Support Buildings

- Reclaimed Water Transmission System
- Effluent Disposal
- Solids Handling

A summary of the evaluations and conclusions detailed in the Facilities Plan is presented in the following pages.

1.2 Replacement Plant Site Selection

1.2.1 General

As recommended in the 2003 Feasibility Study, a replacement plant site was targeted for the area north of the University of West Florida. This area includes several large undeveloped areas of land away from concentrations of residential development, and close to potential reclaimed water reuse sites. The effects of Hurricane Ivan also supported this area as a prudent choice in order to remove the plant from the threat of coastal flooding and minimize the potential of damages from high winds. The Facilities Plan evaluated several parcels in this area against a set of criteria for the selection of the plant site. It also includes evaluation of parcels in several other areas of the County in order to permit selection of the best site for the plant.

1.2.2 Selection Criteria

The engineering team began its efforts by screening 23 potential sites based on a set of minimal pass/fail criteria. This list was narrowed to 13 sites after application of more stringent criteria. These 13 sites were evaluated based on a weighted scoring system that awarded points using the following criteria:

- Amount of usable land above the Category 5 hurricane flood elevation
- Proximity to neighborhoods and homes
- Proximity to potable water wells
- Grade or slope

In addition to the criteria listed above, ECUA also tasked its engineers to consider the potential for industrial and other reuse opportunities, and to ensure that the selected site would have a minimal impact on wetlands, and historical and archeological sites.

1.2.3 The Final Two Sites

Of the 13 sites scored according to these criteria, the top four sites were given additional consideration. Two of these were identified as significantly better than the others:

- Site 21, a 327-acre parcel off Chemstrand Road, owned by Solutia Inc.
- Site 1, an 89-acre parcel off U.S. 29 North, owned by International Paper (IP) Company.

These two sites were further evaluated to determine a final recommendation for the water reclamation facility (WRF) site.

1.2.4 The Recommended Site

Although both sites are good choices, additional factors led to the recommendation of Site 21 as follows:

- The site is well-buffered and invisible to its nearest residential neighbors, which are almost three-quarters of a mile away. Unlike neighbors of the existing MSWWTP, they will most likely not see, smell or hear the plant or its operation.
- The site is zoned for heavy industrial use and adjoins the site of an existing industry.
- The access road (Chemstrand Road) offers easy truck access.
- The site is inland and well above the Category 5 hurricane flood elevation. The plant will not be subject to flooding and is planned to be more resistant to hurricane impacts.
- The site offers potential for beneficial industrial reuse that is not economically feasible at the existing MSWWTP location.

Due to its location, the proposed water reclamation facility at Site 21 is referenced as the Central Water Reclamation Facility (**CWRF)** henceforth in the Facilities Plan. This title is subject to the ECUA Board’s action.

1.3 Flow Determination

In order to proceed with planning the transmission, treatment and effluent disposal/reuse components of the MSWWTP Replacement Facilities Plan, the projected flows to be accommodated had to be determined. This parameter dictates the size of the transmission system, the selection and size of the treatment components, and the scope of the effluent disposal facilities necessary to replace the MSWWTP. Therefore, the determination of the design flow rate is critical to all the other sections of the Facilities Plan.

The Population and Flow Projections component of the Facilities Plan expanded upon the efforts of the 2003 Feasibility Study to incorporate the most recent population data and flow measurements through a multi-step process. This process allowed the association of current population and flow data to specific points of interest in the proposed transmission system. It also included the projection of those flows to the 2030 design year, by associating the geographic areas to the West Florida Regional Planning Council's population projections. Finally, it included the accumulation of flows to indicate the appropriate design flow rates for the proposed lift stations, the treatment plant, and for the reclaimed water reuse systems. The projected flows modeled included the ADF's and the peak-hour flow. This methodology indicated that the CWRF should be designed for an ADF of 20 MGD in 2030. It must also be capable of processing peak-hour flows of approximately 51 MGD. Additionally, the analysis indicated that the CWRF should be easily expandable to treat flows above the 20 MGD in 2030 , which are expected as the service-area population increases.

The evaluation of the peak-hour flows indicated that Hurricane Ivan increased inflow and infiltration (I/I) to the system above previous levels by approximately 3.3 MGD. The Facilities Plan assumes that ECUA will make the repairs necessary to reduce I/I to pre-Ivan levels prior to exceeding the CWRF's capacity.

1.4 Raw Wastewater Transmission System

1.4.1 General

The MSWWTP replacement with the CWRF will require construction of a transmission system to intercept wastewater flows before they reach the MSWWTP and divert them to the CWRF. In order to develop the transmission system recommended in the Facilities Plan, an extensive analysis of the available alternatives was conducted, including computer modeling of relevant portions of the existing system, development of recommended transmission main routes and components, site selection and development of preliminary layouts for new regional sewage lift stations, and development of capital and operation and maintenance (O&M) costs associated with the proposed system components.

1.4.2 Transmission Mains

In order to transmit wastewater from the proposed regional lift stations and other connected lift stations to the proposed CWRF, the proposed project includes a transmission main beginning at the existing MSWWTP site, extending northeasterly approximately 18 miles to the CWRF. The analysis of the necessary transmission main route started with the conceptual route as recommended in Alternative #3 of the 2003 Feasibility Study. This route was re-examined and refined to reflect more detailed evaluations. These evaluations included detailed consideration of the geography along the route, the precise location of the proposed CWRF, constructability, minimization of work within major roadways and intersections, and potential impact on adjacent residences and businesses.

The conceptual sizing of the transmission main was also refined to reflect the updated design flows. Computer modeling was performed to optimize the combination of pipe sizes, lift station pump size and capacities, and lift station location. The recommended transmission main route and pipeline sizes are illustrated on the attached Figure 1.4.2-1, which also illustrates locations where existing ECUA lift stations will be connected to the new transmission mains.

In addition to the primary transmission main from the MSWWTP to the CWRF, a smaller transmission main is proposed to convey flows from the northwestern part of ECUA's service area to the new CWRF. Also, short lengths of force mains will be extended to connect existing ECUA lift stations along the route to the new transmission main. These routes are also illustrated in Figure 1.4.2-1.

Based upon this analysis, the proposed transmission main includes the estimated lengths of pipe as indicated in Table 1.4.3-1:

Table 1.4.3-1 – Transmission Main Quantities

Pipe Diameter	Estimated Linear Feet
18-inch	19,300
24-inch	7,600
30-inch	3,450
42-inch	51,450
48-inch	45,360

In addition to the route and size of the transmission mains, the materials of construction of the proposed force mains were examined. Based upon a number of factors including the durability of the pipe, the limitations of the large diameters required, and the associated costs, ductile iron pipe (DIP) is recommended for the large force mains. PVC pipe is recommended for 24-inch diameter and smaller force mains. ECUA's final selection will be made during project bidding.

1.4.3 Regional Lift Stations

In order to transmit the wastewater to the CWRF, three new regional lift stations will be incorporated into the project. The MSWWTP will be replaced with a lift station located on the northwest corner of Government Street and DeVilliers Street across the street from the existing administration building. This new DeVilliers Street Lift Station site clears the way for the ultimate elimination of all ECUA facilities on the MSWWTP site.

Regional Station A is sited to re-pump flows from the new DeVilliers Street tLift Station on to the CWRF. This station is necessary to limit pressures in the force main to within the established criteria. Regional Lift Station B is configured to intercept a major trunk sewer and divert these flows to the new transmission main upstream of the MSWWTP. Figure 1.4.2-1 also illustrates these proposed regional lift station locations.

While siting the DeVilliers Street Lift Station was a fairly straightforward consideration of the most economical use of existing ECUA property, siting the remaining two regional lift stations was more involved. In order to determine the most appropriate location for these two stations, a matrix analysis was performed similarly to that performed for siting the CWRF. Based primarily upon the desired connection point and availability of undeveloped property, a number of sites were examined. Each of these sites was then scored according to ten criteria similar to those applied to the CWRF site selection. The resulting scores are indicated in Table 1.4.4-1:

Table 1.4.4-1– Scoring Summary For Regional Lift Station Sites

Regional Lift Station A		Regional Lift Station B	
Site	Score	Site	Score
A1	690	B1	529
A2	662	B2	438
A3	658	B3	544
A4	621		

Since most of these parcels are privately owned and may not be obtainable at the appraised value, scoring the sites is recommended as the basis for prioritizing their purchase, rather than as a basis for pursuing only the top choice.

In addition to locating possible sites for the lift stations, the operating parameters and general configurations must be sufficiently detailed to allow the progression of the detailed design following approval of the Facilities Plan. Based on the hydraulic model, the station design parameters were defined as indicated in Table 1.4.4-2:

Table 1.4.4-2 – Regional Lift Station Preliminary Design Parameters

Parameter	DeVilliers Street Lift Station	Regional Lift Station A	Regional Lift Station B
Station Capacity	25.6 MGD	37.2 MGD	13.5 MGD
No. of pumps	4	6	4
Pump Capacity (each)	5,930 gpm @ 215-ft of head	5,170 gpm @ 185-ft of head	3,125 gpm @ 165-ft of head
Approximate Pump Horsepower (each)	450	375	215

Each of these stations will be durably constructed with multiple redundant systems to ensure their continuous operation even during severe weather conditions. The proposed lift stations will have dual wet wells and multiple pumps for redundancy. Each station will have a diesel-powered generator sized to run the lift station equipment. A fuel storage tank will be provided with a minimum of 24 hours of fuel. A carbon adsorption odor control unit will be provided at each station to minimize odors from the stations. The generator, odor control unit and electrical components will be housed in a building designed and elevated to withstand hurricane force winds and storm surge from a Category 5 hurricane.

1.4.4 Secondary Lift Stations

The conceptual layout of the transmission system also includes the rerouting of discharges from several existing lift stations into the proposed transmission mains. This is proposed to minimize re-pumping of flows and the volume of flows reaching the new DeVilliers Street Lift Station. Each of these stations was analyzed using existing ECUA data. The results indicate that up to 29 stations will require modification. Further analysis will be necessary during the design phase.

1.5 Treatment Process Alternatives

1.5.1 General

For the wastewater treatment at the CWRF, the Facilities Plan divides the plant into its treatment unit processes for evaluation and selection. This investigation is performed through the application of a scoring matrix similar to those utilized in the site selections described in earlier sections.

In the application of the unit-process scoring matrix, ECUA staff and the consultant team collaboratively assigned scores for twelve characteristics of each alternative. These scores were then multiplied by a weighting factor, also determined by collaborative discussions. Points for specific characteristics are summed to produce the alternative's score, with the highest scored alternative recommended. The twelve characteristics that were scored included process reliability, capital costs, operating costs, simplicity, and environmental impacts as the most heavily weighted factors. This scoring matrix is applied to the following nine unit processes of the plant:

- Pre-treatment (screening and grit removal)
- Biological Treatment
- Clarifiers
- Filtration
- Disinfection
- Odor Control
- Additional Treatment
- Septage and Grease Treatment
- Biosolids Processing

Each of these selection evaluations is summarized in the following sections.

1.5.2 Design Parameters

Each process component was evaluated in the context of its ability to contribute to the treatment of wastewater to the standards as established for the plan. For this evaluation, the character of the influent wastewater was established by examining ECUA's historical records of influent constituent concentrations. These records reflect the concentrations of the following constituents (with simplified definitions):

- Carbonaceous Biological Oxygen Demand ($CBOD_5$) – a measure of a portion of the oxygen consumed in the biological breakdown of waste in the water
- Total Suspended Solids (TSS) - a measure of the solids suspended in the water
- Total Kjeldahl Nitrogen (TKN) – the sum of free ammonia and organic nitrogen in the water
- Total Nitrogen (TN) – TKN plus nitrates and nitrites in the water
- Ammonia
- Phosphorus
- Alkalinity

Based upon recent data from influent flow sampling performed by ECUA, and after comparison with standard published values, ECUA staff and consulting team agreed on the following monthly average values to represent the anticipated loading to the CWRF:

Parameter	Influent Design Concentration
$CBOD_5$	350 mg/l
TSS	300 mg/l
TKN	40 mg/l
Ammonia	24 mg/l
Total Phosphorus (TP)	8 mg/l
Alkalinity	138 mg/l

For the definition of the treatment performance to be required of the CWRF, the effluent parameters were also necessary. The maximum levels of constituents present in the plant effluent are dictated by the FDEP and vary depending on the ultimate effluent disposal or reuse method utilized. In order to promote industrial reuse of the reclaimed water, as well as possible future residential reuse, ECUA directed that the effluent be treated to meet FDEP's criteria for Advanced Wastewater Treatment (AWT). This level of treatment requires that constituents not exceed the following annual average limits:

Parameter	Effluent Design
BOD_5	5 mg/l
TSS	5 mg/l
TN	3 mg/l
TP	1 mg/l
Ammonia	2 mg/l

In addition to these limits, the FDEP requires that reclaimed water be subjected to high-level disinfection as defined by FDEP to include attainment of a chlorine residual of 1.0 mg/l after a 15-minute contact period. Fecal coliform counts in the effluent must generally remain below detectable limits to satisfy high-level disinfection requirements and be considered an AWT effluent.

1.5.3 Pretreatment (Screening and Grit Removal)

Screening - As wastewater enters a treatment plant, it is generally screened as the first phase of treatment to remove mostly inorganic debris before it enters the biological treatment process. Screens are also used to protect downstream equipment from large solids. Screenings are generally disposed in a landfill.

From the wide variety and configurations of screens available, four types were selected for evaluation as being the most applicable to the proposed downstream components. The discussed matrix evaluation was applied to each of these screen types and the resulting scores are as follows:

Rank	Alternative	Composite Score
1	Step Screen	145
1	Perforated Plate Screen	145
3	Climbing Screen	142
4	Rotary Drum Screen	137

Subsequent to this analysis, two (2) step screens manufactured by Huber Technology were purchased by ECUA for installation at the MSWWTP. ECUA has directed that these screens be utilized at the CWRF.

Grit Removal - Following screening, many plants remove grit upstream of the biological treatment basins. Grit consists of sand, gravel, cinders, or other heavy inorganic materials that have specific gravities or settling velocities considerably larger than those of organic particles. Grit is removed in order to protect moving mechanical equipment from abrasion and associated wear; reduce the formation of heavy grit deposits in channels, pipelines, and conduits; and reduce the frequency of basin cleaning required by accumulations of grit.

There are three basic types of grit removal systems: (1) horizontal flow, (2) aerated, and (3) vortex. Each of these systems uses centrifugal and/or gravitational forces to separate the grit from organics into a central sump for removal. The removed grit is usually washed prior to disposal in a landfill.

The application of the scoring matrix to the three alternatives resulted in the following scores:

Rank	Alternative	Composite Score
1	Tangential Vortex	150.5
2	Velocity Settling Chamber	141.5
3	Aerated Grit Removal	122

Subsequent to this analysis, four (4) Grit King tangential vortex grit chambers were purchased by ECUA for installation at the MSWWTP. ECUA has directed that these units be utilized at the CWRF.

1.5.4 Biological Treatment

For the biological treatment of the wastewater, six processes were considered that have a record of achieving the required reduction in wastewater constituents without reliance on the addition of chemicals. These processes are known as Biological Nutrient Removal (BNR) processes and remove a majority of the wastewater constituents through the promotion of biological growth with the waste as the energy source. Through the application of the previously described scoring matrix, the six evaluated Biological Treatment alternatives are ranked as follows:

Rank	Alternative	Composite Score
1	5-Stage BNR System	188.5
2	Verticel™ Process	155
3	Phased Isolation Ditch (PID) Process	149
4	Aero-Mod™ SEQUOX Process	144
5	Sequencing Batch Reactor (SBR) Process)	139
6	Membrane Bioreactor (MBR) Process	123

Therefore, the 5-Stage BNR System is recommended as the biological process for the CWRF.

1.5.5 Clarifiers

Secondary clarifiers are usually located downstream of the biological treatment process and are used to remove the biomass of the mixed liquor for either return to the biological treatment unit or waste as needed for proper operation of the plant. Clarifiers remove solids by gravity. While there are a few different types of clarifiers available, their performance and costs are similar. However, ECUA has significant experience with center-feed, circular clarifiers, which are currently in place at each of the ECUA treatment plants and are performing acceptably. Therefore, center-feed circular clarifiers are recommended for the CWRF.

1.5.6 Filtration

Filtration is utilized in the treatment of wastewater in order to filter most non-settleable solids from the clarifier discharge. Filters may utilize different types of media in combination with different approaches for cleaning the media. The evaluation for the CWRF included application of the scoring matrix to four available filtration alternatives as follows:

- Upflow/Downflow Media Filters with sand, gravel, plastic, or anthracite media hydraulically flushed for cleaning
- Traveling Bridge/Hood Filters with sand or anthracite media cleaned by a moveable vacuum hood
- Cloth/Polyester Resin Panel Filters with the granular media replaced by filtration cloth in either a traveling hood configuration or a disc configuration
- Membrane Filtration is actually a component of the membrane bioreactor as evaluated in the biological process component of the plan

Based upon the application of the scoring matrix, the Cloth/Polyester Resin Panel Filters in either the traveling hood configuration or in the disk configuration are recommended.

1.5.7 Disinfection

Disinfection is a vital part of the wastewater treatment process to minimize the public's exposure to disease-causing organisms commonly found in wastewater. It is the final step of the treatment process prior to effluent discharge or reuse.

While there are many disinfection methods used for wastewater treatment, those commonly used in the United States include chlorination through use of chlorine gas, bulk hypochlorite or on-site hypochlorite generation; and disinfection through ultraviolet radiation (UV).

Chlorine achieves disinfection by killing most organisms in the effluent stream when applied at sufficient concentrations and allowed adequate contact time. UV disinfection is achieved by the passage of the flow to be treated through a bank or banks of UV lamps, which are placed in a channel. UV exposure destroys the ability of organisms in the wastewater to reproduce.

The three chlorine disinfection alternatives and the UV disinfection alternative were scored and are ranked as follows:

Rank	Alternative	Composite Score
1	On-Site Hypochlorite Generation Disinfection	136
2	Chlorine Gas Disinfection	129
3	Bulk Sodium Hypochlorite Disinfection	128
3	UV Disinfection	128

Based upon the application of the scoring matrix, the on-site generation of chlorine (hypochlorite) is recommended.

1.5.8 Odor Control

Due largely to the directive from ECUA that noxious odor emissions from the proposed CWRF be minimized, odor control units are planned for inclusion at the screening and grit removal area of the plant, and at the biosolids handling facilities. While these components are being designed to reduce odor generation or release, odor control units will further minimize the possibility of odor release from the CWRF. Six types of odor control units were evaluated through the application of the scoring matrix and are ranked as follows:

Rank	Alternative	Composite Score
1	Chemical (Wet) Scrubber	168
2	Carbon Media	162
3	Bio-scrubber	157
4	Wood Media	155
5	Bio-filter	134
6	Regenerative Thermal Oxidizer (RTO)	130

Chemical (Wet) Scrubbers are recommended for installation at both the screenings and grit removal area, and at the biosolids handling area of the CWRF.

1.5.9 Additional Treatment

In addition to the selection of the standard components of the treatment plant, several additional components are warranted by the specifics of the proposed system. Flow equalization is warranted to stabilize variable raw wastewater flow rates and to optimize the size of the treatment facility. The Facilities Plan evaluation determined that flow equalization just downstream of the grit removal components should be included in the CWRF. Any influent flows in excess of the 36 MGD peak flow capacity of proposed biological treatment units will be diverted to this equalization basin for aerated storage. These flows will be sent to the biological process for treatment at lower flow periods. As discussed in the Reclaimed Water Transmission System Section of this Plan, effluent flow equalization is also warranted to minimize the necessary size of the effluent transmission system.

Other additional components of the CWRF include reject storage basins and chemical addition facilities. Reject storage is proposed as simply a lined holding pond that has the FDEP-required volume to retain effluent unacceptable for discharge from the WRF. Inadequately treated effluent will be diverted to these basins and ultimately would be sent back to the CWRF for re-treatment. The FDEP regulations for surface water and wetland discharge require a minimum reject-storage volume equal to the CWRF's ADF. Therefore, 20 million gallons of reject storage capacity will be provided at the CWRF.

As previously indicated, the recommended treatment process removes certain constituents through biological means. In order to ensure adequate treatment, even in adverse conditions, chemical addition facilities are recommended as a backup support of the biological process. These facilities may include provisions to add methanol, aluminum sulfate and flocculent aids. Each of these chemicals has a proven history in the wastewater treatment field as a valuable treatment option. Also, facilities for the addition of sodium hydroxide (also known as caustic soda) will be included to allow the increase of the influent waste stream's pH to the optimum levels for the biological process.

1.5.10 Septage and Grease Treatment

In addition to its influent wastewater flows, ECUA has historically accepted septage and grease trap waste for treatment. These waste originate from on-site sewage treatment and disposal systems, portable toilets, holding tanks, and grease interceptors. While an independent firm currently accepts these flows and ECUA does not accept these flows, this arrangement is subject to being changed or even terminated. Therefore, as directed by ECUA, the Facilities Plan includes septage and grease receiving and handling facilities for the CWRF.

1.6 Biosolids Processing

1.6.1 General

Biosolids are produced as a byproduct of the treatment of wastewater and must be removed from the treatment process to maintain an appropriate level of biological activity. This removal is accomplished through the "wasting " of return sludge from the secondary clarifiers and treatment in the biosolids processing facilities in accordance with the applicable regulations. After treatment, the biosolids may be disposed of by one of several means dependant upon the treatment process utilized.

The Solids Processing component of the Facilities Plan identifies the nature of the materials to be processed, the regulatory parameters to be met, and a general description of available treatment options. It proceeds through a detailed evaluation of the available options for each component of the process, including the application of a scoring system to identify the most appropriate alternative for ECUA. The report concludes with a presentation of the costs associated with the best options and a recommendation for the selection of the system for use by ECUA.

The processes that encompass biosolids handling begin with digestion, with optional thickening, followed by dewatering, and finally drying. Alternative methods and/or manufacturers are presented for each process, where applicable. Each process was evaluated, and the selection methodology applied. Ultimately, for each step through the biosolids processes, this report presents recommendations to ECUA that will take into account overall suitability, capital costs, and operations and maintenance.

1.6.2 Biosolid Treatment Regulation

Biosolids treatment is governed at the federal level by the U.S. Environmental Protection Agency (EPA) through 40 CFR Part 503 and, at the state level, by the Florida Department of Environmental Protection (FDEP) through Chapter 62-640, F.A.C. Implementation of the treatment required by these regulations serves to limit the levels of pathogens, metals and other constituents in biosolids and reduce the attraction of vectors to the biosolids to allow their disposal without creating a health threat. The level of treatment applied to the biosolids is indicated by the use of a class system. ECUA currently produces a Class AA biosolids, which is the highest category of treatment and quality. A Class AA biosolids can essentially be used as a soil amendment. Through the evaluation of the available alternatives to produce and dispose of the available classes of biosolids, the Facilities Plan recommends the continued production of Class AA biosolids as the most cost effective means of biosolids management.

1.6.3 Sludge Pretreatment

The first stage of biosolids management outside of the wastewater treatment process occurs just downstream from the secondary clarifiers. This stage may be the aerobic or anaerobic digestion of the biosolids, or the use of a number of other available processes. Aerobic or anaerobic digestion refers to the reduction of the volatile content of the biosolids through either extended aeration or through extended holding of sludge in an oxygen deficient environment. Of the other processes that may be applied as pretreatment, this Plan limited detailed consideration to a proprietary process know as Autothermal Thermophilic Aerobic Digestion (ATAD). An ATAD unit is basically an insulated aerobic digester operated at a higher temperature.

Each digestion alternative was evaluated through the application of the scoring matrix and they are ranked as follows:

Rank	Alternative	Composite Score
1	Aerobic Digestion	240
2	ATAD	173
3	Anaerobic Digestion	171

Subsequent to the identification of aerobic digestion as the process of choice, the recommendation of a sludge dryer to be discussed in the following sections reduced the advantages of digestion such that aerated sludge holding is recommended. Aerated sludge holding is the accumulating of the liquid sludge in an aerated basin without the express intent to achieve aerobic digestion. The basin configuration and equipment is very similar to that of aerobic digestion except the basin volumes are reduced. Digestion is limited by the relatively short retention times of sludge holding basins.

1.6.4 Thickening

Thickening of the liquid sludge to a higher solids concentration was historically employed downstream of digestion to optimize the operation of the downstream processes. Thickening may be achieved by gravity settling, air flotation, or by mechanical means. However, recent advances in dewatering equipment have reduced the cost effectiveness of thickeners. The Plan evaluated five different types of thickening processes in the context of the evaluated dewatering devices and determined that none of the alternatives offered sufficient advantages to warrant their inclusion in the CWRF. Therefore, sludge thickening is not recommended.

1.6.5 Dewatering

In order to convert liquid sludge to a biosolid, the solids content of the sludge must be drastically increased (typically from around 1.5% to around 18% or higher of the sludge). This may be accomplished though use of various means including the following:

- Sludge Lagoons
- Drying Beds
- Vacuum Beds
- Recessed Plate Filter Press
- Belt Presses
- Centrifuges
- Screw Presses

Based upon qualitative data on these alternatives, only the last three were retained for detailed evaluation in the Plan. The first four were discarded primarily due to their large land requirements or large operator attention demands.

Each of these three alternatives is a mechanical means of dewatering the liquid sludge to approximately 18% solids content. Each uses polymer mixed with the sludge to produce a “floc” that is either squeezed to remove the free water or centrifugally spun to separate the free water from the “cake”. Each alternative was thoroughly investigated in the Plan through the comparative evaluations of equipment proposals and operating costs for 13 dewatering alternatives. The evaluations also incorporated input from treatment plant operators throughout the southeast United States obtained through targeted surveys and site visits. ECUA staff input was obtained during working meetings and during treatment plant site visits throughout Florida and in Arkansas and Alabama. Finally, to confirm the manufacturer’s representations of the screw press, ECUA commissioned a pilot study of the unit. This study indicated that the unit should exceed the ECUA expectations.

Based on this extensive evaluation, the scoring matrix process) as earlier described) was applied to the dewatering alternatives. Based upon this evaluation, the screw press was identified as the dewatering equipment of choice, followed by the belt press and then the centrifuge. These results were constant regardless of which disposal or drying alternative follows dewatering.

1.6.6 Drying

Following the dewatering process, the biosolids or “cake” may be prepared for ultimate disposal through further drying which is expected to yield Class AA biosolids. Other alternatives to drying exist to produce a Class AA product but were discarded from consideration due to their associated disadvantages. These discarded alternatives included composting, advanced alkaline stabilization, incineration, and fluidized bed drying.

Drying processes apply heat to wet biosolids to force the evaporation of water. yielding a higher solids concentration. Examples of the drying processes are solar drying, paddle drying, and drum drying. Passive drying processes such as solar drying require large areas of land and are subject to reduced efficiency during periods of poor weather. Therefore, only mechanical means of drying were considered in the Facilities Plan. The Plan evaluated the following alternatives:

- Komline-Sanderson Paddle Dryer
- US Filter Dragon Dryer
- Andritz DDS-60 Drum Dryer
- Kruger BioCon Dryer
- Fenton Dryer

In evaluating these alternatives, manufacturer proposals were obtained and comparatively evaluated along with input from several of the relatively few dryer operators in the southeast. Additionally, ECUA and consultant staff made field trips to five operating dryers and a manufacturing facility. Information from these sources was incorporated in the collaborative scoring of each alternative through the application of the scoring matrix. This scoring indicated that the paddle dryer is preferred over the batch dryer which is preferred over the drum dryers.

As a final confirmation of the appropriateness of using a drying system, the options of disposing dewatered cake to a landfill or to agricultural land application were scored. This scoring confirmed the strong preference for mechanical drying to produce a Class AA product. Therefore, the Komline-Sanderson Paddle Dryer is recommended for use at the CWRF.

1.7 Treatment Plant Support Buildings

In the support of the CWRF, administrative offices, operations, maintenance and electrical shops must be constructed at the CWRF. A new laboratory to replace the existing laboratory at the MSWWTP facility is also needed. The Facilities Plan includes the development of each of these facilities comparable to those, as they currently exist, at MSWWTP.

1.8 Reclaimed Water Transmission System

1.8.1 General

The reclaimed water transmission system will convey reclaimed water from the CWRF to the reuse and disposal sites.

1.8.2 Design Parameters

The effluent disposal method was presumed to be a combination of man-made wetlands and ECUA/International Paper (IP) Rainwater Tract capacity. The Rainwater Tract accommodates up to 5 MGD of wetland capacity; additional reclaimed water (approximately 5 MGD) could be used by IP, based upon initial discussions.

Other possible means of effluent disposal or reuse are through either rapid infiltration basins (RIBs) or industrial reuse. At this time, neither of these possibilities can be assured. Therefore, the Facilities Plan assumes the utilization of man-made wetlands as the option considered for investigation.

1.8.3 Transmission Mains

A hydraulic model of the reclaimed water transmission system was developed to determine required pipeline sizes, system operating pressures and required design conditions for the CWRF effluent pump station.

The reclaimed water transmission mains were routed from the CWRF effluent pump station to the influent structure of each wetland train and to the point of connection with the ECUA/IP Rainwater Tract outfall pipeline. Generally, the reclaimed water transmission main follows a route from the CWRF effluent pump station west between the man-made wetland parcels and crosses Highway 95A and Highway 29 to the IP property. Pipe branches from the transmission main will convey flow to each of the wetland train influent structures. Figure 1.8.3 illustrates the anticipated routes.

1.9 Effluent Disposal System

1.9.1 Overview

Once the reclaimed water exits the CWRF, it must be either reused or disposed. Several different methods of reuse or disposal, such as industrial reuse, residential reuse, direct surface discharge, and groundwater recharge, have been historically used throughout the United States. The Facilities Plan provides a detailed discussion concerning the review of these different methods. A summary of the evaluation and conclusions detailed in the Facilities Plan is presented in the following pages.

Reuse - Local industries could use the reclaimed water in their processes, or residents could use the water through other means. International Paper (IP) and Gulf Power (GP) were approached for possible reuse of the reclaimed water. Currently, the ECUA has an agreement with IP to provide reclaimed water to a wetland system located in the Perdido watershed of Escambia County. This wetland system, known as the Rainwater Tract, is currently being permitted and has been designed to accept waters from the IP processes as well as from the CWRF.

Preliminary discussions with GP indicate that reuse may be possible in the cooling towers at the Crist Plant. However, these discussions are preliminary and will need to be advanced during the system design to determine if Gulf Power can use reclaimed water.

Industrial reuse is beneficial to the community and is recommended by the FDEP; however, a system must still be in place to provide a means of effluent disposal for periods when the industries cannot accept the CWRF effluent. Also, if industrial reuse is not realized, other means of effluent disposal will be required.

Effluent Disposal - Many means for effluent disposal are available; however, two methods, rapid infiltration basins (RIBs) and man-made wetlands, could provide the most beneficial means of disposal while providing effluent polishing. RIBs are systems in which the CWRF effluent is applied to land at rates as high as ten inches per day. These types of systems utilize percolation and hydraulic conductivity of the soil.

Man-made wetlands minimize percolation and utilize effluent polishing through microbial and vegetative life which are present in the wetland system. Since the man-made wetlands minimize percolation, the effluent must meet water quality based effluent limits established by the FDEP prior to distribution into contiguous wetlands or waterbodies.

1.9.2 Effluent Disposal Site Selection

General - Under a worse case scenario in which industrial reuse is not an option, adequate land must be available to fully accommodate the effluent disposal system. Therefore, 31 sites were identified throughout central and south Escambia County as possible effluent disposal site locations. Using an initial evaluation method similar to that described in the Replacement Plant Site Selection section, above, these 31 sites were reduced to 16 possible sites for wetland use and 3 possible sites for RIBs use.

Wetlands - An additional analysis method was then performed on the selected sites through a site-scoring matrix similar to those described in previous sections. This matrix reviewed such items as site size, average grade, and number of residents within a specified distance to rank the selected sites according to the site's benefit to the project. The top ten sites were further analyzed.

RIBs – Although three of the initial 31 sites passed the initial evaluation, two of them contain a large amount of natural wetlands. Natural wetlands not only indicate low soil permeability and high water tables, their development is restricted and regulated. Therefore, only one of these three sites was considered viable for RIB development. Once the geotechnical and biological investigations are complete on the site, RIBs will be further evaluated.

Secondary Analysis of Potential Wetland Sites - None of the top ten sites could individuallyprovide adequate size for the required man-made wetlands system. Therefore, combinations were made using the top ten sites. Reclaimed water transmission mains were routed to each of the wetlands combinations and opinions of probable costs for these conceptual transmission main routes were estimated. These estimates were then used, with an assumption that wetland differential construction costs were minimal, to determine the best three combinations of land available for wetlands development. A general cost estimate which included wetland development of the three site combinations, transmission main costs, and treatment plant site development cost differentials was used to narrow the site selection further from three land combinations to four individual sites. These four sites were used in subsequent analysis of wetland layouts and development of probable opinions of construction costs.

1.9.3 Wetlands Layout

The conceptual wetlands layout utilizes the top four sites from the previously described analysis and consists of nine individual "trains." Each train will polish CWRF effluent independently of each other, and is composed of several cells, some shallow and some deep for optimal effluent polishing. Headwork structures, cell outlet structures, and wetland effluent structures were strategically located to optimize the land use. Once the conceptual wetlands layout was developed, it was hydraulically analyzed using water budgets, hydraulic modeling and numerical models to determine wetland-polishing effectiveness. Figure 1.8.3 shows a schematic of the proposed wetland layout.

1.9.4 Recommendations

The recommendations for design utilize parallel efforts in determining whether RIBs, man-made wetlands or a combination of both is the most appropriate means for effluent disposal. This determination will be made once the geotechnical and biological investigations of the sites are completed. Additional efforts are recommended to pursue industrial reuse possibilities, since they are beneficial whether RIBs or wetlands are utilized.

1.10 Project Schedule

The proposed schedule for the design and construction of the CWRF and associated transmission and disposal systems is summarized as follows:

Task	Timeline
Detailed Design	March 2006 thru March 2007
Permitting	March 2006 thru March 2007
Bidding & Construction	March 2007 thru July 2009
Startup	July 2009 thru September 2009
MSWWTP Demolition	August 2009 thru October 2009

This schedule reflects FEMA's requirement that the funds it has committed to the project be spent within five years of Hurricane Ivan which is September 16, 2009. Failure to meet this deadline will result in the loss of any unspent FEMA grant funds unless a time extension is requested and received. Current information indicates that only extraordinary circumstances would be an adequate basis for such an extension. Since FEMA is expected to be the largest single source of project funds, its schedule requirements must be met. The completion deadline is not applied to the MSWWTP demolition since its damage after September 2009 would not expose FEMA to additional cost.

This schedule represents a very aggressive undertaking that requires simultaneous efforts in the facility planning, detailed design, permitting, and land acquisition. Additionally, the time allotted for construction requires that the project will be built through multiple concurrent construction contracts. This is an achievable schedule but it does not allow for any wasted time. Therefore, the detailed design of the project, the permitting, and the land acquisition have already begun.

1.11 Project Cost

The construction costs of each component of the proposed project are included in the component narratives. In addition to these construction costs, the project costs include: the land costs for the CWRF, effluent reuse sites, and the lift stations; the costs of obtaining easements for the transmission mains; and professional services fees. The current estimate of these costs projected to 2007 dollars is $281 million.

It should be noted that this cost estimate includes inflation factors that are historically based and may be significantly impacted by a number of factors throughout the project. Such factors include the availability of labor, the cost of materials of construction, and land costs. The cost estimate includes contingency amounts as allowed by the FDEP. However, these amounts may be insufficient to offset actual inflation and other cost related factors.

Finally, the construction costs may be reduced as a result of the ongoing reclaimed water reuse investigations. As previously indicated, possible industrial reuse and use of rapid infiltration basins may be less expensive than the reliance on constructed wetlands. This impact will be determined as the detailed engineering design effort progresses.