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September 30, 1998

VIA HAND DELIVERY

Blanca S. Bayo, Director
Division of Records & Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Docket No. 950387-SU (Remand)
Application of Florida Cities Water Company - North Ft. Myers Division - for increased wastewater rates in Lee County.

Dear Ms. Bayo:

Enclosed on behalf of Florida Cities Water Company, for filing in the above docket, are an original and fifteen (15) copies of following:

1. Remand Testimony of Mike Acosta, along with exhibits (MA-1) through (MA-4); 10756-98

2. Remand Testimony of Larry Coel, along with exhibit (LC-1); 10757-98

3. Remand Testimony of Thomas A. Cummings, along with exhibits (TAC-01) and (TAC-2); and 10758-98

4. our Certificate of Service.

Please acknowledge receipt of the foregoing by stamping the enclosed extra copy of this letter and returning same to my attention. Thank you for your assistance.

Sincerely,

B. Kenneth Gatlin

B. Kenneth Gatlin

BKG/ldv
Enclosures

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TAL:18783:1

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Application for a rate increase for North Ft. Myers Division in Lee County by Florida Cities Water Company - Lee County Division.	DOCKET NO. 950387-SU Filed: September 30, 1998

Certificate of Service

I HEREBY CERTIFY that a true and correct copy of Remand Testimonies and Exhibits of Mike Acosta, Larry Coel, and Thomas A. Cummings have been furnished by U.S. Mail this 30th day of September, 1998 to:

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TAL:18784:1

ORIGINAL

FLORIDA CITIES WATER COMPANY

NORTH FORT MYERS DIVISION

REMAND TESTIMONY OF THOMAS A. CUMMINGS

Docket No. 950387-SU

Q. Please state your name and business address.

A. My name is Thomas A. Cummings. My business address is Black & Veatch, 201 South Orange Avenue, Suite 500, Orlando, Florida 32801.

Q. Please describe your educational background and your professional qualifications.

A. I received my Bachelor of Science degree in Civil Engineering from Purdue University in 1979, and have completed Master of Science degree course work in Environmental Engineering and Science from the University of Missouri through 1985. I am a registered professional engineer in the Florida and Kansas. I was originally registered in Kansas, in March, 1984, after passing the examination in sanitary engineering, and registered in Florida in August, 1990.

Q. Please describe your professional engineering experience concerning water and wastewater utilities.

A. I have over 12 years continuous experience as a registered professional engineer specializing in studying, planning, designing, permitting and managing the construction of water and wastewater facilities for public and private investor-owned utilities in the State of Florida. I have been engineer-of-record for the design and permitting of five wastewater and/or water treatment plants, and assisted with the design, permitting and construction management of numerous others. I have studied and designed water treatment facilities utilizing biological and chemical treatments. I have been involved in the hydraulic model analysis and mechanical review of over fifteen water and wastewater systems and the preparation of over 25 water and/or wastewater treatment plant facility designs. My design and permitting experience also includes over 30 miles of raw water mains, potable water mains and force mains ranging in size from 4 inches to 60 inches.

Q. By whom are you presently employed?

A. I am currently employed by Black & Veatch.

Q. Please briefly describe the services that Black & Veatch provides.

A. Black & Veatch is a professional engineering and consulting firm that has 80 offices and over 6,000 employees. The services that Black & Veatch can provide are capabilities in the environmental, civil, electric, power, building, process, and management consulting fields as well as procurement and construction.

Q. What is your position with Black & Veatch?

A. I am a project manager/project engineer.

Q. How long have you held that position?

A. I have held this position since 1985.

Q. What are your normal duties for Black & Veatch?

A. The majority of my time I am responsible for engineering duties for numerous projects and clients for which my role is either the project manager, or project engineer, depending upon the nature and scope of our services.

Q. Please describe the responsibilities of a project manager.

A. The responsibilities of a project manager include the establishment of the project structure, both technical and financial. The project manager is accountable to the company for meeting project financial goals and technical requirements. The manager will also ensure that the client's project goals are also met.

Q. Please describe the responsibilities of a project engineer.

A. The project engineer is responsible for the production of the project and product. The project engineer will coordinate all technical activities and disciplines to achieve project goals.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the basis of design for the FCWC Waterway Estates Wastewater Treatment

Plant located in N. Fort Myers, Lee County, specifically as it relates to the issue and relationship of annual average daily flow and peak flows.

Q. Were you the Black & Veatch project manager for the Waterway Estates WWTP expansion to provide advanced wastewater treatment?

A. Yes, I was.

Q. Did you prepare the preliminary design report and the FDEP permit application for the Waterway Estates WWTP expansion?

A. Yes, I did. For purposes of this testimony, I will be referring to Figures 2-5 of that report. Exhibit ___ (TAC-1).

Q. Are you the engineer of record for this facility?

A. Yes.

Q. What are the responsibilities and duties of the engineer record?

A. The engineer of record is a Florida Registered Professional Engineer that develops the design criteria and concepts for the project and is responsible for the preparation of the construction documents.

Q. Did Black & Veatch provide the final design and construction management services for the Waterway Estates WWTP ("WWTP") expansion?

A. Yes, it did.

Q. What is the capacity of the WWTP that was actually constructed by FCWC?

A. The plant capacity is 1.25 MGD based upon the average annual daily flow and the waste concentration associated with this flow.

Q. Why did you design a 1.25 mgd plant based upon the average annual flow and waste concentration associated with this flow?

A. Based on our analysis of historical data it was Black and Veatch's professional opinion that a 1.3 mgd plant was the appropriate necessary and economically sized plant to treat the flows, including peak flows and to properly treat the pollutant loading associated with those flows. The size of 1.25 was determined to be the most economical size of plant to provide reuse water to the receiving area and to meet FDER requirements for discharging effluent over 1.0 mgd to reuse.

Q. Please explain how plant capacity is determined.

A. Wastewater treatment plants are normally designed to remove solids and dissolved pollutants contained in the raw wastewater received by the plant. The plants are normally permitted by the regulatory agency to meet effluent requirements on an annual average basis. Of course, the flow received by a wastewater treatment plant is not constant, but varies during the day in relationship to the activities of the customers connected to the plant. The flows also vary daily and seasonally throughout any given year in response to weather conditions, the influx of seasonal and tourist population, changes in the number of wastewater customers, etc. Therefore, these variations must be considered when designing the plant and are normally calculated from historical or industry literature data as a multiple of the annual average daily design flow.

The peak hour flow results when customers are most active during the daytime hours and any plant design must be able to hydraulically allow this flow to pass through the plant to prevent the treatment units from overflowing and at the same time, provide full treatment.

Each individual unit process must be analyzed in relationship to accepted design standards to determine its ability to meet effluent quality limits under varying flow conditions associated with the annual average daily design flow. Even though these unit processes may provide acceptable effluent quality in response to short-term variations in influent flow, the plant generally will not be able to meet these limits on a continuous basis.

The plant capacity is not only based upon the hydraulic load received by the facility, it is also based upon the load or quantity of pollutants carried by the flow which require treatment or removal in order to meet the effluent limitations. The pollutant load is normally determined based upon the average annual daily design flow and the associated design pollutant concentrations. Therefore, the plant capacity determination must also take into account the ability of the unit processes to remove the influent pollutant load down to levels that meet the effluent limitations.

The final determination of plant capacity is based upon the ability to respond to variations in raw wastewater flow and pollutant load, and whichever of these variables is the most limiting upon plant capacity is usually the final determining factor.

Q. Did you determine the 1.25 mgd capacity of the Waterway Estates WWTP using the considerations you just described?

A. Yes.

Q. What was the design process used by Black & Veatch to form the basis of design for the Waterway Estates Wastewater Treatment Plant?

A. The design process created an analytical model using the actual influent to this plant. Based on this influent, a biological model of the treatment process was made, and this model was compared to the existing plant facilities; tanks, mixers, and blowers to determine an economical facility expansion that would provide proper treatment.

Q. What were the parameters input into the analytical model to determine the plant treatment capacity?

A. The plant biological process model and resulting plant expansion was based not only on an increase in plant hydraulic flow in million gallons per day (mgd), but also on the constituents in the incoming waste stream. The plant is required by its Florida Department of Environmental Protection (FDEP) discharge permit to remove specific constituents from the waste stream. These constituents include Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Nitrogen (TN), and Total Phosphorus (TP). It is only by designing around removal of these constituents that an economical plant expansion can be achieved. As stated in the Manual of Practice No. 8, Wastewater Treatment Plant Design, 1977, prepared by the national Water Pollution Control Federation (MOP/8):

"The selection of a process train or alternative process trains should be made on the ability of the individual unit processes to remove specific waste constituents. If the makeup of all wastes were identical, the selection of a process package would be relatively simple. However, variations in the constituents and the relative portions of waste constituents in each phase complicate process selection unless the waste characterization is known. Knowledge of the wastewater condition and constituents is important so that the most applicable process train can be assembled."

The design of the WWTP was consistent with this standard of practice.

The constituents of interest by FDEP are listed in MOP/8 within Table 1-II and 1-III of the chapter entitled "Wastewater Parameters of Significance to the Design Engineer" Exhibit _____ (TAC-2). MOP-8 is a standard publication relied upon in designing wastewater treatment plants.

Q. How were the concentrations of incoming waste stream constituents determined?

A. Historical wastewater concentrations serve as the basis of design for sizing or setting the capacity of the expanded wastewater treatment facility. Process loading design criteria that were used in evaluating the unit operations and processes at the WWTP are as follows:

Average Design Loading - Mean concentration based on historical data. This load is used to estimate sludge production and turndown capability for blowers and RAS pumps.

Maximum Design Loading - Estimated as the mean plus two times the standard deviation of the data. This value represents the 95th percentile of the constituents' concentration data range for the plant and is approximately equal to the maximum monthly value. This loading is used in the modeling and sizing of the biological treatment process and sludge treatment processes.

<u>Peak Design Loading</u> - Computed as the maximum design loading times a peaking factor of 1.5 for carbonaceous load and 1.3 for nitrogenous load. This loading represents the peak day load to the biological system. This load is used to calculate the peak standard oxygen transfer rate (SOTR) required for the biological system. This rate is utilized in sizing blowers for the aeration system.

This approach is consistent with MOP/8 in Chapter I under the section "Flows for Design." This section describes the design average flow rate as "the average flow during same maximum significant period such as 4, 8, 12 or 16 hours." The average monthly influent concentrations for the WWTP from January 1986 to March 1992 were reviewed and used to create the preliminary engineering design report Figures 2 and 5. Exhibit ___ (TAC-1). As identified in the preliminary engineering design report, the statistical analysis of the monthly average influent concentrations yielded the following for the mean and mean plus two standard deviations (2S):

	Mean	Mean +2S
Biochemical Oxygen Demand (BOD_5), Mg/l	200	312
Total Suspended Solids (TSS), mg/l	242	379
Total Kjeldah Nitrogen (TKN), mg/l	33.3	53.2
Total Phosphorus (as PO_4), mg/l	7.8	12.4

The mean + 2S, or maximum design concentrations was used throughout the design. Average monthly BOD_5, TSS, TKN, and PO, are illustrated in Figures 2 to 5. Exhibit ______ (TAC-1). The average and maximum design concentrations are indicated on the figures for reference. The annual average BOD_5 concentration remained relatively constant during the 1986 to 1992 timeframe. The average influent TSS concentration appeared to increase with time. With the distinct exception of high values from October 1988 to February 1989, the average influent TKN concentration was very consistent during the timeframe studied. The influent phosphorus concentration appeared to decrease since 1986, except for the second half of 1989.

Q. Is the process described above consistent with standard design practice for wastewater treatment plants?

A. Yes.

Q. What are the target constituents required for removal at the Waterways Estates Wastewater Treatment Plant?

A. Final effluent from the Waterway Estates WWTP is discharged into the Caloosahatchee River near the site, pursuant to FDEP Permit No. FL0030325. The FDEP has established the following maximum concentrations in milligrams per liter (mg/l) for this surface water discharge:

	Monthly Average Concentration
5-Day Biochemical Oxygen Demand (BOD_5)	20 mg/l (monthly average)
Total Suspended Solids (TSS)	20 mg/l (monthly average)
Total Nitrogen (TN)	3 mg/l (monthly average)
Total Phosphorus (TP)	0.5 mg/l (daily maximum)

The design of the plant expansion was based on achieving these permit limits as a minimum. The use of the denitrification filters to meet the total nitrogen limit resulted in an effluent TSS which was considerably lower than 20 mg/l. Likewise, the biological system design was controlled by the nitrification requirements, not the carbon removal, and effluent BOD_5 levels were well below the required 20 mg/l BOD_5 limit as a result.

Q. What analytical model was used to predict the then existing and potential expanded plant's biological treatment capacity and how does it work?

A. The biological system was modeled with the Black & Veatch

Completely Mixed Activated Sludge (CMAS) program. The program is set up for modeling the anoxic\oxic activated sludge process. The oxic portion of the model is based on first order kinetics for removal of organics as developed by Dr. Ross McKinney. Influent wastewater characteristics input into the model include: BOD_5, TSS, VSS/TSS ratio, alkalinity, peaking factors for the carbonaceous and nitrogenous load, and temperature. Other major parameters input include: the desired dissolved oxygen concentration in the mixed liquor; alpha and beta factors dependent on the type of aeration system selected; and the desired sludge age or mixed liquor suspended solids (MLSS) concentration to be maintained.

The anoxic/oxic mode of operation for the activated sludge is used because biological nitrification/denitrification can be accomplished as well as carbon removal. In the oxic zone, heterotrophic bacteria utilize the organics for synthesizing new biomass and oxidizing a portion to meet energy requirements for growth and maintenance. Autotrophic bacteria in the oxic zone (the nitrifiers) are responsible for the oxidation of ammonia to nitrate nitrogen. The mixed liquor from the oxic zone containing a high nitrate concentration must be recycled back to the anoxic zone where the denitrifying bacteria reduce the nitrate nitrogen to nitrogen gas. The optimum mixed liquor recycle ratio has been found to be four times the influent flow into the anoxic zone.

The maximum design concentrations of 312 mg/l BOD_5, 379 mg/l TSS, and 53.2 mg/l TKN were utilized in the biological process model. Other model inputs supplied by Bob Dick of FCWC based upon actual wastewater constituents data are average influent alkalinity of 200 mg/l and average influent volatile suspended solids of 178 mg/l used in establishing the VSS/TSS ratio. A not to exceed maximum total nitrogen (TN) concentration of 14 mg/l was assumed for the treatment unit effluent which corresponds to the average design influent TN (14 mg/l) to the effluent filters.

Each biological treatment unit (BTU) was modeled separately to account for the differences in treatment capacity and aeration systems. The same mixed liquor suspended solids (MLSS) was input for BTU #1 and BTU #2 during successive model runs at a given temperature. The first model run was made using the maximum design concentrations. The addition of alum to the secondary clarifiers for phosphorus removal results in the accumulation of inert solids in the biological process via the return activated sludge (RAS). This reduces the volume available for active biomass thereby reducing the biological capacity of the process. The results of this first run were used to recalculate the influent TSS of 475 mg/l and VSS/TSS ratio of 0.57 for use in the second model run.

Q. What were the results of the model?

A. The results of the modeling indicated that no additional tankage was required for the biological process at the Phase I average design flow of 1.25 mgd and at maximum design concentrations. The addition of a MLSS recycle was necessary to achieve an effluent TN concentration of less than 14 mg/l. The MLSS recycle supplies nitrates from the aeration zone to the denitrifiers in the anoxic zone. The addition of this recycle results in maximum TN concentrations of approximately 11.6 mg/l and average concentrations of 7.2 mg/l as loadings to the effluent filters.

The secondary clarifier effluent quality predicted by the modeling is approximately 2 mg/l BOD_5, 5 mg/l TSS, 12 mg/l TN, and, <0.5 mg/l TP. The solids loading to each clarifier is 10 ppd/sq.ft. At the maximum design MLSS of 3,300 mg/l. The surface overflow rates of 368 gpd/sq.ft @ average flow and 736 gpd/sq.ft @ peak hour flow are low. Modeling was also performed with the larger BTU completely out of service as required by DEP redundancy rules. This illustrated acceptable treatment at 100% ADF, with the flow limiting factor being clarifier solids loading of 24 ppd/sq.ft at 3,500 MLSS. The results of modeling the Phase II design flow of 1.5 mgd at maximum design concentrations also indicate that no additional tankage is required.

Q. Based upon your analysis, including the modeling that you have described, what is your professional opinion as to the required size and facilities required to adequately treat the polluted loading at the Waterway Estates Plant?

A. It was my professional opinion and recommendation that a 1.3 mgd plant should be built at Waterway Estates with component necessary to treat the associated pollutant flow. The size of 1.25 was the most economical size to address the growth needs for the Waterway Estates and the FDER requirements to only discharge flows above 1.0 mgd to reuse.

Q. What is the meaning of hydraulic flow rate in the determination of treatment capacity?

A. The treatment plant facilities, pipes, pumps, tanks must be able to pass a hydraulic flow rate without overflowing at any point or facility. The flow rate used in the design is not the annual average flow of 1.25 mgd, but a daily peak flow rate that is twice the annual average rate. If the plant was designed for only the annual average flow rate, the plant would overflow during periods when the flow was above the average. And by definition, these higher rates will occur.

Q. Does this complete your testimony?

A. Yes.

For exhibit,
see Hearing Exh. 35

TAL:18538:1