Exhibit No.:
Issue: Capacity
Witness: John S. Young, Jr.
Type of Exhibit: Surrebuttal
Sponsoring Party: MAWC
Case No.: WR-2000-281
SR-2000-282
Date Prepared: May 25, 2000

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2000-281

CASE NO. SR-2000-282

SURREBUTTAL TESTIMONY

OF

JOHN S. YOUNG, JR.

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

JEFFERSON CITY, MISSOURI

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Missouri-American Water Company's tariff sheets designed to implement general rate increases for water and sewer service provided to customers in the Missouri service area of the Company.	)))))	Case No. WR-2000-281

County of Camden)
) ss
State of New Jersey)

AFFIDAVIT OF JOHN S. YOUNG, JR.

John S. Young, Jr., being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Surrebuttal Testimony of John S. Young, Jr."; that said testimony was prepared by him and/or under his direction and supervision; that if inquiries were made as to the facts in said testimony and schedules, he would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of his knowledge, information, and belief.

John S. Young, Jr.

Subscribed and sworn to before me this 23rd day of May, 2000.

Notary Public

My Commission expires:
Sept. 25, 2000

SURREBUTTAL TESTIMONY
JOHN S. YOUNG, JR.

MISSOURI-AMERICAN WATER COMPANY
CASE NO. WR-2000-281
CASE NO. SR-2000-281

TABLE OF CONTENTS

INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is John S. Young, Jr., 1025 Laurel Oak Road, Voorhees, New Jersey, 08043.

Q. HAVE YOU TESTIFIED PREVIOUSLY IN THIS CASE?

A. Yes, I have previously provided direct and rebuttal testimony to the Missouri Public Service Commission (Commission) in this case on behalf of Missouri-American Water Company (MAWC or Company).

Q. WHAT IS THE PURPOSE OF YOUR SURREBUTTAL TESTIMONY?

A. This surrebuttal testimony has been prepared to address the issues raised by Mr. Merciel in his Rebuttal testimony wherein he asserted that the Missouri Department of Natural Resources (MDNR) has not yet allowed operation of the plant at the design filtration rate, and that consistent with this delayed approval the Company could have delayed construction of other facilities and temporarily reduced the costs of the plant. He implies that the temporary reduction in capacity would have had no adverse consequences and could have resulted in a delay in the addition of approximately $2,272,000 in rate base.

Q. DO YOU THINK THIS RECOMMENDATION IS ADVISABLE?

A. No I do not. The 30 mgd capacity is in fact available at this time. I am convinced that it is appropriate and prudent for it to have been provided at this point in time, and I believe that it would not have been either prudent or economically justified to have delayed construction of the facilities as suggested. I will address the reasons that the capacity is appropriate now rather than later. Second, I will explain the relationship of filter utilization with DNR's approval. Third, I will explain why it would not have been economically justified to delay addition of the wells and other facilities named by Mr. Merciel.

CAPACITY

Q. ON PAGE 16, LINE 9, OF HIS REBUTTAL TESTIMONY, MR. MERCIEL STATES THAT HE BELIEVES THERE IS SOME EXCESS CAPACITY AT THE NEW PLANT. HOW DID MR. MERCIEL ARRIVE AT THIS CONCLUSION?

A. Mr. Merciel explains that he did not explicitly perform demand projections. Rather, his analysis was limited to a review of historical peak day demands. On page 17, line 17 he states " However, since the filter capacity is not yet 30 MGD, and peak day demand has been relatively consistent for a number of years at approximately 23 MGD, I think it would have been reasonable to size certain other plant components similar to the filter limitation, where practical."

Q. DID YOUR OFFICE PERFORM THE ANALYSIS DIFFERENTLY?

A. Yes, we undertook a rigorous analysis of system demands to arrive at the decision that the treatment plant needed to have a 30 mgd capacity. One of the important functions of the Company's planning process is a detailed review of system demands. The analysis includes a breakdown of demands into six categories including residential, commercial, industrial, other, non-revenue, and unaccounted for water. Based on a historical analysis of system demands and usage trends, projections of future water demands are made. The analysis of demands for the St. Joseph system is provided in the Demand Projection chapter in the1994 Comprehensive Planning Study (CPS). The Demand Projection chapter was provided in my Rebuttal Testimony as Schedule JSY-16.

Q. IT SEEMS DIFFICULT TO ACCURATELY PROJECT A MAXIMUM DAY DEMAND SEVERAL YEARS INTO THE FUTURE. PLEASE BRIEFLY EXPLAIN HOW PEAK DAY PROJECTIONS ARE MADE.

A. Yes, it is difficult to project future peak day demands, but it is essential for proper planning of large capital projects like the St. Joseph Water Treatment Plant. The American Water System employs a methodology based on accepted water utility industry practice. First, average day demands are projected based on a number of factors including historical trends, population projections, input from large users, and local and regional trends. Then, a statistical analysis of historic peak day to average day demands is performed over a 20-year period. A maximum to average day ratio is selected using a 95% confidence level. Said another way, the selected maximum to average day ratio allows for a 5% chance of actually exceeding the projected demand in any one year. The selected maximum to average day demand ratio is then multiplied by the average day demands to produce a "design" peak day demand.

In this way, the water system will be prepared to meet system demands during most hot, dry summers, which can occur in any year. The maximum day projection using this methodology must not be thought of as the prediction of maximum day demand in a given year. Rather, it represents the demand for which there is a 5% chance that it will be exceeded in that year. Therefore, a direct comparison of maximum day projections to actual maximum day demands in any year has little significance. This is a crucial concept because the Company's facilities must be adequate to meet customer's needs not only in the average year, but also in a hot, dry summer.

Q. WHAT MAXIMUM DAY TO AVERAGE DAY RATIO WAS DERIVED FOR THE ST. JOSEPH SYSTEM IN THE DEMAND PROJECTIONS.

A. A maximum day to average day ratio of 1.60 was determined for St. Joseph in the 1994 CPS. This value is further validated by subsequent analysis of data through 1998 which produces a 95% confidence level peak to average day value of 1.57. These values agree within two percent.

External support for the 1.60 maximum to average day ratio is provided by Mr. Gary M. Lee's absolute agreement with the 1.60 value in his review of the Company's demand projections in Case No. WA-97-46 and Case No. WF-97-241 (the Certificate Case) in 1997 for the Office of Public Counsel. Mr. Lee also explicitly agreed with the Company's 2009 demand projection.

Q. IN YOUR OPINION, IS IT APPROPRIATE TO USE ONLY RECENT DEMAND DATA TO CRITIQUE THE COMPANY'S DEMAND PROJECTIONS, AS MR. MERCIEL HAS DONE?

A. No, it is not, for several reasons.

Q. PLEASE ELABORATE ON THOSE REASONS.

A. First, it should be understood that data after the year 1994 was not available when the Company made the decision to initiate design of the project in December, 1995.

But more importantly, using only the past few years of data is not an adequate representation of key variables, especially weather. For instance, in several years during the 1980's, in particular 1988, the summer weather pattern was hot and dry. In such a weather pattern, peak water usage generally increases. Since 1994, a different, more moderate weather pattern has predominated. Obviously, at some point, which we cannot predict with certainty, a hot, dry pattern will occur again. The 1994 CPS demand projections recognize this issue, stating that although average conditions are appropriate to estimate annual operational parameters, "these values are not adequate to base long term capital planning decisions on" (Schedule JSY-16, page 2-22). As I have stated previously, the Company facilities must be adequate to meet the customer's needs not only under moderate conditions, such as the last few years have been, but also under hot, dry conditions such as 1988.

Q. YOUR OBJECTIONS ASIDE, HOW HAVE RECENT DEMANDS COMPARED TO THE COMPANY'S 1994 PROJECTIONS?

A. A comparison of the 1999 average day demand to the Company's 1999 demand projection from the 1994 CPS is provided as Schedule JSY-21. The 1994 CPS projected an average day demand of 16.13 mgd for 1999. The actual average day demand for 1999 was 16.05 mgd. These values agree within one-half percent, which serves to validate the Company's projections.

Ironically, to the extent that recent demands have been below the 1994 projections, by far the most significant deviation has been that unaccounted-for water (leakage, meter error, theft, etc.) and non-revenue usage have been successfully reduced by the Company, even beyond projections. The Water Company has been able to achieve an unaccounted-for water percentage of below 9 percent for the last several years. This is exceptional, especially for a water distribution system the age of St. Joseph's. To penalize the Company for having excess capacity would effectively penalize the Company for its outstanding progress in controlling unaccounted-for water (UAF).

Without the reduction in UAF, the actual average day demands in 1999 would have been approximately 16.7 mgd which is well above the Company's projections.

Q. HOW DOES THE TREATMENT PLANT CAPACITY COMPARE WITH THE DEMAND PROJECTION FOR 2009?

A. A peak day demand of 27.74 mgd was forecast for 2009 using the 95% confidence level methodology. This value agrees well with the 28.5 MGD effluent capacity of the treatment plant. The treatment plant has a filtered water treatment capacity of 30 mgd but with internal water use has a net system delivery capacity of 28.5 mgd. Mr. Merciel did not account for in-plant usage in his analysis of plant capacity.

The establishment of 2009 as a "design year" with the completion of construction in 2000 is a reasonable criteria. Where unpredictable growth is occurring, it is important to stage the expansion of the water system, including the treatment plant, to avoid excessive reserve capacity. However, for a system like St. Joseph, where demands are relatively stable and predictable, it is reasonable to use a longer timeframe for the next stage of expansion.

APPROVAL OF FILTRATION RATE BY MDNR

Q. ON PAGE 17, LINE 3, MR. MERCIEL ASSERTS THAT MDNR HAS ONLY APPROVED THE FILTERS FOR AT LEAST A ONE-YEAR PERIOD AT A 4 GPM/SF RATING. IS THIS A CORRECT INTERPRETATION OF THE PERMIT REQUIREMENTS?

A. No, the conditions for St. Joseph are unique. In MDNR's construction permit approval in the "Report On Plans And Specifications For A New Water Treatment Plant" (Report), dated January, 22, 1998, MDNR approved the construction of the 30 mgd water treatment plant. A copy of the Report is attached as Schedule JSY-22. Condition No. 4 of the Report states that " The size of the filters is being approved initially as a demonstration until sufficient information is collected...".

Given this permit condition, the filters may be operated at rates up to their design capacity of 5.56 gpm/sf and are not limited to 4 gpm/sf. The plant's full capacity of 30 mgd is available and is not restricted to a lesser capacity by MDNR. Currently, a demonstration study is underway to develop data to present to MDNR. Upon review and approval by MDNR, the demonstration period will be ended.

Q. WHY DID THE COMPANY DECIDE TO BUILD FILTERS AT A HIGHER LOADING RATE ?

A. I believe that MDNR would have approved a 4 gpm/sf filter rate without a pilot study prior to design or a demonstration study after construction. However, the Company recognized the magnitude of cost savings associated with building smaller filters at a higher filtration loading rate. The Company conducted a pilot study prior to design which indicated that a filtration rate of 6 gpm/sf was reasonable for this application. Based on this information, the Company requested MDNR to approve a filtration rate of 6 gpm/sf in the pre-design Engineer's Report. MDNR approved the Engineer's Report, and the subsequent construction permit application with a 5.56 gpm/sf filtration rate.

Construction of filters at the lower filter rate of 4 gpm/sf would have required the filters to be 39 percent larger than actually constructed at the 5.56 gpm/sf rate. The savings associated with construction of the smaller filters is estimated to be $1,000,000 to $2,000,000. The Company could have constructed larger filters (by using the lower filtration rate) but elected to reduce capital costs through appropriate engineering decisions.

Q. DO YOU HAVE ANY DOCUMENTATION INDICATING THAT DNR EXPECTS THE FILTERS TO BE OPERATED AT LOADING RATES HIGHER THAN 4 GPM/SQ.FT.?

A. Yes. By letter of January 23, 1998 from Breck E. Summerford, Chief of the permits Section of DNR, we received a copy of a document entitled "Report On Plans And Specifications For A New Water Treatment Plant" designated Review Number 11911-97 and bearing the signature of Rolando A. Bernabe, an Environmental Engineer in the Permit Section. This document is identified as Schedule JSY-22. The Report stated the following:

> "Six gravity dual media filter units with constant rate effluent control will be provided. Each filter unit, 30 feet wide by 25 feet long, will consist of two cells. At 30 mgd and with one filter unit

out of service, the rate of filtration will be 5.56 gpm per square feet..."

Q. ON PAGE 17, LINE 10, MR. MERCIEL STATES THAT " IT IS ACCEPTABLE PRACTICE TO RUN FILTERS AT A GREATER FLOW RATE THAN THE DESIGN PERIOD FOR SHORT PERIODS". IS THIS WHAT THE COMPANY IS RECOMMENDING ?

A. No, I do not agree that it is acceptable to design treatment plants such that filters are operated beyond their design and permitted rating in order to meet peak day demands. Rather, the appropriate approach is the one taken by the Company by rigorously analyzing water demands and initiating design, permitting, and construction of necessary facilities in a timely and economic manner.

While the Company could have "underbuilt" facilities, and then cited peak demands above the rated capacity of the facility as justification for an expansion, this is not an acceptable industry practice. First, the "under-building" approach is more likely to require operation of the treatment plant at rates higher than those approved by regulatory agencies. Second, the immediate construction of a facility expansion is inefficient since a complete cycle of planning, design, construction, and permitting must be implemented to add facilities to meet maximum day demands. This inefficiency ultimately results in higher costs.

Q. MR. MERCIEL IMPLIES THAT THE COMPANY DESIGNED ALL COMPONENTS OF THE WATER TREATMENT PLANT FOR A 30 MGD "FIRM" CAPACITY ? DID THE COMPANY USE THE "FIRM" CRITERIA OF THE LARGEST UNIT OUT OF SERVICE FOR ALL COMPONENTS ?

A. No. While the water treatment plant has a treatment capacity of 30 mgd, the Company did not design and construct all components to produce 30 mgd with the largest unit out

of service. The Company complied with MDNR requirements in filter design to produce 30 mgd with one filter out of service. However, the Company did not size the clarifiers with the "one unit out of service" criteria since MDNR did not require it, and the Company desired to avoid the additional capital costs associated with a fourth clarifier since it believes that it can operate the facilities reliably without a fourth clarifier.

With one clarifier out of service, the two remaining clarifiers have a treatment capacity of 22.8 mgd. This capacity is based on the MDNR limitation of 1.0 gpm/sf overflow rate, measured at the solids separation line. With average day system delivery demands of 16 to 17 mgd, excluding in-plant use, the Company believes that the 22.8 mgd capacity with two units in service will be adequate to service and maintain the clarifiers, and their internal equipment, during non-peak demand periods.

It would be ill advised to construct only two clarifiers as illustrated by the following example. If only two clarifiers were constructed as advocated by Mr. Merciel, then when one clarifier was taken out of service for service and maintenance, the treatment capacity of a single unit would be only 11.4 mgd. This capacity is approximately equal to the minimum day demand throughout the year. Operation with only a single clarifier is not feasible to meet even average day demands.

FEASIBILITY OF THE RECOMMENDATION FOR DELAYED CONSTRUCTION

Q. ON PAGE 18, BEGINNING WITH LINE 1, MR. MERCIEL LISTS FACILITIES THAT COULD HAVE BEEN SIZED FOR LESS THAN 30 MGD. DO YOU AGREE WITH HIS ANALYSIS?

A. Mr. Merciel appears to base his analysis on the adequacy of a 22-23 mgd maximum capacity. As I have previously explained, a plant capacity of 22-23 mgd is inadequate to reliably meet current demands or future demands. Based on current average day demands of 16 mgd, and the 1.6 maximum day to average day ratio previously determined, a

maximum day system delivery of 25.6 mgd for the year 2000 is determined. With consideration of in-plant uses, the minimum treatment plant capacity is 26.9 mgd for the year 2000.

Mr. Merciel makes the argument that additional facilities could have been constructed in the future to increase the plant capacity from an initial rating of 22-23 mgd. He argues that in addition to the horizontal collector well, only five vertical wells instead of seven are needed at present. Five vertical wells would not be adequate to meet average day demands when the collector well is out of service for maintenance or inspection. Five vertical wells have a maximum capacity of 18.0 mgd when the wells and pumps are new, but when the normal reduction in well output due to mutual interference, low water level, gradual clogging of the gravel pack and well screen, and wear on the pump is recognized, the combined delivery of five vertical wells could be reduced by twenty percent to approximately 14 mgd. When compared to average day demands of 16 mgd, excluding in-plant use, five vertical wells are inadequate to meet average day demands and perform normal maintenance and service on the horizontal collector well.

Items like distributive pumps can be readily added if space, electrical supply, and hydraulic capacity are anticipated correctly. However, the installation of additional filters, clarifiers, clearwells, and vertical wells to a more limited extent, requires a major construction project that involves significant time and expense for planning, design, permitting, and construction.

Q. WOULD MR. MERCIEL'S RECOMMENDATION HAVE BEEN ECONOMICAL IN THE FINAL ANALYSIS?

A. No. In the first instance, his premise is incorrect. The filters can and do operate at the 5.56 gpm/sf design value at this time, and meet the requirements of DNR for acceptance. More importantly, however, the theoretical possibility that the items named by Mr. Merciel could have been added at a later time is not economical. The amount of cost that

Mr. Merciel calculates that could have been avoided initially by deleting the named items may be realistic. However, it is not realistic to assume that this amount is an accurate representation of what it would cost to add the items at a later time. The combined costs of the initial construction activity together with the costs of an immediate expansion would result in increased costs. This is true due to a number of reasons as listed below.

- Economy of scale is reduced in a two step construction program. The ultimate number and size of process units is difficult to optimize in a multi-phase construction program.
- The cost benefit of building on a new site would be diminished. The contractor's cost for the expansion would have to include consideration that the initial facilities on-site are in service. There would be costs for protecting and working around the existing operating facilities during the construction. Excavation costs would be greater since opportunities for mass excavation would be limited. Shoring or other means of protecting existing facilities from adjacent excavation would be required. More supervision and coordination would be necessary in the expansion for tie-ins of new equipment to in-service facilities.
- Costs are increased due to the redundancy of mobilization/demobilization, engineering design supervision and other costs associated with a major construction project. Certain supervision, quality control, and project management costs are associated with the duration of the construction period. It is doubtful that the original construction period would have been reduced significantly, but the addition of major process units such as filters, clarifiers, clearwells, etc. in an expansion would have required an additional estimated 15 months of construction. Additional engineering, procurement costs, construction supervision, inspection, and material testing would have been necessary for the expansion. Field crews and equipment would have to be remobilized for nearly every craft, and much of the experience and efficiency gained in the initial construction period would be lost or have to be re-learned for the expansion. Finally, design and construction of an expansion to an existing facility is

a more difficult project than constructing those same facilities with the initial project, and the contractor's costs would reflect the increased risk.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes.

SCHEDULE JSY-21

COMPARISON OF ACTUAL 1999 DEMANDS TO PROJECTED DEMANDS

(All values are in millions of gallons per day)

St. Joseph

	Residential	Commercial	Industrial	Other	Non Rev	UAF	Avg Day
1999 Actual	4.894	2.743	3.682	2.571	0.729	1.429	16.047
1999 Projection	4.940	2.710	2.880	2.730	0.940	1.940	16.130
difference	-0.046	0.033	0.802	-0.159	-0.211	-0.511	-0.083

STATE OF MISSOURI

Mel Carnahan, Governor • Stephen M. Mahfood, Director

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

CI
St. Joseph, Mo
MO-American Water Co.
Review No. 11911-97
PWS ID # MO 1010714

January 23, 1998

Mr. Mark W. Griffin, P. E.
Engineering Manager
MO-American Water Company
1003 East St. Maartens Drive
P. O. Box 6276
St. Joseph, Missouri 64506-6276

Dear Mr. Griffin:

Enclosed is a Report on Plans and Specifications for a water treatment plant to serve St. Joseph, Missouri, which I believe is self-explanatory.

Please be advised, this facility may be required to obtain other permits from the Water Pollution Control Program. It is your responsibility to insure that any and all necessary permits for this facility have been obtained. You should apply directly to that program for any necessary permits.

I trust that consideration will be given to the comment contained in the report.

Sincerely,

PUBLIC DRINKING WATER PROGRAM

Breck E. Summerford, P.E., Chief
Permits Section

BES:rbe

Enclosure

c Kansas City Regional Office
American Water Works Service Co., Inc.

Schedule JSY-22

DEPARTMENT OF NATURAL RESOURCES OF MISSOURI

REPORT ON PLANS AND SPECIFICATIONS FOR A NEW WATER TREATMENT PLANT

Missouri-American Water Company
St. Joseph, Missouri
January 22, 1998

Review Number 11911-97

INTRODUCTION

Plans and specifications prepared by Gannett Fleming, Harrisburg, Pennsylvania, for a water treatment plant to serve St. Joseph, Missouri, were submitted for review and approval by Mr. Mark W. Griffin, P.E., Engineering Manager, Missouri-American Water Company, St. Joseph, Missouri.

BRIEF DESCRIPTION

In general, these plans and specifications provide for constructing a 30-mgd ground water treatment plant at the NE ¼, Section 29, T58N, R35W, Buchanan County, Missouri. This treatment plant will primarily reduce the iron and manganese from the raw water that will be coming from alluvial wells that will be developed along the northern bank of the Missouri River, near river mile 455.

Raw water will enter through the influent chamber of the treatment plant and overflows into a series of two mixing chambers that are equipped with mechanical mixers. Each mixing chamber will provide at least 30 seconds detention time and the mixers will rapidly disperse pretreatment chemicals into the incoming raw water. Effluent from the mixing chambers will flow into a flume and splits the flow into three recirculating type solids contact clarifiers. Each clarifier, 105 feet diameter by 22 feet side water depth, will provide a detention time of approximately 35 minutes in the flocculation zone and approximately 181 minutes in the clarification zone, producing a rise rate of 0.88 gpm per square feet at the separation zone. Each clarifier will be provided with a rotating sludge scraper. Clarified water will be collected through radial collector launders and transferred on top of the filters. An in-line static mixer will be provided in the filter effluent line to disperse filter aid additives in the water. The sludge blowdown from the clarifiers drains into two equalization basins that are equipped with mechanical mixers for controlled discharge into the city's sewer system.

Six gravity dual media filter units with constant rate effluent control will be provided. Each filter unit, 30 feet wide by 25 feet long, will consist of two cells. At 30 mgd and with one filter unit out of service, the rate of filtration will be 5.56 gpm per square feet. Each filter will be provided with a tile underdrain and air distribution system, media support bed, and a dual filter media. The support bed will consist of 12 inches of layers of different grades of gravel to be placed on top of the underdrains to support the filter media. The dual filter media will consist of 12 inches of silica sand and 18 inches of anthracite. An alternative design for the filters will include a nozzle and strainer type underdrain system supporting a dual filter media. The underdrain will consist of a false bottom floor constructed of reinforced concrete support piers that will be equipped with self-locking nozzle stems and domes provide uniform pressure and flow during filtering and the capability for simultaneous air/water backwashing. The filter media will consist of 16 inches of filter sand and 18 inches of anthracite.

Filtered water will be discharged into a concrete two-cell clearwell. Each cell, 118 feet wide by 112 feet long by 17.5 feet deep, having a capacity of approximately 750,000 gallons, can be independently operated. The clearwell will provide the required disinfection contact detention storage. A high service pumping station, consisting of two wet wells and four vertical turbine pumps, with a provision for a fifth pump in the future, will be constructed adjacent to the clearwell. Pumps #1 & #3 will each have a capacity range of 5,5600 gpm to 3,000 gpm at a total dynamic head range of 90 feet to 116 feet respectively. Pumps #2 & #4 will each have a capacity range of 9,730 gpm to 7,000 gpm at a total dynamic head of 90 feet to 98 feet respectively.

The filter backwash wastewater will be transferred and processed into two wastewater clarifiers. Effluent from these filter backwash wastewater clarifiers will be blended with the incoming raw water at the head of the water treatment plant at a rate not to exceed ten percent of the incoming raw water flow. The sludge blowdown from the filter backwash clarifiers will be discharged into the sludge equalization basin.

Different chemicals will be added to the water at different stages of the treatment process. These chemicals include potassium permanganate, chlorine, powdered activated carbon, hydrated lime, polymer, filter aid and caustic soda. Chemical storage, feed equipment, safety gadgets and the necessary accessories for feeding the different chemicals will be provided as per detailed plans and specifications.

Instrumentation and controls that may provide the capability for automation and remote operation of the treatment plant are incorporated in the design. Unattended operation of the water treatment plant in the future may be considered after a report covering the results and experiences on a one-year demonstration period is reviewed in this office. The report must prove with confidence the reliability of the equipment, monitors, and surveillance system.

COMMENTS

1. Obtain the necessary permits for the sludge equalization basins, filter backwash wastewater clarifiers and other wastewater facilities from the Water Pollution Control Program of this department prior to initiating construction.

2. The filter sand media shall have an effective size of 0.45 mm. to 0.55 mm. having a uniformity coefficient not to exceed 1.7.

3. No support gravel bed was specified for the filter design with nozzle and strainer type of underdrain system. Based on our field experiences, there appears to be plugging of the nozzles when a filter media support bed is not provided. We recommend that at least a layer of torpedo sand having an effective size of 0.8 mm. to 2.0 mm. and a uniformity coefficient not to exceed 1.7 be provided to support the filter media. The torpedo sand shall extend at least 3 inches above the top of the nozzles.

4. The size of the filters is being approved initially as a demonstration until sufficient information is collected to support adequacy of the filters' performance at a filter rate higher than 4 gpm per square feet.

Rolando A. Bernabe
Environmental Engineer
Permit Section

APPROVAL TO CONSTRUCT

The engineering plans and specifications described above were examined as to sanitary features of design which may affect the operation of the sanitary works, including size, capacities of the units, and factors which may affect the efficiency and ease of operation. Approval as regards these points is hereby given.

Approval is given with the understanding that final inspection and approval of the completed works hall be made by the Department of Natural Resources before same is accepted and placed in operation. If construction is not commenced two(2) years after the date of issue or there is a halt in construction of more than two years, the approval to construct will be void unless an extension of time has been granted by the department.

In the examination of plans and specifications, the Department of Natural Resources, Public Drinking Water Program does not examine the structural features of design or efficiency of mechanical equipment. This approval does not include approval of these features.

The Department of Natural Resources, Public Drinking Water Program reserves the right to withdraw the approval of plans and specifications at any time it is found that additional treatment or alterations are necessary to assure reasonable operating efficiency and to afford adequate protection to public health.

1.17