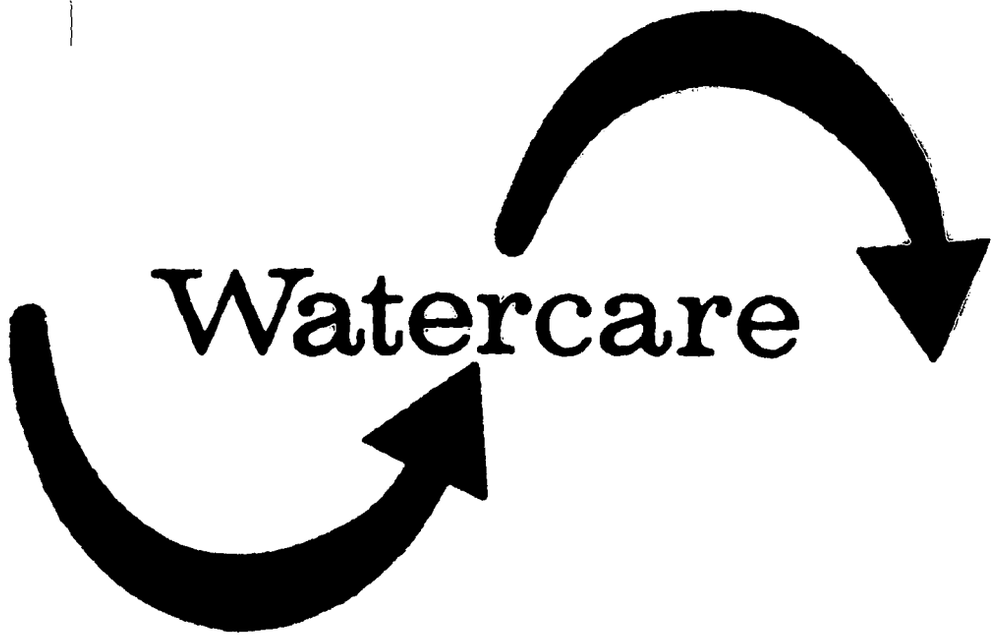
E. H. A. Hoffes

PROCEEDINGS

FOURTH ANNUAL CONFERENCE
CALIFORNIA ASSOCIATION OF RECLAMATION
ENTITIES OF WATER



Theme: Water Conservation and Reuse in the Drought

Host: CONTRA COSTA COUNTY WATER DIST[illegible]
Concord, California 26-28 June, 77

PROCEEDINGS

Fourth Annual Conference
California Association of Reclamation Entities of Water

Theme:
WATER CONSERVATION AND REUSE IN THE DROUGHT

Local Host
Contra Costa County Water District

Sheraton Inn
Concord, California

June 26-28, 1977

Conference Committee

William E. Warne, Chairman
John E. DeVito
John S. Gregg

Purpose of WATERCARE

WATERCARE was incorporated in 1974 as a nonprofit corporation to sponsor and conduct research into water reclamation and reuse, and to promote the extension and improvement of public water supplies through employment of new water sciences.

Directors of WATERCARE

Lloyd C. Fowler, President, WATERCARE
Santa Clara Valley Water District

H. W. (Will) Stokes, Vice President, WATERCARE
Las Virgenes Municipal Water District

Neil M. Cline, Secretary, WATERCARE
Orange County Water District

George W. Adrian
Department of Water & Power
City of Los Angeles

Howard Bensen
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North Marin County Water District

Linda K. Phillips
Goleta County Water District

Polly O. Smith
Marin Municipal Water District

Stanley E. Sprague
Municipal Water District of Orange County

William E. Warne
Associate Director of WATERCARE
Water Resources Development Consultant
Sacramento

Violet V. Enander
Treasurer, WATERCARE

How to Join WATERCARE

Individuals may join WATERCARE as Associate Members. Current Associate dues are $15/year. Public Agencies may join WATERCARE as Participating Members. Current Participating dues are $500/year.

For Further Information Write:

WATERCARE
5750 Almaden Expressway
San Jose, California 95118

CONTENTS

WELCOME

by

Craig Z. Randall
President
Contra Costa County Water District

WELCOME
by
Craig Z. Randall, President
Contra Costa County Water District

Welcome from the Board of Directors of the Contra Costa County Water District. We see old friends and old faces in the crowd and it is kind of reassuring to know that there are still people interested in water.

Just to brag about our weather a little. It's my understanding that on your way over this morning you were using your windshield wipers in San Francisco and Oakland while, you will notice, we turned on good weather for you out here in Contra Costa County and you might not realize this but it is a common occurrence for us to have this beautiful weather while the Bay Area is fogged or rained in. That's one reason why we believe that one day Concord will be discovered.

John DeVito mentioned the wisdom our Board used in selling surplus lands to finance this board room which we regularly share with the public and other agencies. What he left out of that self-effacing story is the fact that we capped up and sold two operating well fields to acquire the funds to build this building with. We have often been reminded, since the drought, that maybe that wasn't as good a decision as we thought at the time. We are now, however, going to rectify that because we are back drilling wells. We, consistent with the Cathy Fiscus tragedy, plugged and capped all the wells we deactivated so we must now start anew and we believe that in the long run, considering the efficiency of the new wells the public came out ahead. It is the day after Sunday and I thought

we should confess. I have not been involved in water as long as many of you, but as a lay participant some 18 to 20 years ago, I read a book that contended any community is a good community that has three things. Recreation, transportation and water. In my younger salad days I realized that the water system in the community was intolerable and I then decided that water was going to be my avocation. A number of us met with Bill Seeger, Manager in Marin County Water District at that time and asked him how to run a water district. I guess 18 years ago he doesn't remember that but I do and he was very helpful and we have been working hard on his advice ever since. What I have found out about water, now that the drought is with us, is that everyone is interested in water when it's in short supply.

It reminds me of a joke, a true joke. I have two secretaries. One of them has a rather precocious 12-year-old boy who spends a great deal of time reading ethnic joke books. He has a whole stack of these books, Italian jokes, and all the others. He came into the office one day and to get the attention of my other secretary he coughed and asked her if she would like to hear a good joke? She said "Yes", what is it? He broke out his Polish joke book and turned to Page 433 and he read her a very mediocre ethnic joke. She gave him a nasty little smile and said - you know, I'm Polish.

He looked at her and said "That's all right, I'll read it one more time and more slowly." She wouldn't appreciate it if she knew I was telling this incident to you but that's kind of the way it's been with water. You have to read it slowly and one more time. Really, because half the people were asleep when we were talking about water when there weren't any apparent problems. In our area, that is no longer true. People are acutely aware of water problems. Your theme for this conference, "Water Conservation And Reuse In The Drought", is particularly timely and we thank you and our board and staff thank you for selecting our area for this conference. Northern California has been naturally recycling and reusing their waste water for many, many years. As you know our intake is located in the Delta just east of Antioch, and whatever is flushed from Redding to Bakersfield is recycled and used by our customers here in the Contra Costa County Water District for their domestic supply. We are the final water aperture for the State of California and we have been coping with that problem for many years. One way we chose to deal with it was to build the Ralph Bohlman Treatment Plant, which is a noted high-efficiency water treatment facility. It is rated at 10 gallons per minute per square foot of filter surface area and it produces a quality of water that is lower in turbidity than the water that is obtained directly from the mountains and served to EBMUD's

customers. This is one way we practice overall recycling and reuse of diluted sewage water in Northern California. We have found that this improved treatment method has worked well, with one exception. We can't cope with salt. When the ocean moves into the Delta and mixes with our intake water, we experience increased chloride. This results in a considerable problem as you might guess. Our industries have found that it is almost intolerable to their manufacturing process and they employ some 14 thousand people. Our customers imagine they taste a lot more salt than is actually present in the supply. If a neighboring supplier announces an increase in salt content our phones start to ring and everyone tells us how they can taste the increased salt and even though there is no relationship between the two water supplies, we have had public relation problems with this phenomenon.

In addition to the increased salt water content we have had to cope with a 30% reduction in our water supply. That is substantially short of our municipal, industrial and agricultural needs. Our General Manager, John DeVito, conceived a plan some eight years ago contemplating the reclamation and reuse of waste water. The plant that is the culmination of those plans was developed in conjunction with the Central Contra Costa County Sanitary District and we are going to be tooled up within the next four or five months to reclaim some 15 million gallons a day of sewage water and convert it to industrial use with a potential to go to 30 MGD.

This has not been an easy task. One of the worst barriers that we have had to overcome was industry. Some industry spokesmen said they did not want to run first, but rather they wanted to run second to be sure there wasn't a big pitfall at the finish line. They didn't care to be first with the largest reclaimation and reuse water program in the world because of the many contengencies and to overcome that our board had to advise them that they had only three choices. They could either use reclaimed water, move their plant, or figure out how they could operate without water. We told them they could either cooperate and help us develop water that would meet their needs or they could stay out and pout and tell the world how oppressive we are, in which case the district would determine the industrial requirements without their input. Fortunately, for everyone concerned, industry decided to participate even though they didn't like it, and accused us of engaging in a monopolistic practice. Since the drought the reclaimed/reuse program has become much more acceptable. Industrial grimaces have turned to smiles. I think of all the things that can be said about the program that might be helpful to you is that the institutional arrangement and the selling of the product to the people that can best use it are the biggest problems. Engineers and experts in the field supply the technology to provide a suitable product but putting that together in a package that is viable for those

who can and must use it is touchy.

After eight or nine years of planning and construction, it would have been nice to be on line with our program in time to help with the drought, but we were one year late. However, we will be on line, hopefully, around mid-1978 and should be a tremendous asset to the constituents of the Contra Costa County Water District and its customers. We hope that what you see and hear in this next two or three days will be of help to you because as I read Ron Robie and other enlightened water people throughout the state we are going to experience a change in the water reuse practices in the State of California and indeed in the whole Western United States whether we like it or not. I know many people don't like it, but there will be reclaimed projects mandated in spite of opposition and lack of vision of those involved. Industry will use reclaimed water. Water districts will be forced to go to more efficient use of their water which will mean the use of reclaimed water sources to supplement their fixed supplies. The world of water producers and users might as well give us the benefit of their technology, ability and cooperation so that everybody "gets the best bang for the buck." With those words, let me once again welcome you to Contra Costa County Water District and the Central portion of Contra Costa County, and hope your visit is a fruitful and pleasant one. Thank you.

WHAT NEXT WATERCARE?

Address by

Lloyd C. Fowler
President, WATERCARE

Chief Engineer
Santa Clara Valley Water District

WHAT NEXT WATERCARE?

On behalf of WATERCARE I thank you, Mr. Randall, for the assistance from your District and staff in setting up this Conference and for the opportunity to meet here at your headquarters. Because of your cooperation and the efforts your District has put forth, I know we will have a successful Conference.

WATERCARE is now 3½ years old and this is the Fourth Annual Conference put on by WATERCARE. It is appropriate that we look briefly at the past, present, and future of WATERCARE.

The question has been asked as to why WATERCARE was formed. We are familiar with the need to look for alternative water supplies and the question as to whether or not water reuse and water conservation could play a significant part as an alternative water supply. We knew there were some existing water reuse programs, but we also knew of numerous reuse projects and conservation projects that, for strange reasons, were not considered as alternatives. The critics of water reuse programs and water conservation programs were most vocal. There was no way we could be assured that water reuse and water conservation alternatives would be considered acceptable parts of water supply programs.

It was in the effort to answer critics that many uncoordinated and ineffective programs were started, using organizations existing at the time. Attempts to work through existing organizations, to change or redirect their policies, where needed, were really hopeless. Established management policy consistently

appeared to be against water reuse and, surprisingly enough, against changing water use patterns. That is, saving water was not really an acceptable process. Attempts to change these management policies just didn't work. The alternative was to form a new organization. One that would be able to create its own policies, that could support its own ideas, and that could advocate water reuse and conservation without fear of running afoul of old negative policies and directorships that would say no.

As a result of putting forth these ideals, a new organization, WATERCARE, the California Association of Reclamation Entities of Water, was formed by a group of California water agencies in 1973. It became a nonprofit California corporation in April 1974. Significant in the bylaws are the objectives of this Association: "The objectives of this corporation shall be to improve and extend the uses of community water supplies; to conserve and render safe and wholesome waters of this State of California; to test and prove the efficacy, or lack thereof, of water reclamation and reuse; to test methods of application of the advanced water sciences to the improvement of community water supplies; and to increase public understanding of all associated water problems and their solutions."

There is a lot in these objectives. Is WATERCARE achieving these objectives? It is not easy to measure achievement in such complex areas, but let's look at what has been accomplished.

To help reach our goal a number of standing committees were formed. Their activities form the bases of WATERCARE programs. The Membership Committee, which is composed of all the members of the organization, has aided the growth of the

Association from the original five member agencies to the present 20 member agencies. A member agency is a California organization that, through a joint powers agreement, can further our objectives of water reuse and water conservation. We also have associate members. Anyone who has an interest in our activities can be an associate member. We now have over 100 associate members.

The Publicity Committee is under the leadership of Neil Cline of the Orange County Water District. A series of newsletters have been produced that while providing some publicity for WATERCARE are more significant in helping our members to improve coordination, initiate correspondence, and integrate their activities in our field of interest. Several brochures have been produced that outline the Association's interest and attract new members. I think the Publicity Committee can count a number of achievements.

The Legislative Committee is chaired by Linda Phillips of the Goleta County Water District. The legislative arena is one not easy to work in; there is so much going on at certain times of the year in both the State and Federal arenas that is of interest to WATERCARE. To help, we have an understanding with the Association of California Water Agencies, the major water agencies' legislative advocate, to have them do the lobbying where our positions agree. Unfortunately, ACWA may not always espouse the same position as WATERCARE. Our Legislative Committee tries to get ACWA to take positions that are in the interest of WATERCARE on legislation that affects water reuse and water conservation. When we are not successful, we are free

to carry on our own activities as appropriate. The Legislative Committee has been very active in furthering the interests of WATERCARE.

Another very important Committee is Program Evaluation, which is under the leadership of Howard Bensen of the City of Santa Barbara. WATERCARE endorses projects that further our objectives of water reuse and water conservation. The Program Evaluation Committee reviews projects, recommends on cooperation between projects, assures coordination, and assists in recommending funding. The progress of endorsed projects is aided because of the review process that insures coordination and cooperation and the reduction of duplication of effort. So far, there have been five endorsed projects which are moving forward and three research activities. It is difficult to get adequate funding for research activities, but the endorsement of WATERCARE has aided in obtaining funding for projects.

John Nelson of the North Marin County Water District chairs the Ways and Means Committee. This Committee is attempting to help provide funding for the various projects and research activities endorsed by WATERCARE. The latest one that the Committee has been of assistance on is the Orange County Organic and Virus Monitoring Program. This program is largely funded by EPA and the Orange County Water District; however, our Ways and Means Committee has been of assistance in obtaining support from other California agencies in furtherance of this project. The Committee is currently looking at the possibility of restructuring the membership of WATERCARE and

changing the dues structure in an attempt to make more funds available to projects.

Our last Committee is Regulatory Agency Review chaired by George Adrian of the Los Angeles Department of Water and Power. It reviews and comments on the local, state, and federal regulatory efforts that affect our objectives of water reuse and water conservation. Items being looked at include the EPA's Federal Water Quality Standards, the State Water Resources Control Board Policy and Action Plan for Water Reuse in California, the State Department of Health's Regulations on Recharge of Groundwater Basins with Reclaimed Water, and EPA Injection Regulations. All of these will have very significant effects on the activities of member agencies of WATERCARE.

It takes a lot of effort to keep these Committee activities moving. The Committee members are the real heart of the organization. Those of you who have not had an opportunity to express your interest in and to involve yourself in Committee activities are encouraged to do so.

WATERCARE endorsement means that a project proposal is reviewed as to its need, that duplication of other activities has been considered, and that they are reduced to a minimum; that cooperation between various projects has been encouraged and, in fact, takes place; and that effective use of funds is being made. WATERCARE endorsement extends to prototype activities, full-size projects; to demonstration projects, ones that illustrate various activities in furtherance of our objectives; to research, to help reach our goals; and to plans

and policies that support our policies. There is a need, a real need, for all of these things. We can build, today, prototype projects and put reclaimed water to use; we can involve ourselves with demonstration projects where there is need for additional information, where there is an opportunity to answer some criticisms. We can also undertake research since there is a need for further understanding of the details of water reuse and water conservation, the part these activities are to play in our water supply systems. Research is essential if we are to answer some of the critics that block the way at the present time. And there is always a need for principles and policies to guide our activities and to guide the activities of other agencies in furtherance of our objectives.

Perhaps the most significant principle that has been adopted by WATERCARE is the Policy Statement Regarding Water Quality. This is as follows: "WATERCARE emphasizes the need to protect all communities through the development and application of adequate water quality standards to water supplies. WATERCARE believes there are no pristine waters since stable organics and trace elements that may have an adverse effect on human life are found in rainwaters, lakes, streams, rivers, and groundwaters. WATERCARE believes that community wastewaters find their way into most of the water supplies of the world, thus requiring water quality standards that adequately consider this contribution. Therefore, WATERCARE believes in and encourages the adoption of water quality standards that protect the public health and endorses the concept of uniform standards

applicable to water supplies according to use regardless of the source of the water." This policy means safety to our water supplies. There are those who doubt the value of this policy; we challenge them to prove that there indeed is safety in water supplies without following this policy. There are those who question if we have the ability to establish adequate standards on water quality. That in itself is a condemnation of our current water quality standards. We respond by saying we do have the ability in that we now use water supplies, we survive with these water supplies, and therefore we can use these water supplies as the criteria; if we can't, then there isn't such a thing as an acceptable water supply. If we start with the quality of the water supplies available to us that we are using, and with which we are surviving, as the base-line quality, we can improve them as research goes forward. If sometime in the future these supplies are demonstrated unsafe, then the criteria are changed. We correct the quality criteria deficiency. That's what WATERCARE's current Policy Statement Regarding Water Quality Criteria means.

In WATERCARE's brief life, we have seen the development of the State Water Resources Control Board's Policy and Action Plan for Water Reuse in California. This has been a major step forward by the State. It has been adopted and is currently being implemented. It has resulted in a change in the grant program available to sewage disposal to aid water reuse projects.

An important aspect of any reuse project is the

distribution system. The existing water distribution systems that could transmit reclaimed water cannot be used because reclaimed water is not acceptable in a domestic water supply system. Therefore a dual or second system has to be created to distribute reclaimed water. This is expensive and, in many cases, it is the factor that stops the reuse project. Under the new policy of the State Board, the grant program has been changed to make the distribution system grant eligible. This is a tremendous step forward in helping to further water reuse. We will eventually demonstrate that wastewaters can be reclaimed and made suitable for domestic purposes. But until that time we are going to have to use a dual distribution system.

The other major aspect of the State Board's policy is the encouragement of the consideration of water reuse as an alternative water supply. There are several ways that this is to be done, all of which present various difficulties and all involve some changes in either the past water management approaches or the current water law. In the water rights area, the proposal is to require that before you obtain a water right, you must consider water reuse as a possibility. After you have a water right, and you want to reuse water, you can without taking the chance of losing your previously acquired rights to water that is not put to use because you use reclaimed water. Another point is the review of water supply contracts; consideration must be given to water reuse as an alternative to the formulation of new water supply contracts.

Obviously there are a lot of activities going on in water reuse and water conservation. But it is difficult to keep up with these activities. WATERCARE aided the Research Foundation of the American Water Works Association in establishing a program of reporting activities on water reuse. This program was originated by the AWWA Research Foundation and had a recommended budget of $50,000 in its first year. An attempt was made to obtain $5,000 from 10 member agencies. The idea would be that each of those agencies would receive information on what was going on in water reuse, this would help them coordinate their activities, and they would have a channel of communication open to the entire United States. In spite of the great number of agencies that are interested and involved in water reuse throughout the nation, it was not possible to obtain 10 member agencies. WATERCARE entered into this program as two member agencies, and with six others the AWWA Research Foundation proceeded with this program. The results of this program have been fabulous. It reviews worldwide activities on water reuse and presents the results in concise reports. The reports are circulated to the member agencies of WATERCARE. The comments received are all favorable. There is a tremendous amount of activity going on. After a rough start the program now has 14 cooperative members, including some international ones. This AWWA Research Foundation activity has now become so significant that the federal government is considering picking up a major portion of the cost of this project and make the reports available to anyone who wishes to apply for a subscription. WATERCARE is interested in seeing that this program continues and will welcome any contributions from the federal

agencies as long as they maintain its independence in reporting. The value of WATERCARE's participation in this program is obvious. A real credit for the program's success must go to the Project Director, Richard D. Heaton. He has done a magnificent job.

The State Department of Health has been developing regulations on recharge of groundwater basins with reclaimed water. This started well over a year ago. A number of agencies suggested that perhaps regulations were unnecessary. Others said regulations are essential. If we are going to plan for future reuse, it appears that the greatest potential for reuse of water is recharging groundwater basins; therefore, we must have a policy as guidance for planning. The Health Department review on a project-by-project basis was not acceptable because of the ever present potential for turndown. Therefore, regulations were desirable, and as a matter of fact they are mandated by the State Legislature. So the Department of Health continues to develop proposed regulations. WATERCARE, along with many other agencies, has participated in their development. At present there is concern over whether or not the regulations will be completed. There are some medical practitioners who question whether water reuse is a viable subject; they muse that as long as there is any other water supply why should anybody want to reuse water. And it is difficult to answer the questions that are continually raised by some of these medical practitioners. Many of their questions are vague; they are expressed as general concerns without any kind of detailed data or support, but nevertheless they are expressed. They are listened to and the questions need to be

answered. One of the ways WATERCARE may help answer those questions is by seeing that the Sanitary Engineering Section within the State Department of Health is adequately staffed and that they are properly funded so that they can have an opportunity to answer some of the questions. Frankly, I believe the State Department of Health will support water reuse; they will provide the guidance and the policies that are appropriate in this area, if they are given the opportunity. If we believe that water reuse is a really viable source of water supply for the future, then it seems the encumbrance is upon WATERCARE to help the State Health Department remove whatever doubts or concerns they may have about water reuse.

That's the past, the present, and now the future.

Is there indeed a need to continue WATERCARE? Is it possible that other agencies or other organizations could take over the function of WATERCARE and achieve the goals WATERCARE has before it? I have seen several water organizations establish water reuse committees in recent years after WATERCARE was formed. To me they appear to be self-defense mechanisms. They are there more to support the established policy of those organizations (that water reuse constitutes a hazard to the water supply) than to give support to water reuse. I would challenge those committees and those organizations to change the thinking of the directors of their organizations. If those committees are indeed not self-defense mechanisms, then let's see those communities have an effective part in changing the direction of those organizations.

Perhaps we will see that happen, but it has not yet occurred. Therefore, it is not yet possible to give up the job that we have set forth. WATERCARE is needed; there still is a job to do.

Water reuse and water savings are still not fully qualified parts of water supply programs in the eyes of many. If we are to change that, WATERCARE needs to renew itself, to come forward with a stronger approach in many arenas in which we have been working. As an example we can adopt a more "advocate" position, we can become stronger at seeing that proper policies are adopted, that appropriate legislation is forthcoming--all to further the cause of water reuse and water conservation. In this drought year there have been more bills introduced into the Legislature on water reuse and water conservation than in the previous history of the State. It seems that it's a popular thing at this time. We cannot afford to accept what is popular today and is unheard of tomorrow. It is necessary to keep this popularity in the forefront. It is necessary for us to see that proper policies are indeed established by all state agencies and that the State Legislature gives proper direction and regard for the further reuse and conservation of water.

WATERCARE can do more by being positive. Positive in its actions of support of others. Establish positive coordination and communication between various groups. The AWWA Research Foundation water reuse reporting activity is an outstanding example of positive support by WATERCARE. But now how can we

get that information around to everyone who needs it? A positive action would be to see that this kind of activity is fully funded by the federal government and made available through subscription service to anybody who wants it. By doing more in support of others I think that we will find our objectives achieved quicker.

WATERCARE project endorsements need to carry with them a greater recognition of the fact that they have been through intensive reviews. We need to assure that endorsement means coordination has taken place, that proper communication between agencies is established, that there is a limit on duplication. We also need to point out that some duplication is not at all bad. In many cases we need more duplication in order to establish fully the answers to the questions that face us about water reuse.

WATERCARE must be more active in research. WATERCARE ought to expand its research budget. Our Ways and Means Committee is looking at possibilities of changing the membership dues and structure to obtain additional funds so that research can be directly supported by WATERCARE itself. WATERCARE has in the past and must continue in the future to receive and expend grant funds, to receive and expend subscription funds from member agencies for the conduct of research activities. Why doesn't WATERCARE press its member agencies to establish research budgets in their own organizations? When you look at the members of WATERCARE you see all sizes and all kinds of water districts (the word "water" includes sewage agencies and

districts), and water management agencies. Nevertheless, they all could allocate a small percentage of their budget to a research fund. This research budget could be very modest in comparison to the total budget of these agencies and still in the aggregate amount to a considerable sum.

These research budgets could be given to or placed through WATERCARE and assigned to worthy high-priority research projects. The determination of what is a worthy and high-priority research project needn't create a problem. There have been numerous conferences and meetings titled "The Needs for Research in Water Reuse". They have established priority and direction for research projects, but they have been relatively ineffective in seeing that their recommendations are carried out. WATERCARE can build on these conferences. The priorities are there; the projects are there. WATERCARE needs to see that the dollars are made available to these research projects.

Every Member Agency Representative ought to attempt to establish a research budget within his organization. And these funds should be made available through WATERCARE for water reuse and water conservation research.

The Associate Membership of WATERCARE is relatively large and can play an extremely important role in seeing that the positions of WATERCARE are made stronger. Through their active lobby, through their direct support of WATERCARE, and by meeting with the member agencies they can get such a thing as a research budget established. The Associate Members can help advocate positions before the Legislature to improve the

opportunities of water reuse and water conservation; they can also help regulatory agencies develop and adopt policies that further the goals of WATERCARE. Associate Members can also take more positive approaches by supporting endorsed projects by supporting one another. Associate Members do and are encouraged to expand their communication and coordination throughout the State of California.

One of these days WATERCARE will have to face the fact that it is either going to expand its activities or it is going to have to get out of the way for something else that is coming along. As a priority item, WATERCARE must expand its adopted positions to include advocacy of positive support of research by financing research activities or someone else is going to do it and WATERCARE will just fade out of existence. I believe we should accept this challenge and see what research program we can adopt immediately.

Stronger approaches, positive actions, and a larger research budget. That's what's next WATERCARE!

I would like to comment just briefly on yesterday's business meeting. John Nelson of the North Marin County Water District, Stanley Sprague of the Municipal Water District of Orange County, and Neil Cline of the Orange County Water District were elected as Directors of WATERCARE for the three-year term 1977-1980. Also elected was an Associate Member Director, Bill Seeger, who is with Kennedy Engineers at the present time. Alternate Associate Member Directors are Joan Kerns from the Montecito area, and Don Finlayson who is with

the State Department of Water Resources. We have been privileged since the founding of WATERCARE to have the support of William E. Warne in the position of Associate Director. Bill Warne probably did more to keep WATERCARE expanding and on an ever improving scale than anyone else. Through Bill, the Associate Members have really played an important part in WATERCARE. Bill is a very active consultant and his activities are such that he can no longer afford to spend the time it takes to be at every WATERCARE meeting and to do the expected work that goes on in between times. So Bill was not available for reelection; otherwise I am certain the Associates would have chosen him once again. We are indeed fortunate that others such as Bill Seeger, Joan Kerns, and Don Finlayson are willing to put in the effort necessary to keep the Associates' position in WATERCARE strong.

For 1977-78 WATERCARE has a budget that contains a modest $10,000 for research activities. The top priority in that budget is to assure that the AWWA Research Foundation reporting activity continues. The next is to aid in the program of organics and virus monitoring at the Orange County Water District, and then such other research projects as the Board of Directors desires. That is not much money; it doesn't go very far. That budget needs to be expanded and the suggestion about research funds from Member Agencies is one way to help expand this program.

WATERCARE has a lot of activities before it, and today we have an extensive conference program. Let's get on with that.

THE KERN COUNTY WATER AGENCY EXPERIENCE

by

Stuart T. Pyle
Engineer-Manager

The Kern County Water Agency Experience
by Stuart T. Pyle, Engineer-Manager

I am with the Kern County Water Agency, which embraces all of the Kern County. Our particular interest is in the San Joaquin Valley. The major urban area there is the city of Bakersfield. Kern County Water Agency was formed in the early 1960's, primarily as a contractor for State Project water. We have a contract with the State Department of Water Resources for 1,153,000 acre-feet of water for both municipal and industrial water, as well as for agricultural water. Out of that total, 140,000 is our ultimate entitlement for M&I, and the remainder is for agriculture. Although I do want to talk primarily about the agricultural aspects, we are quite proud of our M&I activities; and I want to leave a supply of brochures that we have just had printed.

The Kern County Water Agency, acting for what we call Improvement District No. 4 which covers the whole city of Bakersfield and surrounding area of about 170,000 people, has just completed a water purification plant to treat and deliver State Project water to the city of Bakersfield. The brochure is prepared primarily to hand to the people on tours of the plant so we can put something in their hands for our operators to talk about as they go through. The inside page tells how we make good water better. It explains the process; it explains where the water comes from. A blowup shows the State Project, the Kern County area, and the Improvement District No. 4. It also explains the filtration program. I will leave these here, and I think they will be very valuable to us in

making our water story known to the public and making them more conscious of what the water situation is.

As a sidelight about the effect of this water treatment plant to supply a substitute source to the city of Bakersfield in place of the groundwater that they have been pumping over the years, we just ran a special drought water level survey for the Department of Water Resources and received a phone call asking that we go out and check a couple of wells which are located in the Bakersfield area because the water tables were rising in this drought year. Well, that was the effect of stopping pumping in some of those areas of Bakersfield to take the surface supply so the groundwater is now filling the hole. We think that is an indication that our program worked both to serve treated water and to eventually to begin a combination of surface water delivery and groundwater recharge.

Not to use too much time on my commercials and to get to John DeVito's questions--he put a kind of cute little question in here. He asked: Is Delta water delivered to highly subsidized Federal contractors in Kern County being used conservedly? Gee, John, you know it is. One of the big problems we have is everybody generalizes about everything, and everything is so complex that you just can't generalize.

What kind of water delivery makeup do we have in Kern County? We have about 950,000 acres of irrigated land there and a lot of it was developed originally on local, Kern River, sources and groundwater sources. Then the Central Valley Project came in with the Friant-Kern Canal and then the State came in with the State Water Project. So how does this break

down if we took 950,000 acres of irrigated land in Kern County? About 200,000 acres is served by the Federal Central Valley Project and about 600,000 acres is served by the State Project. Now in both those areas the supply is supplemental in that there are many areas which have groundwater or local sources. Then included in the 950,000 acres there is about 150,000 acres served only by a local source; that is the Kern River or groundwater. Nevertheless, groundwater is the major source of supply to the area. So it is a very complex system. If you try to isolate who has gotten Federal water and who has gotten State and who has a high subsidy, you are going to find out that these situations are mixed. Perhaps 25 percent of the area receives Federal CVP water out of the Friant-Kern system and they have some price breaks (and people don't really hold that against them down there. They think, wow, those guys got it when it was easy to get.) So John asks: Is Delta water delivered to highly subsidized contractors? Well, how many Federal contractors are getting Delta water? Delta water goes to the State Project users. There is 600,000 acres of land in 14 districts that we in the Kern County Water Agency supply water to. The Delta water in the State Project does not go to the Federal contractors. But on the other hand, there is a group of enterprising federal contractors in both Kern and Tulare Counties that have contracts for about 128,000 acre-feet annually of Federal CVP water, which is wheeled to them through the State Aqueduct and the Cross Valley Canal through an exchange arrangement which is too complicated to tell about here. So there are a small number of farms getting CVP water from the

Delta. But not a whole lot. You know, we just wonder how we get into these misconceptions.

How much water are we using in the 1977 drought year compared to the normal supplies? I think that is an interesting thing to look at. There are four sources of water in Kern County; we have the Kern River as local supply; we have the State Water Project, the Central Valley Project, and groundwater. We took 1975 as a normal year, which is a pretty good measure. The Kern River had a supply of about 400,000 acre-feet; the State Project delivered 880,000 acre-feet, CVP delivered 454,000, and we pumped from groundwater 1.8 million acre-feet, which balances against consumptive use of about 3.5 million. This is water use for agriculture. One time I had the chance to chat with somebody from Marin County and we started talking about these numbers. You know 3½ million acre-feet of water, and you know if they are talking about 35,000 acre-feet they are talking big numbers. It's hard to get the concept of how much water we are really talking about when you talk about agriculture. On 950,000 acres of land the total consumptive use is about 3½ million acre-feet of water. Well, next you go to last year (1976); we had a moderate drought and our supplies were curtailed. The Kern River delivered about 230,000 acre-feet. Down maybe 40,000. The State Project had about 870,000 acre-feet. Even there we were down 15 percent of what we originally planned. Central Valley Project delivered 220,000 acre-feet, and our estimates of groundwater use showed that it jumped up to 2.4 million. There was about

600,000 acre-feet more groundwater pumped in that year because of the increased drilling and increased use of wells that are already in operation. Now, our estimates for this year are that the Kern River will deliver about 150,000 acre-feet, the State Project is going to deliver 392,000 acre-feet, and the Central Valley Project is going to deliver 33,000 acre-feet only. Our estimate is that the groundwater will increase to about 3.1 million acre-feet. That is up another 600,000 from the year before.

The well drillers are going all out, the pumps are running all out, and we are still going to be up to about 3.6 million acre-feet of consumptive use. Even so, we estimate that the planted acreage will be off about 10 percent. We know they are making surveys, that there is about 110,000 acres that will not be planted.

Why should the consumptive use be so much higher on an amount of land that is perhaps only 90 percent of what we had before? The reason is the lack of rainfall; that is, there is no rainfall to charge the soil moisture, the crops have just about the same demands, and it has to either be applied or the crops do not produce.

Now I will get to one of John's questions. He asked: What are the differences in water conservation and rationing programs of the State and Federal contractors in the Agency? Something I want to talk about is do we have rationing? You can bet your boots we have rationing. The surface water supplies are about 25 percent of what they have been. And

there are established methods by which the agricultural community takes its cuts in water allocations. Water rights exist by which various parties have the first rights to the given flows, and junior appropriators come in second or third or fourth. In the State Project we are required to allocate all of our water on a pro rata basis; so there isn't much room for argument and our Board certainly likes that.

We have considered for this year and, more particularly, for next year some type of rationing. If next year is a repeat of the 1924 water year and there is in essence no water for agriculture, or a very small amount, would we go to some other type of rationing than a pro rata share as we have done in the past? We have talked about this with our Board, with our attorneys, and with our member units, as we call people who contact with us for water. And the idea that we would like to undertake is could we allocate a limited amount of water just to the permanent crops? We think that might be a reasonable method. However, we have a number of districts who say--"Well, if you do that, we will sue to make sure we get our fair share of whatever is available." Now those may be districts that do not have permanent plantings, but may have field crops. When I say "permanent plantings", I mean trees and grapevines. We generally do not consider alfalfa and pasture to be permanent plantings. But nevertheless, this year one district that is predominantly planted to orchards made their decision early in the year to allocate a certain percentage of their water to the permanent plantings to the orchards and then allow the rest to go to whatever use the farmers might make of it in field

crops. And as you might guess, Kern County seems to be famous for this, some of the landowners sued the Board. So, that's life down there.

One of John's questions was what circumstances prompted the development and implementation of water conservation programs? Now in the agricultural community I can't say that there are any conscious or mandated water conservation programs, but there are a lot of factors that come into play; and I think you will find that the agricultural water use is as conservative as people can make it. With the prices of water being as high as they are, and availability so low, we just don't find water use that we would call extravagant, particularly in a year like this. We even argue that in normal years our cost of water is so high and the availability is so low that we do not have extravagant water use. Farmers and farm operators are trying to trim down their operations so they get the most mileage, the most crop production out of the water that they apply to the field. But there are a lot of variables that they have to work against. One thing that is needed in agriculture is freedom for these people to use their ingenuity to get the most out of their water supply. They are working against the availability of the water and the amount of land. How can they cover the most land with the most water and get the best productivity? So they have to take into account such things as the soils and the land slopes, the types of crops they want to grow, their farm management costs, the type of system they have on the land, and whether or not the cost of putting in new irrigation

systems is going to be offset by income from increased production. They also need to consider the labor situation if they go into a sophisticated system; can they get people who can handle that type of system without going into higher labor cost? So the thing is excessively complicated, but I think you will find there is a trend towards more efficient management of imported water in Kern County. We made a survey about two years ago, using 1974 numbers, to see what type of water application methods were being used with the State Project water. We determined at that time that about 65 percent of the water was applied by sprinkler systems. More of this water has come into use since 1968; as people have put in new systems, they have gone to sprinkler systems for various reasons. There has been a growing utilization of drip irrigation in Kern County. In the survey made in 1974 we can identify about 10,000 acres of land where water was supplied by drip irrigation. There is increased use of drip irrigation, particularly in new plantings, and also some people are converting old orchards to drip irrigation. But that again is a complicated problem and it gets into such technical details as the source of water, the types of sediment, solids, or algae in the water, and the need to filter this water. Along with good, efficient use of water we know that there are inefficient users of water who may be doing something the way they have been doing over the years. They may have cheap water from a USBR system or they may have just gotten into practices of using water pumped from the ground that used to be cheap. Let's say 10 years

ago groundwater could be pumped for $5 or $6 an acre-foot, which was competitive with what they could get for water from the Central Valley Project. But taking current conditions with groundwater levels dropping where pumping depths are 250 to 300 feet and where the cost of pumping groundwater is about 10 cents per acre-foot per foot of lift, the cost of pumping groundwater is now about $20 to $30 an acre-foot. So the people who have inefficient practices have not really found that out until they get their power bills. But you can bet once they do find it out they are going to get somebody in there to help them design a system which cuts down on that excessive output of money.

Then, what if some people are relatively inefficient? That is not always bad. I mentioned soils types are one of the considerations that have to be taken into account in how efficient a farm operation can be. We have a lot of different soils in Kern County. There are sandy soil areas where you probably can't use furrow irrigation because to cover one furrow from one end to the other takes an excessive flow of water, or you just don't reach the end of the furrow. We have other areas where you have a clay soil and if you use furrows, the water runs off the tail end of the field before you have any penetration at the upper end. So people take all of those things into consideration and they try to meet the challenge. In most cases in our area, the water that is applied to the farm and is not used will penetrate downward to the groundwater.

I have a report by Ed Price of the U.S. Bureau of

Reclamation talking about these problems in Kern County, and he has divided the San Joaquin Valley into several areas. Taking the Kern County area (and I am not sure what year he is talking about), he says about 3 million acre-feet of water is being applied to the groundwater basin. He says the overall efficiency of that application of water is from 92 to 96 percent and about 200,000 acre-feet of agricultural wastewater is produced a year. Taking all the irrigation operating within that area and the water that goes on the field and the water that comes out, the efficiency is between 92 and 96 percent.

In the northern areas, Delta-Mendota area's overall efficiency is 87 percent, in the San Luis area 86 to 94 percent; in the southern area on the eastside around Fresno and Tulare it is 85 to 94 percent. Those are very high uses of water and they mean we have a drainage problem in the San Joaquin Valley. We are not putting enough water on those lands to carry the salts off and whatever salts that are brought in by imported water. State Project water that has a hardness of about 220 ppm total dissolved solids will bring in 600 pounds of salt per acre-foot. If you take that times 3 acre-feet, you have 1800 pounds of salt or close to a ton of salt per acre going to every field every year. If there is not enough water to move that either off the field or down into the groundwater (which is bad from everybody's standpoint), the increase in soil salinity decreases agricultural production. This is one of the most serious situations that we have in the San Joaquin Valley. A number of studies are concentrating on this and maybe someday there will be some answers.

John asked what would you do if you have to start all over? I think we are talking about the allocation of State Project waters. I don't think we would do differently from what we have done in the past. The State Project water and most of of the new water which has come into the basin and continues to come in will be to replace existing groundwater use to help bring our water supplies into balance. If we said we were going to start all over, because of the serious nature of the drainage problem, there needs to be some way, as is done in the Central Valley Project, to insure that the drainage system is put in as an initial part of the project. Putting in the water supply system and then having to get yourself into an emergency condition of salting up the lands and causing people to lose production and go out of business before you can afford an agricultural drainage system, just is not good. I don't know about the economics, but it's just not a good social system to put the burden on certain lands for a condition that can be foreseen and needs to be corrected. If we were going to start all over again, would we try to limit crop types, or types of irrigation application, or place limitations on consumptive use? I would say not. I believe that the system that we have at present of allowing the farmer the most freedom to make the social and economic choices to operate to produce a crop within a market system is the one that we should continue to follow.

WATER SUPPLY AND CONSERVATION FOR THE CITY OF LOS ANGELES

by

Le Val Lund
Engineer of Design

Los Angeles Department of Water and Power

WATER SUPPLY AND CONSERVATION FOR THE CITY OF LOS ANGELES

by

L. Lund*

Where does the City of Los Angeles get its water? In normal years, the City uses its own groundwater basin in the San Fernando Valley and at other locations on the coastal plain. This is about 15% of the supply to the City of Los Angeles. The City has developed and spent several hundred million dollars in developing an aqueduct system to tap the waters of the eastern Sierra Nevada. This is the Owens Valley-Mono Basin supply and is about 80% of the water supply. Throughout the years the citizens have invested a lot of money in developing and financing the Metropolitan Water District of Southern California (MWD) which developed the Colorado River Aqueduct system and a large portion of the State Water Project. Los Angeles receives in normal years about 5% of its supply from the MWD. When you look at the entire State Water Project, Southern California actually will pay for over half of that project. So far they have paid about 1/2 billion dollars in developing the features of the State Water Project.

What is the water situation for Los Angeles in 1977? In order to provide for the City's needs, the groundwater pumping is being expanded by 50%. There will be approximately 140,000 acre

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feet extracted from the local groundwater basins this year. This is virtually a mining operation. Certainly it is well beyond the safe yield of the basin and of course a number of agencies are doing this. This will be required to be replaced in future years. The Owens Valley-Mono Basin supply is down by more than 50% due to the drought, but also to litigation preventing the pumping from City's lands of a large groundwater basin in the Owens Valley. The City's increase in MWD supply is over 800%. This is coming from the Colorado River and from terminal storage on the State Water Project, since the supply from the State Water Project was shutoff on March 1, 1977.

When and what started Los Angeles in a water conservation plan? If you go back into history when the City Water Department was first established in 1902, it was a policy of the Board of Water Commissioners to establish a metering program to reduce waste. Also, this would result in lower water rates and supported the policy the people would pay for the amount of water they used. Initially, the central business district was metered and by 1927 the entire city was 100% metered. Today, the consumption in the City of Los Angeles is 162 gallons per capita per day. It is a low rate and compares favorably with other cities which are metered.

In 1975, a Department of Water and Power (DWP) Water Conservation Coordinating Committee was established to intensify the City's conservation program. Special emphasis was placed on creating an awareness that water supplies are energy intensive, especially the State Water Project and the Colorado River Aqueduct.

Pumping along those aqueducts requires the use of energy as compared to the Los Angeles Owens River Aqueduct system, which is a gravity system. It generates electricity from the flow to Los Angeles.

In 1976, the Los Angeles Board of Water and Power Commissioners adopted an aggressive position on water conservation. The Board wanted to generate public interest in more efficient use of water and they wanted the public to recognize the environmental cost in using of water and also emphasize this includes energy. This program provided literature on conservation, speakers and film programs, which would help reduce water consumption on a voluntary basis.

In early 1977, Mayor Tom Bradley, recognizing the situation as the worst drought since 1924 and the circumstances which were resulting in drastically reduced flows from Owens Valley asked for a voluntary 10% cut back. This was not achieved. The voluntary system was not the way to go, so he formed a Blue Ribbon Water Conservation Committee. In March, he appointed 12 citizens representing all fields of interest in the City of Los Angeles to this committee. They were given a task to develop in 30 to 45 days an Emergency Water Conservation Plan for the City of Los Angeles.

The reason for this, of course, is the low precipitation throughout the state. In the Owens Valley-Mono Basin it will be 33% of normal. Also, the court restriction limiting the pumping on City's lands to less than 1/2 the available capacity in the Owens Valley groundwater basin. The groundwater basin has 30 million acre feet in storage. Pumping was limited to 108,000 acre feet per year

although recharge is at the rate of 300,000 acre feet per year. In contrast, storage was being depleted in the State Water Project and MWD reservoirs in Southern California, and City-owned storage facilities. The MWD asked that a 10% curtailment be achieved by all its member agencies. The shutdown of the State Water Project to Southern California certainly was an important factor. The Colorado River Aqueduct depends upon 45 pumps, some of them have been in operation since 1940. There are no standbys and whenever one pump goes out you can loose 11% of the aqueduct supply.

What is your conservation plan? The Emergency Water Conservation Plan for the City of Los Angeles as adopted by the City Council on May 12, 1977, provides for both a long-range and a short-range conservation program. The long-range program is the educational program with the schools, industry and general public. A Conservation Speakers Bureau has been established to provide speakers on residential, commercial and industrial conservation. Mailings were made of water conservation materials as bill stuffers. Movies on water conservation were given to the Los Angeles City Schools. Also brochures, pamphlets and the usual items to emphasize the need for water conservation were distributed. A Conservation Hot Line was established which is a telephone number the citizens could call to ask any questions on both water and energy conservation. The DWP has been receiving about 1,000 calls a day on the Hot Line.

An in-house program was initiated last year with 200 employees. They were provided conservation devices for installation in their homes to see how much water could be saved by these employees.

These employees could compare their water consumption with the conservation devices with the period before without the devices. Also, a comparison was being made with a control group which was not aware of the conservation needs. The DWP also wanted to find out what the acceptability and durability would be of the conservation devices: How easy they would be installed; and if there were any problems. That is the long-range program.

The short-range program is of an emergency nature. It consisted of three parts:

Part 1. Education Program. Continue the educational program and distribute free residential retrofit kits including toilet displacement devices, dye tablets to check for leaks, washers for reduced flow in the shower heads, and literature to explain conservation ideas.

Part 2. Prohibited Uses. The Mayor's Blue Ribbon Water Conservation Committee decided it was not desirable to have a large number of activities that would be prohibited. They wanted to allow the people to conserve as they felt best, however, they did establish the following five prohibited uses, effective May 16, 1977:

a. The serving of water in restaurants without request.
b. The use of non-recycling water fountains.
c. The watering of landscaping and lawns between the hours of 10 a.m. and 4 p.m.
d. The delay in fixing leaks.
e. The hosing down of driveways, sidewalks, and parking lots.

Part 3. Emergency Water Curtailment. It calls for mandatory curtailment in the use of water in phases of 10%, 15%, 20% and 25%. The plan includes monetary penalties on the excess amount of water used and it also provides for a warning system which could result in the installation of flow restrictors and ultimately in the shutoff of water service. The mandatory 10% curtailment phase begins July 1, 1977.

What has been the consumers response? The water consumers generally have responded well to the conservation plan. They recognize they can save some water and at least 10%. Some concerns are that specific individuals have special requirements and across the board percentage curtailment is unfair. They believe they should be treated on the individual basis. There are those people who are concerned they have saved to a maximum and they cannot save any more. There are those who are concerned about an increase in water rates, because of the loss of revenue and the cost to implement a water conservation program. A group of contract landscape gardeners were concerned about the period of time 10 a.m. to 4 p.m. in which they could do the watering of their clients lawn.

What are the results? The result so far even though the mandatory curtailment has not become effective are quite gratifying. During the month of May, the City had a 31% curtailment compared to 1976. One must be careful of this figure because during the month of May the City did have two unusual rain storms. It is estimated about 1/2 was due to conservation. So far, for the first 1/2 of

the month of June, the City has achieved 29% curtailment without any rain. A conservation indicator is the reduction in sewage flow which represents only inside use. This interior use is not affected by the weather on the outside. Measuring these flows there has been 10 to 15% conservation curtailment.

What would you do differently? The Blue Ribbon Water Conservation Committee was a good way to get input from the public. They had public meetings with over 30 different types of water users invited to make presentations (residential, commercial, industrial, governmental, agricultural). For direct ideas in developing the plan, the City expressly thanks the respresentatives from San Francisco Water Department and the East Bay Municipal Utility District who made presentations before the Blue Ribbon Committee. A great deal of information was gained by the Blue Ribbon Committee from those two agencies. The Mayor gave the committee a very short time table - 30 to 45 days. This was almost a night and day operation. It is felt the activity worked well. It was somewhat hazardous and hectic at times, as ideas kept changing, but eventually it resolved into a fairly good plan. The plan does allow for the City to change from one percentage to another percentage of curtailment almost automatically. It is the duty of the Chief Engineer of the Department of Water and Power to recommend to the Mayor and City Council an increase in percentage curtailment or a decrease in curtailment.

What specific changes should be made? There exists an ordinance in the City that restricts water flow in the gutter. This was passed many years ago as a safety measure. This should be included as one of the prohibitive uses. Clarification of the

language should be made for sprinkling of landscaping and lawns during the hours between 10 a.m. and 4 p.m. Consideration should be made to adjust through the appeals procedure to allow fertilizing of lawns or for special treatment during the development of new lawns. One of the items provided for in the emergency ordinance is a warning system. On the second warning, it requires a representative of the DWP to visit the customer to warn him that he has exceeded his allotment or has violated a prohibitive use and the next time he does this he will be restricted to flow of one gallon per minute. That is going to be quite costly and quite time consuming. Probably a better way of doing this would be a mailing by certified mail or something that we could be positively assured that the customer did receive his second notice and was aware of the restriction of flow at a later date if there was another violation.

Finally, the conservation plan certainly results in reduced revenue from the sale of water. Utility costs are fixed and vary very little with change in flow. It also costs money to implement the conservation plan, administer the appeals procedure, and purchase and distribute the conservation retrofit devices. A drought surcharge to cover these costs on the water used should be included as a part of the total water conservation package. The DWP is presently going through a completely separate operation to develop a drought surcharge to cover these costs.

The basic principle in the City Council's adoption of the 10% mandatory curtailment now, is that it could prevent more drastic cuts if 1978 is as bad as 1977 drought year.

THE EAST BAY MUNICIPAL UTILITY DISTRICT EXPERIENCE

by

Donald G. Larkin
Chief Engineer

The East Bay Municipal Utility District Experience
by Donald G. Larkin, Chief Engineer

EBMUD was prompted to go into a water conservation program when 1976-77 proved to be the second successive dry year. The extent of the normal runoff of our principal source of supply (the Mokelumne River) is about 700,000 acre-feet a year. In the winter of 1975-76, the runoff was a little over 200,000 acre-feet, one of our three worst years of record. This year (1976-77), runoff is estimated to be only 115,000 acre-feet, making it by far the worst year on record.

Our Board of Directors decided that after the 1975-76 dry year we should carefully monitor the precipitation beginning in the water year 1976-77 (October 1976), and we did that very carefully. We depend on Sierra snow surveys which are made the first of each month, February through May. When the January 1977 precipitation was again far below normal, we began to seriously consider a mandatory water conservation program.

Up until that time, we had urged our customers to voluntarily conserve water by 25 per cent, and they were just beginning to meet that goal when the Board adopted a mandatory 25 per cent program, which became effective early in February 1977. Our initial 25 per cent cutback was based on the possibility of continued below-normal precipitation for the rest of this year after January.

The conservation program was also aimed at providing enough carryover storage in our system to get into 1978, even if 1977-78 became a third successive dry year. In April, at which time we normally get 90 per cent of the runoff, we predicted that the runoff for the whole year would be about 65,000 acre-feet, because up to that time the snow surveys again indicated very low precipitation. Therefore, in April with this new information at hand, our Board decided to increase the conservation cutback to 35 per cent, which became effective May 1, 1977.

In May, we had a record runoff of rain and snow, resulting in record runoff on the Mokelumne watershed and most of the Sierra watershed for the month of May. On the Mokelumne watershed, the precipitation in May just about equaled the precipitation throughout the winter to that date. Our prediction in April of 65,000 acre-feet runoff has now about doubled to 115,000 AFA. We have not modified our 35 per cent cutback program because we feel that the unpredicted May runoff will provide a cushion providing more carryover storage into 1978. This in turn may preclude the need for a stricter conservation program next year, and it also may preclude the need for us to pump dead storage from Pardee Reservoir. Up to now, we had predicted that the water in Pardee Reservoir could fall below the lowest outlet, requiring pumping from the dead storage into the outlet. However, because of the precipitation in May and the resulting increase in runoff, we anticipate that dead storage pumping will not be necessary.

At the Board meeting of June 28, 1977, there will be a public hearing on our water conservation program, but no changes to the program will be recommended to the Board. The next public hearing will be on August 23, and at that time a decision will be made on whether it is necessary to reduce the residential allotments further to reflect reduced fall-winter irrigation needs as originally planned to achieve the 35 per cent cutback for the year.

The residential cutback limits the amount of water to 225 gallons per day per household (figuring three people in a household). For each additional person permanent residing in the residence, 35 gallons per day can be added upon written application. Average daily use above maximum will result in an excess use charge with a limit of 850 gallons per day for a family of three. If the 850 gpd figure is exceeded, the District will issue a warning; if that fails, a flow restricting device will be installed at the service. To date, no flow restricting devices have been required.

For industrial customers, water used in production is reduced to 80 per cent of last year. All other internal use is reduced to 70 per cent of last year, and water use to maintain landscaping is reduced to 40 per cent. For commercial and public authority accounts, interior use of water is reduced to 70 per cent of last year. For all exterior and landscaping (for parks and golf courses, etc.), the reduction is to 40 per cent of last year. For apartments, condominiums and townhouses with five or more units served by one meter, the allocation is 65 per cent of last year.

The overall cutback goal is 35 per cent of water consumption in 1977. This program is based on the principle that water conservation will not have such an effect on the customers of the District that there will be a loss of jobs or other major economic effect.

The most encouraging news I can report is that the customer acceptance to date has been excellent and fully cooperative. As I mentioned, we had initially started in January with a 25 per cent voluntary program, and at that time the consumption began to drop. When the mandatory 25 per cent program became effective in February, the water consumption went down at a greater rate and soon exceeded the requested 25 per cent. The 35 per cent program, which went into effect in May, was quickly accepted by our customers. Customers have exceeded this cutback and now our overall water consumption is approximately 50 per cent below that of last year.

At present, 95 per cent of our residential customers are remaining within their allotments. Of the industrial and other customers, about 75 per cent of them are remaining within their allotments. Of the customers exceeding allotments, most are using just over their allotments and are in the minimum excess use charge range. It is apparent to us that our customers realize the emergency we face, and are accepting the water cutbacks as a challenge and meeting it with pride. The industrial customers have reduced or eliminated wasteful use of water, and more and more are going to recycling and reuse of water.

Initially, the staff recommeded to our Board a different approach to water conservation -- one based on a variable percentage cutback on the previous year's consumption. However, at the first public hearing there was great objection to this plan, particularly from small businesses or persons claiming they had already been conserving water. Therefore, we did not adopt the percentage cutback but did adopt the allotment plan just described.

One of the problems in our allotment plan is that we serve water in two distinct climatic areas -- one on the west side of the Oakland-Berkeley Hills where it is rather cool, and one east of the hills, where it is rather warm. So the people in the warm areas are not as well off as those west of the hills. However, if people in the warmer areas choose to exceed their allotments for a couple of months in the summer, they may do so and then pay the excess use charge. Up to now this has not usually been the case, but we have not had much hot weather yet this summer. We have had a little rain this spring, and we are waiting to see what occurs in the next couple of months. We feel that even though the allotment program is not perfect, it is working very well. You probably all have heard that in San Francisco, where they have adopted the percentage cutback, they are already experiencing numerous complaints and problems.

We plan to improve our allotment system by means of a census which will be taken in the near future. We will then be able to further restrict the use of water for households with less than three people. Right now our whole program is based on three people in a household, but by means of the census we hope to find the households with one or two residents, and then have a further restriction on their allotments.

We also are reviewing methods for assigning allotments for industrial or commercial accounts which have no record of prior use. We are presently basing them on a general average, and we hope to improve on that. Another problem not resolved to everyone's satisfaction involves temporary occupants of residential services.

In conclusion, I can say that our program is working very well. The customers are complying, and the standard of living in the East Bay Area has not been adversely affected, and there has been no adverse impact on jobs. I can sum up our program by saying that we are guardedly optimistic for 1978, even if next winter is dry.

THE CONTRA COSTA COUNTY WATER DISTRICT EXPERIENCE

by

John S. Gregg
Manager of Operations

The Contra Costa County Water District Experience
by John S. Gregg, Manager of Operations

The Contra Costa County Water District has a unique water supply situation. I would like to share with you a couple of aspects of that situation and then review how we attempted to respect those in our water conservation program and specifically in our water rationing program. First, the District has two wholely separate water operations--a wholesale operation and a retail operation. In the wholesale operation, the Water Supply Division purchases water from the Bureau of Reclamation. We have no water conservation facilities; we have no carry-over facilities. We take it one contract year at a time. So we may be different than some of you in terms of our resource management. The Water Supply Division wholesales water for primary industry along the north shore of Contra Costa County and to the communities here in the Northeastern and Central Contra Costa County. We are unique in that our industries are very quality sensitive so that in this past year, though our supply was cut only slightly, the degradation of quality has imposed a substantially greater hardship, particularly on our industrial community. Looking to the municipal customers within the District a 30% reduction of their 1976 use is required. Our Treated Water Division, the retail part of our water operations, is handled exactly like any of the other municipal customers who purchase, treat and retail the water. So we must, in our Treated Water Division, get by with about 70% of the water we had last year. Our basic conservation program has evolved with the long-term intent of involving individual customers and the community in

that program and of getting them to make definite water usage decisions.

In early 1976 we were monitoring closely State and Bureau operations. It became apparent to us that State and Federal Project operators and planners had grossly overestimated the yield of the Central Valley and State Water Projects during dry and critical years, at the very least. At this point, we started worrying. We began to think in terms of how much our supply might be cut back and what to do. We never thought in the terms of the cutback that ultimately came to be. We began, early in January, particularly in our Treated Water Division, a general program to inform our customers of water use and water conservation, not knowing what type of decisions they and we might have to make later in the year. We set out by first putting gallons per days on the individual customer's bills and simply giving them some ideas of how to manage their water use. In March we followed that up with a better picture of what was happening with a report on how they were doing. We actually put the percentage of how much they had saved since the previous billing period on the bill.

We needed to get our customers involved. They are the ones who buy the air conditioners and high water using equipment not in sprinkling systems and leave the faucets running. They are the only ones who can make water saving decisions. For us, with a staff of 30 or 40 people to call on 40,000 customers is an endless task. We got into this problem in terms of water conservation devices and the question of whether we should distribute them or whether the business community should sell them.

In February we sent the plumbing contractors, hardware stores and building supply people a letter. It suggested we would be checking back in 30 days to see what things they had stocked and after that we might have to take action----IT WAS AMAZING---- In 30 days the shelves were full of water conservation devices. Anytime you go into a store now they are right out in front. I think the community has to be involved with the utility in devising ways to save water. They will rise to the occasion. I think you have seen that in the evolution of various types of water conservation devices.

When we get to looking at the actual rational plan, we need to respect the uniqueness of our community. I am not going into all the details of the program. In the interest of time I would like to dwell on just a few of the key points that I think have been considered either directly or indirectly in most conservation programs. The first is to consider what factors actually determine the amount of water used at a particular water service. If we look for just a moment at a single-family residence, we must deal with their interior use and their exterior use. Exterior use has little if any relationship to the number of persons. It has to do with the size of the lot, the way it is landscaped, both as to planting and to grading; if you are in a community where a large proportion of your water use is for landscape purposes per capita rationing is a loser, unless there is no water remaining for irrigation. If you serve a diverse community, where there are some services with large irrigation, some with none, you have a more complex problem. We have that situation. We have individual residences with secondary water

supplies. They have wells, they have water from our canal system, so that they don't use treated water for irrigation. In the second area, in-house water, or interior use, a generality has been made that this use is a direct function of the number of persons. There was some detail work done by Johns Hopkins University in the mid-1960s with sampling and measuring throughout the United States including large subdivisions in this area and in the East Bay service area. The general conclusion of that study--I think if you reflect on it you'll see it has some truth to it--was that unless the water supply is constrained, interior use is not a direct function of population. However, if you have a water supply to an area that is on septic tanks, for example, or if you have a limited supply, Johns Hopkins University studies suggested that interior use is more a function of the economic standard of the dwelling unit and their actual statistical work related it to the relative market value of the home. As we look at our service area and see, particularly through the appeals process, people with water problems, this is pretty much borne out. We have people with large families appealing for more water. We had one family of eight who was satisfied with something just over 300 gallons a day for their total use, no well, no other source. Just a little bit before that we had a family of five who weren't going to be able to get by on 480 gpd. They had done everything that was possible, endured all the hardships they could. So the idea of water conservation hardship is largely a function of life-style (perhaps of where we are from, such as a place that didn't have much water, and economic stature of our origins). The District tried to develop a system that would

respect different life-styles. We also tried to develop a system that would respect the historic water conserver. The particular system we devised provides up to 180 gallons per day, with no reduction for single families. The reduction then scales up so that there is a 30% cut for a historic use of about 440 gallons per day. There is a 50% cut at 900 gallons per day, and it scales upward to a maximum ration of 480 gpd. The place that this rationing concept breaks down is primarily with extremes in persons per service. You get 14 people in a house, I don't care where you are, they are going to use a lot of water so you can't go by any one criterion alone. But conceptually, if you challenge the idea of what part of the water use is really related to the population, what part by economic standard, what part by the nature of landscaping, you think about it in terms of the real community that you serve, I think you can evolve a rationing plan that will be unique to your area and will best respect your community. On that basis, we are pleased with ours.

It involves a couple of additional things that are unique. We have a seasonal factor to respect the high irrigation requirement in our service area so that we allocate an average for the year and there are a series of multipliers to give you a peak in the summertime. The other thing we have is banking or carry-over so that if you do not use the allocation, you may carry it on over into the next billing period or some subsequent billing period. I think that those are the basic neat things of the rationing program.

In terms of customer reaction, we have about 2500 appeals --to be perfectly honest about it, we had not given our consumption

record in the computer as much importance as we should have so perhaps a third of those are our own fault, and are really not appeals. We have somewhere in the neighborhood of a 15% annual turnover and I think given differences in family structure and situations, that 1800 real appeals is not too bad in the appeals category.

Some of the principal complaints have been that the fact a lot of people think in terms of per capita use, and when one family in the neighborhood gets 200 or 300 gallons and everyone around them has 400, they just can't take it. It was OK until they found out what their neighbors had. Beyond that it is extremes in number or a particular, unique character of the family that requires special attention.

Is the program working in terms of saving water? We are just into the program, so it is early to decide. However, I think over-reaction of the customer is one of the problems that I am most concerned about today. If you drive through our community, you are going to see dead lawns everywhere and I don't think dead lawns were necessary. The original goal of our plan was landscape survival maintenance. The customers are doing plenty for the general cuase; however, this District can't save the water for another year if the customers don't use it. We may be able to reallocate it in the community. I think they may have gone farther than even our program called for because the Board did not intend that they would lose or actually sacrifice their lawns.

One of the other areas I am concerned about is the relationship between utilities and what programs we adopt. Here, within

the Water District, we had a Municipal Water Users Committee, and all the municipal contractors of the Water Supply Division met and discussed what rationing programs and approaches we would have, what kind of press information we would release. However, as we have monitored our phones whenever the major water utilities adjacent to us, be it East Bay or San Francisco, decided something, we were swamped and in all candor a lot of customers don't know from whom they buy water, and so someone says it is going to be 280 gallons per day--it's 280 gallons per day! I think in terms of what we might do differently when we have a common problem in a general area such as the Bay Area--this is not to criticize what has happened, but to look at how to do it better the next time if we have to--I think there should be more coordination on a total utility basis in terms of timing and content of news releases and the things that are going on in rationing programs.

FEDERAL-STATE DROUGHT AID

by

Maj. Gen. Frank Schober
California National Guard

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I just opened this speech material; I was a speech writer at one time and it is always good to look a speech over before you come up on the platform. While I was in Washington there was a story going around about a speech writer who was very, very successful at his craft. A southern Senator depended on him, for his speeches were widely quoted in and out of the Congress. This fellow, in the course of events, came to the Senator one day and asked for a pay raise, and was turned down. He went back to his work and continued to write for the Senator. The Senator got even greater applause within the halls of the Congress and throughout the country. So the fellow again went to the Senator about the pay raise and said, "I need your help; inflation is rising", and the Senator turned him down again. "Lower your expectations!" he was told. That satisfied him for a while but the inflation continued to rise, so he went back to the Senator and pleaded with him; and the Senator turned him down again. The next day on the floor of the Congress the Senator, giving a very important speech, in conclusion said that the "most important part of my speech is a simple point I now wish to make". He flipped to the last page of his text and read: "Now you are on your own, you S.O.B." There was much laughter! So after that joke you can understand why I read mine very carefully.

I think you may be asking a question--why a National Guardsman and a general officer involved in a very key problem here in California? My answer to that involves both a personal

memoir and a discussion of the Governor's feeling on the drought and the need for a task force director. I have been introduced in some places in California as the drought director. I'm not--He's upstairs. I was called to attend some meetings at the Governor's cabinet room, in which we brought together representatives of state agencies--the heads of various agencies. The Governor was searching for a coherent definition of what the drought is and what effect it has on us. He was getting different answers, a bit like five wives of five blind men who were describing the elephant--feeling a different part and describing the trunk as a snake, for example. I made the statement that what the Governor needed was a coordinator and a task force to put this thing together with some teeth, and to develop some quality options for the Governor and, hopefully, for the Legislature during this drought year. Having said that, the president of the State Public Utilities Commission nominated me for the job and I got it. Like all good soldiers I saluted but I asked one thing. I had learned at Harvard that coordination is the lowest form of public administration; that very little is accomplished by departmental groups or just by "coordination". So I asked for a very tough executive order from Governor Brown that would indicate what our mission was and, very importantly, one that would give representatives from various agencies, such as Food and Agriculture, Water Resources, Water Resources Control Board, the P.U.C., Office of Emergency Services, real authority to speak and act, for everyone has either to be a part of the problem or a part of the solution. In problems of the drought I had to assure that those people

could or would commit their departments to a course of action. So with that executive order, plus another requirement that the Governor tack on that we were not to create any staffs or hire any people--we were just going to draft loan executives and loan secretaries, loan typewriters and loaned office supply. That is the situation we are in and it is working out very well. Our finance people are happy with it and I can testify that we have a very competent State Department of Finance, which is largely responsible for our State budgetary surplus. Because those of you who have dealt with it or have served with State government know that their initial reaction to even the most positive program is "No". And you go from there. But this task force, I feel, is doing something that is not normally done in State government. I was amazed, frankly, to learn that we have 65-plus State government departments in California and I know from my job in the National Guard that those departments don't talk to each other, much less coordinate with each other. They don't communicate. Each is in its own little budgetary box and doesn't communicate from one department to the other. So one thing we are doing is getting people in Agriculture to talk to people in Water Resources and work together on common solutions for our common problem of the drought.

The other thing I found out about bureaucrats is that the military bureaucrat has a different view of the cause of action from the civilian. I mean people who are really competent, well educated, and well experienced. Sitting around the table, they indicate the problem and if you indicate a course of action initially in the first five minutes they will be positive and

say, "Yes, a very good idea," but if you let them talk for a half-hour they will decide to do nothing--in every such case they will decide to do nothing; and I think the reason is that when differing points of view come up, they say things that make a lot of sense and you should pay attention to them. But I just don't think they understand the course of action. They reason, number one, "if we can't do it for everybody then let's not do it for anybody." That is all. Number two is "if you get on this course of action how will we ever get off?" And the third one is a pretty general one, I found that "it is politically dangerous."

I need not review for you gentlemen, all experts in your fields of water distribution and water reclamation, transmission, use and conservation, the extent of California's drought. I will say that the prime concern of the drought emergency task force is to try to get the bureaucracy to work. And we have put together a compendium of federal aid available, and that has been sent to every agricultural advisor as well as the head of every Board of Supervisors in the State and City Council. I understand that those federal programs--from several conversations I had earlier here today--are not working as fast as they really ought to. I would really like you to know that I have been in contact, as has the drought task force, with the appropriate members of the Congress, with people in the Department of Agriculture, and the Interior. If you, in any attempts to get loans from the DVA or FMHA or a variety of federal agencies in California, are not getting quick support this is pretty bad and I want to know about it and I want to act on it.

So that is our key job--we have got to make Sacramento bureaucracy work, we have got to make State bureaucracy work, and Federal bureaucracy as well; we have got to develop a sense of emergency. I know that those of you who have worked in Washington must know, as surely as I do, that from Washington, California problems, however severe they may be, don't look to be that big--it is still a big country in spite of trans-continental jet and all kinds of communications. I have the honest feeling, though, that in terms of size, probably some people who live and work in Washington--even some former Californians--tend to think that California and several of the other western states suffer from the distortions of the Mercator projection. They are not really that big but sort of like Greenland on the map. I have had top-ranking officials in the Department of Agriculture tell me that as far as agriculture was concerned the work with the Department of Agriculture ended at the Rockies; beyond that it was the Department of the Interior. Now we know that this is not true, because people in the Congress are looking at the number of people employed by the Department of Agriculture and looking at the problem of intersecting curves. I don't know if <u>you</u> know this, but at the present rate of decline in the number of farmers in the United States and the increase in employees in the Department of Agriculture, by the year 1990 we will have as many people working in the Department of Agriculture as we have farmers. We have found one other thing. I am going to have to be careful about assessing suggestions because a lot of them are very good. Some of them are less than practical but we must keep our eyes and ears open in a drought

year. The State Government has been chastised for not doing more about a lot of things. Then there is an educational problem--how do you make that pay? How do you make it economical, because it is not just that it can be done, but can it be done economically? And within the State's resources? I would say that it is obvious that every crisis brings out two main groups of people we look out for-- the vultures and the kooks. Vultures who attempt to profit--vultures who want to sell things that are not economically sound. And there are kooks, and I can certify that every California community seems to have one certified kook. One lady in Bakersfield is kind of a fixture around the Board of Supervisors there; I bet they come to some of your meetings, too. She was dressed kind of interestingly; she was kind of an elderly person in Shirley Temple curls, a kind of a sack dress, and she wore tennis shoes. But she got up and said, "General, it is not going to rain until Jesus and I decide." I told her that I hope and pray for rain, I can tell you that! And then we had a fellow in Northern California, who in a group would have been taken for a college professor if he'd been on "What's My Line?" He got up--his name is Dr. Beter and Dr. Beter spent $10,000 that he inherited to look for a submarine in Oroville Lake recently. Dr. Beter said that the drought was everybody's fault here for not paying attention. He wanted a Congressional investigation of 50 Soviet submarines that he said were off the coast of California bombarding the State with rich plutonium, causing both the swine flu and the drought. Aside from the vultures and the kooks, we have things to do.

The Governor has asked the drought task force and everybody

in the State Government to plan for the worst case, the worst case in terms of just one more dry year, one more year as bad as the two we have had. Certain things begin to happen and you can't wait for them to happen before you develop plans and programs and capital investment to handle them. If we have one more dry year, we have to know exactly, as exactly as we can, what California will look like. And whether or not we ought to be moving to put down pipes and a few other things that bring water to needy areas from elsewhere. Next year, if we should have another year like this year, the State Water Project will not have any agricultural water at all to deliver and the Bureau of Reclamation is not likely to have much either. That will mean more wells, and we have to ask ourselves some policy questions about new wells. I understand there are 10,000 new wells in Fresno County alone. Incidentally, I learned one other thing about the water business and that is that these people are not called well diggers; they want to be called well <u>drillers</u>. But maybe it's not good for the State and for the water tables and because of saltwater intrusion, and for a whole lot of other things, for us to drill more wells. What are the choices left for us to meet the drought, of putting together, in conjunction with State Government, a "what we do" book, a contingency plan, which every state agency will have a part in preparing? The State Department of Health is going to come out with some guidelines on use of water. We are going to have to get cooperation from CalTrans if we have more dry years. What happens to the very large investment in landscaping around our State buildings and freeways? We are going to have to make more effort on

saving water and agriculture. There have been several newspaper editorials indicating we ought to have acted earlier on to meet the crisis--that to authorize statewide mandatory water rationing would have fixed things up. I found that California is too complex for that. We have 1,500 or 2,000 different water agencies and we have different climate zones, many different land forms. In addition, water from the southern six counties, as you very well know, cannot be easily transported back to the North--you can't convert those pumps very well and pump it back. I've learned some things that I mentioned earlier to Bill Moore. I learned some things too about the Owens Valley problem. I decided to go up there and meet an old college friend of mine, Dan Bryan, who is the assayer of Mono County. I recall that 25 years ago he told me that as a kid his mother would never let him throw rocks at cars unless they were L.A. Water Company cars. I was wondering if that same feeling was there when I went up there recently and, sure enough, that same feeling was there. That is one of the dangerous things that I want to stay out of. I hope that is not going to be a part of your action.

We of the task force have supported some legislation I would like to review with you.

The Legislature is, unfortunately, out of session now. One bit of legislation is a bill which would help out ranchers in terms of the head tax on cattle, to give them some help; ranchers, as you know, need very serious help in this second-year drought. We have two other bills; one is to get some relief to farmers and ranchers who have land assessed as pasture and have to pay for it as pastureland but because of the drought now have no

pasture at all. It makes no sense, I feel, to assess that, and part of bringing some equity to the thing is to give them some relief. Our goal, and one that the Governor subscribes to, is that we cannot make up any kind of legislation insuring per dollar loss, so what we ought to do is to try to keep California farmers producing. I don't know if most Californians know this, but California produces 25 percent of the nation's table food; 25 percent of the nation's dinner table is provided by California. Well, that very clearly makes the point that it is not just a California problem but proves that California water problems are national problems and, in some cases, international problems. If California were an independent nation I think you might be interested to know that it would be the seventh or eighth largest nation in the world in terms of agricultural productivity. If Fresno County alone were an independent nation, it would be the thirteenth largest nation in producing agriculture in the world. And the Counties of Kern, Tulare, and the others are very close behind. But that is something that should give us all cause to think. Hopefully our Legislature will grow to understand that California agriculture is terribly important to the rest of the economy of the State. It is an interesting pattern in terms of California agriculture; I am sure that those of you who work with agriculture know this. We have about 66,000 farmers in the State's population of nearly 23 million; 66,000 farmers producing all that crop. And of that number, 6,000, the top 10 percent or so, produce a little over 50 percent; but the other group, the group of single-family farms of single owners of farms and ranches, we are also concerned with in keeping productive farmers

productive. Incidentally, in addition to learning of the problems of bureaucracy I have learned the problems of farmers. And one thing I've learned is that they never, two or more, agree, and if you add disagreement geometrically in terms of what we ought to do and what recommendation we should have they agree on very little. It is very difficult to get several farmers telling you what to do when help is needed, and then find out that others say "No, forget that, those guys are always moaning anyway; I will take care of myself." It is very important that we do the best, not just for individual farmers but for the State as a whole. The other two items of legislation, or one more item of legislation, is the bill for loans for farmers, ranchers, and dairymen who are not covered by the Bureau of Reclamation or other federal assistance and there are some who are not covered who need assistance again with the view of keeping farmers productive. We have to do something and it may appear in the short run not to relate to the drought and its problems, but one very wise individual in the Department of Water Resources made the statement to the press recently that after this drought we must have farmers we can serve in another water year. California will never be the same after this drought and I think that it is very true that we have done water rethinking and we have to do <u>more</u> rethinking. We have three general objectives in our program. We have to get the people to conserve efficiently. We have found some interesting things about conservation as a moral issue, but unless the moral issue can be coupled with the economic issue of saving money and being cost effective for the businessman or householders, or whatever, we are not going to be successful

anywhere in California. Not even in areas that were relatively water abundant do you get water in restaurants anymore and in many places there are little table cards indicating the restaurateur as saying "We do our share." That's the way it should be. But it saves him a lot too. It takes 6 or 7 glasses of water in order to produce that one glass of water which nobody may use. Some other restaurants in the State have begun a simple thing never done before and that is when you go into a restaurant you no longer see the entire service laid out, whether you come in for coffee or you come in for eats; they just give the silverware that is needed. So conservation efficiency, coupling the economic effort with the moral way, is successful. The second thing is to retrofit, retrofit all our facilities to the extent that we can economically amortize them. And do it quickly. I think the most important retrofit is probably in our minds to recognize that the water and energy are tied together. Electricity production is down because the water over tbe dam is less and we have to burn more fuel as a result. I found an interesting thing in terms of Los Angeles water conservation. The Governor and others were urging a 20 or 25 percent reduction in water use of Los Angeles, but it has yet to achieve 10 percent reduction the last I heard. I feel it can be done. I think all of you are aware of the problem. If you lessen the cash flow as a result of fewer receipts from customers, then you must raise rates to pay off bonds and capital accounting and capital outlay. Nothing discourages the householder more than to be told that as a result of successful savings, he now has to pay 25 percent more for the water he uses; but the economics are there and that

retrofitting has to take place.

Comparing Northern and Southern California I see two different problems. Hopefully, north of the Tehachapi is a trend toward realistic awareness; I mean we must go ahead and build our Peripheral Canal and underground reservoirs. That is good but we are very likely, hopefully, going to get some rain north of the Tehachapi. What population would the Los Angeles Basin hold if they had no water development? I heard 50,000 people could not live there if they had not brought the tremendous amounts of water from elsewhere. But something different is happening here. Conservation takes on a different meaning, I feel, for a southern county in that they have to conserve as a resource. Conservation has to be built on a reflex, changing people's habits. Water is very important in the southern six counties, because they are not getting water from the north and they may not get it next year. The Central Arizona Project is coming on the line in five or six years; it will be taking a great amount of water. That water deficit is going to have to be made up someplace somehow and I feel it is going to have to come through changed habits and more efficient ways of using water. We are doing one other thing and I met last week and the week before with the chancellor and the associated presidents of the State University and the college system. We have 19, State University and colleges. It just happens that they all have various specialities--Pomona State has the speciality of hotel-motel management, restaurant management. Humboldt has a speciality in forestry, Cal-Poly at San Luis Obispo in agriculture, and so on. We hope to take the question posed by State

Government Departments and pose these questions to the various state universities and groups of facilities and students with a view to producing public policy memoranda that will be useful for State Government. This will be a way of harnessing this talent instead of having types of just reading each other's books and have them produce things that are useful for public policy. I think that this is a better ride for our tax dollar and will be quite useful in the present emergency and the future need to conserve. About the Federal Government programs, to touch back again on their operation, you are probably aware of the Bureau of Reclamation's effort, the ETA, the Small Business Administration--and the least productive of all has been the Federal Disaster Assistance Administration. They have the long books called the Federal Disaster Act that refers to drought. It is mentioned but beyond that it is really not dealt with. It does not mention famine but the way they help people as a result of the drought is to provide that if you could prove that 20,000 people died from famine, then you could get food for those 20,000 people. This is how our Federal Disaster Administration is working. You know how it works when things are knocked down or blown down or flooded; you know how to take care of it. But drought is a different situation. It affects people differently. The third object--first is to conserve efficiently, second to retrofit, and the third is to plan and provide for the future. Part of the plan of providing for the future has to be to get some very brave people who are also knowledgeable and have a lot of prestige in the law and to reform and revive the California Water Law. And that is an indeed difficult undertaking.

But maybe we can say sweet are the uses of adversity and this is the time when we can get the most cooperation. But I think of the problem that we have in the present water law or at least practice in which somebody has a large farm and can afford a large well. Let's say he put that well down at 300 feet, which might be a hundred feet deeper than his neighbor who can't afford a new well, and he can suck up the water on this side and this side can have a water treatment crop and then they will go to court and ten years later and several crops later he might get satisfaction and be safe. But we need some method of controlling that problem. Some States do it better than others but that is a legal element I have nothing to do with. I don't know if you have this at your Board of Directors' meetings, but every time I have a good idea I look down at the staff people and if the lawyers are not saying "No", the controllers are telling me I can't do it so the State's legal expertise is going to be devoted to this blue ribbon commission headed by a former Justice of the California Supreme Court. Hopefully it will bring some sense to our water law. The other fortunate plan for providing for the future is that we have no choice. We have, over the years, been lucky in the southern six counties and a lot of money has gone into production of water in the north. We have the California Water Project, we have dams and water bank accounts. We are thinking now about the Auburn Dam, about the Peripheral Canal, about underground water reservoirs in the south; but we have to provide for the future. And what I urge you today, and your institution, the WATERCARE Conference, is to help us. It is important to unify effort between those who claim and those

who produce water.

I was reading recently about people who came back from mainland China and saw those people were really Chinese and saw signs everywhere that said all waste is a sin. The Chinese have led the way, I understand, in use and economic means to save everything and I firmly believe and practice the philosophy that you don't throw anything away but save it, reclaim it, and use it again. If you do anything else you are fouling the nest. And that in a resource shortage we cannot do.

In providing for the future it is important to realize that our State population will grow 35 percent by the year 2000. All counties with the exception of San Francisco County will gain in population. The counties that gain the most will be those who have a great deal of the population now. I understand those are Orange and Ventura. When I mentioned that earlier at the lunch table, somebody said those two counties are probably the most difficult to provide water for and the most costly. So that is our future. We are one State and this water crisis has led us to believe and, hopefully, we will translate that belief into action. We <u>are</u> one State with one problem and we have to put people in government with the brains, with the background and the experience in industry together, and together we can come up with some efficient solutions to our common problems. Thank you very much.

A PUBLIC HEALTH RATIONALE ON REUSE STANDARDS

by

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A PUBLIC HEALTH RATIONALE ON REUSE STANDARDS

The early history of public health in the environmental field has been one of efforts to provide safe water supply and safe disposal of sewage. For water supply, this required providing treatment for hazardous water sources or substituting safe sources for contaminated ones. With sewage disposal, the first efforts were directed at eliminating indiscriminate discharge of raw sewage to the environment and at providing sewage treatment. These efforts progressed to providing higher degrees of treatment; in particular, biological oxidation to restore receiving waters to aerobic conditions and chlorination of effluents to protect against the grossest health hazards from public contact with recreational waters.

Standards for acceptable performance gradually evolved from these practices - standards which in regard to both water and sewage represented standards of good practice - standards which could be attained by well designed and operated plants - standards which were validated by indications that the resulting conditions were no longer producing epidemic disease. This is the history of the bacteriological standards for drinking water and of the standards for sewage disposal. To say this in another way, standards evolved as a part of the process of cleanup of major public health hazards associated with domestic water supply and community waste disposal.

Presented at WATERCARE Conference by H. J. Ongerth, State Sanitary Engineer, June 27, 1977, Concord, CA

As an example, the 1925 drinking water standards for coliform are said to have been developed from a study of the records of performance from a group of water filtration plants treating water obtained from some of the major polluted rivers of the midwest and east. The standards which resulted were representative of the kind of performance of the better water treatment plants. Another example closer to home is that derived from our work in dealing with the discharge of the City of Los Angeles from the Hyperion Plant into Santa Monica Bay. A major water pollution survey in the 1940's demonstrated that inadequately treated sewage (primary effluent) discharging to the Bay caused accumulations of sewage - grease and fecal particles on the beach and resulted in high coliform concentrations in the surf waters. More significantly, an effort at an epidemiological investigation provided some evidence of increased disease incidence associated with recreation in the polluted waters. On the basis of the survey findings, a coliform concentration was determined which was adjudged to be a standard of assured safety for such recreational waters. This coliform concentration of 1000 organisms of 100 ml correlated with observations of the absence of particles of sewage origin on the beach and was supported in court as being reasonable. As a consequence, this was adopted as the standard for ocean water contact sports areas.

The evolution of regulations pertaining to sewage reclamation in California followed the same pattern. The first standards adopted by the State Board of Health in about 1918 prohibited the use of raw sewage for crop irrigation and limited the use of treated effluents to irrigation to non-food crops. As wastewater reclamation became more prevalent both

in the number and type of reuse applications, more restrictive standards were established for more critical kinds of use. In 1933 the regulations were modified to allow sewage which had been treated to meet the drinking water standards to be used on food crops. In each instance the standards were developed on the basis of attainability and "good practice" and in each case was associated with efforts to strictly limit public health risks from sewage reclamation. Largely the standards represented a response to reducing existing or potential risks.

The Santee project represented a major departure from past circumstances with relation to establishing regulatory standards. For the first time, standards were not developed in order to provide a basis for correcting an unsatisfactory situation. In this case, public health agencies were being asked to develop a standard for a project proposing a deliberate exposure of the public to a proposed new use of reclaimed sewage. A fundamental decision was made that the standard to be applied was to be the total absence of any enterovirus, based on the assumption that a waste-treatment process assuredly controlling enterovirus would without question be free from any human pathogen and thus be a safe water for the intended recreational use. As a backup, decision was made to carry out an epidemiological study of the population to be exposed. An important consideration in this case ultimately was the fact that the wastewater was percolated into the ground and picked up downstream, thus providing a positive and presumably fool-proof barrier to entero-pathogens. The recreational program at Santee was gradually increased by careful short steps from passive aesthetic enjoyment of the lakes to boating, through a season of "fishing for fun", to fishing which permitted fishermen to keep and eat their catches, and finally to swimming.

Each stage of the recreational program development was accompanied by a carefully conceived study directed at health concerns. For example, during the season of fishing for fun, the catches were examined for the presence of pathogenic agents, including virus, and the results evaluated by health advisors before fishing for keeps was allowed. A several-agency committee, including federal, state, and local authorities, outlined, planned, and conducted the study of successive health issues. The resultant standards for the Santee operation were based on a thorough prior evaluation of extensive field data and have been shown to be reasonable and feasible and yet acceptable from a public health standpoint.

It is important to note that prior to approval of the effluent for use in a swimming area, the State Department of Health appointed an ad hoc Advisory Committee on Epidemiology to review the past program of non-contact water use and to advise the Department of Health on the risks, if any, in body contact use of the reclaimed water. After reviewing the information from the previous two years of study, the Committee sanctioned the swimming pool program if various standards and controls were complied with (and they were). The use of expert advisory panels to aid the Department of Health in developing new or revised reuse standards is now standard procedure, the most recent example being the Consulting Panel on Health Aspects of Wastewater Reclamation for Groundwater Recharge.

In recent years there has been a great deal of controversy surrounding the reuse of wastewater for domestic purposes. We presently do not have adequate information on which standards could be based and must proceed cautiously as was done at Santee.

As with the Santee project, domestic reuse presents a categorically different situation, where the responsible parties must identify the line between safety and hazard, not for existing conditions which are to be cleaned up, where any improvement is a step in the right direction, with no potential for added risk. Instead, we are attempting to provide the basis for safely embarking on new practices seen as having social value, but which are optional.

In creating new standards, if it is possible to deal in absolutes, as at Santee by establishing a standard on the basis of the absence of some constituent, the problem may be relatively easy. On the other hand, if a number must be selected representing a line between safety and hazard, a very great problem exists. How is such a safe level established? Not by experiments on humans, though Neefe did this with human volunteers in the 1940's working on infectious hepatitis - but probably never again in this country. Not by animal experiments, because it is not yet possible to convert dose-response from animal to human, except in terms of absolutes such as is done for carcinogens in food additives (Delaney amendment to the Federal Food, Drug & Cosmetic Act). How, therefore, can we establish standards for domestic reuse? The best that I can visualize is to continue in the direction represented by Santee. It may be possible to select one or more indicator substances and seek to control them to such a degree that none can be found in a final product. Then tests can be performed for the presence or absence of specific constituents. In doing this, perhaps the unsurmountable problem of identifying that line between safety and hazard can be avoided.

In conclusion I would like to read some fairly extensive excerpts from an article appearing in the December 1976 issue of the magazine, "Environmental Science & Technology." The article is titled "Environmental cancers: humans as the experimental model?"

"Puzzling out the mechanisms that trigger cancerous states and finding how to prevent them may be the most challenging medical feat of the next several decades. Now that most infectious diseases have been conquered, the war on cancer looms ever more important.

"But a shift in emphasis is taking place. With the general acceptance that the majority of human cancers are caused by environmental factors, investigators are turning from a search for cancers' causes to better methods of prediction and prevention.

"Cancer has been called a 'social disease,' a 'disease of civilization.' One consumer advocate claims that we are entering the 'carcinogenic century,' and the facts may very well bear him out.

"Fact: Cancer is totally nondiscriminating; it crosses all age, ethnic and sex barriers to kill nearly one of every five Americans, and this death rate is increasing.

"Fact: Cancer's economic impact is overwhelming; for 1971, the minimal estimate is $15 billion for direct and indirect costs.

"Fact: There can be no cancer without a cancer-causing agent. As many as 90% of all cancers may be caused by environmental factors--a substantial portion of which are chemicals--and these cancers are potentially preventable.

"Fact: Research on environmental carcinogens and the prevention of human cancers has received low government priority. The National Cancer Institute (NCI), the federal agency spearheading the war on cancer, expends only 15% of its $700-800 million budget on research to unravel the mysteries of environmental carcinogensis.

...

"Environmental pollution is not new. Quietly and insidiously health hazards have been introduced by man into his environment for centuries. ... The greatest health concern today is over cancer. And a chemical legacy of almost 40 years lays buried: a dormant time-bomb waiting to be triggered. Certainly, society must soon decide what clean-up measures and preventive controls it is willing to finance. ... The trend is toward prevention through the elimination of carcinogens from all environments.

"However, to prevent means that one must first detect and define. And to detect and define, one must test. Accurate, rapid and relatively inexpensive tests to assess the carcinogenic potential of pesticides, industrial solvents, food contaminants, toxic metals, air and water pollutants, drugs and cigarettes are being developed. ...

"Using today's standard tests, no threshold level below which a substance is 'safe' has yet been demonstrated for a carcinogen. Since risk cannot be eliminated entirely, standards-setting regulatory agencies such as the EPA and the FDA must find that level of risk (the probability of cancer being induced) which is 'socially' acceptable. Implicitly factored into such a definition is an assessment of the benefits to be derived from the use of a potentially toxic material.

"EPA has indeed adopted risk/benefit analyses in its standards-setting process; but these analyses are not very precise, often because the first level of input--the scientific data--is not available or is imprecisely known. This imprecision has led industrialists to say that the risks are inherently overestimated, while ecologists argue the converse. ...

"In the assessment of risk of cancer to man from chemicals in his environment, two sources of information are generally available: epidemiologic data and animal studies. Epidemiologic data are available for only a few industrial chemicals, and animal studies pose many problems.

"To obtain statistically significant data from any test protocol, cancer incidences of 5-10% must be obtained. This requires the administration of large doses of the test substance to a reasonably large number of animals, usually rats or mice. The data obtained must then be extrapolated across species and at exposure levels that are many times lower than the equivalent administered dose. This experimental design does not take into account human genetic, geographic, dietary, occupational, age or health status variability.

"Current methods for detecting a chemical's cancer-causing potential are relatively insensitive at best. A negative finding in animals does not necessarily indicate that the chemical is harmless to man: arsenic is an excellent case in point. Even if a chemical produces a positive response in the test system, it is extremely difficult, and may be impossible, to set a safe exposure level for humans. Many scientists question the validity of extrapolating animal data to man.

"However, because of the long latency period before the appearance of cancer, strict cause and effect relationships are difficult to demonstrate in man. ...

"So far the tests used to detect cancer-causing agents have 'red-flagged' only those most powerful agents hazardous enough to produce cancer when acting alone. Yet, indications are that many human cancers result from the synergistic interaction of several factors present chronically and at low levels.

"Late last year, the House Subcommittee on Environment and the Atmosphere, chaired by Congressman George E. Brown, Jr. (D-Calif), held hearings on the costs and effects of chronic exposure to low levels--often below present federal standards--of pollutants. The hearings were held primarily to serve as a warning against complacency and a 'relaxation of environmental standards in the absence of short-term acute effects.'

"An earlier commissioned Library of Congress study of the issue prompted Brown to state: 'What seems to come out from their review is that we don't even know what it is that is killing us, and very little is being done to find out.' The hearings reinforced the Library's findings that the evidence is fragmentary at best and that quantification of the effects is made more difficult by the inadequacy of present laboratory and monitoring techniques.

"Starting with inadequate health and ecological monitoring systems, and a dearth of baseline information from which to assess man's contributions to changes in human or ecological health, potentially dangerous trends go unrecognized. Remedying this

situation, according to Brown's subcommittee, calls for improved monitoring systems, and a reorganization of federal environmental research programs. The latter to assure better interagency coordination, a more efficient utilization of existing information-gathering systems, and more rapid exchange of data and methodology."

* * *

"The best summary of the health problems besetting all industrialized countries, but particularly the U.S., was put forth by E. F. Schumacher, author of Small is Beautiful. He stated that America's rising rate of environmentally-induced cancers emanated 'not from our failures but from what we thought were our greatest successes.'

"So, until man can duplicate the detoxification mechanisms of the common cockroach--one organisms that can live on a diet of carcinogens and survive--he will quickly have to learn to prevent pollutants from entering his environment and, in all, make a better accommodation with his surroundings...or he will be doomed to quietly poisoning himself."

It has always been the policy of the Department of Health that the best quality water available should be used for domestic purposes and poorer quality water used for less demanding purposes. Until positive and "solid" scientific information is available, water reuse projects can and should proceed for end uses that do not include ingestion of the reclaimed water.

CALIFORNIA WATER RESOURCES CONTROL BOARD'S WATER REUSE POLICY

by

Bill E. Dendy
Executive Officer

CALIFORNIA WATER RESOURCES CONTROL BOARD'S WATER REUSE POLICY

by Bill E. Dendy, Executive Officer

There are two basic roles for the Water Resources Control Board. One is our regulatory program in which we set and enforce waste discharge requirements as well as reclamation requirements which have been established by the Department of Health. Another regulatory program we administer is the appropriative water rights system for the State.

In addition to the regulatory work we have a program of grants and another program of loans in which we use funds available to us to encourage wastewater reclamation, among other things. Both the regulatory and financial assistance programs are supported by modest planning and research programs. We try to direct what money we do have for that purpose to where we think it will do the most good.

The basic policy direction for the Board's water reclamation activities comes from a couple of sections of the Water Code. One is in the Porter-Cologne Act, in Section 13512, and has to do with wastewater reclamation activities. Section 13512 says that the intention of legislature is that the State undertake all possible steps to encourage development of water reclamation facilities so that reclaimed water may be made available to help meet the growing water requirements of the State. Section 13512 is in that part of the Code having to do with regulations.

There is another Section in the part having to do with funding. The board is authorized to enter into contracts with municipalities for reclamation of water. Both of these Sections

have their foundation in the California Constitutional provision that "the water resources of the State be put to beneficial use to the fullest extent of which they are capable. Waste and unreasonable use or unreasonable method of use of water will be prevented and that conservation of such water should be exercised with the view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare."

In addition to these State laws and Constitution, the Federal Water Pollution Control Act (Public Law 92500) in the section on construction grants has two provisions that guide the EPA as well as the State. It says that "the administrator shall encourage waste treatment management which results in the construction of revenue-producing facilities providing for the reclamation of wastewater and, as appropriate, the works proposed for grant assistance will take into account and allow to the extent practicable the application of technology at a later date which will provide for the reclaiming or recycling of water or otherwise eliminate the discharge of pollutants."

Both of these laws are very direct in what they set forth as policy. The Board has always tried generally to comply with these policies but not in a particularly well-structured way until recently. Jean Auer saw the need for an overall plan for the Board's activities in reclamation, and she became the driving force behind the development of our Wastewater Reclamation Policy and Action Plan. I am sure you are all familiar with that from Jean's discussions with you in the past but, just briefly, the plan has set in motion at the Board a new emphasis on

reclamation in our program of planning and grants and loans and regulations on water quality and water rights and research. The action plan identifies some of the current impediments to wastewater reclamation, which are the focus to our research needs. I might just list some impediments.

One is the area where Henry Ongerth is concerned: the probable presence of pathogenic organisms, such as bacteria and viruses, and toxic constituents such as stable organic compounds, heavy metals, etc., which raise questions that need resolution for certain uses and require that the quality of reclaimed water be carefully matched to beneficial uses.

The second is environmental impact, such as groundwater degradation, accumulations of toxic materials in soil, plants and animals, etc. A third impediment is a requirement that reliability of the conventional waste treatment facilities be maintained at a high level. And a fourth is a requirement for the development of improved and more expensive monitoring techniques.

The Board's regulatory role is not strictly reactive in the sense of most regulatory agencies. Instead, our policy defines what we consider to be an assertive implementation role in which the Board will initiate action to foster wastewater use whenever and wherever it is the sensible thing to do, using the regulatory tools and the funding tools that are available to us.

We are currently trying to get two regional wastewater reclamation planning efforts underway in the Los Angeles/Orange County Area and San Francisco Bay Area, using the construction grant funds. In those studies we cannot limit participation to

the conventional wastewater agencies, some of which are telling us now that they really have no stake in wastewater reclamation unless it is the least costly disposal alternative. We intend to include also the local and regional water supply agencies as well as the Department of Water Resources and the U.S. Bureau of Reclamation. EPA and the Department of Health will participate as well because of the water supply protection responsibilities they share.

In that regard I am particularly concerned about the possibility that the Federal Drinking Water Act may turn out to be a major institutionalized impediment to wastewater reuse.

Due to my impending demise as Executive Officer of the Board, I feel like I am in a particularly good position to give advice; and there are three things that I think WATERCARE should do. One is that you more actively lobby for water management programs that include wastewater reclamation as a part and, when I say "lobby", I mean before the State Board, the Department of Water Resources, the Bureau of Reclamation, the EPA, the Department of Health and, particularly, the new commission that has just been formed and is going to be looking at California water law over the next year: the Governor's Water Law Review Commission. This is a once-every-forty-years effort to take a look at the water laws of the State, and I think you would be missing a good opportunity if you do not go to this Commission, participate in its deliberations, and help to find a way to build more incentive for wastewater reclamation into the law.

The second thing I think you should do is push even harder than you are now pushing to resolve the outstanding constraints

which seem to limit the reuse of water. I listed some of them.

The third thing, and very important, is: I think that you should find a way to counteract the anti-reuse sentiment that has built up in the water supply industry, particularly in agriculture, in recent months. I think if you do not do this the "anti's" are going to win the day, and WATERCARE may be the only viable nongovernmental organization available to carry the banner of including water reclamation in future planning for water supply.

Since EPA is not here, I will report for them. I have just been in Washington, last week, and had several meetings with EPA. I had the pleasure of spending some time with the new Assistant Administrator for Water Programs, Tom Jorling. Tom has a good history in the water program. He was on the staff of the Senate subcommittee that drafted much of Public Law 92500. He is very supportive of the idea of wastewater reclamation. I think you will find a strong advocate there for this function, and I hope he perseveres in his effort because if he does, and if he can have the kind of impact that is possible there, I think you can look ahead to constructive programs at EPA.

FORMULATION AND FINANCING OF WATER REUSE PROJECTS

by

Ronald B. Robie
Director
California Department of Water Resources

FORMULATION AND FINANCING OF WATER REUSE PROJECTS

Edited transcript of Ronald B. Robie's Comments at the Fourth Annual Conference of WATERCARE, 26-28 June 1977, Concord, California

Thank you very much.

It is truly a pleasure to be here at the annual conference of WATERCARE, and I am also glad to be in Contra Costa County.

The title of my speech today is Formulation and Financing of Water Reuse Projects, But I'll try not to be as stuffy as that sounds. I will describe some of the things that are going on in water reclamation, and point out some areas where I think we can do more.

During the 1960's and early 1970's there was a lot of talk about water reclamation, but very little actual activity. In contrast -- and this may be one of the positive influences of the drought -- there has been considerable progress in the field during the past two or three years.

There has, for example, been quite an increasing emphasis in the last couple of years on the issue of reclaimed water for power plant cooling. In 1974, the Legislature passed a law encouraging the use of waste water for cooling, and my Department has made a study of the possibilities in an attempt to define the problems and approaches that should be taken.

The California Environmental Quality Act, which requires evaluations of the environmental impact of governmental actions, requires that water reclamation be considered as an alternative to the more traditional water management concepts, and it has been my Department's policy since 1975 that we encourage the reclamation of water.

A suit now awaiting decision by the California Supreme Court may have a profound effect on the future of waste water reclamation in this State. That action was brought by the Environmental Defense Fund and others against the East Bay Municipal Utility District, and the key contention so far as reclamation is concerned is that the district should reclaim more waste water instead of seeking a new source of fresh water.

Most importantly and most recently, the State Water Resources Control Board adopted its policy and Action Plan for Water Reclamation in California, and the plan is about

to be implemented in a variety of ways.

I am somewhat discouraged, by the way, at the outcry that arose after publication of the State Board's plan. For years, people talked about the need for reclamation, and when the Board began implementing it, a lot of people in the water industry screamed and yelled.

We are finding, as the plan begins to take effect, that it is not as offensive or as impossible to deal with as many contended. I predict it will be seen as a very significant action and will result in much more reclamation, and the Board should be commended for perserverance. It came through with a workable means of accomplishing what we all had been talking about.

Reclamation always produces arguments, and we in this room have heard them all -- it is too expensive, it may cause health problems, and so on. I think we will make progress with regard to financing, and I will comment on the health issues later.

This past winter, the Department of Water Resources worked with a variety of water interests in the State to put together a package of legislation -- the Delta Alternatives program spelled out in Senate Bill 346 -- that for the first time, considers the use of reclaimed water as a source for the State Water Project. I think it is an important step forward -- and it fits in well with some other concepts that are not new in themselves but are new in the implementation phase of the State Water Project.

For example, SB 346 also includes groundwater storage of State Water Project water, a concept Governor Pat Brown talked about 12 years ago. Even then, it was not really a new idea; we're simply talking about using groundwater reservoirs as a place to store water.

But the point is that a lot of concepts many people have thought about for a long

time are now beginning to come to the fore. Water management programs at all levels must include a wide range of approaches -- one single approach of one kind or another just isn't enough.

The drought has, of course, had a positive influence on water reclamation, just as it has on water conservation. In fact, I think the current drought will be a very large incentive to our loosening up on some of the restrictions on water conservation.

Unfortunately, in the last couple of years some have felt that water reclamation might actually be a threat to other kinds of water development, and we actually lost ground in implementing reclamation programs in some areas.

While the drought is having devastating effects in some areas, it is also letting people experiment with water reclamation and to see that it can be done. This is also true of water conservation, as I mentioned earlier -- the less water we have available, the more interested we are in conserving it. However, if we develop effective water conservation programs, we could find that we have less waste water available to reclaim.

I think it is obvious that local agencies are the best candidates to carry out water reuse projects; those at the local level with the confidence of potential users can best analyze the potential and they find it much easier to deal with farmers or other industrial users in their service areas.

People should not expect Sacramento to do the job for them -- but they should expect us to support those programs either through technical knowledge or through any financial aid we can make available.

If you go into a reclamation project, I urge you to lay the groundwork very carefully and develop a program that is appropriate for a given community and situation. Some have tried to develop programs without that kind of careful planning and have

encountered opposition. And once people are turned off a project, it is very hard to get them back on the track.

Before I get down to specifics on reclamation, let's talk a bit about water conservation. The last time I discussed water conservation at a WATERCARE meeting, the drought had not yet arrived and it may have seemed that my expectations were unreasonably high.

Since then, efforts to conserve water around the State have exceeded my fondest hopes -- although, unfortunately, it took a record drought to make that happen.

Despite the impetus of the drought that helped us out, I think there is an opportunity to get people to use less water on a long-term basis. We have shown that we can save water without a drastic change in life style; we can get by with less water in our cities and we can also reduce agricultural water demand in many areas of the State. In other areas, we can't reduce demand much, but there are potential savings as described in our water conservation report, Bulletin No. 198, "Water Conservation in California." I think it is important that all agencies in the State look at that report and give attention to its basic recommendations.

In addition to that study, we have undertaken this year a pilot program for urban water conservation. This program was established under Assembly Bill 380, which was introduced at the request of the Department by Assemblyman Eugene Gualco. We will have six pilot projects in various parts of the State dealing primarily with water conservation by means of water-saving shower and toilet devices. The overall objectives of the study are to demonstrate the willingness of the people to use the devices, to find the most effective means of getting the devices into homes, and to evaluate the effectiveness of various types of devices.

The details changed as the program developed. As we went through the legislative process, people suggested that we charge for the devices rather than giving them away. So, in two of our program areas, devices will be sold to the public. In

San Diego, the largest of the six areas, we will be dealing with over 300,000 homes. The other five areas are Santa Cruz County, the El Dorado Irrigation District, the City of El Segundo, the City of Sanger, and the community of Oak Park (near Ventura).

We picked San Diego for one of the largest of our programs because it didn't have as acute a water shortage as some of the other areas of the State. We are very desirous of seeing how these kinds of programs would go in the absence of critical drought. A situation such as now exists in Marin County would obviously increase the citizen participation compared to other communities. So far, we have had very good response in Santa Cruz, which is the first program which got under way.

We will have a preliminary report on these studies by the middle of July and a final report to the Legislature by the end of the year. We hope that it will contain information useful to local agencies and to the State in determining the best means of more fully implementing water conservation programs.

Turning back to the subject of water reclamation, one of the most important things we can do is to get the Federal Government off the dime.

In the first place, in both conservation and reclamation the Environmental Protection Agency has not been in the forefront. In fact, our water conservation program under SB 380 should have started six months before it did. We tried to get a federal grant to fund it and we finally gave up in complete despair. The EPA thought well of our plan but wouldn't approve it. As a result, California California funded it with $600,000.

EPA has not encouraged water conservation even though it could be an important part of EPA's management program. EPA has also displayed a lack of enthusiasm for water reclamation until very recently, and it changed its attitude then only because the State Water Resources Control Board sort of forced it upon them. In addition, the Bureau of Reclamation and the other federal water agencies have done almost nothing

in regard to either water conservation or water reclamation.

Secretary of Interior Cecil Andrus in his recent speech to the National Conference on Water indicated that the President and the new administration of the Department of Interior are concerned about water conservation and water reuse, and we hope very strongly that this philosophy will find its way into project formulation at the federal level.

Many of you are aware that when the San Felipe Project was before the Congress two years ago, my Department raised questions about water conservation and water reclamation. We worked out an arrangement with the Santa Clara County Water District that provided for a 15,000 acre-foot reduction in the yield of the project to the district if water reclamation is feasible. This condition was incorporated into the District's contract with the government. In other words, the burden is placed on finding water reclamation a feasible water source and represents the first time the federal government has agreed to a water management plan for a project that included both surface supplies and water reclamation as well as water conservation.

We think all federal projects should be so formulated. The Bureau of REclamation has been negative and resistant to change, and I hope there will be impetus toward modifying those views now that the new Secretary has committed himself to a philosophy of modern water management. I think we can look for some leadership from the federal government -- or at least from the Department of the Interior -- in the area of water reclamation.

Under AB 346, the legislative package dealing with the Delta Alternatives Program that I mentioned earlier, my Department can use water from reclamation to supply our State Water Project contractors.

In a related development, the Los Angeles Department of Water and Power is working on a large-scale program for reclamation that involves all of its existing or proposed

facilities. Under this program, they would consider replacing or supplementing water supplied by the Metropolitan Water District -- one of our contractors -- with reclaimed waste water, exchanging dollars between agencies as appropriate. This fits right into our program, and I look upon it as an exciting new angle to the State Water Project.

At dinner we discussed briefly with Linda Phillips the possibility that this kind of thing could be done for example, in the Santa Barbara area, which is scheduled to receive water from the State Water Project. I think there is a tremendous opportunity for supplementing -- not replacing -- the yield of the project with reclaimed wastewater. I think this is going to be one of the more important breakthroughs in the future. We will in time, need additional supplies for the State Water Project. We can't really tell what sort of water will be used in the Project 20 years from now, and I think we need as broad a management scheme as possible.

What about the financing for all these projects?

As I mentioned in my comments about EPA, this is one of the big barriers. Right now, however, we can use funds from the Clean Water Grant Program, local funds, and in some cases, funds from EPA or other federal programs, depending upon the nature of the community.

The water reclamation action plan adopted by the State Board this year will, I think, greatly liberalize the use of federal and state grant funds for water reclamation. In the first place, a special category is created for water reuse projects for water supply under 201 planning of the Clean Water Grant Program.

Beginning July 1, funds will be available to projects in California. Since January, these projects have been considered on a case-by-case basis and those that are placed in the new category can be elevated individually to a fundable category. Funding

Funding will cover all the preliminary preparation including the research and demonstration activities that are necessary, in addition to the step two and step three grants available for actual design and construction.

One of the problems in the past was leaving off funding at the end of the outfall. Currently, funding of water reclamation projects includes transportation to the area of use. The State Board has now extended the use of grant funds to the actual user just about as far as it can. In fact, there will be a substantial amount of money available from the current grant list. There is, in my opinion, a much better opportunity now for funding of our reclamation projects than ever before, and I think this will be filled in the next year or so and I hope that all of the agencies that are interested will now take advantage of the opportunity.

I would like to mention a couple of things the Department is doing with regard to its role in water reclamation. We are working on an agriculture irrigation water demonstration project in the Castroville area, we are developing a waste water reclamation project through the Santa Clara Valley Water District that is one of our commitments under our agreement with them on the San Felipe project, and we are also working on several research projects.

Parenthetically, I might say there has been a continuing concern by the Legislative Analyst on the relative roles the Department of Water Resources and the State Board concerning water reclamation. We have signed a number of written agreements on our various responsibilities and to avoid a duplication of roles we very carefully analyze each project submitted to us and each subject area that we are advised to get into.

The Castroville project is a very interesting one. The purpose of the project, which is being sponsored by the Monterey Peninsula Water Pollution Control Agency, is to demonstrate that reclaimed water can be safely used to irrigate food crops. It

was developed in part because we objected to an application for a federal small project loan on the grounds that reclaimed water was not considered as a source of water. We are now spending about $50,000 annually in services to this project, and we hope to find another agricultural demonstration project to try to overcome some of the resistance built up in recent years to using reclaimed water for various crops. The food crops that will receive water from the Castroville project include artichokes, broccoli, cauliflower, celery, and lettuce, all of which will at times come into contact with reclaimed water.

In cooperation with the Santa Clara Valley Water District, we are studying the possibility of using reclaimed water from the San Jose/Santa Clara waste treatment plant for agricultural irrigation and reclaimed water from the Gilroy/Hollister area for landscape and agricultural use in the Santa Clara area. This is a broad study and one which we are committed to as a result of our San Felipe work. It is quite encouraging to me that we are all working together in that area.

Our dollars are supporting research into groundwater recharge at Water Factory 21 and the Palo Alto project in the Santa Clara Valley Water District and two research projects involving spreading grounds. We will be spending about $60,000 next year on these projects and $130,000 the following year, so you can see we are using our own resources to join with the State Board and the Department of Health in moving forward on water reclamation.

These research programs are aimed, in part, in coming to grips with some of the health issues involved in waste water reclamation, and we are beginning to make progress with the Department of Health. We are now at the point where we are able to work in specific areas on specific projects, and I hope we can expedite these kinds of studies so we can clear the air on the many heretofore vague concerns about the effects of water reclamation.

No matter how you look at our future, the principal use of reclaimed water in the coming years will be to replenish groundwater supplies.

Again, it is obvious that the drought has been a big help to us with regard to moving ahead on both water conservation and reclamation. It is vital now to make certain that those areas irrigated this year on a temporary basis with reclaimed water go on being irrigated with reclaimed water in the future.

The drought has taught us some important lessons, and we must not forget those lessons when it starts to rain.

Thank you very much.

DUAL DISTRIBUTION SYSTEMS

by

Hal Marron
Lowry & Associates

DUAL DISTRIBUTION SYSTEMS

by
Hal Marron, Lowry & Associates

I am here to tell you more about what the Irvine Ranch Water District is doing in the field of water reclamation and reuse. The Irvine Ranch Water District was formed primarily to provide water and sewer service for the Irvine Ranch, a large landholding with extensive agricultural operations in Orange County. Portions of Costa Mesa, Tustin, Newport Beach and Irvine are on lands which originally made up the Irvine Ranch. When the Irvine Company decided that they were going to develop their ranch and urbanize it, they brought together some consultants to plan something different from ordinary land developments. As farmers who had developed a water supply and distribution system for their agricultural needs, they knew the value of water and the need to use it carefully. Therefore, as long ago as 1961, they had the foresight to hire consultants to make a study of the use of reclaimed water and sewage effluent for agricultural reuse.

The Irvine Ranch has an extensive water system with reservoirs, dams, canals, and everything needed to transport their water. To them the very idea that water would be treated and allowed to run to waste was unthinkable. The 1972 Master Water Resources Plan for the Irvine Ranch Water District included a plan for a reclaimed water system. That plan has progressed to the point that they have reclaimed and reused every drop of sewage from the district since they started to urbanize the area.

Now there have been problems, of course, and it hasn't been all that simple. The original idea was to treat the sewage and then return

it to the irrigation system of the ranch for reuse. The ranch has reused most of the effluent to date. Extensive studies were made to determine if there were locations where we could recharge the groundwater basin, since recharging the groundwater basin has been pretty much the classical method of reclaiming sewage effluent, but we were unable to find any suitable recharge area.

And so the idea was used to develop a complete non-potable water distribution system, sometimes referred to as a reclaimed water system. However, we use our new terminolgy, a non-potable water system, because we have more demands on this system than we can supply from our sewage treatment plant. The difference is made up with untreated Colorado River water.

To give you a little background, the Irvine Company has about 14,000 acres under irrigation. This includes about 5,000 acres of tree crops, 1,000 acres of commercial nurseries, 300 acres of turf grass, and the rest of it in row crops. They grow almost everything, including asparagus, tomatoes, celery, and strawberries, on a year-round basis. They take one crop off and put another one down. The reclaimed water was, until just recently, secondary treated effluent. This water is also being used for irrigation of a county park and a golf course. The District is dedicated to the fact that all the sewage water that they produce will be reclaimed and used.

When the Irvine Company did their planning they developed what they call the village concept--a cluster of self-contained individual villages with shopping centers, parks and schools. Most of these are

condominium style with common open green belts. Irrigation of the open green space between the various units is the responsibility of the various homeowner associations. These green belts have been irrigated from the domestic water system, but now they are being designed to be irrigated from our non-potable water system. We have several sources of non-potable water. Untreated water from the Metropolitan Water District is received at Irvine Lake and brought into the district by an open canal to the various dams and reservoirs for the ranch and our non-potable water system. Some wells are available in the area that were developed by and used primarily for the Ranch. There is also some local runoff that is captured. Then we have the effluent from our treatment plant. We have just gone on-line at the plant with complete filtration facilities so that we are now meeting the requirements for unrestricted irrigation. We are presently blending water from all of these sources. We are now planning that anything that is green and can be irrigated conveniently from our reclaimed water system such as streetscapes, parkways, median strips and the common green belt areas will be served reclaimed water. In the typical Irvine village, these areas will run from 18 to 23% of the total land area, and will be irrigated from our non-potable water system. We are now putting in a pressurized system for sprinkler irrigation, because we have found that the ranch system that is primarily a gravity system for row crops and orchards isn't suitable for the pressurized irrigation needs that we do have today.

With this comes other problems, and one of them is how to design a system that is separate and identifiable. We have developed a set of

standards which includes a tape warning system for all reclaimed pipe lines. The regulations require that every irrigation system has to be reviewed and the plans checked by the District to make sure that it complies with their standards. We are working in cooperation with both the County and State Health Departments and have developed a set of rules and regulations for the use of reclaimed water. The operators and the individuals that are going to use the reclaimed water must be responsible to the District for the proper use of the reclaimed water. They must be educated in their system, we don't just turn them loose. The worst thing that could happen would be to have something get cross-connected and have a group of people get sick; it would really set the program back. We don't intend to have anything like that happen at the District. We are going to end up with a dual water system with the same pressure standards in the non-potable system as the domestic water system. That gives you a little thumbnail sketch of what the Irvine Ranch Water District is doing in this field. If there are any questions, I will be happy to try to answer them.

Q. Very briefly you mentioned something that you used to distinguish these dual systems. You mentioned a tape alarm system. Do you use colored pipe and what is the tape you use?

A. Well, because most of the water materials look alike, particularly the asbestos cement that you will use in your systems, we are using a yellow tape that is about a foot wide and says "caution-reclaimed water". This tape is placed right on top of the pipe so that

anybody that digs to make a tap runs into this tape which is continuous over the entire pipeline.

Q. What kind of tape?

A. It's a plastic tape, yellow with black letters on it. Anybody that runs into it sure knows it's there. I think the most important thing is that, while the system is identified, the district is actually seeing the plans and supervising the construction of the individual irrigation systems. The district requires inspection at the time they go in and to the same construction standards they would put in their domestic system.

Q. What is the alarm?

A. Well it's not really an electronic alarm to that extent, it's a visual alarm.

Q. What would you do it you have a plant upset and how are you going to dispose of the water?

A. We have automatic sensors, turbidity meters and chlorine residual meters that actually shut down our delivery system. Fortunately, at our plant location we have a number of acres of duck ponds where we can transfer the water, if necessary, then we have the capability of bringing it back and retreating the water through the plant. We are looking for this complete system dependability.

Q. What is your ultimate source of supply in case of a long-term shut down? How would that problem be solved?

A. In case of a long-term shut down of our supply from the treatment plant, we have a source of untreated Colorado River water that we

can bring into our non-potable system. To give you some idea of the amount of agricultural water needed, the ranch itself will use about 38,000 acre feet. And of this, about 23,000 acre feet is imported water at the present time. About 3,000 acre feet is local runoff, about 6,000 acre feet from wells, and then someplace in the neighborhood of 6,000 acre feet is the reclaimed water. With the 25,000 acre feet of storage that we have in Irvine Lake, we can pretty well make up the difference of water.

Q. The peaking requirement of your users, are you going to put them on a schedule of water use to cut down the peak use?

A. With our agricultural customers, we have no problem, because they are used to scheduling. They do want water when they want it, naturally, but they are used to scheduling. The balance of our customers are generally using time clocks, and we find that they don't seem to mind scheduling, but we are not stressing it. We feel that it is going to be self-regulating, and we are not trying to discourage people from using the reclaimed water. But, as you can appreciate, we are trying to develop a base so that we have a demand for the reclaimed water before we really have the reclaimed water to use, and so our non-potable water is a blend of reclaimed water and untreated imported water.

Q. In your present program do you permit individual residential usage or do you envision eventual individual user situations?

A. No. One of the present uses prohibited, is to even have a hose bib on a reclaimed water system. You should appreciate the fact, that

the City of Irvine's development of these village concepts has resulted in practically every resident being a part of a condominium or included in a homeowners' association. The homeowners' association maintains the green belt area in the village. The common areas are under a single supervisor employed by the homeowners' association, who handles the green belts and the irrigation of these green belts from the reclaimed water system. So where you have an individual 5 or 6,000 square foot lot, we don't have that.

Q. How much treatment do you give your reclaimed water?

A. The reclaimed water, up until 6 months ago, was standard secondary effluent. Now we have installed filters for tertiary treatment and we are actually producing a polished effluent. One thing I might say also, is that reclaimed water for agricultural use has someplace between 25 and 35 of fertilizer value in every acre foot. So that while we sell this water for landscaping and irrigation at $69 an acre foot, there is $20 to $25 rebate in less fertilizer that they have to buy.

Q. Do you have that information available?

A. I don't have it with me, but we do have it in several of our reports. If you give me your card, I will send it to you.

Q. Is all of your reclaimed water blended?

A. No, it is not all blended, but we supplement as needed. We have a greater demand for non-potable water than we are presently reclaiming. We like to use our reclaimed sewage first, because if we

put it in our reservoir system, the nutrients which are great for agriculture and great for growing things also causes the lakes to turn green. So we don't like to put it in the reservoirs if we can help it because it degrades our water. We have been experimenting with pressure builders and fine screens. We are still learning about what happens to the water after you put it in the reservoirs and what treatment is required when you want to take it back out.

Q. Are the nurseries using reclaimed water?

A. We haven't convinced them yet, because the boron content of our reclaimed water is right at threshold for some plants. One of the larger commercial nurseries is looking into the use of reclaimed water very seriously, because they are very conscious of the cost of water. I think that they probably will use it as a blend with their other water sources so that the boron content comes down to where it's acceptable.

Q. Will Henry allow them to use it for the nurseries?

A. Yes, I don't see any reason why he wouldn't.

Q. What is the cost of agricultural water, the cost of water for landscape?

A. Our potable water for agriculture purposes is $60.58 an acre foot. Our non-treated MWD water for agriculture purposes is $41.66 and our reclaimed water for agriculture purposes is $33.50 or $26.80, depending on what our source of domestic water is. I might point this out, the District normally receives a 50/50 blend of State water and Colorado River water which brings the total dissolved

solids to about 500 ppm and the TDS of our reclaimed water up around 750 ppm. When we are on straight Colorado River water, it is coming into the District in the neighborhood 700 parts of TDS and then our reclaimed water about 900 ppm, and it takes more reclaimed water, if you would, to leach out the salts, that is the reason that we have the lower price.

Q. How did you arrive at the fertilizer value of the water?

A. The way we determine the value is to find out the nitrogen and phosphorus content in pounds per acre foot and then determine what it would cost for the same amount if you bought commercial fertilizer with the same nutrients. Then we approach the Irvine Company and tell them how great this is that we are giving them this bonus of having these nutrients in the water. Just so we don't get too big-headed and think that we are giving them something, they let us know that there is a right time to fertilize, so consequently, the value of the fertilizer is diminished somewhat because there are times when they really don't want to fertilize, particularly, in citrus farming.

Q. What restraints has the health department placed on your reuse, and what is their attitude?

A. The health department, as you heard Henry today, is concerned with the safety and the health aspects of reclamation. We have found that you don't fight the health department, but you enlist their cooperation and it works much better. The District has a set of rules and regulations for the use of reclaimed water and the

construction of the system. We wanted this document to be something that we could live with and wasn't just a consultant's viewpoint or a water purveyor's, or of somebody that had to get rid of the effluent. So we brought the State and County Health Departments in right to begin with and they worked with us in writing the regulations. We have found them to be nothing but cooperative. You have to be able to put on two or three different hats once in a while and be able to look at something from the other person's point of view. And we are not fighting Henry to make a direct reuse, we have plenty of places to put all the water we can get without direct reuse for domestic consumption. We are going slow step-by-step, and we are working with them. And, true, we haven't worked out all of the problems, but whatever we have is working, and we find the spirit of cooperation from the State and the County Health Departments is nothing but a plus. You can't work it any other way. You have too much at stake.

RECENT ACTIVITIES OF THE ORANGE COUNTY COASTAL PROJECT

By

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RECENT ACTIVITIES OF THE ORANGE COUNTY COASTAL PROJECT

Introduction

Orange County's greatest natural resource is its groundwater basin. This basin was used by the early pioneers to develop the area into the focus of a notable agricultural industry. Although the water demand was supplied by diversions from the Santa Ana River, the level of the groundwater table gradually subsided. Water was being extracted faster than it could be replaced naturally.

During the late 1940's and 1950's, the population within Orange County exploded. The sparsely populated agricultural community was rapidly becoming a densely populated urban and industrial center. Corresponding with the change in the character of the County's economy came an intense increase in the demand for water. The groundwater basin which had previously supplied nearly all water was diminishing. Groundwater levels were declining at an increasing rate and seawater had begun to intrude and replace fresh water along the coast.

The Orange County Water District (OCWD) whose responsibility is to manage, conserve and protect Orange County's groundwater, began supplementing the basin with imported surplus Colorado River water. As a result of OCWD's action, adequate water levels were attained to halt the deleterious effects of seawater intrusion. However, seawater had already advanced over two miles inland. In order to confine the saltwater and permit greater flexibility in basin management, OCWD embarked on the Orange County Coastal Project (OCCP).

The OCCP consists of a series of extraction, injection and deep water supply wells, observation wells and Water Factory 21, a 15 million gallon per day (mgd) advanced wastewater treatment (AWT) plant coupled with a 5 mgd reverse osmosis (RO) system. This report intends to present a brief description of each facet of the OCCP and review performance of Water Factory 21 for the six-month period of October 1, 1976 through March 31, 1977.

Observation Wells

Most of the water extracted for use in Orange County is taken from the upper zone which has four divisions - the Talbert, Alpha, Beta and Lambda aquifers. These four aquifers merge in the Talbert Gap (see Figure 1) to form one aquifer which is continuous with the ocean. The middle and lower zones are protected by the Newport-Inglewood Fault.

There are 29 observation wells in the area. Fifteen of these monitoring wells are adjacent to the injection well line and are intended for use in evaluating the effects of injection in each of the separate aquifers. The other monitoring wells, as can be seen in Figure 1, are distributed throughout the Talbert Gap. All wells are sampled on a regular schedule and analyzed to determine the water quality in the area.

Extraction Wells

Seven extraction wells are aligned approximately parallel to the coastline as seen in Figure 1. These wells penetrate only the Talbert aquifer and remove brackish water, creating a pumping

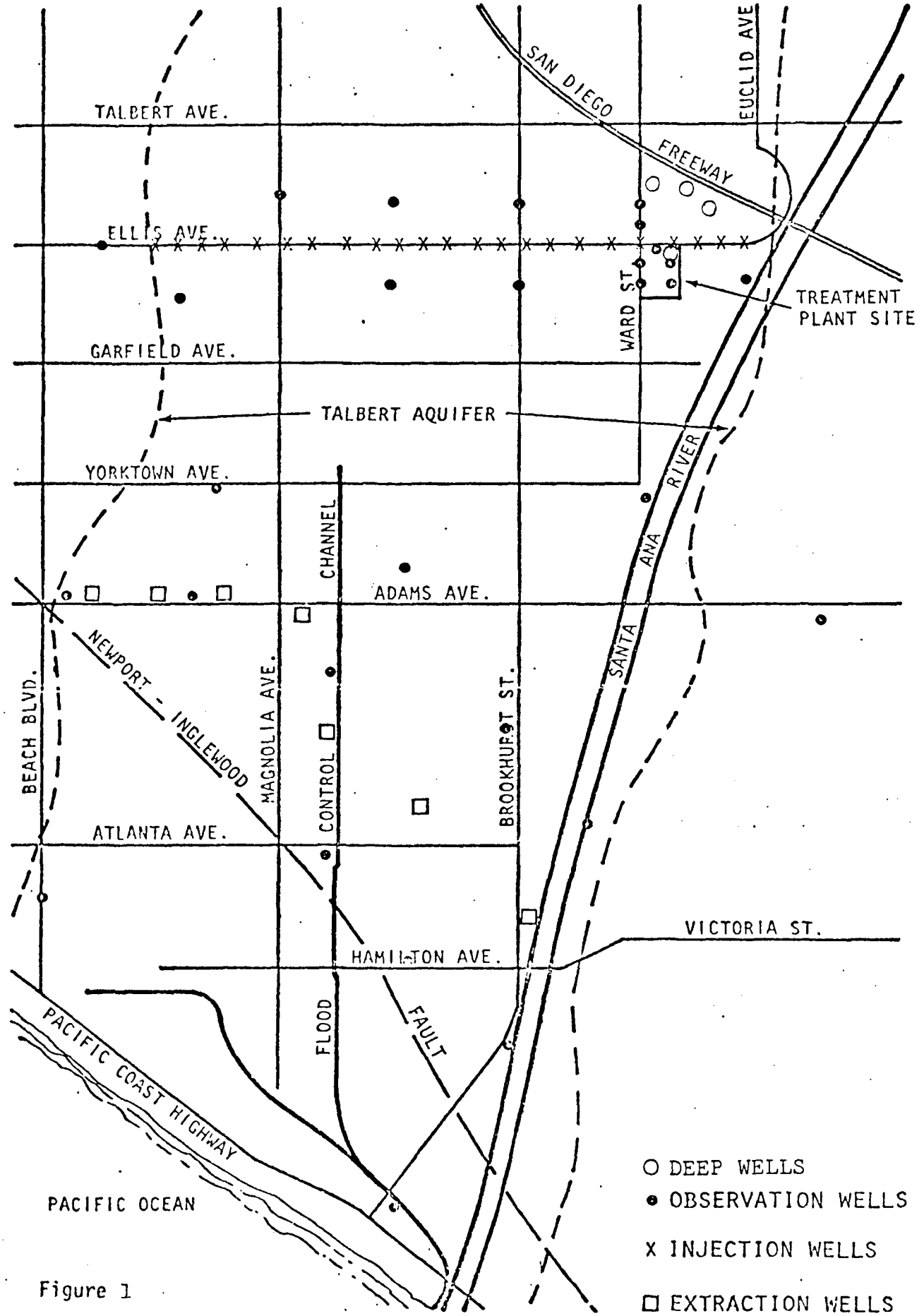

TALBERT AVE.
SAN DIEGO FREEWAY
EUCLID AVE
ELLIS AVE.
WARD ST.
TREATMENT PLANT SITE
GARFIELD AVE.
TALBERT AQUIFER
YORKTOWN AVE.
CHANNEL
ANA RIVER
SANTA
ADAMS AVE.
BEACH BLVD.
NEWPORT - INGLEWOOD
MAGNOLIA AVE.
CONTROL
BROOKHURST ST.
ATLANTA AVE.
VICTORIA ST.
HAMILTON AVE.
FLOOD
FAULT
PACIFIC COAST HIGHWAY
PACIFIC OCEAN
O DEEP WELLS
• OBSERVATION WELLS
X INJECTION WELLS
□ EXTRACTION WELLS

Figure 1

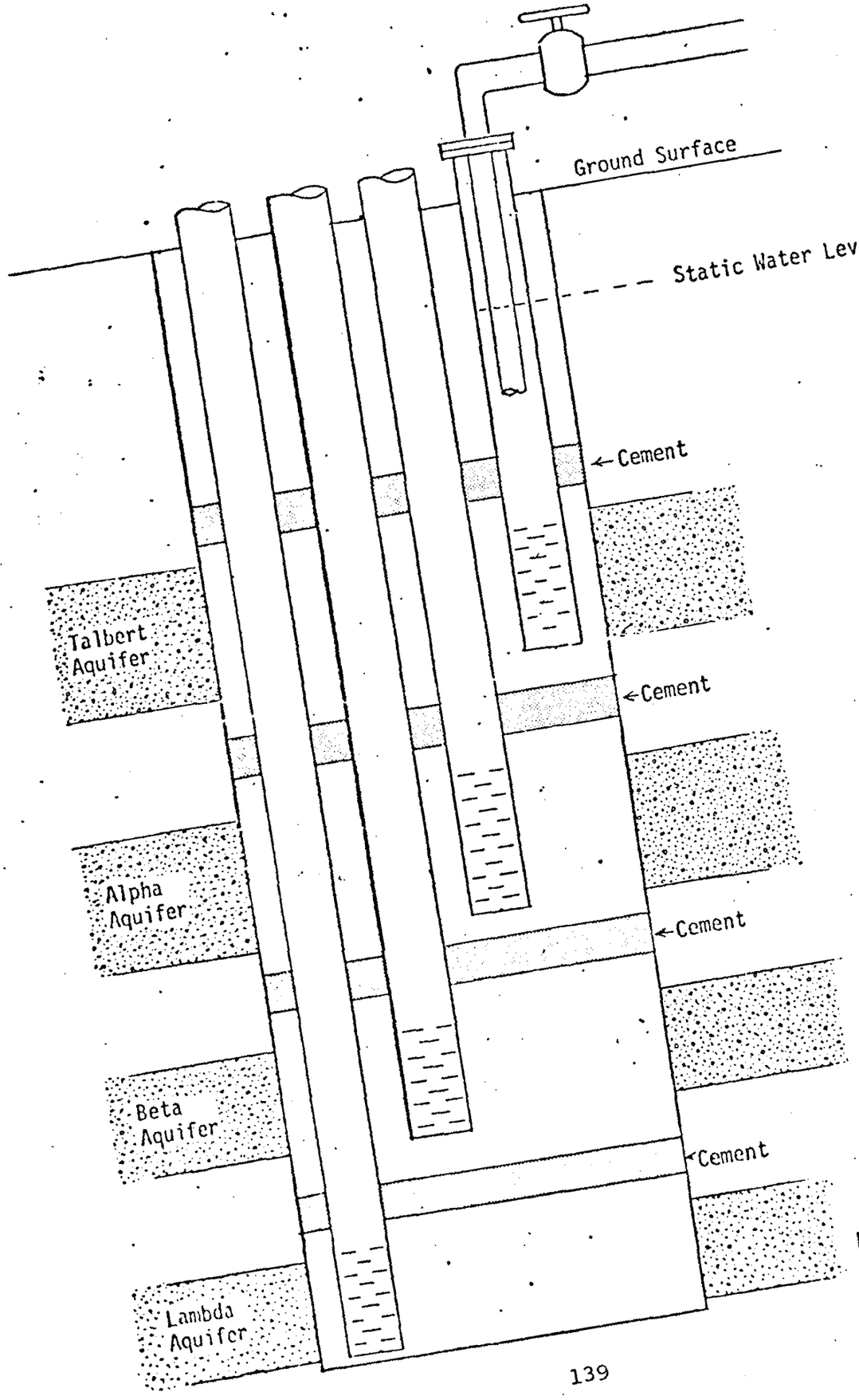
trough and return it to the ocean via adjacent flood control channels. However, because the water levels have decreased during the past two years, the extraction wells have not been operated.

Deep Wells

The OCWD owns and operates four deep water wells. These wells are 1,000 to 1,200 feet deep, penetrating aquifers that are unaffected by seawater intrusion. Each well is capable of producing up to 3,500 gallons per minute (gpm) of low TDS water for blending and injection into the barrier system. During this period, approximately 3,278 acre-feet were produced from the deep wells.

Injection System

Twenty-three injection wells were used to form the freshwater hydraulic mound portion of the seawater barrier. The wells are aligned 600 feet apart along Ellis Avenue which approximates the front of seawater intrusion. Also, because of the differences in each aquifer's characteristics, it was deemed desirable to be able to control the flow to each aquifer separately. To achieve this, the wells were designed with up to four separate casings, each perforated in a different aquifer and each controlled from the surface. Figure 2 is a diagram showing a typical four casing well. Flow and pressure into each injection point, 81 in all,



Not to scale

Figure 2

can be measured manually at the well, but is also telemetered to a computer in the central control room of the AWT plant. Here the data from each well can be displayed as often as desired by the operator.

Injection into the barrier began on October 6, 1976. Fifteen injection wells were initially brought into service allowing an injection rate of 50 gpm per well; then gradually more wells were brought into service until the peak of 20 mgd was being injected. From October through March, almost 2 billion gallons of blended reclaimed water was injected. Table I displays the quantity of water that was injected each month.

Advanced Wastewater Treatment (AWT)

The other water supply that is used for injection is tertiary treated, trickling filter, municipal wastewater. The AWT plant is capable of producing up to 15 mgd of high quality water for injection into the barrier system.

Ultimately, the water used for the injection barrier will be extracted by wells in the basin and used for municipal, industrial and irrigation purposes. Because of its eventual use, strict limitations on water quality have been issued by the California State Water Quality Control Board - Santa Ana Region. As can be seen in Table II, the quality of the injection water closely parallels that imposed on drinking water. Also, under the same mandate, it is required that the wastewater be blended with at least an equal portion of demineralized or well water prior to injection.

TABLE I

VOLUME OF WATER INJECTED

Month	AWT, MG	Wells, MG	Total, MG
October	79.9	162.9	242.8
November	118.7	241.8	360.5
December	96.2	196.1	292.3
January	105.6	188.1	293.7
February	111.0	235.4	346.4
March	106.7	235.3	342.0
	618.1	1,259.6	1,877.7

Blend ratio is about 2 parts well water to 1 part wastewater

TABLE II

REGULATORY AGENCY REQUIREMENTS
FOR INJECTION WATER

CONSTITUENT	MAXIMUM CONCENTRATION (mg/l)
Ammonium	1.0
Sodium	110.0
Total hardness ($CaCO_3$)	220.0
Sulfate	125.0
Chloride	120.0
Total nitrogen (N)	10.0
Fluoride	0.8
Boron	0.5
MBAS	0.5
Hexavalent Chromium	0.05
Cadmium	0.01
Selenium	0.01
Phenol	0.001
Copper	1.0
Lead	0.05
Mercury	0.005
Arsenic	0.05
Iron	0.3
Manganese	0.05
Barium	1.0
Silver	0.05
Cyanide	0.02
Electrical Conductivity	900 µmhos/cm
pH	6.5 - 8.0
Taste	None N
Odor	None
Foam	None
Color	None
Filter effluent turbidity	1.0 JTU
Carbon adsorption column effluent COD	30 mg/l
Chlorine contact basin effluent	Free chlorine residual

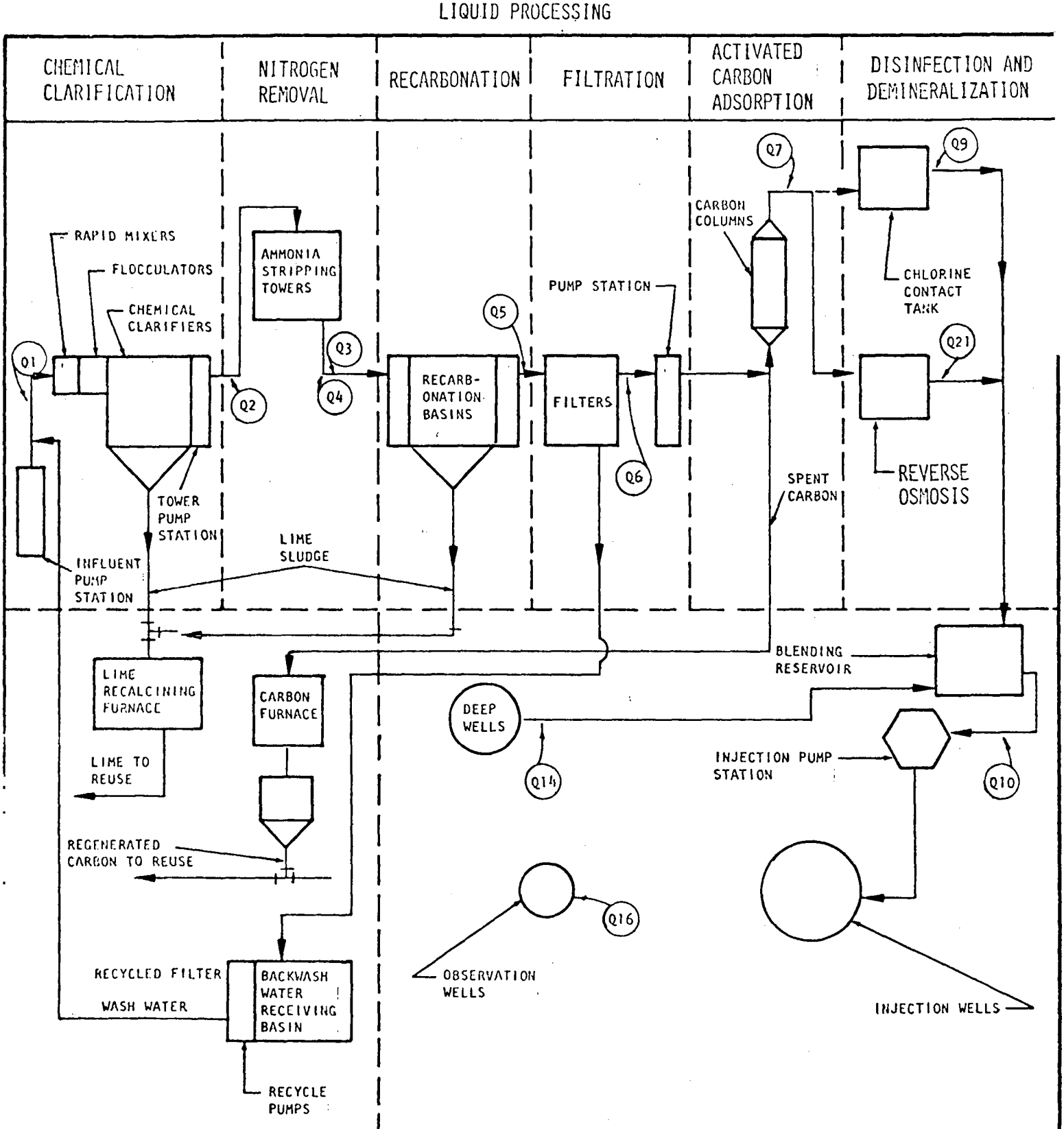
The original concept of the Water Factory, linked a Federally funded seawater desalter with the AWT facility. However, due to the discontinuation of the Federal Government's seawater desalting plant and lack of sufficient quantities of blending water, the OCWD began planning and construction of a 5 mgd RO facility. This large RO plant will produce 5 mgd of very high quality desalted wastewater which will be used for blending. The RO system will be completed and ready for operation in early June 1977.

The AWT plant is designed to treat 15 mgd of trickling filter effluent from the Sanitation Districts of Orange County. From Figure 3, the AWT treatment processes include: lime coagulation, flocculation, and clarification; ammonia stripping; two-stage recarbonation; multi-media filtration; activated carbon adsorption; disinfection; breakpoint chlorination;and blending. All of the processes are designed in parallel trains so that each is capable of treating up to half of the flow.

During the six-month operating period, the AWT plant average flow was 4.7 mgd and treated about 860 million gallons of water for injection.

Lime Treatment

Trickling filter effluent as received into the AWT plant, is high in suspended solids, turbidity, phosphate and chemical oxygen demand (COD) (see Table III). In order to reduce the



FLOW SCHEMATIC & SAMPLING LOCATIONS

15 MGD WASTEWATER RECLAMATION PLANT

FIGURE

TABLE III

CHARACTERISTIC WATER QUALITY
AWT PLANT INFLUENT

Ammonia-Nitrogen (NH_3-N)	40 mg/l
Boron (B)	1 mg/l
Calcium (Ca)	109 mg/l
Chloride (Cl)	250 mg/l
Chemical Oxygen Demand (COD)	133 mg/l
Electrical Conductivity (EC)	1676 µmho/cm
Magnesium (Mg)	23 mg/l
pH	7.6
Phosphate-Phosphorus (PO_4-P)	6 mg/l
Sodium (Na)	200 mg/l
Turbidity	40 FTU

parameters, lime is used as the primary coagulant in chemical clarification. Lime is slaked and added as a slurry to the rapid mix basin, then, to aid in increasing floc particle size and improve sedimentation, an anionic polymer, Dow A-23, is added to the final stage of the three stage flocculation. Lime addition is automatically controlled to achieve an optimum pH of 11.3, resulting in lime dosages of roughly 500 mg/l with polymer additions of 0 - 0.1 mg/l.

Flocculated water is allowed to settle and the performance of the clarifier is monitored primarily by observing the pH, turbidity, COD and phosphate concentrations. Figures 4, 5 and 6 indicate the periodic average of these parameters. It can be seen that the chemical clarification is a highly effective process for reducing turbidity, suspended COD, phosphate and elevating the pH for effective ammonia removal.

Removal efficiency was very high:

Parameter	Average Influent Quality	Average Clarifier Effluent Quality	Average % Removal
COD (total)	133 mg/l	49 mg/l	63
Mg	23 mg/l	0.2 mg/l	99
PO_4-P	5.8 mg/l	0.1 mg/l	98
Turbidity	40 FTU	1.1 FTU	97
pH	7.6	11.5	-

By elevating the pH above 9.5, magnesium is removed by the formation of magnesium hydroxide with the precipitation of $Mg(OH)_2$ essentially complete at pH 11; so raising the pH to 11.5, not only allows for ammonia removal, but also removes over 99 percent of the dissolved magnesium, resulting in the reduction of total hardness.

FIGURE 4

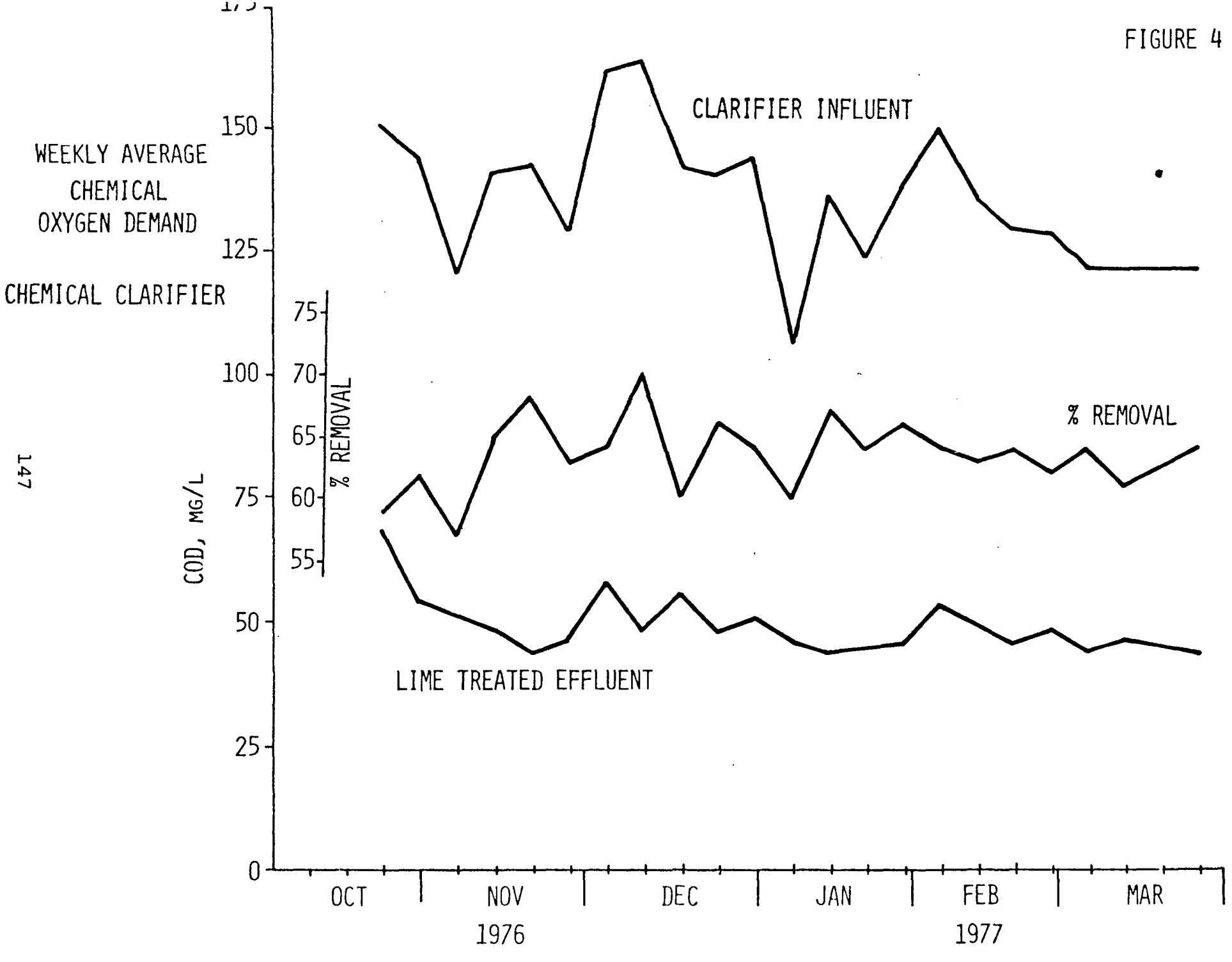

WEEKLY AVERAGE
CHEMICAL
OXYGEN DEMAND
CHEMICAL CLARIFIER
COD, MG/L
% REMOVAL
CLARIFIER INFLUENT
% REMOVAL
LIME TREATED EFFLUENT
150
125
100
75
50
25
0
75
70
65
60
55
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

FIGURE 5

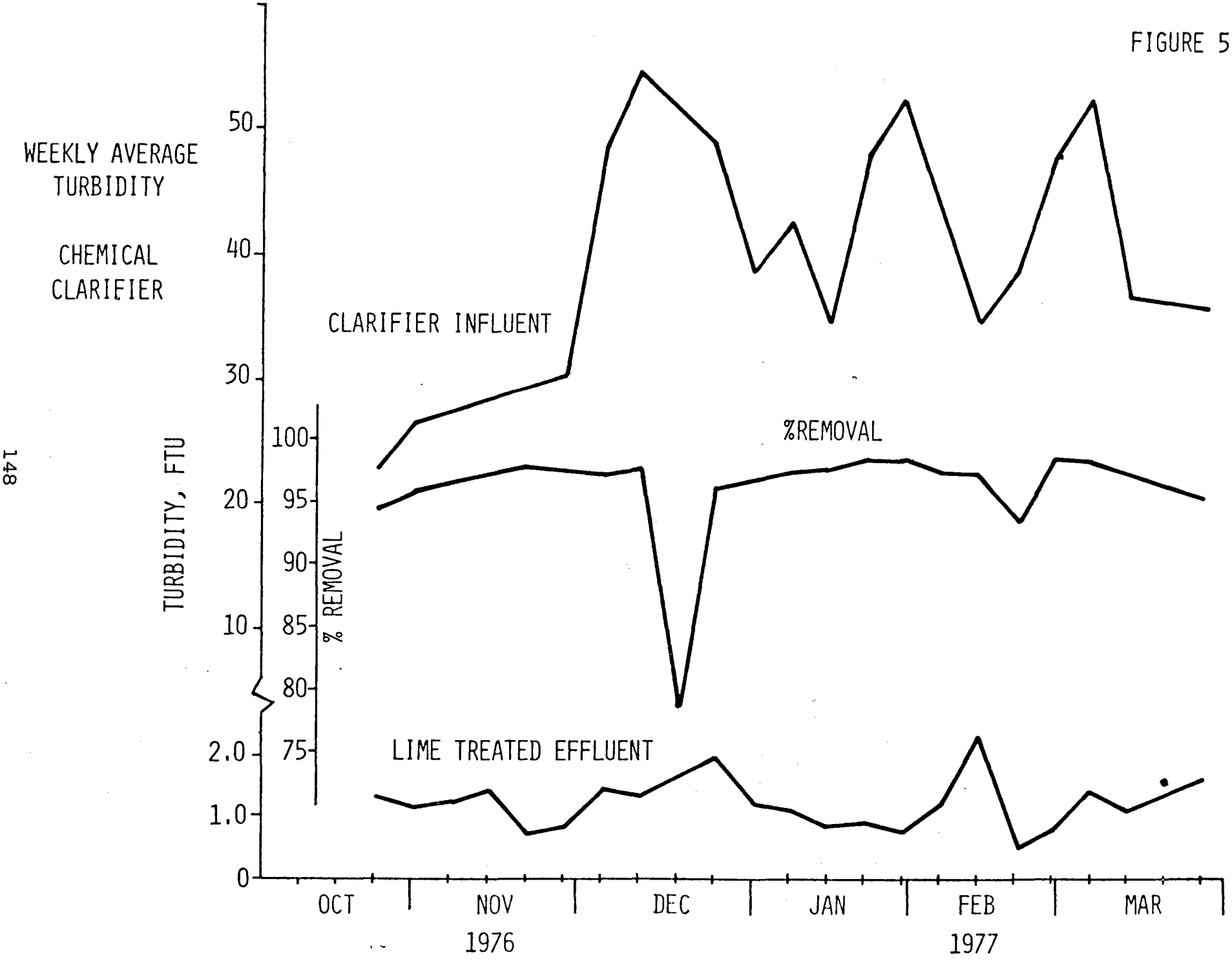
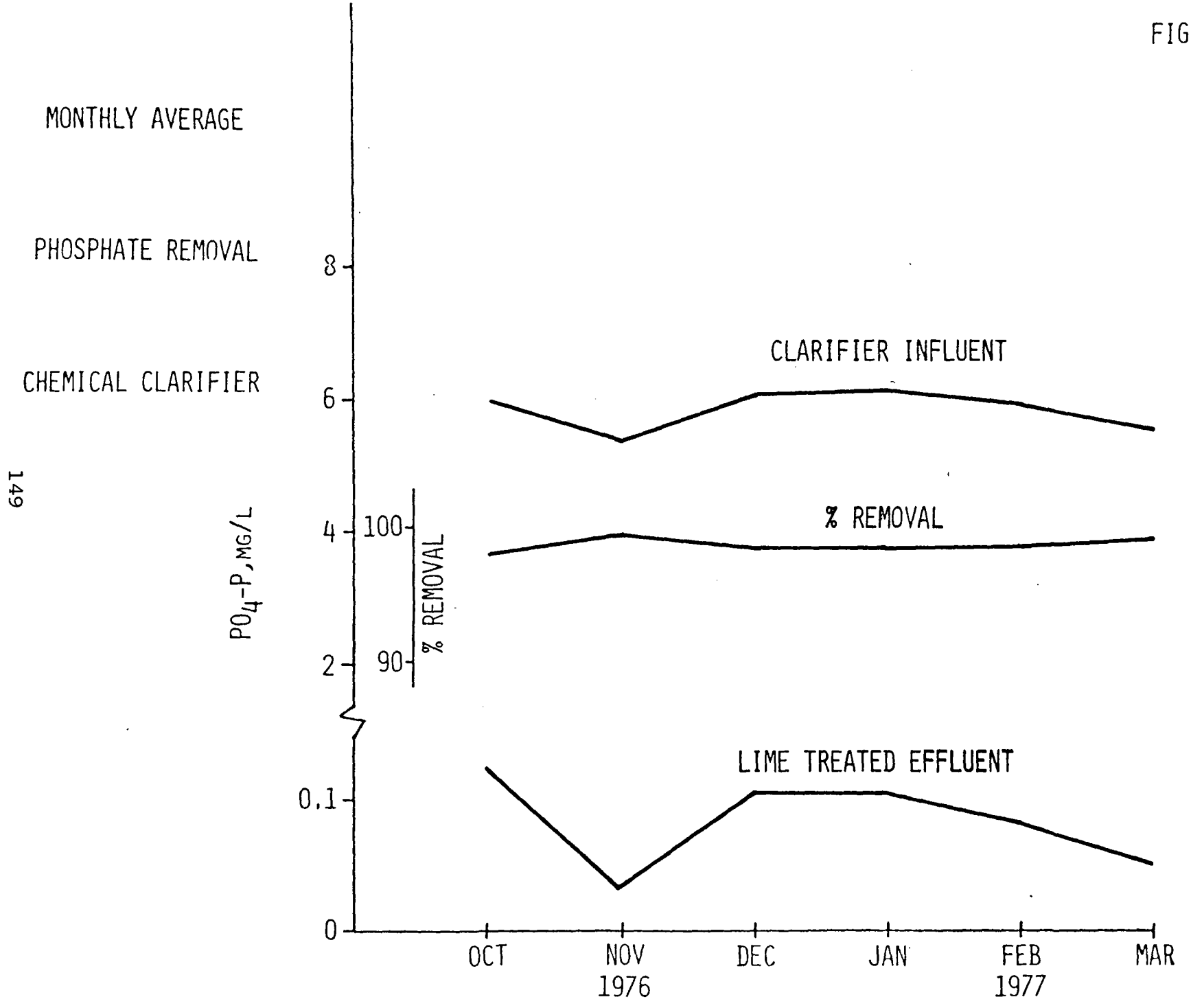

WEEKLY AVERAGE
TURBIDITY
CHEMICAL
CLARIFIER
CLARIFIER INFLUENT
%REMOVAL
LIME TREATED EFFLUENT
TURBIDITY, FTU
% REMOVAL
50
40
30
20
10
2.0
1.0
0
100
95
90
85
80
75
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

FIGURE 6


MONTHLY AVERAGE
PHOSPHATE REMOVAL
CHEMICAL CLARIFIER
PO_4-P, MG/L
8
6
4
2
0.1
0
100
90
% REMOVAL
CLARIFIER INFLUENT
% REMOVAL
LIME TREATED EFFLUENT
OCT
NOV
1976
DEC
JAN
FEB
1977
MAR

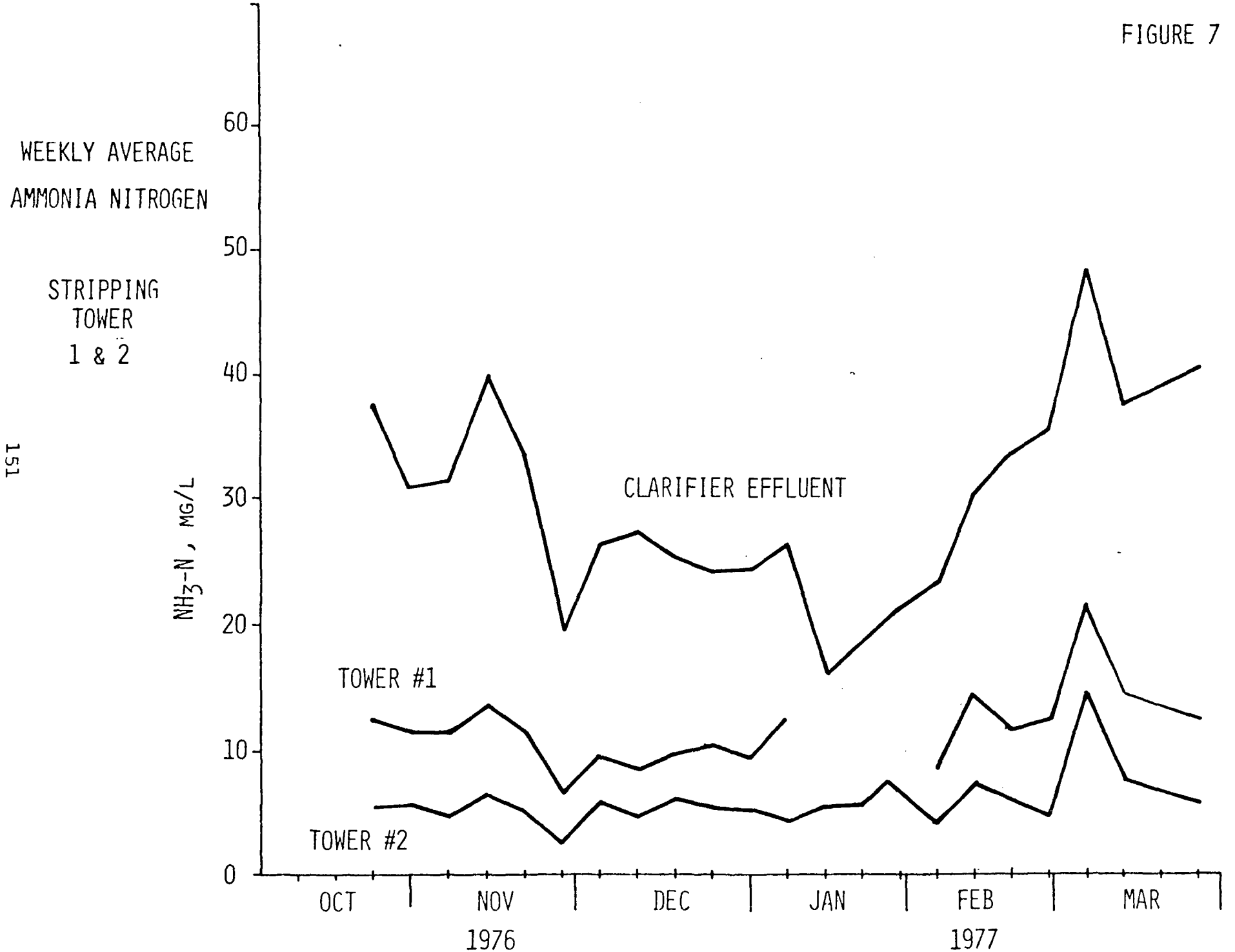
Ammonia Removal

The effluent from the chemical clarifier had an average pH of 11.5 and was pumped to the top of the ammonia stripping towers. The towers were originally designed to achieve two goals: (1) to air strip ammonia gas from the chemical clarifier effluent, and (2) to cool brine and process waters from a VTE/MSF seawater desalting system. The towers are fashioned with counter-current induced draft air flow at a designed hydraulic loading rate of approximately one gallon per minute (gpm) per square foot of packing area, achieving an air flow to water ratio of 400 cubic feet (cf) per gallon of wastewater. The depth of the polypropylene splash bar packing is 25 feet.

Each tower was originally designed to operate independently of the other. However, since no hot process waters are available to enhance ammonia removal for the individual towers, they were repiped so that the towers operate in series. This increased the efficiency of the ammonia removal.[1] Previous to this modification, ammonia removal was averaging only 65 percent. However, after the change and during this period, removal increased to an average 81 percent, with highs of 87 percent achieved. During the warm summer months, removals of well over 90 percent have been observed.

The ammonia-nitrogen concentration entering the plant averaged 40 mg/l. Approximately 20 percent was removed by the chemical clarifier either by surface desorption of the ammonia gas after lime addition or by precipitation of a magnesium ammonium phosphate complex. This removal resulted in a tower influent average of 32 mg/l. From Figure 7 it can be seen that the first ammonia stripping tower reduced the ammonia to 11.2 mg/l with

FIGURE 7


WEEKLY AVERAGE
AMMONIA NITROGEN
STRIPPING TOWER 1 & 2
NH_3-N, MG/L
60
50
40
30
20
10
0
CLARIFIER EFFLUENT
TOWER #1
TOWER #2
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

the second tower diminishing the concentration to a mean of 5.7 mg/l. Extreme influent ammonia concentrations were 72 mg/l in November and a low of 20 mg/l during January. Ammonia tower effluent averaged 5.7 mg/l during the entire six months which was 69 percent less than the previous six months.

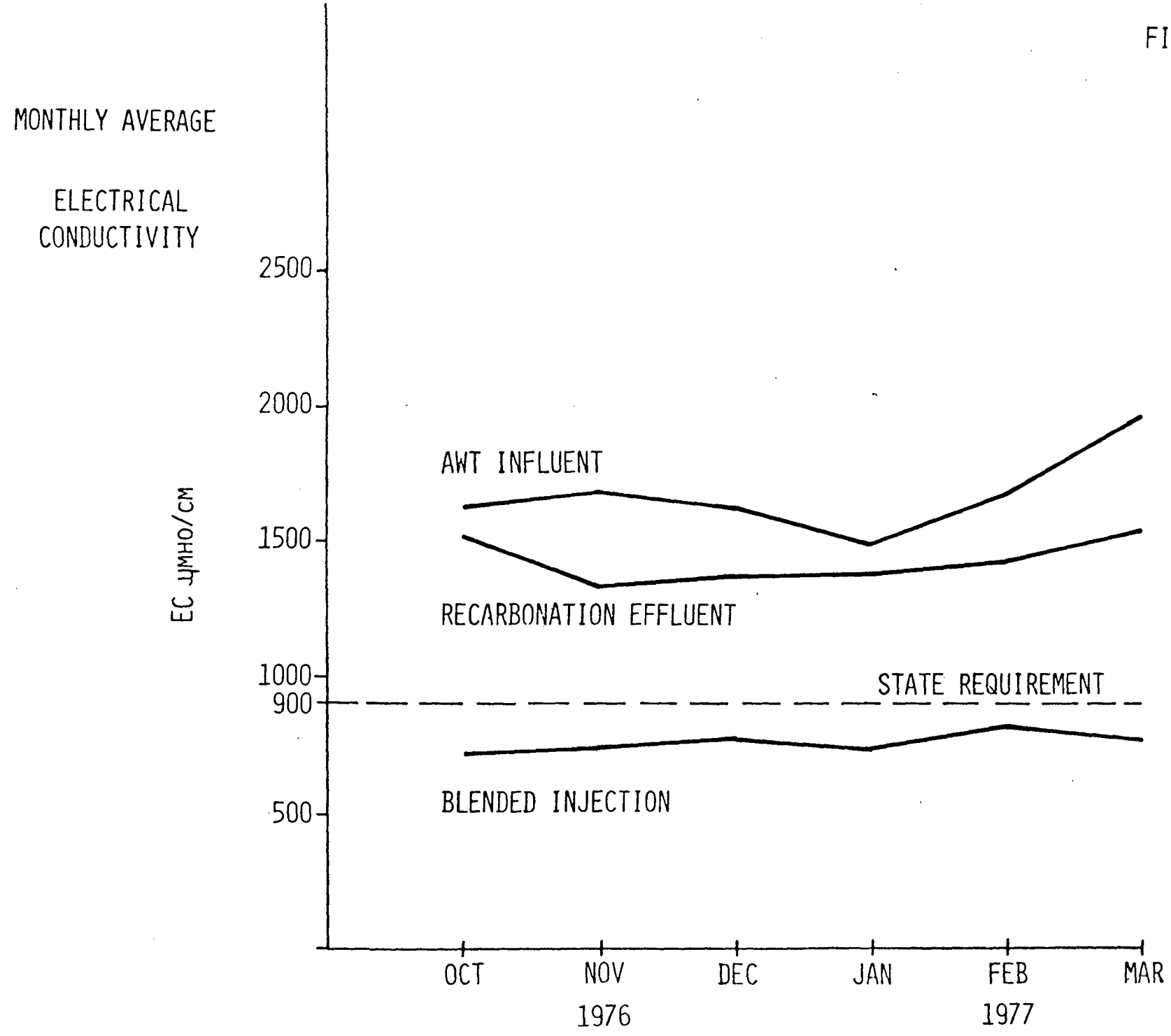
Recarbonation-Breakpoint Chlorination

Recarbonation is attained by diffusing carbon dioxide gas into the flow. Recarbonation can be accomplished in either one of two stages. Cooled and compressed stack gases from the lime recalcining furnace provide the source of CO_2 for recarbonation.

The purpose of two-stage recarbonation and intermediate settling is to recover as much calcium as possible. By reducing the pH to the pH of saturation for calcium carbonate, much of the dissolved calcium can be recovered, recalcined and reused in the chemical clarification. Two stage recarbonation proved difficult. The calcium fine precipitated in the first stage was difficult to settle and after trying polymer and sludge recycle, two stage recarbonation was discontinued. Figure 8 shows the typical decrease in electrical conductivity achieved through recarbonation.

Since the residual ammonia remaining after the ammonia towers is still too high for injection, the District began breakpoint chlorination. Previous attempts at breakpoint chlorination in the chlorine contact basin severely reduced the pH, hampering the

FIGURE 8


MONTHLY AVERAGE
ELECTRICAL CONDUCTIVITY
EC μMHO/CM
2500
2000
1500
1000
900
500
AWT INFLUENT
RECARBONATION EFFLUENT
STATE REQUIREMENT
BLENDED INJECTION
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

breakpoint reaction. Therefore, laboratory jar test analysis was initiated using high pH water prior to recarbonation to determine current pH and chlorine to ammonia ratios. The data from that work is shown in Figure 9.

The graph in Figure 9 indicates a final pH of 7 - 8 is optimum to achieve breakpoint, and with this pH range, a minimum of 9:1 Cl_2:NH_3-N is required. The data also indicates longer contact times are required for the lower chlorine to ammonia ratios.

The chlorine addition was subsequently modified so that the pH control process would be a result of combined CO_2 and chlorine addition. The pH is controlled by operating single stage recarbonation immediately followed by sufficient chlorine to meet the required 9:1 chlorine to ammonia weight ratio. Addition of chlorine at this location also provides one hour contact time through the recarbonation basin. This resulted in consistent reduction of ammonia nitrogen from the average 5.7 mg/l to less than 1 mg/l as well as reducing the pH to 8.3. Data collected from the full-scale combined recarbonation-breakpoint chlorination is displayed in Figure 10.

Filtration

Following pH adjustment, the wastewater flows onto one of four open, gravity flow, multi-media filter beds. The filter media is 30 inches deep and consists of stratified, coarse coal, silica and garnet sand. The supporting media is layered silica and garnet gravel with a Leopold underdrain system.

FIGURE 9

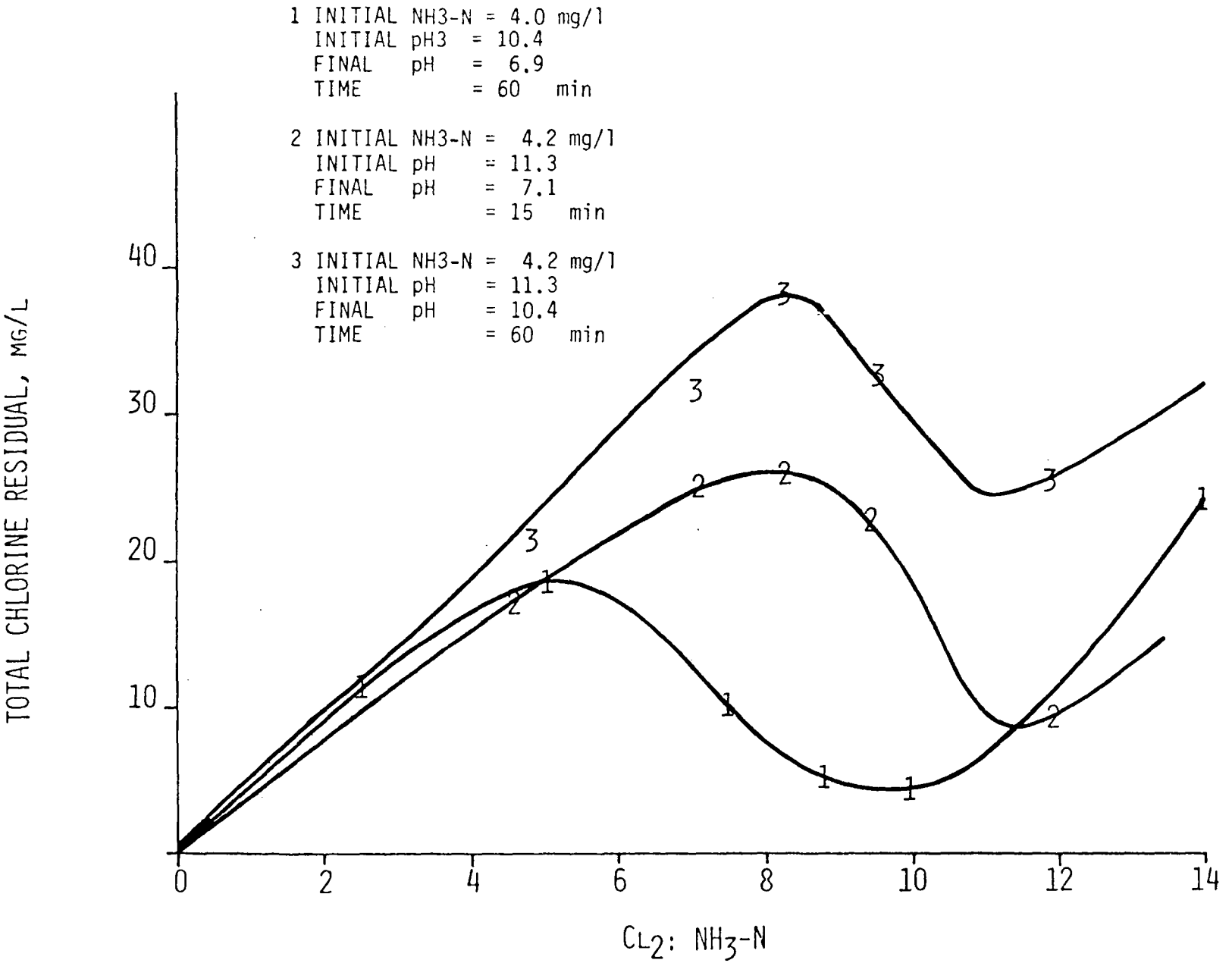
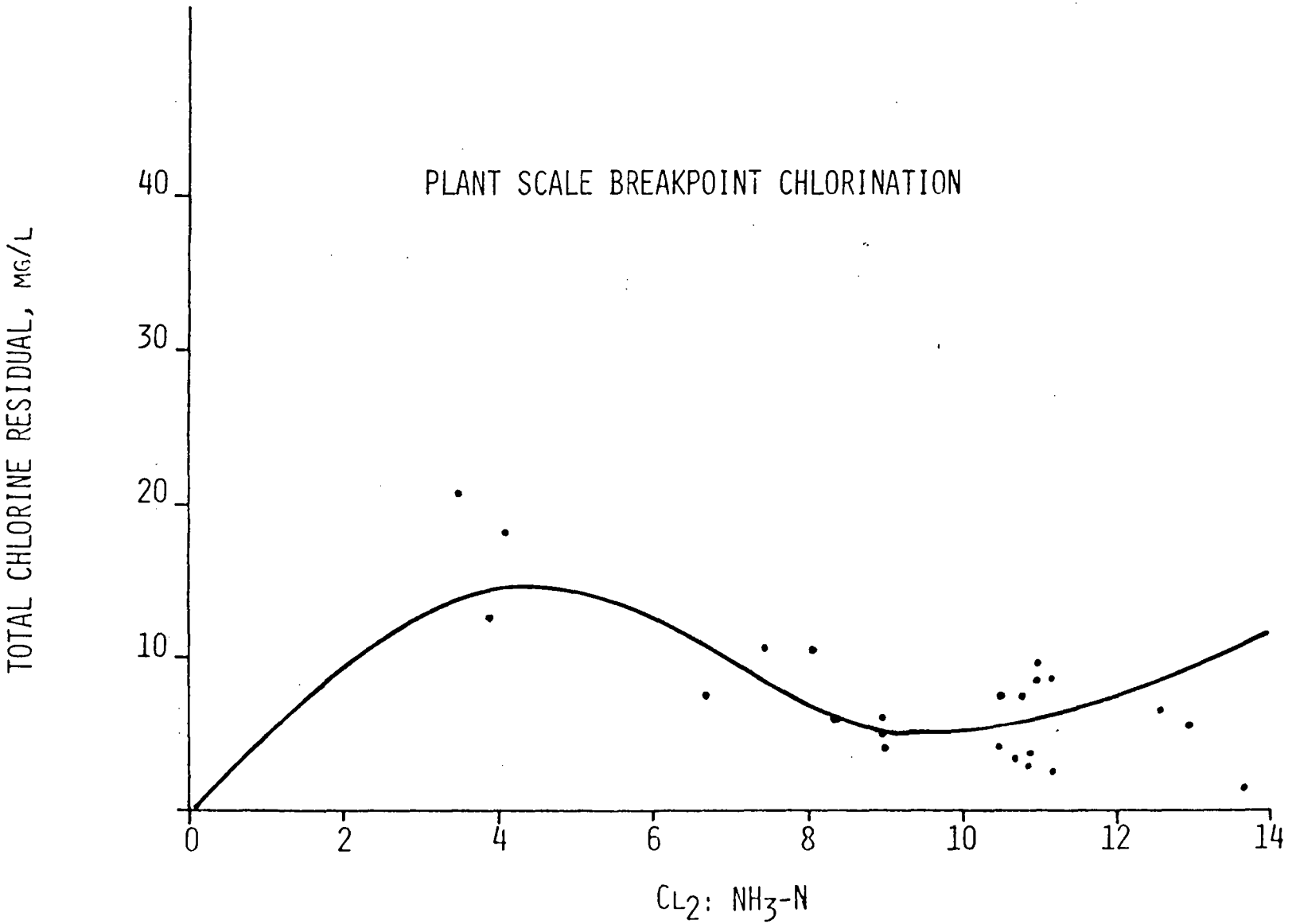

1 INITIAL NH3-N = 4.0 mg/l
INITIAL pH3 = 10.4
FINAL pH = 6.9
TIME = 60 min
2 INITIAL NH3-N = 4.2 mg/l
INITIAL pH = 11.3
FINAL pH = 7.1
TIME = 15 min
3 INITIAL NH3-N = 4.2 mg/l
INITIAL pH = 11.3
FINAL pH = 10.4
TIME = 60 min
TOTAL CHLORINE RESIDUAL, MG/L
40
30
20
10
0
2
4
6
8
10
12
14
CL2: NH3-N

FIGURE 10


PLANT SCALE BREAKPOINT CHLORINATION
TOTAL CHLORINE RESIDUAL, MG/L
40
30
20
10
0
2
4
6
8
10
12
14
Cl2: NH3-N

The filter system is designed to operate in parallel. Each of the four filters has a design capacity of 3.75 mgd and a throughput rate of 5 gpm/ft^2 of surface area. Thus, the filters were able to run at 100 percent of capacity during the entire operational period.

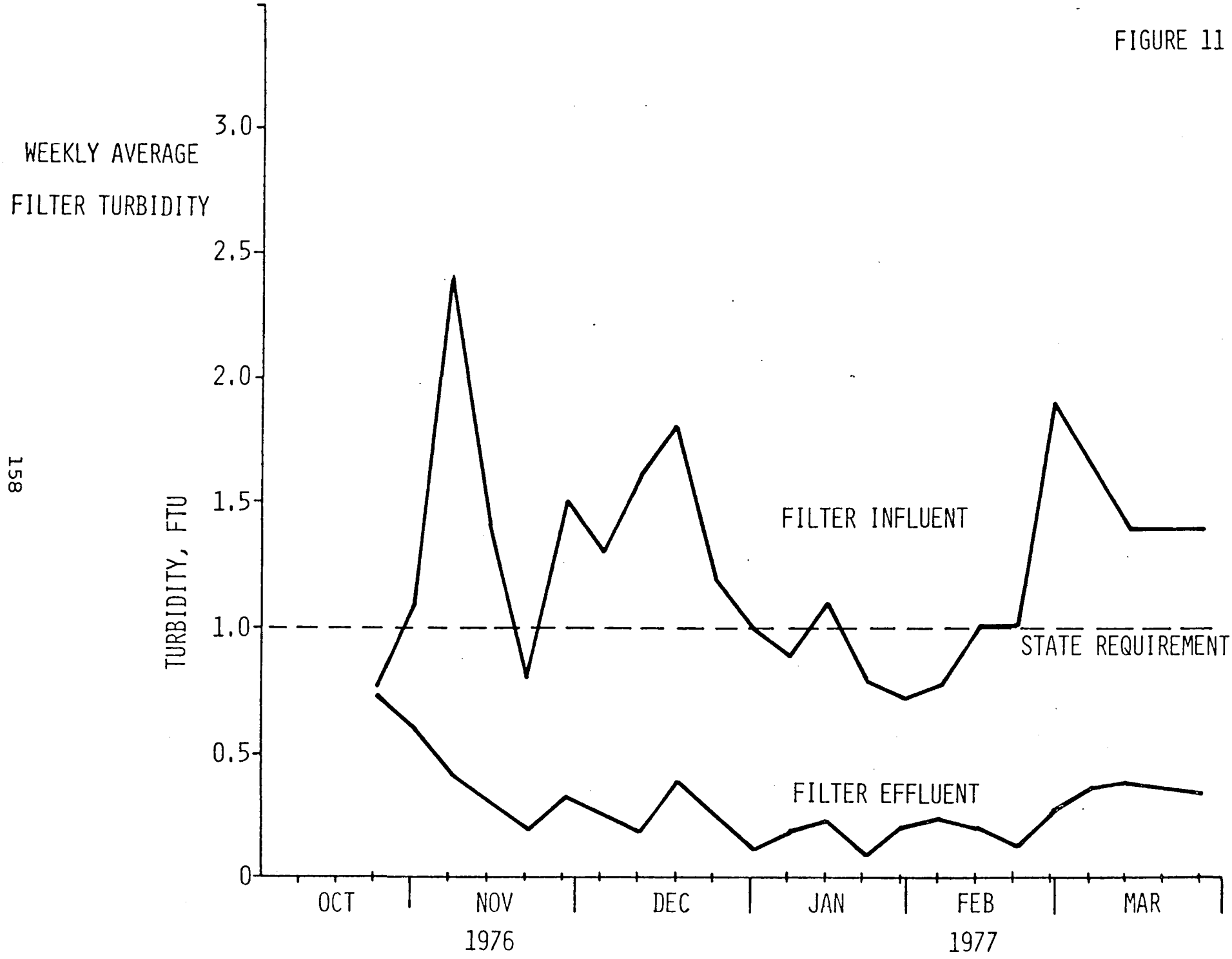
Discharge requirements specify that filter effluent turbidity should not exceed 1 FTU, but filtration also reduces the organics, suspended and colloidal solids reaching the activated carbon, as well as reducing the chlorine demand prior to disinfection.

Enhancement of turbidity removal is accomplished by addition of alum in dosages from 10 - 15 mg/l and polymer in dosages of 0.05 - 0.1 mg/l. Typical filter runs were 20 - 30 hours, averaging 26 hours, with a mean effluent turbidity of 0.28 FTU. Filter performance for the period of October through March is shown in Figure 11 and it can be seen that filters can consistently produce water with turbidities less than half of the mandated 1.0 FTU.

Activated Carbon Adsorption

The activated carbon adsorption process follows the mixed-media filtration. The purpose of the activated carbon is to remove residual organic compounds remaining after conventional secondary treatment and lime clarification. Additionally, activated carbon adsorption can furnish some removal of trace inorganics. Seventeen parallel carbon contact columns, containing approximately 50 tons each of activated carbon, are available for use.

FIGURE 11


WEEKLY AVERAGE
FILTER TURBIDITY
TURBIDITY, FTU
3.0
2.5
2.0
1.5
1.0
0.5
0
FILTER INFLUENT
STATE REQUIREMENT
FILTER EFFLUENT
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

Sixteen columns operate in parallel with one remaining unit available for carbon storage and standby service. The activated carbon columns are designed to operate as packed bed, upflow, counter-current mode, at a hydraulic loading rate of 5 gpm/ft^2 and 30-minute detention time (empty bed basis).

Figures 12 and 13 exhibit the chemical oxygen demand (COD) and total organic carbon (TOC) result for this six-month period. Performance of activated carbon treatment is monitored by measuring the COD of each column and the combined effluent of all columns. Other parameters measured are TOC, MBAS, and phenol and are summarized below:

Constituent	Influent Concentration mg/l	Combined Column Effluent mg/l	Percent Removal
COD	45.2	15.8	65
TOC	14.2	5.9	58
MBAS	0.93	0.10	89
Phenol	0.002	0.0	100

Individual columns are taken out of service when the effluent COD concentration approaches 30 mg/l. Figure 12 indicates that during the first week of December, columns in service were approaching exhaustion. The following two weeks, these columns were taken completely out of service and replaced with new contactors. Typically, this occurs when 1,500 pounds of carbon per million gallons have been treated.

Carbon column effluent is used as the feed water to a 5,000 gpd pilot reverse osmosis unit on site. Operation of the pilot plant was adversely affected by a high pressure drop across the pressure vessels. It was determined that the high delta P was

FIGURE 12

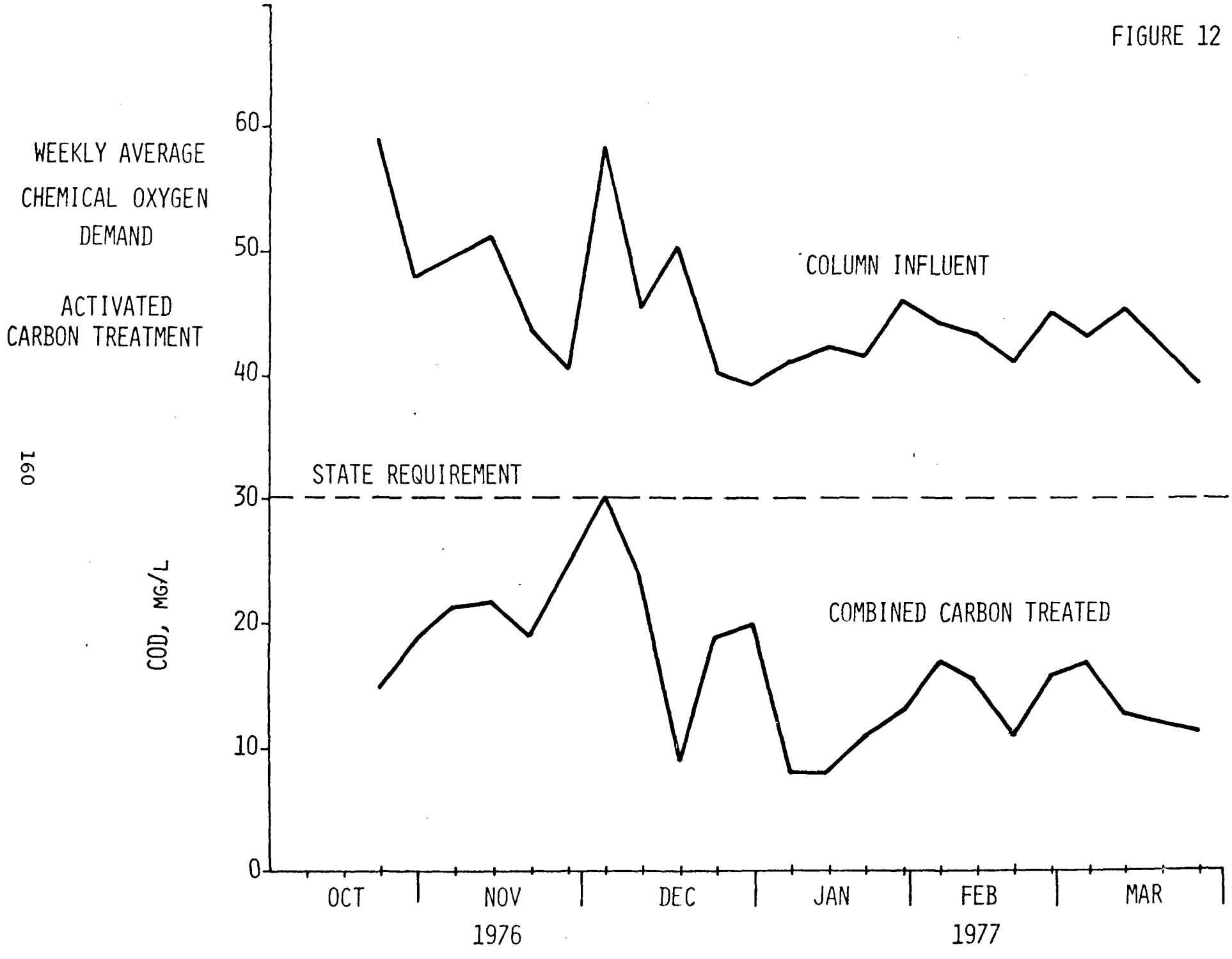
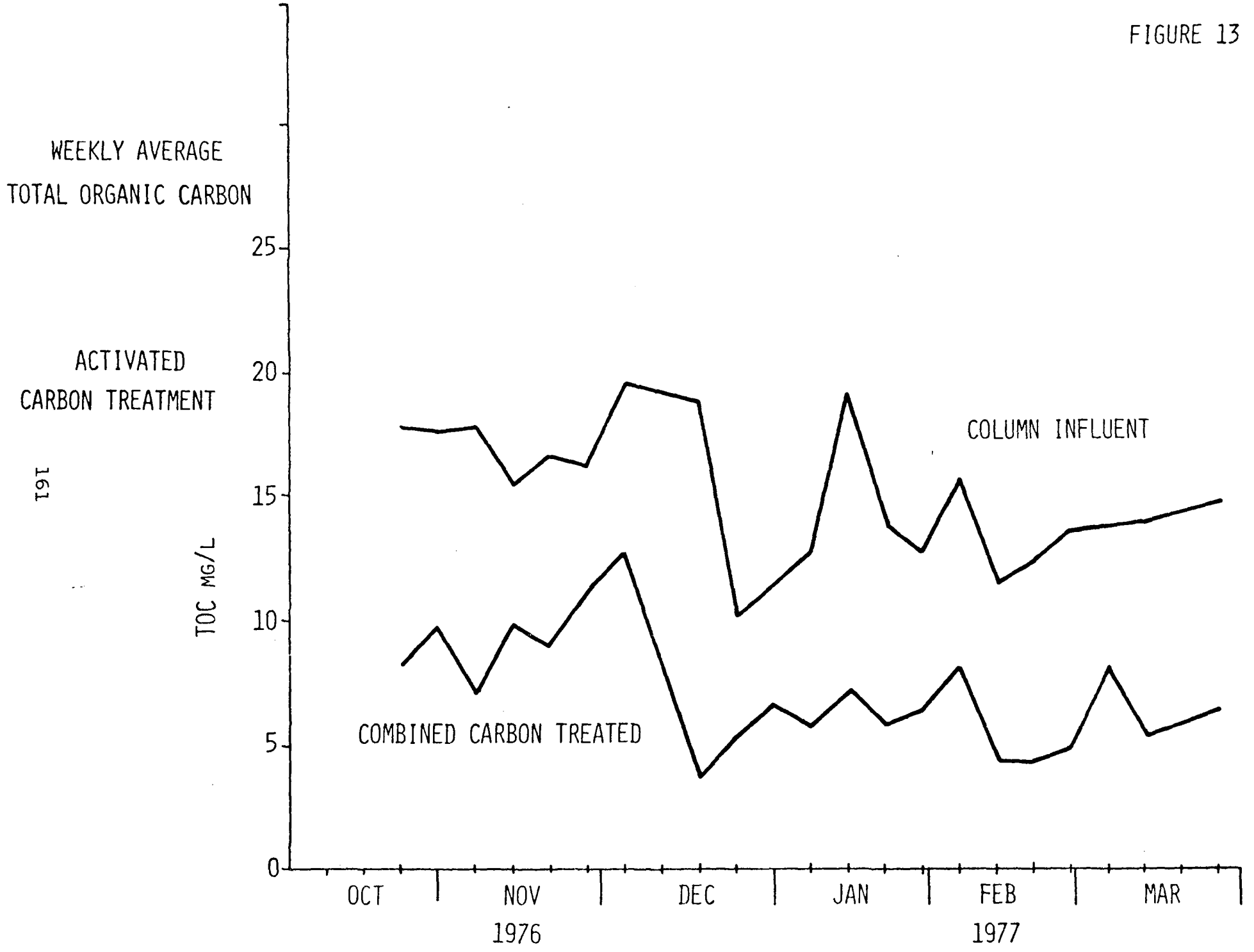

WEEKLY AVERAGE
CHEMICAL OXYGEN
DEMAND
ACTIVATED
CARBON TREATMENT
160
COD, MG/L
60
50
40
30
20
10
0
COLUMN INFLUENT
STATE REQUIREMENT
COMBINED CARBON TREATED
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

FIGURE 13


WEEKLY AVERAGE
TOTAL ORGANIC CARBON
ACTIVATED
CARBON TREATMENT
TOC MG/L
25
20
15
10
5
0
COLUMN INFLUENT
COMBINED CARBON TREATED
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

caused by the carryover of carbon fines from the upflow contactors. Several alternative modes of operating the columns were tried, including packed bed upflow and downflow. The best operational mode was downflow. Downflow operation eliminates the carbon fines carryover. All upflow modes including packed bed, resulted in carbon fines.

Carbon fines have caused two additional problems. Fines have clogged many of the effluent screens in the columns, requiring wire brushing to remove them. Also, carbon fines are clogging the screens in the dewatering bins prior to regeneration. Alternative solutions to these problems are being examined. Studies are under way to determine the cause of the fines. The source of the fines may be from attrition during upflow operation or present due to inadequate defining of the original charge of carbon. To date, no conclusion has been made as to the origin of the fines.

Chlorination

The polished effluent from the activated carbon contactors flows by gravity to the chlorine contact basin, primarily to destroy remaining bacteria or virus. The chlorine is added by diffuser in the transmission pipe upstream from entering the contact basin. The water/chlorine solution is completely mixed by means of a series of mixing baffles upon entering the contact basin. Contact time is approximately 30 minutes (at 15 mgd).

A chlorine dose of 2-5 mg/l provides for a complete disinfection and removal of bacteria and virus since the water has already received breakpoint chlorination earlier in the treatment process at the recarbonation basin. At this time, no bacteria or virus have ever been detected in the AWT effluent. Table IV summarizes the result of bacteriological and virus testing which has been conducted on the AWT plant effluent.

Water Quality

During the six months of operation between October 1976 and March 1977, the effluent from the AWT plant was capable of meeting all discharge requirements with the exception of sodium. The sodium limit (110 mg/l) was exceeded by an average of 13 mg/l during the six-month period. The blended injection water exceeded all other requirements imposed by regulating agencies. Table V compares the influent, effluent, blended water and regulatory requirements. By examining Table V, one can see that organics, turbidity, heavy metals, bacteria and virus are readily removed by AWT. It can also be seen that the water injected meets or exceeds the standards which have been established for drinking water.

Although the treatment is more than capable of diminishing or removing all crucial parameters, mineral quality of AWT effluent is still a problem and stresses the need for additional demineralization which will be provided by the new 5 mgd RO plant.

TABLE IV

SUMMARY OF BACTERIOLOGICAL AND VIRAL ANALYSIS
FOR WATER FACTORY 21 INFLUENT AND EFFLUENT

Coliform (MPN/100 ml) Influent	Effluent	Date	Virus (PFU/gal) Influent	Effluent
14×10^6	0	Oct. 11	ND	ND
-	-	Oct. 12	NS	ND
-	-	Oct. 14	180	ND
-	-	Oct. 15	146	ND
19.2×10^6	0	Oct. 19	13	ND
-	-	Oct. 20	ND	ND
-	-	Oct. 21	ND	ND
33.8×10^6	0	Oct. 25	ND	ND
-	-	Oct. 26	NS	ND
-	-	Oct. 27	ND	ND
-	-	Oct. 28	33	ND
-	-	Oct. 29	ND	ND
10.2×10^6	0	Nov. 1	12	ND
-	-	Nov. 2	16	ND
-	-	Nov. 3	70	ND
14×10^6	0	Nov. 8	ND	ND
-	-	Nov. 9	22	ND
-	-	Nov. 10	13	ND
-	-	Nov. 12	13	ND
11.7×10^6	0	Nov. 19	21	ND
-	-	Nov. 22	16	ND
-	-	Jan. 19	6	ND
-	-	Jan. 20	ND	ND
-	-	Jan. 21	ND	ND
12×10^6	0	Jan. 24	10	ND
-	-	Jan. 25	ND	ND
-	-	Feb. 3	ND	ND
7.8×10^6	0	Feb. 15	ND	ND
-	-	Feb. 16	ND	ND
-	-	Feb. 17	ND	ND
-	-	Mar. 2	2	NS
-	-	Mar. 3	2	ND
-	-	Mar. 8	ND	ND
46.4×10^6	0	Mar. 21	2	ND
-	-	Mar. 29	25	ND

TABLE V
WATER FACTORY 21
SIX-MONTH OPERATING PERFORMANCE SUMMARY

Parameter	Units	Plant Infl.	Clarifier Effl.	Recarbonation Effl.	Filter Effl.	Activated Carbon Effl.	Blended Injection Effl.	Regulatory Limit
Alk	mg/l	-	-	99.1	-	-	119.6	-
NH_3-N	mg/l	40.2	32.0	-	2.9	2.3	0.6	1.0
B	mg/l	1.0	0.8	-	-	-	0.4	0.5
Ca	mg/l	108.5	-	103.0	-	-	40.1	-
Cl	mg/l	250.0	-	230.0	-	-	93.1	120
COD	mg/l	133.4	49.3	-	45.2	15.8	11.2	30
E Coli	MPN/100ml	19.4×10^6	-	-	0.32	0.0	0.0	0
EC	µmho/cm	1676	1985	1429	-	-	761	900
F	mg/l	-	-	-	-	-	0.6	0.8
Mg	mg/l	22.5	0.2	-	-	-	0.6	-
pH		7.6	11.5	8.3	-	-	7.7	6.5 - 8.0
PO_4-P	mg/l	5.8	0.1	-	-	-	-	-
Na	mg/l	199.6	-	-	-	-	123.0	110
SO_4	mg/l	-	-	-	-	-	78.0	125
TH	mg/l	-	-	-	-	-	102.8	220
Total-N	mg/l	48.4	37.6	-	-	-	2.2	10.0
TOC	mg/l	-	-	-	14.2	5.9	-	-
Turb.	FTU	40	1.1	1.2	0.35	-	0.3	1.0
As	µg/l	3.3	3.0	-	3.0	2.9	2.8	50
Ba	µg/l	78.0	36.6	-	32.1	40.0	17.1	1000
Cd	µg/l	22.6	0.9	-	2.2	1.9	0.6	10
Cr	µg/l	133.9	40.0	-	35.8	21.2	8.7	50
Cu	µg/l	316.6	90.0	-	70.2	28.7	13.0	1000
Fe	µg/l	344.3	51.2	-	275.8	62.3	62.5	300
Pb	µg/l	20.6	4.4	-	10.8	3.3	3.6	50
Mn	µg/l	34.0	4.7	-	7.4	6.1	5.3	50
Hg	µg/l	3.5	2.8	-	1.3	2.4	1.9	5
Se	µg/l	1.8	1.8	-	1.8	1.9	1.8	10
Ag	µg/l	5.2	1.9	-	1.6	1.4	0.7	50
Zn	µg/l	369.0	292	-	501.8	158.3	201.0	-

Reverse Osmosis

A portion of the AWT plant effluent will soon be demineralized by reverse osmosis (RO). The resulting desalted wastewater will have a very high quality and reduce the demand for supplemental blend water to reduce the total dissolved solids concentration.

The 5 mgd RO plant is very near completion and will be capable of producing water in June. The feed water to the RO plant can be taken either before or after activated carbon treatment. The RO plant, like the AWT plant, is designed as two parallel systems of 2.5 mgd each. The Fluid Systems Division, ROGA, spiral-wound membrane element, 8150 HR, is the basic essential component of the RO system.

The flow diagram of the RO plant is shown in Figure 14. The plant will incorporate feeding sodium hexametaphosphate as a precipitation inhibitor, 25 micron cartridge filtration, and pre-chlorination pH control with sulfuric acid. A 5,000 gpd pilot unit has been operated jointly by the District and Universal Oil Products since early 1975 to evaluate the long-term performance of RO on AWT plant effluent. Summarized in the following table is some of the data collected while the RO plant was operating on activated carbon effluent. It can be easily seen that RO is an effective process for removing the unwanted dissolved minerals.

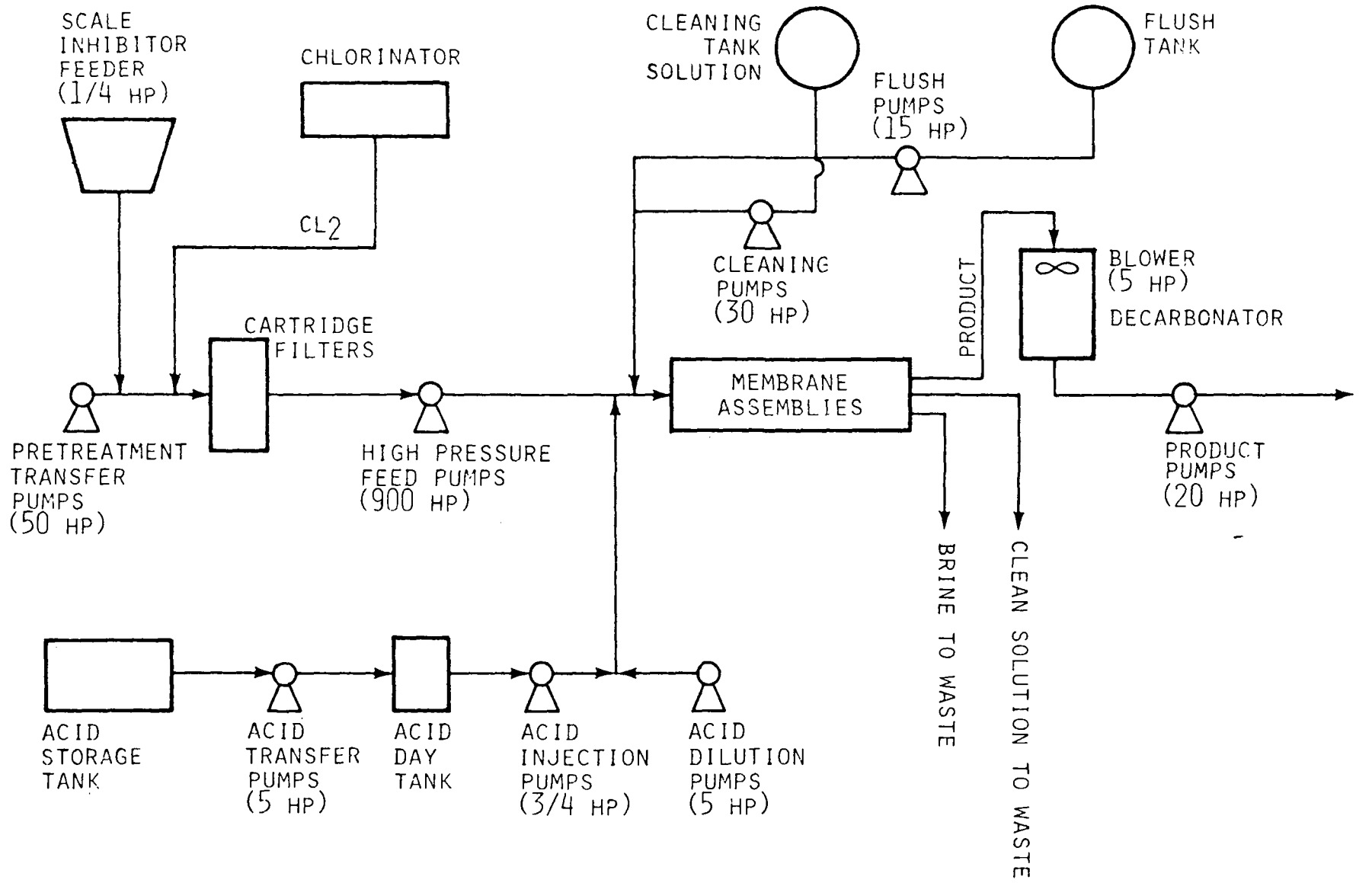


FIGURE 14 - REVERSE OSMOSIS PLANT FLOW DIAGRAM

RO DEMINERALIZED WASTEWATER

Parameter	Mean Influent Concentration (mg/l)	Mean Effluent Concentration (mg/l)	Mean Percent Removal
EC	1459	71	95
Sodium	196	10.8	94
Chloride	280	16	94
Sulfate	220	0.8	99
COD	25	1.5	94

A summary of the process data collected between October 1976 and March 1977 is attached in Appendix A. Appendix B is available as a separate volume and is a detailed tabulation of each month's raw data.

Appendix A

Summary of process data

gathered between

October 1976 and March 1977

TABLE A

WATER QUALITY MONITORING STATIONS

Monitoring	Description
Q1	Plant influent (clarifier influent)
Q2	Clarifier effluent
Q5	Recarbonation basin effluent
Q6	Filter effluent (carbon column influent)
Q8	Combined carbon column effluent
Q10	Blended injection water

Month October

TABLE A-1

Parameter	Units	Q1	Q2	Q5	Q6	Q8	Q10	Limit
Alk	mg/l	-	-	118.7	-	-	131.4	-
NH_3-N	mg/l	38.5	34.0	-	-	-	1.0	1.0
B	mg/l	1.4	1.1	-	-	-	0.5	0.5
Ca	mg/l	100.4	-	97.4	-	-	37.8	-
Cl	mg/l	230.7	-	230.0	-	-	102.8	120
COD	mg/l	141.9	56.4	-	51.8	15.6	0.0	30
E coli	MPN/100ml	20.8×10^6	0	-	0.1	-	0.5	0
EC	µmho/cm	1621	1951	1504	-	-	705	900
F	mg/l	-	-	-	-	-	0.6	0.8
MG	mg/l	21.9	0.3	-	-	-	0.6	-
pH		7.6	11.3	10.3	-	-	7.6	6.5-8.0
PO_4-P	mg/l	5.9	0.12	-	-	-	-	-
Na	mg/l	198.3	-	-	-	-	132.1	110
SO_4	mg/l	-	-	-	-	-	82.4	125
TH	mg/l	-	-	-	-	-	91.8	220
Total-N	mg/l	47.9	38.0	-	-	-	1.9	10.0
TOC	mg/l	-	-	-	-	-	-	-
Turb.		26.3	1.3	1.0	0.80	-	0.30	1.0
As	µg/l	3.3	3.5	-	3.0	2.8	-	50
Ba	µg/l	133.0	83.9	-	76.7	84.3	-	1000
Cd	µg/l	25.4	2.7	-	3.1	3.3	-	10
Cr	µg/l	155.3	17.8	-	16.6	7.5	-	50
Cu	µg/l	234.3	79.1	-	69.5	22.7	-	1000
Fe	µg/l	330.7	25.7	-	94.7	108.5	-	300
Pb	µg/l	18.6	6.2	-	4.6	4.3	-	50
Mn	µg/l	36.1	1.0	-	3.2	5.5	-	50
Hg	µg/l	9.8	6.2	-	4.2	7.4	-	5
Se	µg/l	2.0	2.0	-	2.0	2.0	-	10
Ag	µg/l	6.7	2.1	-	4.1	1.5	-	50
Zn	µg/l	480.3	337.0	-	501.3	284.7	-	-

Month November

TABLE A-2

Parameter	Units	Q1	Q2	Q5	Q6	Q8	Q10	Limit
Alk	mg/l	-	-	96.7	-	-	109.6	-
NH_3-N	mg/l	42.9	33.0	1.2	-	-	-	1.0
B	mg/l	0.9	0.7	-	-	-	0.36	0.5
Ca	mg/l	131.8	-	90.5	-	-	40.2	-
Cl	mg/l	212.6	-	-	-	-	104.8	120
COD	mg/l	137.6	48.9	-	45.0	21.9	14.3	30
E coli	MPN/100ml	11.4×10^6	0		0	0	0	0
EC	µmho/cm	1690	2035	1336	-	-	746	900
F	mg/l	-	-	-	-	-	-	0.8
MG	mg/l	21.8	0.14	-	-	-	0.48	-
pH		7.6	11.6	8.9	-	-	7.8	6.5-8.0
PO_4-P	mg/l	5.3	0.03	-	-	-	-	-
Na	mg/l	193.4	-	-	-	-	115.6	110
SO_4	mg/l	-	-	-	-	-	79.5	125
TH	mg/l	-	-	-	-	-	81.9	220
Total-N	mg/l	51.3	37.2	-	-	-	1.8	10.0
TOC	mg/l	-	-	-	-	-	-	-
Turb.	FTU	32.9	1.1	1.5	0.31	-	0.39	1.0
As	µg/l	5.0	5.0	-	5.0	5.0	5.0	50
Ba	µg/l	85.0	49.8	-	42.0	42.6	44.1	1000
Cd	µg/l	20.3	2.6	-	2.1	1.9	1.0	10
Cr	µg/l	117.3	33.1	-	34.5	22.0	10.0	50
Cu	µg/l	249.6	76.1	-	64.5	31.1	5.0	1000
Fe	µg/l	325.4	47.2	-	391.7	81.2	53.6	300
Pb	µg/l	25.7	6.3	-	6.5	5.8	4.7	50
Mn	µg/l	27.4	2.4	-	17.7	9.1	8.5	50
Hg	µg/l	-	-	-	-	-	-	5
Se	µg/l	2.0	2.0	-	2.0	2.3	2.0	10
Ag	µg/l	-	-	-	-	-	-	50
Zn	µg/l	501.6	253.2	-	486.0	216.2	254.0	-

Month December

TABLE A-3

Parameter	Units	Q1	Q2	Q5	Q6	Q8	Q10	Limit
Alk	mg/l	-	-	88.7	-	-	116.2	-
NH_3-N	mg/l	39.9	30.5	-	-	-	0.63	1.0
B	mg/l	0.98	0.90	-	-	-	0.35	0.5
Ca	mg/l	95.3	-	104.8	-	-	42.4	-
Cl	mg/l	215.8	-	-	-	-	124.8	120
COD	mg/l	141.9	51.5	-	46.1	17.4	8.0	30
E coli	MPN/100ml	26.5x106	0	-	0	-	0	0
EC	µmho/cm	1613	1887	1370	-	-	787	900
F	mg/l	-	-	-	-	-	-	0.8
MG	mg/l	21.7	0.10	-	-	-	0.60	-
pH		7.5	11.6	7.8	-	-	7.8	6.5-8.0
PO_4-P	mg/l	6.0	0.10	-	-	-	-	-
Na	mg/l	177.3	-	-	-	-	119.1	110
SO_4	mg/l	-	-	-	-	-	79.3	125
TH	mg/l	-	-	-	-	-	125.8	220
Total-N	mg/l	49.6	34.9	-	-	-	1.6	10.0
TOC	mg/l	-	-	-	14.3	6.5	-	-
Turb.	FTU	49.2	1.3	1.4	0.2	-	0.44	1.0
As	µg/l	2.5	1.5	-	2.2	1.7	2.1	50
Ba	µg/l	68.5	18.2	-	15.8	17.8	10.7	1000
Cd	µg/l	30.2	1.0	-	1.4	0.5	0.4	10
Cr	µg/l	148.0	42.7	-	23.4	8.6	7.9	50
Cu	µg/l	361.7	89.6	-	55.1	29.9	23.7	1000
Fe	µg/l	473.3	120.7	-	705.3	84.8	52.4	300
Pb	µg/l	22.9	4.9	-	44.7	4.1	6.0	50
Mn	µg/l	44.2	16.1	-	4.8	7.5	6.6	50
Hg	µg/l	4.4	2.3	-	2.0	2.0	2.8	5
Se	µg/l	1.0	1.0	-	1.0	1.0	1.0	10
Ag	µg/l	3.7	5.8	-	3.4	2.5	1.2	50
Zn	µg/l	328.7	472.0	-	986.7	111.3	209.7	-

Month January

TABLE A-4

Parameter	Units	Q1	Q2	Q5	Q6	Q8	Q10	Limit
Alk	mg/l	-	-	113.4	-	-	120.3	-
NH_3-N	mg/l	27.5	24.1	2.8	2.9	-	0.40	1.0
B	mg/l	0.97	0.87	-	-	-	0.37	0.5
Ca	mg/l	87.3	-	107.5	-	-	43.3	-
Cl	mg/l	213.7	-	-	-	-	115.3	120
COD	mg/l	127.0	45.8	-	42.5	10.1	4.4	30
E coli	MPN/100ml	13.5×10^6	0	-	0	-	0	0
EC	µmho/cm	1496	1882	1397	-	-	743	900
F	mg/l	-	-	-	-	-	0.56	0.8
MG	mg/l	21.6	0.13	-	-	-	0.53	-
pH		7.5	11.5	7.7	-	-	7.8	6.5-8.0
PO_4-P	mg/l	6.1	0.10	-	-	-	-	-
Na	mg/l	188.0	-	-	-	-	117.7	110
SO_4	mg/l	-	-	-	-	-	49.0	125
TH	mg/l	-	-	-	-	-	109.1	220
Total-N	mg/l	35.5	27.9	-	-	-	2.23	10.0
TOC	mg/l	-	-	-	14.2	5.9	-	-
Turb.	FTU	46.6	0.92	0.90	0.18	-	0.29	1.0
As	µg/l	2.0	1.0	-	0.7	0.7	0.1	50
Ba	µg/l	57.3	22.3	-	15.7	16.7	9.4	1000
Cd	µg/l	34.1	2.4	-	2.2	1.0	0.4	10
Cr	µg/l	95.8	35.7	-	35.1	23.4	7.3	50
Cu	µg/l	299.3	81.3	-	71.7	14.3	9.2	1000
Fe	µg/l	242.0	81.9	-	98.6	28.2	86.8	300
Pb	µg/l	14.4	2.5	-	1.9	1.0	2.9	50
Mn	µg/l	43.2	5.1	-	11.0	6.7	4.1	50
Hg	µg/l	0.3	1.5	-	1.4	1.1	1.9	5
Se	µg/l	2.0	2.0	-	2.0	2.0	2.0	10
Ag	µg/l	4.3	0.5	-	0.6	0.4	0.5	50
Zn	µg/l	186.3	124.7	-	197.4	61.3	204.7	-

Month February

TABLE A-5

Parameter	Units	Q1	Q2	Q5	Q6	Q8	Q10	Limit
Alk	mg/l	-	-	84.5	-	-	116.3	-
NH_3-N	mg/l	42.1	27.5	1.66	-	0.83	0.16	1.0
B	mg/l	1.0	0.8	-	-	-	0.40	0.5
Ca	mg/l	121.8	-	105.8	-	-	42.0	-
Cl	mg/l	244.6	-	-	-	-	110.9	120
COD	mg/l	130.2	48.5	-	43.5	16.7	21.3	30
E coli	MPN/100ml	11.0×10^6	0	-	0	-	0	0
EC	µmho/cm	1681	2046	1424	-	-	813	900
F	mg/l	-	-	-	-	-	0.59	0.8
MG	mg/l	24.0	0.23	-	-	-	0.70	-
pH		7.5	11.5	7.3	-	-	7.6	6.5-8.0
PO_4-P	mg/l	5.9	0.08	-	-	-	-	-
Na	mg/l	219.0	-	-	-	-	120.3	110
SO_4	mg/l	-	-	-	-	-	83.9	125
TH	mg/l	-	-	-	-	-	104.3	220
Total-N	mg/l	50.5	41.0	-	-	-	2.87	10.0
TOC	mg/l	-	-	-	13.4	4.6	-	-
Turb.	FTU	41.2	0.94	1.2	0.24	-	0.29	1.0
As	µg/l	2.0	2.0	-	2.0	2.0	2.0	50
Ba	µg/l	50.5	20.0	-	16.0	14.5	11.0	1000
Cd	µg/l	22.4	2.7	-	1.7	1.0	0.4	10
Cr	µg/l	129.7	47.3	-	43.7	24.6	8.3	50
Cu	µg/l	381.0	117.0	-	58.0	24.3	13.5	1000
Fe	µg/l	303.7	20.4	-	159.5	37.4	70.4	300
Pb	µg/l	18.5	1.8	-	1.6	0.5	1.1	50
Mn	µg/l	22.5	2.6	-	1.9	4.6	4.0	50
Hg	µg/l	2.0	2.0	-	2.0	2.0	2.0	5
Se	µg/l	2.0	1.8	-	2.0	2.0	2.0	10
Ag	µg/l	5.0	0.2		0.3	0.2	0.1	50
Zn	µg/l	382.3	209.7	-	530.3	193.7	188.5	-

Month March

TABLE A-6

Parameter	Units	Q1	Q2	Q	Q6	Q	Q	Limit
Alk	mg/l	-	-	92.8	-	-	123.8	-
NH_3-N	mg/l	50.3	43.0	3.7	-	3.8	0.73	1.0
B	mg/l	0.9	0.65	-	-	-	0.30	0.5
Ca	mg/l	114.3	-	111.9	-	-	35.0	-
Cl	mg/l	382.3	-	-	-	-	91.7	120
COD	mg/l	121.9	44.0	-	42.0	13.2	10.7	30
E coli	MPN/100ml	33.0×10^6	0.3	-	1.8	0.0	0.0	0
EC	µmho/cm	1956	2110	1542	-	-	769	900
F	mg/l	-	-	-	-	-	0.67	0.8
MG	mg/l	24.2	0.15	-	-	-	0.56	-
pH		7.6	11.5	7.6	-	-	7.8	6.5-8.0
PO_4-P	mg/l	5.5	0.05	-	-	-	-	-
Na	mg/l	221.5	-	-	-	-	133.0	110
SO_4	mg/l	-	-	-	-	-	99.6	125
TH	mg/l	-	-	-	-	-	103.6	220
Total-N	mg/l	55.8	46.6	-	-	-	2.66	10.0
TOC	mg/l	-	-	-	14.8	6.6	-	-
Turb.	FTU	44.1	1.1	1.4	0.34	-	0.33	1.0
As	µg/l	5.0	5.0	-	5.0	5.0	5.0	50
Ba	µg/l	73.4	25.2	-	26.4	21.8	10.5	1000
Cd	µg/l	28.5	3.7	-	2.7	3.8	1.0	10
Cr	µg/l	157.3	57.3	-	61.4	41.3	9.8	50
Cu	µg/l	373.6	96.6	-	102.1	36.6	13.4	1000
Fe	µg/l	390.6	11.0	-	204.8	33.5	49.5	300
Pb	µg/l	23.4	4.9	-	5.3	4.5	3.5	50
Mn	µg/l	30.7	1.0	-	5.6	3.0	3.3	50
Hg	µg/l	1.1	2.0	-	1.0	1.0	1.0	5
Se	µg/l	2.0	2.0	-	2.0	2.0	2.0	10
Ag	µg/l	6.5	1.0	-	1.0	1.0	1.0	50
Zn	µg/l	334.5	353.0	-	309.0	82.4	148.3	-

FIGURE A-1

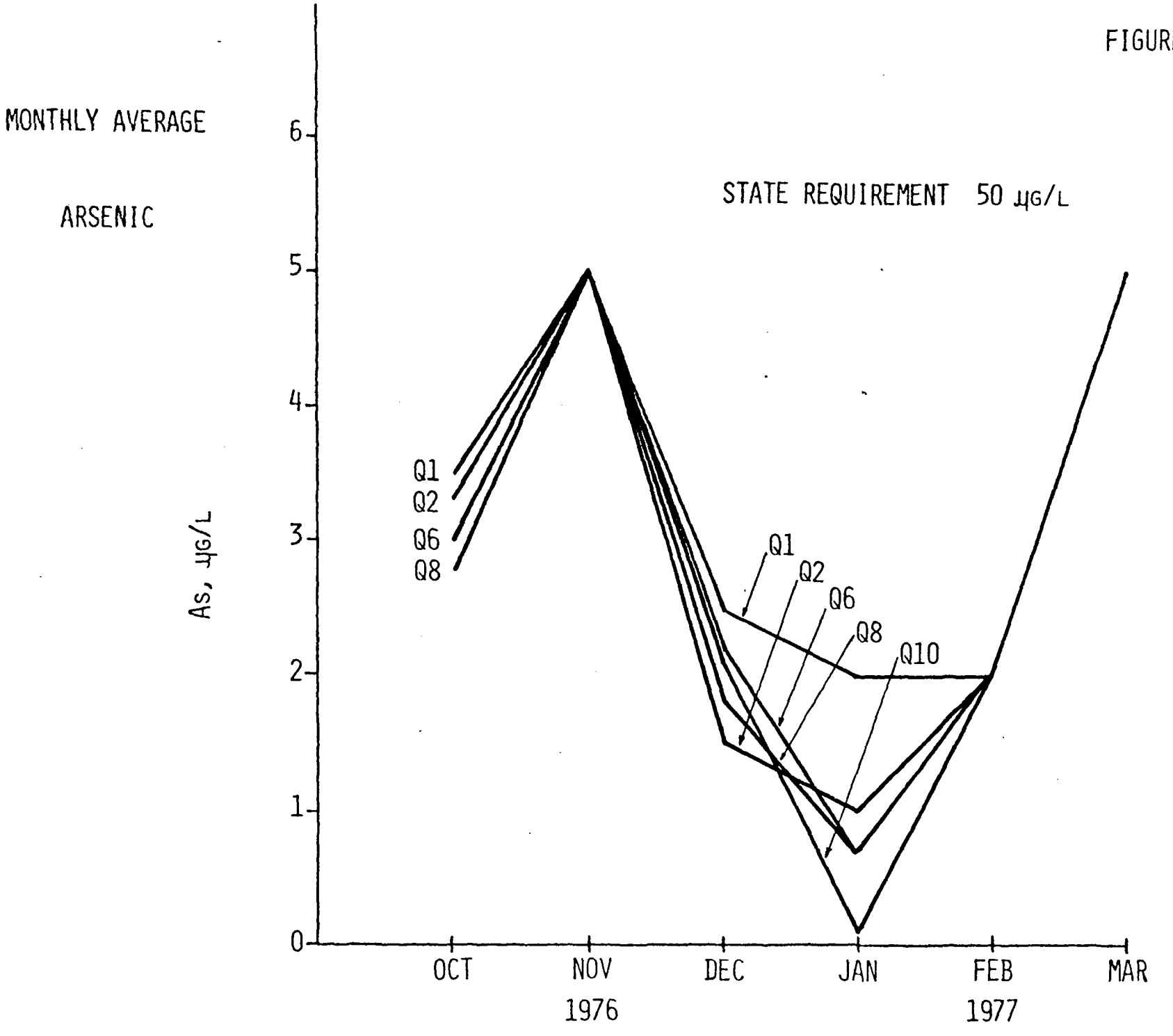

MONTHLY AVERAGE
ARSENIC
STATE REQUIREMENT 50 µG/L
As, µG/L
0
1
2
3
4
5
6
Q1
Q2
Q6
Q8
Q1
Q2
Q6
Q8
Q10
OCT
NOV
1976
DEC
JAN
FEB
1977
MAR

FIGURE A-2

MONTHLY AVERAGE

BARIUM

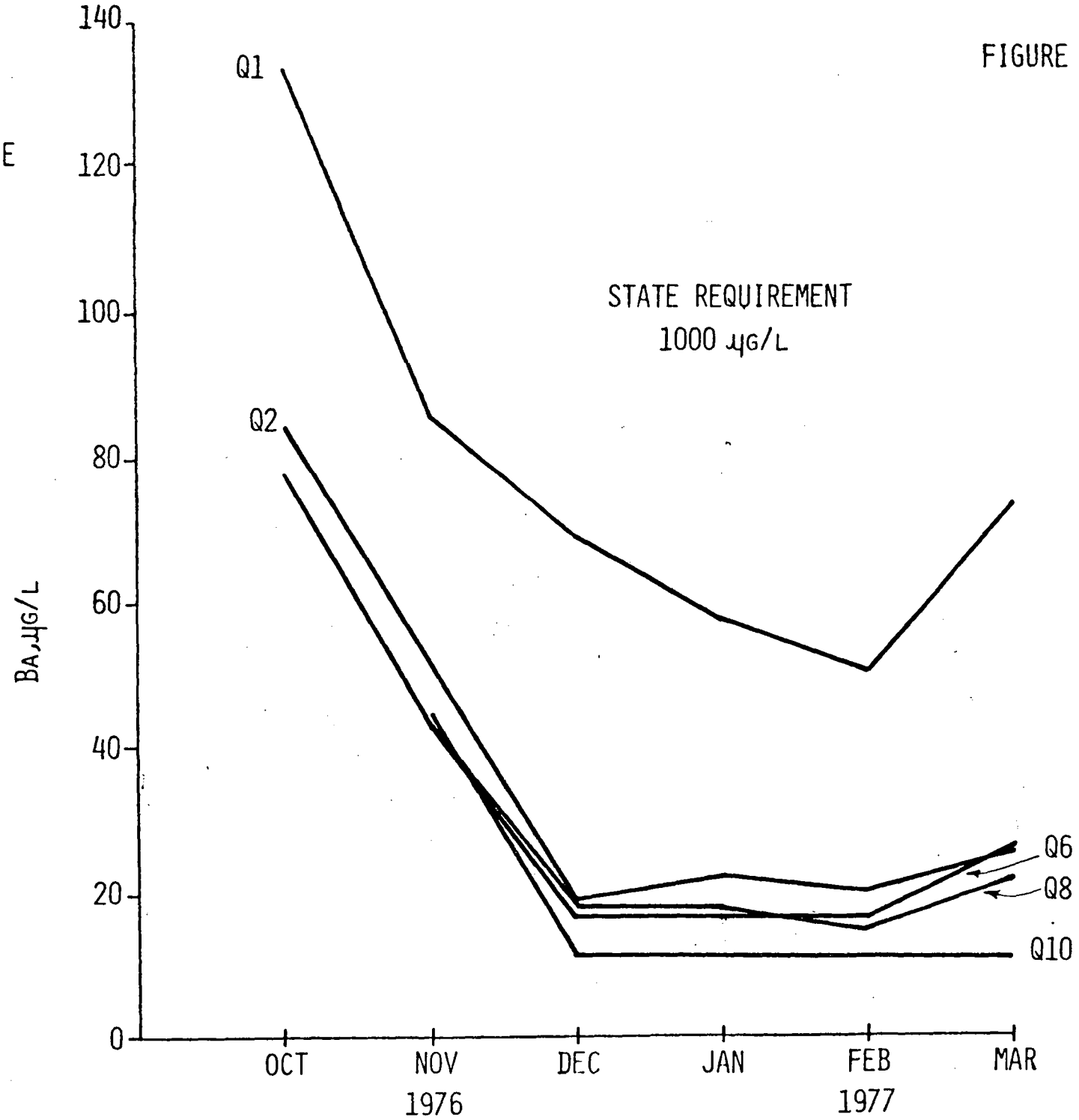


FIGURE A-3

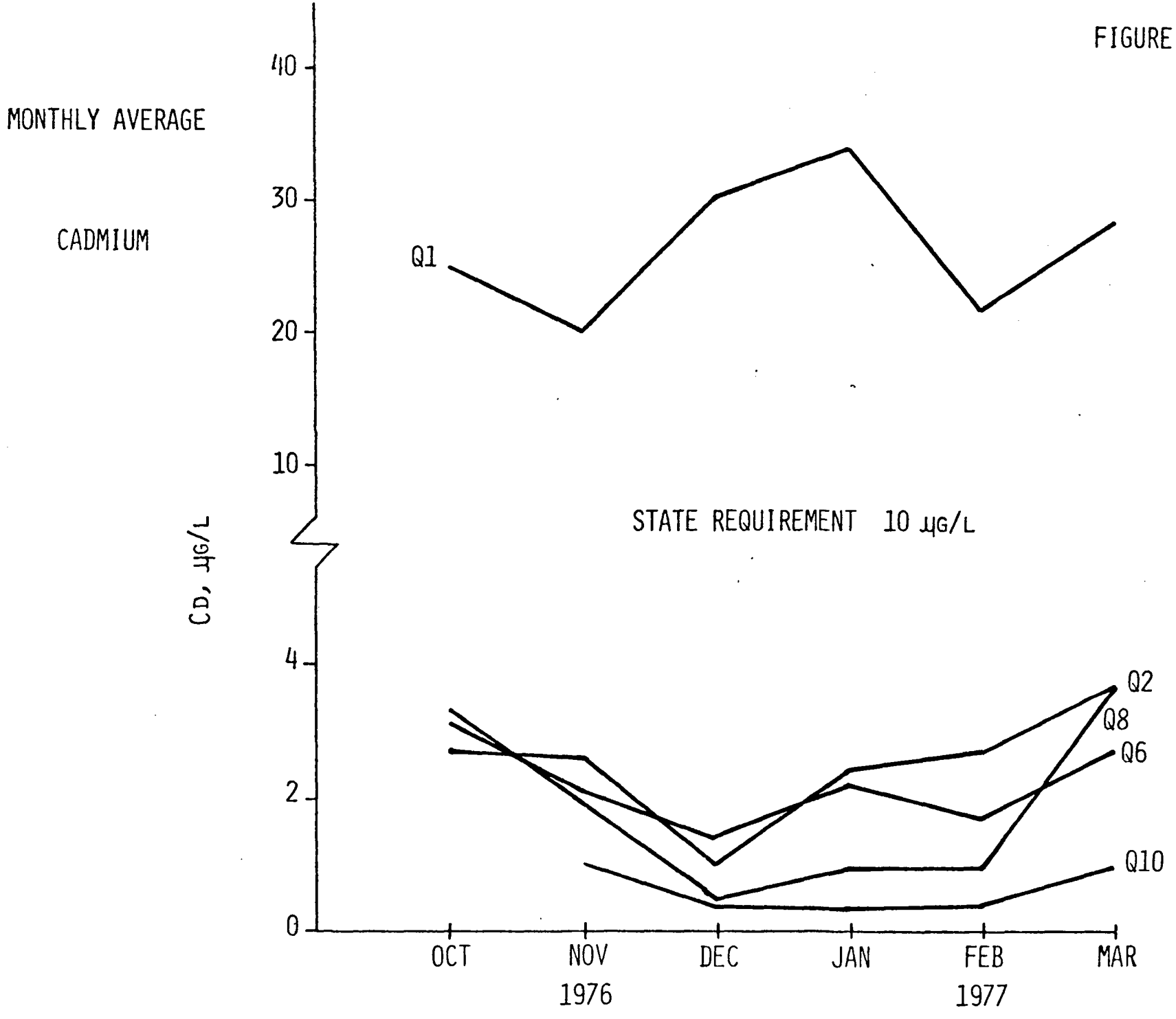

MONTHLY AVERAGE
CADMIUM
40
30
20
10
4
2
0
Q1
STATE REQUIREMENT 10 µG/L
Q2
Q8
Q6
Q10
OCT
NOV
1976
DEC
JAN
FEB
1977
MAR
CD, µG/L

FIGURE A-4

MONTHLY AVERAGE

CHROMIUM

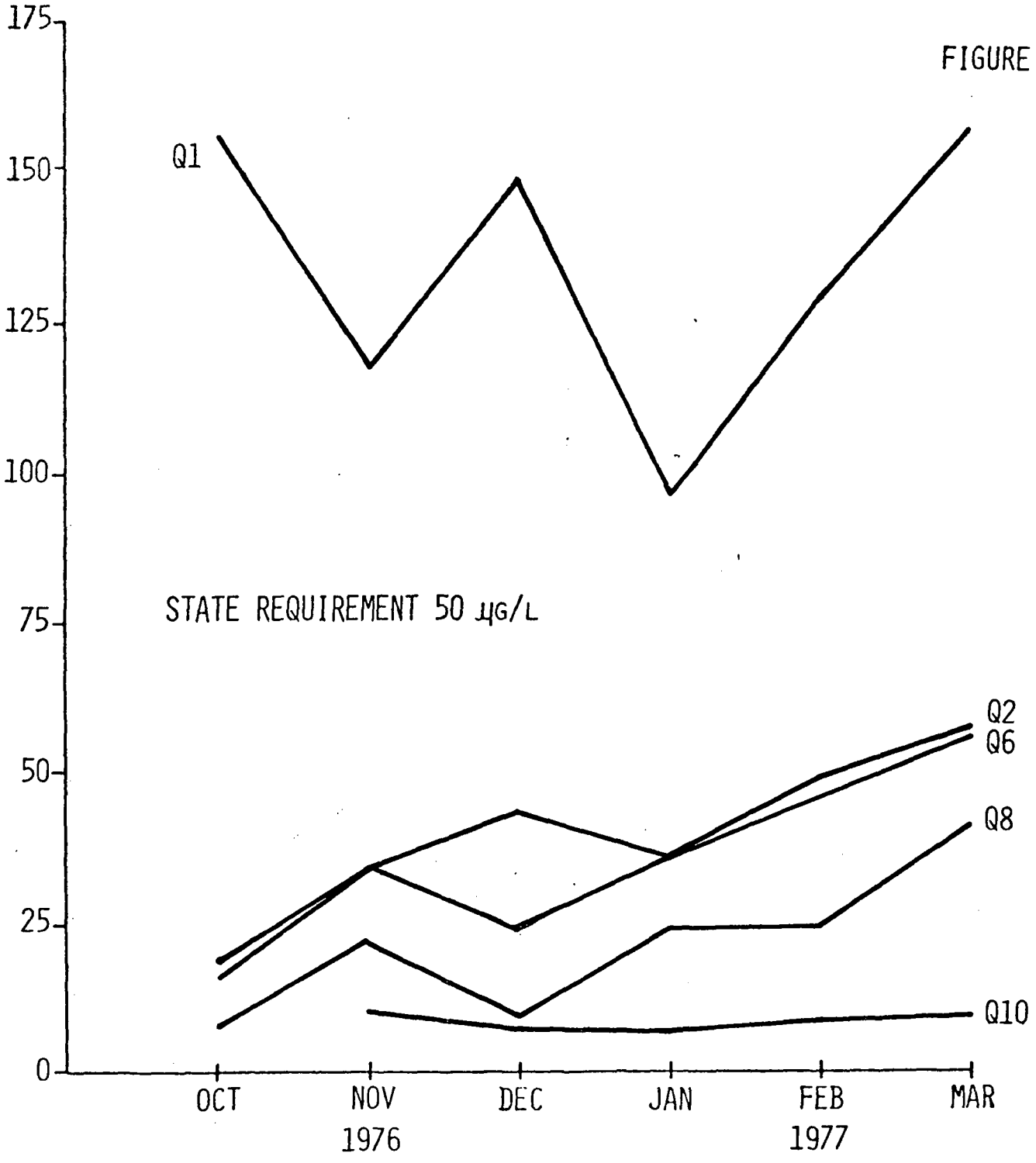


FIGURE A-5

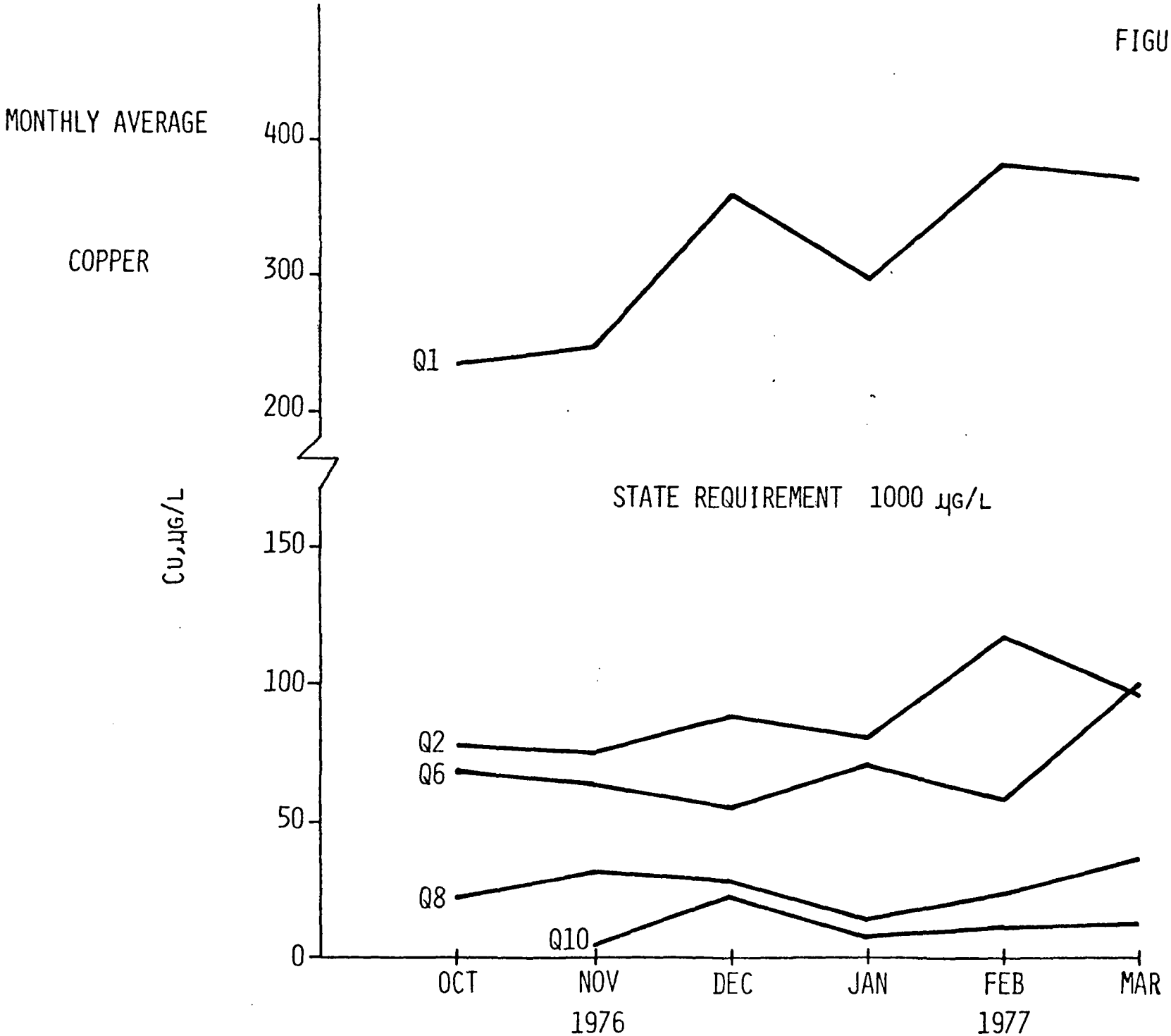

MONTHLY AVERAGE
COPPER
Cu, µG/L
400
300
200
150
100
50
0
Q1
STATE REQUIREMENT 1000 µG/L
Q2
Q6
Q8
Q10
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

FIGURE A-6

MONTHLY AVERAGE

IRON

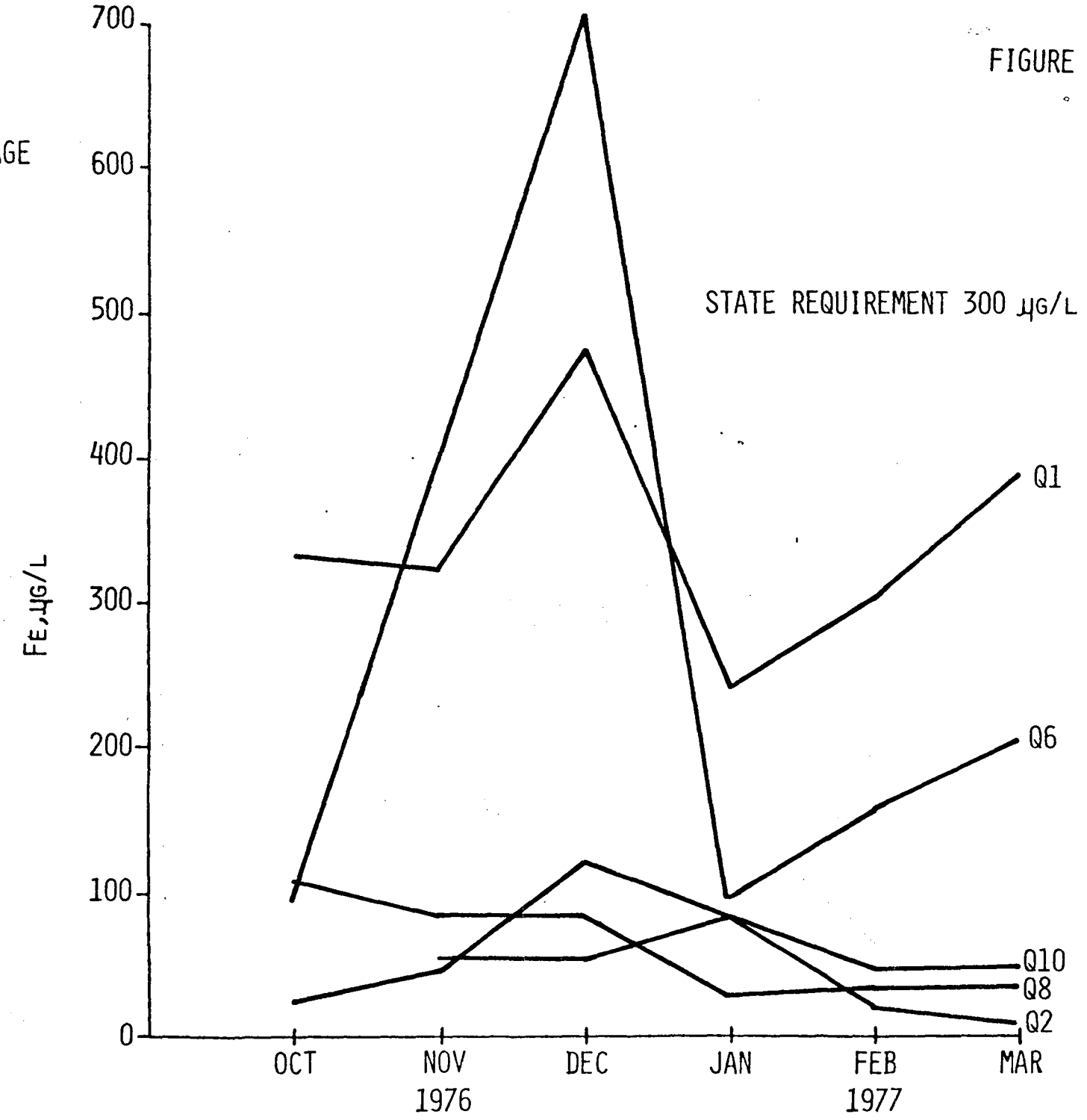


FIGURE A-7

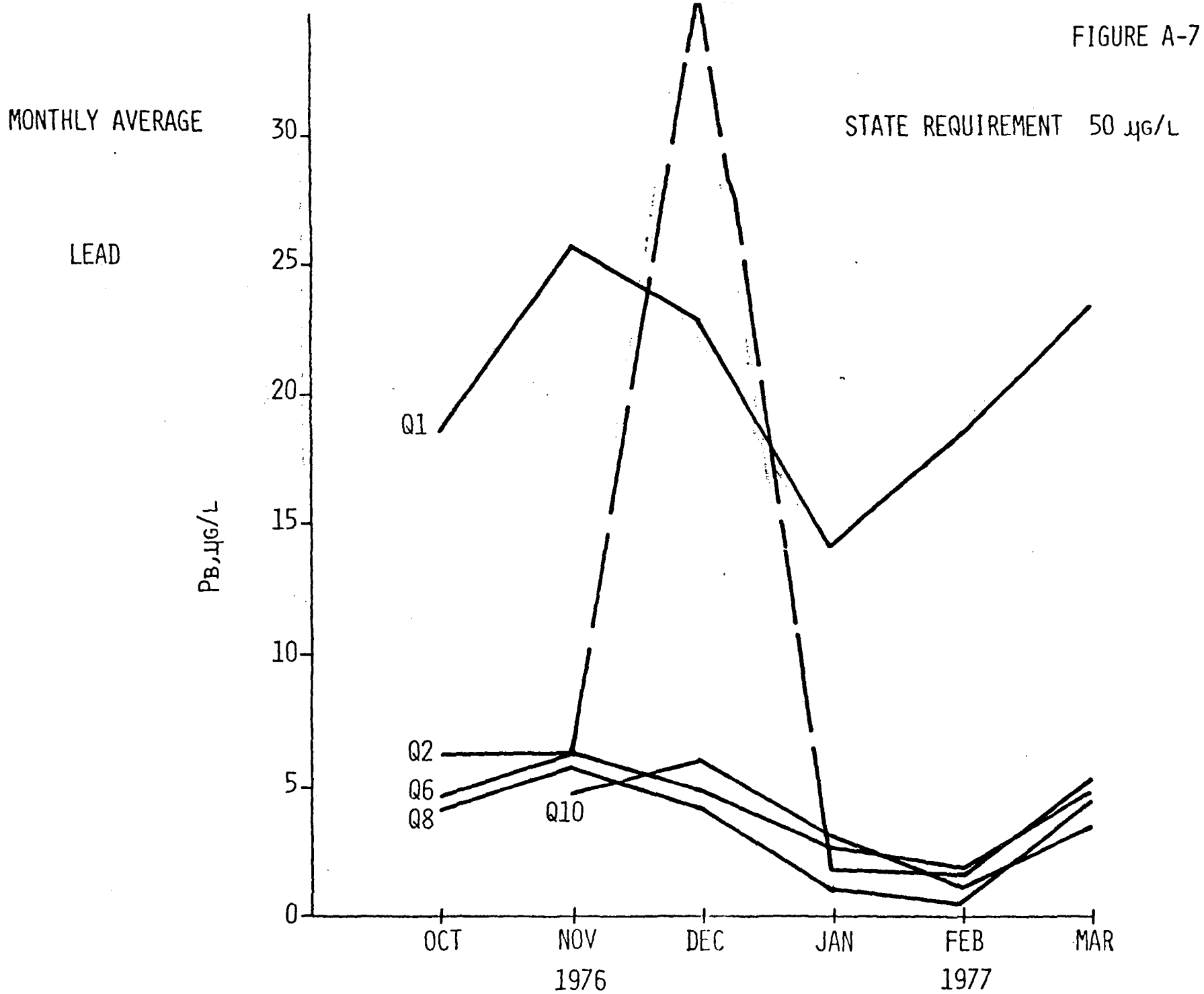

MONTHLY AVERAGE
LEAD
STATE REQUIREMENT 50 µG/L
PB,µG/L
30
25
20
15
10
5
0
Q1
Q2
Q6
Q8
Q10
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

FIGURE A-8

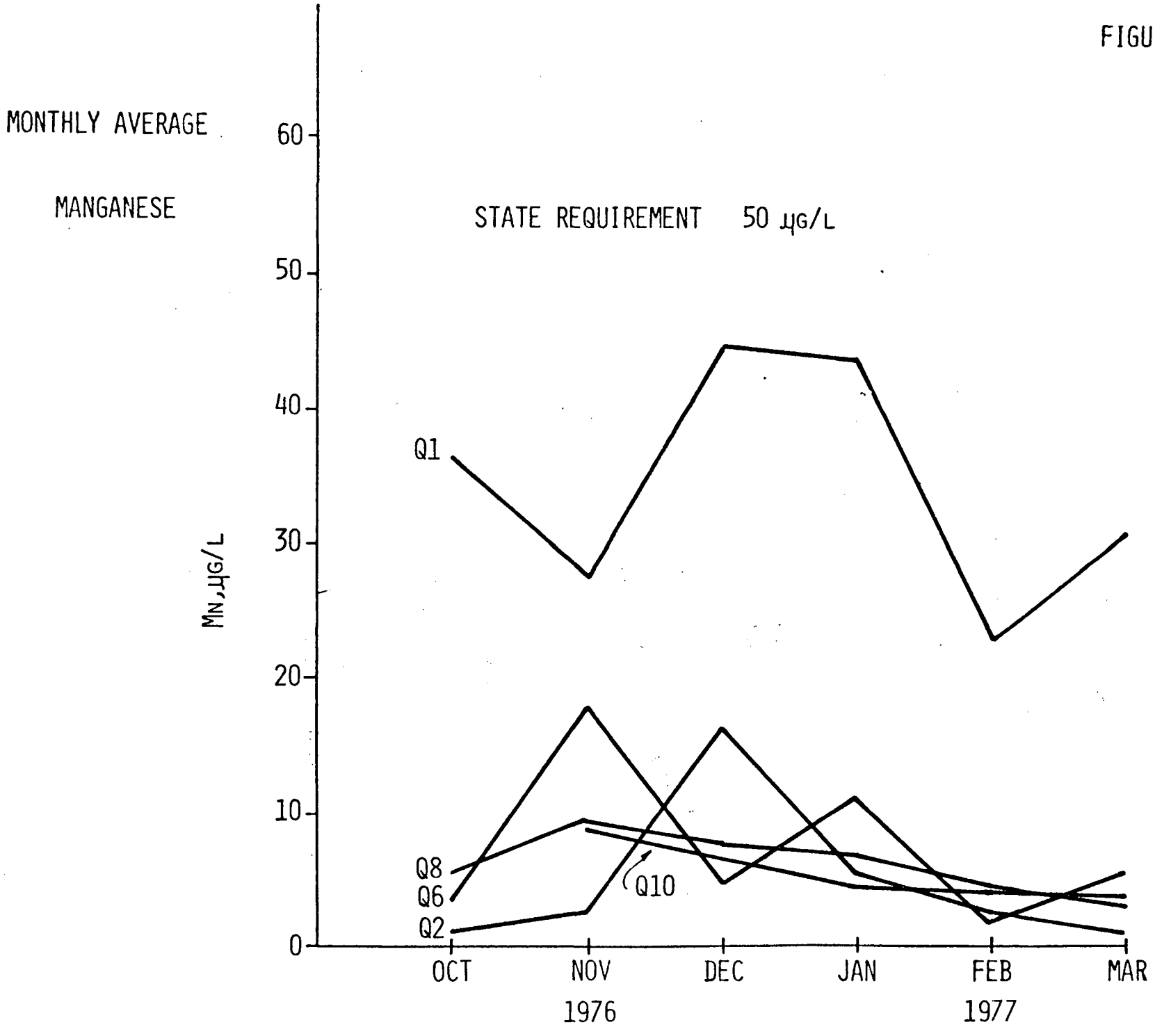

MONTHLY AVERAGE
MANGANESE
STATE REQUIREMENT 50 µG/L
MN, µG/L
60
50
40
30
20
10
0
Q1
Q8
Q6
Q2
Q10
OCT
NOV
DEC
JAN
FEB
MAR
1976
1977

FIGURE A-9

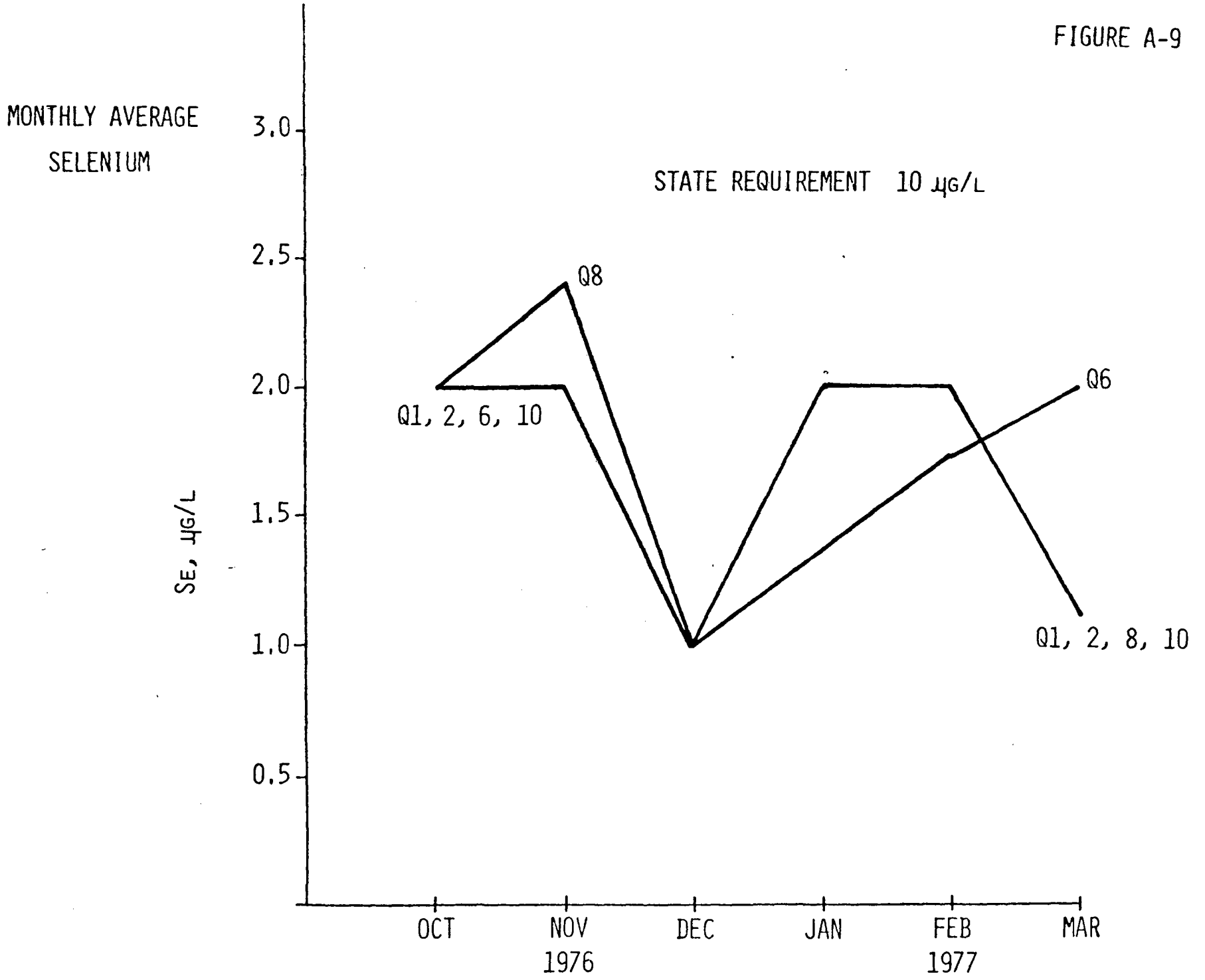
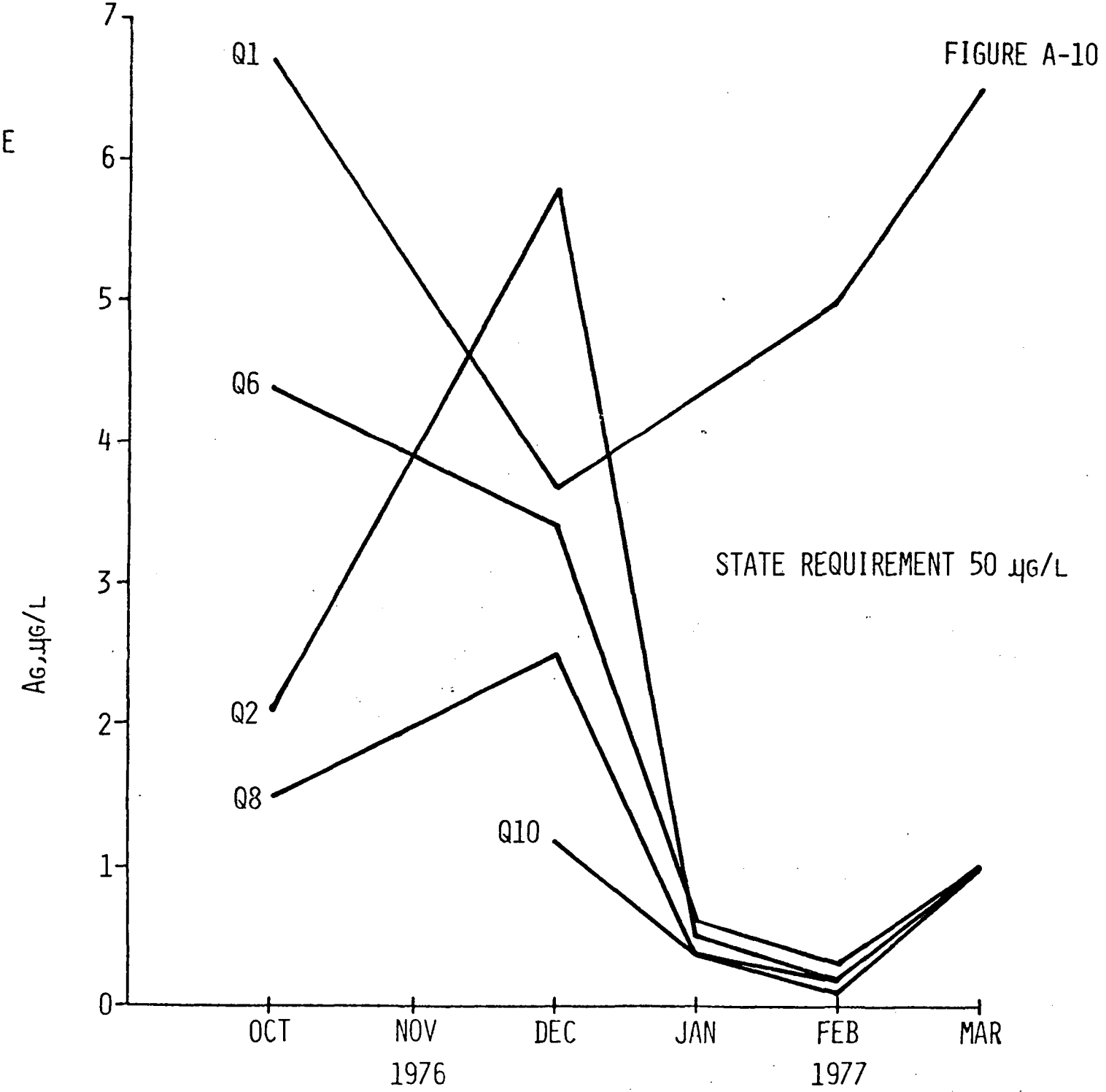

MONTHLY AVERAGE
SELENIUM
STATE REQUIREMENT 10 µG/L
Q8
Q6
Q1, 2, 6, 10
Q1, 2, 8, 10
SE, µG/L
3.0
2.5
2.0
1.5
1.0
0.5
OCT
NOV
1976
DEC
JAN
FEB
1977
MAR

FIGURE A-10

MONTHLY AVERAGE

SILVER



Appendix B

Tabulation of process data

collected between

October 1976 and March 1977

TABLE B

TABULATION
LINE NUMBER DESCRIPTION

Number	Description
1 - 31	Daily parameter value (-1.0 indicates no data)
33	Number of data observation
34	Maximum of data set
35	Minimum of data set
36	Range of data set
37	Standard deviation of data set
38	Mean of data set

Sample Point	Description
Q1	Plant influent
Q2	Clarifier effluent
Q3	Ammonia tower #1 effluent
Q4	Ammonia tower #2 effluent
Q5A	Recarbonation basin at intermediate settling
Q5, 5B	Recarbonation basin effluent
Q6	Filter effluent
Q7 (x)	Effluent from carbon column x
Q8	Combined carbon column effluent
Q9	Chlorination basin effluent
Q10	Blended injection water
Q21A	Pilot RO plant influent
Q21B	Pilot RO plant effluent

Water Reclamation

Reclamation in Marin
The Importance of the MMWD Story

by

Polly Smith

Member, Board of Directors
Marin Municipal Water District

Presented at a Panel Discussion
Sponsored by Watercare

June 28, 1977

RECLAMATION IN MARIN
THE IMPORTANCE OF THE MMWD STORY

I am sandwiched between two large reclamation facilities: Contra Costa's and Orange County's famed Factory 21. Both produce about 15 mg daily for (the former) industrial cooling and (the latter) injection into a ground water aquifer. And the State Department of Water Resources (DWR) is represented here, one of the state's largest purveyors of water, now factoring in re-use as well as conservation in its re-analysis of the California Water Plan.

In contrast the MMWD projects are SMALL. Presently they include:

Las Gallinas Plant :

Will have a capacity of 1 mgd for irrigation around Marin's Civic Center. It will be constructed this year with a grant approved in concept by the State Water Resources Control Board (SWRCB) - and includes funding for a large part of the distribution system.

Lower Ross Valley Plant :

Hopefully this will be constructed about six months behind Las Gallinas, again for public and private irrigation purposes near Marin's new ferry terminal. Capacity will be about 500,000 gallons daily.

Both plants will start at half capacity but are expandable. Both are high in priority on the SWRCB's approved list of projects for 1977-78.

A third project in Mill Valley, currently proposed by that city, is now seeking approvals, would initially be a transport facility for providing 200,000 gallons daily for irrigation of city and state lands. Eventually this will become part of the MMWD system.

All three projects have received endorsement from WATERCARE. Other locations are under study as the MMWD plans to realize at least a total annual reclamation of 2,000 AF by 1995.

What is important about these efforts and the Marin story?Small though these projects may be I find them large in impact and scope. Just what is their significance?

And how did the MMWD become involved in reclamation?Many of you know about the MMWD's recent history - the bond issue defeats, the enactment of a moratorium on new service connections in 1973 because of an overcommitment of supply, and our rationing efforts these past two years. Depending on your point of view you may damm or applaud us, or just be plain confused.

The largest of Marin's water districts, the MMWD serves over three fourths of its population and ten of the eleven cities. Until recently the District has relied totally on runoff from rainfall into six reservoirs - all located within the county. Presently a seventh reservoir is under construction, having been approved by voters last fall. Reservoir runoff now is supplemented, as of last year, by a small import project, bringing to MMWD off peak, surplus Russian River water from Sonoma County.

Four bond issues for additional water supply have been placed before the electorate in the 70's. Two passed (1970 and 1976) and the two which failed were for traditional, larger importation projects from the Russian River up north. It's important to realize these were decisive defeats - 9 to 1 against in 1971 and 2 to 1 against in 1973. The message from the MMWD voter was clear. Stay small, and within Marin County if possible. And explore other alternatives.

Significantly, the reuse of wastewater was one of the alternatives the voters wanted. Mr. William Seeger, then the District's General Manager, stated in a paper, before AWWA in June 1974, that . . . "I can say unequivocally that one of the major objections brought up . . . was the accusation that we had not taken into consideration the possibility of reclamation . . ." He further cited a public opinion poll, run by a professional, which revealed two unexpected and startling attitudes: about 65% of people polled said they would have no concern using reclaimed water for non-consumptive uses; and surprisingly, about 25% claimed they would not have a problem reusing wastewater for domestic and potable purposes.

Marin, in the early 1970's, began to realize that water is a resource, a limited resource too valuable to waste, and a resource badly in need of a total management plan. Many agreed with a philosophy best stated by Jean Auer before the San Francisco Commonwealth Club in 1974. "Surplus water is an endangered if not an extinct concept in California. We are now reaching the point where each increase in use – which we often encourage with unplanned growth – puts heavy pressure on other needed uses of water."

And as MMWD voters became more and more committed to the conservation ethic, they insisted through their votes that reclamation - and water conservation - be considered in any plan for expanding the District's water supply.

From 1974 on, five new directors were elected on this type of platform. Then with the resignation of Mr. Seeger, Mr. J. Dietrich Stroeh became General Manager and together we honed in on a totally new approach to a Water Resources Management Plan through 1995.

Wastewater reclamation is one of five elements in this Plan. The others include: additional water from natural sources, savings through conservation, efficient operation of the district's system, and a proposal to allocate new supply in order to insure that it lasts as long as intended - through 1995. (The latter has not yet been finalized). Our two years of drought have not changed these basic concepts, just the timing; additional supplies now must be found to provide for newly projected needs through 1995 - and beyond.

THINKING of water reuse - and conservation - as NEW WATER and part of a total water supply program are new concepts. This, to me, is the primary significance of MMWD's small reclamation projects. Without them our total program wouldn't work; without both reclamation and conservation the District would have been obligated to provide a much larger natural source - over twice the size of the new reservoir approved by the voters and under construction. Now and in the future the MMWD must utilize a variety of approaches, I believe, rather than depend solely on runoff from rainfall. As I think ahead to the probability of another drought, I hope - long range - that MMWD's reclamation plans can be expanded further.

There are other reasons why I find our projects significant and broad in scope.

. They are pioneers of a new age - putting into practice policies adopted and encouraged by DWR but rarely seen.

. MMWD's projects are operational rather than purely research oriented, and in an urban, coastal basin, "people" setting. To a large extent this reclaimed water will replace potable water now being used up on landscaping.

. The Clean Water Grant approved for the Las Gallinas project includes monies for distribution. To my knowledge this is a first - and I hope not the last.

. I think their very smallness is beautiful, helping to make reclamation more manageable and accessible to the public. This size and type of project can be developed by almost all water agencies. What it takes is a firm commitment to reuse, intelligent cooperation with state and federal agencies, and a great deal of tenacity.

. Small projects should be easier to implement, causing less upset environmentally and economically. They set guidelines, establish precedents, and help define problem areas.

. The MMWD Board has adopted policies for reclamation which I find innovative and practical. Their basis is the concept that reclaimed water, although only used for irrigation, is still water supply and thus of benefit to the district as a whole. Policies include:

- The same rate will be charged for both potable and reclaimed water.

- All new water supply costs (new reservoirs, reclamation, conservation) are put together in one pot. Total costs will be paid back through rates and new connection charges.

- The District will bear the costs of dual distribution systems, unless grant monies are available, as part of this total water supply cost.

- The area around each reclamation facility will be designated a reclaimed water use area where reclaimed water must be used for irrigation.

And finally these projects - and our whole program - have helped board and staff overcome the tunnel vision which so often plagued the water industry in the past. Reclamation has induced tremendous cooperation between MMWD, sanitary districts, general purpose government and state agencies.

In spite of cooperation, I would judge that the knottiest obstacles in implementing MMWD's projects have come from what is euphemistically called "institutional constraints". Consensus is this has resulted from a heavy overload of work caused by the Clean Water Act Grant Program. Also a large turnover in personnel in various agencies has meant a repeat and rehash of many parts of each proposal. I find the role of the EPA confusing. Most clear cut is the role of State Health whose officials have an important job to perform. The MMWD has found them fair and open to negotiation. They negotiate tough, and well they should.

Perhaps WATERCARE can come up with recommendations to help solve the universal, bureaucratic problem of institutional constraints.

Cost problems, formerly prohibitive for reclamation projects, I think are lessening as the true cost of new water projects escalates due to energy and inflation. MMWD's reclaimed water can be produced for less than our potable water. This is the result of (one) increasing costs of our old and new reservoir water, and (two) the high degree of treatment now demanded for sewage effluent discharged into San Francisco Bay. Our reclamation plants will filter and further chlorinate secondary level effluent - that's all that will be necessary - in order to maintain a consistent quality irrigation water.

The financial impact and feasibility of reclamation proposals certainly will vary with circumstance and from place to place - and has to be thoroughly analyzed. But I believe the public is willing to accept reasonable costs for reclamation - especially when defined as an alternative to new water supply. As the DWR Policy Statement of May 1975 states, "The least expensive alternative will not necessarily be selected."

A good example of public willingness has been Marin's acceptance of wastewater for irrigation during this present emergency, utilizing wastewater coming directly from the sanitary district plant. During last summer's drought secondary effluent, with a coliform count of not more than 23 ppm was used for non-residential irrigation. This summer the program has been expanded for residential - utilizing a higher grade effluent with a coliform count of not more than 2.2. ppm Only one sanitary plant can meet this standard (Las Gallinas) with four others dispensing irrigation water for commercial, public areas.

Approvals for this use were sought from State Public Health, Bay Area Regional Water Quality Control Board and from Marin County Health. Truckers, trained and monitored by the MMWD distribute the effluent under stringent, controlled conditions. Wastewater is not available for vegetable gardens, just landscaping; may not be used to fill swimming pools or be applied through irrigation systems, or stored in containers. It is applied by the driver, trained not to spray or pool water. The MMWD charges $1.00 per 1,000 gallons for its services, but, because of the expense of trucking, the consumer pays between 7 to 10 cents a gallon. It has become a thriving business in Marin and expands every day, sometimes beyond our capacity to manage. The public has accepted.

Much progress for reclamation has been made in Marin. In view of future demands statewide, I do not think any of us can turn back to the old ways. Your voters may not yet be insistent, or your costs may be higher. But I think the question is not whether or not we should reclaim and reuse wastewater. The question is how can we do it in a reasonable way?

As one of MMWD's waterworks engineers, Mr. Bernie Heare, stated in a Counterpoint article for the AWWA Journal:

> "Public policy is turning against those agencies that insist on doing single purpose planning. The policy now emerging demands that water agencies, sewer agencies, cities, counties and other such planning entities work together . . ."
> And . . . "Development of natural supplies should be minimized and reclamation of wastewater and water conservation should be maximized in planning new water supplies."

I agree. Especially when we know that only 5% of our potable water is actually used for potable purposes. Much of the remainder goes for mundane purposes such as flushing toilets, washing automobiles and sidewalks and for irrigation. The time has come for reclamation on a statewide basis.

CONTRA COSTA COUNTY WATER DISTRICT
WATER REUSE ACTIVITIES

by

Geoffrey L. Casburn
Chief
Water Supply Division

CONTRA COSTA COUNTY WATER DISTRICT
WATER REUSE ACTIVITIES

by
Geoffrey L. Casburn
Chief
Water Supply Division

The drought has had an effect and we think it will have a continuing significant effect on the reclamation project in Contra Costa County. Also, we think the reclamation project will make a significant contribution to this area in getting through the drought. I would like to review with you a little bit of what we see as significant this year. In looking at this, we need to ask several questions and, hopefully proceed to satisfactory answers to them. First, who is reclaiming water? There are a lot of different things going on in the District and statewide. Let's take a look at what re-use is underway and what value that re-use has; and, what effect do these varied uses have on other uses that one might put wastewater to?

As I mentioned, many, many different things are going on--the one we hear the most is the use of "grey water" by the residential owner, as well as the use of toilet dams and much shorter showers, which affects me greatly (I have always enjoyed a 15 minute shower, but not anymore). The second area I would like to discuss is what industry in this county is doing. We've seen, and I think it is very encouraging, a great deal of internal recycling and in-plant re-use of water. These actions have resulted in significant strides toward these industries being able to get through the year with full employment.

A third area I would like to discuss is the Water District and Sanitary District joint project to supply cooling water to six industries in the

Pacheco/Martinez/Avon area. I would like to go over what we see as the effect of the drought on this project. We will look at the volume of water available and the effect of source water quality. In Contra Costa County, we have had over the last two years a tremendous water quality problem.

Also, we want to look at what happens to the water when it passes through its initial use, through the house or through the industry, and see how much of an increase of solids or mineral content we might find. I will say at the outset this is our first try on this subject; we are new to the drought like everybody else and, hopefully, we won't get old.

My emphasis this morning will be on industrial re-use. Mineral quantity of the water--primarily calcium, magnesium, alkalinity, sulphate, and the infamous chloride ion, are all important, as well as nitrogen and phosphates, from a biological standpoint.

The use of grey water is quite prevalent. I talked the other day with the County Health Department and they say it is widely used. You see, there are two problems: first, there is a loss of flow available to the Sanitary District for reclamation; second, as the amount of water available to the Sanitary District decreases, the mass addition of minerals stays roughly the same. Therefore, the concentration of minerals per volume of water increases dramatically. As of now, we would expect, under normal conditions, to have a TDS in our reclaimed water of about 600 miligrams per liter; we are now running at 900, and could go a bit higher, depending on source water degradation. So, we find problems, even with conservation of water at the home level--one, the flow is cut down for future use, and, two, the mineral content of the remaining flow is increased. At a later time, I think we will have to take a

closer look at whether water conservation in the house is balanced by potential use later and try to balance these things. I don't think that we have the flexibility today to really do that in the current drought situation, but, on the long-term basis, we are going to have to look at it.

One of the brighter spots, I think, in the drought years is, in my estimation, the response of industry in this county to the drought. They are suffering, both in reduction in flow and also in reduction in water quality. The reduction in water quality typically means they must use more water, not less. They have a two-edged sword at them this year. To give you an idea of whom I am talking about this morning, we have in the District two oil refineries, Lion Oil and Shell, with a combined output of a little over 200,000 barrels per day. We have two paper plants in the Antioch area, Crown Zellerbach and Fibreboard Corporation. One is a craft mill and the other is a tissue and finished product mill. We have five chemical companies--DuPont, Monsanto, Dow, Stauffer, Union Carbide, and any number of smaller chemical companies served by retail distributors in the District. In primary metals, we have U. S. Steel, Pittsburg Works, which is one of the largest employers in the District, Inland Steel, and American Bridge.

About 44% of P. G. & E. fossil fuel production facilities are located within the District. Everytime the light switch goes on, a little more of the water goes down. We seem to lose both ways this year.

I would like, for background, to tell you a little bit about what we did to distribute the water we have available. We have a Bureau Contract and have been supplied about 96,000 acre feet of water under that contract.

The District Board passed an ordinance in March, allocating water to customers. Each of the major industrial customers, in fact, every customer of the Water Supply Division, has an allocation of water for the calendar year 1977. In the case of the industries, when they have used their allocation, we do not have more water for them. Out of our total supply, we have been reserved 1.5 percent, which amounts to 1,500 acre feet out of the 96,000. So, each of the industries has been told "here is the amount of water you may have; you make take it all in one month, spread it out through 12 months, take it only during the summer, schedule it any way you desire, but that is all the water we have for you". The industries have cooperated--they have been conserving water.

To give you some examples of what can be done, one particular industry that takes about 9,000 acre feet a year put a washwater recycling program into effect and saved about 1,000 acre feet. Unfortunately, they did it last year instead of this year, so they didn't get credit for it in their allocation, but they did save the water. Another customer, a chemical company, has gone to front end treatment to demineralize all water going to their cooling towers. They felt the demineralizer blowdown was much less than the tower blowdown. They save a significant amount of water by doing this. Also, they went to zero blowdown on their towers. Another chemical company has tried to use reclaimed water from a refinery in their finished product. Unfortunately, the organics were too high and they have had problems and could not, but I think the important thing here is they are willing to take a chance and try to blend reclaimed water--to try different things to get through. There were quite a few industries drilling wells.

In making allocations, we sent out letters, asking people what they could do if we cut them 10%, 15%, 20%, and so on. And two industries came back

and said "We can reduce 16%", and another industry said "We can reduce 17%". Even though the industrial demand, as a whole, was cut only 7½%, we graciously accepted their offer to cut them 16% and 17%. I am not sure--I see a man in the audience, who will go unidentified, who made the offer which was accepted. Industry has faced the problem of having a limited water supply this year, and I think they have done an excellent job. As one of the plant managers said during one of our many meetings, "That is my job--to keep the plant open, not close it". Industry is spending over $150,000 per plant on drought related equipment. This does not include any of the costs associated with operating and maintaining the equipment. So, we have quite a recycling program going there.

The last area that I would like to review with you is that of our joint project with Central Contra Costa Sanitary District. We plan to serve the cooling water demand of six industries...Shell Oil, Lion Oil, Monsanto, Stauffer, and two P. G. & E. steam plants. Central San serves the Central County area, the cities of Concord, Walnut Creek, Pleasant Hill, Martinez, Orinda, Lafayette, Danville, and unincorporated areas. The service area source water is approximately half of East Bay Municipal Utility District and half of Contra Costa water. There is an increasing amount of groundwater being used now, even though it is still quite small, on a percentage basis. This split in source water is significant to us in that the Delta water TDS is up to 800 mg/l. The East Bay Municipal Utility District water is much lower, so that as you vary the blend of these two waters, you find different final TDS values.

Again, for background, let me go through briefly what we have done over the last ten or twelve years in reclaimed water. First of all, there were Federal grants for pilot plant studies conducted by the Central Sanitary

District. They ran an Advanced Treatment Test Facility over a large period of time to develop and refine the basic processes. In 1973, we got together with Central San and with what was then Phillips Petroleum and ran what is called the On-Site Test Program. We delivered 1/2 million gallons a day of reclaimed water to a production cooling tower located at Phillips Petroleum. As part of this program, Phillips had also instrumented a similar tower that was using Delta water. A report on the comparison of Delta Water and Reclaimed Water resulted from this program. From that data, we prepared what we called a "Water User Cost Study", which was done by Montgomery Engineers, where we went to the industries, took our data, got their data on the testing they did and developed "real" data on what it would cost to use the reclaimed water. This analysis showed that the Water District should soften the reclaimed water in order to get the cycles of concentration up high enough in the cooling tower to make the use of the water economically feasible. We were surprised to find that while we charged $35 to $40 per acre foot, the industries would put up to $300 per acre foot in treatment and disposal. And it is difficult to offset a $35 price to take care of $100 penalty in treatment and disposal when they're using 1/3 more water. So, you can see where the economics lay there. We spent quite a bit of time and effort in working with the industries and Central San in coming up with a project that met the end use. Central San has constructed and is beginning start-up of the pollution control facilities. Filters, 30 million-gallon clear well, and about a mile long pipeline and pump station are complete. The Water District is completing construction on the remainder of the distribution system, the elevated storage, and we have under contract now the softening plant equipment and we will shortly bid the base facilities for the softening plant. The entire system should be online about the first of April of next year, however, we

hope to be delivering unsoftened water prior to the first of the year.

In my opening statement, I said that this project will contribute toward the District, as a whole, getting through this drought year. Let's go into a little bit about quality and the drought. Extensive water conservation has reduced the flow to Central San. We find this reduction to be from an average of about 24 mgd average dry weather flow down to about 19 mgd. Now, with a reasonably worse case, we will need 18 mgd to supply cooling needs in industries, those six industries, without softening. This volume may tax the discharge treatment facility of industries because of their blowdown rates. With softening going on line in April, we could get that down to about 13 mgd; in other words, we could increase the cooling tower cycles from about 2½ cycles to up to 6½ cycles. If the Central San flow drops much below 19 mgd and we are up to 18 and we have almost 1 mgd of brine, then we are just about neck and neck right now in meeting full demand. What this means is that we will blend the canal water to deliver reclaimed water just to get the volume necessary due to drought related conservation. We are planning on about 4 or 5 thousand acre feet of reclaimed water this fiscal year.

Secondly, the effect of the potable supply quality on the quality of reclaimed water is significant. Everything is conservative, in terms of mineral quality, and all minerals that come into the District via the canal or the East Bay M.U.D., or which are added at the point of use come right through. Society pays the bill when these minerals get there, in terms of reclaimed water user cost. Everything comes through to the industrial user.

The Delta water chlorides for this district have reached about 315 mg/l so far. Water at Frank's Tract is now about 514 mg/l. Water at Contra Costa Canal this morning was about 215 mg/l. We expect it to be up at 250 mg/l

I guess you are not familiar with--we have a blending supply from Middle River provided by DWR and that provides some relief. It has saves us from having some 400-450 mg/l water. There is no question about that. If East Bay M.U.D. were to shift to Middle River, which I believe they will, we would expect an increase to about 900 mg/l. These numbers are quite rough but we would expect then to lose the advantage of the East Bay M.U.D. water on half of the source water and we would expect to shift up. With the conservation effort, we think the increment due to home use at about a 20 mgd rate would be about 400 mg/l add-on in minerals. By the time you conserve and get a 10 mgd rate into the treatment plant, we feel the result would be about 900 mg/l, in terms of TDS. We need more data, but it looks like the short-term impact of conservation on reclamation will be severe. Conservation in the service area is extremely good. There is no question about that. It allows industry to continue to employ people, but, in terms of reclamation, it is not a big plus at any rate. I think it backs up the old statement, "there is no free lunch" and there are trade-offs in everything--we are finding them in this project, certainly.

If I can just summarize, we have 10-12 years of effort on this project. Its 15 mgd initially. Central San is designed for 30 mgd. In fact, everything is designed for 30 mgd, except the softening plant, which is 15 mgd, primarily due to first cost. We have worked with industry over the last ten years and quite a bit over the last five years, and it has been a good project, but I think it points up that you have to work with the customers on a reclamation and what works in this District may not work anywhere else, or it may work everywhere else. It is extremely hard to tell and you have to have, if you are going to serve agriculture, an ag. project; if you are going to serve residential, you have to build a small residential project. If you are going to serve industry, it has to be tailored to the end use. There is no way to

generalize on that. I think that is probably the lesson I have learned in this project.

Thank you for your attention.

REUSE OF AND TREATMENT OF WASTE WATER IN AGRICULTURE

by

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REUSE OF AND TREATMENT OF WASTE WATER IN AGRICULTURE*

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The reusing of waste waters in agriculture in California is not a new method of reuse; however, there is need to increase the amount of waste water that is reused in agriculture and a need to gain public acceptance especially in the area of municipal waste water reuse by agriculture. The California Department of Water Resources has for several years been engaged in work to determine the practicality of reusing salty agricultural waste water and municipal waste water in agriculture.

For many years in California some agricultural and municipal waste waters have been reused directly or indirectly for agricultural purposes both as a source of a new water supply and a means for disposal of waste water. Some of this reuse is by direct application, but much of the reuse occurs indirectly through the mechanism of recharging of ground water bodies with waste water from which water is pumped from wells and used for irrigation.

Definition of Agricultural Waste Water

Before I go further, I want to define what I mean by agricultural waste water. Irrigation in arid regions will result in a salt buildup in the soil unless measures are taken to remove the salt. In California subsurface drainage systems are used to

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* Presented at the Fourth Annual Conference of Watercare, June 28, 1977, in Concord.

carry away excess salts in the drainage water in some of the arid areas. When the salinity of this drainage water becomes too high for reuse by agriculture, it is called agricultural waste water.

Reuse of Waste Waters

The reuse of water has special significance when your water supply is not sufficient. During drought years, such as at present in California, the use of waste water for irrigation may mean the difference between growing and not growing a crop or saving permanent plants, such as vines and trees. But even during a normal year, there are several reasons why reuse would be practical;

1. To augment natural water supplies and reduce the need for development of new sources and imports of water,
2. To provide a more economical alternative source of water for many uses, and
3. To provide control of pollution by waste waters and greater protection for the environment.

In many parts of California agricultural drainage water has been reused directly by farmers for many years as a ready source of water supply and a means to dispose of drainage water. This drainage water is a mixture of both good quality excess surface runoff and salty agricultural waste water. When there were ample supplies of low cost water and the cost of farm labor and irrigation improvements were high in relation to the cost of water, it was practical to forget about the drain water as it left the lower boundary of the irrigated field in a drain ditch.

Generally, another farmer down slope would take the water from the drain ditch if needed to irrigate his fields or the drain water would flow into a stream or river and was rediverted downstream by another water user for agricultural or municipal use. This is the typical use of water in some areas adjacent to the Sacramento River. These waters are reused for agriculture without treatment.

In recent years salt balance and water logged soils have become a recognized problem in some agricultural areas in California. In the San Joaquin, Coachella and Imperial Valleys subsurface drains have been installed to remove both excess salt and water from the soil. The salty water from these drains generally contains too much salt for the water to be reused economically and has created a waste water disposal problem. Where there is excess salt in the water, these waste waters, after proper treatment, can be reused for either industrial or agricultural purposes.

Quantities of Waste Waters Reused

The latest statewide survey of municipal waste water reclamation facilities was made in 1975 by the Department of Health[1/]. The Department surveyed 194 facilities and found that 184 used 200 cubic hectometres (162,000 acre-feet) of reclaimed waste water for the direct irrigation of food, fiber, fodder, and seed crops, orchards, and landscapes. A tabulation of the data

contained in the report shows that 20 cubic hectometres (19,700 acre-feet) of reclaimed water from 16 different treatment plants were used to irrigate food crops. Fodder, fiber, and seed crops were irrigated using 161 cubic hectometres (131,000 acre-feet) of reclaimed water from 139 plants and orchards were irrigated using 30 cubic hectometres (24,100 acre-feet) of water from 16 water reclamation plants. Landscapes were irrigated using 50 cubic hectometres (40,200 acre-feet) of treated effluent from 45 plants. The summation of the number of plants and quantities of reclaimed water exceed the total of the plants surveyed because reclaimed water was used for more than one use at 31 plants and the quantity for each use was not shown separately. The locations of waste water reclamation plants in California were more than 5,700 megalitres per year (1,500 million gallons per year) of reclaimed municipal waste water was treated in 1975 for use in agriculture are shown in Figure 1. Most of the waste water collected in coastal areas is discharged to saline water and not reused.

We are not aware of an inventory of the agricultural waste water that is reused in California. Most of the reuse is done on an individual farm-operator basis and not by a public agency as is the case with most municipal waste water. Even though we do not have a measure of the present reuse of agricultural waste water, studies have been made of the amounts of agricultural waste waters that exist today and are expected to exist in the future. The major amounts of this waste water are expected to occur in the San Joaquin, Imperial, Coachella and Palo Verde Valleys. The general locations are shown in Figure 2.

FIGURE 1

LOCATIONS OF WASTE WATER RECLAMATION PLANTS WHICH SUPPLY AS MUCH AS 5,700 MEGALITRES PER YEAR (4,500 ACRE-FEET PER YEAR) FOR USE IN AGRICULTURE IN 1975.

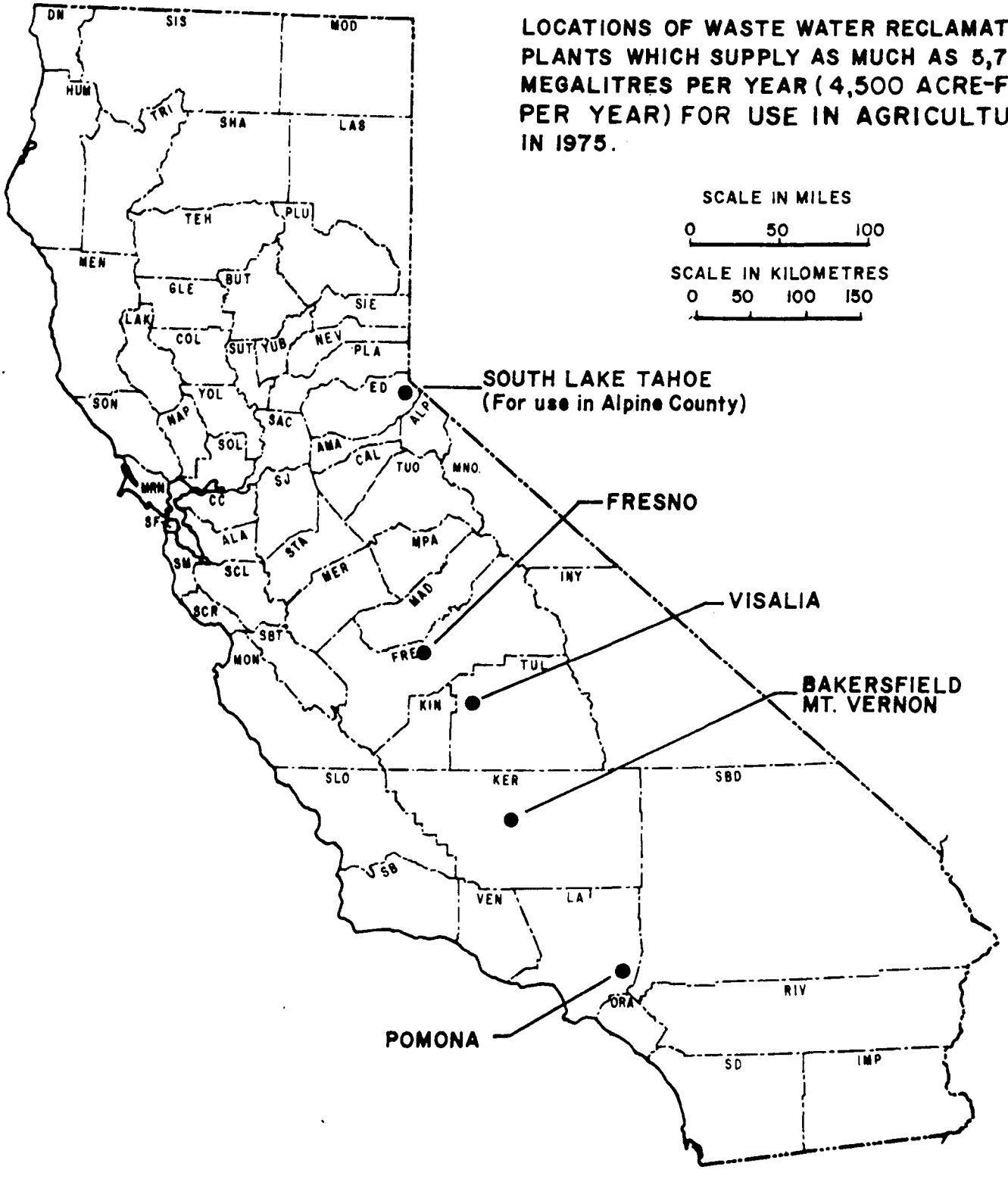
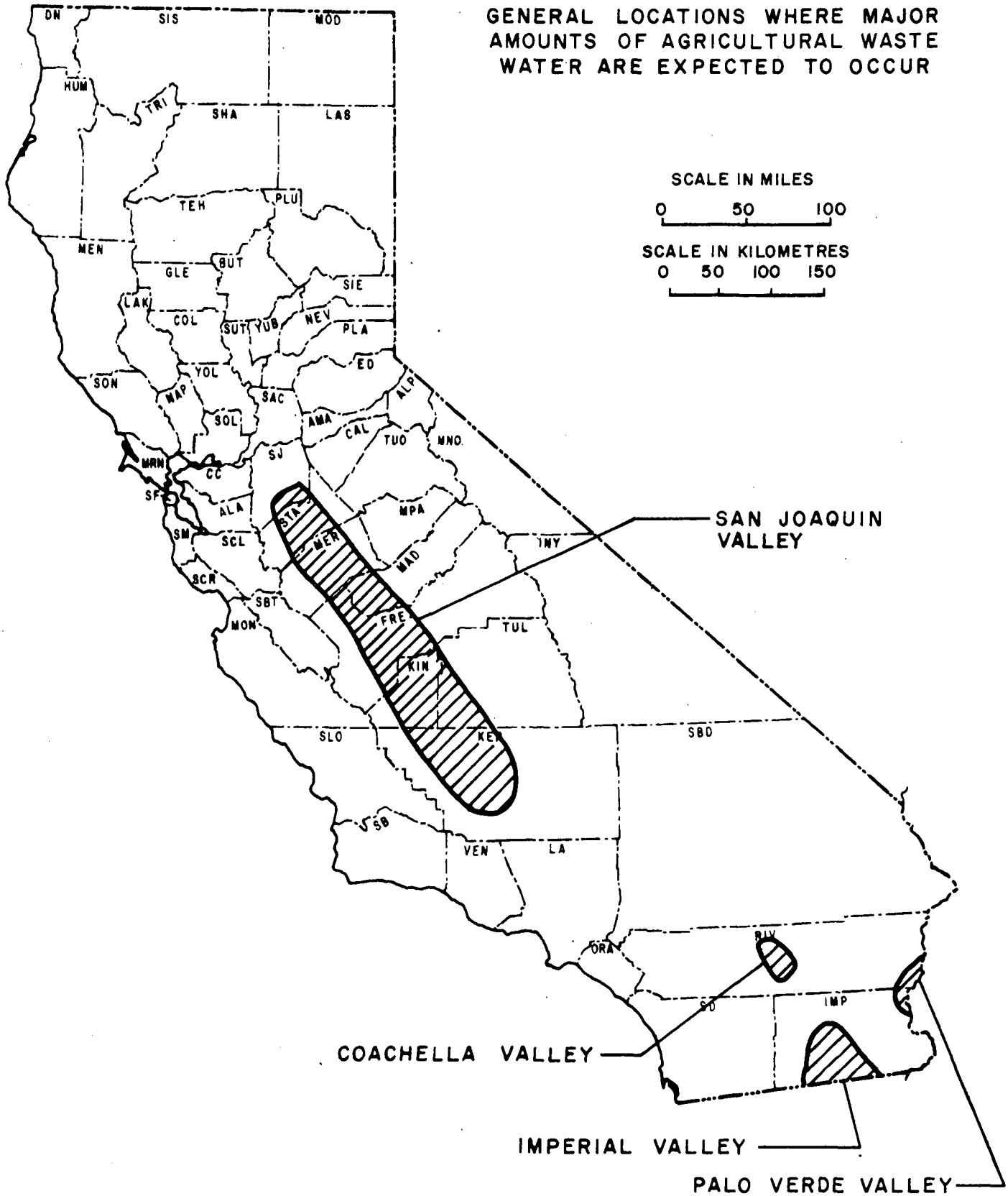


FIGURE 2

GENERAL LOCATIONS WHERE MAJOR AMOUNTS OF AGRICULTURAL WASTE WATER ARE EXPECTED TO OCCUR



In the San Joaquin Valley the California Department of Water Resources has made extensive studies in seeking a solution to the anticipated wide-spread agricultural waste water disposal problems. In these studies, it was estimated that at present about 86 cubic hectometres per year (70,000 AF/yr.) of agricultural waste water would be removed from the land if the necessary collection systems were in place. In 30 to 50 years it is estimated that the amount of agricultural waste water in the San Joaquin Valley would increase to 620 to 740 cubic hectometres per year (500,000 to 600,000 AF/yr.), if the necessary collection systems are in place. In the early years of operation of the systems the salinity of the drainage water is likely to be relatively high and variable. The estimated ultimate mean salinity of the waste water would be 2,000 to 3,000 mg/l.

The agricultural waste water from the Imperial Valley and Coachella Valley flows into a natural sink called the Salton Sea. In 1971 the flow from the Imperial Valley was about 1,470 cubic hectometres (1,190,000 acre-feet) and had a salinity ranging from 2,000 to 4,000 mg/l. The flow from the Coachella Valley in 1975 was about 212 cubic hectometres (172,000 acre-feet). The agricultural waste water flow from the Palo Verde Valley in 1974 was about 490 cubic hectometres per year (400,000 AF/yr.) with a salinity ranging from 1,500 to 2,000 mg/l. This water flows back into the Colorado River. We are not aware of future projections of the agricultural waste water flows from the Imperial and Coachella Valleys; however, it is known that programsare being implemented to reduce the amount of waste water flowing from fields in the Imperial Valley. In the Palo Verde Valley the

annual flow of agricultural waste water to the Colorado River appears to have reached an almost steady state.

Treatment of Waste Waters

Waste water must be treated to some degree before it can be reused directly. The degree of treatment before it can be reused for agriculture may vary considerably, depending on the nature of the waste and the proposed method of application of the waste water. In agricultural waste water the concentration of total salts in the water or the concentration of some specific salt is generally the controlling factor. The salt concentration in the water may be decreased to an acceptable level through blending with higher quality waters. Such waste water can also be treated by desalting methods to produce a good quality water that can be reused for agricultural or industrial purposes. One contemplated reuse in California for these saline agricultural drainage waters is for cooling thermal power plants. This use serves the purpose of substantially reducing the volume of waste water that must be disposed of and at the same time provides a source of cooling water for thermal power plants in arid regions where other water supplies are not likely to be available for cooling purposes.

The treatment of municipal waste water before it can be used directly for an agricultural water supply depends on the type of crop to be irrigated, the method of water application and the wastes contained in the water. This treatment may vary from only primary sedimentation to a much higher degree of treat-

ment, such as oxidation, coagulation, clarification, and filteration followed by a high degree of disinfection. Treatment of municipal waste water is required by the California Department of Health before it can be reused. The degree of treatment depends on the application. The resulting cost of the treated water may be too high to be practical for irrigation reuse.

Desalting of Agricultural Waste Water

The California Department of Water Resources has been operating pilot plants* for several years to develop desalting technology suitable for treating agricultural waste water. Since 1971 at a field test site, the Department has been studying the desalting of agricultural waste water by the reverse osmosis (RO) process. The study is being done in two phases (1) to determine the technical feasibility of using the RO process and (2) to investigate the economic aspects of using the RO process. The field test site is known as the Waste Water Treatment Evaluation Facility (WWTEF). It is located in the San Joaquin Valley in western Fresno County near Firebaugh, California.

In 1972, the federal Office of Water Research and Technology and the Department jointly funded an evaluation study of three proto-type RO membrane units. The three types of membranes were hollow fiber, spiral wound and tubular design. In this evaluation study the three units were operated to determine (1)

* The primary pilot plants were designed and built by the University of California, Los Angeles, under the direction of J. W. McCutchan.

the life and performance of the semipermeable membrane, (2) the effect of agricultural waste water on the RO process, (3) feed water pretreatment procedures and (4) the product recovery obtainable under various conditions of feed water salinity and treatment.

In 1973, the Department contracted with the University of California at Berkeley[2/] for Robert C. Cooper to study the bacteriological aspects of membrane decomposition and surface fouling in the RO units. Microorganisms were identified that affected the life and performance of the RO membrane. Various feed water pretreatment procedures were investigated to control the bacteriological effects. It was found that pretreatment by acidification, oxygen removal, or chlorination must be performed to protect the membrane from biodeterioration. It was also found that the membrane composition can affect the susceptibility of the membrane to biological attack.

To establish the maximum fresh water recovery levels that can be attained in a tubular RO unit, when limited by scaling tendency due to calcium sulfate in the feed water, a series of investigations were conducted. With softened feed water*, a 180-tube unit was operated successfully at 90 percent recovery when the total dissolved solids (TDS) were higher than 6,000 mg/l and at a 95 percent recovery when the TDS were 3,000 mg/l. The unit was operated at a 90 percent recovery level from May to October 1974 with an average flux of 815 litres/(square metre-day) and product salinity of 400 mg/l[3/].

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* T. Vermeulen and G. Klein, University of California, Berkeley, assisted in the design specifications for the softening unit.

Following completion of the Phase I technical studies in June 1975, preparations were begun for the fabrication and installation of a 500-tube, tubular RO desalter with a 95,000 to 114,000 litres per day capacity. In April 1976 operation of this plant began at the Firebaugh site for the purpose of establishing the economic feasibility of desalting agricultural waste water by the RO process. The Phase 2 studies are intended to provide design information from which desalting costs can be estimated for comparison of reverse osmosis desalting with alternative methods of agricultural waste water disposal. It will also provide information on the feasibility of integrating the RO process into power plant and other industrial cooling systems.

Since the cost of replacing the membranes in an RO system is a significant part of the RO operating cost, emphasis has been placed on trying to reduce this element of the cost. It was believed that a significant reduction in membrane cost could be realized if the membranes were fabricated at the plant site by operating personnel. Therefore, as an adjunct to the tube-type RO plant operation, a membrane fabrication laboratory was set up, with the assistance of Joseph McCutchan from the University of California, Los Angeles, to make the initial 500-membrane tubes and to provide replacement.

It was decided to establish the laboratory because the manufacture of the tubular cellulose acetate (CA) membrane was determined to be a relatively simple process, requiring the use of only semiskilled labor and off-shelf equipment. This manufacturing capability made the RO operation at the site self-sufficient in membrane production and demonstrated that such manufacturing could be done on-site.

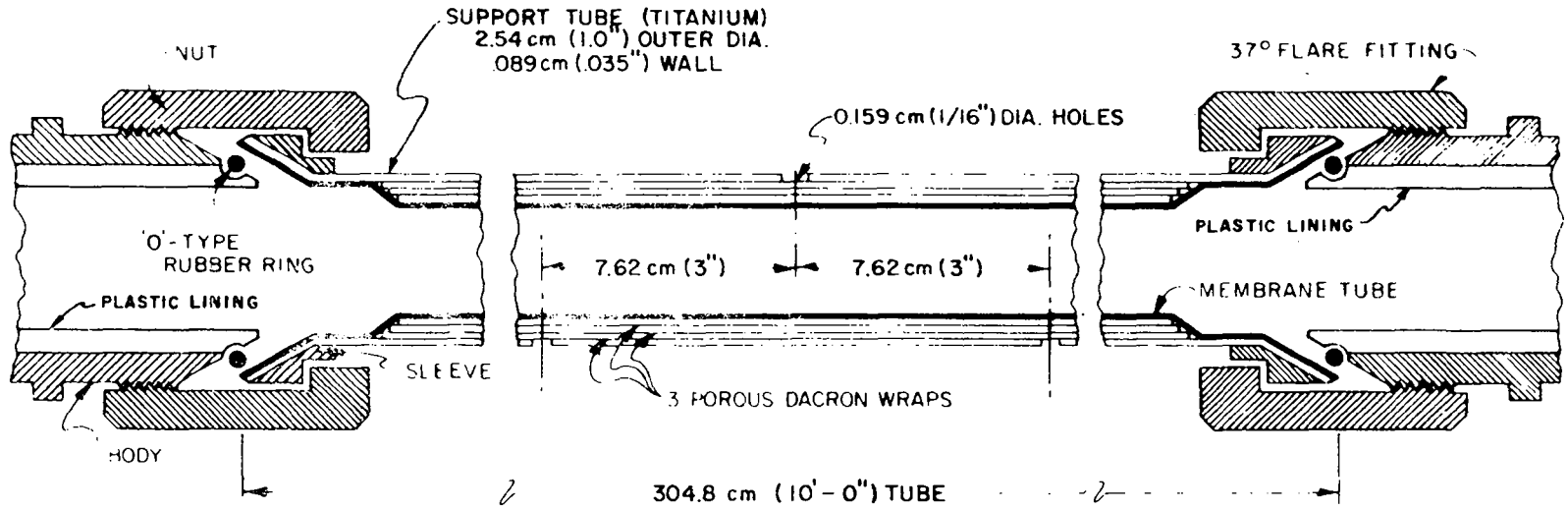
The CA membrane used in the tube-type RO plant is made by a process developed and patented by the University of California, Los Angeles[4]. The membrane is prepared from a solution consisting of cellulose acetate, formamide, and acetone, mixed in a typical ratio of 23:27:50 percent by weight. A viscous liquid resulting from this mixture is cast into a tubular-shaped film. The cast membrane is then fabricated into a working assembly (Figure 3) and posttreated to develop its salt-rejecting property.

The membrare is batch-cast using a specially designed apparatus (Figure 4). A casting tube is used to form the membrane into a tubular shape. The bottom of the tube is charged with casting solution, and a casting bob is inserted to hold the solution in place. A winch-driven chain is used to pull the bob upward through the tube at a rate of about 150 millimetres per second. The bob pushes the casting solution ahead of it leaving a thin wiped film of solution of the inner wall of the tube.

The casting tube is immediately dropped into a chilled water well located below the casting apparatus. The well water is held at a temperature of 1°C to gel the solution. The casting tube is then transferred to a shrink tank containing hot water at 80°C. The shrinking process allows the membrane to be removed from the casting tube.

After removal from the casting tube, the membrane is wrapped in three layers of dacron cloth and inserted in a titanium support tube. The ends of the membrane are trimmed, plasticized, and flared to conform to a flared tube connector.

The completed assembly (see Figure 3) is installed in a curing loop through which hot water at a pH of 4.5 is circulated for 15 minutes. Citric acid is added to the water to maintain a pH of 4.5. There is a slight variation in the cure temperature



NO SCALE

FIGURE 3- TYPICAL TUBULAR ASSEMBLY - 500 TUBE (UCLA) R O UNIT

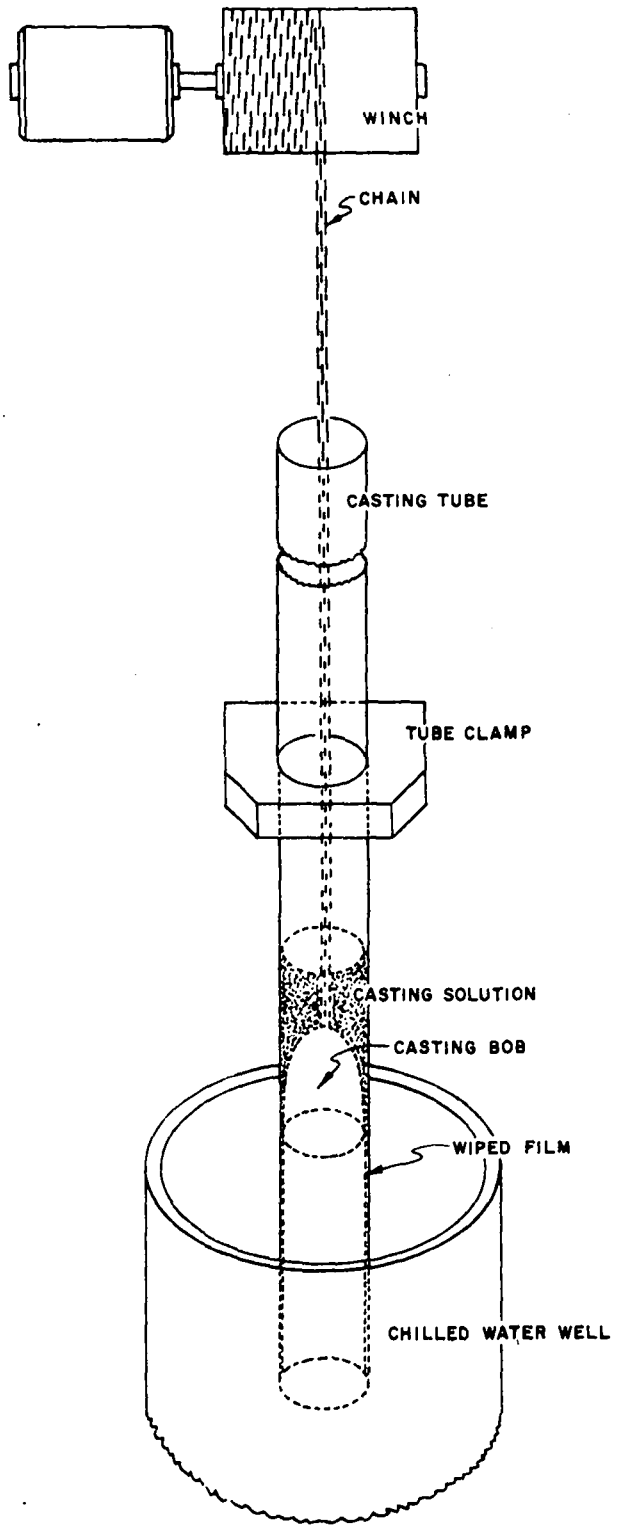


FIGURE 4 – R O MEMBRANE CASTING APPARATUS

because of heat loss in the curing loop. This curing process develops the membrane's salt-rejecting property, and a water temperature of 90°C gives the membrane an intermediate permeability to both water flux and salt. The loop is then flushed with cold water at a pH of about 7.1.

As a final step, the tube assemblies are installed on a test rack where they are proof-tested for defects and desalting performance. Feed water containing sodium chloride (NaCl) solution at a concentration of 5,000 milligrams per litre is passed through the test rack at a flow rate of 0.32 litre per second and 2,800-kPa pressure. Table 1 shows the results of a typical two-day test run.

The cast membrane is composed mainly of cellulose diacetate and has a dense surface layer formed during the casting process and a relatively porous sublayer. The total film thickness is about 100 micrometres, and the dense layer has a thickness of about 0.2 micrometre. The thin, dense layer is formed on the side exposed to the air during casting and is the primary barrier to salt passage. This surface must be in contact with the brine to gain full membrane performance.

TABLE 1

RO TUBE TEST RESULTS

Date	Feedwater NaCl (mg/l)	Test Slot No.	Product Water Flux (cm3/min)[1]	Product Water Flux (gfd)[2]	Product Water NaCl (mg/l)	DR[3]
3/12/76	4800	1	84	14.3	310	15.48
		2	85	14.4	270	17.78
		3	84	14.3	380	16.84
		4	92	15.6	345	12.63
		5	93	16.0	380	13.91
3/16/76	5200	1	117	19.9	470	11.06
		2	115	19.6	410	12.68
		3	115	19.6	460	11.30
		4	122	20.7	490	10.61
		5	122	20.7	410	12.68

[1] Cubic centimetres per minute (per tube).

[2] Gallons per square foot per day (of membrane area).

[3] Desalination ratio = $\frac{\text{salt concentration of feedwater}}{\text{salt concentration of product water}}$

Managing Agricultural Waste Water

Before treatment and reuse can be practiced, a system to collect the agricultural waste waters and convey them to treatment locations must be implemented. In the San Joaquin Valley the agricultural waste waters occur at scattered locations on the valley floor. Collector and storage systems will be needed to collect the waste water and store it to meet the demands for beneficial purposes. The economical control of biological growth in these waters while in the collector and storage systems poses another problem. The California Department of Water Resources, the California Water Resources Control Board and the U. S. Bureau of Reclamation are jointly studying the best method for managing these agricultural waste waters.

Power Plant Cooling

Another pilot plant program was begun in January 1977 at the Firebaugh site involving an improved distillation system[5] combined with a novel ion exchange system*. The energy input to drive the system is obtained primarily from the operation of a cooling tower in which the concentrated salt solution removed from the cooling tower is used to regenerate the ion exchange resin. The pilot plant equipment was designed and built by the University of California at its Sea Water Conversion Laboratory, Richmond Field Station. The pilot plant will be operated during 1977 to obtain data for design and cost estimating purposes of this treatment system, which is especially suitable for treating agricultural waste water for power plant cooling.

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* The ion exchange system was developed by T. Vermeulen and G. Klein University of California, Berkeley.

There are three proposed nuclear power plants at which waste water is a possible source of cooling water. The Sundesert Nuclear Power Plant planned for construction near Palo Verde Valley in southeastern Riverside County will use agricultural drainage water from the Palo Verde Irrigation District. Cooling water to be used at the proposed San Joaquin Nuclear Power Plant to be located northwest of Bakersfield will include the available agricultural waste water. Municipal waste water together with agricultural drainage may be the source of cooling water for the proposed East Stanislaus Nuclear Power Plant, which may be constructed east of Modesto.

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3. Department of Water Resources (1976), "Agricultural Waste Water Desalination by Reverse Osmosis - Technical Aspects", The Resources Agency, State of California, Bulletin 196-76.

4. Loeb, S. (1966), "A Composite Tubular Assembly for Reverse Osmosis Desalination", Desalination 1, 1-100.

5. Sephton, H. H., (Principal Investigator), "The Use of Interface-Enhanced Vertical Tube Evaporation, Foam Fractionation, and Ion Exchange to Improve Power Plant Cooling with Agricultural Waste Water", UCB-Eng-3841, University of California, Berkeley, February 14, 1975.

THE CENTRAL CONTRA COSTA WASTEWATER RECLAMATION PROJECT

by

John E. DeVito
General Manager
Contra Costa County Water District

THE CENTRAL CONTRA COSTA WASTEWATER RECLAMATION PROJECT by
John E. DeVito, General Manager, Contra Costa County Water District

My comments today are from notes on the subject during a presentation to the American Water Works Association in 1960 at San Diego, the San Francisco Commonwealth Club in 1968, and updated to the current situation. Those of you who attended those prior meetings, please bear with me.

We talk about recycling -- as though it were something new. Just go back to that most popular history book, to the Old Testament, Book of Genesis. Following the third day of creation you will recognize there a phenomena, "universal recycling"--powered by pollution free solar energy, the hydrologic cycle operates perfectly, endlessly ---- lifting polluted sea water, cycling it first through the beneficial use of the earth, and then back to the ocean receiving waters. Recycling started in the beginning -- all we are really doing is intercepting the hydrologic cycle by adding a plumbing technique at ground level before water returns to the receiving waters. However, we didn't take a good lesson out of the good history book. What we started practicing after we got kicked out of the Garden of Eden, was "involuntary recycling." Now, what is involuntary recycling? That is precisely the same water use method that occurred in Biblical civilizations of the Tigress and Euphrates, where people used water upstream, then returned their effluent for someone else's use downstream. Those two civilizations were lost applying the "dilution of pollution" re-use technique.

That same technique has been applied in California. Waters of the Sierra streams is used by upstream people who discharge it to downstream users, thereby repeating the process, and finally often re-used and diluted water finds its way to the Delta. That's the involuntary recycling that I submit we have experienced historically in California, with of course, some added sophistication.

Over the years, the primary discharge concern regarding domestic sewage was the physical health of the communities --- at the expense of the receiving waters --- be they lakes, rivers or the ocean. It wasn't until 1948 when the Congress started taking a position; they did so again in 1955 and 1961, eventually leading to the Federal Water Quality Control Administration Act of 1965. Congress finally said 'we are going to do something about protecting receiving waters'.

Just prior to that time, during the 1960's, Contra Costa County Water District, who relies totally and solely on the Delta by way of a water right, and a contract with U. S. Bureau of Reclamation, turned to Bureau studies which found that we would exceed our supply of 195,000 acre feet by 1980. Also, these studies indicated that we would exceed the capacity of the Contra Costa Canal by 1975.

Two major financial impacts faced the District, major capital improvements and costly additional source water. Then came the Federal Water Quality Control Act of 1965. This Act clearly indicated that no longer could we concentrate only on the public health aspects of sewerage disposal, but we must, by Federal law, concentrate on restoring, protecting, and possibly enhancing the quality of the receiving waters wherever they may be.

With the assistance of District Engineering Consultant Harvey O. Banks, we tried to explain the local impact of the Federal Water Quality Control Act of 1965. We left them with the following message: "Ladies and Gentlemen of cities and industry, pay toilet is here, and you'd better get ready to plumb and pay the cost." However, no one really believed that anything mandatory was going to occur. Bear in mind, the acts similar in nature of 1948, 51 and 61 that, to some degree, had gone unheeded.

Following the Federal Act of 1965, and in the face of those two major impacts on our District, additional water and capital improvements, our staff was asked to explore methods to augment supply and minimize the need for capital improvements. We looked at de-salting, ground water, and domestic sewerage as potential sources. Our staff study, confirmed later by Mr. Banks, pointed to an ideal situation where the Central Sanitary District had an adequate level of sewerage effluent and their discharge facilities were located near the industries selected for re-use. Industrial water use in that sector was approximately 30 million gallons per day including process, boiler make up and cooling water. Phillips Petroleum now Lion Oil, Shell Oil, Stauffer Chemical, Monsanto Chemical and P.G.& E. were the designated re-use industries. Also included in our planning for re-use was an open-space irrigation area consisting of several golf courses, several schools and some 2,000 residences now using canal water for lawn and garden purposes that we designate as "domestic irrigation". Also if supplies per-

mit, we could consider this reclaimed water for injection to protect against underground saline water intrusion.

At that same time, we started tying down Federal grants, in Washington, D.C., that were available to help us handle this potential new source. We, like others, were caught up in a transition of Federal agencies---from U. S. Public Health Service to Federal Water Control Administration --- later the National Environmental Protection Agency.

Our staff and consultant looked at the possibility of converting an outdated water treatment plant for upgrading domestic sewerage treatment. House studies showed that it could be updated, it could be modified, but our study did demonstrate one important aspect, you just can't drive a milk truck with treated sewerage too far and have favorable economics. Moving the effluent from the Central Sanitary District to this plant and back to the industrial area proved far too costly.

As our efforts progressed, we faced an important decision. Do we go into the pollution control business in order to be construction grant eligible? Being a Division 12 Water Code State agency we could embrace sewerage treatment as a responsibility. With the Central Sanitary District, a well-organized operating public sewerage agency nearby, we elected to prevail upon them to join us in a joint venture rather than start a new sewerage treatment division within the Water District.

Following many meetings, in 1969 we developed and signed a memorandum agreement between the two agencies, which in effect said, "You Central Sanitary District, are the pollution control agency, being eligible for pollution control construction grants, and we, the Contra Costa County Water District, are the water supply agency". Together we can bend that discharge pipe around, add treatment and develop an industrial water source.

Emphatically, allow me to state that at no time have we ever envisioned using reclaimed water for domestic purposes. Our philosophy, our rationale, our policy is clear -- take the Sierra water that is used once through for people, treat it up to a level that can be used by industry, and that's where efficient and effective re-use of water takes place.

Under the agreement with Central San we selected a common consultant, divided the responsibilities and proceeded with the necessary studies. We then together traveled to Washington, D.C. and transferred to the Sanitary District the Federal Pilot and Demonstration grants previously tied down by the Water District.

Needless to say, this program was not at all well received in the water supply and pollution control domain. Critics of reclaiming sewerage voiced the age-old arguments--the state of the art was poor and the economics were adverse---nothing seemed to be right. However, our position was a positive effort directed to meet the requirements of two public agencies. The Sanitary District faced major capital improvements to upgrade their pollution control

waste discharge requrements, and the Water District faced potential large expenditures for water supply or for import facilities. Rather than wait until the need prompted a crisis-type decision resulting in the standard "business as usual approach", we elected that by way of a high early start we could overcome state of the art and economic problems.

You may be interested in the amounts of front monies risked by the Water District and the Sanitary District from 1969 through 1971:

Contra Costa County Water District Expenditure:

Feasibility Study	$30,122
Sampling and Analysis Program	16,713
District share in Federal grant	16,596

In addition, the Water District rehabilitated an old 21" cement-coated steel water line at a cost of $92,715 and asked the U.S.B.R. to redesign a low head 60" pipeline to a pressure line adding $250,000 to the cost. Both of these extra costs were risks betting that the re-use program would fly. Contra Costa County Water District costs totaled $406,146.00.

Central Sanitary District Expenditures:

Share in Federal grant program	$52,500
Advance treatment test facility	70,000
Environmental Impact Report	3,000
Water Reclamation Report	25,000
Preliminary Design---Renovation Facility	76,500
TOTAL	$227,000

Compare the expenditures of the two Districts ($633,146) with the Federal Water Pollution Control Grant of $322,250. These are the kinds of money experiences that occur when two sub-regional

organizations get together and finance the pioneering efforts necessary to go forward on a re-use project.

Now let's take a look at some of the setbacks that were imposed on the two Districts, any one of which could have absorbed the project:

During 1971, we learned that under the Federal Water Pollution Control Grant program, advanced treatment, that is, beyond secondary effluent to meet waste discharge levels, was not grant eligible. Our consultants informed us that advance treatment facilities such as filtration, clear well, etc. would cost approximately $16 million. Bear in mind, the Water District has no grant eligibility on our side of the Water District/Central San agreement. Rather than let the project die, the Water District went to Congressman Biz Johnson and Senator Muskie, both members of the Conference Committee on Amendments to the Pollution Control Act. Simply stated, our approach was "If the United States spends billions of dollars of taxpayers' grant money to treat sewerage up to roughly secondary levels and then throw it away, why not spend a few more dollars, thereby protecting your initial investment and realizing true water re-use source?" I can't say enough for these two men who got the job done in the Conference Committee process. By letter of June, 1971, Biz Johnson wrote:

"Dear John: The only amendment added to the Pollution Control Act of this year was yours, that extended grant eligibility for the advance treatment facilities such as filtration,

clear well and transmission main."

On November 10, 1971, the State Water Resources Control Board mandated that certain conditions precedent must be met for grant eligibility certification.

First: both agencies must negotiate and execute a long-term agreement specifying service area, quantity, quality and price of re-use water along with respective operation and maintenance responsibilities. A committee consisting of two Board members of each agency, supported by staff, through many challenging meetings, accomplished that assignment.

Second: we must guarantee a market for this reclaimed water. I won't say that the designated industries were "ardent suitors" to receiving reclaimed water; let's say they were "reluctant dragons". Please understand that Shore Line Industries had enough problems spending millions of dollars on treating their waste up to a point where it would meet receiving waters discharge standards. Introducing reclaimed water would place other burdens on them, including re-plumbing and the obsolescence of certain plant equipment. Here again our engineering consultants came through beautifully, working with the industries, helping them through their particular problems.

On the subject of guaranteeing re-use water, we turned to our attorney and asked him to prepare a resolution that in effect would allow us to "withhold other water sources". This, of course, in order to comply with announced federal and state policy. Our resolution says in effect, that the Board of Directors can at any time

determine the area of use, and the customers of the reclaimed water. This resolution, the first of its type, found its way into the Congressional records.

Third: we must amend our water service contract with the U. S. Bureau of Reclamation so as to allow us to substitute reclaimed sewerage effluent in their service area. The Bureau's position, from the Regional Director in Sacramento to the Commissioner in Washington, was that we must pay for their water on the annual contract buildup schedule, even though we used reclaimed water. Estimated payment to the United States over the buildup period was in the order of $14 to $16 million. Needless to say that this type of dual cost would have aborted the re-use project.

We turned to Secretary of the Interior Rogers Morton. It was August of 1971, the groundbreaking ceremonies of Orange County Water District's factory 21, where Secretary Rogers Morton was keynote speaker. At a breakfast meeting, the Secretary listened intently to my comments reciting the spirit and intent of the Federal Water Quality Act, and the national policy as such encouraged the re-use of water, and specifically the need for the U.S.B.R. to accommodate our re-use program within our long term water supply contract. Within 72 hours the Secretary asked Commissioner of Reclamation Ellis Armstrong to amend our U.S.B.R. agreement providing for the U.S.B.R. contract payment deferral necessary to offset the quantity of reclaimed water used.

Our experience clearly indicates that you must maintain flexibility when developing a reclamation and re-use project. It takes a very flexible Board of Directors, staff and consultants.

For example, our objective from the beginning was for a total industrial use, that is, process, make-up and cooling water. But, during the pilot and demonstration study, we learned that while high quality domestic water, that is low TDS and hardness, may enter a home on one end, by the time that water passes through a sewerage plant, it's on the order of Colorado River water--700 to 800 parts TDS. Necessarily we had to back off of the initial total re-use objective, start first with cooling water and then build up to process and boiler make-up. Our engineering consultants responded to our request and recommended a selective demineralization, staged treatment process called SANAX (strong acid--sodium exchange).

Just about the time the SANAX process was well along in design, EPA and the local Bay Regional Board decided that even though the Central Sanitary District had constructed a full denitrification system, they need not denitrify until such time as the regulatory agencies can make a determination as to the effects of a nitrified effluent on the receiving waters. Our agreement with Central San specified denitrification and industry expected and insisted on a denitrified product.

To provide the Water District with a denitrified product would have imposed an annual operating cost on the Sanitary District in the order of $800,000 per year. In spite of the fact that the re-use customers demanded denitrification and our contract required

same --- good sense prevailed, and the two Districts adjusted our agreement deferring denitrification until future requirement by the regulatory bodies. Another back to the design drawing board experience resulted in a first stage sodium exchange system expandable to a full SANAX process in the future.

This change means that although a 30 million gallon day reclamation and the re-use system will reach completion sometime next spring or mid-year, but the initial stage for cooling tower use will be reduced to approximately one half or 15 million gallons per day.

Fifteen million gallons per day reclaimed for direct industrial re-use represents a recycling of 25% of the Sierra water that is imported into the Central Sanitary District service area.

It should be noted that should the current drought continue, depending on the quality utility value of the reclaimed water, this source could very well be a needed critical augmentation to our 1978 water supply.

How does the Water District finance a project of this magnitude? Our costs totaled $5.2 million, none of which was grant eligible. We looked into various alternatives, such as G.O. and revenue bond issues, as well as forming a joint exercise of power structure. In any case, long-term debt service raised the total project cost from $9 to $11 million. Following several public hearings, we elected to proceed on a "pay as you go" basis. Pay-as-you-go

required that the Water District double the water rate and triple the tax rate during the time of construction. Increasing the tax rate sans an election was possible due to the fact that all agreements had been executed prior to SB 90.

Who should bear the cost of the substantially increased tax and rate structures? Certainly not exclusively the five selected re-use industries. By way of a public information program and public hearings, we took the position that the entire District benefited by the reclamation and re-use program, because (a) we could defer for many years and possibly eliminate the need to spend approximately $40 million to enlarge the Contra Costa Canal System; and (b) Delta diversions via the U.S.B.R. contract would be reduced initially by approximately 1/3.

This Water Conference, in my opinion, was one of the most timely since Watercare's formation. Let's review for a moment two important questions that were raised: First, are water conservation efforts in conflict with reclaimed water efforts or vice versa? I think not. What the conference participants were really saying was that water conservation efforts and reclaimed water projects respectively, must be tailor-made to domestic, industrial, agricultural and open space use. Having done so, a compatible balance between conservation/reclamation will be realized.

Secondly, there seems to be a sense that wastewater reclamation is not, and will not be, competitive with conventional upstream

reservoir conservation facilities. Don't you believe it! Recall that on the first day of this conference I pointed out that the over-committed combined Federal and State reservoir system went bankrupt after one critical dry year period. Let's examine briefly project costs to produce the new water necessary to makeup the Federal and State overcommitments? By example, the $500,000,000 Auburn project hopefully will yield 250,000 acre feet. Also, let's look at some of the facilities proposed in Senate Bill 346, considering time of construction inflated costs: Glenn Reservoir at $2-1/3 billion yields one million acre feet; Cotton Creek project at $640 million yields 170,000 acre feet; Los Vaqueros at $1 billion yields 160,000 acre feet. For good measure include the proposed Dos Rios project at a cost and yield as yet unknown. New project water in my opinion will cost out in the order of $200 per acre foot. I also believe that the current $9 per acre foot Delta service charge when compared to a realistic GOA accounting process will probably exceed $100 per acre foot. With the advent of the realistic pricing of conventional water supply facilities, it is my considered opinion that reclamation and re-use of domestic sewerage will not only be competitive, but also becomes a very attractive alternative within a municipal, industrial and open space water use areas.

Allow me to express my views as to where wastewater renovation and re-use provides the most viable opportunity. The basic ingredients are:

A. A high quality domestic water delivered to a highly urbanized area, with close proximity to industrial,

open space or agricultural uses.

B. A water supply agency that faces the need to augment water supplies or import facilities, and

C. A strong Board of Directors and staff who are willing to take the risks and make decisions way beyond the term of their respective offices.

That criteria in my judgment fits most of the nine Bay Area counties,as well as other urban/industrial water use areas in the State and the nation for that matter.

Ladies and gentlemen of Watercare, the Contra Costa County Water District was honored to host you during the past two days in Concord. Please join us in our efforts to "Compliment the hydrologic cycle by developing new cost effective water by way of appropriate institutional and plumbing activities at the point of discharge to receiving waters.

MINUTES OF
MEETING OF BOARD OF DIRECTORS OF
CALIFORNIA ASSOCIATION OF RECLAMATION ENTITIES OF WATER
(WATERCARE)

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CALIFORNIA ASSOCIATION OF RECLAMATION ENTITIES OF WATER
(WATERCARE)

June 26, 1977, Concord, California

The Board of Directors of the California Association of Reclamation Entities of Water (WATERCARE) held a meeting in the Sheraton Inn, Concord, California, on June 26, 1977. President Fowler called the meeting to order at 2:00 p.m. and the recording secretary pro tem called the roll.

Present were the following Directors of the Association:

Dr. Linda K. Phillips, Goleta County Water District
Mr. H. W. (Will) Stokes, Las Virgenes Municipal Water District
Mr. Stanley E. Sprague, Municipal Water District of Orange County
Mr. Howard Bensen, City of Santa Barbara Public Works Department
Mr. Lloyd C. Fowler, Santa Clara Valley Water District
Mr. William E. Warne, Consultant, Associate Member Director

Alternate Representatives Messrs. David Ringel and Bill Ree were present representing Director George W. Adrian, City of Los Angeles Department of Water and Power.

Member Agencies whose Representatives are Directors and which were not represented:

Marin Municipal Water District
North Marin County Water District
Orange County Water District

The following member agency Representatives and Alternates were present:

Mr. Orrin Harder, Alternate Representative, East Bay Municipal Utility District
Mr. Eugene Bowers, Alternate Representative, Metropolitan Water District of Southern California
Mr. Patrick Ferraro, Alternate Representative, Santa Clara Valley Water District
Mr. Roger Dolan, Representative, Central Contra Costa Sanitary District
Mr. David Niles, Alternate Representative, Central Contra Costa Sanitary District

Associate Members present included:

Mr. Don Finlayson, Central District, California Department of Water Resources
Ms. Joan Kerns, Montecito County Water District

Guests in attendance were:

Mr. Bob Cozens, Otay Municipal Water District
Mr. Niel Nielson, Aqueonics, Inc.
Ms. Linda Peralta, Santa Clara Valley Water District
Mr. David Stephens, Kennedy Engineers
Mr. Donald Brice, California Department of Water Resources
Ms. Justine A. Faisst, CDM, Inc.
Mr. G. Stanley Van Sickle, Leucadia County Water District
Mr. Richard E. Hanson, Leucadia County Water District
Mr. Charles Kleine, California Department of Water Resources

Ms. Phyllis A. Homa, Santa Clara Valley Water District, was present and served as recording secretary pro tem.

The Agenda was accepted with the alteration suggested by Dr. Phillips to postpone the elections until a later time during the meeting to accommodate possible late arrivals.

APPROVAL OF MINUTES

MOTION NO. 77-4-177 — It was moved by Mr. Warne, seconded by Mr. Bensen and carried that the Minutes be approved with the following changes:

Page 5, Legislative Committee, third paragraph - delete words "and SB 262" in third sentence.

Page 6, Organic Identification and Virus Monitoring in Orange County, Funding for Study, $100,000 - delete "Orange County" and substitute funded by "Water Research and Technology, Department of Interior".

Page 10, Virus Lab Committee - delete present wording and substitute "Mr. Bowers said there was nothing new regarding the Virus Lab Committee to report".

TREASURER'S REPORT

MOTION NO. 77-4-178 — It was moved by Mr. Stokes, seconded by Mr. Sprague and carried that the Treasurer's Report for period ending 5/31/77 be approved as mailed.

APPROVAL OF BUDGET

MOTION NO. 77-4-179 — It was moved by Dr. Phillips, seconded by Mr. Bensen and carried that the proposed budget for 1977-78 be approved.

A copy of the Final Budget and Revenue Estimate is attached.

ELECTION OF AUDITOR

MOTION NO. 77-4-180 It was moved by Mr. Stokes, seconded by Dr. Phillips and carried that Mr. Dave Perkins, East Bay Municipal Utility, District be elected as Auditor for next fiscal year 1977-78. The Audit is to take place in August 1978.

COMMITTEE REPORTS

Membership Committee

MOTION NO. 77-4-181 It was moved by Mr. Warne, seconded by Dr. Phillips and carried that the application of Mr. David Davis for Associate Membership be accepted.

President Fowler recommended that WATERCARE members develop interest in WATERCARE by other Water Districts and actively recruit more Members. New Member Agencies are needed to give a broader base to WATERCARE activities and to help support research activities.

Publicity Committee

The next Newsletter will come out after this annual meeting. All are urged to send information regarding projects and activities to Barbara Barber.

The WATERCARE brochure is undergoing revisions; the old one is still being used but is out of date.

Legilative Committee

Dr. Phillips reported status on the following:

AB 380 - passed
AB 395 - passed
SB 51 - moved to other House
AB1954 - moved to Senate
AB 775 - some progress
SB 262 - died
AB 581 - dropped

Dr. Phillips reported on new legislation as follows:

AB 1784 - passed the Assembly
AB 1782 - no progress being made

President Fowler recommended that the Committee work on support, or not, of appropriate bills and report at the next meeting on any action taken during the ensuing time.

Mr. Warne stated that only the bills that have cleared one House will be on the Agenda for the August session. All the bills that were hung up and did not move will be revivable next January but not in August.

President Fowler suggested that Dr. Phillips review the two bills, AB 1784 and AB 1954, with the Committee and decide what position should be taken and let the members know what happened at the next meeting. Dr. Phillips suggested that if the bills go to the Committee Hearings in August, the Members should be polled by phone or letter.

Mr. Ferraro asked for a discussion of efforts of the Board in lobbying to put forth WATERCARE'S message to Committees, Authors, and Legislators. President Fowler responded that WATERCARE works through ACWA on legislative matters and when appropriate writes letters to Authors and makes presentations to Committees. Dr. Phillips added that WATERCARE is able to work through ACWA fairly well.

President Fowler asked Dr. Phillips to look at SB 346 and report the Committee's opinion of it.

Program Evaluation

Endorsed Projects

Mr. Stokes stated that the three people who he anticipated reporting on endorsed projects were not in attendance. He noted that there would be a written report at the next meeting. He stated there were four endorsed projects. They are:

1. Orange County Water District and the Department of Water Resources Cooperative Study on Water Quality being done in the Lompoc and Orange County areas.

2. Marin Municipal Reclamation Projects:

   a. Las Galinas) Providing reclaimed water
   b. Lower Ross Valley) for irrigation through a dual pipeline.

3. North Marin - Effects of alum sludge on sewage treatment processes.

Project Review

The Committee had no new projects under review since the last meeting.

Mr. Stokes mentioned that the Monday afternoon program on Dual Water Systems at the WATERCARE Conference could result in requests for recognition by WATERCARE since dual water systems are needed

to provide water for in-tract greenbelts or homeowner use or both. This concept will need support from WATERCARE.

Mr. Bowers brought up the water quality program in the Lompoc area. President Fowler said that there was a report on it at the last meeting; however, no new conclusions were reached at that time. Dr. Hussan is working on the program.

Ways and Means

In the absence of Mr. Nelson, President Fowler briefly stated that the Committee was working on a number of possible changes in classification of Members and the proposed dues to accompany them. They are trying to determine the effects on WATERCARE and what the advantages are to the Association and its membership from changes of that nature.

Regulatory Agency Review

Status Report

In the absence of Mr. Adrian, Mr. Dave Ringel reported that the Department of Health has summarized the comments received at their eight workshops on Regulations for Groundwater Recharge. The Department is in the process of developing a position paper for presentation to their Directors and expect it to be completed in late August. They are considering a number of options: 1) to apply these proposed regulations only to new projects and consider existing projects as demonstration studies; 2) to issue only guidelines which would have no direct enforcement authority; or 3) to retain their current method of case-by-case evaluation. They expect that if they select the option of adopting regulations, they could have them ready by early 1978.

The Health Department is working on drinking water standards. The Task Force is reviewing draft regulations and hopes to have adopted Drinking Water Standards by October.

The State Water Resources Control Board is revising the Ocean Plan. The Committee will continue to monitor this activity.

Mr. Warne asked that the Board reaffirm the WATERCARE Policy Statement on Water Quality Criteria and endeavor to obtain additional funding for the Public Health Service to do necessary research work. After lengthy discussion, it was decided that the Board should review the Policy Statement and consider reaffirmation at the next meeting.

ELECTION OF DIRECTORS

Mr. Stokes read the Nominating Committee's letter of June 17, 1977. After it was read, Mr. Fowler commented on the excellence of the presentation and asked that the full report be placed in the Minutes of the meeting and be made available for future elections in WATERCARE.

MOTION NO. 77-4-182 It was moved by Mr. Stokes, seconded by Dr. Phillips and carried that the three following names be placed in nomination:

Neil M. Cline
John O. Nelson
Stanley E. Sprague

MOTION NO. 77-4-183 After asking if there were additional nominations from the floor and there being none, it was moved by Mr. Stokes, seconded by Dr. Phillips and carried that the nominations be closed, that the report of the Nominating Committee be accepted, and the three Directors nominated be elected to a three-year term, 1977-80.

ELECTION OF ASSOCIATE DIRECTOR AND ALTERNATE DIRECTOR

MOTION NO. 77-4-184 It was moved by Mr. Warne, seconded by Mr. Stephens and carried that the following be elected:

Mr. Bill Seeger, Associate Director
Ms. Joan Kerns, First Alternate
Mr. Don Finlayson, Second Alternate

Mr. Warne expressed his deep appreciation for the pleasure of having worked with WATERCARE for the past few years. President Fowler, in turn, thanked Mr. Warne and assured him that it was WATERCARE'S pleasure having Mr. Warne as a founding father, guiding them through the past three and one-half years.

MOTION NO. 77-4-185 It was moved by Mr. Stokes, seconded by Mr. Sprague and carried that a Resolution of Appreciation to Mr. Warne be adopted.

OTHER BUSINESS

President Fowler distributed copies of a letter, dated June 22, 1977, from The League of Women Voters. The letter was referred to the Program Evaluation Committee for review as to the interest of WATERCARE. If there is an interest, potential funding will be considered by the Ways and Means Committee. A copy of the letter is attached to these Minutes.

ADJOURNMENT

The meeting was adjourned at 4:45 p.m. to the next meeting of the Board to be held at a time and place to be noticed by President Fowler.

Lloyd C. Fowler, President

Neil M. Cline, Secretary