MOJAVE WATER AGENCY
Apple Valley, California

REGIONAL
WATER MANAGEMENT PLAN

BOOKMAN-EDMONSTON ENGINEERING, INC.
Glendale, California
June 1994
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MOJAVE WATER AGENCY
Apple Valley, California

REGIONAL
WATER MANAGEMENT PLAN

BOOKMAN-EDMONSTON ENGINEERING, INC.
Glendale, California
June 1994
June 29, 1993

Mr. Norman Caouette  
Mojave Water Agency  
22450 Headquarters  
Apple Valley, CA  92307

Subject: Regional Water Management Plan - Deliverable for Phase V

Dear Mr. Caouette:

Transmitted herewith is the Regional Water Management Plan dated June 1994, prepared pursuant to the agreement between the Mojave Water Agency and this firm dated November 12, 1991. Changes to the September 1993 final draft recommended by MWA staff after review of comments received from the public review process are incorporated herein.

The investigation and plan reported on herein was authorized by your Board in recognition of the generally deficient water supplies within the Mojave Water Agency and the need to develop a plan to manage both local and imported water supplies to eliminate overdraft conditions in the underlying ground water basins. Overdraft correction is also the subject of the adjudication of ground water pumping rights in the Mojave River portion of the Agency which was initiated during the course of the work on the plan. The final judgment by the Court may incorporate some of the planning concepts presented in this document as part of the physical solution adopted by the adjudication.

The objective of this investigation was to develop sufficient information to provide a basis for decision making by the Board with respect to policies on the amount of State Water Project and other imported water supplies to be delivered over time, the type and extent of facilities required to deliver imported water supplies within the Agency, financing and repayment options, and the level of participation in the physical solution imposed by the adjudication. The plan provides a certain amount of flexibility in the timing and annual delivery of the imported water supplies by use of the ground water aquifers for storage but these policies must be adopted prior to implementation.

We are pleased to have completed this assignment for you and trust that this document will assist you and your Board in the development and successful implementation of a water management plan for the Mojave Water Agency.

Sincerely,

[Signature]

Robert G. Beeby

Enclosure
DATE: June 7, 1994

TO: Board of Directors

FROM: Norman T. Caouette, Director of Planning and Resource Development

RE: Resolution No. 575-94
Adoption of Regional Water Management Plan

Attached Resolution No. 575-94 addresses adoption of the Mojave Water Agency Regional Water Management Plan. The Resolution incorporates by reference the appended staff report and recommendations to the Board regarding adoption of the Regional Water Management Plan prepared by Bookman-Edmonston Engineering, dated September 1993, which has previously been provided to the Board. Staff will summarize their recommendations at the Board meeting.

Please bring your copy of the Regional Water Management Plan with you to the Board meeting.

STAFF RECOMMENDS that the Board consider the attached resolution and staff report and:

Request any additional comment from the public present at the meeting, and;

Adopt Resolution 575-94.
RESOLUTION NO. 575-94
A RESOLUTION OF THE BOARD OF DIRECTORS OF
THE MOJAVE WATER AGENCY
APPROVING THE MOJAVE WATER AGENCY
REGIONAL WATER MANAGEMENT PLAN

WHEREAS, Chapter 97 of Appendices to the Water Code ("MWA Law") enabled
formation of the Mojave Water Agency, and prescribes the powers and duties of the
MWA; and,

WHEREAS, Section 15 (a) of said Chapter 97 declares that "The Agency may do any
and every act necessary so that sufficient water may be available for any present or
future beneficial use or uses of the lands or inhabitants of the agency, including without
limiting the generality of the foregoing, irrigation, domestic, fire protection, municipal,
commercial, industrial, and recreational uses.",; and,

WHEREAS, Subsection (1) of Section 15 (b) of said Chapter 97 empowers the Agency
"To make surveys and investigations of the water supply and resources of the agency,
to gather data on water use, to plan water projects and to publish and distribute reports
thereof.",; and,

WHEREAS, Subsection (11) of Section 15 (b) of said Chapter 97 empowers the
Agency "To gather data for, and to develop and implement, after consultation and
coordination with all public and private water entities who are in any way affected,
management and master plans to mitigate the cumulative overdraft of groundwater
basins, to monitor the condition of the groundwater basins, to pursue all necessary
water conservation measures, and to negotiate for additional water supplies from all
federal, state and other sources.",; and,

WHEREAS, in December of 1991, the Agency began preparation of a Regional Water
Management Plan (RWMP); and,

WHEREAS, a number of "Alternative Management Strategies" were developed as a
step in the RWMP process to address the water supply and water demand issues
identified within the Agency, and said Alternatives were presented for review and
discussion to the Technical Advisory Committee to the Mojave Water Agency and the
general public at several public meetings throughout the Agency in November and
December 1992; and,

WHEREAS, said Alternative Management Strategies and the public comments received
were considered during development of a Draft RWMP, and in June and July 1993 the
Draft RWMP was again presented to the Technical Advisory Committee to the Mojave
Water Agency and to the general public at several public meetings throughout the
Agency for review and comment as to both the recommendations in the RWMP and
environmental impacts which should be reviewed in association with the
recommendations in the RWMP; and,
RESOLUTION NO. 575-94
Page Two

WHEREAS, the Draft RWMP was further reviewed in the context of the comments received and was redrafted and formally released for review and comment by the Agency in October 1993; and.

WHEREAS, written responses to comments received by the Agency on the Draft RWMP were prepared and provided to the Board of Directors and duly considered; and.

WHEREAS, the Agency also prepared an Environmental Impact Report in accordance with the California Environmental Quality Act, which was circulated for public review and comment from February 23 through April 9, 1994; and.

WHEREAS, a Final Environmental Impact Report (SCH # 93062020) has been certified and necessary findings of fact, mitigation measures, and statement of overriding considerations have been made by the Agency Board of Directors pursuant to Resolution No. 574-94; and.

WHEREAS, the Board of Directors has reviewed and considered the Final EIR (SCH # 93062020), findings of fact, mitigation measures, and statement of overriding considerations prior to a decision on the Regional Water Management Plan:

NOW, THEREFORE, BE IT RESOLVED by the Mojave Water Agency Board of Directors that the Regional Water Management Plan prepared by Bookman-Edmonston Engineering dated September 1993, the staff report and recommendations to the Board of Directors dated June 7, 1994, and all mitigation measures identified in the Regional Water Management Plan EIR (SCH # 93062020), are hereby adopted by the Agency to describe management programs which the Agency can perform as authorized by Chapter 97 of Appendices to the Water Code.

ADOPTED:

________________________________________

John H. Russell
President

ATTEST:

________________________________________

Peggy Sartor
Secretary
DATE: June 7, 1994

TO: Board of Directors

FROM: Norman T. Caouette, Director of Planning and Resource Development

RE: Adoption of Regional Water Management Plan (RWMP)

Following is a summary of the process to date resulting in the proposed adoption of the RWMP, summary of comments and major issues identified through the review and comment process, and a number of recommendations from staff to the Board to be considered with the adoption of the RWMP.

RWMP PROGRAM SUMMARY

The Mojave Water Agency has been processing a Regional Water Management Plan since December of 1991, when Bookman-Edmonston Engineering began development of technical information for the Mojave River drainage area, and Boyle Engineering began development of technical information for the Morongo Basin/Johnson Valley area within the MWA. The information developed from those efforts was documented by a series of technical memorandums, and this information was used by the consultants to develop a number of “alternative management strategies” to address the water management issues identified for each of seven identified planning subareas. The planning subareas include the Alto, Centro, Baja, Este, and Oeste subareas in the Mojave River Basin area, and the Morongo Basin and Johnson Valley subareas.

The management strategies were presented to the Board of Directors and the Technical Advisory Committee to MWA, and were subsequently presented to the public in a series of advertised public meetings that were held in Victorville, Hesperia, El Mirage, Barstow, Newberry Springs, Lucerne Valley, Joshua Basin, and Town of Yucca Valley. The purpose of these meetings was to summarize the findings and management concepts developed by the consultants, and to solicit both verbal and written comments about the management strategies that were presented. These comments were summarized and presented to the Board.

Bookman-Edmonston Engineering (B-E) was then tasked with compiling the information prepared for the management alternatives by both firms into a single recommended RWMP. The Plan was developed following additional engineering consideration of the alternative strategies which had been developed, and consideration of the input received from staff, the Board and the referenced public meetings. In
December of 1992, the firm of Jones and Stokes Associates was retained to assist with preparation of environmental documentation for the RWMP. In May of 1993, B-E presented MWA with a first draft RWMP, and a workshop was held with the Board. A second series of advertised public meetings then commenced for the purposes of presenting the draft RWMP for discussion, and for scoping associated environmental issues. The public meetings were also announced in a notice of preparation for a Draft EIR which was mailed to interested parties in June of 1993. These meetings occurred in June with the TAC in Victorville, and with the general public in June and July in Apple Valley, Adelanto, Lucerne Valley, Barstow, Newberry Springs, and Yucca Valley. The results of the scoping meetings and letters in response to the notice of preparation were presented to the Board in September of 1993 in the form of a scoping report prepared by Jones and Stokes.

B-E presented the MWA with a Final Draft of the RWMP dated September 1993. This document was circulated for comment in October 1993. Four comment letters directly addressing the RWMP were received and responded to by staff working in conjunction with B-E. The referenced comment letters and MWA responses are attached as Appendix “A” for your consideration.

In February 1994, a draft Program EIR for the RWMP was released to the public for a 45 day review period. The EIR was presented and summarized to the TAC on March 9, and a noticed public hearing was held in Victorville on March 22. The comment period on the DEIR closed April 9, and responses to the comments received have been incorporated into a Final EIR.

EXCEPTIONS TO RECOMMENDATIONS IN THE RWMP

There are two specific components in the draft RWMP that staff recommends NOT be adopted as part of the final RWMP. These include groundwater recharge using water extracted from dry lake beds, and the capture of storm water within the Mojave River for recharge in spreading basins.

The use of recharge water extracted from select dry lakes within the RWMP was suggested by B-E as a potential means to increase recharge to the Mojave basin area. B-E noted that the process would result in a relatively small yield to the basins (approximately 1,800 acre-feet per year, based on a once in a five year storm event), at a very high cost ($1,000 - $3,300 per acre-foot), and therefore recommended that any action be deferred until such time as the MWA could collect additional information through monitoring of potential capture in dry lakes. Since that recommendation, the
process of circulating the draft RWMP and associated draft EIR demonstrated potential for these activities to interfere with both formal Bureau of Land Management (BLM) planned recreational use at El Mirage Dry Lake, and informal recreational uses at other dry lakes. Potential for water quality problems due to high minerals and salts contents of dry lake waters, and potential impacts to fairy shrimp and other species suggest that it is appropriate to discontinue further consideration of this alternative.

One of the important considerations to enhance water supply which needed to be addressed by the RWMP, was potential to capture storm flows for purposes of groundwater recharge in basins. Technical evaluation for the Morongo Basin/Johnson Valley area indicated that, on average, the operation of such facilities would result in the increase to storage of about 4% per year (approximately 30 acre-feet in the Warren Valley Basin), at a substantial cost. On the Mojave River, it was estimated from review of long term River flow data that approximately 1,000 acre-feet per year additional recharge water could be added through capture of storm flows. This is approximately equal to the amount that could physically be captured in the Baja subarea (compared to a maximum of 15,000 acre-feet in Alto and 21,000 acre-feet in Centro, if the storm flows were of sufficient magnitude and facilities were in place).

B-E subsequently suggested that consistency with the Mojave Basin Area Judgment (prohibition against interference with storm flows to avoid detriment to water supplies for downstream subareas), would preclude capture of storm flows in Alto and Centro, but not Baja. However, the BLM noted in their response to the draft EIR for the RWMP that if the MWA reverses the overdraft and groundwater levels subsequently rise, but flood flows are not allowed to occur through riparian areas, then these conditions would favor tamarisk (an invasive exotic species) to the detriment of native riparian species. BLM has developed a tamarisk eradication program which specifically targets the Afton Canyon area, downstream of the Baja Subarea. The endangered Mojave Tui Chub fish is also currently maintained at the Soda Springs area downstream of Afton Canyon, with area water supply also requiring periodic replenishment from Mojave River storm flows. Staff is of the opinion that capture of storm flows should not be conducted in the Baja subarea along the Mojave River unless it can be demonstrated through proper technical analysis at some future date that such activity would not exacerbate the referenced tamarisk problem, or impact the endangered Mojave Tui Chub.

The RWMP also reviewed the possibility of development of MWA operated wellfields and pipeline facilities to facilitate water transfer and conjunctive use programs. The objective of this component was to provide ability to receive large quantities of
imported water either due to relatively sudden availability from the State Water Project, or due to a conjunctive use or water transfer project involving another entity. This component would allow MWA to store the water in locations close to major transmission facilities (such as the Morongo Basin or Mojave River Pipelines), with wellfields and pipelines designed to extract the water for delivery to other areas. The RWMP considered this a component of "Phase Three," and likely to be outside the planning horizon of the RWMP. The Program EIR therefore considered this component not to be part of the "preferred" alternative, although the potential impacts were assessed at the program level. Staff concurs with these conclusions, principally because the development of such facilities would likely occur in conjunction with a specific water transfer or conjunctive use program, or its necessity would become evident due to future changes in operation of the State Water Project, both of which are currently unknown. Regardless, it is apparent that such a program would require a significant amount of future site specific engineering and environmental analysis based upon projects with specific objectives, possibly involving third parties.

SIGNIFICANT COMMENTS AND ISSUES REGARDING THE RWMP

As noted, the comment letters received regarding the RWMP and responses to those letters by staff are attached as Appendix "A". The comments received are generally summarized below.

RWMP Program Status

Many of the comments received on both the RWMP and the associated Draft EIR evidenced a significant degree of confusion regarding the programmatic nature of both documents. Some reviewers mistakenly assumed that upon adoption of the RWMP, all of the projects identified in the RWMP would be implementable, and sufficient information should be available to forego additional engineering, financial, or environmental analysis. The RWMP is programmatic in nature, and therefore analyzes a series of plans, policies or programs that could be implemented by phase to address the water supply and demand problems identified through the planning process. The RWMP and its EIR will set the stage for future implementation of plans and programs, and will reduce, but not eliminate, the need for future engineering, environmental and financial analyses.

It is also important to recognize the need for the RWMP to be a flexible document, allowing MWA to adapt to inevitable changes in water supply availability and water
demands in varying locations throughout the MWA. The need for flexibility is one of the planning objectives well served by a program document.

Other Agency Responsibilities

Some commentors exhibited expectations of the MWA, and therefore the RWMP, that are clearly not within the mandates of the Agency Act. For example, some anticipated that the MWA would control land use practices for the benefit of water quality or species habitat issues, or expected the MWA to influence beneficial uses for these purposes. There was also some confusion exhibited between roles of the MWA and the RWMP, and that of the Watermaster and the Courts regarding the Judgment for the Mojave Basin Area Adjudication. Some of the comments and the RWMP did note that some issues overlap between MWA and other Agencies, particularly in issues associated with well permitting, well head protection and associated impacts to water quality. Staff noted that steps should be taken in the future to clarify issues of overlapping responsibilities either through amendment to the MWA Act to authorize specific activities and to allow MWA to seek outside funding, or through cooperative agreements with entities with current responsibility for these programs.

Financing Issues

Concern for equity in financing needed facilities and imported water was also a frequent topic. Opposition to use of some types of financing in particular (developer fees, standby charges, increases to ad valorem taxes) were expressed, with general comment that equity in financing should be achieved through a proper allocation of cost to those that benefit from facility construction or water purchase. As noted in the staff response to these comments, benefit assessment is a complex issue, and the Board of Directors will continually be challenged to develop means to finance needed facilities and water purchases, with benefit assessment a key element. Financing was one of the issues that some commentors incorrectly assumed would become effective upon adoption of the RWMP by the Board, rather than developed for each component when implemented.

Water conservation issues also generated significant comment. Extent of comments ranged from the need for MWA to take a proactive role in development of sanitary sewer systems and reclaimed water use (including funding for those purposes), to the Agency acting in a secondary role only. The latter scenario suggested that conservation measures are a local issue which should be implemented by the local purveyors. As the Board is aware, MWA conservation efforts to date have consisted primarily of
education efforts (water awareness participation, school education support programs, dissemination of educational materials, etc.). Additional conservation support by MWA has included purchase of a CIMIS station for operation by the Mojave Desert Resource Conservation District, and funding for water conservation demonstration gardens.

One suggestion stated that the MWA should develop a model conservation ordinance pertinent to each of the subareas, to create consistency within each subarea. If this is pursued, staff suggested that it should initially be addressed by MWA working with the TAC Conservation Subcommittee prior to consideration by the Board. It was also pointed out by staff that there are areas within the MWA that are not within organized water systems or have smaller water systems that may seek conservation assistance from the MWA. The MWA Act and future legislation may also obligate the Agency to implement or support conservation measures beyond current levels of activity.

AMENDMENTS TO MWA ACT

The Legislative Act which created MWA contains very broad mandates for the Agency to achieve its objectives, as stated in the Act to do "...any and every act necessary to be done so that sufficient water may be available for any present or future beneficial use or uses of the lands or inhabitants of the agency...". Development of the RWMP through the technical memorandums and alternative management strategies programs identified a few key areas that MWA should become more involved with, but are not clearly stated in the MWA Act as responsibilities that should be undertaken. Some of the stated objectives currently may be achieved only through agreements with other entities which may have current authority for needed activities.

One example of desirable programs not clearly stated in the Act are what are commonly referred to as well head protection programs. These programs include identification of important well field locations (current or future) and means to preclude contamination or elimination of those areas; identification of land use practices (principally illegal) that have the potential to contaminate groundwater supplies; and, identification of improperly abandoned wells that can serve as a conduit for contamination of groundwater supplies. The MWA is a logical entity for development of such programs in coordination with other entities with similar responsibilities within the MWA boundaries. The current Act implies that MWA should be eligible to participate in such programs, but the RWMP concludes that explicit authority in the Act would provide MWA with a substantially greater potential for success while pursuing grants and other financial assistance for such programs.
Consideration should also be given to modification of the MWA Act to more closely align the Act with responsibilities of the MWA contained within the Judgment for the Mojave River Basin Area Adjudication. In time, it may also be necessary to amend the MWA Act to allow specific types of financing required for component project implementation.

MONITORING PROGRAMS

For the past three years, MWA has invested significantly in development of monitoring and modeling programs with the United States Geologic Survey (USGS). These programs include the on-going cooperative monitoring program (basic well measurement and water quality program), the Ground- and Surface-water Relations Program (which focuses on the effects of storm flow and artificial recharge to the Mojave River channel and adjacent groundwater basins), and the Regional Aquifer Systems Analysis (RASA) program. These coordinated programs will provide a greatly enhanced foundation of understanding of the Mojave River system and interaction between the River and the regional ground water system. The principal product of those efforts will be groundwater and surface water models, expected to be delivered to the MWA and documented by USGS within the next two years. In Fiscal Year 1993-94, the MWA also instituted programs with USGS to expand the modeling program to include the Lucerne Valley, Johnson Valley, and Morongo Basin areas of the MWA.

The RWMP places great emphasis upon the need to develop and maintain monitoring programs to provide feedback on the effectiveness of components in the RWMP. In some instances, monitoring data will be needed before implementation of component projects within the RWMP are presented for consideration to the Board. Monitoring programs are also key to implementation of the physical solution within the Judgment for the Mojave Basin Area Adjudication.

Many of the monitoring requirements have been and are being developed in conjunction with the referenced programs with the USGS. The RASA and Ground- and Surface-water Relations Programs have identified locations where multi-nested monitoring well sites were needed for the modeling program. In turn, development of these wells have provided data which allowed USGS personnel to develop levels of confidence in data available for existing wells. To date, the USGS has constructed or is monitoring 15 multi-nested well sites for MWA, including wells installed at the interface between the Alto and the Este and Oeste subareas to analyze potential for subsurface flow towards
Alto. Additionally, 8 relatively shallow, single piezometer wells have been installed for monitoring purposes in the Mojave River area by USGS for MWA.

In the Morongo Basin area, USGS has installed nested wells at two sites along the Yucca Wash for the purposes of assessing recharge potential at sites selected for the Hi-Desert Pipeline from the Morongo Basin Pipeline. The USGS have also conducted pump tests using existing wells near potential recharge sites in the Yucca Valley area, and compiled data on recharge rates at these sites.

These programs have also been fortunate to benefit from data developed cooperatively by, or funded by, other entities interested in the hydrology of the Mojave River system. Specifically, four nested monitoring wells have been funded by the Mojave River County Water District to assist with the USGS programs: the City of Barstow has constructed 3 wells to assist with understanding of local hydrology and impacts from discharge of wastewater from their treatment plant; and, the Department of the Navy has funded construction of 8 wells, to assist with model development for remediation programs at the Yermo and Nebo Marine Bases.

All of these efforts have resulted in information important to the modeling programs, and will be important to future monitoring efforts for both groundwater level and quality changes. A significant number of the monitoring points have been developed, but some additional wells will be necessary, principally for implementation of the Mojave Basin Area Judgment physical solution; as modeling efforts progress for the Lucerne, Johnson Valley and Morongo Basin areas; and, as future recharge locations are identified for implementation of components of the RWMP. An example of the latter is the method that has been employed to monitor the effectiveness of recharge at the Rock Springs turnout when completed. Although the selected site was identified as acceptable for recharge, nested well sites have been developed both upstream and downstream. In addition, existing shallow wells have been selected that are suitable for the purposes of monitoring changes in both water level and water quality. For Federal Fiscal Year 93-94, the USGS was tasked with developing both baseline data (pre-delivery), and data following discharges to indicate the effectiveness of the recharge program. Efforts are also underway to incorporate MWA staff into the data gathering process to assist USGS with this program, and to assure continuity. A report to MWA from USGS will be provided regarding this effort, which will serve as the prototype for future site-specific monitoring programs.

Staff is also working with USGS to develop an expanded "key wells" program, which is intended to provide indicator data points to assess overall program effectiveness.
The key well program will be based upon the knowledge gained to date by USGS personnel, and consideration of the data needs determined by the implementation of the Mojave Basin Area Judgment. Other important monitoring data being developed as components of USGS programs include water quality parameters. The expanded water quality data being collected as part of the annual cooperative monitoring program and the modeling program will provide an important baseline of water quality data which should be regularly updated. The USGS is also developing estimates of unaged stream flow quantities using channel geometry techniques for approximately 20 major streams tributary to the Mojave River Basin Area. This information will provide better data for estimation of water supply availability, and identification of sources of recharge.

Other efforts have been made to enhance different kinds of hydrologic data. For example, as a result of a climatology study of the MWA prepared in October 1992, the MWA has installed 9 class A evaporation pans (including the CIMIS station site at Victor Valley College) operated by cooperators at various locations throughout the Agency. A pan and weather station have been installed at MWA offices, and 9 precipitation stations have been added at cooperator sites. Twelve existing precipitation stations with long-term records have also been selected for inclusion in an annual climate data collection process. The Agency utilizes this information to develop an annual climatology analysis.

Annual reporting will occur through a document currently being drafted in-house referred to as the "Annual Engineer's Report on Water Supply". The document will summarize data collected at key wells, but will also include information on precipitation, water quality, climatology data (from recently installed MWA stations and cooperator stations), native water supplies, imported water supplies delivered, and changes to water demand from the previous year. This document should provide an annual snapshot of the water supply and water demand balance.

The monitoring and modeling programs currently underway do not address the timing or specific quantities of water that should be imported to each of the subareas within the RWMP. The RWMP contains some general guidelines (i.e. avoiding filling of the basins to the point that natural inflow is rejected), and the modeling programs underway will address many of the impacts which would result from specific import or storm flow scenarios. These programs, combined with annual monitoring results, will provide the Agency with clear trend analysis.
Staff have reviewed with USGS the most effective means of utilizing the data being developed for management decisions. USGS staff indicated that the data would support a discipline of computer modeling for hydrologic systems known as "optimization modeling". As the name implies, it is intended to utilize data generated from modeling programs like MWA's to develop long-term management scenarios to optimize use of a particular hydrologic system based on a prescribed set of management objectives. The USGS Water Resources Division in San Diego (which is conducting current MWA programs) has staff onboard that are leaders in the field of optimization modeling. Staff recommends that the Board consider optimization modeling programs to assist with future decisions regarding programs intended to increase local water supplies. Some of the comments received on the RWMP expressed concern that there may not be sufficient information available to implement some of the "costly" components of the Plan, or to time implementation of those components correctly. The referenced modeling may be an effective means to address those concerns.

**RWMP IMPLEMENTATION TIMELINE**

The RWMP contains a timeline for implementation of the phases as recommended by B-E. Staff has attached as Appendix "C" a timeline which incorporates those components of the RWMP recommended for consideration by the Board. The timeline also contains an update of major projects well under way prior to consideration of the RWMP. These were included (and are so identified) in order to provide a complete synopsis of Agency activity, and to provide a basis for future status review of all Agency activity, both operational and planned. It is suggested that the timeline be reviewed and updated annually as part of the Agency budgeting process.

The Board will note that the timeline contains project components that are categorized as either being dependent upon actions by other entities (such as additional extensions from the Morongo Basin Pipeline), and actions that currently have no specific timeline attached but will be reviewed annually in the context of monitoring program results. This was done to assure that these components will be reviewed annually in the context of overall MWA activity.

**RECOMMENDATIONS:**

Based upon the process described above, and in consideration of the findings contained within the Draft Program EIR and the comments received on the RWMP, staff recommends that the Board:
1). Adopt the RWMP dated September 1993, with the exception of the components listed in 12. below, and with the corrections to the document noted on the attached Errata, presented as Appendix “B”.

2). Incorporate this staff report to the RWMP, to be included with the document which constitutes the Final RWMP.

3). Direct that future implementation of the RWMP shall be consistent with the terms of the Mojave Basin Area and Warren Valley Basin Adjudications.

4). Clarify that financing methods used for identified facilities will be considered and developed at the time each facility is designed and developed, using the principles contained within the RWMP, including consideration of regional benefits where appropriate.

5). Adopt the attached projects timeline (Appendix "C") as the intended phasing for future development of the components identified in the RWMP in conjunction with projects currently underway. Review and update of the projects timeline will occur as part of the annual MWA budget process.

6). Direct MWA staff to review the RWMP for possible update approximately 5 years following adoption, with specific consideration of, but not limited to, the following:

A. Whether a treatment facility for delivery of State Project water to potable standards and direct use is then feasible because of off-aqueduct storage potential, interest by water purveyor(s), potential financing, etc.

B. Potential to provide recharge within the vicinity of Oro Grande Wash and the Aqueduct, depending upon data available at the time indicating potential for effective recharge of these areas, and identification of potential benefit to water users.

C. Effectiveness of monitoring programs implemented by that time.

D. Status of MWA conservation programs and sufficiency relative to the objectives of the RWMP and then current State Law.

E. Status of MWA conjunctive use and transfer programs.
7). Direct staff to initiate discussions with the TAC Executive Committee relative to feasibility of development of model conservation and water use ordinances for subareas within the MWA.

8). Direct staff to seek amendment to the MWA Act to authorize the Agency to pursue funding, activation, and coordination of well head protection programs with affected agencies.

9). Direct staff to seek amendment to the MWA Act to authorize the Agency to implement the requirements of the Judgment for the Mojave Basin Area Adjudication.

10). Direct staff to develop a proposal with the USGS for consideration by the Board which specifies potential for optimization modeling to further the objectives of the RWMP, including program scope, timeline and costs.

11). Direct staff to continue efforts to effect specific water transfers and conjunctive use programs for the benefit of water supplies within the subareas identified in the RWMP.

12). Components which should NOT be adopted with the RWMP at this time include:

   A. Groundwater recharge using water from dry lakes.

   B. Capture of stormflows in recharge basins along the Mojave River for groundwater recharge.

   C. Groundwater extraction and conveyance facilities for use with Mojave River Pipeline and Morongo Pipeline facility. This or similar projects will be identified through separate engineering, environmental and financial analyses as a component of future specific conjunctive use or water transfer programs.
APPENDIX "A"

COMMENTS RECEIVED ON RWMP

AND STAFF RESPONSES
December 28, 1993

Mojave Water Agency
22450 Headquarters Avenue
P.O. Box 1089
Apple Valley, CA 92307

Attention: Mr. Larry Rowe
General Manager

Reference: Comments to Final Draft of MWA Regional Water Management Plan

Dear Larry:

Our joint staff's have completed a review of your Agency's Draft Water Management Plan and we would like to offer the following comments:

(1) **On Page 3 of the Report (under "Summary of Findings and Recommendation")**

   a) **Subsection 12 -** Add an alternative entitled "Waste Water Reuse" under listing D, consistent with current and proposed water policy and existing legislation.

   b) **Subsection 13 -** Elements A and B appear to be contrary to legislation previously sponsored by Assemblyman Paul Woodruff and contrary to discussions with representatives of MWA-TAC.

The word "unilaterally" needs to be deleted especially when the indication is to give MWA the exclusive authority on how to address conservation issues by selective pricing of imported water as indicated in Sections 1 and 6 of the Report. The water purveyors should have involvements and joint discussions with MWA on all the pricing issues. Also, any legislative changes should be considered by all sub-area advisory committees to make sure that they are not giving away their authority and ability to maintain a check and balance of future acts that could adversely affect their area.

   c) **Subsection 13 -** Suggest adding element D "MWA will support the following: water conservation and water reclamation reuse."

(2) **On Pages 4, 5 and 6 under "Summary..."**

Construction projects and funding requirements (especially if special taxes are contemplated) need to be reviewed and approved by affected local jurisdictions in each sub-area as they will be the ultimate consumers and liable for payment of all projects in one form or another. The voting structure should be based on assessed valuation and assessments should be made for benefits received in each sub-area. Case in point, the aqueduct capital cost and O & M charges are being
paid for mostly by the Alto Sub-Area as it contains the largest assessed valuation. The water right benefit committed to Morongo Basin for example (one seventh of existing state allocated supply) is much greater than its cash contribution to the aqueduct. It is also not located in the Mojave River Basin, so there is no re-charge benefit to the river. If Morongo Basin is going to incumber 1/7th of the Aqueduct delivery, it should also pay for 1/7th of its capital and O & M costs.

The cost for imported water per page 6 indicates an expenditure of $275 per acre foot of which $150 is currently being paid for by taxes and is proposed later in the plan as an ongoing solution to financing imported water in Section 9 (page 107). This again points out the need to look closely at areas of benefit. If special tax revenue is selected to subsidize imported water cost, it appears that the Alto Sub-Area will be paying more than its fair share because its valuation is far greater than other basins.

The cost of capital improvements to implement the Management Plan is going to be significant. It appears that there is a suggestion of establishing development fees through legislation to defray these costs. Development fees should be the responsibility of affected local jurisdiction and individual water purveyors. This again points out the need to have direct input by affected local jurisdictions and water purveyors into both matters of capital improvement programs and financing. We must make sure that whoever receives benefit also pays and that the improvements are necessary, equitable, and cost effective.

(3) On Page 5 under "Summary...."

a) Subsection 18 - Standby Fee (also see page 126, Subsection D; page 139 involving changes to MWA Act; and page 140 involving additional sources of revenues). Standby charges or any form of one-time capacity fees as suggested for MWA in the Management Plan, is inappropriate. Individual purveyor should determine how to pay for the replacement water set forth under the 1993 stipulated judgement. Any reference to standby fees by MWA in the Management Plan should be deleted.

b) Subsection 19 - Financing for facilities serving each sub-area should be reviewed and approved by each sub-area affected local jurisdictions.

(4) On Page 6 under "Summary...."

It is suggested that a statement be added in the summary chapter under findings as follows: "Water Management Plan, when adopted by MWA, will not adversely affect purveyors' ability to take appropriate actions to meet safe drinking water standards as promulgated by the Environmental Protection Agency (EPA) and/or the Department of Health Services of the State of California."
(5) **On Pages 8 and 9 Under Recommendations**

a) "Conservation Measures" under Item 4 is a local agency issue. MWA’s involvement should be limited review and comment the plans adopted by each agency (purveyor). MWA could participate in developing a model conservation ordinance for each sub-area as discussed under Comment #12.

b) Construction of the Mojave River Aqueduct and El Mirage Pipeline should be put on hold along with Phases II and III of water delivery facilities until the areas of benefit have been established and how capital costs are to be distributed have been discussed. Millions of dollars are proposed to be spent with no revenue structure from which to pay the debt service and very little assessed valuation or population at the points of delivery.

c) Paragraph 9 on page 9 suggested several revenue sources and new revenue sources that have to be authorized by amendments to the MWA Act. If the new sources include "Developer Fees", it should be a responsibility of affected local jurisdictions as indicated under comment (2) herein before.

d) Add an Item #10 to the recommendations as follows: "MWA will support "wastewater reuse" within the MWA boundary".

(6) **On Page 20, Section III of Report**

A clarification should be made in the Management Plan that the 65,000 acre feet per year of surface inflow to Alto Sub-Area does not include the treated effluents from Lake Arrowhead Community Services District and Crestline Sanitation District.

(7) **On Pages 22 and 23, Section III of Report**

The wastewater handling facilities including onsite septic tanks, small and medium size public owned waste treatment works (POTWS), septic tank effluents versus advanced secondary treated effluent within each basin (Mojave River and Morongo Basin) is not clearly described. Quantification of septic tank effluent through leach-line or leach pit systems in recharging the basins has not been thoroughly studied and documented. The Water Management Plan should include a thorough discussion on water balance analysis. The rate of municipal consumptive use of water has been estimated to be approximately 50% in the stipulated judgement for the Mojave River Adjudication, meaning that about 1/2 of the water produced and delivered for use will return to the ground water system for subsequent use. The water balance analysis should compare the scenario noted to the quantities of water that would not have to be extracted from the ground water system due to availability of reclaimed water for beneficial uses.
(8) On Pages 30 and 32, Section III of Report

a) Table 3 on page 30 of the Plan should include "Oeste" sub-area.

b) The statement in page 32 of the Plan that "Groundwater underlying both these locations has a high nitrate concentration attributable in part to the relatively high nitrate levels in the effluent applied to the sites" failed to be supported by logic and water quality data as follows:

- On page 20, Report identified that surface water inflow to Alto Sub-Area is about 65,000 AF/year.
- The estimated annual effluent flow from Crestline Sanitation District for pasture irrigation in the Las Flores Ranch area is about 870 AF/year (about 1.3 percent of total surface flow).
- Discharges of the treated effluents are under strict NPDES permit requirements as set forth by the State Regional Water Quality Control Board.
- Maximum recommended level for nitrate under the Safe Drinking Water Regulations is 10 mg/l. The nitrate level found in the treated effluent for Crestline Sanitation District averages around 10 mg/l. Statements concerning treated effluents from POTWS should be based on water quality data. Therefore, the "inference" in the Plan that high nitrate levels is attributable to treated POTW effluent discharge, is not supported and should be clarified or deleted.

(9) On Pages 34, 38 and 42, Section III of Report

a) In reference to water quality protection program under last paragraph of page 34, we concur that a stringent well permitting/abandonment (well head protection) program is necessary. It should be administered by either County Health Department (as is being practiced now) or by Mojave Water Agency to avoid duplication of efforts.

b) For water utilization on page 38, agricultural usage of water should be adequately quantified and discussed since agricultural users are currently the major producers of water in the basin.

c) On page 42, it is our understanding that the 8,400 AF/year outflow measured at Afton Canyon includes the storm flow.
Section IV of Report (Pages 48 to 55)

a) Mid-paragraph on page 51, provide a definition of "unauthorized production from or recharge to the Mojave River". Consistent with the stipulated judgment and existing state law related to wastewater reclamation, the Management Plan should in no way, prohibit member agencies of the Victor Valley Wastewater Reclamation Authority (VWWRA) to utilize highly treated effluent for beneficial reuse or groundwater recharge.

b) On page 52, it is our understanding that 100 percent (%) of the Free Production Allowance (FPA) refers to the highest production as recorded during the period from 1986 to 1990. It is further our understanding that any purveyor exceeding the 100% FPA during the first judgment year due to growth will be required to pay for replacement water amount produced above the 100% FPA.

Section V of Report (Pages 58 to 69)

a) In the beginning paragraph on page 58, it is recommended that "wastewater reuse" be added as Item #6 and a new definition of wastewater reuse be provided, consistent with State Water Code Section 13550 et seq.

b) On pages 59-60, providing percolation is adequate, it is possible to consider recharge basins in washes west of Aqueduct, using either Oro Grande or wash located in Section 8 near Verbeena Road, adjacent to the Aqueduct. This would provide more direct percolation into well fields of Baldy Mesa, Victor Valley and possibly Oak Hill/Phelan area.

c) On page 66, clarify permanent transfers as it relates to water right purchases within a sub-basin and transfers out of basin. What does the SWRCB have to do with such transfers? Why is the farmer required to sell the land with the water or does the farmer have an option?

Would negative impact declaration be sufficient for this type of transfer or does it require a full EIR? This should be addressed in the Water Management Plan EIR such that future basin transfers can be exempted from either negative declaration or full CEQA process.

d) On page 66, what are some of the specific requirements for transfer of ground water from outside of MWA boundaries: i.e. regulatory, environmental, and institutional? Noted in Report but not defined.

e) Concerning water banking on page 69, could a water purveyor be able to purchase and bank water from MWA and how would the banking be calculated? Would the purveyor have to use its banked water first and would there be any reduction (shrinkage) of the water being banked? Would water banked by MWA have to meet the same conditions?
f) Water banking procedures need to be described in the Management Plan, or be a supplementary part of the Plan. A definition of shrinkage under water banking needs to be included.

(12) Comments for Section VI and VII (Pages 70 to 82)

a) Concerning water conservation on page 70, majority of the water purveyors presently have a water conservation ordinance. However, because not all of the ordinances are uniform and one purveyor does not wish to be more severe than the other for political reasons, it is recommended that MWA should develop a model conservation ordinance within each sub-area as part of the Management Plan that will be applicable to all users in the Mojave River Basin. By doing this, the enforcement would be uniform and there would be no reason for any producer to be concerned about what his neighbor is or is not doing. MWA would not have to resort to pricing to accomplish its conservation goals.

b) On page 70, consistent with the basin plan of the Lahontan Regional Water Quality Control Board, MWA should discourage the use of septic tanks and encourage the use of public sewerage facilities in all future developments. Treated effluent from a wastewater plant is far more effective in recharging a river basin that septic tanks scattered all over the desert.

c) As the terms "consumptive use" and "septic tank effluent" appears in Section VI (pages 70, 71, 73 and 74) and in Section X (pages 118, 127 and 139) it is important that their meaning or intent are totally clear.

d) On page 73, under Sub-heading 2, measures that reduce water production only, measure 2(f) should be amended to read "water reuse including the installation of grey water systems".

e) On page 74, top of the page stated that "the proposed ordinance (§9) has not as yet been adopted by MWA." There are strong concerns (as previously expressed by public agencies in Victor Valley) about the ordinance in its current draft form. The Water Management Plan should not rely on a proposed ordinance not yet adopted and any reference thereof should be deleted.

f) On bottom of page 74 and top of page 75, the statement "water constitutes a source of recharge....additional treatment and reuse for other purposes....areas" is conflicting. At present, wastewater collected through sewer systems in the greater Victor Valley area is treated to advance secondary level and is acceptable under Title 22 of the California Administrative Code for golf course irrigation and landscape irrigation.

g) Concerning SWP water extraction and distribution, refer to comments under Item 13 (b).
13) **Comments to Section VIII (Pages 84 to 104)**

a) Concerning alternative 3 shown on page 91, does this mean that MWA proposes to pump water from wells located near the Mojave River through the Morongo Pipeline to the Morongo Basin? If this is what is being proposed, we do not believe that such an alternative is in the best interest of the Alto Sub-Area purveyors. It does not make either fiscal or logical sense to deliver domestic grade water through a system that was designed primarily to deliver raw water from the State Project Aqueduct. We do not see how such a plan would do anything but contribute to the existing over-draft in the Alto Sub-Area.

b) On pages 91, 92 and 93, if treatment of State Aqueduct water is a consideration, it is recommended that the plant be constructed adjacent to a lake or large storage reservoir for a reliable water supply during down time of the Aqueduct system. From the treatment plant, a transmission pipeline facility will be extended to serve Hesperia, Victorville, Baldy Mesa, Apple Valley, and possibly Adelanto. One large regional water treatment plant is far more efficient and cost effective to operate than numerous small treatment plants that have no emergency raw water storage facilities.

c) On page 95, while we understand that a portion of delivery pipeline oversizing is already completed, why would it be necessary to construct a recharge facility and transmission pipeline from the Morongo Pipeline to the Forks Area of the Mojave River when water delivery could be accomplished by releasing water from Lake Silverwood or the Las Flores turn-out and flow down to the natural recharge area between the Forks and Rock Springs Road? This could eliminate $5,000,000 in additional capital cost and considerable O & M cost.

d) On page 99, it appears impractical to extract recharge water from the Alto Sub-Area for delivery to the Morongo Basin. If the water is being imported initially for Morongo Basin, why not transport it through the pipeline from the Aqueduct and bank it there rather than first recharging in the Upper Mojave Basin and then use extraction wells to pump water into the pipeline and deliver it to the Morongo Basin, similar to concern expressed under 13 (a) above.

14. **Comments on Section IX (Pages 106 to 117)**

a) Concerning using tax monies to fund replacement water on page 106, this would work if each sub-area receives replacement water proportional to the amount of taxes paid by the sub-area.

b) On page 107, if pump assessments are being considered as a method of financing for part or all of the replacement water, then all pumpers should pay an equal amount per acre foot.
Concerning sale of water on page 114, will there be an administrative charge should MWA sell water to the watermaster (MWA Board) who in return could sell water to a pumper? If so, why?

c) Concerning financing measures on page 115, promissory notes issued by MWA must identify debt service payment sources. $5,000,000 is a significant amount and MWA should be required to indicate repayment sources prior to issuing any promissory notes.

d) Concerning Section X (Pages 118 to 141)

a) On page 126, it is essential to stress that water conservation is a local agency issue. MWA’s input will be welcomed, but there is no need for MWA to consider additional staffing.

b) On page 128, ground water extraction for MWA and Morongo Basin Pipeline needs more explanation as to accountability. It appears difficult to identify basin loss including shrinkage and flows to downstream areas.

c) On page 129, to construct and operate water treatment plants to meet peak demands is not cost effective or efficient. It would be better to operate plants on year round average demand basis and supplement the peak demands with auxiliary supply from wells.

d) On page 130, some clarification needs to be made as to whose taxes are being used to pay for imported water and what is the benefit ratio.

e) On page 137, provide more detailed breakdown of capital cost being charged to Alto Sub-Area. It appears to be very high in relation to benefit received by the Alto Sub-Area.

f) For Figure 20, it appears that releases of water from Silverwood will only take place until the Morongo Pipeline is operational and then all releases will be made from the Morongo Pipeline. It further appears that this is being done as a way to recover MWA’s investment in the Reach 111 oversized pipeline section and not as the most cost effective operation. Direct water releases from Silverwood would be much more cost effective and beneficial to Alto Sub-Area than the use of the Morongo Basin Pipeline turnout to the Mojave River.
Jointly reviewed and respectfully submitted by the following public agencies in the Alto Sub-Area.

Town of Apple Valley

County Service Area 64 (SVL), 70-C (Helendale), 42 (Oro-Grande)
70-J (Oak Hills) of County of San Bernardino

Victor Valley Water District

City of Victorville

Hesperia Water District,
City of Hesperia
May 27, 1994

Mr. Bruce Williams  
Town of Apple Valley  
PO Box 429  
Apple Valley, CA 92307

Mr. Duane Davis  
Baldy Mesa Water District  
PO Box 1347  
Victorville, CA 92393

Mr. Steven Steeie  
Hesperia Water District  
PO Box 2966  
Hesperia, CA 92345

Mr. William Smillie  
San Bernardino County  
Special Districts  
11954-B Hesperia Road  
Hesperia, CA 92345

Mr. Donald E. Songer  
Victor Valley Water District  
17185 Yuma Street  
Victorville, CA 92392

Mr. Guy Patterson  
City of Victorville  
14343 Civic Drive  
Victorville, CA 92392

RE: Joint Comment Letter for Draft Regional Water Management Plan

Gentlemen:

Thank you for your jointly submitted comments to the Mojave Water Agency dated December 28, 1993 addressing the Agency’s draft Regional Water Management Plan (RWMP). The manner in which you have coordinated your response has assisted the process significantly through reduction of potential repetition of response. The comments have been considered by Agency staff during preparation of final recommendations to the Board of Directors prior to action by the Board on the RWMP. Both your comments and staff’s responses will be forwarded to the Board of Directors for their consideration.

Your letter was grouped into 15 comment sections. This response will attempt to address each of those sections and their subsections in the order presented.
Section 1.a. The RWMP does not identify waste water reuse as a specific alternative for the MWA Board to consider, because the MWA does not operate or control any waste water reclamation facilities and cannot make direct decisions regarding use of reclaimed water. The Agency can take policy positions relative to use of reclaimed water, however, in the context of 12 A or B on page 3 of the RWMP.

Section 1.b. Agency staff concur that the word “unilateral” should be deleted, because it does not properly represent the intent of this section. Staff will recommend that subsection 13, A and B on page 3 of the RWMP be amended to read as follows:

“A. Measures that are an authorized activity for the MWA under the current Agency Act.”

“B. Measures that are not an authorized activity for the MWA under the current Agency Act, but could be accomplished through agreement between the MWA and other entities that have authority to implement the desired programs within MWA boundaries.”

“C. Measures that cannot be accomplished directly by the MWA or by agreement with other entities, and would therefore require amendments to the MWA Act.”

Item 4 on page 84 (and subsequent sections) will also be appropriately modified.

This section was not intended to imply that the MWA will abandon the existing meet and confer process between the MWA and the Technical Advisory Committee (TAC) or the TAC Executive Committee. The MWA also does not anticipate that anything in the RWMP would modify the current process, which we believe serves a valuable function. It should be noted, however, that the subarea advisory committees perform an advisory function to the Mojave River Basin Area Watermaster, and not the MWA Board of Directors and/or the RWMP activities, the latter being coordinated with the TAC.

Section 1.c. As noted in 1.a., above, the MWA cannot implement water reclamation programs for facilities which it does not control. The Agency can, however, either support or oppose reclamation projects.

Section 2. Focuses on financing issues associated with development of capital facilities identified for the RWMP, particularly on the need to prepare benefit assessments to equitably fund new facilities. You will note that the RWMP does identify benefit assessment as a means to fund project facilities. When the MWA implements the programs in the RWMP, subject to public input, individual engineering and environmental
analyses would be prepared to assess feasibility and cost of each capital project, and a financing mechanism would have to be selected at that time. Selection of the financing mechanism used would require analysis of the equity issues raised in your letter, and would have to be in conformity with public financing available to all public entities in California. Your comments regarding these issues have been noted and will be presented to the Board of Directors for their consideration. This section of your letter also questions the arrangements in place to provide water to the users of the Morongo Basin Pipeline. The decision to allocate a share of the MWA State Water Project entitlement was developed as Board Policy in June of 1983. The policy decision was subsequently institutionalized in the contract between the MWA and the Morongo Basin Pipeline Joint Powers Authority for water service.

Your letter states opposition to the use of developer fees by MWA to offset the cost of capital facility development. Your comment is noted and will be submitted to the Board of Directors. This issue has been discussed with the Board of Directors in response to a letter from the local chapter of the Building Industry Association. In February of 1994 the Board directed staff to transmit a letter to the BIA essentially stating the MWA generally does not consider developer fees to be a viable means of financing needed facilities, with the possible exception of an instance where it is necessary for MWA to construct facilities for the benefit of a specific development project. This issue was raised by the BIA due to language in the Judgment for the Mojave River Basin Area adjudication requiring MWA to develop a cost allocation plan which may include a mix of revenue sources, and specifically included “developer or connection fees”. Any proposed cost allocation plan under the Judgment would be subject to Court review to verify that costs are allocated fairly and according to benefits received. Proposals, if any, to use development impact fees for construction of facilities identified for purposes of the RWMP would likewise require consideration and approval by the MWA Board of Directors for a specific project. The Agency should preserve the ability to use all financing mechanisms available to public entities in California.

Section 2 also reiterates the conclusion in the summary on page 6 of the RWMP that the cost of imported water would be approximately $150 per acre-foot for the water and $125 per acre-foot for delivery, totaling $275 per acre-foot. Your letter points out that the cost of the SWP facilities are paid for by property taxes, underscoring the need to assess benefits and cost allocations effectively. The summary data on page 6 was intended to estimate the costs to MWA to secure supplemental water for the MWA in addition to what would be available to MWA from the contract for SWP entitlement (in other words, participate in the water market to secure water in addition to the 50,800 acre-foot entitlement). At the time, water sales were occurring to the State Water Bank for approximately $125-150 per acre foot. Bookman-Edmonston (B-E) assumed the higher
cost, and also assumed the power costs that would be charged to MWA for transport of the additional water through the State Water Project would be approximately $125 per acre-foot. This was their means of estimating the cost of additional supplies with the information available at the time. Since then, the emerging water market has seen water sale prices of $30-50 per acre-foot. Again, the cost to MWA to transport that water to this area from the point of sale would include the power costs to MWA for transport through the State system. The cost of energy to transport the water through the State system is a principal component of the direct per acre-foot charge to MWA by the State for water deliveries and is therefore a principal component of the MWA rate structure. The referenced figures presented in the RWMP are estimates of potential future costs associated with purchases in the water market (based on costs at that time), and do not reflect the cost of water purchased from the Department of Water Resources under the existing contract entitlement.

Your statement that the Alto area, because of a relatively large assessed value, may be subsidizing imported water delivery is a complex issue. The means of financing the obligations of the Agency with ad valorem taxes are defined in part 97-16 of the Water Code Appendix (Mojave Water Agency Law).

**Section 3.** states that references to standby charges should be deleted, and your comment is noted. As discussed earlier, the MWA should preserve the ability to use all financing mechanisms available to public entities in California. Additionally, as discussed in response t.b., the Agency does not anticipate change to the current process of coordinating Agency programs with affected entities.

**Section 4.** MWA will also be subject to the regulatory environment created by changes to the Safe Drinking Water Act and Clean Water Act. MWA would not intentionally create a situation in which actions by the Agency would jeopardize a water purveyor’s capacity to meet the standards promulgated by EPA and/or the Department of Health Services. Legislation and regulations promulgated to enact legislation are frequently subject to interpretation by the agency promulgating the regulation. It is not possible for MWA staff, the Board of Directors, or water purveyors to anticipate future standards, or anticipate how those future standards will be interpreted and enforced by EPA or the State of California. It is therefore possible that future new standards and enforcement activity may create situations in which either water purveyor or MWA activities which had previously been in compliance may not be due to newly adopted rules. This is a circumstance beyond the control of either the purveyor or MWA, but would nonetheless have to be addressed by either or both to correct the non-compliance situation. We therefore do not believe it appropriate to introduce policy statement into the RWMP regarding unknown future events.
Section 5.a. Your comment is noted. Agency staff does not at this time propose to become active in conservation measures other than in a supporting capacity for water purveyors (principally through education programs), or to persons not within an organized system that request assistance of the Agency. However, Part 97-15 of the MWA Act does mandate the Agency to preserve all waters within its territory, which may at some time require more substantial conservation program activity than currently underway or contemplated. Section 5.b. suggests deferral of new facilities pending identification of funding sources. The RWMP is a program level document which was not intended to contain sufficient information to allow construction or finance of a specific project. In order to accomplish construction, project-specific engineering, environmental and financial analysis will have to occur, with ultimate approval by the Board of Directors. During this process, the specific issues of facility sizing, location, design, environmental impacts and mitigation, costs, benefit and funding methods would be considered by the Board.

For Section 5.c., see response to Section 2. For response to Section 5.d., please refer to Section 1.c., above.

Section 6., comment noted; the tabulation on page 20 will be appropriately footnoted to reflect the referenced flows.

Section 7. Further analysis of recharge from septic systems and the water balance analysis for reclaimed water use you reference is beyond the scope of the RWMP. The RWMP is intended to discuss what is known about the existing hydrology, and is fundamentally based upon long-term average natural supply conditions and components of the available supply that are consumptively used. There are currently no reclamation programs in operation which result in direct reuse of treated effluent, other than as a means of disposal. Discharges of waste water now made either accrue to the ground water system or are consumed by vegetation (crops or phreatophytes). In order to conduct the type of analysis you reference, it would be necessary to know of specific reuse programs, either existing or approved. There have been proposals for development of reclaimed water systems within the MWA, but none have presented proposals to date which declare intent for specific uses of reclaimed water. In order for reuse proposals to become reality, the project proponent would have to first acquire approval for the use and method from the Lahontan Regional Water Quality Control Board. This is also obviously beyond control of MWA.

It is not possible to estimate impact from reclaimed water use without knowing the place and type of use. Introduction of reclaimed water does not always assure that fresh water pumping for a specific use may be reduced, but instead may result in water uses which
would never occur had treated effluent not been available. Increases to density of land use due to introduction of sanitary sewers, and resultant increase to water use, would also have to be known. General information is available from the Department of Water Resources regarding the potential for reclaimed water use to offset fresh water pumpage and the potential affects to local hydrology from various reuse scenarios. That information can be made available to you, if desired.

Section 8 a. Table 3 does not contain a reference to Oeste subarea because B-E determined that there was not sufficient technical data on that subject for Oeste. Table 3 should have contained a footnote or an indication in the table that sufficient data was lacking. Table 3 will be properly noted. Section 8 b. MWA staff concur with your observation and comments. B-E will be directed to sufficiently clarify the discussion on nitrates, or it will be deleted.

Section 9 a. The MWA appreciates your recognition of the potential problems which should be addressed by an effective well head protection program. We also concur that it should be done in a manner which avoids duplication of effort. The “duplication” issue, incidentally, is relevant to the discussion contained in the MWA response to your issue under 1 b. Section 9 b. The agricultural use discussion and Table 6 on page 39 were intended to provide a sufficient summary of current and projected consumptive use of water by agriculture. Section 9 c. Your understanding is correct.

Section 10 a. “Unauthorized production from or recharge to the Mojave River” refers to production or recharge within the adjudicated area that occurs contrary to the terms of the Mojave Basin Area Judgment. The RWMP does not prohibit the beneficial reuse of treated effluent or groundwater recharge with treated effluent. Section 10 b. Your understanding is correct, with the clarification that the highest production verified during the reporting period provides the basis for FPA. Although discussed in the RWMP, this and the recharge issues above are adjudication issues, not RWMP issues.

Section 11 a. Section V is intended to discuss “Potential Additional Water Supplies”, including ways to capture more of the natural storm flows in the ground water basins than occurs currently, securing additional imported supplies (greater than the entitlement now available) through exchanges, transfers, conjunctive use, etc. Wastewater reuse cannot be considered “additional water supplies”, or new water in this context, unless reclaimed water generated outside the area is imported for use within the MWA. Wastewater reuse should be discussed in the context of water conservation and potential to reduce fresh water pumpage. Section 11 b. Your suggestion that recharge basins in washes west of the State Aqueduct (Oro Grande Wash) or adjacent to the Aqueduct (near Verbena Road) merit further review. There is not sufficient information available at this time to conclude
whether this is an appropriate component project for consideration in the RWMP. Information currently being developed for MWA by the USGS, particularly through the RASA Study, may provide sufficient information to determine whether such an option should be considered in the future. Agency staff will recommend to the MWA Board of Directors that the RWMP be revisited approximately five years following adoption for update. This option should be reconsidered at that time.

Section 11.e. Permanent transfers in this context does not refer to transfers under the Mojave Basin Area adjudication, but refers to a transfer to MWA by a water right holder outside of MWA boundaries, probably with a transferor that has access to State Water Project facilities. If such a transfer were to occur and the water right to be transferred is under jurisdiction of the State Water Resources Control Board (SWRCB) (i.e. post-1914 water right involving surface or subterranean stream flows), the SWRCB would generally require that an application to transfer be approved by the State Board. The example given in the RWMP assumed that a farmer wanted to sell his land, but was not required to sell it. It is not possible for the RWMP DEIR to assess the environmental impacts of such transfers since it is not possible to precisely determine where transfers of this type may be occurring in the future. Also note that inter- and intra-subbasin transfers within the Mojave Drainage area are an adjudication issue and not a RWMP issue.

Section 11.d. As noted above, regulatory, environmental and institutional requirements could include approval by the SWRCB, compliance with CEQA, and coordination with Department of Water Resources and/or Bureau of Reclamation (if involving Central Valley Project supplies or facilities) for access to facilities and timing of access. Section 11.e. Water banking as described in the context of the RWMP referred to programs that allowed MWA to take "pre-delivery" of imported supplies during a wet year, for use during periods of drought. It is conceivable that individual purveyors taking delivery of imported supplies could also avail themselves of ability to take "pre-delivery" of supplies during periods of relative abundance. Note, however, that both MWA and others desiring to pre-store water within the boundaries of the Mojave Basin Area adjudication would be required to have a storage agreement with the Mojave Basin Area Watermaster. The Judgment, and not the RWMP, will determine issues such as timing of use, shrinkage, etc. for storage agreements with the Watermaster.

Section 11.f. Policies regarding water banking will have to be developed in concert with proposals for banking programs as they occur (such as with outside entities), and consistency with the referenced Mojave Basin Area Judgment. MWA is currently working with other organizations with similar interests to address conjunctive use, transfer, banking, and related issues. These efforts will assist in development of policy considerations for the MWA Board. Please note that the Warren Basin is also
adjudicated, and water banking programs in that basin would require a storage agreement with the Warren Basin Watermaster.

Section 12.a. Your comment is noted. If your proposal is implemented it would have to be clear that the model ordinance is a joint effort and not a proposal of MWA; otherwise the net effect would only be to shift political pressure from the individual purveyors and their governing boards to the MWA Board of Directors. This is an issue which should appropriately be addressed with the TAC Conservation Subcommittee, and then presented for consideration by the TAC before submittal to the Board of Directors. Section 12.b. See 1.c., above. You should also be cognizant that it may not be financially feasible or technically necessary for all future development projects to be sewerized, particularly low-density development within rural areas. Section 12.c. "Consumptive use" means "the permanent removal of water from the hydrologic unit through evaporation or evapotranspiration." "Septic tank effluent" refers to waste water that is discharged from the leach lines or leach pit of a septic system to the ground water. Section 12.d. Comment noted; measure 2(f) will be amended. Section 12.e. B-E used Ordinance 9 as an example only. It's inclusion by reference has no bearing on the RWMP or it's implementation. Section 12.f. The reference was intended to state that water currently being discharged via septic tank effluent might be used more efficiently if treated at a waste water treatment plant and subsequently used for irrigation. It did not state that wastewater flows from the VVWRA facility are not suitable for use on landscaped areas. Section 12.g. The reference on page 78 is intended to discuss whether conjunctive use or "banking" programs may require that MWA operate wells and delivery systems to extract stored water and transport it to either a treatment plant facility or major pipeline facilities (such as Morongo Basin Pipeline or the Mojave River Pipeline). You are correct that "economies of scale" would be an important consideration of such an undertaking.

Section 13.a. This alternative assumes that there may be instances where water purveyors in the Morongo Basin area or other areas potentially served by the MBP have the financial resources to purchase quantities of water in excess of either available delivery capacity or local storage capacity. This component envisions ability to store this water in other basins with subsequent extraction near the point it was stored and delivery at a later date by placement in a delivery facility such as the MBP or Mojave River Pipeline. This could temporarily assist water producers in the Alto subarea through increased groundwater levels and therefore reduced energy costs of production due to reduced pumping lifts. The water would likely be used to recharge the local groundwater basin of the water purveyor originally purchasing the excess water, and would not be treated prior to use. Implementation of an alternative such as this would require site-specific engineering and environmental analysis, and would require that third party impacts be identified and mitigated. Section 13.b. MWA staff concur with your observations about the economies
of scale associated with potable treatment of State Project Water, and the need for a large storage facility to avoid outages at a treatment plant. Because of the need for storage and the associated expense and lead time required, treatment to potable standards is considered outside the planning horizon for the RWMP. If storage becomes a more feasible option to MWA in the future, a potable treatment plant may become a Plan component at a future update. As an alternative, MWA may be able to enter into a joint powers arrangement if local purveyors were willing to participate in the costs of designing, constructing and operating a storage facility large enough to support a potable water treatment plant. A joint powers activity of this type would occur outside the scope of the RWMP, and possibly require amendment and associated environmental review. Section 13.c. A transmission facility from the MBP to recharge facilities just below the Forks area was considered because the USGS identified a large area of dewatered basin storage immediately downstream of the dam, which would increase storage capability during periods of abundant supply from the State system. Additionally, because MWA does not own a share of capacity in Lake Silverwood, the Department of Water Resources currently charges MWA $9.25 per acre-foot for use of Lake Silverwood for water delivery through Cedar Springs Dam. This cost is expected to increase with future adjustments for inflation. Direct discharge to the area can also minimize losses from evaporation and evapotranspiration during transport from Lake Silverwood to the Forks area. Cost is a significant consideration for this component, and would have to be carefully considered against other potential uses of available imported supplies as part of a project specific engineering and environmental analysis. Section 13.d. See 13.a., above.

Section 14.a. Comment noted. Section 14.b. Comment noted. Section 14.c. The Mojave Water Agency Board of Directors recently adopted a resolution establishing the cost of State Project water, which included an MWA administrative charge to offset the costs to the Agency. Administrative charges are typically included in transactions of this type to recover costs from the entity which benefits. Also note that administrative assessments collected by the Mojave Basin Area Watermaster are for the purposes of administration of the Judgment, and are not related to MWA administrative costs. The administrative assessments collected by the Watermaster are also levied against water produced, not water purchased for replacement. Examples of administrative costs associated with the Judgment include the production verification process, storm flow scalping estimates for the Lower Narrows, preparation of annual reports, etc. Section 14.d. Comment noted.

Section 15.a. MWA staff concur that water conservation is a local issue; however this section conflicts somewhat with your statements under section 12.a. There are also areas within MWA that are not within an organized system, and there may be water users that request assistance with water conservation measures for either agricultural or M and I
uses. Also, MWA conservation education activities (school programs, water awareness, etc.) will continually demand a certain amount of MWA staff time. As noted above, the MWA Act mandates conservation activity by MWA. The future demand for conservation programs will establish the need for additional staffing, if any. **Section 15.b.** Banking and subsequent extraction programs would require agreements between MWA and other participants in the program. Were this to be pursued, the necessary agreements would have to address shrinkage and losses due to downstream flows, in the context of the best technical data available about the site proposed for the activity. If satisfactory technical data were not available (through either existing or new monitoring programs) it is not likely that the activity could occur. **Again,** these activities would be subject to additional site-specific analysis. **Section 15.c.** Comment noted.

**Section 15.d.** Discussions of use of proceeds of taxes to pay for imported water and/or facilities suggests that one means of finance could be to raise MWA #2 tax rate for this purpose, if consistent with the MWA Act. The MWA has not discussed pursuit of this option, but has instead to date made use of benefit assessment districts (i.e. IDM), and relied upon benefiting parties to raise necessary capital through means such as increased water rates or additional local property taxes. However, as discussed earlier, the MWA should consider use of all funding mechanisms available to public entities in California. **Section 15.e.** This estimate is based on both current and projected future growth within all of the subareas, and the costs estimated by B-E for water and facilities needed to meet the associated demand. The Alto subarea is expected to experience the most significant increase in growth and water demand (in acre-feet), and therefore should see a significant increase in associated water supply costs.

**Section 15.f.** As noted in 13.c., above, DWR currently charges MWA $9.25 per acre-foot of water delivered from Lake Silverwood because MWA does not have capacity in the Lake (and, therefore does not pay a share of the debt service for the Lake). This amount will increase in the future. Additionally, deliveries through the MBP will reduce losses to evaporation and evapotranspiration in the channel between Lake Silverwood and the Forks, resulting in more efficient delivery. Later this year, the Department of Water Resources will begin construction of a new outlet tower to transport water from Lake Silverwood to the Devil Canyon power plant in San Bernardino. This project will require that the level of Lake Silverwood be lowered significantly for approximately one year, with reduction to “dead storage” for an additional three months. The Metropolitan Water District and DWR are also discussing the addition of another outlet tower and tunnel from Lake Silverwood to the San Bernardino area at some time in the future. Construction activity of this type at the Lake has the potential to temporarily interfere with delivery of imported water to MWA. Use of the MBP for delivery to the Mojave River
will allow MWA to continue delivery without interruption due to construction at Lake Silverwood.

Again, thank you for your comments. The MWA appreciates your participation in the RWMP process.

Sincerely,

[Signature]

Norman T. Caouette
Director of Planning and Resource Development

c. Board of Directors
Mr. Larry Rowe, P.E.
General Manager/Chief Executive
Mojave Water Agency
P. O. Box 1089
Apple Valley, CA 92308

RE: Regional Water Management Plan. Final Draft

Dear Mr. Rowe:

Thank you for allowing us to review the Final Draft of the "Regional Water Management Plan". Our comments will be limited to how the plan addresses Wastewater related issues.

We found the document to be curiously lacking in meaningful recognition. much less discussion, of the use of reclaimed water. It left one with the impression that the Mojave Water Agency (MWA) is concerned that continual sewerage of the Victor Valley will decrease the ground water recharge potential of septic tanks and that further development of central wastewater collection systems is detrimental to the goals of the MWA. If this impression is accurate, then we find this position to be flawed and short-sighted.

It is our position that there will always be septic tanks and sewers in the Victor Valley. It will be too expensive to provide wastewater systems in residential areas that have large lots (1/2 acre or larger). Septic tanks will prevail in these areas as long as the soil conditions will accommodate them. Where there are tract homes so will there be, for the most part, wastewater collection systems. The Victor Valley cannot develop solely on septic tanks, as the Draft Water Management Plan leads us to believe.

In passing the Water Recycling Act of 1991, the California Legislature made a strong commitment to recycling and reuse, declaring reclaimed water a valuable resource and encouraging its use in all appropriate applications. The Governor has also acknowledged that recycling can stretch the State's limited supply of water. He has expressed confidence that reclaimed water can provide a reliable source of irrigation, industrial, recreational and environmental uses. The regional water agencies, such as Mojave Water Agency, should provide capital and operational funding assistance for sub-regional and local reclamation projects.
In the State of California, reuse has jumped from about 270,000 AFY in 1987 to over 380,000 AFY in 1992 - more than a 40 percent increase in less than five years. It is projected that by the year 2000 we will be reusing more than 700,000 AFY State-wide.

The VVWRA has the potential to reuse 14,600 AFY by the year 2000; virtually half of the projected 29,800 AFY of overdraft in the Alto sub-area. The immediate potential is approximately 6,150 AFY in irrigating golf courses, parks, cemeteries, schools and freeway median strips. This valuable resource can also be used to recharge the Alto sub-area.

It is therefore, our collective responsibility to utilize reclaimed water to the maximum extent possible to minimize the ground water over-draft potential.

The following are specific comments regarding the Draft Water Management Plan:

- Page 3. 12. The alternatives to eliminate ground water overdraft are: Add - D. Wastewater Reuse.

- Page 9. RECOMMENDATIONS: Add - 10. Mojave Water Agency will support wastewater reuse within the boundary.

- Page 51. Water Rights and Obligations "The Watermaster is authorized to bring an action to prevent any unauthorized production from or recharge to the Mojave River Basin." Add - Consistent with the stipulated judgment and existing State Law related to wastewater reclamation, the Management Plan should not prohibit member agencies of the Victor Valley Wastewater Reclamation Authority (VVWRA) to utilize highly treated effluent for beneficial reuse of ground water recharge.


- Page 73. 2. Measures that reduce water production only. Change - f. water reuse.

- Page 74. Some allocation policies are listed below and briefly discussed in this section. Change - 5. Designation use of reused water for certain purposes.
• Page 119. The Plan recommended herein has the following broad objectives: Change 6. To work closely on key issues, particularly water conservation and use of reclaimed water with local agencies and water purveyors.

• Page 139. Water Conservation: Add - (4) Encourage the use of reclaimed water for irrigation.

We would appreciate your serious consideration of the suggested corrections and additions to your Management Plan. Please call me if you need additional assistance.

Sincerely,

[Signature]
Chuck Wigley
General Manager

CW:cn

cc: VVWRA Board Members
Mr. Chuck Wigley, General Manager  
Victor Valley Wastewater Reclamation Authority  
P.O. Box 1481  
Victorville, CA 92393  

May 27, 1994

RE: Comments to Regional Water Management Plan

Dear Mr. Wigley:

Thank you for the comments in your letter dated December 29, 1993 regarding the MWA Regional Water Management Plan (RWMP). Your letter, and MWA staff response, will be provided to the MWA Board of Directors prior to their consideration of the RWMP.

It may be helpful for you to understand some events which occurred prior to your tenure as General Manager at the VVWRA. During the very earliest phases of development of the RWMP, MWA staff communicated with VVWRA staff regarding status of the RWMP program and the VVWRA Master Plan underway at that time. It was agreed that coordination of these efforts was appropriate due to potentially overlapping issues. As you can see from the attached letter dated August 30, 1991, MWA followed through and provided the initial scope of work for the RWMP program. The MWA did not, however, receive data from the VVWRA. When approximately 30 days had passed, MWA staff contacted the VVWRA to inquire about transmission of the VVWRA scope of work, and was informed that VVWRA staff had received instructions not to provide the requested information, or discuss the project further with MWA.
During review of RWMP issues with the Technical Advisory Committee and discussion of reclamation issues in other forums, staff concluded that there is not unanimity among operators of treatment facilities regarding many of the issues associated with wastewater reuse. Consideration of the foregoing, and the fact that MWA does not operate any reclamation facilities, influenced the approach considered for the purposes of developing a practical RWMP.

Staff agrees with your contention that there will always be septic tanks and sewers in the Victor Valley, with associated costs of facilities and site specific characteristics being primary considerations. Your impression that the MWA views further development of central wastewater collection systems as detrimental to the goals of the MWA is incorrect. The only position stated by MWA relative to introduction and use of sanitary sewers and associated reclaimed water use is that such proposals should be reviewed carefully to assess impacts to local and regional hydrology from proposed sewer and reclamation facilities to assure they are a prudent use of the resource.

Your letter also states that due to the actions of the State Legislature and policy statement by the Governor, regional water agencies such as MWA should provide capital and operational funding assistance for sub-regional and local reclamation projects. You will notice that the Draft RWMP identifies several capital intensive projects as priority for MWA, in order to transport supplemental water supplies and provide recharge to areas of demand. As always, funding issues for these priority facilities are complex and controversial, and will challenge all funding sources available to MWA. Staff will not recommend to the MWA Board that funding be diverted to provide capital and operational funding assistance for reclamation projects.

Your letter also summarizes reuse potential for VVWRA discharges, both current and future. We assume that this potential will be addressed in the VVWRA Master Plan. You also comment that the discharges can also be used to recharge the Alto subarea. Please note that discharges from the VVWRA plant currently provide a source of recharge to the Alto subarea, although technically, since VVWRA discharges were extracted in Alto they are not a new or outside source of recharge.
Again, thank you for your comments.

Sincerely,

[Signature]

Norman T. Caouette
Director of Planning and Resource Development

Attachment: Letter dated 8/30/91
c. Board of Directors
August 30, 1991

Mr. Kevin Kurtz  
Victor Valley Wastewater  
Reclamation Authority  
PO Box 1481  
Victorville, CA 92393  

Dear Mr. Kurtz:

Attached is the scope of work the Agency developed for preparation of the Agency-wide Water Supply Plan. We are currently in the negotiation phase for selection of the Firm to prepare the Plan. The negotiation process will result in a refined scope of work.

The Agency will be pleased to coordinate our planning efforts with your master planning program. Please transmit the appropriate information for this purpose to my attention.

Sincerely,

Norman T. Caouette  
Director of Planning and  
Resource Development
Mr. Larry W. Rowe, General Manager
Mojave Water Agency
P.O. Box 1089
Apple Valley, California 92307

Re: Mojave Water Agency's Final Draft Regional Water Management Plan, September 1993

Dear Mr. Rowe:

Thank you for the opportunity to comment on the Final Draft Regional Water Management Plan (Draft Plan) prepared for the Mojave Water Agency (MWA) by Bookman-Edmonston Engineering, Inc. My comments on the Draft Plan are submitted on behalf of the City of Adelanto.

In general, the Draft Plan is more a concept than a real implementable plan. By this I mean that the Draft Plan does not provide a detailed specific project, but rather a list of possible measures and ideas. The Draft Plan provides a laundry list of alternatives for distributing water within the Mojave Basin, but fails to address the broader issues. Those broader issues are: 1) where will the water come from; 2) how much water is needed; 3) who will pay for it; and 4) what are the water importation alternatives? These broader issues should be specifically defined and addressed in the plan.

The Draft Plan's biggest flaw is that it makes the assumption that there is sufficient water available through water transfers to meet anticipated demand through the year 2015. The Draft Plan projects that total annual consumptive use in the Mojave River Area will reach 160,500 acre-feet by the year 2015. The Draft Plan estimates the safe yield of this area to be 55,800 acre-feet per year. This is approximately 10,000 acre-feet higher than the safe yield estimate of the Department of Water Resources in Bulletin No. 84. Assuming the Draft Plan's figure of 55,800 acre-feet per year is correct, a deficit of 104,700 acre-feet per year results which must be imported or approximately 45,000 acre-feet per year more than the Mojave Water Agency's State Water Project maximum entitlement of 50,800 acre-feet.

The assumption that water transfers can readily be accomplished is wrong in that there are many obstacles to their implementation and the majority of past transfers completed were accomplished during the drought on an emergency basis.
By assuming that water will be made available, the Draft Plan then considers the alternatives of supplying water within the MWA boundaries. This approach runs the risk of building pipeline facilities with no water to put in it. The plan must address the broader issues of water supply before identifying alternatives for distributing water within the agency’s boundaries.

A specific permanent transfer must be identified as part of the Draft Plan if the MWA is going to accept the responsibility of supplying the projected water needs of the high desert. Alternatives to the proposed project which should then be considered are: 1) The supply of only MWA’s 50,800 acre-feet allotment (40,000 acre-feet estimated annual average), 2) The supply of 50,800 acre-feet plus an additional amount to alleviate the current overdraft with no additional growth. 3) meeting supply needs through transfers of waters within the Mojave River Basin plus MWA’s 50,800 acre-feet. and 4) The No Project Alternative.

The following specific comments on the Draft Plan are made:

1. The Draft Plan estimates the “safe yield” of the Mojave River area as 55,800 acre-feet per year. This is 10,000 acre-feet higher than the safe yield estimate made by the Department of Water Resources in Bulletin No. 84. The reason for the discrepancy is that the Draft Plan estimates the water requirements for riparian habitat at a much smaller quantity than did the Department of Water Resources.

2. The Draft Plan estimates that the current annual overdraft is 68,000 acre-feet. This is lower than the previously reported 90,000 acre-feet figure provided by Bookman-Edmonston in March of 1992. The reasons for this discrepancy are differences in the consumptive use estimates made for agricultural and, again, the reduced estimate of the amount of water required for riparian habitat.

3. The Draft Plan recommends the construction of recharge facilities to store imported water. On page 58 it is stated that these “facilities should be located near the upstream ends of the Alto, Centro and Baja subareas in the Mojave River alluvial aquifers to take advantage of dewatered ground water storage capacity within each subarea and to reduce the potential for increasing amounts of rising water at the downstream ends of the subareas.”

In order to maintain recharge to the City of Adelanto’s wells located near the river, surface flow through the Lower Narrows must be maintained. The Draft Plan’s statement concerning rising waters at the end of the subareas is in conflict with Adelanto’s needs. It is also indicative of the plan’s lack of concern over riparian habitat which requires rising water conditions and near surface flow.
The City of Adelanto must be assured that at least historic flow rates are maintained at the Lower Narrows. The current stipulation does not provide for this. Rather, the stipulation provides that historic flow rates be maintained downstream just below the discharge of the Victor Valley Regional Wastewater Reclamation Plant. Hence, the Narrows could be dry, providing no recharge to Adelanto's wells, and all water commitments to the Centro subbasin could be met through wastewater discharges.

4. On page 62, the plan suggests that stormwater outflows below Afton Canyon be reduced to the "minimum feasible flow". "Minimum feasible flow" is not defined. Waters would be recharged higher on the river by constructing instream recharge facilities rather than be allowed to flow past Afton Canyon. This could adversely effect or eliminate the Mohave Tui Chub located downstream at Soda Springs.

5. On page 65, the Draft Plan states that the MWA "may" be able to obtain additional water supplies through water transfers from other agencies or individuals" [emphasis added]. The term may is the correct term to use in describing the possibility of obtaining water transfers. However, in no way can the high desert area rely on an action which is only conceivable and not absolutely assured. Again, there is the need to identify a specific permanent water transfer as part of this plan.

6. The Draft Plan states on page 124 that data will be needed on all parameters that affect the hydrologic inventory such as surface flows, groundwater pumpage, groundwater levels, wastewater discharges, water quality, and water storage. It is envisioned that new wells will be constructed to determine groundwater flow quantities. The cost of this program is estimated at $300,000 per year which would be used to hire additional staffing. No money is included for well construction or cooperative studies with the U.S.G.S.

7. The Draft Plan recommends that water be released to the Mojave River from the Morongo Basin Pipeline. In order to accomplish this, a four mile pipeline from the Morongo Pipeline upstream to a 400 to 500 acre recharge facility within the Mojave River Channel is proposed. There is no information presented in the report identifying how the 400 to 500 acre figures were determined. The maps in the report erroneously show very small areas for recharge. Five hundred (500) acres is an area approximately 1/4 mile by 3 miles in dimension. Another plan alternative is to release water from the Morongo Pipeline to recharge facilities below the pipeline. The costs of these alternatives are estimated at $25.9 and $14.1 million dollars respectively and include the cost of enlarging the first reach of the Morongo Basin Pipeline.

The specific method of payment for this project is not noted. It is unknown whether the City of Adelanto would be responsible for a portion of the costs.
Channel improvements are to be made in the Baja Subarea. It is proposed that temporary sand dams be constructed across segments of the river. These improvements would reduce flow through Afton Canyon.

9. The Draft Plan proposes four water conveyance facilities: Morongo Basin Pipeline Extension, Morongo Basin Pipeline Turnout to Lucerne Valley, Mojave River Aqueduct, and El Mirage Turnout. The plan provides that the benefitting area must pay for the cost of constructing and operating the conveyance facilities. This would be done through the establishment of Improvement Districts. There is no information provided as to who the benefitting parties are to these facilities. Is it expected that the City of Adelanto will participate in both the Mojave River Pipeline and the recharge to the river from the Morongo Basin Pipeline? It is unknown whether Adelanto would directly benefit from the construction of any of these facilities.

10. The Draft Plan identifies three potential methods of payment for imported water: 1) the method identified in the proposed stipulation for judgment; 2) the formation of Zones of Benefit; and 3) production assessments. The plan should specify which of these methods are to be used.

In closing, the continued growth and economic stability of the high desert area depend upon an adequate and reliable water supply. This supply does not presently exist. Planning for water supply needs must focus on specific actions. The Draft Plan needs to identify a specific water transfer project if it is to achieve its desired ends.

Again, thank you for the opportunity to comment on the Final Draft Regional Water Management Plan. If you have any questions concerning these comments, please contact our office at (916) 541-1912.

Very truly yours,

Craig W. Morgan
Professional Civil Engineer

cc: City of Adelanto/ Patricia Chamberlaime
    Michael B. Jackson, Esq.
    Morrison and Foerster, Lauri Zelon, Esq.
    R. Zaiden Corrado, Esq./ City Attorney
Mr. Craig W. Morgan  
Roy C. Hampson and Associates  
2435 Venice Drive East  
Tahoe Keys Marina, Suite 115  
South Lake Tahoe, California 96150

May 27, 1994

RE: Draft RWMP Comments

Dear Mr. Morgan:

Thank you for your comments regarding the MWA Draft Regional Water Management Plan (RWMP), submitted on behalf of the City of Adelanto. Following are responses to the issues contained in your letter, provided in the order in which they were posed. Your letter and staff’s responses will be provided to the Board of Directors for their consideration prior to action on the RWMP.

Many of your comments result because you did not recognize that the RWMP is a program document, which is why the Draft RWMP “does not provide a detailed specific project”. A program document, such as the RWMP, is typically prepared to review and summarize a series of actions that are closely related, such as phased projects, plans, policy or regulatory programs. A project document, however, is what would be used to analyze a specific project or program. Another example of a program document is a general plan of land use for a city or a county. The project document in this context would be a site specific plan or a subdivision project.

The RWMP was intended to assess component projects which the MWA can pursue in the future to provide sufficient water supply to areas of demand within the MWA. It would be well beyond the scope of any program document, such as the RWMP, to provide the level of engineering detail required to address some of the questions you pose. The component projects of the RWMP are not proposed to be constructed at one time, but are rather submitted for consideration and implementation by phase (specifically through the 2015 planning horizon). It is the Agency’s contention that the RWMP adequately
estimates the quantities of water that will be needed through the planning period (see Section III. Water Supplies, Utilization and Deficiencies), and assesses those needs relative to the availability of water supplies, both native and imported. The RWMP acknowledges that it will be incumbent upon the MWA to seek water supplies in addition to the State Water Project entitlement available, and identifies different mechanisms to pursue those additional supplies. The RWMP also identifies the variety of mechanisms available to pay for capital facilities and/or water purchases. Again, because the RWMP is a program document, pursuit of each component project would require project specific engineering and financial analyses.

Your assertion that the RWMP’s “biggest flaw” is the assumption that there is sufficient water available through water transfers to meet demand, is contrary to the basic water supply mechanisms of the State. The water supply and economy of Southern California has for some time been based upon transfers of significant quantities of water from Northern California and the Colorado River. Recent legislation and Water Code sections 109, 382, 470-483, and 1725-1740 support the policy of the State to facilitate voluntary water transfers. The State Drought Water Bank was a beginning. Valuable lessons were learned from the State Water Bank, and are being applied to current transfer programs to enhance, not diminish, the potential for transfers.

Water transfers are now used by many groups as an effective means to address current water allocation conflicts among agriculture, municipal and industrial, and environmental uses. Our experience is that there is keen interest and cooperation in current efforts to develop the emerging water transfers market, in both the public and private sectors.

The estimates of safe yield in the RWMP differ from those in DWR Bulletin 84 because: 1) streamflow data between 1961 and 1991 were included in records used in determining natural supply; 2) area of riparian habitat (phreatophytes) reflects 1986-90 conditions; and 3) precipitation used in B-E estimates was based on deep percolation to the underlying groundwater reported in DWR Bulletin 84, not net precipitation used by DWR. Please also refer to pages 102 through 104 in Bulletin 84 regarding their calculations, the potential for variability of results depending upon assumptions made, and application of assumptions. Of particular interest are the footnote to Table 33 and the last paragraph on page 104. The former indicates that pumpage for safe yield calculations were estimated from State Water Right Board’s records, but noted that MWA was undergoing a detailed production verification process at the time which would likely alter the estimates of safe yield. The latter reference states “The amounts of ground water overdraft and safe yield are dependent upon the set of physical conditions used in their determination, one of which is pumpage. Accordingly, the amounts of ground water overdraft and safe yield are subject to redetermination whenever major changes occur in these
conditions. Such a reevaluation may be necessary periodically in the future to provide a continuing guide to the use of ground water in storage.” (emphasis added). B-E undertook the necessary reevaluation of the hydrologic inventory for the purposes of the RWMP program. Simple repetition of the values created for Bulletin 84 using physical conditions in 1960-61 for a planning document in 1993 would not be accurate or adequate.

Your statement that by assuming that water will be made available “...runs the risk of building pipeline facilities with no water in it.” ignores an important component of the RWMP, and operates on a false premise. First, the assumption inherent in your statement is that all of the analyses that will be performed to build capital facilities is contained within the RWMP, and that upon adoption of the RWMP, MWA will proceed with all of the desired components. As noted above, this is not the case. Your letter does not acknowledge discussion within the RWMP that indicates that a means of addressing water supply deficiency is through allocation, if needed (obviously not a desired alternative). We also disagree with your assertion that a specific permanent transfer must be identified as part of the RWMP. As noted above, the processes of the water market are emerging, and transfers are complex. Successful water transfers will require time and appropriate finances. Your letter seems to suggest that efforts to address the water supply needs of the MWA should cease until a new water supply has been found. That scenario is not acceptable, and is contrary to mandates contained within the MWA Act.

The following addresses the numbered comments from your letter in the order in which they were presented.

1. See the discussion above regarding Bulletin 84 and the estimates in the RWMP.

2. B-E did not indicate a current annual overdraft of 90,000 acre-feet in March of 1992 as you state. In May of 1992, B-E provided information to the Joint Engineers Committee for the Mojave River Area adjudication which included preliminary estimates of overdraft. That document estimated annual overdraft of 82,700 acre-feet. This was subsequently revised to 68,000 acre-feet by B-E to account for present (1989) phreatophyte use rather than the figure used by DWR Bulletin 84. I believe that the 90,000 acre-foot figure appears in court documents prepared by Attorney Michael Jackson for the City of Adelanto in opposition to the water rights adjudication.

3. You have misinterpreted the intent of the discussion on recharge facilities. It is technically ineffective to place recharge basins at the lower end of a subbasin, only to have the water be rejected to the next subbasin due to lack of storage capacity and/or shallow bedrock or other constriction. It is much more effective to provide the recharge water at
the upstream end of the subbasin to take advantage of dewatered storage and to benefit downstream water users. Your conclusion that this scenario will cause the Mojave River Narrows to dry up and deprive water supply to the City of Adelanto and/or riparian vegetation is not correct. A basic objective of the RWMP is to achieve water supply balance within all of the subareas. Your conclusion is also contrary to the terms of the Judgment for the Mojave Basin Area adjudication.

Review of the Stipulated Judgment fails to support your conclusions regarding the effects of the Judgment on Adelanto’s wells due to downstream obligation requirements. Regardless, this is an adjudication issue and not a RWMP issue.

4. The referenced reduction to stormwater outflows from Afton Canyon to minimum feasible flows was suggested as an alternative, but this would obviously require additional engineering and environmental analyses. Potential for this proposal to conflict with the terms of the Judgment for the Mojave Basin area adjudication would also have to be considered.

5. See discussion above.

6. Comment noted. The referenced USGS programs, including well construction costs, are currently underway, and their costs have been included in the annual budget process. The referenced MWA cost is for MWA personnel to perform on-going sampling and monitoring programs.

7. The estimate of 400 to 500 acres was based on a projected overdraft in Alto of about 45,000 acre-feet per year. The area was estimated based on long-term percolation rates of 0.5 feet per day, 250-300 days of operation and alternate wetting and drying of recharge basins. The map is not intended to show a precise location or sizing for facilities, because the RWMP is a program level document. Both the size and location of the facilities could change depending upon the results of site-specific engineering and environmental analysis. If the City of Adelanto were to purchase water from MWA with subsequent delivery through the Morongo Basin Pipeline, the City would be required to share in the cost of the facility proportionate to the quantity of water delivered.

8. See response to 4, above.

9. As noted, the RWMP is a program document. The issues raised would be addressed specifically at the time a facility is actually proposed, sized, engineered, and reviewed with affected entities and the Board of Directors.
Mr. J. Duane Davis, General Manager  
Baldy Mesa Water District  
P.O. Box 1347  
Victorville, CA 92393

May 27, 1994

RE: Water Treatment Plant Study - MWA Regional Water Management Plan.

Dear Duane:

Thank you for your letter dated February 2, 1994, regarding the status of a potential joint feasibility study and joint powers authority for participation in a water treatment plant using State Project Water. Your letter stated that after consideration of storage needs associated with a treatment plant, and discussions with the Victor Valley Water District, your Board of Directors has concluded that they do not wish to participate in this study, and that this issue should be addressed in the Regional Water Management Plan (RWMP). The issue of potential potable water treatment was also raised in the letter jointly submitted by your District and other entities in the Victor Valley area.

Potential water treatment was an issue addressed by the RWMP, but was not included in the recommendations from Bookman-Edmonston Engineering (B-E) to the MWA Board of Directors. As you noted, a treatment plant would require a large storage facility in order to avoid outages due to supply interruptions on the State Water Project. Due to the complexity of this issue, cost, and other facilities which may have priority, treatment was considered by B-E to be “outside of the planning horizon”.

22450 Headquarters  •  P.O. Box 1089  •  Apple Valley, CA 92307  •  (619) 240-9201  •  FAX (619) 240-2642

George R. Parker  
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Division #7

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Division #4

Larry W. Rowe, P.E.  
General Manager/Chief Engineer

Thomas H. Irwin  
Division #5
As noted in the MWA comments to the joint response letter, staff will recommend to the Board of Directors that the RWMP be revisited approximately five years following adoption. The potential for potable treatment, whether operated by MWA or a joint powers entity, may be an appropriate issue for review at that time.

Sincerely,

[Signature]

Norman T. Caouette
Director of Planning and Resource Development

c. Don Songer, VVWD
Board of Directors
APPENDIX "B"

ERRATA TO RWMP
The following changes should be incorporated to the Final Draft of the Regional Water Management Plan document dated September 1993. Strikeout indicates text to be deleted. bold indicates text to be added where shown.

On page 3, change paragraph number 13, A., B. and C. as follows, from:

A. Measures that can be unilaterally implemented by MWA.

B. Measures that require actions or agreements with others that are beyond the ability of MWA to implement unilaterally.

C. Measures that would require legislative changes to the MWA Act in order to be implemented.

To:

A. Measures that are an authorized activity for the MWA under the current Agency Act.

B. Measures that are not an authorized activity for the MWA under the current Agency Act, but could be accomplished through agreement between the MWA and other entities that have authority to implement the desired programs within MWA boundaries.

C. Measures that cannot be accomplished directly by the MWA or by agreement with other entities, and would therefore require amendments to the MWA Act.

On page 20, for the data which summarizes estimated average annual surface water supply for the 1931-1990 period to the Mojave River, change footnote (a) to (b), and add a footnote (a) to “Surface water inflow to Alto subarea” as follows: “(a) Does not include inflow from the Lake Arrowhead CSD or Crestline SD wastewater facilities.”

On Page 30, Table 3, add a footnote which reads: “Data regarding the Oeste subarea were not included because of insufficient data regarding this subject.”

On page 32, change the second paragraph as follows:

A pasture in Summit Valley is irrigated by outflow from the Crestline Sanitation District. Ground water underlying both these locations has a high nitrate concentration, attributable in part to the relatively high nitrate levels in effluent applied to the sites. While identification of the specific cause of the high levels of nitrate is beyond the scope of the Regional Water Management Plan, the Lahontan Regional Water Quality Control Board indicates that high nitrate levels could have been caused by
wastewater effluent used for irrigation. Other potential sources could have been septic tanks or agricultural operations. It is also possible that the high nitrate concentrations could be naturally occurring. Corrective measures have been...

On page 62. Table 12. change “(say 100)” to “(say 1,000)”.

On page 84. change number 4 as follows:

4. Measures that require actions or agreements with others and are beyond the ability of MWA to implement unilaterally under the current MWA Act.
APPENDIX "C"

PROJECTS TIMELINE
# MOJAVE WATER AGENCY PROJECTS IMPLEMENTATION TIMELINE

## STRUCTURAL FEATURES

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- Mojave Recharge from Oversize MBP
- Alto Recharge Basins (from MBP)
- Morongo Basin Pipeline
- Hi-Desert Pipeline
- Ames/Means and Joshua Basin Ext.
- Mojave River Pipeline
- Este Recharge Basins
- Oeste Aqueduct Facility/Recharge
- USGS Monitoring Well Installation

## NON-STRUCTURAL FEATURES

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- Releases from Silverwood
- Conservation Programs
- Water Transfers and Conjunctive Use
- USGS Cooperative Monitoring
- USGS Mojave River Channel Program
- USGS RASA Program
- USGS Optimization Modeling
- MWA GIS Program
- Wellhead Protection Programs

**KEY:**
- Planning Phase
- Design Phase
- Construction Phase
- Operational Phase
- Unknown
- Non-MWA Project

### NOTES:

Non-MWA Project refers to components identified in the RWMP that may be initiated by another Agency, working with MWA.

This Timeline is intended to be reviewed annually by the MWA Board of Directors as part of the budgeting process, and updated at that time, if appropriate.
SECTION I
SUMMARY OF FINDINGS AND RECOMMENDATIONS

As a result of the investigations and analyses conducted in connection with the preparation of this report, the findings and recommendations are as follows:

FINDINGS

1. Urban consumptive use in the Mojave River area is projected to increase from the current use of 46,000 af/yr to 82,000 af/yr in year 2015. Agricultural consumptive use in the Mojave River area is projected to decrease from 78,000 af/yr in 1990 to 63,000 af/yr by the year 2015.

2. The average annual local water supply to the Mojave River area is about 72,000 af/yr, the current total use including phreatophytes and outflow from the area is about 140,000 af/yr, leaving a current overdraft of 68,000 af/yr. By the year 2015 the overdraft is projected to increase to 89,000 af/yr unless actions are taken to increase supplies and/or reduce demands.

3. The estimated operational storage capacity of the Mojave River area ground water basins is 4,900,000 acre-feet with about 3,000,000 acre-feet of water in storage as of the end of 1990. If no actions are taken to reduce overdraft, the ground water basins will be depleted by about an additional 1,860,000 acre-feet by year 2015 leaving 1,140,000 acre-feet of water in storage at that time or about 25 percent of total full conditions.

4. The current urban consumptive use in the Morongo Basin/Johnson Valley area is 2,900 af/yr and is projected to increase to 6,000 af/yr by year 2015. There is no agricultural use in the Morongo Basin/Johnson Valley area.
5. The average annual local water supply to the Morongo Basin/Johnson Valley area is about 1,400 af/yr and the total use is 2,900 af/yr, resulting in a current overdraft of 1,500 af/yr. By the year 2015 the overdraft is projected to increase to 4,000 af/yr unless actions are taken to increase supplies and/or reduce demands.

6. Although the Mojave Water Agency (MWA) has a maximum annual water entitlement from the State Water Project (SWP) of 50,800 af/yr, the water supply problems of the SWP are such that MWA will experience a fluctuating annual water supply projected to average no more than 40,000 af/yr of the MWA SWP entitlement.

7. Even with MWA purchasing all of the SWP water it is projected to receive (40,000 af/yr average), the overdraft on the ground water basins within the boundaries of MWA will increase from nearly 30,000 af/yr currently to 53,000 af/yr by the year 2015 unless additional supplies are obtained and/or water demands are reduced.

8. If the May 1993 stipulated judgment is accepted by the Court, the parties to the judgment will in time be the major purchasers of imported water.

9. Some additional water supplies can likely be obtained by water transfers, water exchanges and water banking agreements with other water agencies. Obtaining these supplies will be a complex and time-consuming process and the supplies will be more costly than SWP water.

10. MWA can act to reduce its water demands through conservation and water allocation. The effects of water conservation programs on reductions in consumptive use will be relatively small. Water allocation and water pricing mechanisms are controversial.

11. The MWA Board needs to make decisions on three types of alternatives:

   A. Alternatives to reduce and eventually eliminate ground water overdraft.
   B. Water service alternatives.
   C. Structural alternatives.
12. The alternatives to eliminate ground water overdraft are:

A. Water supply enhancement.
B. Water conservation that reduces consumptive use.
C. Water allocation and water pricing.

The amount of water that can be conserved through water conservation measures is small compared to the overdraft, and therefore it must be combined with one or both of the other measures in order to eliminate overdraft.

13. Any ground water overdraft correction program adopted by MWA would include measures required to comply with the judgment adopted by the Court as the physical solution to the water rights adjudication and will have one or more of the following elements, not necessarily in order of priority:

A. Measures that are an authorized activity for MWA under the current Agency Act.

B. Measures that are not an authorized activity for MWA under the current Agency Act, but could be accomplished through agreement between MWA and other entities that have authority to implement the desired programs within MWA boundaries.

C. Measures that cannot be accomplished directly by MWA or by agreement with other entities, and would therefore require amendments to the MWA Act.

14. MWA has a wide range of water service options it could undertake ranging from the minimum action of purchasing SWP water and releasing it from Lake Silverwood to the Mojave River channel to a number of more complex alternatives.

15. Except for Item C, the water service alternatives listed below are in addition to each of the previous ones and provide additional services and higher costs.
A. Continue the release of purchased SWP water from Lake Silverwood to the Mojave River channel.

B. After completion of the oversizing of Reach 1 of the Morongo Basin Pipeline (MBP), release water from this facility by construction of an outlet structure to recharge facilities in the Alto subarea and construct monitoring wells.

C. Implement economically feasible measures to increase local water supplies by channel modification recharge facilities near the Mojave River and near dry lake beds.

D. Construct the Mojave River Aqueduct (MRA) and facilities to deliver imported water to recharge facilities to be constructed in the Centro and Baja subareas.

E. Construct facilities to deliver imported water from the MBP to recharge facilities to be constructed in the Este subarea.

F. Construct the El Mirage Pipeline to deliver imported water from the California Aqueduct to recharge facilities to be constructed in the Oeste subarea.

G. Construct facilities to deliver water from the MBP to recharge areas in the Morongo Basin/Johnson Valley.

H. Construct wells and construct facilities to deliver ground water to the MRA.

I. Construct facilities to deliver imported and ground water to water users.

J. Construct storage facilities or construct additional wells to meet peak requirements and construct water treatment facilities.
16. One or more structural solutions exist for some of the water service alternatives listed in Item 15 for specific subareas.

17. Alternative sources of revenue for the payment of the increasing costs of SWP supplies are the zone of benefit assessments, ground water production assessments, direct sales of water, and some combination of these sources. If the Mojave River adjudication proposed stipulated judgment dated May 1993 is accepted, revenues from that source could become available in 1998.

18. Additional potential sources of revenue such as capacity charges and standby charges will require legislative changes in the MWA Act.

19. Sources of financing for construction of facilities are general obligation bonds of an improvement district or of MWA as a whole. Other sources are revenue bonds, state loans, federal loans and/or federal grants.

20. The estimated cost for full delivery each year of the available SWP water estimated to average 40,000 af/yr through 2015 will be from $12.2 to $13.4 million per year for both fixed and variable costs based on DWR Bulletin 132-91.

21. Acquisition of a long-term water supply for overdraft correction is estimated to cost $150/ac-ft for delivery from its source to the California Aqueduct and an additional $125/ac-ft for delivery to MWA Turnouts using SWP facilities.

22. Assuming the acquisition of an additional long-term water supply, the total estimated annual water cost for full overdraft correction would range from about $21.7 million in the year 2000 to $26.8 million in 2015 for both fixed and variable costs.

23. The annual cost of debt service plus operation and maintenance of the water conveyance and distribution alternatives varies depending upon the water service alternatives selected by MWA. The only cost estimates used are for facilities projected to be implemented before 2015.
24. The capital costs increase from negligible for Item 15 Alternative A to $138.0 million for Alternatives B-G. The annual costs of debt service, operation, maintenance and replacement and administration increase from negligible in Item 15 Alternative A to about $15.9 million/yr for Alternatives B through G inclusive.

### ESTIMATED COSTS OF FACILITIES

<table>
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<th>Description</th>
<th>Subarea</th>
<th>Estimated Costs ($ Millions)</th>
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<tr>
<td>Lateral from Morongo Basin Pipeline and recharge site</td>
<td>Alto</td>
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<tr>
<td>Mojave River Aqueduct and Hodge/Lenwood recharge sites</td>
<td>Alto, Centro</td>
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<td>Mojave River Aqueduct and Daggett/Terminal (at Minneola) recharge sites</td>
<td>Baja</td>
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<td>El Mirage Pipeline and recharge site south of SWP Aqueduct</td>
<td>Oeste</td>
<td>11.9</td>
</tr>
<tr>
<td>Extension of Morongo Basin Pipeline and recharge sites in Means/Ames, Joshua Tree and Warren Valley Basin areas</td>
<td>Morongo Basin/Johnson Valley</td>
<td>14.5</td>
</tr>
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</table>

**Total** 138.3

(1) Includes approximately $5 million for enlargement of Reach 1 of the Morongo Basin Pipeline.
25. The total estimated annual costs of Alternatives 15 B through G when fully implemented are:

<table>
<thead>
<tr>
<th>Item</th>
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<tr>
<td>Additional Imported Water</td>
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<tr>
<td>Debt Service</td>
<td>13.0</td>
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<tr>
<td>Operation, Maintenance, Replacement</td>
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<tr>
<td>MWA Administration</td>
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<tr>
<td><strong>Total:</strong></td>
<td><strong>$41.3</strong></td>
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(1) Includes $500,000 per year for use of Morongo Basin Pipeline to deliver water to Este recharge areas.

RECOMMENDATIONS

1. Consistent with its legislative charge and the responsibilities given to it in the May 1993 stipulated judgment for the Mojave River, MWA should implement a program that would make imported water available to each of its subareas.

2. A three-phase program with various structural and nonstructural components should be undertaken as described herein.

3. The structural features of Phase 1 conveyance facilities are completion of the Morongo Basin Pipeline with an outlet structure to the Mojave River, and construction of the Mojave River Aqueduct and the El Mirage Pipeline. The distribution facilities structural measures are construction of recharge facilities and connecting pipelines in all of the subareas, drilling of wells for a well monitoring program, and construction of any economically feasible program to increase local water supplies.

4. The nonstructural features of Phase 1 are establishment of a water monitoring program, maximization of the purchase of SWP water with initial deliveries being the release of SWP water to the Mojave River from Lake Silverwood. Other measures include establishment of zones of benefit, formation of improvement districts, implementation of conservation measures that reduce consumptive use, investigation
NOTE: MAP FROM CALIFORNIA DEPARTMENT OF WATER RESOURCES.

MOJAVE WATER AGENCY
REGIONAL WATER MANAGEMENT PLAN
LOCATION MAP

FIGURE 1
of additional water importation projects, development of water quality protection programs that would include involvement in well construction permitting, abandonment and well site protection, and legislative changes to the MWA Act.

5. After implementation of the measures described in Phase 1 have been commenced, MWA should decide whether to proceed with the structural measures of Phase 2, which could include ground water extraction and delivery to the Mojave River Aqueduct. A decision should also be made whether, and to what extent, to proceed with the structural measures of Phase 3, delivery of imported and ground water to water users and meeting of peaking water requirements and constructing water treatment facilities.

6. If the Phase 2 structural measures are approved, the nonstructural actions need to be taken to establish zones of benefit and improvement districts.

7. The key nonstructural measure of Phase 3 will be the evaluation of future availability of water supplies to MWA, existing and future water demands, and a determination if water allocation and water pricing are needed to eliminate ground water overdraft.

8. MWA should continue to use its present taxing authority on land and improvements (MWA 1 and 2) to pay for the fixed and variable costs of water from the State Water Project as well as Agency administrative costs. The additional revenues needed to purchase all available imported water should be raised by a combination of increasing rates under MWA taxing authority, zones of benefit assessments and water production assessments. These charges would be reduced as income from water sales from the Mojave River adjudication increases.

9. The total annual cost of the recommended conveyance and distribution program could be paid for by a combination of revenues from existing sources of revenue, zones of benefit assessments, ground water pumping assessments based on benefit, water sales and any other new revenue sources to be authorized in amendments to the MWA Act.
SECTION II
INTRODUCTION

The Mojave Water Agency (MWA) retained the services of Bookman-Edmonston Engineering, Inc. in November of 1991 to develop a regional water management plan (Plan). The Plan, when adopted by the MWA Board of Directors, will provide a guideline for actions to be taken, consistent with the on-going Mojave River adjudication, that will eliminate overdraft of the ground water basins and provide for future water requirements in a flexible, cost effective and environmentally sound manner. The planning period extends through 2015 and it is anticipated that the Plan will be reviewed and revised periodically. The objective is to provide the maximum flexibility to MWA in meeting future conditions and challenges as they relate to the water supplies and water needs of the area. The purpose of this report is: (1) to describe the factors that relate to developing a plan; (2) to describe the structural, nonstructural, and financial management alternatives; and (3) present a recommended plan.

LOCATION AND HISTORY

The area encompassed by MWA Regional Plan includes the Mojave River area, defined as that portion of MWA that drains to the Mojave River, and the Morongo Basin/Johnson Valley area which is part of the Colorado River drainage. Surface flows in the El Mirage area drain to the dry lakes rather than the Mojave River but El Mirage is included in the Mojave River area because subsurface flows contribute to the water supplies of the Mojave River. A small amount of subsurface flows from the Lucerne Valley area also contribute to the water supplies of the Mojave River area. The boundary of MWA encompasses about 4,900 square miles in the High Desert area of California and is shown on Figure 1. The Mojave River area and the Morongo Basin/Johnson Valley were further divided into smaller subareas generally bound by hydrogeologic boundaries and faults. Presented in Figure 2 are the subareas of MWA used in this report, the principal communities, the Mojave River and the principal geologic faults.
The Mojave River originates in the San Bernardino Mountains from a drainage area above the Forksite Dam (also referred to as the Mojave River Dam) of just over 200 square miles. From the Forksite Dam, the channel proceeds northerly to the vicinity of the community of Helendale and then northeasterly past Barstow and Afton. Significant surface flows generally follow storm events. At several locations, rising water occurs due to rock outcrops but most of the river channel is dry throughout the year.

Early development of the lands in MWA was generally driven by land sales and speculation related to early irrigation schemes, railroads that made the area accessible, and mining operations. The principal obstacle to the various proposals was the availability of water.

The alluvial soils and long growing season are two factors that led the early attempts to develop the area for agriculture. Water for these developments was initially obtained from surface diversions from the river but flows were not reliable throughout the year. The first recorded appropriation of water from the Mojave River was in the early 1870s. From the mid to late 1880s to about 1920 a number of water companies were formed to meet the needs of the growing population.

Completion of the Atcheson, Topeka & Santa Fe Railroad in the mid 1800s and the establishment of Barstow as a hub for freight consolidation and distribution contributed greatly to the prosperity of the town and the northern portion of MWA.

GROUND WATER RESOURCES

Utilization of the ground water resources of MWA began in the late 1800s with the development of centrifugal pumps installed in relatively shallow (10-20 feet) dug wells. Development of the deep well turbine-type pump in the early 1900s allowed large volumes of ground water to be extracted from the underlying aquifers and used for agricultural purposes. Small submersible pumps are used to extract ground water for residents not served by a county, municipal or private water purveyor. Ground water essentially supplies all of the water used in the MWA service area.
The average annual water supply exceeded water demands in MWA until about the 1950s for the Mojave River portion of MWA. Continuous and fairly rapid growth occurred during the 1950s and 1960s and caused water demands to exceed water supplies. The resulting imbalance between supply and demand is referred to as "overdraft" and the result over the long term is a lowering of the ground water levels.

Overdraft conditions presently exist throughout MWA and total on the order of about 70,000 acre-feet per year. Most of the overdraft, about 68,000 acre-feet per year, occurs in the Mojave River portion of MWA with the balance occurring in the Morongo Basin/Johnson Valley area. The effect of the overdraft conditions on ground water elevations in the Alto and Baja subareas are shown on Figure 3.

Overdraft conditions also exist to varying degrees in the Morongo Basin/Johnson Valley area. There is a severe overdraft in the Warren Valley ground water basin, which was adjudicated in 1977, mild overdrafting in the Copper Valley Mountain Basin, and Means/Ames Valley Basin is considered to be entering an overdraft condition.

In the middle to late 1950s it became obvious to community leaders that the declining trend in ground water levels would ultimately place a ceiling on continued development. One solution was to secure an imported water supply.

MOJAVE WATER AGENCY

MWA was formed in 1959 by an act of the State legislature and activated by a vote of the residents within the proposed boundaries in 1960. The area of MWA as originally formed encompassed most of the Mojave River, Lacerne, and El Mirage areas. The Morongo Basin/Johnson Valley area, located in the southeast portion of MWA was annexed in 1965 at the request of the residents of that area. Included in the Morongo Basin/Johnson Valley area are the communities of Joshua Tree, Landers, Pioneertown and Yucca Valley.

The Act establishing MWA provides broad powers to implement the purpose of MWA which is described as doing "any and every act necessary to be done so that sufficient
water may be available for any present or future ... uses of the lands or inhabitants of the agency...".

In carrying out this legislative directive, MWA entered into a contract with the California Department of Water Resources (DWR) in 1963 for a maximum annual entitlement of 50,800 acre-feet from the State Water Project (SWP). The purpose of this contract is to provide a supplemental water supply for the constituents of MWA. The MWA SWP contract is for a municipal and industrial water supply, which generally carries a higher priority than an agricultural water supply in times when SWP supplies are limited. Under the SWP contract, during the latter portion of lengthy dry periods such as the 1986 to 1992 period, municipal and agricultural water users are required to share equally in water supply deficiencies.

Numerous studies have been performed by the U. S. Geological Survey (USGS), DWR and engineering consultants to identify the magnitude of the overdraft conditions in various areas within MWA. Facilities such as canals, pipelines and recharge facilities were proposed and costs were estimated by various consultants. In 1990 voters in the Morongo Basin area approved a bond issue for up to $66 million to construct the MBP. Ground breaking ceremonies for this facility were held December 9, 1992. The project is scheduled to be completed so that water deliveries from the SWP can commence in late 1994.

In late 1990, MWA retained the services of Bookman-Edmonston Engineering, Inc. to perform an analysis of the establishment of zones of benefit that would affect ground water pumpers along the Mojave River channel. Funds raised through the zone of benefit procedures would be used to purchase water from the SWP. The analysis was based on releases of MWA's SWP entitlement supply to the channel for ground water recharge over a ten-year period. This report was accepted by the Board of Directors but not implemented due to the recognition that a regional water management plan should be prepared to fully address the problems and needs of MWA.

In late 1991, MWA retained the services of Bookman-Edmonston Engineering, Inc. to prepare a regional water management plan, the subject of this report. Boyle
Engineering Corporation was retained to study the Morongo Basin/Johnson Valley area and participated in the preparation of the Plan for that area.

Historically, only limited amounts of water have been delivered to MWA from the SWP. Essentially all SWP water delivered to MWA has been for ground water recharge and has been released from Silverwood Lake to the channel of the Mojave River. Small amounts have been delivered to the Antelope Valley-East Kern Water Agency through an exchange agreement. Total deliveries since 1972 for ground water recharge amount to about 60,000 acre-feet, of which about 10,000 acre-feet were delivered in 1992.

MWA is also involved with others in quantification of water rights within MWA boundaries. Presently, only the Warren Basin, located in the Morongo Basin/Johnson Valley area has been adjudicated. An attempt to adjudicate the Mojave River area was initiated in the mid-1960s but was never finalized. The present on-going adjudication was initiated by the City of Barstow and will affect the Mojave River area.

ADJUDICATION

Population growth within the Mojave River area of MWA has been greatest upstream from Victorville and ground water levels have significantly declined in this area. In 1990, the City of Barstow filed a complaint against upstream Mojave River water users claiming that the increased pumping and the resulting declining ground water levels reduced the quantity of natural runoff that reached the Barstow area and recharged the underlying alluvial deposits tapped by wells serving Barstow. MWA identified the issue as one with regional implications and, consistent with its Act filed a cross-complaint to extend the adjudication to include essentially all water users in the portion of the Mojave River area within the MWA boundary. This action effectively initiated the on-going adjudication.

On April 27, 1993 Judge Michael Kaiser ordered the distribution of a proposed stipulated judgment to all of the parties for signature or further filings. This proposed stipulated judgment was drafted by a committee representing most of the parties.
The principal relationships between the Plan and the physical solution to the adjudication are listed below:

1. MWA, through its Plan will undertake the importation of additional water supplies to eliminate the overdraft conditions and meet future water demands.

2. MWA is appointed in the draft judgment as initial Watermaster to purchase replacement water for water rights holders whose production exceeds their rights and to perform other duties.

3. MWA would be responsible for monitoring the impacts of the Plan and could incorporate additional measuring activities in the overall program as the watermaster.

SCOPE OF WORK AND RESPONSIBILITIES

The area within MWA was divided into two drainage study areas described earlier as the Mojave River area and the Morongo Basin/Johnson Valley area and shown on Figure 2.

The principal differences between the Mojave River and Morongo Basin/Johnson Valley areas are summarized below:

1. The on-going adjudication applies only to the Mojave River area.

2. The Morongo Basin Pipeline is already financed and is being constructed to deliver SWP supplies to water users in the Morongo Basin area and to the Mojave River channel in the Alto Subarea.

3. Present overdraft conditions in the Warren Valley Basin portion of the Morongo Basin/Johnson Valley area were recognized and this area was adjudicated in 1977.
4. Water use in the Morongo Basin area is for urban purposes.

5. Water use in the Mojave River area includes significant amounts for agriculture, phreatophytes and recreational lakes as well as for urban purposes.

The Plan was developed under a scope of work which included the following five phases:

I. Data Review and Assessment
II. Issue Identification
III. Alternative Management Strategies
IV. Supplementary Technical Analyses
V. Regional Water Management Plan

Phases I through III were independently completed by each firm for its study area and submitted to MWA for review and comment. Each firm conducted a workshop for the Board of Directors and public meetings held at various locations in the MWA to discuss Phases II and III. Phase IV, Supplementary Technical Analyses, was not required to develop the Plan.

In accordance with the Scope of Work, this Regional Water Management Plan constitutes the deliverable for Phase V. Phase V summarizes details and analyses presented in Phases I, II and III and develops the components of the Plan. Documentation of Phases I, II and III is available in the MWA offices.

The overall responsibility for the preparation of the Plan, including both study areas was delegated to Bookman-Edmonston. Bookman-Edmonston retained URS of San Bernardino for issues relating to water quality and population, and Bartle Wells of San Francisco for financing issues, as subcontractors. Boyle was responsible for recommendations and the development of components of the Plan that related to the Morongo Basin/Johnson Valley area, including specific features such as the location of the recharge areas. Features that were common to both the Mojave and Morongo Basin/Johnson Valley areas were developed jointly by Bookman-Edmonston and Boyle.
SECTION III
WATER SUPPLIES, UTILIZATION AND DEFICIENCIES

WATER SUPPLIES

The major sources of water supply available for the Mojave River and the Morongo Basin/Johnson Valley area are local runoff and imported water from the SWP. Most of the runoff to the Mojave River and the smaller streams in the Morongo Basin/Johnson Valley area originates from the snowmelt and rainfall on the San Bernardino and Little San Bernardino Mountains. Practically all of this surface water percolates in the various ground water basins that furnish the water supply for users in MWA. A portion of the SWP entitlement supply has been utilized since 1990 for ground water recharge in the Mojave River channel.

The Mojave River area is divided into five subareas in this report. The boundaries of the subareas are shown on Figure 2. The channel of the Mojave River extends through three of the subareas: Alto, Centro, and Baja. The Alto subarea extends from the Forksite Dam downstream to the Helendale Fault; the Centro subarea from the Helendale Fault to the Waterman Fault; and the Baja subarea from the Waterman Fault to the MWA boundary located about eight miles upstream from the stream flow gage at Afton Canyon. The Este subarea includes the Lucerne Valley, and the Oeste subarea includes El Mirage.

The Morongo Basin/Johnson Valley area's water supply originates as runoff from the surrounding mountainous areas which percolates to the underlying aquifers. Some runoff accumulates in dry lake beds or in the upper portion of the soil profile and evaporates before it can recharge ground water. Historically, the major water use in the Mojave River area has been agriculture. Urban water use has been increasing in recent years and is expected to exceed agricultural use within the next 15 years. Evaporation of water from recreational lakes is a significant item. Water use in the Morongo Basin/Johnson Valley area is exclusively for urban purposes.
Water demands for water users in both areas are met by extracting ground water from the underlying aquifers. Water production to meet these demands is measured or estimated based upon well records. Water not consumptively used by evaporation or plant transpiration returns to the aquifers where it is available for future use. Consumptive use values were estimated to determine net water demand in the Mojave River area. Total production was estimated to be about double the consumptive use based on estimated irrigation efficiencies and wastewater flows from sewered areas. Consumptive use was calculated as 50 percent of estimated ground water production for the Morongo Basin/Johnson Valley area.

Local Surface Water Supplies

The local surface water supplies for the Mojave River area can be broken down into runoff of the Mojave River from the San Bernardino Mountains and runoff resulting from rainfall on the remainder of the Mojave River area referred to herein as "tributary runoff". Local surface water in the Oeste subarea occurs as runoff in Sheep Creek which originates in the San Gabriel Mountains. For the Morongo Basin/Johnson Valley area, essentially all of the local surface water supply is runoff from the San Bernardino and Little San Bernardino Mountains.

Mojave River Stream Flow Data

The Mojave River's major tributaries are the West Fork and East Fork (Deep Creek). Runoff from the approximately 211 square-mile drainage area upstream of the Forks is highly variable from year to year and within each year. Essentially all of the runoff from the San Bernardino Mountains into the Mojave River is measured at the Forks. Prior to 1972, gage readings on the West Fork and East Fork were added to estimate flow at Forks. Although records at the Forks gaging station commenced in 1905, this report utilizes the 1931-1990 period selected for study purposes by the Joint Engineering Committee (JEC) involved in the Mojave River Adjudication as some of the measurements prior to 1931 are considered questionable. Figure 4 shows that the annual runoff has ranged from less than 5,000 acre-feet to over 360,000 acre-feet during the 1931-
MOJAVE WATER AGENCY
REGIONAL WATER MANAGEMENT PLAN
ANNUAL RUNOFF AT THE FORKS 1931-90
BOOKMAN-EDMONSTON ENGINEERING, INC.
JUNE 1993

Annual Average (1931-90):
65,000 acre-feet
1990 period of record. Approximately 65 to 70 percent of the annual runoff occurs during the three months of February, March, and April. Downstream of the Forks, the Mojave River is currently gaged at four locations: at Lower Narrows near Victorville, near Hodge, at Barstow, and at Afton. These gages measure water inflow to and outflow from the Alto, Centro, and Baja subareas. The estimated average annual surface water supply for the 1931-1990 period to the Mojave River area is summarized as follows:

| Surface water inflow to Alto subarea | 65,000<sup>a</sup> |
| Surface water inflow to Este subarea | 1,700<sup>b</sup>  |
| Surface water inflow to Oeste subarea | 1,500           |
| Deep percolation of precipitation   | 3,500            |
| **Total**                           | **71,700**       |

<sup>a</sup> Does not include inflow from Lake Arrowhead CSD or Crestline SD wastewater facilities.

<sup>b</sup> Does not include inflow from Big Bear Area Wastewater Reclamation Authority.

The key gaging stations are shown on Figure 5. The gage at Afton, which is just east of the MWA boundary and very near the boundary of the Baja subarea, has records since 1953 (excluding 1979 and 1980), and is considered to be a good measure of the surface water which escapes or is lost to the Mojave River Basin. Taking the records at this gage as such a measure, and considering all years of record, the average annual volume of water passing Afton has been about 4,600 acre-feet (for the 39 years of record).

James C. Hanson, Consulting Engineer, was retained by MWA to assist in developing detailed hydrologic and water production data for purposes of the adjudication. Hanson's analysis of the outflow at Afton Canyon included a synthesis of flow for the missing years from 1931 to 1952. Inclusion of the synthesized flows with recorded flows results in an average annual flow at Afton Canyon of approximately 8,400 acre-feet per year for the 1931-1990 period.
In summary, considering the surface water measured "in" at the Forks and "out" at Afton, on average, about 90 percent of the flow of the Mojave River is retained within the Mojave River area to recharge the ground water basins.

**Morongo Basin/Johnson Valley Area Precipitation and Stream Flow**

The location of study area, basin and subbasin boundaries of the Morongo Basin/Johnson Valley area are illustrated on Figure 6. The hydrologic areas were defined by DWR as a portion of the Colorado River Basin.

Five drainage areas encompass the bulk of the Morongo Basin/Johnson Valley area: Warren, Copper Mountain, Emerson, Means, and Johnson. Two of the areas, Warren and Means, are contained almost completely within MWA. The watershed boundaries of the other three all extend beyond the borders of the MWA.

The majority of precipitation data available for the study area is concentrated in the Yucca Valley/Joshua Tree area. There are three precipitation gages and a stream gage on Quail Wash in the Joshua Tree Hydrologic Unit. Two other precipitation gages are located near Morongo Valley, but are outside of MWA. The only other rain gage in the study area is located in the Johnson Hydrologic Unit near Melville Lake.

Annual precipitation is highly variable within and adjacent to the Morongo Basin/Johnson Valley area. Average annual precipitation ranges from nearly 22 inches at Big Bear to about four inches at Twenty-nine Palms. Valley floor areas receive an average precipitation of less than eight inches annually.

Thirty-two years of hydrologic data from 1957 to 1989 indicate that the average precipitation exceeds 0.2 inches per day only 10 days per year. Precipitation less than 0.2 inches a day does not produce significant runoff for recharge purposes. On an annual basis, precipitation less than 8 inches per year is not considered to contribute significantly to basin recharge.
Storage Facilities

There are no major storage reservoirs on the Mojave River that provide regulatory storage from the high runoff months to the low runoff months or carryover storage from wet years to dry years. There are three major reservoirs shown on Figure 2 constructed for specific purposes that do provide some minor regulation of the Mojave River. The Forks Reservoir located just below the Deep Creek and West Fork has a capacity of 89,700 acre-feet and is a U.S. Corps of Engineers reservoir limited to providing flood control. Silverwood Reservoir, a DWR facility located on the West Fork, has a storage capacity of 78,000 acre-feet and Lake Arrowhead, owned by the Arrowhead Lake Association, on the East Fork has a capacity of 48,000 acre-feet. However, the major purpose of the Silverwood Reservoir is to store SWP water and the purpose of Lake Arrowhead is for recreation and delivery of water to local residents for municipal use.

Storage facilities in the Morongo Basin/Johnson Valley area consist principally of above-ground tanks owned by the individual water purveyors. There are no reservoirs for the capture of surface runoff.

Wastewater

Most of the wastewater generated in the Mojave River area reaches the ground water basins through individual septic tanks. Wastewater is treated by the Victor Valley Wastewater Reclamation Authority which discharges its treated wastewater from its plant near George Air Force Base to the river channel. These discharges, which wet certain reaches of the channel, affect channel percolation and phreatophyte growth in those reaches. Treated wastewater from the Big Bear Area Wastewater Reclamation Authority (BBAWRA) is an import to the Mojave River area and is used to irrigate alfalfa fields located in the southern portion of the Este subarea within MWA boundaries. Communication with officials from BBAWRA indicate that since 1980, an average flow of 2,450 acre-feet per year was discharged to the Este subarea. Small quantities of
wastewater are also produced from the Crestline area, Rancho Los Flores, San Bernardino County Service Districts, Barstow and Silver Lakes.

Wastewater in the Morongo Basin/Johnson Valley area is disposed of through septic tank systems. The downward percolation of septic tank effluent contributes to ground water basin replenishment.

**Surface Water Quality**

The Mojave River is primarily calcium carbonate in character and has generally less than 200 parts per million (ppm) total dissolved solids (TDS) at storm flow periods. Rising water at Victorville has a TDS concentration of about 300 ppm with a larger sodium percent than storm flow of the Mojave River. The rising water at Afton is a poor quality supply with a TDS concentration of 900 ppm and a sodium bicarbonate chloride character.

Data on surface water quality are not available for the Morongo Basin/Johnson Valley area largely because streams flow for only short periods after storms. This is not significant as surface runoff is not used directly. The quality of the runoff water is assumed to be similar to other surface flow from the San Bernardino Mountains, probably calcium-bicarbonate in character, and low to medium hardness and total dissolved solids.

**Tributary Runoff**

Tributary runoff can be divided into runoff which finds its way to the Mojave River channel, small channels in the Morongo Basin/Johnson Valley Area, and runoff which collects in one of the several so-called "dry lakes." Some portion of the former may be reflected at the previously described surface water measurement stations. However, a significant portion percolates in the river and stream channels before being measured.
The local drainage area which has the potential of contributing runoff to the Mojave River is extensive, estimated at over 1,900 square miles. There are no active gaging stations for any part of the local drainage area in either the Mojave River or Morongo Basin/Johnson Valley areas. Similarly, local runoff which collects in the dry lakes is not measured and is largely lost to evaporation. Dry lakes are located throughout the desert area of the Mojave River Basin, with one or more located in each of the subareas.

The principal dry lakes range in area from less than two square miles to more than ten square miles and are listed in Table 1 and located on Figure 7. The reported lake areas are considered to be indicators of the relative storage capacity of the lakes. There are no direct measurements of the amounts of tributary runoff. The amounts that reach the ground water basins from this source are estimated to be relatively small.

Typical storms in the Morongo Basin/Johnson Valley area create little runoff or significant flows in the local stream courses. Precipitation generally percolates into the ground, evaporates, or is used by native vegetation. Flows from large storms with intensity and duration capable of creating significant runoff, either recharge the ground water basins by percolation in the stream beds or flow to terminal lake beds where the accumulated water is evaporated. The average annual amount of water which flows out of the study area or is lost to evaporation from the lake beds is not known but is considered to be relatively small.

Several dry lakes, shown on Figure 7, overlie unconsolidated deposits. Although these areas have high ground water levels, they are not important water sources because they are fine-grained, yield water slowly to wells, and water is typically poor in quality.
### TABLE 1
PRINCIPAL DRY LAKES WITHIN THE MOJAVE WATER AGENCY

<table>
<thead>
<tr>
<th>Name</th>
<th>Subarea/ Hydrologic</th>
<th>Drainage Area</th>
<th>Dry Lake Area (Sq. Mi.)</th>
<th>Annual Rainfall (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mojave River Area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit Lake</td>
<td>Este</td>
<td>110</td>
<td>1.5</td>
<td>12</td>
</tr>
<tr>
<td>Lucerne Lake</td>
<td>Este</td>
<td>400</td>
<td>6.0</td>
<td>7</td>
</tr>
<tr>
<td>Harper Lake</td>
<td>Centro</td>
<td>730</td>
<td>11.0</td>
<td>5</td>
</tr>
<tr>
<td>Coyote Lake</td>
<td>Baja</td>
<td>210</td>
<td>9.0</td>
<td>7</td>
</tr>
<tr>
<td>Troy Lake</td>
<td>Baja</td>
<td>330</td>
<td>6.0</td>
<td>5</td>
</tr>
<tr>
<td>El Mirage(4)</td>
<td>Oeste</td>
<td>150</td>
<td>4.5</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1,930</td>
<td>38.0</td>
<td></td>
</tr>
<tr>
<td><strong>Morongo Basin/Johnson Valley(4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soggy Lake</td>
<td>Johnson</td>
<td>160</td>
<td>0.7</td>
<td>3</td>
</tr>
<tr>
<td>Melville Lake</td>
<td>Johnson</td>
<td>160</td>
<td>1.3</td>
<td>2</td>
</tr>
<tr>
<td>Means Lake</td>
<td>Means</td>
<td>50</td>
<td>0.3</td>
<td>2</td>
</tr>
<tr>
<td>Emerson Lake</td>
<td>Surprise Spring</td>
<td>320</td>
<td>3.4</td>
<td>2</td>
</tr>
<tr>
<td>Copper Lake</td>
<td>Copper Mountain</td>
<td>200</td>
<td>5.0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>890</td>
<td>10.7</td>
<td></td>
</tr>
</tbody>
</table>

(1) Based on area outlined on USGS 1:250,000 mapping for San Bernardino and Trona.
(2) Based on plate 1 from DWR Bulletin 84. Data included for comparison purposes only.
(3) Not in surface drainage area.

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**Ground Water Supplies**

Ground water is the source of water supply in the Mojave River and Morongo Basin/Johnson Valley areas. Water is pumped from a number of ground water basins, some of which are connected to each other and others that are essentially isolated.
Description of Ground Water Basins

The alluvial deposits in the ground water basins of the Mojave River and Morongo Basin/Johnson Valley area are the result of erosion of adjacent mountainous areas, and the transportation and deposition of the eroded materials. Previous geologic studies have defined several alluvium units as: channel deposits of relatively high permeability; younger and older alluvial fan and alluvium deposits with low to moderate permeability; and deposits of very low permeability. Geologic conditions vary considerably in the ground water basins with the highly permeable coarse river deposits being essentially confined to the Alto, Centro, and Baja subareas.

Aquifer transmissivities measure the ability of the aquifer to transmit water and to yield water to extraction wells. Transmissivity varies depending on the permeability of the alluvial material and the thickness of the aquifer. A thick strata of coarse sands and gravel would provide a high transmissivity (larger than 100,000 gpd per foot), while a thin strata of silty and clayey deposits would have a low transmissivity (less than 25,000 gpd per foot).

The portions of the Mojave River area with high transmissivities are concentrated in the Alto subarea and in a narrow band of between 0.5 and 4.0 miles along the Mojave River. The high transmissivities in the Alto subarea are reflective of a thick section of generally permeable sediments derived from the mountains to the south. The alluvial fan deposits that predominate in ground water aquifers away from the Mojave River have generally low transmissivities that range from 25,000 to less than 10,000 gpd per foot. The distribution of existing wells indicate that transmissivities lower than 25,000 gpd per foot greatly restrict the ability to economically pump ground water. These low transmissivity areas would also have limited potential for recharge activities, due to problems with mounding and difficulty in recovering recharged water.
Alluvial deposits in the upper portions of the Este (Lucerne) and Oeste (El Mirage) subareas are comprised of relatively coarse grained material with favorable recharge characteristics. However, the lower portions of both subareas have relatively low transmissivities in the deeper deposits which may limit their development as artificial recharge sites.

Several barriers to ground water flow have been identified in previous studies of ground water basins in the Mojave River area. These barriers fall into two classes—shallow subsurface bedrock and faults. Three locations where shallow subsurface bedrock affects ground water flow in the Mojave River ground water basins are the Upper Narrows and the Lower Narrows near Victorville, and at Afton. The shallow bedrock conditions at these sites constrict ground water movement, causing ground water to rise above ground (referred to as "rising water") and provide surface flow in the Mojave River channel. Relatively shallow clay layers restrict percolation and result in relatively shallow ground water in the vicinity of Camp Cady.

The ground water basins in the Morongo Basin/Johnson Valley area are water-bearing formations of unconsolidated sedimentary rock. Many of them are bounded or traversed by faults. Depths of the basins are generally unknown because of the lack of wells reaching bedrock. Test holes near the communities of Yucca Valley and Joshua Tree are over 750-feet deep without reaching bedrock (USGS, Lewis, 1972). Near Twentynine Palms, east of the Morongo Basin/Johnson Valley area, water-bearing deposits are believed to exceed 1,000 feet in thickness (USGS, Dibblee, 1968). In this area, an exploratory well hit granite at 2,106 feet (USGS, Smith, 1959).

The ground water basins in the Morongo Basin/Johnson Valley area have been defined in various configurations by different investigators. The references to the basins sometimes conflict but each study has evaluated the same water bearing geologic formations. Although there has been no single comprehensive presentation of the characteristics of the ground water basins, the available data is adequate for preparation of the Regional Water Management Plan.
The basin boundaries as presented by USGS (Lewis, 1972) and the Ames Valley Basin Water Agreement (1991) are shown on Figure 6 provided earlier in this report.

**Ground Water Storage**

Numerous faults cross ground water basins in MWA and affect ground water movement. These faults are shown on Figure 2. Four major northwest-southeast trending faults have been identified—Helendale, Lockhart, Waterman, and Calico-Newberry—that are all considered to be associated with the regional San Andreas and Garlock fault systems. The lateral movement associated with faults can cause low permeability by severing connected layers of coarse to medium grain deposits. Large gradients have been identified across some faults within MWA, indicating their effectiveness in affecting ground water movement.

Some Mojave River area ground water basins are effectively divided into subbasins by the low permeability zones at faults. Ground water in the Lucerne Valley of the Este subarea, for instance, is effectively divided into two subbasins by the Helendale Fault and ground water levels are considerably higher to the southwest of the Helendale Fault than to the northeast.

Information of the ground water basins defined by the DWR and related to subareas used in this report are shown on Table 2.
### TABLE 2
DATA ON MOJAVE RIVER AREA SUBAREAS AND GROUND WATER BASINS

<table>
<thead>
<tr>
<th>Subarea</th>
<th>Ground Water Basin⁽¹⁾</th>
<th>Area (sq. miles)</th>
<th>Well Yields Maximum</th>
<th>Well Yields Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alto</td>
<td>Upper Mojave River</td>
<td>600</td>
<td>3,600</td>
<td>630</td>
</tr>
<tr>
<td>Centro</td>
<td>Middle Mojave River</td>
<td>1,500</td>
<td>1,500</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>Harper Valley</td>
<td>510</td>
<td>3,000</td>
<td>725</td>
</tr>
<tr>
<td>Baja</td>
<td>Lower Mojave River</td>
<td>430</td>
<td>1,700</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>Coyote Lake Valley</td>
<td>150</td>
<td>1,740</td>
<td>660</td>
</tr>
<tr>
<td></td>
<td>Caves Basin</td>
<td>100</td>
<td>300</td>
<td>---</td>
</tr>
<tr>
<td>Este</td>
<td>Lucerne Valley</td>
<td>260</td>
<td>2,500</td>
<td>700</td>
</tr>
<tr>
<td>Oeste</td>
<td>El Mirage Valley</td>
<td>120</td>
<td>1,000</td>
<td>230</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3,670</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⁽¹⁾ From DWR Bulletin 118.

B-E estimated the total operational storage capacity of the Mojave River area ground water basins and broke it down into water currently in storage in the ground water basins and the amount of empty space available for storage. The operational storage capacity reflects estimates of the volume of good quality water available at economic pumping lifts. The 1930 water levels generally reflect the upper limit of water levels since any ground water in storage above the 1930 levels would be transitory as it would be subject to relatively rapid drainage into the Mojave River. With respect to the lower limit of usable storage capacity, a judgment was made by B-E that this would average 100 feet below the 1930 levels. This estimate is based largely on economics of pumping and that ground water conditions including well production rates, water quality, and storage availability are speculative below depths commonly penetrated by wells. The lateral limits of the ground water basin were determined by the area of pumping of low salinity water (generally less than 500 ppm) adjacent to the Mojave River. Table 3 shows the results of these analyses.
### TABLE 3
ESTIMATED OPERATIONAL GROUND WATER STORAGE CAPACITY AND WATER IN STORAGE
MOJAVE RIVER AREA GROUND WATER BASINS\(^{(a)}\)
(Acre-Feet)

<table>
<thead>
<tr>
<th>Subarea</th>
<th>Total Capacity</th>
<th>Water in Storage as of end of 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alto</td>
<td>2,086,000</td>
<td>1,126,000</td>
</tr>
<tr>
<td>Centro</td>
<td>740,000</td>
<td>340,000</td>
</tr>
<tr>
<td>Baja</td>
<td>1,544,000</td>
<td>371,000</td>
</tr>
<tr>
<td>Este</td>
<td>530,000</td>
<td>110,000</td>
</tr>
<tr>
<td>Total</td>
<td>4,900,000</td>
<td>1,947,000</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Data regarding the Este subarea were not included because of insufficient data regarding this subject.

Two ground water basins in the Morongo Basin/Johnson Valley area, Warren Valley and Copper Mountain Valley Basins, have experienced a long-term decrease of water in storage. In the Warren Valley Basin, a loss of approximately 30,000 acre-feet of water in storage has been estimated. In the Copper Mountain Basin, the loss of water in storage is within the Joshua Tree Subbasin, and may be in the range of 5,000 to 10,000 acre-feet.

### Safe Yield of Ground Water Basins

Use of safe yield or an alternative yield definition is an issue that affects the Plan. For the purposes of this report, the safe yield reflects the average annual amount that can be consumptively used without resulting in a long-term reduction in ground water storage. It was calculated by taking the difference between the estimate of total natural water supply and the sum of consumptive use by phreatophytes, ground water outflow, surface water outflow and export water values shown on Table 10 presented later in this section. The estimated safe yield of the Mojave River area is shown on Table 4 by subareas. Water supplies such as wastewater imported to the Este and Alto subareas are not
included in the estimates of safe yield over the long term. Under existing conditions, these inflows could constitute a significant portion of the total water supply.

### TABLE 4

<table>
<thead>
<tr>
<th>Subarea</th>
<th>Safe Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alto</td>
<td>27,500</td>
</tr>
<tr>
<td>Centro</td>
<td>20,000</td>
</tr>
<tr>
<td>Baja</td>
<td>6,100</td>
</tr>
<tr>
<td>Este</td>
<td>1,500</td>
</tr>
<tr>
<td>Oeste</td>
<td>700</td>
</tr>
<tr>
<td>Total</td>
<td>55,800</td>
</tr>
</tbody>
</table>

The estimated safe yield of the ground water basins in the Morongo Basin/Johnson Valley area is shown on Table 5.

### TABLE 5

<table>
<thead>
<tr>
<th>Basin</th>
<th>Safe Yield (^{(1)}) (Af/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means/Ames</td>
<td>660</td>
</tr>
<tr>
<td>Copper Mountain</td>
<td>550 (^{(2)})</td>
</tr>
<tr>
<td>Johnson Valley</td>
<td>2,300 (^{(3)})</td>
</tr>
<tr>
<td>Warren Valley</td>
<td>900 (^{(4)})</td>
</tr>
</tbody>
</table>

(1) Safe Yield is assumed to be equal to the estimated natural recharge. Subsurface inflow and outflow is unknown and is not included. Safe yield may be limited for domestic purposes due to poor water quality in some areas.


(3) Lewis, 1972; DWR, 1975.

(4) Adjudication pumping limitation.
Ground Water Quality

Ground water quality is generally suitable for most uses throughout MWA. Figure 8 shows locations where certain constituents have been measured as exceeding the Maximum Contaminant Levels (MCL) established by the State for domestic water supply and sites where hazardous materials may be present. Some of the best quality ground water is found in the Alto subarea which receives flows directly from the San Bernardino Mountains. Ground water total dissolved solids (TDS) concentrations are typically below 200 milligrams per liter (mg/l) in the part of the Alto subarea adjacent to the Mojave River near Hesperia. The average TDS for Hesperia municipal water wells is 176 mg/l. Localized poor quality water in the Alto subarea is located near Apple Valley which is believed to be related to the shallow depth of basement rock there. Besides salinity, a major trichloroethane (TCE) contamination site has been identified at George Air Force Base. Leaking underground fuel tank contamination sites are also located on George Air Force Base and at several gasoline stations and equipment yards in the Alto subarea. An extensive ground water remediation program is being implemented at the Base which is a Superfund site. Ground water in the vicinity of Oro Grande has iron and manganese levels in excess of MCL. Nitrate levels in excess of MCL established by health authorities are also found in several locations in the Alto subarea.

Two locations upstream from Hesperia are irrigated with wastewater effluent. The Lake Arrowhead Community Services District treatment plant provides irrigation to an alfalfa field located adjacent to the Mojave River. A pasture in Summit Valley is irrigated by outflow from the Crestline Sanitation District. Ground water underlying both these locations has a high nitrate concentration. While identification of the specific cause of the high levels of nitrate is beyond the scope of the Regional Water Management Plan, the Lahonton Regional Water Quality Control Board indicates that high nitrate levels could have been caused by wastewater effluent used for irrigation. Other potential sources could have been septic tanks or agricultural operations. It is also possible that the high nitrate concentrations could be naturally occurring. Corrective measures have
been implemented at these sites to control nitrate buildup. Two landfill sites in Victorville and Apple Valley have documented localized leaching of volatile organic components and salts to the ground water.

Ground water in the Oeste subarea is characterized as predominantly sodium/calcium bicarbonate in composition, which is typical of ground water in older alluvium situated away from the influence of recharge from the Mojave River. TDS concentrations in Oeste approach 1000 mg/l near El Mirage Lake. In the Centro subarea, ground water along the Mojave River area rises above 500 mg/l. The predominant ground water type in this area is calcium sulfate or sodium chloride. The Harper Lake Basin portion of the Centro subarea contains large areas of moderately good quality water that is above 500 mg/l, although TDS concentrations exceed 1,000 mg/l near the Harper Lake itself. Volatile organic components, nitrates, and salts have leached from the Lenwood landfill to the local ground water. In addition, an effluent irrigation from the City of Barstow wastewater reclamation facility near the boundary between the Centro and Baja subareas may also be affecting naturally occurring nitrate and salts in the underlying soils. Remediation efforts are being studied at this site to control the nitrate problems.

The ground water near the Waterman Fault contains high salinities with peaks of 1,100 to 1,200 mg/l. This area, downstream of the Barstow Narrows, contains higher concentrations of sulfate and TDS due to the presence of old salt deposits in subsurface soils. Downstream of Daggett, ground water TDS in the Baja subarea drops to around 300 mg/l. However, near the edge of the subarea, by Afton, the TDS rises above 500 mg/l. Several pockets of ground water with TDS concentrations greater than 1,000 mg/l are located in the lower portion of the valley and TDS concentrations are also generally above 1,000 mg/l in large areas surrounding three playa (or dry) lakes, Cudebeack, Superior, and Coyote. In addition, an area of high ground water TDS exists at the Coolwater Generating Plant near Daggett probably due to the evaporation from a pond operated by the plant.
Nine underground storage tank leakage sites have been identified in the Barstow area. The Santa Fe Railroad is conducting pollution characterization studies to investigate historical fuel leaks and industrial waste discharges at its maintenance center and classification yard in Barstow. Ground water contamination plumes of TCE have been identified near the Mojave River at the Marine Corps depots at Nebo and Yermo. Both of these depots were designated as Superfund sites in 1990 and extensive soil and ground water testing is being conducted to characterize the extent of contamination at the sites.

In the Este subarea, the Lucerne Valley has generally good quality water in the southern portion of the Valley with TDS typically below 500 mg/l. Ground water quality in the northern portion of the Valley is poorer, with TDS values as high as 4,000 mg/l in the vicinity of the Lucerne Lake playa.

The ground water quality of existing production wells throughout the Morongo Basin/Johnson Valley area is generally suitable for existing beneficial uses, mostly residential with some commercial, including golf course irrigation. There are localized areas where salinity or individual constituents exceed recommended limits. Fluoride exceeds the recommended 1.4 mg/l in some wells in Means/Ames Valley, Copper Mountain, Warren Valley and Johnson Valley Basins. TDS exceed 500 mg/l and 250 mg/l for chloride and sulfate in some wells in Johnson Valley, Means/Ames Valley and Copper Mountain Valley Basins.

There has not been a trend of declining water quality apparent from available data. However, water quality should be monitored to identify any declines in the future if they should occur.

A large number of improperly abandoned wells within MWA were identified through the ground water production verification program conducted for the adjudication. These wells are potential entry points for contaminates to be introduced to the ground water system. Water quality protection programs undertaken by MWA as part of the Plan would address proper well construction
and abandonment procedures as well as land uses adjacent to well sites and potential recharge areas.

State Water Project

MWA entered into a contract with the DWR in 1963 for an imported water supply with a "maximum annual entitlement" building up to 50,800 acre-feet per year in 1990 from the SWP to be used for municipal and industrial purposes. Water entitlements from the SWP of 5,400 acre-feet were available to MWA commencing in 1972 with incremental increases of 2,300 acre-feet per year. As indicated in Section 2, about 10,000 acre-feet of its entitlement supplies have been ordered by MWA for delivery to the channel of the Mojave River for ground water recharge in the 1991-1992 period. It is noted that MWA ordered more SWP water for 1991 and 1992 than was delivered but the drought caused deliveries to be reduced from the amounts requested.

Improvement District "M" (IDM) located within the Morongo Basin/Johnson Valley area was formed within MWA Division 2 to establish a funding mechanism to construct facilities and purchase SWP water. Up to 7,257 acre-feet per year of the MWA SWP entitlement supplies are allocated to the participants in IDM.

The dependable annual supply of the SWP was estimated to be 4,230,000 acre-feet per year when DWR signed its first contract in the early 1960s. This amount is defined as the "minimum project yield" and is the amount the DWR contracted for with 30 SWP contractors.

The water shortage provision in the state contract provides that in the event of a shortage "due to drought or other temporary cause" agricultural contractors shall take shortages of up to 50 percent in any one year and 100 percent in any seven consecutive years before deliveries are reduced to all contractors. Agricultural contractors took a 50 percent cut in deliveries in both 1990 and 1991. This means that through the year 1996, municipal contractors will not have a priority over agricultural contractors in the event of shortages.
The SWP is beset by many difficulties in meeting its contractual water deliveries. Other than completion of the installation of all units in the Delta Pumping Plant in 1972, no units that increase the Project's water supply have been constructed. Until recently, it was estimated the "Project conservation facilities" (projects that result in a water supply for the SWP) are sufficient to supply a firm yield of 2.4 million acre-feet per year during a dry period, or slightly more than one-half of the minimum project yield originally estimated. However, the current firm yield will be further reduced as a result of pumping restrictions in the Delta to protect threatened and endangered species.

The November 17, 1992 Draft Water Rights Decision No. 1630 would have required the SWP to shift a portion of its pumping in the Delta from late winter and spring to late fall and early winter. The amount lost to the SWP could vary from year to year depending upon the water supply of each year. The average reduction in water supply to the SWP would be about 230,000 af/yr, primarily in the spring months. This is about 10 percent of the current dependable annual supply of the project. It is estimated that in dry years, the SWP would lose approximately 350,000 af/yr. The draft decision would establish a mitigation fund with a charge of $10 per acre-foot for SWP water users. It would also have required urban water users to implement the provisions of the September 1991 Memorandum of Understanding Regarding Urban Water Conservation.

Early in 1993, Governor Wilson rescinded the Draft Decision citing the problems created by the Federal Endangered Species Act. Spokespersons for the U.S. Environmental Protection Agency (EPA) have been quoted as stating that due to the action by the Governor, the EPA would have to set standards to protect the Delta.

In the past two decades the SWP has experienced additional severe dry periods. The 1976-1977 period was drier than any previous two-year period and the six-year 1987-1992 period was a severe dry period. Under the SWP criteria, firm yield is defined as the average annual amount of water the project is capable of delivering, including agricultural deficiencies, to contractors during a repeat of the 1928-1934 seven-year dry period.
DWR has several projects in various states of planning. DWR Bulletin 160 published in 1987 discusses several projects that the DWR anticipated would be completed by 2010. The projects include South Delta Facilities, North Delta Facilities, Kern Water Bank and Los Banos Grande Facilities.

South Delta improvements involve widening and deepening channels and other facilities. This will allow the SWP Delta pumping plant to be operated at full capacity of more than 10,000 cfs without adverse impacts such as scouring in the channels.

Full North Delta Facilities would allow water released from Oroville and Shasta to flow to the eastern part of the Delta, thus improving circulation and reduce, perhaps to zero, carriage water requirements. Carriage water is the amount of additional water that must be released under certain flow conditions in the Delta so that good quality water can be pumped at the SWP and Central Valley Project Delta pumping plants. North Delta Facilities could be staged. DWR assumes for planning purposes that the South Delta and part of the North Delta Facilities will be operational sometime between 1995 and 2000.

The Kern Water Bank is located in the south San Joaquin Valley near Bakersfield and essentially consists of storing water in the ground water basin during surplus years and subsequent withdrawal from the basin during dry years. It is composed of a number of elements. Some of the elements would store water by direct spreading and some by delivery of surface water to farmers who otherwise would have pumped ground water (in-lieu banking). The Kern Water Bank is to be implemented in stages.

Los Banos Grandes Reservoir, a proposed off-stream reservoir, would be located immediately south of San Luis Reservoir in the San Joaquin Valley. The planned capacity of this reservoir is 1.75 million acre-feet.

If these projects were constructed and operated as planned, DWR estimated in DWR Bulletin 160 that the SWP project yield would be increased by 1.2 million acre-feet a year. However, in 1992 the State Water Contractors Association, an organization that represents practically all of the SWP contractors, requested the DWR to stop spending
money on planning the above proposed projects since threatened and endangered species pumping restrictions from the Delta would reduce the yield of these projects, making them infeasible.

Studies of water supply of the SWP under the current Decision 1485 of the SWRCB indicate that MWA could expect to receive approximately 43,000 acre-feet per year. Our best estimate at this point in time is that for planning purposes MWA should expect no more than an average of 40,000 acre-feet a year of entitlement water from the SWP from its maximum annual entitlement of 50,800 acre-feet per year.

WATER UTILIZATION

Historically, the major water use in the Mojave River area has been agriculture. Urban water use, including use for recreational lakes, has been increasing in recent years and is expected to exceed agricultural use within the next 15 years. The Morongo Basin/Johnson Valley area has no agricultural development. Urban development in the Morongo Basin/Johnson Valley area is projected to increase significantly during the planning period.

Water for agricultural and urban demands is provided by extracting ground water from the underlying aquifers. Water production figures can be measured or estimated from well records. Water not consumptively used by evaporation or plant transpiration essentially returns to the aquifers where it is available for future use. Estimates of consumptive uses for irrigated areas, lake evaporation, and urban usage were utilized to determine net water demand in the Mojave River area. Net water demands in the Morongo Basin/Johnson Valley area were based on water deliveries and an estimated consumptive use factor.
Agricultural Use

Irrigated acreage in the Mojave River area was determined from aerial photography taken in 1989 and 1991. Unit consumptive use values are based on estimates reported by the U.S. Department of Agriculture District Conservationist in a previous investigation. A unit consumptive use value for alfalfa (a major crop) of 3.8 acre-feet per acre was used for the Alto, Este and Oeste subareas. Values of 4.6 and 5.0 acre-feet per acre were used for the Centro and Baja subareas respectively.

Agricultural use increased from 19,500 acre-feet in 1930 to about 78,000 acre-feet in 1990. It is projected that the declining water levels, need for a supplemental supply, and the high cost of imported water combined with other factors will lead to a reduction in agricultural use in the future. Table 6 shows the estimated agricultural consumptive use for 1990 and projected consumptive use through 2015. The projected agricultural consumptive use is based on a reduction of 20 percent between 1990 and the year 2000 and stabilization thereafter.

<table>
<thead>
<tr>
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<td>10,400</td>
<td>10,400</td>
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<td>62,600</td>
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</table>
Population

Estimated population in the Mojave River area of the MWA grew slowly from 6,000 in 1930 to 112,000 in 1980. Rapid growth commenced around 1981 and is expected to continue in the future. Estimates of future population were projected by URS for B-E using growth rates developed through consultation with Southern California Association of Governments (SCAG). SCAG was consulted in order to determine growth rates by five-year increments that were consistent with SCAG's Growth Management Plan. The data are presented in Table 7. Figure 9 shows the historical population of the Mojave Water Agency from 1930 through 1990 and projected population through 2015 for three levels of population growth. Population is projected to increase from 234,000 in 1990 to 461,000 in 2015 based on the medium projection.

Population in the Morongo Basin/Johnson Valley area has grown from about 3,000 in the 1950s to nearly 40,000 in 1991. Estimates of future population were developed from SCAG projections. The population is expected to increase to approximately 83,000 in 2015.

Urban Use

Urban consumptive use values for several communities with sewer connections to VVWRA were calculated as the difference between water deliveries to several areas and wastewater discharges. Unit urban consumptive use in gallons per capita per day (gpcd) was then computed as the ratio of urban consumptive use to population estimates. The resulting urban unit consumptive use values for the different communities ranged between 122 gpcd and 164 gpcd with a weighted average of 141 gpcd. It was also found that total urban consumptive use was about 54 percent of water delivered. For the purposes of the Plan, a unit urban consumptive use of 140 gpcd and a consumptive use to water delivery ratio of 50 percent were both adopted. These figures generally agree with previous investigations.
### TABLE 7
MWA POPULATION PROJECTION BY SUBAREA (1990–2015)

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<tr>
<th>Subarea</th>
<th>Projection</th>
<th>Year</th>
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<th>% Growth</th>
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</tr>
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<td>--</td>
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<td>6,700</td>
<td>7,600</td>
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<td>13,300</td>
<td>15,400</td>
<td>17,900</td>
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<td>Warren Valley Basin</td>
<td>--</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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Based on water deliveries, per capita water use in the Morongo Basin/Johnson Valley area is about 130 gpcd. It is estimated that one-half of the delivered water is consumptively used.

Current and projected urban consumptive use of water estimates for the entire MWA area are given in Table 8.

Other Uses

Other uses or demands on the supplies include phreatophytes, and outflow from the Mojave River area.

Phreatophyte use in the Mojave River channel generally increases with higher ground water levels and decreases with lower ground water levels. Based on aerial photographs and unit water use values of 3.9 acre-feet per acre, the average annual water use for the long term 1931-1990 period was estimated to be 22,100 acre-feet for the Mojave River area. During the 1986-1990 drought period, average annual phreatophyte use was estimated to be 7,500 acre-feet per year.

Outflow from the Mojave River area measured at Afton was determined to be about 8,400 acre-feet per year for the 1931-90 period and 600 acre-feet per year for the 1986-90 period.

Total Uses

The total current and projected consumptive uses and outflow of water for MWA are shown on Table 9. The projections are based on a 20 percent decrease in agricultural consumptive use by the year 2000.
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<td>4,800</td>
<td>5,000</td>
<td>5,300</td>
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<td>7,800</td>
<td>8,800</td>
<td>9,700</td>
<td>10,700</td>
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<tr>
<td>Este</td>
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<td>1,200</td>
<td>1,400</td>
<td>1,500</td>
<td>1,700</td>
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<td>1,300</td>
<td>1,500</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<td>--(^{(4)})</td>
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<td>940</td>
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<td>1,250</td>
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<td>65,510</td>
<td>73,320</td>
<td>80,240</td>
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</tr>
</tbody>
</table>

\(^{(1)}\) Consumptive use includes 2,600 acre-feet for golf courses and 5,600 acre-feet for lakes through the planning period.

\(^{(2)}\) The figures presented in the 1990 column actually represent quantities for 1991.

\(^{(3)}\) Population in the Johnson Valley Basin has not been quantified and is considered negligible. During 1991 no ground water production was reported in the Johnson Valley Basin although a certain amount is known to exist.

\(^{(4)}\) In 1991, a supply of 800 acre-feet was exported from the Warren Valley Basin to the Means/Ames Valley Basin (based on an agreement between HDWD and BDVWA). The entire amount (800 acre-feet) is included as consumptive use in the Warren Valley Basin, since no return flows from this exported water would occur in the Warren Valley Basin. The total consumptive use for the Means/Ames Valley Basin is reduced by approximately 400 acre-feet (assuming 50% consumptive use), to account for return flows in the Means/Ames Valley Basin from the imported water. For 1991, this makes the net effective consumptive use in the Means/Ames Valley Basin approximately zero.

\(^{(5)}\) In 1995, an emergency drought supply of 500 acre-feet is included in the consumptive uses of the Warren Valley Basin and the Means/Ames Valley Basin (based on the temporary 5-year agreement between HDWD and BDVWA). The entire amount (500 acre-feet) is included as consumptive use in the Means/Ames Valley Basin (the source of the emergency water), and the consumptive use of the Warren Valley Basin is reduced by 250 acre-feet to account for return flows into the basin from the emergency supply (assuming 50% consumptive use).
TABLE 9
CURRENT AND PROJECTED TOTAL CONSUMPTIVE USE
AND OUTFLOW OF WATER
WITHIN MOJAVE WATER AGENCY
(Acre-feet)

<table>
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<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural</td>
<td>78,300</td>
<td>70,500</td>
<td>62,600</td>
<td>62,600</td>
<td>62,600</td>
<td>62,600</td>
</tr>
<tr>
<td>Urban</td>
<td>45,500</td>
<td>53,800</td>
<td>61,700</td>
<td>68,900</td>
<td>75,100</td>
<td>82,000</td>
</tr>
<tr>
<td>Phreatophyte(1)</td>
<td>7,500</td>
<td>7,500</td>
<td>7,500</td>
<td>7,500</td>
<td>7,500</td>
<td>7,500</td>
</tr>
<tr>
<td>Surface water outflow(2)</td>
<td>8,400</td>
<td>8,400</td>
<td>8,400</td>
<td>8,400</td>
<td>8,400</td>
<td>8,400</td>
</tr>
<tr>
<td>Subtotal</td>
<td>139,700</td>
<td>140,200</td>
<td>140,200</td>
<td>147,400</td>
<td>153,600</td>
<td>160,500</td>
</tr>
<tr>
<td>Morongo Basin/Johnson Valley Area(3)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Agricultural</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Urban</td>
<td>2,940</td>
<td>3,270</td>
<td>3,810</td>
<td>4,420</td>
<td>5,140</td>
<td>5,980</td>
</tr>
<tr>
<td>Phreatophyte</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Outflow of water</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal</td>
<td>2,940</td>
<td>3,270</td>
<td>3,810</td>
<td>4,420</td>
<td>5,140</td>
<td>5,980</td>
</tr>
<tr>
<td>Total</td>
<td>142,640</td>
<td>143,470</td>
<td>144,010</td>
<td>151,820</td>
<td>158,740</td>
<td>166,480</td>
</tr>
</tbody>
</table>

(1) Consumptive use of 7,500 acre-feet annually assumes phreatophyte areas remain the same size.
(2) Surface water outflow is a historical average during the 1931-1990 period.
(3) The figures presented in the 1990 column actually represent quantities for 1991.

OVERDRAFT IN WATER SUPPLIES

Review of existing records indicate that water demands commenced exceeding local supplies around the 1950s for the Mojave River area. The overdraft has been increasing at an accelerating rate in recent years and is projected to increase in the future. Table 10 shows the total estimated current average annual overdraft for the Mojave River area and its subareas. The estimate was based on using the present (1990) agricultural and urban use and the long term average 1931-1990 water supply and other uses. It shows that the current average annual overdraft is 68,000 acre-feet per year.
**TABLE 10**

HYDROLOGIC INVENTORY
FOR SUBAREAS OF THE MOJAVE RIVER AREA *(1)*
(HISTORICAL SUPPLY AND PRESENT USE)
(QUANTITIES ROUNDED TO THE NEAREST 100 ACRE-FEET)

<table>
<thead>
<tr>
<th>STUDY SUBAREA</th>
<th>Alto</th>
<th>Centro</th>
<th>Baja</th>
<th>Este</th>
<th>Oeste <em>(2)</em></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEMENTS OF HYDROLOGIC INVENTORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEMENTS OF HISTORICAL SUPPLY (1931-1990):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURFACE WATER INFLOW <em>(3)</em></td>
<td>65,000</td>
<td>34,900</td>
<td>14,000</td>
<td>1,700</td>
<td>1,500</td>
<td>117,100</td>
</tr>
<tr>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Import</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Wastewater</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>DEEP PERCOLATION OF PRECIPITATION <em>(4)</em></td>
<td>3,500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,500</td>
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<tr>
<td>GROUND WATER INFLOW <em>(5)</em></td>
<td>1,000</td>
<td>2,000</td>
<td>2,000</td>
<td>0</td>
<td>0</td>
<td>5,000</td>
</tr>
<tr>
<td>TOTAL SUPPLY</td>
<td>69,500</td>
<td>36,900</td>
<td>16,000</td>
<td>1,700</td>
<td>1,500</td>
<td>125,600</td>
</tr>
<tr>
<td>ELEMENTS OF PRESENT USE (1990):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSUMPTIVE USE OF PUMPAGE</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>AGRICULTURE <em>(6)</em></td>
<td>13,000</td>
<td>22,800</td>
<td>30,700</td>
<td>8,400</td>
<td>3,400</td>
<td>78,300</td>
</tr>
<tr>
<td>URBAN</td>
<td>34,400</td>
<td>5,500</td>
<td>3,900</td>
<td>800</td>
<td>900</td>
<td>45,500</td>
</tr>
<tr>
<td>SUBTOTAL</td>
<td>47,400</td>
<td>28,300</td>
<td>34,600</td>
<td>9,200</td>
<td>4,300</td>
<td>123,800</td>
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<td>OTHER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSUMPTIVE USE OF PHREATOPHYTES <em>(6)</em></td>
<td>5,100</td>
<td>900</td>
<td>1,500</td>
<td>0</td>
<td>0</td>
<td>7,500</td>
</tr>
<tr>
<td>GROUND WATER OUTFLOW <em>(5)</em></td>
<td>2,000</td>
<td>2,000</td>
<td>0</td>
<td>200</td>
<td>800</td>
<td>5,000</td>
</tr>
<tr>
<td>SURFACE WATER OUTFLOW <em>(5)</em></td>
<td>34,900</td>
<td>14,000</td>
<td>8,400</td>
<td>0</td>
<td>0</td>
<td>57,300</td>
</tr>
<tr>
<td>EXPORT</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SUBTOTAL</td>
<td>42,000</td>
<td>16,900</td>
<td>9,900</td>
<td>200</td>
<td>800</td>
<td>69,800</td>
</tr>
<tr>
<td>TOTAL USE</td>
<td>89,400</td>
<td>45,200</td>
<td>44,500</td>
<td>9,400</td>
<td>5,100</td>
<td>193,600</td>
</tr>
<tr>
<td>DEFICIENCY BY SUBAREA</td>
<td>19,900</td>
<td>8,300</td>
<td>28,500</td>
<td>7,700</td>
<td>3,600</td>
<td>68,000</td>
</tr>
<tr>
<td>TOTAL AVERAGE ANNUAL OVERDRAFT</td>
<td>68,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

(1) The portion of the Mojave River Basin lying within boundaries of the Mojave Water Agency.
(2) Located within the Mojave Water Agency boundary, but outside the Mojave River surface drainage area.
(3) The estimated average annual water supply totals 71,700 acre-feet; the sum of surface water inflow to Alto, Este and Oeste subareas plus deep percolation of precipitation into the Alto subarea.
(4) Developed in DWR Bulletin 84 as an average annual quantity for a 25-year base period.
(5) Based on similar estimates developed in DWR Bulletin 84.
(6) Based on aerial photographs (1989) and regional consumptive use estimates.
(7) Based on historical stream gage data and estimates by James C. Hanson and William Hardt.
Currently, ground water is the sole source of supply to the Morongo Basin/Johnson Valley area. Overdraft conditions exist in the Warren Valley Basin and the Joshua Tree Subbasin. However, completion of the Morongo Basin Pipeline and delivery of imported water from the SWP, combined with management of the local ground water supplies, should meet the water needs of the study area through 2015.

Table 11 shows the current (1990) and projected annual future overdraft in the Mojave River and Morongo Basin/Johnson Valley areas if no actions are taken to obtain additional water supplies and reduce existing demands.

If no actions are taken to increase supplies and reduce demands, the overdraft in the Mojave River area increases from 1990 to 2015 to an annual deficiency of 88,000 acre-feet per year. The cumulative deficiency in the Mojave River area would be nearly two million acre-feet.

Presented in Figure 10 is the relationship between MWA SWP entitlement supplies, estimated average annual entitlement deliveries, and projected overdraft conditions.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td><strong>Water Supply</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alto</td>
<td>69,500</td>
<td>69,500</td>
<td>69,500</td>
<td>69,500</td>
<td>69,500</td>
<td>69,500</td>
</tr>
<tr>
<td>Centro</td>
<td>36,900</td>
<td>36,900</td>
<td>36,900</td>
<td>36,900</td>
<td>36,900</td>
<td>36,900</td>
</tr>
<tr>
<td>Baja</td>
<td>16,000</td>
<td>16,000</td>
<td>16,000</td>
<td>16,000</td>
<td>16,000</td>
<td>16,000</td>
</tr>
<tr>
<td>Este</td>
<td>1,700</td>
<td>1,700</td>
<td>1,700</td>
<td>1,700</td>
<td>1,700</td>
<td>1,700</td>
</tr>
<tr>
<td>Oeste</td>
<td>1,500</td>
<td>1,500</td>
<td>1,500</td>
<td>1,500</td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td>Morongo Basin/Johnson Valley(1)(2)</td>
<td>1,400 (3)</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>**Total</td>
<td>127,000</td>
<td>127,600</td>
<td>127,600</td>
<td>127,600</td>
<td>127,600</td>
<td>127,600</td>
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<tr>
<td><strong>Water Use</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alto</td>
<td>89,400</td>
<td>94,500</td>
<td>99,300</td>
<td>104,800</td>
<td>109,600</td>
<td>114,900</td>
</tr>
<tr>
<td>Centro</td>
<td>45,200</td>
<td>44,100</td>
<td>42,900</td>
<td>43,900</td>
<td>44,800</td>
<td>45,800</td>
</tr>
<tr>
<td>Baja</td>
<td>44,500</td>
<td>41,700</td>
<td>39,000</td>
<td>39,300</td>
<td>39,500</td>
<td>39,800</td>
</tr>
<tr>
<td>Este</td>
<td>9,400</td>
<td>8,800</td>
<td>8,100</td>
<td>8,300</td>
<td>8,400</td>
<td>8,600</td>
</tr>
<tr>
<td>Oeste</td>
<td>5,100</td>
<td>5,000</td>
<td>4,800</td>
<td>5,000</td>
<td>5,200</td>
<td>5,300</td>
</tr>
<tr>
<td>Morongo Basin/Johnson Valley(1)</td>
<td>2,940</td>
<td>3,270</td>
<td>3,810</td>
<td>4,420</td>
<td>5,140</td>
<td>5,980</td>
</tr>
<tr>
<td>**Total</td>
<td>196,540</td>
<td>197,370</td>
<td>197,910</td>
<td>205,720</td>
<td>212,640</td>
<td>220,380</td>
</tr>
<tr>
<td><strong>Overdraft</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alto</td>
<td>19,900</td>
<td>25,000</td>
<td>29,800</td>
<td>35,300</td>
<td>40,100</td>
<td>45,400</td>
</tr>
<tr>
<td>Centro</td>
<td>8,300</td>
<td>7,200</td>
<td>6,000</td>
<td>7,000</td>
<td>7,900</td>
<td>8,900</td>
</tr>
<tr>
<td>Baja</td>
<td>28,500</td>
<td>25,700</td>
<td>23,000</td>
<td>23,300</td>
<td>23,500</td>
<td>23,800</td>
</tr>
<tr>
<td>Este</td>
<td>7,700</td>
<td>7,100</td>
<td>6,400</td>
<td>6,600</td>
<td>6,700</td>
<td>6,900</td>
</tr>
<tr>
<td>Oeste</td>
<td>3,600</td>
<td>3,500</td>
<td>3,300</td>
<td>3,500</td>
<td>3,700</td>
<td>3,800</td>
</tr>
<tr>
<td>Morongo Basin/Johnson Valley(1)</td>
<td>1,540</td>
<td>1,270</td>
<td>1,810</td>
<td>2,420</td>
<td>3,140</td>
<td>3,980</td>
</tr>
<tr>
<td>**Total</td>
<td>69,540</td>
<td>69,770</td>
<td>70,310</td>
<td>78,120</td>
<td>85,040</td>
<td>92,780</td>
</tr>
</tbody>
</table>

(1) The projections presented here include transfers of water between Means/Ames Valley and Warren Valley. The figures presented in the 1990 column actually represent quantities for 1991.
(2) Production in Copper Mountain Valley Basin currently consists of extractions from the Joshua Tree Subbasin which has an estimated safe yield of 500 acre-feet per year. The overdraft figures estimated herein assume that all production is from the Joshua Tree Subbasin. This overdraft may be reduced by development of production in other parts of the basin.
(3) Does not include quantities from Means/Ames Valley.
MOJAVE WATER AGENCY
REGIONAL WATER MANAGEMENT PLAN

ESTIMATED WATER NEEDS FOR OVERDRAFT CORRECTION

BOOKMAN-EDMONSTON ENGINEERING, INC.

JUNE 1993
SECTION IV
ADJUDICATION OF WATER RIGHTS

The Warren Valley ground water basin in the Morongo Basin/Johnson Valley area was adjudicated in 1977. There are no other adjudicated basins in MWA.

There has been extensive activity in the past few years concerning adjudication of the Mojave River Basin. On May 30, 1990 the City of Barstow filed a complaint for adjudication of water rights upstream from the City of Barstow. On July 26, 1991 MWA filed a cross-complaint extending the adjudication to cover essentially all of the water users in the Mojave River area. After extensive discussions among the parties it was generally agreed by the parties that a physical solution was needed that would involve equitable allocation of rights to local water supplies and an equitable sharing of costs for imported supplemental supplies. A drafting committee representing various parties agreed to a proposed stipulated judgment in May 1993. On April 27, 1993 Judge Kaiser, Superior Court in Riverside County, issued an order which stated that the parties must either sign the proposed stipulated judgment by July 1, 1993 or file an answer to the complaint. He also determined that a mandatory settlement conference would be held on July 16, 1993 with a hearing date of August 20, 1993 on a motion for entry of order of interlocutory judgment.

The proposed judgment is summarized as follows:

SUMMARY OF PROPOSED MOJAVE RIVER STIPULATED JUDGMENT

Introduction

The purpose of the judgment is to (1) create incentives to conserve local water, (2) guarantee that downstream producers will not be adversely affected by upstream production, and (3) assess producers to obtain funds to purchase imported water. The judgment does not place any pumping restrictions on the producers. Instead it relies
upon the conservation of local water, purchase of imported water and transfers among producers to, in time, eliminate the ground water overdraft.

The parties to the judgment include virtually all pumpers in the Mojave River Basin that produce over 10 acre-feet per year. MWA has agreed to implement a program to identify producers of 10 acre-feet per year or less (minimal producers) and to attempt to amend its Act to facilitate collection of assessments from minimal producers. MWA is to provide to the Watermaster an annual written report concerning actions required by the terms of the judgment including (1) actions taken in identifying and assessing minimal producers, (2) summary of collection of assessments, (3) report of water purchases and distribution, and (4) actions taken to implement its Regional Water Management Plan including actions relating to conveyance facilities.

Definitions:

There are a number of terms used in the proposed adjudication, several of which are summarized as follows (the full definition of these terms and other terms is contained in the proposed judgment):

**Base Annual Production** is the maximum annual production for each Producer during the 1986-90 period.

**Base Annual Production Right** is the relative right of each Producer to a share of the Free Production Allowance assigned to the Producer's subarea expressed as a percentage of the aggregate Base Annual Production of all Producers in the subarea.

**Carry Over Right** is the right of a Producer to delay production of a portion of the Producer's share to the Free Production Allowance until the following year free of any Replacement Water assessment.

**Free Production Allowance (FPA)** is the total amount of water that may be produced from a subarea each year free of any Replacement Water obligation.
**Makeup Water** is the amount of water needed to satisfy a minimum subarea obligation.

**Overdraft** is where the annual consumptive use of Mojave River area or its subareas exceeds the long-term average natural supply of the Mojave River area or its subareas.

**Producer** is a person who produces more than ten acre-feet of water per year.

**Replacement Water** is water purchased by the Watermaster (or otherwise provided) to replace water produced in excess of the annual rights established by the stipulated judgment.

**Supplemental Water** is water imported to the basin, captured local water that would have otherwise been lost to the basin, and FPA acquired by the Watermaster.

**Watermaster** is the person or persons appointed by the Court to administer provisions of the judgment.

**Water Rights and Obligations**

MWA, separate from its duties as Watermaster, is to exercise its authority to construct conveyance or other facilities to deliver Supplemental Water to all of the subareas at fair and equitable prices. The Agency is to prepare a report by February 1, 1995 on potential alternative facilities or methods to deliver Supplemental Water. The financing, cost allocation and time schedule for the conveyance facilities developed by MWA shall be submitted to the Court. The recommendations by MWA may be accepted or rejected by the Court which may also order additional studies. Financing of any conveyance facilities shall be based upon benefits to the parties in accordance with the MWA Act.

The adjudicated area is divided into five subareas (Alto, Centro, Baja, Este and Oeste). The boundaries of these subareas for purposes of the adjudication are as shown on Figure 2. It is recognized that overdraft conditions have existed in each subarea for at least five years prior to the filing of the complaint. Based on the above, the proposed judgment assumes that the rights of all parties are of equal priority.
Producers in a subarea have rights to receive certain average annual water supplies and minimum annual water supplies from upstream subareas (if any). Producers in a subarea also have an obligation to provide certain average annual supplies and minimum annual water supplies to downstream subareas.

Each subarea may have to purchase Makeup Water needed to meet an obligation to a downstream subarea or for periodic reduction of any cumulative debt. All Producers are enjoined from producing water except as authorized by the judgment or from changing the purpose of the use without notifying the Watermaster. All parties are enjoined from transporting water out of the Mojave River Basin without an order from the Court. No party can recapture recharged water in the Basin without a storage agreement with the Watermaster. The Watermaster is authorized to bring an action to prevent any unauthorized production from or recharge to the Mojave River Basin. No party in a subarea can construct a project that would reduce the amount of storm flow that would otherwise go to another subarea. The Court will retain continuing jurisdiction, power and authority, and may issue further orders and directions. Failure to produce all of the water that a party is entitled to will not constitute abandonment of a right. Abandonment requires a written election by the party and a hearing followed by a court order.

The Mojave River is not a navigable stream nor does use of its waters in any way impact upon navigable waters. Arguably, the public trust doctrine might not apply to any interest in the Mojave River Basin Area. In an abundance of caution, and as part of the general scheme of the Physical Solution to eventually restore the Basin Area ground water aquifers and to maintain the Mojave River stream flows at their long-term average levels, riparian habitat and protected/threatened/endangered species are protected and greatly benefitted. Ground water tables at areas identified by the California Department of Fish and Game (DFG) as areas where water levels conceivably affect the public trust interests at or near the Mojave River channel are to be restored to levels identified by Fish and Game officials or, in the alternative, the Watermaster will collect an assessment to mitigate the effect of lower ground water tables upon biological resources.
Physical Solution

The parties are ordered by the Court to comply with a physical solution. The purpose of the physical solution is to provide practical methods of making maximum reasonable beneficial use of all water available to the Mojave River area. The proposed judgment mandates MWA to construct conveyance facilities so that all subareas will benefit equitably from the physical solution. Recognition is given to the need for flexibility and the possibility of future changes to the physical solution.

To the extent that production by a Producer in any subarea exceeds the Producer’s share of the FPA, sufficient Replacement Water will be purchased by the Watermaster and the costs assessed to the Producer. If a subarea does not meet its obligation to the downstream subarea, the Watermaster shall purchase Supplemental Water and assess the cost to the Producers in the subarea. For the initial five (5) years after entry of the Judgment, the FPA for each subarea shall be set as the amount of water equal to the following percentages of the aggregate Base Annual Production for that subarea:

<table>
<thead>
<tr>
<th>Judgment Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Full Year*</td>
<td>100</td>
</tr>
<tr>
<td>Second Full Year</td>
<td>95</td>
</tr>
<tr>
<td>Third Full Year</td>
<td>90</td>
</tr>
<tr>
<td>Fourth Full Year</td>
<td>85</td>
</tr>
<tr>
<td>Fifth Full Year</td>
<td>80</td>
</tr>
</tbody>
</table>

* Year begins on October 1 and ends September 30 of the following year.

The proposed judgment initially allows significant unassessed production, and phases in the obligation to purchase Supplemental Water. The proposed judgment further recognizes that the proposed provisions may not be sufficient to eliminate the overdraft in each subarea and that any adverse impact such as ground water decline in a subarea shall be the responsibility of the producers in each subarea.

Any Base Annual Production Right, or any portion thereof may be sold, assigned, transferred or leased pursuant to rules and regulations established by the proposed judgment. No party can change its purpose of use without first notifying the
Watermaster of the impending change. Water produced in the Mojave River Basin cannot be transferred to parties outside of the Basin area. Every party is enjoined from producing water from the Mojave River Basin except pursuant to the provisions of the proposed judgment.

Powers and Duties of the Watermaster

The MWA is appointed by the Court as the initial Watermaster. The Court retains jurisdiction to remove the Watermaster and appoint another Watermaster. MWA is required to segregate its accounts and activities as Watermaster from its activities pursuant to its statutory powers except as to actions that result in cost savings.

The Watermaster’s duties are generally administrative and are defined in the proposed judgment. These duties include the following:

1. Establish rules and regulations for conduct of its affairs.

2. Employ experts as required.

3. Determine Makeup Water and Replacement Water requirements for each Producer and subarea.

4. Install, operate and maintain measuring devices and wells as required to obtain necessary hydrologic information.

5. Require parties to install measuring devices, only as deemed necessary, at their cost and inspect and test devices.

6. Levy and collect all assessments, invest unused funds, and borrow as necessary in advance of receipt of assessments.

7. Use assessment funds to purchase supplemental water for the basin for the purpose of implementing the Physical Solution.
8. Encourage enforcement of reasonable water quality regulations affecting
the Mojave River area.

9. Maintain a current list of party designees entitled to receive notices.

10. Annually prepare draft administrative budget, hold hearings, adopt
budget and subsequently file annual fiscal report with the Court and the
parties.

11. Annually prepare draft report to the Court on all pertinent activities,
hold hearings, and submit final report.

12. Prepare reports on water production, any transfer of Base Annual
Production Rights, and adjustments to those rights. In accounting for
use of water, the first water used in any year is the Carry Over Right.

13. Prior to the end of the first five-year period after the effective date of the
Judgment and annually, recommend adjustments if needed to the FPA
for any subarea. Court approval is needed if increases or decreases in
the FPA are recommended for any subarea. In no event should the
reduction in any year for a subarea exceed five percent of the aggregate
Base Annual Production for that subarea.

14. Enter into ground water storage agreements on its own behalf or on
behalf of other parties. No party can recapture recharged water except
pursuant to a storage agreement with the Watermaster.

15. Place funds in investments authorized for public agencies in California
and borrow in anticipation of the proceeds from assessments.

16. Bring an action to enjoin unauthorized production.
17. Levy a Biological Resource production assessment and establish a Biological Resource Trust Fund. DFG may use this fund for required Biological Resource Mitigation measures.

Advisory Committees

Each of the five subareas is authorized to form an advisory committee. Each committee shall consist of five producer representatives elected following a system that gives every party one vote for every acre-foot of Base Annual Production for that party in that particular subarea. The California Department of Fish and Game shall serve as a permanent ex-officio member of the Alto and Baja Committees. The purpose of the committees is to make recommendations on all discretionary determinations made by the Watermaster which may affect that subarea. The Watermaster is directed to meet on a regular basis (at least twice a year) with the committees to review Watermaster activities and receive advisory recommendations.

Analysis of Proposed Stipulated Judgment

MWA as a party to the Mojave River adjudication is obligated to comply with the provisions of the final judgment. The most significant provisions applying specifically to MWA provide that MWA:

1. is the initial Watermaster.

2. identify and assess all minimal producers (10 acre-feet per year or less of water production) to offset administrative costs and participate in purchase of Supplemental Water, and attempt to amend its Act to facilitate collection of assessments from minimal producers.

3. prepares an annual report to the Watermaster on its actions relative to the judgment.
4. submits a report to the Court by February 1, 1995 on conveyance facilities alternatives, costs and timetable for construction.

5. constructs conveyance facilities to deliver supplemental water to all subareas at fair and equitable prices.

The proposed judgment will, in time, provide a market for purchase of imported water from MWA and incentives for MWA to construct conveyance facilities for the imported water. Its provisions give all parties an incentive to reduce their production over time so as to minimize their purchase of imported water. The proposed judgment also provides the opportunity to increase the purchase of imported water when appropriate.

The following provisions tend to delay purchase of imported water by:

1. Establishing a high production Base Annual Production Right for each party (highest year of the 1986-90 period). This allows producers to take annual cuts in water production for some period of time and still meet their water demands.

2. Setting the first year at 100 percent of the above base. Given the schedule established in the Court’s order, 1993-94 would be the earliest first year if the proposed judgment is approved on August 20, 1993.

3. Allowing a transfer program that permits Base Annual Production Right to be sold, assigned, transferred or leased. This would most likely result in an active market for transfer of rights at a price below MWA’s sales price for imported water.

4. Encouraging purveyors to establish financial incentives for their water users to install low flow toilets, low flow showerheads, bubblers and other devices to reduce their water use. This would result in reducing the water production requirements of the Producers but would not result
MOJAVE WATER AGENCY
REGIONAL WATER MANAGEMENT PLAN
REPLACEMENT WATER REQUIREMENTS

BOOKMAN-EDMONSTON ENGINEERING, INC.
JUNE 1993
in any reduction in imported water requirements which must be met by
MWA.

The proposed judgment has the following provisions that tend to increase demand for
purchase of water by:

1. Reducing the Base Annual Production of each party by five percent each
year for five years and allowing a continuing reduction of up to five
percent a year with the approval by the Court.

2. Requiring the purchase of Makeup Water to meet specific downstream
water releases.

Projections of Replacement Water requirements as well as projections of water
requirements for overdraft correction are presented in Figure 11. Also shown in
Figure 11 is the imported water supply required in addition to SWP imported supply
for overdraft correction.

The estimates of Replacement Water requirements shown on Figure 11 are based upon
the projections of use shown in this report and a maximum annual five percent per year
reduction of the aggregate Base Annual Production Rights to eliminate overdraft. The
projected Replacement Water requirements do not include any projections of water
transfers, or projections of reductions in production as a result of reduced in-house uses.
SECTION V
POTENTIAL ADDITIONAL WATER SUPPLIES

As indicated in Table 11 of Section III, the estimated overdraft in 2015, is about 93,000 acre-feet in MWA. The overdraft can be eliminated through a combination of measures consisting of conservation, water allocation and water pricing, ordering SWP entitlement, and obtaining additional water supplies. Conservation, water allocation, and water pricing are discussed in Section VI. This section contains a discussion of additional water supplies which are categorized as follows:

1. Maximizing the use of local water supplies.
2. Maximizing the use of SWP supplies.
3. Water transfers.
5. Water banking.

Given the availability of large ground water basins with empty storage and the use of these basins to furnish practically all of the water supply for the area, the most effective way to use additional water supplies in the near term is to directly recharge the basin.

RECHARGE OF WATER SUPPLIES

All of the programs for water supplies will require utilization of the water storage capacity in the ground water basins located in MWA by constructing recharge facilities to receive the various water supplies.

Recharge Facilities

These facilities can range from simple channel modifications to increase the opportunity time for percolation to the construction of extensive recharge facilities into which water is diverted and allowed to infiltrate to the underlying ground water aquifers. The facilities should be located near the upstream ends of the Alto, Centro and Baja subareas in the Mojave River alluvial aquifers to take advantage of dewatered ground

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water storage capacity within each subarea and to reduce the potential for increasing amounts of rising water at the downstream ends of the subareas. Facilities in the Oeste, Este and Morongo Basin/Johnson Valley Basin would be located to recharge local aquifers with available storage capacity.

Modifications that could increase the absorption capacity of the channel include construction of small check dams or collapsible rubber dams to create cells in the channel to impound the flow; construction of noncontinuous dikes (baffles) that would have the effect of increasing the effective channel length between two points; and construction of unlined canals parallel to the river channel.

Recharge facilities could be constructed at various sites located outside the flood plain of the Mojave River or adjacent to selected dry lake beds that capture sufficient storm flows to warrant the construction of facilities for ground water recharge. Water would be diverted to the recharge basins by gravity or pumping. Recharge facilities are generally comprised of a series of ponds into which flow is controlled to maximize percolation and minimize evaporative losses. These facilities would probably be more capital intensive than river channel modifications but are not subject to failure by high flows in the river. Figure 12 shows the areas suitable for ground water recharge.

If the proposed judgment is finally approved by the Court as described in Section IV, facilities cannot be constructed in the Alto and Centro subareas that would reduce stream flow without concurrence of all of the parties to the adjudication.

Recharge Potential

Review of historical stream flow records show that the maximum amount of recharge in the Mojave River reaches was as follows:

- Between the Forks and the Lower Narrows: 153,000 acre-feet
- Between the Lower Narrows and Barstow: 159,000 acre-feet
- Between Barstow and Afton Canyon: 138,000 acre-feet
These estimates of percolation indicate the order of magnitude of the absorption capacity of the Mojave River channel in its natural condition. Even in years of relatively high precipitation and runoff, it is rare for the maximum absorption capacity of the Mojave River to be utilized for a long period of time.

MWA's maximum annual entitlement to SWP water from the California Aqueduct of 50,800 acre-feet is substantially less than the absorption capacity of the natural channel of the Mojave River. Even without recharge facilities or channel modifications to increase absorption, in most years the SWP release schedule could be coordinated with the recession of storm water flows such that there would be no increase in flow at Afton Canyon. Thus, percolation capacity of the channel would not be a constraint should MWA adopt a policy of ground water recharge for its entire SWP supply. The conclusion would probably be the same in years when water supplies in excess of the entitlement are available to MWA from the SWP or other sources.

The recharge potential in the Morongo Basin/Johnson Valley area, specifically in the Means/Ames Valley Basin and in the Joshua Tree Subbasin, is not a constraint on the implementation of a program to recharge the ground water basins in the area.

Conjunctive Use

In time, MWA could develop conjunctive use programs since the Mojave River area has the following characteristics that are necessary for a successful conjunctive use program.

1. The variable local supply and variable imported SWP supply.
2. Good ground water recharge areas.
3. Large ground water basins with available capacity for storage.
4. Locations of ground water basins in close proximity to the California Aqueduct (Aqueduct), the major water transportation facility for imported water.

Conjunctive use of surface water supplies, both local and imported, with ground water supplies would allow the delivery of SWP water from the Aqueduct whenever water is available from that source. These supplies would recharge the ground water basins
in wet years and would be extracted in years of deficient supplies. Extracted water could be moved to downstream ground water basins, after construction of a Mojave River Aqueduct, and managed so as to obtain the maximum beneficial use in an economic manner.

Opportunities may exist for obtaining additional imported water supplies through purchases, transfers and exchanges. These additional water supplies would be conveyed to MWA in the Aqueduct utilizing capacity not required by other SWP contractors and could be incorporated in a conjunctive use program developed by MWA.

Conjunctive use programs could also be incorporated in the Morongo Basin Area.

Local ground water basins, primarily the Warren Valley Basin, Joshua Tree Subbasin and the Means/Ames Valley Basin also could be operated conjunctively with SWP supplies. It is estimated that the Warren Valley Basin has approximately 30,000 acre-feet of dewatered ground water storage. In the Joshua Tree Basin dewatered ground water storage is on the order of 5,000 to 10,000 acre-feet.

A 1978 USGS study evaluated the potential for a recharge and banking program for SWP water in the Johnson Valley ground water basin. The study presented some preliminary conclusions regarding siting of recharge facilities and extraction wells. However, since the quality of ground water in the Johnson Valley is marginal for domestic purposes, implementation of a conjunctive use program in this area will not be considered during the planning period.

MAXIMIZING LOCAL WATER SUPPLY

Most of the flow of the Mojave River percolates to the alluvial deposits underlying the River channel and constitutes the principal source of recharge to the ground water basins. Storm water outflow through Afton Canyon may constitute an additional local supply if it could be recharged in upstream ground water basins. An investigation was made to determine if these additional flows could be conserved by constructing additional recharge facilities to increase percolation. The objective would be to reduce
the outflow at Afton to the minimum feasible flow. Key to the study was determination of available recharge capacity in the ground water basins adjacent to the river. Detailed analyses were made of daily flows at the four key gaging stations on the Mojave River for the 1971-1990 period. This period has an average annual flow that is approximately the same as the 1931-1990 period. The results are presented in Table 12.

<table>
<thead>
<tr>
<th>TABLE 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVERAGE ANNUAL ADDITIONAL RECHARGE POTENTIAL FOR LOCAL RUNOFF IN MOJAVE RIVER AREA GROUND WATER BASINS 1971-1990 (Acre-feet)</td>
</tr>
<tr>
<td>Alto</td>
</tr>
<tr>
<td>Centro</td>
</tr>
<tr>
<td>Baja</td>
</tr>
</tbody>
</table>

Mojave River flows are higher near the upstream end of each subarea and are higher in Alto than in Baja. This suggests that absorption capacity should be increased in the upstream end of each of the Mojave River Area subareas. The amount of potential additional recharge shown in Table 12 is not cumulative. For example, if an additional 15,000 acre-feet per year of local runoff was recharged in Alto, the potential additional recharge in the downstream subareas would be less than shown in Table 12. The location and size of the recharge facilities will depend on the management options included in the Plan but they would generally be located near the upstream or uphill portions of the various subareas to take advantage of higher percolation rates and availability of dewatered ground water storage.

Based on the analyses summarized in Table 12, it is estimated that over a long-term period, an average of an additional 1,000 acre-feet per year of local water could be added to the ground water basin over existing conditions by increasing the absorption capacity in any of the three Mojave River subareas. This is approximately equal to the recharge potential in the Baja subarea. This is also consistent with the principle
expressed in the proposed judgement that restricts any party from interfering with storm flows.

The Morongo Basin Area also presents some opportunity for increasing the recharge of local runoff.

Studies performed for the Warren Valley basin indicate that the safe yield could be increased by approximately four percent by increasing the natural recharge of storm flows with streambed modifications and detention basins. These modifications were proposed for five locations to capture an average of about 30 acre-feet annually.

Storm flow data are not available for the streams and washes in the Morongo Basin/Johnson Valley. Consequently, firm estimates of the potential increase in natural recharge or the effects on water supplies available to the area cannot be made. However, if it is assumed that a four percent increase in natural recharge could be accomplished by streambed modifications throughout the area, there would be an overall increase in local water supplies available to the Copper Mountain, Means/Ames Valley and Warren Basins of approximately 80 acre-feet per year. The cost would not be justified unless combined with ground water recharge facilities for the SWP supplies.

In addition to the surface water supplies, there is accumulation from time to time of water in the dry lakes located in the Mojave River Area. There are several dry lake beds or playas within the Centro, Baja, Este and Oeste subareas. Storm water that accumulates in these lake beds after heavy rain storms that occasionally occur over the area evaporates and does not contribute significantly to recharge of the underlying aquifers because of poor percolation within the lake bed area. Construction of an intake structure and a small canal or temporary pipeline leading away from the lake bed to a suitable recharge site would allow these waters to be put to beneficial use. Storm waters would be retained in the lake beds to reduce the sediment content and provide regulation of inflow to the recharge facilities before being released for recharge. Facilities to accomplish this are discussed in greater detail in Section VIII.

There are no long-term data relating to amounts of storm water that accumulates in the dry lake beds. However, following the heavy rains in March 1992, aerial photographs
provided some information regarding the area of inundated lake bed area. The depth of water was estimated, and the volume of water in the lakes was calculated from the area and depth. Rainfall measurements for the March 1992 storm were correlated to other storms for the period of record to estimate the frequency of the March event. The results of this rough estimate of the potential use of captured storm flow is shown in Table 13.

<table>
<thead>
<tr>
<th>Subarea</th>
<th>Centro</th>
<th>Baja</th>
<th>Este</th>
<th>Oeste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Lake Water Volume (acre-feet/yr)</td>
<td>Harper</td>
<td>Coyote</td>
<td>Troy</td>
<td>Lucerne</td>
</tr>
<tr>
<td>600</td>
<td>400</td>
<td>200</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

* Based on a once in five-year event.

MAXIMIZING SWP SUPPLY

In addition to ordering its SWP entitlement each year from DWR, the following actions could maximize deliveries of SWP supplies:

1. Each year order and be prepared to receive any unscheduled surplus water.
2. Each year order and be prepared to receive "12(d)" water. Article 12(d) of MWA’s contract with DWR provides that any year that the state is unable to deliver a portion of MWA’s annual entitlement, MWA can elect to receive the amount undelivered in a succeeding year to the extent that such water is available.

WATER TRANSFERS

Mojave Water Agency may be able to obtain additional water supplies through water transfers from other agencies or individuals. "Water transfer" is defined as another
water agency transferring all or a portion of its water supply to MWA. Water transfers fall into two broad categories:

1. Permanent transfers wherein the available water supply is transferred every year, and

2. Intermittent transfers wherein the water supply is transferred only in the year it is wanted.

The considerations in determining the appropriate type of water transfer for the Mojave Water Agency would be the availability, cost, transportation system capacity and storage capability within MWA.

Permanent Transfers

A permanent transfer may require an annual payment or a one-time initial payment to acquire the water supply or a combination of the two costs. For example, a farmer with water rights that can be transferred may wish to sell his land and quit farming. In this case the cost of the water supply would be the agreed-upon price for the land plus any costs involved in approvals for transferring the supply plus the cost of transporting the water to MWA. Water would then be available to MWA every year irrespective of MWA’s need or of the availability in the Aqueduct to transfer the water. Most permanent transfers must be approved by the SWRCB and all would require environmental documentation.

An example of a permanent transfer is the Castaic Lake Water Agency’s purchase of the Devil’s Den Water District. Both entities are SWP contractors. Castaic bought all the farmland that received SWP water and plans to transfer the water to its own service area. One issue for urban agencies interested in acquiring additional SWP water is that SWP agricultural contractors take shortages of up to 50 percent in any one year and 100 percent in any seven consecutive years. This restriction would not be as important to MWA as it is to others since the Mojave River ground water basins would be able to regulate a fluctuating supply.
There may be other opportunities to transfer SWP entitlement and there may also be opportunities to transfer Central Valley Project (CVP) water. The CVP is a federal project with a specified service area that does not extend south of the Tehachapi Mountains. However, the 1992 amendments to the 1992 CVP Act allow CVP contractors to sell a portion of their CVP water to agencies outside of the existing service area. This may present transfer opportunities in future.

Other water supplies located outside the boundaries of MWA, such as ground water and surface supplies, could also be transferred to MWA on a permanent basis given a willing seller and compliance with the regulatory, environmental and institutional requirements.

**Intermittent Transfers**

With MWA’s ability to store water in the ground water basin, MWA might find intermittent type water transfers more cost effective than permanent transfers. For example, MWA might have a contract with an entity that has water rights to transfer water only in wet years when such water may be surplus to the needs of the entity. The cost of such a transfer program would have to be assessed, based on the cost of the water plus the costs of the facilities required to take wet year water, to determine if this approach would be cost effective. Such supplies would not be as valuable as dry year supplies.

The State Water Bank, created in 1991, is an existing example of the mechanism for an intermittent water transfer during dry years. This program is still in the developmental stage. As conceived and implemented to date, DWR acquires water from various sources during dry years and makes this water available to water users that have the ability to receive the water. The price is established by DWR based upon a number of factors.

**Water Transfer Problems**

The competition for water supplies in California is increasing as are the problems relating to obtaining additional supplies. This process in California is a very difficult,
complex, time-consuming, and expensive negotiating process. It involves detailed engineering, economic, financial, environmental, and hydrologic issues and resolution of political issues.

Many potential water transfer sources are north of the Sacramento-San Joaquin Rivers Delta and would require the movement of water through the Delta, the subject of complex environmental issues. Securing transfer partners south of the Delta would facilitate the process. However, should MWA transfer water through the SWP, it would have to do so using its share of the capacity of the SWP or using the capacity not required by other SWP contractors. This could present a problem due to capacity constraints at both the Delta and Edmonston pumping plants. In addition, the State may need to acquire additional power supplies to transport the additional water acquired by the MWA. Further, a more recent problem is future requirements to be set by the SWRCB or the EPA limiting SWP releases for environmental reasons. The reduction in the time available to pump water from the Delta that is mandated in this decision will severely reduce the capacity available for water transfers.

Because of the complexities and costs, consideration should be given to joining with others in seeking viable water transfers. The Metropolitan Water District of Southern California has been developing water transfers and exchanges for a number of years and continues to do so. They should be considered as a potential partner in developing additional water supplies for the MWA. There may also be other SWP contractors that are seeking water to augment to their SWP supplies. Several smaller agencies seeking sufficient water may combine their resources to have the financial, political, and technical capabilities to negotiate as a team for additional water supplies. These possibilities should also be investigated by MWA.

WATER EXCHANGES

Water exchange is defined as two agencies agreeing to use each other's water supplies under certain conditions. A typical exchange arrangement would involve another SWP contractor taking delivery of MWA's State Project water in dry years, and in exchange, returning the original amount of water plus additional water to MWA in wet years. The shortages experienced by SWP contractors in the last couple of years and the severe
problems that the DWR is having in constructing additional units of the SWP would probably make this type of arrangement attractive to other SWP contractors, particularly those with limited local sources of supply.

WATER BANKING

The banking of local water supplies and MWA’s SWP supplies was discussed earlier in this section. In addition, MWA should investigate:

1. Banking MWA supplies in aquifers outside MWA; and

2. Banking water for others in aquifers within MWA.

There will be times in the future when there are capacity constraints in the SWP which would prevent MWA from importing water obtained through transfers and exchanges. It would be useful for MWA to investigate if such water could be temporarily banked outside its boundaries and imported during times when there were no capacity constraints.

A variation of the exchange described above would be for MWA to bank the water of other agencies. The agency banking water with MWA would deliver water for storage during wetter years. The water would be withdrawn in dry years by MWA giving up all or part of its SWP entitlement during dry years and extracting previously banked ground water for delivery within the MWA. The agency banking water would pay for facilities to extract ground water to replace the SWP water and would pay for the use of MWA facilities. Another benefit to MWA is that while the other agency’s water is stored in the Mojave ground water basins, pumping levels would be less which is a benefit to the ground water producers in MWA.
SECTION VI
DEMAND REDUCTION

Any major water resource management program needs to include implementation of demand reduction programs as well as water supply enhancement programs. These activities are authorized by MWA's Act which states that the purpose of MWA is to do "... any and every act ... so that sufficient water may be available for any present or future beneficial use of lands and inhabitants of the agency ... ". Further, the act specifically authorizes MWA "to pursue all necessary water conservation measures," and "reduce the waste of water." Demand reduction is discussed in this section under the headings of Water Conservation, Water Allocation, and Water Pricing.

WATER CONSERVATION

Water conservation activities apply to both agriculture and urban use. In the last several years, there has been emphasis on reducing the quantity of water delivered to the urban water user. Water conservation inside the house is largely accomplished by education, the installation of low flow shower heads, and ultra low flow toilets. Water conservation activities outside the house are accomplished by education, landscaping practices that use drought-tolerant plants, and reducing lawn areas. Both water conservation inside and outside the house reduce the amount of water delivered to the urban water user but only the latter reduces the amount of water consumptively used. It is a reduction in consumptive use that will result in a reduction of overdraft conditions in MWA.

MWA can accomplish water conservation by:

1. disseminating educational materials;

2. requiring that specific conservation goals be met in its agreements with purveyors;
3. the setting of standards in its agreements with purveyors; and

4. offering financial incentives for specific water conservation activities undertaken by its purveyors and individual users.

It is clear from the above outline that purveyors and individual users must accept and implement any water conservation plan in order for it to be successful. The various water conservation programs can be grouped into three categories:

1. Measures that reduce consumptive use as well as water production. (These are generally programs that reduce outside use.)

2. Measures that reduce water production only. (These are generally programs that reduce inside use. The water that is saved would otherwise most likely have percolated into the ground water basins and become available for further use, thus eliminating any consumptive use savings.)

3. Measures that could reduce both water production and consumptive use or could reduce only water production. (These are educational and administrative actions that would have either of the above impacts.)

Since MWA’s objective is reduction in consumptive use of water, any water conservation measures financed by MWA should be those that result in a reduction in consumptive use and not just a reduction in water production. Reduction in consumptive use has the same value in reducing ground water overdraft as importation of the same amount of water and may be less costly than the acquisition of additional imported supplies.

Reduction of water production will be important to water purveyors if the final Mojave River adjudication settlement follows the principles stated in the proposed judgment submitted to the Court in May 1993. A reduction in unit production will allow a water purveyor to serve more customers with its "free production allowance." There are also
other benefits in reducing production use such as lowering future costs for needed facilities.

Water conservation measures can be different for the following customer categories:

1. single family homes
2. multifamily units
3. commercial/institutional users
4. industrial users
5. irrigation
6. recreation

Some conservation can be achieved through education and consumer acceptance of a change in habits. Also some conservation measures are simple and inexpensive while other conservation measures are costly and in some cases inconvenient. The degree and intensity of the program to be adopted by MWA will depend upon the conservation programs selected, the amount of money available, and the degree of acceptance by water purveyors and consumers.

Water conservation measures are summarized as follows:

1. Measures that could result in reduction of consumptive use and water production.

   a. landscaping audits,
   b. landscape conservation requirements for new and existing developments,
   c. landscaping devices that reduce consumptive use,
   d. water conservation programs for irrigated agriculture,
2. Measures that reduce water production only.
   a. interior audits,
   b. installation of ultra low-flow toilets,
   c. installation of water-saving devices such as low-flow showerheads and bubbler-type "sprinklers" for landscape irrigation,
   d. installation of water-saving appliances,
   e. improved irrigation practices for agriculture.
   f. installation of "grey" water systems.

3. Programs that could reduce both water production and consumptive use or water production only.
   a. programs that give financial incentives for reduction in water use,
   b. public information and school education,
   c. water conservation regulations,
   d. appointment of a Water Conservation Administrator,
   e. installation of water meters on non-metered services,
   f. conservation-oriented pricing structures in conjunction with water meters.

WATER ALLOCATION

Water demands can also be managed through establishment of policies that limit or prevent use of water for certain purposes. An example of impacting use through a water allocation policy is MWA draft water sale policy Ordinance No. 9 dated April 1993, which states, "All applications shall be evaluated and deliveries authorized based on the following priority of uses: 1) municipal, 2) industrial, 3) agricultural, 4) recreational, 5) other. Service may be refused if the Board determines that the applicant's ultimate intended use is not in accordance with Agency policies or permitted under the Constitution of the State of California." (Emphasis added). The ordinance has not as yet been adopted by MWA.
Some allocation policies are listed below and briefly discussed in this section.

1. Land use
2. Allocation by subareas
3. Specific requirements for industrial use
4. Restriction of high water use activities
5. Designating use of treated wastewater for certain purposes
6. Reduction of phreatophyte use

The marketplace will determine some changes in type of use as urban areas replace some agricultural areas or as the increasing cost of water discourages agricultural use. Allocation by MWA based on the various categories of land use: urban, agricultural, industrial, recreational and environmental, would also impact land development and use. MWA might also choose to allocate its SWP supplies to the subareas similar to those listed in this report on the basis of estimated water supply deficiencies. A condition for approval of new industrial developments might be to require that the industry demonstrates that it can provide its own supply or pay for the cost of conserving and reducing consumptive use by an equivalent amount of water. Examples of high water use activities are recreational activities and water used for solar power generation. Consumptive water demand for lakes and golf courses in Alto alone is more than 3,700 acre-feet per year. In 1990, Luz Construction Incorporated reported a pumpage of about 7,800 acre-feet for the operation of solar power plants at Harper Lake and Kramer Junction. Of this amount, about 95 percent is consumptively used.

A large percentage of wastewater in the Mojave River area is discharged to septic tanks. Using a 50 percent ratio of urban consumptive use to applied water and the 1990 population data, it is estimated that a basin-wide amount of about 40,000 acre-feet of return flow from urban uses is produced annually and discharged to septic tanks or sewer systems in the Mojave River area. Although this water constitutes a source of recharge to underground aquifers, a portion of it could be used more efficiently by additional treatment and reuse for other purposes such as irrigation of golf courses and landscape areas.
About 7,500 acre-feet were consumptively used by phreatophytes in 1989 in the Mojave River area. Using the current unit urban consumptive rate, this amount is equivalent to that used by 47,000 people for one year (about 18 percent of the current Mojave River area population). The elimination of all phreatophyte water use would not be feasible but there are environmentally acceptable water management methods to reduce phreatophyte use which should be investigated. Any action to reduce phreatophyte water use would be evaluated for environmental impacts and coordinated with the United States Fish and Wildlife Service and the California Department of Fish and Game.

WATER PRICING

Water pricing can be used as a tool to reduce demand. Since MWA is a wholesaler, any water pricing policies would have to be achieved through agreements with the water purveyors. Water pricing policies should be implemented only after extensive public hearings and educational activities in order to develop public support. Pricing policies by MWA will depend in large part on the type of plan adopted by MWA and its relationship with the Watermaster after the adjudication is complete. If MWA approves only a ground water recharge program, it would recover all of its costs through an agreement with the Watermaster and there would be little opportunity to implement a pricing policy to reduce demand. If MWA develops a program of building extensive works and contracting with purveyors for repayment, it will have an opportunity to influence demand by its pricing policies.

The water pricing considerations for the Morongo Basin area have been generally established through the financial arrangements established for the Morongo Basin Pipeline.

The MBP agreement between MWA and the five participants in the project provides that MWA shall fix charges to produce revenues to MWA equal to the amounts of fixed and variable cost of transporting SWP water from the California Aqueduct to the Morongo Basin/Johnson Valley area.
With the accelerating development in the Mojave River area and the proposed judgment, it is clear that MWA must develop a program to make maximum use of the SWP water as soon as possible. A pricing policy consistent with the proposed judgment can help achieve this objective.

If MWA decides to limit its activities to recharge only, possible pricing policies to recover costs for the Mojave River area are summarized as follows:

1. Until the adjudication is final, all capital and other fixed costs of SWP water can be repaid by ad valorem taxes. Other costs such as debt service and purchase of additional imported water would have to be repaid through production or zone of benefit assessments or under terms of contracts MWA may enter into with water users.

2. After the adjudication is settled, all costs could be recovered by:

   A. Assessments by the Watermaster.

   B. A combination of the following:

      1. A uniform rate per acre-foot charge to all pumpers who exceed their adjudicated rights;

      2. A rate per acre-foot charge for the water that would vary depending upon type of water apportioned to the user as follows:

         (a) surplus water obtained from SWP (lowest cost)

         (b) the base price for SWP water (next lowest cost)
(c) some portion of cost of SWP water plus additional charges for water purchased in addition to SWP water (highest cost).

C. A basin-wide assessment based on ground water extractions.

If MWA's program becomes more complex, it can use additional pricing measures such as:

1. Favor certain types of uses by charging more for less favored uses.

2. Encourage water conservation by raising unit costs on increasing blocks of use.

3. Reduce ground water pumping and encourage use of available imported water by setting prices for imported water that are competitive with ground water pumping and recover the balance of costs through assessments.
SECTION VII
WATER SERVICE RESPONSIBILITIES

The type and extent of water service to be provided by MWA will depend upon the particular Plan adopted by MWA’s Board of Directors (Board). If the decision is to only provide for recharging of the ground water basin with water acquired under the existing SWP contract, then water service will be relatively simple. If the Board decides to pursue a more complex conjunctive use program, other activities could be undertaken which are discussed in this section. Section V, Potential Additional Water Supplies, describes a conjunctive use program that would maximize SWP and local water supplies and conveyance facilities needed for this program. In addition, distribution works, peaking responsibilities, storage and treatment need to be considered in the division of responsibilities between MWA and the water purveyors.

EXTRACTION AND DISTRIBUTION

If the decision is made that MWA will implement a conjunctive use program to maximize SWP and local supplies and construct the necessary water recharge and conveyance works, the next decision relates to extraction and distribution responsibilities. The key question is whether MWA can construct, operate and maintain this part of a system more economically and efficiently than each purveyor building its own works to extract and take delivery of water. Furthermore, MWA needs to decide if it wants this responsibility.

Distribution facilities would provide for direct deliveries to purveyors or major water users. Water could be delivered to existing pipeline systems or storage tanks or to recharge sites operated by the purveyors. The location and size of these facilities would be decided jointly with the purveyors.
PEAKING

Peaking is provided largely through surface tanks constructed by various purveyors and well fields located in the ground water basins. Estimates of peaking requirements in the Mojave River area were obtained from discussions with water purveyors. Expressed as a percent of average daily use, they are as follows:

- Monthly: 160%
- Weekly: 180%
- Daily: 230%
- Hourly: 370%

If MWA were to develop a major conjunctive use program involving the construction of a system to recharge the ground water basin, extract and deliver surface water, its agreements with the water purveyors would describe its peaking responsibilities. Some peaking could be obtained by proper scheduling of SWP water and increasing the size of the distribution lines. Additional peaking would require the drilling of new wells or acquisition of existing wells and construction of pipelines from the extraction facilities to the purveyors and/or construction of surface tanks.

The peaking alternatives that could be provided by MWA are summarized as follows:

1. MWA would size its distribution lines to deliver flow at a constant rate and would provide no peaking.

2. MWA would provide peaking service limited to the extent that it could peak off the California Aqueduct of the SWP. Purveyors would provide the additional required peaking.

3. MWA would commit to meet all peaking requirements of the contracting purveyors.
4. MWA peaking responsibilities would be some amount between Items 2 and 3 as agreed to with the water purveyors.

If Item 2 above were implemented and the distribution pipelines were sized to be larger than under Item 1, the existing storage on the SWP system would provide a significant benefit to the Mojave River area purveyors. The SWP contract with MWA allows for 11 percent monthly peaking factor. If MWA were to deliver all of its SWP supply to the water purveyors through a surface water system, it could provide monthly peaks of 132 percent by peaking off the SWP system based solely on the SWP portion of average monthly demand. If MWA were to deliver only a portion of its SWP supply to the water purveyors it could provide a higher peak off the SWP system. For example, if it delivered one-half of its supply to surface water system and the other half directly to recharge the ground water basins, it could provide monthly peaks of 164 percent to its purveyors. Various peaking rates would be obtained depending upon the assumption of the amount of surface deliveries. Any additional peaking requirements could be met by the water purveyors. If MWA were to agree to deliver peaking beyond the amount provided by peaking off the SWP system, it would involve even greater capital and operating costs with the addition of surface storage and/or well fields.

The water service responsibilities of MWA and the Morongo Basin Pipeline participants are identified in the agreement among the entities. In summary, the participants each own capacity in the facilities. MWA may contract with any public agency or private company for the operation and maintenance of the project facilities.

STORAGE

The ground water basins in the Mojave River area perform the major function of regulating local inflow. One possible project for providing major surface storage is the installation of one or more gates on the outlet structure of the United States Corps of Engineer (USCE) Forksite Dam. The USCE follows national standards in designing its flood control structures. Preliminary indications from conversations with USCE officials are that modifications to Forksite Dam would require an Act of Congress. Even if the
necessary approvals could be obtained, preliminary review by Bookman-Edmonston Engineering, Inc. of costs and water supply benefits show that installation of gates would not be feasible. Additional storage would have to be considered only if MWA were to agree to undertake peaking responsibilities beyond what could be obtained by peaking off the SWP facilities.

TREATMENT

Water treatment associated with ground water delivered for urban and industrial purposes within MWA generally consists only of chlorination. Direct use of the supplies imported in the SWP facilities will require a higher level of treatment to comply with the state health standards for drinking water. If MWA were to agree to take the responsibility for providing treated water to its water purveyors, it would have to consider treatment of imported water at a regional treatment plant versus treatment by individual water purveyors with water service contracts with MWA.

A regional water treatment plant for the imported water supplies could be constructed near the California Aqueduct. However, because of the variability in anticipated deliveries from the SWP and the likelihood that a significant portion of the SWP supply will be used for recharge of the ground water basin, the construction of a regional treatment plant to treat the entire SWP supply is not likely to be feasible.

Local water treatment facilities, operated by individual purveyors (or groups of purveyors) may be more practical than the regional approach because local ground water and local supplies could be blended to provide a more uniform source of supply than use of the imported supply alone.

The cost-effective option appears to be to treat only the water supply to be used for municipal purposes. Current technology in packaged water treatment plants allows for modular expansion of treatment facilities to meet changes in demand. This concept could also fit well to meet the needs of small to medium size individual water purveyors individually or facilities could be constructed by MWA to meet the needs of several water purveyors.
MONITORING

The development of a program to monitor the hydrologic parameters is essential to the successful implementation of the Plan. Items to be monitored include surface and subsurface flows, water deliveries, wastewater return flows, ground water elevations, water quality and land use. MWA should develop monitoring programs in cooperation with the individual purveyors and include the specifics of the program as part of the water service agreements. Things such as the type and frequency of measurements, reporting practices, data verification and reliability would be included in the agreements. MWA would be responsible for the overall monitoring program and would likely provide staff to conduct measurements in areas not served by individual purveyors and to analyze the data developed through the monitoring program.

WELL CONSTRUCTION

Ground water extraction is a key component of any conjunctive use program proposed by MWA. It could be accomplished using the purveyors' wells, both existing and future, or by wells constructed by MWA. The greatest amount of flexibility would be provided by wells constructed by MWA since the wells would be located near the recharge facilities and connected to the main conveyance facilities. The details of this type program would be defined by the MWA Board in cooperation with the purveyors and would have to reflect the institutional constraints imposed by the adjudication in the Mojave River area and the conditions currently in place in the Morongo Basin area.

Two specific issues in the Morongo Basin/Johnson Valley area that would be addressed and resolved prior to the implementation of the extraction portion of the ground water recharge program are: (1) the effects on programs implemented by the participants in the MBP; and (2) obtaining court approval of any program that could impact the adjudicated Warren Valley Basin.
SECTION VIII
REGIONAL WATER MANAGEMENT PLAN
ALTERNATIVES

Consistent with its legislative charge and with the intent of the Mojave Basin adjudication, the basic objective of MWA is to develop and implement a plan which would eliminate the overdraft of the ground water basins. In the Mojave River area, the current estimated annual overdraft of the ground water basin is 68,000 acre-feet and is projected to increase to approximately 89,000 acre-feet by 2015 if no corrective measures are taken. In the Morongo Basin/Johnson Valley area, the estimated overdraft is expected to increase from about 1,500 acre-feet at the present time to 4,000 acre-feet in 2015.

MWA’s SWP water supply is projected to yield an average of approximately 40,000 acre-feet per year. Thus, even with full utilization of its SWP water, MWA will require additional supplies or reductions in demand on the order of 53,000 acre-feet per year by the year 2015 in order to eliminate a total overdraft of approximately 93,000 acre-feet (Mojave River area plus Morongo Basin/Johnson Valley overdrafts).

The alternatives requiring decisions by MWA’s Board can be grouped into two major areas. The first concerns the management strategy for reduction and elimination of the overdraft. In brief, measures required to eliminate overdraft will be costly, difficult to implement and will have one or more of the following elements:

1. Measures that can be implemented by MWA.
2. Measures required to comply with the terms of the adjudication and the physical solution entered by the Court.
3. Measures that would require legislative changes to the MWA Act in order to be implemented.
4. Measures that require actions or agreements with others and are beyond the ability of MWA to implement under the current MWA Act.
Assuming that feasible conservation measures would be maximized, there would be two other extreme approaches. One extreme would be to obtain imported water, in addition to SWP deliveries, sufficient to meet all demands and eliminate overdraft. The other extreme would be to limit imported water deliveries to that obtained through the SWP and meet the remaining overdraft by water allocation strategies. The most probable management strategy is one based on a combination of water conservation, utilization of available SWP supplies, acquisition of additional water supplies, and finally, water allocation.

The second group of alternatives concerns alternative facilities for water conveyance and distribution systems to be provided by MWA, which could range from the simple releasing of SWP water into the Mojave River channel to more complex water distribution activities. These strategies and alternatives are discussed in some detail in the following sections.

**MANAGEMENT STRATEGIES**

The basic alternative management strategies available to MWA to reduce overdraft are water conservation, water supply enhancement and water allocation. In theory, these are three distinct alternatives, but pragmatically, the management strategy to be adopted by MWA will likely include a combination of all three approaches based upon economic and financial considerations, measures required to comply with the terms of the proposed judgement, and the physical solution entered by the Court and future growth of water demands in MWA.

**Water Conservation**

Water conservation measures are discussed in Section VI of this report. Some or all of these items could be combined in a water conservation program to benefit both the MWA and the water purveyors in the Mojave River area.

As stated in Section VI, some conservation measures will reduce consumptive uses (landscape irrigation) while others will reduce primarily water production (in-house
uses) and still others may affect both consumptive use and water production. From the standpoint of reducing or eliminating the overdraft on the ground water basin, measures to reduce consumptive uses will be most important to MWA.

The effectiveness of any water conservation program adopted by MWA for inclusion in the Plan will depend upon the measures selected and the degree of acceptance by water purveyors and water consumers. However, and as indicated in Section VI, water conservation measures alone would not be sufficient to eliminate the overdraft conditions in the Mojave River area.

**Water Supply Enhancement**

This strategy would be based on increasing water supplies by: (1) maximum capture of local runoff that currently does not contribute to ground water recharge; (2) maximum utilization of water available to MWA under its existing SWP contract; (3) acquisition of additional SWP supplies that may be available from the SWP Water Bank; and, (4) by obtaining additional water supplies from sources inside and outside MWA.

**Local Water Supplies**

It is estimated in Section V of the report that approximately 1,000 acre-feet per year of local water could be added to the ground water basin by construction of recharge facilities. Assuming this could be accomplished within the constraints imposed by the proposed judgment, an annual cost of $132,000 has been included for construction of temporary sand dams in the channel on an as-needed basis. Analyses were made of the capture of stormwater in "dry lake" beds on an infrequent (once-in-five year) basis. Pumps and aluminum piping would be rented and installed to convey stormwater from the dry lake beds to nearby recharge facilities. Lucerne Dry Lake and Rabbit Dry Lake are located in the Este subarea. The third, El Mirage Dry Lake, is located in the Oeste subarea. The estimated cost of recharge adjacent to the "dry lakes" are shown in Table 14 as ranging from $1,000 to $3,300 per acre-foot. This is much more
costly than other supply alternatives, but it should be considered and reevaluated in the future when more information becomes available.

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost</th>
<th>Debt Service$^{(2)}$</th>
<th>O&amp;M</th>
<th>Total</th>
<th>per Acre-Foot$^{(1)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucerne Dry Lake - Este</td>
<td>500</td>
<td>47</td>
<td>14</td>
<td>61</td>
<td>1.5</td>
</tr>
<tr>
<td>Rabbit Dry Lake - Este</td>
<td>600</td>
<td>57</td>
<td>8</td>
<td>65</td>
<td>3.3</td>
</tr>
<tr>
<td>El Mirage Dry Lake - Oeste</td>
<td>500</td>
<td>47</td>
<td>13</td>
<td>60</td>
<td>1.0</td>
</tr>
</tbody>
</table>

(1) Based on Total Annual Cost divided by estimated average annual yield based on a once-in-five-year rainfall event.
(2) Based on amortization at 7% for 20 years.

SWP Contract Supplies

The MWA entitlement to SWP water supplies is 50,800 acre-feet annually but as discussed in Section III, average annual deliveries are expected to average only about 40,000 acre-feet per year due to the fact that authorized SWP facilities have not been completed and due to the increased water needs for environmental mitigation. In order to average the 40,000 acre-feet per year, MWA will have to maximize SWP deliveries in wet years to offset the short supplies in dry years such as were experienced in the late 1980s and early 1990s. Maximization of SWP contractual supplies is the simplest of the water supply augmentation alternatives as no new actions by the MWA Board are required.

Additional SWP Supplies

The DWR developed the SWP water bank as a means of obtaining additional water supplies during the recent drought. The water bank concept is based on obtaining temporary water supplies from agricultural water users north of the
Delta who agree to make their water supplies available to DWR for a price. DWR then sells this water supply to SWP contractors. The average annual amount that may be available from this source would be a function of the price the contractors would be willing to pay and cannot be estimated at this time.

Additional Water Supplies

Several possibilities for obtaining additional imported water supplies are outlined under Water Transfers in Section V of this report. If agreements can be reached with other water agencies willing to transfer water, all of the overdraft remaining after implementation of the foregoing sources, might be met under this alternative. Obtaining these supplies, however, is competitive, complex and time consuming. Costs will be high as other urban agencies are seeking additional water supplies. Any additional imported water obtained would be conveyed to MWA in the SWP facilities and delivered through MWA turnouts. Based on recent experience, it is estimated that the average annual cost of purchasing an acre-foot of additional imported water delivered into the California Aqueduct is $150 an acre-foot. The cost of delivering that water to the MWA turnouts is estimated to average $125 per acre-foot. Table 11 in Section III shows the 1995 deficiency from MWA to be 69,800 acre-feet and the 2015 deficiency to be 92,800 acre-feet. If water supply enhancement is used to balance the portion of the overdraft not met by SWP entitlement supplies, the cost in 1995 would be $8,195,000 (29,800 x $275) and the cost in year 2015 would be $14,520,000.

Implementation of the adjudication as set forth in the proposed draft judgement provides for transfers of water rights within MWA. Water rights transfers do not constitute a "new" source of water but could serve to reduce the overdraft if water rights are transferred to the watermaster and not used for replacement water. It is not considered likely that transfers and retirement of water rights could eliminate overdraft conditions because of the magnitude of the current overdraft and projected future water demands within MWA.
Water Allocation

Water allocation strategies could be utilized by MWA to eliminate overdraft conditions remaining after water conservation and water supply augmentation strategies were fully utilized. Water allocation focuses on reducing water demands by establishing priority of uses for the available supply and/or establishing progressively lower unit uses of water for different purposes. Water pricing can be utilized as a water allocation tool by charging higher prices for less desirable uses or charging higher unit rates for use above an established base. If MWA decides that water allocation and water pricing should be implemented, it would determine which types of uses should be regulated and commence a water allocation program. After passage of sufficient time to evaluate the program, it should determine the effects of the program and instigate additional allocation measures to reach the objective of eliminating the overdraft.

Implementation of water allocation strategies under the proposed draft judgment would require the approval of the Court. Specifically, the priority of water uses and rate structure for low priority water uses would have to be developed and evaluated to assure they were consistent with the intent of the water rights adjudication and the availability of replacement supplies.

To summarize, a water conservation strategy alone would not result in sufficient water savings to overcome the overdraft and would require legislative changes to define MWA's role in enforcing conservation standards. Agreements with water purveyors might also be required. Implementation of the water supply enhancement strategies would require agreements with others for obtaining water supplies in excess of the SWP supplies and thus is beyond the ability of MWA to implement unilaterally. The water allocation strategy could also require legislative changes, depending on the level of allocation imposed.

FACILITIES ALTERNATIVES

In addition to adopting the management strategy to eliminate the overdraft of the ground water basins, the MWA Board must decide the level of water service it will
provide and the type and extent of conveyance and distribution facilities required to provide the service. The Board would also consider the distribution of costs and benefits in its determination of the facilities to be constructed. MWA is currently constructing the Morongo Basin Pipeline and has initiated preliminary design activities for the conveyance facility to deliver imported water supplies from the California Aqueduct to the vicinity of Newberry Springs in the Baja Subarea as part of their ongoing responsibilities.

Capital and annual costs have been estimated for the facilities described using 1993 price levels. These estimates are suitable for planning purposes but more detailed layouts and cost estimates would be required to develop feasibility level reports. Four basic alternative levels of facilities and water service have been developed for purposes of the Plan, recognizing the ongoing projects and are listed as follows:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Continue the release of purchased SWP water from Lake Silverwood to the Mojave River channel until the MBP is completed, then release water from the MBP to the Mojave River channel.</td>
</tr>
<tr>
<td>2.</td>
<td>Construct major conveyance and ground water recharge facilities in the Mojave River area, extend the MBP to the Warren Valley area in the Morongo Basin, and deliver imported water for ground water recharge to all subareas within MWA.</td>
</tr>
<tr>
<td>3.</td>
<td>Construct MWA wells for ground water extraction and delivery to major conveyance facilities constructed in Item 2.</td>
</tr>
<tr>
<td>4.</td>
<td>Construct water treatment facilities, provide for direct delivery of imported and ground water supplies to water users peak requirements.</td>
</tr>
</tbody>
</table>

Each of the above alternatives provides additional levels of service from the one above it and increases the total cost to MWA. Alternative 1 is the least costly but has the
disadvantage that the bulk of the recharge would accrue to the Alto subarea, leaving the downstream subareas dependent on increased outflow from the Alto subarea in order to receive benefit from the SWP supply. Alternative 2 constitutes a major undertaking by MWA that would allow for direct recharge in all principal subareas, thus providing for a distribution of direct benefits. The discussion of the facilities required to implement Alternative 2 is presented in the following section. Alternative 3 would give MWA the flexibility to deliver ground water, as well as imported water, to customers in years when the SWP and other imported water is in short supply and provides an additional tool for the management of the operational storage capacity of the basins. Alternative 4 would allow the direct delivery of imported and ground water to purveyors and would allow MWA to provide a complete wholesale water delivery service by meeting peak demands and treating water.

It is not considered likely that Alternatives 3 and 4 would be implemented during the planning period which extends through 2015. This is because the terms of the proposed judgement and physical solution contains water transfer provisions that would negate the need for ground water extraction facilities operated by MWA until sometime in the future, if at all, and the fact that water purveyors are better able to handle the physical and institutional constraints associated with direct water deliveries to end users.

DESCRIPTION OF FACILITIES

The required facilities for the water service alternatives are listed under the subheadings of conveyance, recharge, extraction and distribution facilities. Some of the service alternatives have alternative structural facilities that can essentially accomplish the same goal (i.e., the location of recharge facilities within a subarea).

The imported water supply available to MWA would be conveyed in the California Aqueduct and delivered to MWA. There are three turnout structures from the California Aqueduct in the MWA service area located west of the Mojave River channel. One turnout is located in the El Mirage area, another near Highway 395, and the third is located near Hesperia. These locations are shown on Figure 13. No facilities have
been completed to convey SWP water from these turnouts, but the Morongo Basin Pipeline extending from the Hesperia turnout is under construction.

Sizing the system for the conveyance of water available from the Aqueduct could be based on SWP contractual constraints which limit monthly deliveries to 11 percent of annual entitlements plus possibly some capacity for additional future supplies. The combined MWA delivery capacity under its SWP contract (as amended) is 136 cfs.

Conveyance Facilities

The principal MWA conveyance facilities that will deliver water to the Alto, Baja, Centro, Este, Oeste and Morongo Basin/Johnson Valley subareas are the Morongo Basin Pipeline, currently under construction, and the Mojave River Aqueduct, currently in the preliminary design phase.

Morongo Basin Pipeline

The MBP, currently under construction, is a key component of the Plan. It will extend for approximately 70 miles from MWA Turnout 3 to the Morongo Basin/Johnson Valley area and ranges in size from 30 to 54 inches in diameter. Two pumping plants will be provided to lift the water to the service area of the participants.

The general alignment of the MBP is shown on Figure 13. The design capacity to meet water needs in Morongo Basin is 22 cfs. The initial reach of the MBP that extends from MWA Turnout 3 to the Mojave River has been enlarged to carry 100 cfs to provide for ground water recharge in the upstream portion of the Alto subarea. It is estimated that about 36,000 acre-feet per year could be delivered to recharge facilities and/or the Mojave River channel for ground water recharge.
Mojave River Aqueduct

The Mojave River Aqueduct will constitute the principal conveyance facility providing imported water to the Alto, Centro and Baja subareas. This conveyance facility will extend about 66 miles from MWA Turnout 2 to the vicinity of Newberry Springs and will deliver water for ground water recharge or direct deliveries to water users. MWA issued a Notice to Proceed with the preliminary design phase of this facility in February 1993. The two alternative alignments under consideration are shown on Figure 13.

Two general configurations of the main conveyance facility are being considered: (1) a pressure pipeline from the Aqueduct to the Baja subarea or (2) an alternate system, with a pipeline from the Aqueduct to near Victorville, and a small concrete lined canal from Victorville to the Baja subarea. Both the pipeline and the pipeline/canal alternatives would be within the alignment corridors shown on Figure 13.

The reconnaissance level cost estimates presented for the Mojave River Aqueduct are based on a continuous flow of about 50 cfs from the California Aqueduct to the terminal recharge facility at Minneola so as to provide maximum operational flexibility and provide for a total delivery of about 36,000 acre-feet annually. This facility is in the preliminary planning stages and the design will be refined further in that process.

The pipeline alternative would consist of a 36-inch, Class 150 pipe extending from the California Aqueduct to the Minneola recharge facilities near Newberry Springs. Turnouts from the pipeline would be provided to deliver water to recharge facilities to be located in the Centro and Baja subareas.

The total head between the Aqueduct and the Minneola recharge facility is nearly 1,500 feet. Pressure reducing facilities would be provided in order to use the Class 150 pipe. The opportunity for hydroelectric power generation will be
explored during the preliminary planning for the MRA facilities but will not be addressed in this Plan.

The general characteristics of the MRA as described above would apply to the pipeline/canal alternative. The pipeline would extend to the Victorville area. A small canal would be constructed from the end of the pipeline to the Minneola recharge facility. The canal would be concrete lined and have a bottom width of two feet with an operating depth of about two feet.

The MRA could also be used to convey Mojave River water from upstream to downstream subareas. This could be accomplished by constructing a river diversion structure, pumping plant and pipeline to discharge stream flow to the MRA. However, this alternative has institutional and environmental constraints that could make it infeasible. Additionally, in view of the preliminary conditions of the Mojave River adjudication with regard to Mojave River flows, it is considered unlikely that this alternative could be implemented within the planning period.

El Mirage Pipeline

The El Mirage Pipeline would be constructed to convey water from the California Aqueduct to recharge facilities in the Oeste Subarea. The length of the pipeline depends on the final location of the recharge facilities but would range from 1,000 feet to a little less than four miles. A diameter of 30 inches has been used for planning purposes.

Recharge Facilities

Specific recharge sites are discussed in the following sections by subarea.
Alto Subarea

Alternative recharge sites in the Alto subarea are located adjacent to the Mojave River channel upstream and downstream from the MBP crossing and possibly in the eastern portion of the subarea south of The Town of Apple Valley. The characteristics of the Mojave River channel in the vicinity of the MBP crossing are generally favorable for ground water recharge. However, preliminary investigations conducted by the USGS indicate that locating the recharge facilities upstream (south) of the crossing would be advantageous. The upstream location would utilize more of the dewatered storage capacity and have higher percolation rates than the downstream location. The total area required for the recharge facilities ranges from about 400 to 500 acres. Furthermore, there is approximately 400 feet of pressure head in the MBP at the river crossing. This head could be utilized to convey water about four miles upstream from the crossing to the proposed recharge facilities or to the channel for release and recharge. Locating the recharge facilities downstream from the crossing would require an energy dissipation device.

The greatest potential for ground water recharge in the Alto subarea is in the above-described sites. Additional recharge in the eastern portion of the Alto subarea, but on a much reduced scale, might be accomplished using stream channels crossed by the MBP. This possibility should be investigated in more detail. Costs have not been estimated for the east Apple Valley recharge facilities.

Centro Subarea

Review of the potential recharge areas along the Mojave River from the Helendale Fault to the Waterman Fault indicates that the recharge facilities should be located a short distance upstream from Lenwood. Water would be delivered to the facilities by the Mojave River Aqueduct. The total area required is about 500 acres.
**Baja Subarea**

The recharge facilities in the Baja subarea would be located near Daggett and downstream from the Calico Newberry Fault, upstream from Camp Cady as shown on Figure 13. The downstream area was selected to assure that local pumphers would benefit from the recharge program and to avoid the shallow clay layers located further downstream. The total area required for these facilities would be about 500 acres.

Modifications to the Mojave River channel in the Baja subarea to increase ground water recharge of local runoff are also considered recharge facilities. They would consist of temporary sand dams located to impound small amounts of water which would percolate to the underlying aquifers. Following high flows in the river, the sand dams could be replaced.

**Oeste Subarea**

The facilities required for the ground water recharge program would consist of the El Mirage Pipeline constructed from Turnout Number 1 on the California Aqueduct to recharge facilities located to the north or south. This is shown on Figure 13.

Recharge facilities located south of the Aqueduct would require pumped deliveries. However, the advantages of locating the recharge area south of the Aqueduct are that a greater portion of the dewatered aquifer could be utilized and that the direct benefits to Phelan would be greater than if the recharge facility were located north of the Aqueduct. Detailed investigations of the location of the facilities to serve the Oeste subarea would be performed during the preliminary design phase, not yet authorized by MWA.

Three alternative configurations for the Oeste conveyance and recharge facilities were evaluated and costs were estimated to provide a range. The costs are presented later. The basic differences among the alternatives are the distance
from the Aqueduct and the pumping requirements. The size of the recharge facilities would be about 200 acres for each of the alternatives.

Two of the proposed recharge facilities would be located south of the Aqueduct. One would be adjacent to the Aqueduct and the other would be located approximately four miles south. Both would require pumping. The system located to the north of the Aqueduct would operate by gravity and would be the least expensive of the three Este alternatives.

Preliminary analyses of the March 1992 storm event were performed to estimate the potential for diverting stormwater from the El Mirage Dry Lake for ground water recharge. These analyses indicate that approximately 300 acre-feet of stormwater which accumulates in the lake bed could be recovered and used for ground water recharge on a five-year recurrence interval. The facilities required to divert accumulated stormwater from the lake for ground water recharge would consist of a permanent pump structure in the lake bed and recharge facilities located about two miles to the south. Pumps and aluminum pipe would be rented as necessary to convey the water from the pump station to the recharge facilities.

Este Subarea

The MBP is the main conveyance facility that could be utilized to deliver water to the Este subarea. It is anticipated that MWA and the MBP participants would develop a joint-use agreement to permit water to be conveyed from the MBP to recharge sites in the Este subarea.

Based on this assumption, preliminary designs were prepared for spreading sites located east and west of the Helendale Fault in areas that are generally favorable for ground water recharge. For planning purposes the size of these facilities have been based on a design capacity of 20 cubic feet per second which requires about 100 acres of recharge facilities.
The recharge area west of the Helendale Fault would be located about three-quarters of a mile north of the Morongo Basin Pipeline and southeast of Rabbit Lake. The east recharge area would be located south of the Morongo Basin Pipeline and south of Lucerne Dry Lake. The locations of both sites are shown on Figure 13.

Stormwater accumulations in both Lucerne and Rabbit Dry Lakes could provide a source of local ground water recharge. As in the Oeste areas, facilities would be required to collect the stormwater, convey and discharge it to percolation ponds. Analyses indicate that approximately 200 acre-feet and 100 acre-feet would be available from Lucerne and Rabbit Dry Lakes respectively on a five-year recurrence interval.

Morongo Basin

Three potential recharge sites would be located in the Morongo Basin area in the Means/Ames Basin, the Warren Valley Basin and the Joshua Tree Subbasin as shown on Figure 13. Water would be provided to all three sites by extensions from the terminus of the Morongo Basin Pipeline. The Joshua Tree and Means/Ames recharge sites would consist of ten acres each while the Warren Valley site would consist of 15 acres.

Physical constraints to recharge at these sites include a peak MBP capacity of 22 cfs and limited storage capacity of the ground water basins. Planning of recharge facilities should include further evaluation of storage capacity, infiltration rates, and selection and sizing of site and facilities.

Extraction Facilities

As part of the long range management objectives of MWA, the capability to extract previously stored ground water would provide operational flexibility in the joint operation of the local and imported water supplies. The local water supplies in the Mojave River area tend to recharge the Alto ground water basins. In order to maintain
available storage space in the Alto ground water basin, it would be advisable to be able to extract this supply for controlled delivery to the Centro or Baja subareas. It could also be delivered to the Morongo Basin Pipeline for conveyance to the Este subarea and Morongo Basin/Johnson Valley subarea.

Wells constructed by MWA in the vicinity of the ground water recharge facilities and connected to the MRA and the MBP would accomplish the ground water extraction component of a conjunctive use program for MWA and could provide the makeup water obligations not met by imported supplies. The wells would be located to minimize the effects on existing wells. The number of wells would be determined at a later stage of the planning process and construction phased in accordance with the growth in water demands and the quantity and reliability of the future imported water supply. Construction of extraction wells by MWA is not considered likely during the planning period.

Distribution Facilities

At some time in the future, distribution facilities could be constructed to deliver water from the Aqueduct, the MBP, and the MRA to distribute water directly to some of the major water purveyors. Water delivered for municipal uses from the SWP would require treatment.

Direct deliveries of SWP supplies to purveyors in the Mojave River area of MWA is not considered likely during the planning period. In this area, ground water underlies most of the areas served by the purveyors or they have located their wells in favorable ground water areas and constructed conveyance facilities to their service areas.

Another concern with the direct use of the imported water supply for domestic purposes is the lack of reliability in water deficient years. Purveyors would have to maintain both their ground water production facilities and incur the additional annual costs associated with treatment of the imported supplies.
ESTIMATED CAPITAL AND ANNUAL COST OF FACILITIES

There is no capital cost for Alternative 1 (release of SWP water to the Mojave River channel from Silverwood), only the $9.25 per acre-foot SWP cost of using the Aqueduct from MWA Turnout #3 to Lake Silverwood multiplied by the number of acre-feet delivered.

The estimated capital and annual costs of facilities included in Alternative 2 are discussed in the following sections and include costs for both the conveyance and recharge facilities. The discussion is organized by subarea or facility.

Alto Recharge Facilities

The principal costs associated with the Alto recharge facilities include $5,000,000 for the oversizing of the MBP from the California Aqueduct to the Mojave River and providing outlets to the river, the cost of the required recharge facilities and the costs of the pipeline to connect the MBP to the alternative facility sites. Both alternative recharge sites would be located adjacent to the Mojave River channel in the upper part of the Alto Subarea. The north site would be served directly from the MBP. The south recharge site would include approximately four miles of pipeline to convey water to the recharge facilities. It is assumed that only one of the alternatives would be constructed. The estimated costs are shown on Table 15. The debt service was computed by utilizing an interest rate of 7 percent, amortized over a 20-year period. Although 30-year bonds would likely be issued, the marketing of bonds of different maturity dates would be such that the use of 20 years at 7 percent would provide a reasonable estimate of the annual debt service.
TABLE 15

ESTIMATED COST OF RECHARGE FACILITIES IN THE ALTO SUBAREA

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost</th>
<th>Annual Costs</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alto North Recharge Site(1)</td>
<td>14,100</td>
<td>1,300</td>
<td>183</td>
<td>1,483</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alto South Recharge Site(2)</td>
<td>25,900</td>
<td>2,400</td>
<td>334</td>
<td>2,734</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Based on amortization at 7% for 20 years
(2) Includes cost of MBP enlargement and pipeline to recharge facility

Mojave River Aqueduct

Construction of the MRA is the most costly of the facilities alternatives. Two structural alternatives were considered: (1) a pipeline or (2) a pipeline/canal system to deliver SWP water from the East Branch of the California Aqueduct to recharge facilities to be located in the Centro and Baja Subareas. The recharge facilities would be included in either structural alternative and both are intended to accomplish equivalent amounts of recharge. Costs are summarized in Table 16.

TABLE 16

ESTIMATED COST OF MOJAVE RIVER AQUEDUCT AND RECHARGE FACILITIES IN BAJA AND CENTRO SUBAREAS

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost</th>
<th>Annual Costs</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline only</td>
<td>81,900</td>
<td>7,700</td>
<td>1,069</td>
<td>8,769</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline/Canal</td>
<td>46,500</td>
<td>4,400</td>
<td>741</td>
<td>5,141</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mojave River channel modifications</td>
<td>(2)</td>
<td>N/A</td>
<td>132</td>
<td>132</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Based on amortization at 7% for 20 years.
(2) Construction of temporary sand dams shown as an operation and maintenance cost.
Este Facilities

There are two structural alternatives for delivery of water from the MBP to the Este subarea for groundwater recharge. The alternatives involve pipelines and recharge facilities located to the east and west of the Helendale Fault. One or both of the Este recharge facilities could be constructed and the estimated costs are shown on Table 17.

<table>
<thead>
<tr>
<th>TABLE 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESTIMATED COST OF RECHARGE FACILITIES IN THE ESTE SUBAREA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost</th>
<th>Annual Costs</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Este Recharge Area West</td>
<td>4,800</td>
<td>500</td>
<td>559</td>
<td>1,059</td>
<td></td>
</tr>
<tr>
<td>Este Recharge Area East</td>
<td>3,800</td>
<td>400</td>
<td>545</td>
<td>945</td>
<td></td>
</tr>
</tbody>
</table>

(1) Based on amortization at 7% for 20 years.
(2) Includes $500,000 for use of MBP. Actual use charge will be negotiated.

Oeste Facilities

There are three structural alternatives from the California Aqueduct to the Oeste subarea with recharge facilities located north or south of the Aqueduct. The two Oeste alternatives located south of the Aqueduct would require pumping and hence are more expensive than the recharge site to the north of the Aqueduct which would operate by gravity. Cost estimates for delivery to the Oeste subarea are presented in Table 18.
TABLE 18

ESTIMATED COST OF RECHARGE FACILITIES IN THE OESTE SUBAREA

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost</th>
<th>Annual Costs</th>
<th>Debt Service(1)</th>
<th>O&amp;M</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oeste Recharge #1 - Pumping</td>
<td>11,900</td>
<td>1,100</td>
<td>480</td>
<td></td>
<td>1,580</td>
</tr>
<tr>
<td>Oeste Recharge #2 - Pumping</td>
<td>5,400</td>
<td>500</td>
<td>117</td>
<td></td>
<td>617</td>
</tr>
<tr>
<td>Oeste Recharge #3 - Gravity</td>
<td>4,600</td>
<td>400</td>
<td>60</td>
<td></td>
<td>460</td>
</tr>
</tbody>
</table>

(1) Based on amortization at 7% for 20 years.

Morongo Basin Facilities

Extension of the Morongo Basin Pipeline would provide the conveyance facility to deliver imported water supplies to recharge facilities to be located in the Means/Ames Basin, the Warren Valley Basin and the Joshua Tree Basin. It is assumed that facilities would be constructed to provide service to each of these basins. The cost estimates for the Joshua Tree facility and Warren Valley Basin facility are interdependent in that the cost of the joint transmission line extension for the two areas is included in the Warren Valley Basin estimate.

Cost estimates for the Morongo Basin Pipeline extension and recharge facilities are summarized in Table 19.

TABLE 19

ESTIMATED COST OF RECHARGE TO THE MORONGO BASIN/JOHNSON VALLEY SUBAREA

<table>
<thead>
<tr>
<th>Description</th>
<th>Capital Cost</th>
<th>Annual Costs</th>
<th>Debt Service(1)</th>
<th>O&amp;M</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morongo Recharge #1(1)-Means/Ames Basin</td>
<td>2,200</td>
<td>200</td>
<td>9</td>
<td></td>
<td>209</td>
</tr>
<tr>
<td>Morongo Recharge #2(1)-Warren Valley Basin</td>
<td>9,500</td>
<td>900</td>
<td>44</td>
<td></td>
<td>944</td>
</tr>
<tr>
<td>Morongo Recharge #3(1)-Joshua Tree Subbasin</td>
<td>2,800</td>
<td>300</td>
<td>20</td>
<td></td>
<td>320</td>
</tr>
</tbody>
</table>

(1) Source: Boyle Engineering, March 1993
(2) Based on amortization at 7% for 20 years.
Future Facilities

The estimated capital costs of drilling wells and delivering previously stored ground water to the Mojave River Aqueduct, is $700,000. The estimated annual operation and maintenance costs is $97,000 per year. The estimated capital costs of constructing the backbone distribution system to deliver imported water and ground water to major purveyors, is $18,700,000. The estimated annual operating cost would be around $280,000. No cost estimates were made for providing peaking and treatment facilities. As stated earlier, it is not likely that these future facilities would be constructed prior to 2015.
SECTION IX
FINANCING ALTERNATIVES

The financing issues to be faced by Mojave Water Agency (MWA) depend in large part upon the Regional Water Management Plan (Plan) adopted by MWA and the time frame in which the adopted Plan is to be implemented. Just to reduce a portion of the current overdraft would require that MWA purchase each year the maximum amount of SWP water available to MWA and provide for any additional administrative costs. The amount of additional payments and financing would depend on the measures adopted to eliminate ground water overdraft and the extent of MWA’s involvement in conveyance and distribution of water in the Mojave River area and the Morongo Basin/Johnson Valley.

Payment and financing alternatives for the Mojave River area (and associated subareas) and the Morongo Basin/Johnson Valley (MB/JV) area are independent even though both areas are currently in a state of ground water overdraft and require substantial expenditures for corrective measures. For example, payment and financing for the Morongo Basin Pipeline project currently under construction, is in place through a general obligation bond issue approved by the voters in Improvement District M and agreements between the participants and MWA. Additional facilities in the Morongo Basin/Johnson Valley area are planned to be funded by local entities, not MWA. The proposed stipulated judgment for the Mojave Basin area directs MWA to plan, finance and construct facilities in the Mojave River area and a recommended financing and construction plan must be prepared and submitted to the Court by February 1, 1995.

FUNDING REQUIREMENTS

MWA currently has obligations to pay its share of the fixed costs of the State Water Project (SWP) and variable SWP costs to the extent it orders and takes delivery of SWP water. In addition, MWA has annual administrative expenses, special studies expenses and is responsible for repaying construction costs of the Morongo Basin Pipeline (MBP) through Improvement District M. In the future, MWA will have operation and
maintenance obligations for the MBP, may incur expenses associated with purchasing additional sources of water and may be required to fund the construction and operation of additional facilities to distribute and spread water within MWA.

MWA's Act authorizes MWA to collect revenues in a variety of ways to fund current and future costs.

**SOURCES OF REVENUE**

Section 16 of MWA's Act states the following: "The Agency may annually levy an assessment against pumping within the agency and shall fix and collect rates and charges for water sold by the agency ...". Also the same section of the Act states that MWA may levy ad valorem taxes to collect SWP and MWA administrative costs. MWA currently derives revenues from the tax base within the Agency through ad valorem taxes and has used ground water production assessments to raise funds for specific purposes. In addition, MWA's Act provides for the establishment of Zones of Benefit and Improvement Districts within the Agency. MWA can also enter into contracts with other entities.

**Ad Valorem Tax Assessments**

MWA has authorization in its Act for Ad Valorem tax assessments to repay the costs of MWA's contract with the State and MWA administrative costs. This authority has been implemented by the establishment of ad valorem assessments MWA #1 and MWA #2.

MWA #1, based on land only, is limited to a maximum rate of $0.1125 per $100 assessed value and is to be used only for MWA's share of SWP fixed costs and for SWP variable costs required to deliver SWP water. MWA #2 is based on land and improvements and is used pay for SWP costs not covered by MWA #1 and MWA administrative costs. The maximum rate allowed for MWA administrative costs is $0.025 per $100 of assessed value of all taxable property in MWA exclusive of personal property. Currently MWA is charging the full MWA #1 rate of $0.1125 per $100 of
assessed value. MWA #2 rate is presently $0.035 per $100 assessed value. MWA administrative costs are currently covered by an MWA #2 rate of $0.015 per $100 of assessed value which is $0.010 per $100 of assessed value less than the full $0.025 per $100 of assessed value authorized in MWA's Act. The remaining $0.020 per $100 of assessed value is used for SWP costs.

Current and projected assessed valuations are shown on Table 20. Under the requirements of Proposition 13, which was approved by the voters in 1978, the assessed value of land and improvements can increase by only a maximum of two percent per year unless the property is sold, at which time the assessed value is adjusted to the sales price. The projected assessed values shown in Table 20 are derived by establishing a relationship between population growth and assessed value since Proposition 13 was enacted. As indicated in Section III of this report, the population in MWA was projected using three levels of population growth: low, medium, and high. The corresponding average annual growth rates were 1.4 percent, 2.8 percent, and 3.4 percent respectively. Projected assessed valuations were calculated based on the historical relationship between assessed value and population growth at the medium level. The increase in assessed valuation in MWA over time is estimated to average slightly over 3.2 percent per year or to increase from $12.5 billion in 1993 to approximately $25.4 billion in 2015 as shown in Table 20.
### TABLE 20

**CURRENT AND PROJECTED ASSESSED VALUATIONS**
(millions of dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mojave River Area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Only</td>
<td>4,192</td>
<td>4,209</td>
<td>5,322</td>
<td>6,330</td>
<td>7,206</td>
<td>8,172</td>
</tr>
<tr>
<td>Land and Improvements</td>
<td>11,266</td>
<td>12,102</td>
<td>15,134</td>
<td>17,883</td>
<td>20,271</td>
<td>22,902</td>
</tr>
<tr>
<td><strong>Morongo Basin/Johnson Valley Area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Only</td>
<td>374</td>
<td>376</td>
<td>475</td>
<td>565</td>
<td>643</td>
<td>730</td>
</tr>
<tr>
<td>Land and Improvements</td>
<td>1,239</td>
<td>1,331</td>
<td>1,665</td>
<td>1,967</td>
<td>2,230</td>
<td>2,519</td>
</tr>
<tr>
<td><strong>Total MWA Area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Only</td>
<td>4,566</td>
<td>4,585</td>
<td>5,797</td>
<td>6,895</td>
<td>7,850</td>
<td>8,902</td>
</tr>
<tr>
<td>Land and Improvements</td>
<td>12,505</td>
<td>13,433</td>
<td>16,799</td>
<td>19,850</td>
<td>22,500</td>
<td>25,421</td>
</tr>
</tbody>
</table>

<sup>a</sup> Values for 1992-93 were obtained from San Bernardino County Assessors Office records.

Using the current and projected assessed valuation for MWA shown in Table 20 and assuming current MWA #1 and MWA #2 tax rates, current and future revenue from the tax base that can be used for MWA administrative and SWP costs can be estimated. This information is shown in Table 21. The amount of SWP water that can be purchased based on these assumptions is also shown. As can be seen from Table 21, based on current tax rates, MWA cannot purchase its full entitlement until sometime after 2010.
Table 21 shows the revenue requirement and MWA #1 and MWA #2 tax rate required for purchasing either 50,800 acre-feet (full entitlement) or 40,000 acre-feet (estimated average annual amount of water available) of SWP water. As shown in the Table, in order to order full entitlement in 1995, the current MWA #2 rate would have to be increased by $0.045 per $100 of assessed value and to order 40,000 acre-feet, the MWA #2 rate would have to be increased by $0.0369 per $100. As assessed values within MWA increase in the future, tax rates could be decreased. By 2010, revenues from MWA #1 and MWA #2 at current rates would be sufficient to purchase 40,000 acre-feet of SWP water. By 2015 the full entitlement supply could be purchased with MWA #1 and MWA #2 revenues at current rates. This is based on projected increases in assessed value as discussed earlier and shown in Table 20. Administrative costs would still be collected using MWA #2.
## TABLE 22

**REQUIRED TAX RATES TO PURCHASE SWP WATER**

<table>
<thead>
<tr>
<th>Year</th>
<th>40,000 AF</th>
<th></th>
<th>50,800 AF</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Cost ($1,000)</td>
<td>MWA #1 ($/100)</td>
<td>MWA #2 (2) ($/100)</td>
<td>Total Cost ($1,000)</td>
</tr>
<tr>
<td>1995</td>
<td>12,796</td>
<td>0.1125</td>
<td>0.0569</td>
<td>13,889</td>
</tr>
<tr>
<td>2000</td>
<td>13,318</td>
<td>0.1125</td>
<td>0.0405</td>
<td>14,684</td>
</tr>
<tr>
<td>2005</td>
<td>13,360</td>
<td>0.1125</td>
<td>0.0282</td>
<td>14,888</td>
</tr>
<tr>
<td>2010</td>
<td>12,986</td>
<td>0.1125</td>
<td>0.0185</td>
<td>14,560</td>
</tr>
<tr>
<td>2015</td>
<td>12,230</td>
<td>0.1125</td>
<td>0.0087</td>
<td>13,905</td>
</tr>
</tbody>
</table>

(1) Estimated fixed plus variable cost from DWR Bulletin 132-91.
(2) Excluding administration tax rate at $0.015 per $100 of assessed valuation.

### Ground Water Production Assessments

As stated, MWA has authorization under its Act to establish ground water production assessments and has used and is currently using a ground water production assessment to fund the preparation of the Regional Water Management Plan. The ground water production assessment was established in July 1991 and is $1.00 per acre-foot of ground water produced for agricultural purposes and $2.00 per acre-foot for ground water produced for Municipal and Industrial purposes.

Revenues from a ground water production assessment would not be restricted to MWA administrative and SWP costs as are MWA #1 and MWA #2 assessments. Ground water production assessments could be used, among other things, to fund debt service on new facilities, administrative costs, the purchase of SWP water and the purchase of additional water supplies. For example, if MWA decided to order and take delivery of either its full annual entitlement of 50,800 acre-feet or the estimated average annual SWP supply of 40,000 acre-feet, but did not want to increase its tax rates, the ground water production assessment could be used to cover the cost of water not covered by the ad valorem assessment. To demonstrate this Table 23 shows the estimated ground water production in MWA through 2015, the cost of SWP water which is not covered by the assessment and the cost per acre-foot for each level of deliveries. As is shown
on Table 23, assuming full entitlement deliveries, in 1995 the ground water production assessment would be $24 per acre-foot and would reduce to zero after 2010 based on current tax rates and an annual 3.2 percent increase in assessed values.

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated Ground Water Production (AF)</th>
<th>Revenue Required ($1,000)</th>
<th>Production Assessment ($/AF)</th>
<th>Revenue Required ($1,000)</th>
<th>Production Assessment ($/AF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>254,600</td>
<td>4,951</td>
<td>19</td>
<td>6,045</td>
<td>24</td>
</tr>
<tr>
<td>2000</td>
<td>256,200</td>
<td>3,437</td>
<td>13</td>
<td>4,803</td>
<td>19</td>
</tr>
<tr>
<td>2005</td>
<td>271,800</td>
<td>1,633</td>
<td>6</td>
<td>3,161</td>
<td>12</td>
</tr>
<tr>
<td>2010</td>
<td>285,600</td>
<td>0</td>
<td>0</td>
<td>1,229</td>
<td>4</td>
</tr>
<tr>
<td>2015</td>
<td>301,100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Zone of Benefit Assessments

Section 38 of MWA’s Act authorizes the formation of Zones of Benefit within MWA. Section 38 states that if a zone of benefit is formed, MWA "may annually thereafter levy an assessment upon the property within the zone, excluding personal property, in such amounts as shall pay not less than the variable costs of purchasing water under any contract entered into with the state for the purchase of water and delivery and use of that water." This section has been interpreted to authorize the formation of Zones of Benefit within MWA for the purpose of paying for water imported to MWA under a contract with the State and to pay for facilities and costs of transporting such water for use within the Zone of Benefit. The only requirement is that the zone of benefit assessment must be at least equivalent to the variable cost of delivering imported water under a contract with the State.
MWA may establish a Zone of Benefit "within any area within which the use of water affects or is affected by the natural available water supply within the agency...". The location and area of the proposed Zone of Benefit must be described in sufficient detail so that property owners may determine if they are within the proposed zone. A notice of intention to establish the zone must be published and a public hearing must be held. Landowners may request exclusion. MWA's board of directors establish the zone if not more than 25 percent of eligible voters file written protests to the formation of the zone. If more than 25 percent of eligible voters protest, an election must be held unless the board of directors decides not to establish the zone. If an election is held, a majority of voters must approve in order to establish the zone.

Improvement Districts

MWA has authorization in Section 40 of its Act to form Improvement Districts within its boundaries. MWA's board of directors can form Improvement Districts within MWA by passing a resolution stating the purpose for which the district is to be formed, the estimated expense of carrying out such purpose, that taxes for carrying out such purpose will be levied and that a map showing the location and area of the proposed district is on file for inspection by any interested person. The board must hold a duly noticed hearing on the formation of the district. If written protests by owners of more than one-half of the value of the property within the proposed district are received, the district cannot be formed. An election must be held regarding the formation of the district if 10 percent or more of the voters within the proposed district request such an election. If a majority of the voters in the election approve formation of the district, its formation can be completed.

Once an Improvement District is formed, an election can be held for the purpose of issuing bonds which, if approved become legal obligations of the agency for the improvement district.

Improvement District M (ID-M) was formed to construct and finance the construction of the Morongo Basin Pipeline (MBP). Forty percent of the pipeline cost is collected
through taxes within ID-M. The rest of the cost is collected from participating water districts within ID-M.

Creating improvement districts would be a way of obtaining authorization from benefitted parties for the construction of facilities and the allocation of costs of such facilities to specific benefitted areas.

Contracts

Among the powers of MWA specified in its Act is the power to "enter into contracts...". The power to enter into contracts could be useful to MWA as a source of revenue to pay for the purchase of SWP water or pay for debt service and operation and maintenance costs of new facilities to transport water within MWA.

For example, MWA might enter into a contract with a city, water district or individual and the Watermaster to deliver water into the underground in advance of the entity's replacement obligation under the stipulated judgment. The entity would pay for the water and the water would be effectively banked in the ground water basin until needed to satisfy the entity’s future obligation to replace water. This benefits MWA in that it provides an income to purchase water and pay for facilities. The entity benefits by purchasing water before costs increase and would remove some of the uncertainty inherent in establishing water rates to its customers.

Direct Sale of Water

MWA’s Act allows MWA to sell water to recover the cost of importing and distributing such water. MWA has not yet sold water directly to purveyors or individual water users. To do this MWA would have to enter into contracts with such users as described above. In addition, in the future, MWA would likely sell water to the Watermaster so the Watermaster could in turn sell it to producers that had pumped ground water in excess of their free production allowance. This source of revenue for MWA could be used to pay for the cost of importing water, MWA administrative costs and all costs associated with the distribution of water within MWA.
FINANCING MEASURES

As discussed above, in addition to taxing authority, MWA has the authority to form improvement districts, hold bond elections and issue bonds if the election is successful. The Agency also has the authority to issue negotiable promissory notes with a limitation of $5,000,000. Other possibilities which MWA staff are currently investigating include the U.S. Bureau of Reclamation Small Project Loan Program, and federal grants.

General Obligation Bonds (GO Bonds)

MWA may issue general obligation bonds for water facilities in an improvement district or for MWA as a whole as provided in Sections 29 and 21 of the Act. Approval of two-thirds of the electorate is required. The bonds are secured by the power to levy a tax on all property except personal property. Some of the major considerations of GO bond financing are:

- The tax levy can be reduced by other revenues such as water sales, pumping assessments, development fees (where authorized) and contract payments from purveyors.

- Voted general obligation bonds will provide the lowest-cost tax-exempt financing for all purveyor areas, including private companies and mutual water companies, on a regional basis.

- A general obligation bond authorization is the only way to create a new source of revenues from property taxes, and permits greater flexibility in development of a financing plan.

Revenue Bonds

Under the revenue bond concept, the revenues from a project are pledged as security for a bond issue. The agency may issue revenue bonds under the Revenue Bond Law of 1941 (Government Code §54300), which requires a 50 percent majority approval.
Revenue bond financing is more costly than GO Bond financing because revenue bonds are considered less secure than GO Bonds. This is because GO Bonds are secured by the property value in the district and revenue bonds are secured only by the revenues of the Agency. Revenue bonds typically have reserve requirements that GO Bonds do not have and typically have higher interest rates than GO Bonds. However, revenue bond authorization is much easier to obtain since it requires a simple majority approval of 50 percent plus one of all votes in an election.

State Loans

The DWR can authorize low-interest loans for water projects in California under the State’s Water Conservation Bond Act of 1988. Currently the maximum loan for a project is $5 million and the interest rate is less than 4 percent. MWA has filed application for loan funds for the enlargement of Reach 1 of the Morongo Basin Pipeline. This type loan may be available for a portion of future MWA capital costs.

Federal Loans

The U.S. Bureau of Reclamation (USBR) provides loans for the construction of small water projects under P.L. 984. MWA has filed a Letter of Intent with the USBR to apply for a small project loan. Current limitations on this program are about $30 million. The USBR loan program is currently under review.

Federal Grants

Federal grant monies may be available for projects related to urban water supplies or for low income areas. Ground water contamination in MWA caused by federal activities at George Air Force Base and at the Marine Corps logistic depots at Nebo and Yermo may also be the basis for obtaining federal grants for facilities which would allow full use of the ground water basin in the Mojave River area and contain the areas of contamination.
ALLOCATION OF COSTS

As was discussed previously, MWA has considerable flexibility in its methods of financing capital improvements and sources of revenue to pay for MWA administrative costs, SWP water supplies, additional water supplies, debt service, and operations, maintenance, power and replacement costs of new facilities. The selection of a source or combination of sources of revenue to pay these costs is a policy matter to be decided by the MWA Board of Directors. Usually costs are allocated on the basis of benefits received.
MWA has, in recent years, aggressively pursued a course of action to develop long-range planning goals, utilize its entitlement to SWP supplies, develop conveyance facilities to transport imported water supplies to areas of need and participate in development of the concepts and physical solution to the adjudication of rights to pump ground water in the Mojave River area. The regional water management plan presented herein was developed in this dynamic environment and is intended to be flexible in defining the system and management alternatives available to MWA in meeting the long-range water needs of its constituency. One of the keys to the success of the planning effort is the need for review and update of the Plan on a regular basis, which initially may be every two to three years.

The Plan recommended herein has the following broad objectives:

1. To eliminate overdraft of the ground water basins in the Mojave River area and Morongo Basin/Johnson Valley area by obtaining additional imported water supplies and/or reducing consumptive water demands.

2. To meet future water demands by obtaining additional imported water supplies and/or reducing consumptive water demands.

3. To protect the ground water basins from degradation of water quality.

4. To participate in the implementation of any judgment resulting from ongoing Mojave River adjudication.

5. To be responsive to changing conditions by modification of the Plan as necessary.
6. To work closely on key issues, particularly water conservation, with local agencies and water purveyors.

7. To accomplish the above in a cost-effective, environmentally sound manner within the financial capability of the community.

PHASES OF THE PLAN

It is proposed that implementation of the Plan objectives be accomplished in three phases. The payment and financing methods proposed are those allowed by the existing MWA Act. If the MWA Act is amended to allow additional payment and financing methods, modifications can be made to the Plan. In brief, the three phases can be summarized as follows:

Phase 1

Phase 1 involves establishing a monitoring program to develop a data base of all factors affecting water supplies and demands, maximizing the purchase, delivery and ground water recharge of SWP water and implementing the proposed judgment adjudicating water rights in the Mojave River area by establishing zones of benefit and improvement districts, if necessary, to provide the mechanism for repayment of the costs of the programs. Recommended facilities from Alternative 2, described in Section VIII, including the Mojave River Aqueduct, the El Mirage Pipeline and the Morongo Basin Pipeline and associated recharge facilities would be constructed and operational during this phase. In addition, a water conservation program to reduce consumptive use would be established, MWA would seek changes in its Act and investigations of projects to develop additional imported water supplies for MWA would be made.

Phase 2

Phase 2 involves establishing additional zones of benefit and improvement districts, if necessary, and implementation of feasible water importation projects. Drilling wells and constructing pipelines from the wells to the Mojave River Aqueduct and the
Morongo Basin pipeline could also be included in Phase 2 but would likely occur outside the 2015 planning horizon.

Phase 3

Phase 3 involves implementation of any imported water delivery agreements, water storage agreements, and water treatment agreements with purveyors and water allocation policies, if necessary. Phase 3 is considered to be outside the planning horizon unless there are major changes to the proposed judgment or it is not entered by the Court.

The principal elements of the recommended Plan are listed on Figure 14 and described in the following sections. The recommended structural features of the Plan are shown in red on Figure 15. Facilities considered but not recommended are shown in black.

Phase 1 - Structural Features

A. Drilling Wells for Monitoring Programs.

MWA will have to estimate ground water flows from the Este and Oeste subareas into Alto, from Alto subarea into the Centro subarea, from Centro into the Baja subarea, and from Baja into the area outside of the MWA area and between subareas in the Morongo Basin/Johnson Valley areas. Existing wells will be used to the maximum possible extent but some drilling of new wells is anticipated to obtain sufficient information to measure ground water flow from one subarea to another. Drilling would follow a detailed survey of existing wells that could be used to monitor flows across subarea boundaries. Well drilling should be coordinated with USGS and possibly undertaken by USGS under contract with MWA.
### PHASES OF RECOMMENDED REGIONAL WATER MANAGEMENT PLAN

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<th>Structural Features</th>
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<td>Increase recharge of natural supplies (channel modifications, dry lakes, etc)</td>
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<td>Ground water recharge in Centro and Baja from Mojave River Aqueduct</td>
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<td>Ground water recharge in Este (Lucerne) from MBP</td>
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<td>Ground water recharge in Oeste (El Mirage)</td>
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<td>Recharge in Morongo Basin with MBP Extension</td>
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<td>Ground water extraction and delivery to Mojave River Aqueduct</td>
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<td>Delivery of imported and ground water to water users</td>
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<td>Meeting peaking requirements and constructing water treatment facilities</td>
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<th>Nonstructural Features</th>
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<td>Release to Mojave River from Silverwood</td>
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<td>Water monitoring program</td>
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<td>Purchase of SWP water</td>
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<td>Well construction permit process</td>
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<td>Water conservation program to reduce consumptive use</td>
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<td>Investigation of additional water importation projects</td>
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<td>Zones of Benefit to collect benefit assessments</td>
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<td>Improvement districts to repay bonds</td>
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<td>Implement feasible water importation projects</td>
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<td>Contracts with purveyors</td>
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<td>Water allocation policies</td>
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B. Release to Mojave River (Alto) from Morongo Basin Pipeline.

Completion of the initial reach of the MBP will provide for the diversion of water from MWA Turnout #3 and subsequent release to the Mojave River Channel near Rock Springs Road. Completion of the four-mile pipeline from the MBP to the recharge facilities to be constructed south of the MBP would provide better control of the recharge operations and utilize more of the dewatered ground water storage in the Alto Subarea than would the north site. Detailed analyses would be performed to evaluate the benefits of the south site compared to the additional costs.

Turnouts from the MBP could also be provided to allow for release of imported water to small stream channels or basins located in the eastern portion of Apple Valley for ground water recharge. These facilities are not shown on Figure 15 because detail studies of the stream channel and subsurface geology are required to determine suitable sites.

C. Increase Recharge of Natural Supplies

Channel improvements would be limited to the Mojave River in the Baja Subarea. This is consistent with the proposed judgment referred to in Section IV which states that no project should be constructed that would directly reduce storm flows that would otherwise flow to a downstream subarea.

Capture of storm flows in dry lake areas and diversion through temporary facilities does not appear economically feasible, based on preliminary analyses. It is recommended, however, that more detailed analyses be conducted to evaluate this possibility as more data regarding the amounts of runoff collected in the "dry" lake beds following storm events are collected through the monitoring program.
D. Ground Water Recharge in Centro and Baja from Mojave River Aqueduct.

The Mojave River Aqueduct would be constructed to the Minneola recharge facility to be located downstream from the Calico-Newberry Fault. Recharge facilities would also be constructed near Hodge, Lenwood, and Daggett.

Turnouts could be provided from the Mojave River Aqueduct to allow for releases of imported water supplies to the channel or small basins for ground water recharge and to provide for mitigation of local ground water problem areas. Any basins constructed in the Alto or Centro Subareas would be designed to handle only the imported water supplies as capture of local storm flows is not permitted in the proposed judgment.

E. Ground Water Recharge in Este (Lucerne) from Morongo Basin Pipeline.

Completion of the Morongo Basin Pipeline would provide a conveyance facility that could be used to deliver imported water to the Este recharge facilities. It is recommended that MWA take the lead in developing agreements with the MBP participants to permit use of the facility for imported water delivery to Este recharge facilities. The recharge site located east of the Helendale Fault is recommended because most of the water demands are located in that area. MWA may decide to construct facilities both east and west of the Fault that would have the same recharge potential as the recommended facility. This would not have a significant effect on the estimated costs discussed later in this section.

F. Ground Water Recharge in Oeste (El Mirage).

A conveyance facility from Turnout #1 of the State Aqueduct to the El Mirage area should be constructed to supply imported water to this area.
Ground water recharge of imported supplies in the Oeste Subarea would be accomplished by the construction of recharge facilities south of the California Aqueduct, a pumping plant and a pipeline between the Aqueduct and the basins. The south site is the recommended alternative in order to utilize dewatered ground water storage capacity. However, an evaluation of the benefits of this alternative compared to the costs would be performed. As an interim measure, recharge could be accomplished by diverting from the Aqueduct to stream channels located to the north.

G. Ground Water Recharge in Basins in Morongo Basin.

The Morongo Basin Pipeline Extension would convey water from the terminal reservoir on the Morongo Basin Pipeline to recharge facilities in the Means, Warren and Joshua Tree ground water basins. The recharge facilities would range from 10 to 15 acres in size.

Phase 1 - Nonstructural Features

A. Release to Mojave River from Silverwood.

Until conveyance and recharge facilities are completed, it is recommended that MWA continue to release available imported water supplies from Silverwood for ground water recharge pursuant to the terms of the agreement with DWR. The charge for use of the reach from MWA Turnout #3 to Silverwood is $9.25 per acre-foot.

B. Water monitoring program.

In order to manage local and imported supplies and provide the information required for the Mojave River adjudication, data will be needed on all parameters that affect the hydrologic inventory such as surface water flows, ground water pumpage, ground water levels, waste
water discharges, water quality, and water storage in the aquifers underlying MWA. Data collected by others will be utilized by MWA to the maximum extent possible. The U.S. Geological Survey should be relied upon to provide the necessary surface water measurements. Purveyors should provide the necessary ground water data from their wells and the Victor Valley Wastewater Reclamation Authority, and others, should provide information on wastewater discharges. The MWA office should be the central depository for all water data collected in its area or that affects the area. The MWA staff should prepare annual reports summarizing and analyzing the data and prepare special reports as required. Some additional staff and additional costs will be needed to carry out a comprehensive monitoring program.

C. Purchase of SWP Water.

MWA should purchase the maximum amount of SWP water available to it each year. With minor exceptions, through 1992 the SWP costs paid to date have been for MWA's share of the fixed costs of SWP, and have been paid for by an ad valorem tax on the MWA tax base. This method of repayment should be continued.

Variable costs for the Mojave River area should be financed to the extent possible by the method stated in the proposed judgment for the Mojave River area. Under this method, the Watermaster would purchase imported water for each subarea sufficient (1) to meet the water obligation to the downstream subarea that is not met by the local water supply, plus (2) to meet the sum of uses by producers in the subarea that exceeds the sum of free production allowances in that subarea. The variable costs for the Morongo Basin should be obtained by passing the SWP charges directly to the users of the Morongo Basin Pipeline.

MWA should begin to develop the detailed report on alternative facilities to deliver supplemental water to the various subareas as required by the
proposed judgment. The detailed report on facilities and financing must be submitted to the Court by February 1, 1995. The Plan discussed herein constitutes the bases for the required report but cost estimates presented herein should be upgraded to feasibility level and the plan for financing and cost repayment developed.

MWA could establish Zones of Benefit for each subarea. In the event that the amount of imported water ordered by MWA exceeds the amount of water ordered by the Watermaster, the balance of unpaid costs for the imported water could be assessed to each subarea based on the benefit to the subarea or obtained through the various authorities granted MWA in its Act.

Until the draft judgment is in place, MWA should monitor the amount of water used by each subarea. It could then use its production assessment authority to raise funds for SWP costs that would have been paid for by the Watermaster under the judgment. It should be noted that a production assessment to be charged by MWA would be on the gross amount of pumping by each water user, while the production assessment under the proposed judgment would be based on the amount of ground water production in excess of the Free Production Allowance.

D. Legislative Changes to MWA Act.

Several changes to the MWA Act may be required to provide additional tools for funding costs of water purchases and conveyance and recharge facilities. These changes are discussed later in this section but could include provision for additional sources of revenue such as capacity fees, water availability fees and stand-by charges.
E. Water Quality Protection Programs

Protection of the quality of the ground water resources underlying MWA is essential for successful implementation of the Plan. It is important for MWA to become involved in new well permitting, abandonment and well site protection programs within its boundaries. This could best be accomplished by working with San Bernardino County authorities to develop cooperative programs relating to approval of construction of new wells, proper well abandonment and well site protection programs. These programs are essential for MWA to assure that ground water quality is protected as the Plan is implemented. MWA should consider developing these programs unilaterally if County resources are unavailable.

F. Water Conservation Program to Reduce Consumptive Use

MWA should appoint a staff person as Water Conservation Administrator. The Administrator would have the responsibility of developing policies and working with water purveyors and the community to implement an active and successful water conservation program in MWA. This would include the development of a "Best Management Practices" program for MWA with emphasis on conservation practices that reduce consumptive use.

MWA should amend its Act, if necessary, to allow conservation costs that reduce consumptive use to be funded on a similar basis to acquisition of new water supplies. The major criterion for implementing a water conservation project should be that the cost in dollars per acre-foot of the water conservation project be less than the cost of acquiring an acre-foot of additional imported water.
G. Investigation of Additional Water Importation Projects.

MWA should implement a comprehensive program to obtain additional imported supplies. This would include analysis of the options of making its own investigations of imported supplies or joining with other Southern California agencies in the investigative effort.

H. Zones of Benefit to Collect Benefit Assessments.

MWA should establish zones of benefit in all subareas of the Mojave River Area that benefit from the ground water recharge programs. The procedures to be followed are described in the MWA Act.

I. Improvement Districts to Repay Costs of Facilities.

MWA should establish improvement districts in all subareas of the Mojave River Area to pay for the costs of facilities. The procedures to be followed are described in the MWA Act.

Phase 2 - Structural Features

A. Ground Water Extraction and Delivery to Mojave Water Aqueduct and Morongo Basin Pipeline.

The drilling of new wells and construction of facilities to deliver ground water to the Mojave River Aqueduct and the Morongo Basin Pipeline would be a significant increase in MWA responsibility and activities. It would give the MWA service area additional flexibility in terms of water supply availability. The amount of water delivered would be equal to the amount of imported water spread into the ground water basin less any losses or flow to the downstream areas. Construction of ground water extraction facilities by MWA is not considered likely during the planning period (2015).
Phase 2 - Nonstructural Features

A. Additional Zones of Benefit to Collect Benefit Assessments.

MWA should reevaluate zones of benefit established in Phase 1 for all subareas of the Mojave River Area that benefit from the ground water recharge programs and establish new zones if necessary. The procedures to be followed are described in the MWA Act.

B. Additional Improvement Districts to Repay Costs of Facilities.

MWA should reevaluate improvement districts established in Phase 1 and, if necessary, establish additional improvement districts in the Mojave River Area to pay for the costs of facilities. The procedures to be followed are described in the MWA Act.

C. Implement Feasible Water Importation Projects.

Water importation projects, in addition to the SWP, investigated in Phase 1 would be implemented in Phase 2. Projections of overdraft conditions indicate that about 53,000 acre-feet per year of water in addition to SWP supplies will be required to balance the overdraft to meet future growth through year 2015.

Phase 3 - Structural Features

A. Delivery of Imported Water to Water Users.

In addition to pumping and delivering previously spread imported water, MWA has the authority to enter into agreements with purveyors to directly deliver them imported water without first spreading the water. Implementation of this program would have to be consistent with the terms of the proposed judgment.
B. Meeting Peaking Requirements and Constructing Water Treatment Facilities.

In the future, the needs within MWA may be such that it would be desirable for MWA to undertake the responsibility of meeting peak water demands and to construct water treatment plants to serve some communities. It is not considered likely that this action would be implemented during the planning horizon (2015).

Phase 3 - Nonstructural Features

A. Contracts with Purveyors.

To accomplish the above Phase 3 structural features would require that MWA enter into agreements with purveyors. These contracts should contain language establishing the financial terms and conditions that assure a source of revenue for MWA.

B. Water Allocation Policies.

Development of water allocation policies will require additional information on:

1. Future availability of water supply from SWP.
2. Reduction of consumptive use achieved by water conservation programs.
3. Amounts of additional water to be obtained from water transfers inside and outside MWA, exchanges and banking projects.
4. Future increases in urban demand due to development.
5. Future reductions in agricultural demand.

After integration of the above factors, combined with increased knowledge of the yield and reliability of local supplies developed from
the Phase 1 monitoring program, the MWA Board can determine whether MWA will be able to meet demands and eliminate overdraft. If there is still an overdraft after analysis of the above factors, MWA should approve one or more of the allocation policies outlined in Chapter VI to reduce water demands sufficient to eliminate the overdraft condition within a reasonable time period.

FINANCING AND PAYMENTS FOR REGIONAL WATER MANAGEMENT PLAN

The principal objectives of the financial program to be developed by MWA with or without the adjudication is to develop the means to purchase the maximum amounts of available SWP water and establish an equitable balance between costs and benefits. This will be particularly difficult in the early years of Plan implementation, before all recommended facilities are operational and MWA is trying to import the maximum available SWP supplies for overdraft correction. Also in the early years, most of the revenue required to purchase the imported supplies from the SWP for the Mojave River Area and the Morongo Basin/Johnson Valley Area would be derived from the tax base sources historically used by MWA and discussed in Section IX and water purchased by users. The two principal objectives of any MWA financial plan would be to provide the means for purchasing imported water and for repayment of funds used for the construction of recommended facilities.

SWP Entitlement Purchases

Presented on Figure 16 is a comparison of projected tax base revenues with projected SWP water costs. As shown, there would be a revenue deficiency from the present until about 2009. The bases for the curves shown in Figure 16 are discussed below.

Revenues from MWA #1 and the portion of MWA #2 not dedicated to payment of MWA administrative costs are shown increasing over time as assessed values increase. The 1993 rates for both MWA #1 and MWA #2 are used in the projection of revenues. Also shown is a small increment of revenue from water sales to the Morongo Basin/Johnson Valley area, based on the variable cost of SWP water.
SWP fixed and variable costs, based on DWR Bulletin 132-91 projected costs and the purchase of 50,800 acre-feet per year through the year 2000 and 40,000 acre-feet per year thereafter are shown as the top curve on Figure 16.

Revenues derived from the MWA tax base and current rates for MWA #1 and MWA #2 would be sufficient to repay all SWP costs by the year 2009. However, the shaded area on Figure 16 labeled "Revenue Deficiency" is revenue that would have to be derived through tax rate increases in MWA #2, zone of benefit assessments, production assessments or other funding sources.

Discussed in Section IX were the various funding mechanisms available to MWA under its Act. The effects of implementing these various mechanisms are illustrated in the following figures. Establishment of zones of benefit and assessing those benefitting from the delivery of imported water would be one means of funding the annual revenue deficiency. This is shown on Figure 17. Another means to fund the revenue deficiency would be to establish a water production assessment on gross ground water production. The water production assessment rate is illustrated on Figure 18. A third way to fund the deficiency would be to increase the MWA #2 assessment rate. The required increase is shown on Figure 19.

**Purchases of Additional Imported Supplies**

Water supplies in addition to the MWA SWP entitlement supplies will be required to eliminate the projected overdraft conditions in MWA. The acquisition and delivery costs for the additional supplies could be funded under existing MWA authorities (zones of benefit or production assessments) or by selling these additional supplies to the watermaster for delivery as replacement water as defined in the proposed judgment.

Replacement water requirements were discussed in Section IV and shown on Figure 11. It is noted that the estimates of replacement water requirements cannot be considered particularly reliable until the verification of the ground water production is completed in the late summer of 1993. It is also noted that transfers of base production rights within MWA will delay the need to import water for replacement sales to the
MOJAVE WATER AGENCY
REGIONAL WATER MANAGEMENT PLAN
ZONES OF BENEFIT REVENUE TO RECOVER ALL OF THE REVENUE DEFICIENCY
BOOKMAN-EDMONSTON ENGINEERING, INC.
JUNE 1993
watermaster. However, the funding mechanisms for the purchase and delivery of replacement water are defined in the proposed judgment and would be utilized by MWA.

Water purveyors may wish to purchase available imported water supplies for delivery to a storage account under the provisions of the proposed judgment. Revenues for the purchase of water for predelivery to a storage account would be derived from the purchaser under the terms of an agreement with MWA. It is recommended that MWA develop the principles for the storage agreements early in the implementation process.

ALLOCATION OF COSTS

As was discussed in Section IX, MWA has considerable flexibility in its methods of financing capital improvements and in its sources of revenue to pay for administrative costs, SWP water supplies, additional water supplies, debt service, and operations, maintenance, power and replacement costs of new facilities. The selection of a source or combination of sources of revenue to pay these costs is a policy matter to be decided by the MWA Board of Directors. Usually costs are allocated on the basis of benefits received.

It was determined at project inception that since the MBP would benefit only the Morongo Basin area, the cost of the MBP should be paid only by the Morongo Basin area. This was achieved through the formation of an improvement district. This approach could also be used to pay for the development of facilities that benefit other subareas of the MWA. Improvement districts could be formed that correspond to subarea boundaries established for the adjudication. This would allow the cost of facilities that benefit each of these areas to be charged directly to the subarea as in the case of the MBP. As indicated in Section VIII, the initial reach of the MBP has been enlarged to provide for ground water recharge in Alto and could be used to convey imported water to Este. The cost of these modifications will be allocated to the benefitted subareas.
Along the Mojave River, the Alto, Centro and Baja Subareas each contribute to the overall ground water overdraft. The Baja Subarea contributes most to the total current overdraft conditions along the Mojave River while Centro subarea contributes the least. By the year 2015, it is projected that most of the overdraft will be in Alto and Centro will still exhibit the least amount of overdraft. The most effective way to correct the overdraft along the Mojave River is to construct a conveyance facility from the California Aqueduct to the recommended recharge facilities. Since relative contribution to the overdraft does not remain constant over time, a possible equitable way to share the cost of facilities that may be required to overcome the overdraft might be to allocate part of the costs of the facilities to the current overdraft and part of the costs to growth. The facilities costs allocated to the current overdraft could be charged to each subarea on the basis of its current contribution to the overdraft. Facilities cost allocable to growth could be charged on the basis of each subarea’s estimated future contribution to the overdraft. The vehicle for allocating these costs could be the formation of improvement districts.

Currently SWP costs are collected through ad valorem taxes. In the future these costs could be recovered through water sales to the Mojave River watermaster, purveyors and individual users. How costs are allocated in the future will in large part depend on the water management plan adopted by MWA.

CAPITAL AND ANNUAL COSTS OF THE PLAN

The estimated capital and annual costs of the alternative facilities were presented in Section VIII. The capital and annual costs of the recommended facilities and the nonstructural components of the Plan are presented in the following sections. Funding would be obtained utilizing a combination of the alternatives discussed in Section IX.

**Estimated Capital Cost of Facilities**

Presented in Table 24 are the estimated total capital costs of the recommended components of the Plan for the Morongo Basin/Johnson Valley area and the subareas of the Mojave River area that would be in place by 2010. The recommended facilities
<table>
<thead>
<tr>
<th>Description</th>
<th>Subarea</th>
<th>Estimated Costs ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral from Morongo Basin Pipeline and recharge site</td>
<td>Alto</td>
<td>25.9</td>
</tr>
<tr>
<td>Mojave River Aqueduct and Lenwood recharge site</td>
<td>Alto, Centro</td>
<td>42.1</td>
</tr>
<tr>
<td>Mojave River Aqueduct and Terminal recharge site</td>
<td>Baja</td>
<td>39.8</td>
</tr>
<tr>
<td>Lateral from Morongo Basin Pipeline and recharge site east of Helendale Fault</td>
<td>Este</td>
<td>3.8</td>
</tr>
<tr>
<td>El Mirage Pipeline and recharge site south of SWP Aqueduct</td>
<td>Oeste</td>
<td>11.9</td>
</tr>
<tr>
<td>Extension of Morongo Basin Pipeline and recharge sites in Means/Ames, Joshua Tree and Warren Valley Basin areas</td>
<td>Morongo Basin/Johnson valley</td>
<td>14.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>138.0</td>
</tr>
</tbody>
</table>
would be constructed over time based on present and future water demands and the ability of MWA to secure financing for the various Plan facilities. High priority would be given to the Mojave River Aqueduct as required in the proposed judgment and physical solution to the adjudication.

Estimated Annual Cost of the Plan

The annual costs include fixed costs such as the fixed cost associated with the MWA contract with the DWR for its SWP entitlement supplies, debt service on Plan facilities and, to a large extent, MWA administrative and operation and maintenance cost. Fixed costs are not dependent on the actual amounts of imported water purchased and delivered by MWA. The fixed costs of the additional imported supply is dependent on the timing of acquisition and the amount of water acquired.

Variable costs are dependent on deliveries of imported water from the SWP and additional supplies acquired by MWA. These supplies are needed now as shown on Figure 10 in Section III, but lack of facilities and financial resources may delay actual deliveries. Presented in Table 25 are the estimated annual costs of the recommended Plan based on water demands projected for 2010. Except for the fixed annual of the SWP entitlement supply, the costs shown in Table 25 do not include current MWA costs. The estimated annual costs of the water conservation program included in Table 25 would be about $75,000 per year for staff and about $20,000 for publications. Other costs would depend on specific projects undertaken. The costs could be financed by current taxing authorities as are current administrative costs.

Annual costs associated with the monitoring program are estimated to be about $300,000 based on increases in MWA staff of two engineers, two technicians and one clerical employee. It is noted that all, or a portion of the annual monitoring costs associated with the Mojave River area could be recovered under the terms of the proposed judgment.
### TABLE 25
ESTIMATED ANNUAL COSTS OF REGIONAL WATER MANAGEMENT PLAN FOR YEAR 2010

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ESTIMATED ANNUAL COSTS ($1,000)</th>
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<tbody>
<tr>
<td></td>
<td>DEBT SERVICE (1)</td>
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<tr>
<td>SUBAREA FACILITIES</td>
<td></td>
</tr>
<tr>
<td>Alto</td>
<td>$5,902</td>
</tr>
<tr>
<td>Centro</td>
<td>1,221</td>
</tr>
<tr>
<td>Baja</td>
<td>3,053</td>
</tr>
<tr>
<td>Este</td>
<td>355</td>
</tr>
<tr>
<td>Oeste</td>
<td>1,123</td>
</tr>
<tr>
<td>Morongo Basin/Johnson Valley</td>
<td>1,369</td>
</tr>
<tr>
<td>Facilities Subtotals</td>
<td><strong>$13,023</strong></td>
</tr>
</tbody>
</table>

MWA PLAN COSTS

- Water Conservation: $95
- Monitoring: 300

**MWA Plan Costs Subtotal**: $395

**Facilities and MWA Plan Costs Subtotal**: $15,919

WATER SUPPLIES

- SWP Water (3): $12,986
- Additional Water (4): 12,375

**Subtotal Water Supplies**: $25,361

**TOTAL ANNUAL COSTS**: $41,280

(1) Capital costs amortized at 7 percent for 20 years and allocated based on current overdraft and projected growth.
(2) Includes an estimated $500,000 for use of the Morongo Basin Pipeline.
(3) Based on purchase of 40,000 acre-feet of SWP water.
(4) Based on purchase of 45,000 acre-feet of additional imported water.
The initial study efforts related to the acquisition of additional water supplies would be on the order of $50,000 per year which would be funded as administrative costs. The estimated additional costs required to implement feasible projects are shown in the lower portion of the table.

MWA administrative costs and the fixed portion of imported water costs would be spread uniformly throughout MWA, at least in the early years of Plan implementation. As more data are developed as to replacement water requirements and future water demands, MWA could consider shifting some of the current and incremental Plan costs from the tax base to the water users. Care should be exercised in adopting this policy due to the fluctuating nature of the imported water supply. Placing a large portion of the MWA costs on the water user through a water sales policy would require the maintenance of a large reserve fund to provide for those years of deficient imported water supplies.

**PLAN IMPLEMENTATION**

Presented in Figure 20 is a tentative schedule showing the approximate timing for the implementation of various components of the Plan. The current MBP construction schedule and the anticipated schedule for MRA were both considered in the development of Figure 20. Consideration was also given to the projected need for replacement water discussed in Section IV. The priority items are the development of the repayment program and acquisition of funds for the capital costs, modification of the MWA Act as required and completion of activities related to the judgment.

**POSSIBLE CHANGES TO MWA ACT**

In order to implement the recommended plan in the most effective manner, consideration should be given to making the following changes to the MWA Act:
## Preliminary Implementation Schedule for Regional Water Management Plan

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<tbody>
<tr>
<td>Drilling wells for monitoring program</td>
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<tr>
<td>Release to Mojave River (Alto) from Morongo Basin Pipeline</td>
<td></td>
<td></td>
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<tr>
<td>Increase recharge of natural supplies (channel modifications, dry lakes, etc)</td>
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<tr>
<td>Ground water recharge in Centro and Baja from Mojave River Aqueduct</td>
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<tr>
<td>Ground water recharge in Este (Lucerne) from MBP</td>
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<tr>
<td>Ground water recharge in Oeste (El Mirage)</td>
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<tr>
<td>Recharge in Morongo Basin with MBP Extension</td>
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<tr>
<td>Ground water extraction and delivery to Mojave River Aqueduct</td>
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<tr>
<td>Delivery of imported and ground water to water users</td>
<td></td>
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<tr>
<td>Meeting peaking requirements and constructing water treatment facilities</td>
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<tr>
<td>Release to Mojave River from Silverwood</td>
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<tr>
<td>Water monitoring program</td>
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<tr>
<td>Purchase of SWP water</td>
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<tr>
<td>Legislative changes to MWA Act</td>
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<tr>
<td>Well construction permit process</td>
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<tr>
<td>Water conservation program to reduce consumptive use</td>
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<tr>
<td>Investigation of additional water importation projects</td>
<td></td>
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<tr>
<td>Zones of Benefit to collect benefit assessments</td>
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<tr>
<td>Improvement districts to repay bonds</td>
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<tr>
<td>Implement feasible water importation projects</td>
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<tr>
<td>Contracts with purveyors</td>
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<tr>
<td>Water allocation policies</td>
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</tbody>
</table>
Water Conservation

The primary water conservation goal for MWA is to reduce consumptive use of water outside of any dwelling or commercial structure. Reduction of an acre-foot of outside use means a like reduction in the purchase of imported water. This reduction, which would not apply to consumptive use reduction by phreatophyte control, can be accomplished if the MWA Board acts to:

1. Issue enforceable water conservation regulations,
2. Restrict the use of MWA water for certain purposes, and
3. Provide that funds can be expended and payments can be made for conservation projects that reduce the consumptive use of water.

The MWA Act would have to be amended to cover the funding of Item (3) above.

Water Quality Protection Programs

Although the Act makes general reference to the MWA role in protection of water quality, language could be added that would specifically define authority to become involved in the permitting process for new well construction and enforcement of regulations relating to the abandonment of wells. The MWA Act should be amended to clarify that MWA programs should assist protection of general water quality for all beneficial uses, including both surface and ground water. The Act should indicate that the means for the MWA to assist with water quality protection would include involvement with new well construction permitting programs and well abandonment programs. The Act should also identify the MWA as a logical entity to develop well head protection programs and assist local agencies with implementation thereof.

Amended language of this type could assist the MWA with appropriation of grant funding from State and Federal sources to develop and implement well head protection and well abandonment programs.
Water Deliveries to High Water Use Activities

The MWA Act empowers MWA in a broad sense to set water use standards and restrict deliveries that involve high water use activities. Clarification of the language of the Act should be considered.

Additional Sources of Revenues

The Board should consider Act changes to give MWA the authority to charge a one-time capacity fee or connection fee for new development and the authority to set annual standby charges for service.

Payment for Imported Water

The MWA Act allows MWA to enter into agreements with the State and other entities for water supplies but with regard to raising funds to pay for this water makes frequent references to "contract with the State." Since MWA will attempt to obtain imported water from sources of other than the SWP, the Act should be modified to delete the reference to the "contract with the State" and replace it with broader language that would include any imported water delivered to MWA. This would allow the MWA to collect money to repay the costs for any imported water supplies.

ENVIRONMENTAL COMPLIANCE

MWA is preparing the necessary environmental documentation for the Plan.

The Notice of Preparation (NOP) was distributed to interested agencies and the public for comment in May 1993. Public meetings were held as part of the EIR process. A scoping report was prepared after the conclusion of the public meetings. A draft program EIR will then be prepared that will include the previously identified environmental issues as well as issues identified in the public meetings or by other concerned entities.
The draft program EIR will describe the overall recommended plan as the "project" under CEQA. As individual projects are proposed at a later date, MWA could utilize the environmental documentation of the program EIR for the individual projects. If there are no additional factors to be considered, this will avoid the necessity for the preparation of additional EIRs. The draft EIR will analyze environmental impacts of alternatives to the Plan as well as the environmental impacts of the Plan. After review and approval by MWA, this Draft EIR will be released to the public and comments will be received at public hearings and through written comments.

A final EIR will be prepared that will incorporate responses to all the comments received on the Draft EIR.

Early in the process, a determination will be made if it is necessary to comply with the National Environmental Policy Act (NEPA). If so, it will be necessary to coordinate with federal agencies and comply with NEPA procedures.