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CITY COUNCIL REPORT POLICY AGENDA

DATE: April 23, 1990 DATE: May 22, 1990

TO: George W. Britton
Deputy City Manager ITEM: 4A

FROM: Michael Gritzuk, P. E.
Water and Wastewater Director

SUBJECT: PHOENIX WATER RESOURCES PLAN - 1990

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CITYWIDE

This report summarizes the major improvements, planning assumptions, resource issues and recommendations of the Phoenix Water Resources Plan - 1990 (1990 Plan). It also summarizes public comment on the 1990 Plan and requests conceptual approval by Council.

BACKGROUND

The 1990 Plan supports three Key Result Areas of the Phoenix Corporate Plan: Fiscal Strength, Environmental Management and Planning the City. It forms the basis for funding of water resource projects, provides programs designed to meet Arizona Department of Water Resources (ADWR) water conservation and supply requirements and supports planned growth. Attached is a draft of the Summary of the Plan titled, "Must the Roses Die?" (Summary). A copy of the 1990 Plan and the Summary are available in the City Council Conference Room.

The water demand projections of the 1990 Plan use the IWR-MAIN Computer Model and are based on the population and employment projections approved by the Maricopa Association of Governments in 1987.

As a result of Salt River Project's (SRP) new water supply policy, the 1990 Plan uses significantly different assumptions for on-project water supply projections than were used in the 1987 Plan. Projected SRP water supplies during droughts have also been revised upward in the 1990 Plan. Although the 1990 Plan indicates no projected normal year water supply deficits on-project, it is possible that some portion of SRP's augmentation costs could be passed on to Phoenix. Additional costs may also be incurred to fund acquisition of supplies for use during drought periods. If this occurs, an on-project water resources acquisition fee would need to be maintained to fund these new resources.

For the off-project planning area, the 1990 Plan uses a more conservative approach in determining the need for acquiring additional off-project resources than has been used in previous resources plans. This approach was based on an evaluation of the reliability of current and proposed water supplies and the Phoenix conservation programs now in various stages of implementation. Based on the low to moderate reliability of some programs, off-project resource acquisitions are timed such that total available

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off-project supplies will exceed projected hot-weather demands through the year 2040, assuming current conservation program savings. In previous plans, resource needs were based on projected demands assuming all Conservation Plan programs would be fully implemented and result in the projected water savings. The 1990 Plan emphasizes that although the implementation of some conservation programs may involve minor lifestyle changes, conservation can alleviate the need for significantly higher water costs in the future related to additional water rights, acquisition and additional treatment costs for reclaimed water use.

DISCUSSION

Plan Implementation

The 1990 Plan's implementation section recommendations include the following resources and conservation actions:

1) Implementation of the Roosevelt Irrigation District water exchange to provide additional supplies for off-project areas.

2) Encourage the acquisition of Cliff Dam replacement water.

3) Implement an ordinance to limit turfed areas in new commercial/industrial developments.

4) Implement an ultra low-flow plumbing code for new development.

5) Upon completion of the Groundwater Production Capacity Study, accelerate development of new wells and begin remediation of inactive wells that do not meet water quality standards.

6) Accelerate the plumbing fixture retrofit program.

Public Review of 1990 Water Resources Plan

On November 15, 1989, the City Council Natural Resources Subcommittee reviewed the 1990 Plan. Following a review of the public comment described below, the Natural Resources Subcommittee recommended conceptual approval of the plan on April 18, 1990.

Many questions were asked during the following presentations on the 1990 Plan. The most substantive comments received on the City's overall water resources planning approach during the meetings are summarized below:

1) Resources Plan Public Meeting - The City's conservation program should be more ambitious than the current and proposed program. Residential graywater reuse systems should be required through building codes. More stringent conservation programs should be imposed if necessary to prevent the need for groundwater transfers from rural communities in western Arizona.

2) Sierra Club Local Chapter - Water rates should be raised significantly to promote conservation and surplus revenues used to implement conservation programs. The 1990 Plan should include an analysis of the feasibility of all conservation alternatives, such as requiring the elimination of existing residential turf areas, turf retrofit rebate programs and graywater systems. In response to this comment, a section has been added to the 1990 Plan explaining the evaluation of program alternatives done during development of the 1986 Water Conservation Plan.

   In general, those present felt the City's existing program was not strict enough, and that conservation efforts should be increased so that no additional water transfers would be required to meet demand. It was suggested that additional development within the service area be limited to that which can be supported with current water resources, including maximum reuse of treated wastewater.

3) SRP Water Quality Committee - The Committee voiced the concern that the current resource planning approach of acquiring sufficient supplies to provide for projected growth is not consistent with the recent Futures Forum Environmental Task Force recommendation that growth be limited to currently available supplies. Questions were raised concerning the water quality impacts of increased groundwater pumping to meet demand during drought.

4) Meetings on Proposed Turf Ordinance - Several individuals and representatives from industry organizations suggested that water rates be increased to achieve conservation in lieu of programs such as the turf area limitations, which limit the individual's freedom of choice. More intensive educational efforts related to appropriate landscaping were also suggested as an alternative to mandatory conservation programs. On the other end of the spectrum, one individual suggested the City discontinue all conservation efforts, and acquire new water rights and implement water transfers as needed to meet additional demands.

As noted, some modifications to the 1990 Plan have been made as a result of these comments. A more thorough examination of conservation programs will be included in the next update of the Water Conservation Plan to be completed in 1991.

RECOMMENDATION

It is recommended that Council give conceptual approval to the Phoenix Water Resources Plan - 1990. This item was reviewed and approved by the Natural Resources Subcommittee at a public meeting held April 18, 1990.

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Attachment

cc: Standard Distribution List

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"DRAFT"

MUST THE ROSES DIE?

PHOENIX WATER NEEDS, SUPPLIES AND STRATEGIES

A Summary of
the Phoenix Water Resources Plan--1990

City of Phoenix
Water and Wastewater Department

Water Conservation and Resources Division

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At a public hearing on the Phoenix Water Resources Plan--1985, an elderly gentleman expressed concern that proposed conservation actions and the rising cost of water could force his family to change their long-established Phoenix life-style.

"Why is Phoenix forcing this change?", he asked. "Must we let the roses die to have water for the future?"

He urged City officials to preserve the quality of life that he found synonymous with Phoenix living and expressed a concern important to all Phoenicians --what must we do to ensure that Phoenix will have enough water for the future?

Can we change the ways we use water and still maintain the high standard of living that characterizes our city?

IS THE IMAGE OF WATER ABUNDANCE AN ILLUSION?

Contemporary Phoenix life-style suggests an abundance of water. Our environment includes man-made lakes, private swimming pools, and lush green golf courses and landscapes. Recently, increases in the flow of the Salt and Verde rivers have necessitated releases of water from reservoirs too small to contain this unusually high runoff. Flowing into Phoenix, this water laps at the canal banks, and rushes through the normally dry Salt River bed, contributing to an impression of plenty.

Thus, we tend to forget that this sprawling modern city is located in the northern reaches of the Sonoran Desert. In this semi-arid climate, summer temperatures climb to over 100 degrees Fahrenheit and hot weather lasts almost six months. The average annual rainfall is only 7 inches per year. Droughts remain a part of the Salt River Valley's weather cycle.

Historical records show that water surplus is more the exception than the rule. Within the last 100 years, the Salt River Valley has suffered droughts of up to 10 years in duration. Scientific analyses of tree rings show that between the 12th century and the turn of the 19th century, droughts, lasting sometimes more than 50 years, have been interspersed with periods of surplus.

While a history of drought contradicts today's apparent abundance, one must ask, "Will Phoenix have enough water for the future?" The answer does not suggest a picture of a "desert Eden," but of a metropolitan area where shortages could seriously affect the quality of life--unless planning strategies are implemented.

How will these strategies, once implemented, affect business, industry, the economy, and life-style of Phoenix citizens? And how would failure to implement conservation programs and to acquire new resources affect the quality of Phoenix life? Would industry and development dry up? Would landscapes turn brown? Must Phoenicians let the roses die?

The answers to these questions are complex. Economic growth and high standards of living can continue only if Phoenix water users will support water conservation and resources acquisition efforts. The City of Phoenix has prepared this report to help Phoenicians understand better what must be done to secure their water future.

Information presented here summarizes the Phoenix Water Resources Plan--1990, a comprehensive water management plan prepared by the City of Phoenix Water and Wastewater Department. The plan looks at water needs and supplies over a 50-year period, from 1990 to 2040, and solutions to anticipated water supply problems. The plan is updated every two to three years as population projections and other factors affecting water supplies and demands change.

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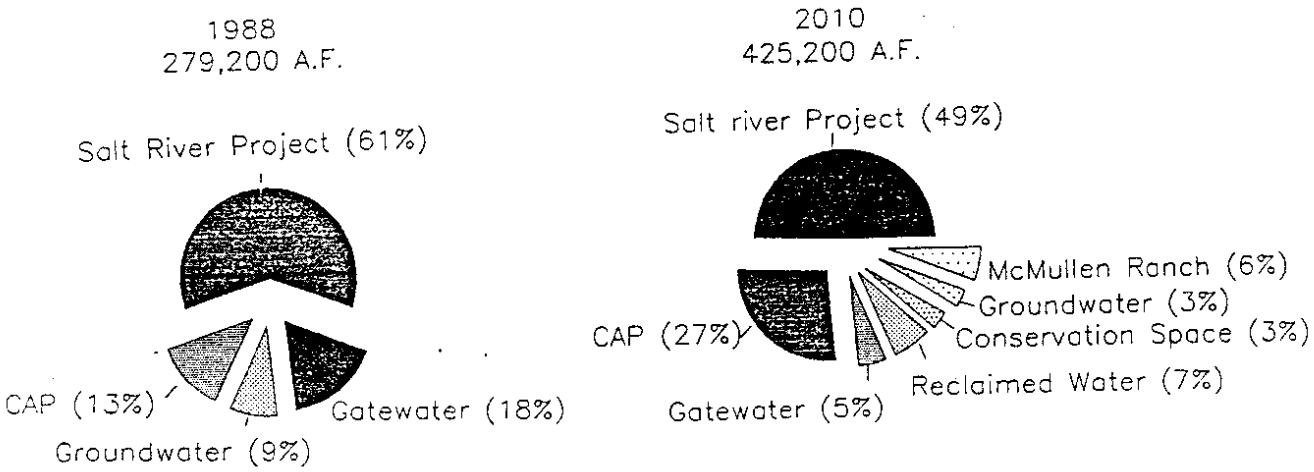
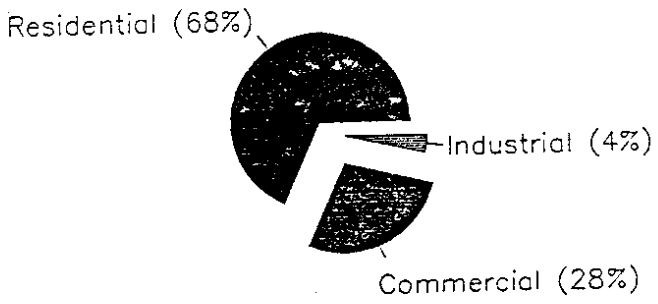
Where the Water comes from . . .



Currently the City of Phoenix Obtains most of its water from the Salt River Project (SRP). Other Supplies must be developed to meet future needs as SRP supplies are reduced by various pressures.

. . . and where the Water goes.



Residential Water Customers consume more than all of industrial and Commercial customers combined. Approximately 60% of total residential consumption is used indoors. Approximately, 40% of annual residential demand goes to outdoor use.

WHAT FACTORS PLACE PRESSURES ON THE WATER SUPPLY?

The many pressures on the water supply dispel the image of abundance. These pressures include population growth, restrictive legislation, concern over water quality, unreliable precipitation, unresolved water rights claims, and reservoirs too small to hold runoff during wet years.

Population Growth

Phoenix, the ninth largest city in the nation, continues its rapid growth. It now delivers water to about one million people. Total water consumption has increased accordingly. In 1988, Phoenix customers used an average of 253 gallons of water per capita per day, including commercial water use.

Phoenix must supply water to a service area of nearly 600 square miles. Less than 200 square miles of land in this area are located within Salt River Project (SRP) boundaries. This portion of the service area is called "on-project," designating lands which are entitled to water developed, stored, and delivered by SRP. The remaining 400 square miles encompasses two areas, "off-project" and "nonmember," which are not entitled to SRP water.

Over the past 20 years, new residential and commercial developments have mushroomed in the off-project and nonmember areas. This growth rate is expected to level out over the next 50 years, but not before the population of these areas alone exceeds one million people.

Although agricultural water use in the Phoenix service area will fall to almost zero within the next 50 years, urban population growth and industrial development will offset the decreases in SRP agricultural demand.

Legislation Restricting Groundwater Pumping

Recent legislation encouraged Phoenix to develop aggressive conservation measures and to augment its water resources. The 1980 Arizona Groundwater Management Act requires that after the year 2025 water users in the Phoenix metropolitan area no longer pump groundwater faster than the groundwater is being naturally or artificially replenished. Groundwater has been a primary supply source in off-project and nonmember areas where surface water rights have been limited.

After the year 2000, the Groundwater Management Act will strongly impact development in the City's off-project and nonmember areas. Permits for development after that date will be granted only if Phoenix can provide an assured 100-year water

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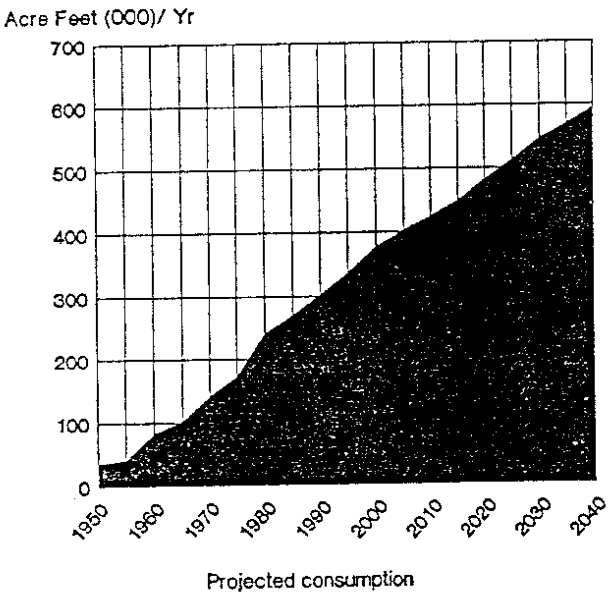
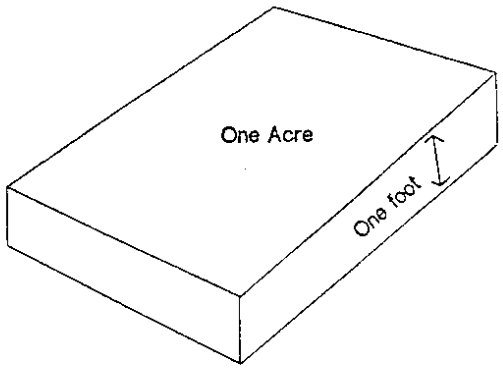
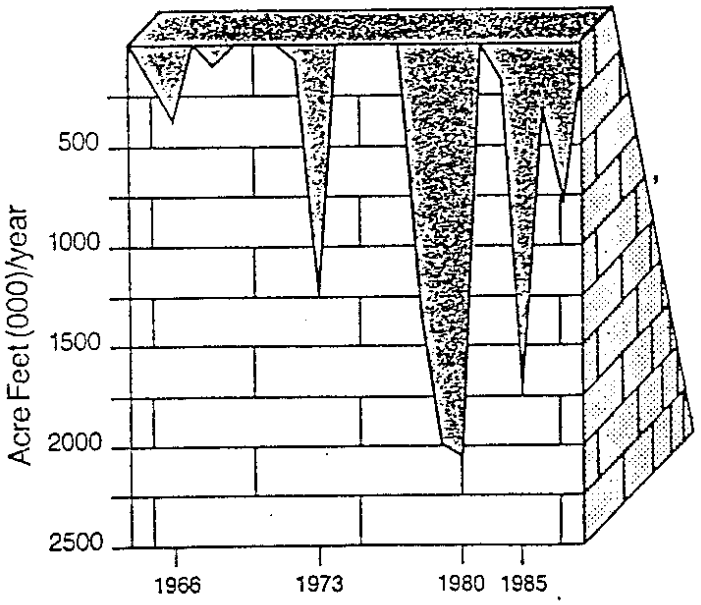
WATER CONSUMPTION FOR PHOENIX SERVICE AREA 1950-2040



How much Water is an Acre Foot?



1 acrefoot = 325,851 gallons
or
1 million gallons = 3 acre feet



More than the Dams Could Hold

Although the Salt River Project reservoirs hold over 2,000,000 acre feet of water, water has spilled over the dams and has been lost to beneficial use 23 times over the past 25 years.

supply for that development. With the present per capita water consumption rate and the existing water supplies, Phoenix cannot offer such a guarantee for off-project and nonmember area growth beyond approximately 2002.

Concern Over Water Quality

Concern over potential public safety hazards has led Phoenix to eliminate some groundwater wells from production. In 1980, Phoenix began enforcing water quality standards which extend far beyond minimum federal and state legal requirements.

Phoenix water quality experts monitor the water system for many agricultural and industrial contaminants for which published minimum safety standards do not currently exist. This water testing program has been recently expanded to test for over 100 potentially toxic compounds. Monitoring will continue to be expanded in compliance with the federal Safe Drinking Water Act of 1986.

Although monitoring has thus far revealed only trace amounts of contaminants in some Phoenix wells, the City has removed over 25 wells from production since 1981. This action is in accord with the City's stringent policy of removing supplies from production even when compounds found in the water do not have published minimum safety levels.

Conservative estimates suggest that over the next 50 years, up to an additional 20 percent of the groundwater supply could be unavailable as a result of the city's safe water quality policy. An estimated 25 percent of this total production loss may occur from the closure of off-project wells and 75 percent from on-project shut downs.

When water resources from the Salt and Verde rivers and the Central Arizona Project (CAP) remain adequate, groundwater losses do not present a serious problem. If a drought should occur, however, groundwater supplies may be needed to make up short falls in surface water deliveries. Thus, concern over water quality compels Phoenicians to look closely at the status of the city's groundwater production capacity for use as an emergency drought supply.

Unreliable Precipitation

The Salt River Project (SRP), in addition to its agricultural deliveries, wholesales water to valley cities which, in turn, treat and deliver water to municipal customers. All of the city's on-project and some of its off-project surface water supply comes from the Salt River Project (SRP) reservoirs, which are fed by the Salt and Verde rivers. Flows in these rivers depend upon precipitation and watershed conditions, unpredictable factors which can vary tenfold from year to year.

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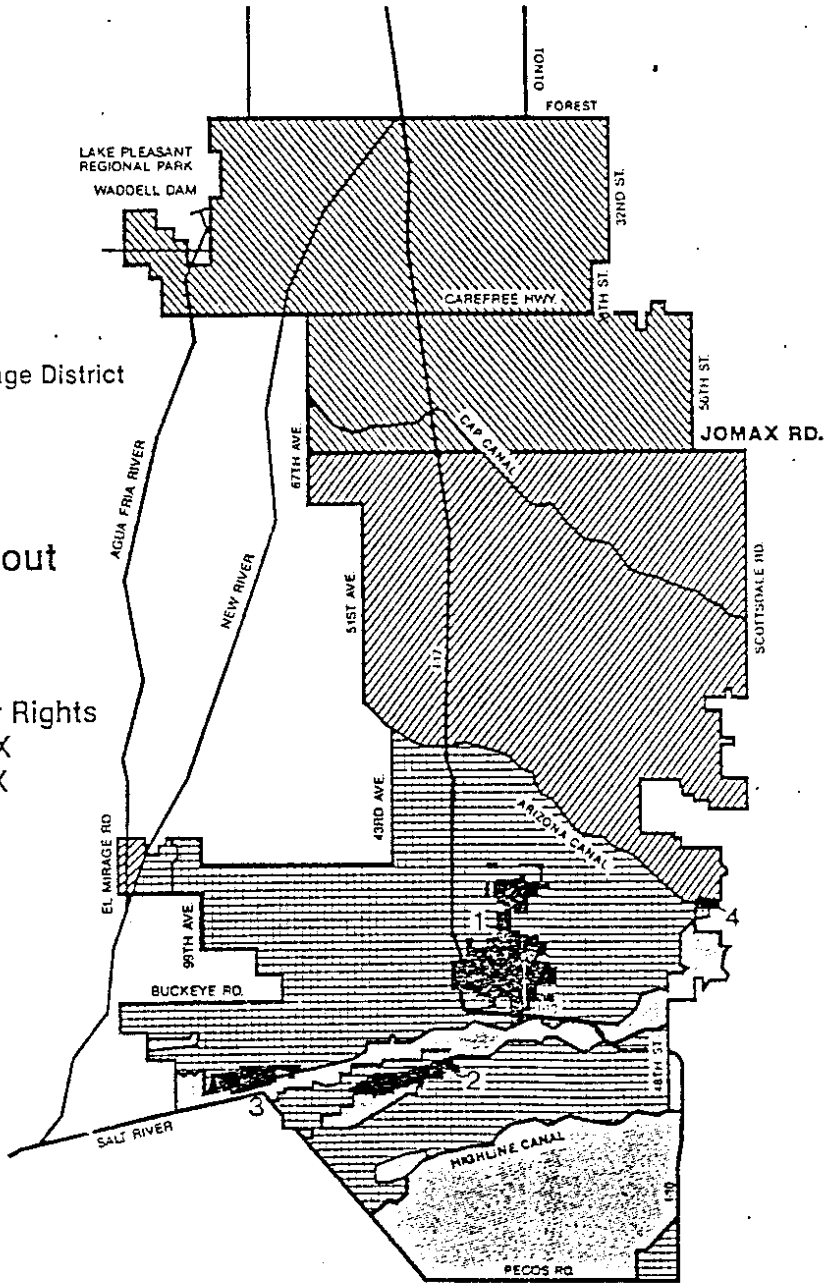
Future Water Service Area

SRP Member Lands and Water Right Areas

- Member Lands
- Water Right Areas
  1. Townsite Lands
  2. Maricopa Gardens Farms
  3. New State Irrigation & Drainage District
  4. Ingleside

Nonmember Lands Without SRP Water Rights and Off-project Areas

- Nonmember Without Water Rights
- Off-project South of JOMAX
- Off-project North of JOMAX



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SCALE OF MILES

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Recent increases in precipitation, resulting in greater flows from the watershed, are more an exception than the rule. Prior to current wetter-than-average years, the Salt River Valley suffered 25 years of lower-than-normal runoff. Water from the Salt and Verde rivers has been sufficient to meet demand in only one out of every three years. Groundwater has supplemented the surface water supply in years when the flow of these rivers has been inadequate to meet demand.

The water stored behind spillway gates on top of Horseshoe Dam, or "gatewater" is an additional resource which Phoenix has depended on for use in off-project areas. Constructed with Phoenix funds in 1950, these gates increased the storage capacity of Horseshoe Dam by nearly 75,000 acre feet (24 billion gallons). When water behind these gates reaches a certain level, Phoenix is entitled to receive gatewater "credits."

From 1952 to 1978, gatewater accumulated at an average of 12,000 acre feet per year (11 mgd). Salt River Project (SRP) projections based on watershed flows since 1889 indicate that future annual gatewater availability will average around 21,000 acre feet per year through the year 2040.

In 1978, 1982, 1985 and again in 1986, gatewater credits fell to alarmingly low levels, demonstrating the relative unreliability of this water source. Central Arizona Project (CAP) deliveries to the off-project area, beginning in 1986, have temporarily eased the dependence on gatewater, however.

The CAP is a multipurpose water resource development and management project that uses water from the Colorado River to supplement supplies to cities, industries, Indian reservations, and agricultural lands in central Arizona.

Phoenix has contracted for 113,882 acre feet per year (102 mgd) of CAP water. The Arizona State Selection Board has the authority to grant up to 12,000 acre feet per year (11 mgd) of additional CAP water to Phoenix to facilitate development on state trust land.

How dependable is the future of CAP water? During a drought, CAP deliveries to Phoenix could fall from 113,882 to 45,000 acre feet per year. Estimates of future CAP supplies by the U.S. Bureau of Reclamation are based on the assumption that all features of the CAP Plan 6 will be implemented. Plan 6 is described elsewhere in this report. CAP Plan 6 will benefit Phoenix because it will add to reservoir space and permit the City to store more surface water on the Salt and Verde river system.

Even when Plan 6 is implemented, water shortages for the off-project and nonmember parts of the service area could begin as soon as 2002. Without additional water supplies or implementation of additional water conservation programs, a deficit of

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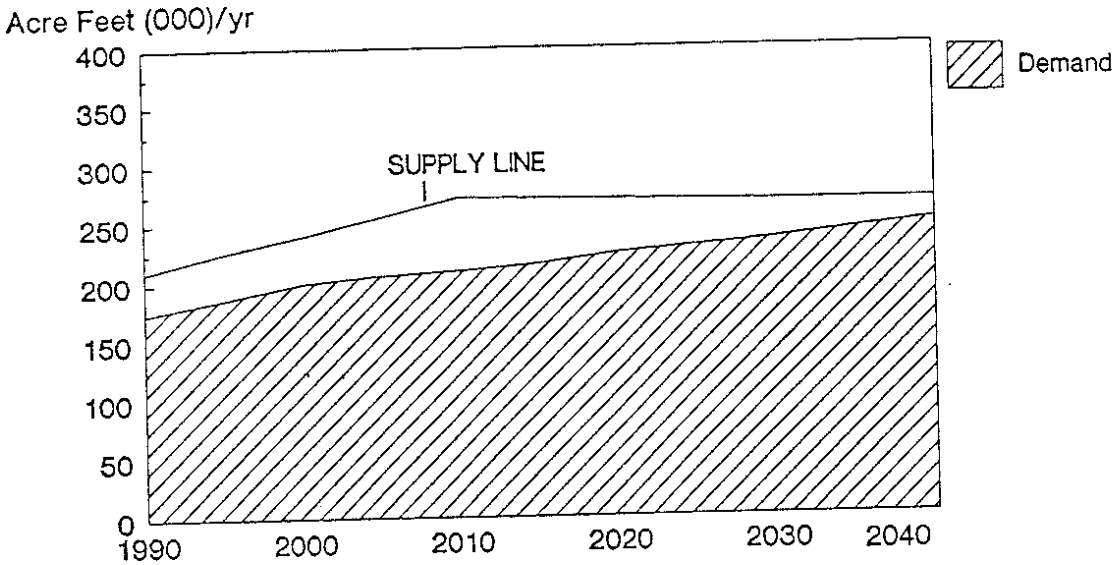
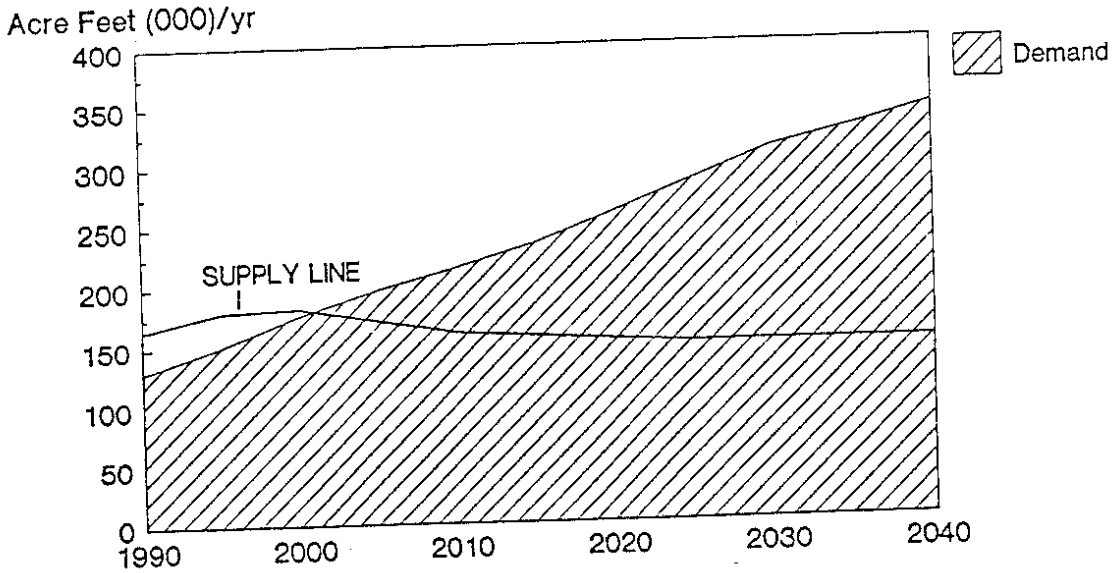
On-Project
CURRENT SUPPLY & DEMAND



Off-Project & Nonmember
CURRENT SUPPLY & DEMAND



195,000 AF/YR Shortage by 2040.

Between 2000 and 2005, the supply deficit for off-project and nonmember areas will be much greater than the anticipated on-project deficit if conservation actions are not taken.

54,000 acre feet per year (48 mgd) could occur in the off-project area in 2010, and 195,000 acre feet per year (174 mgd) in 2040.

Unresolved Water Rights

While legislation and water quality policies restrict groundwater supply, legal disputes over water rights increase competition for the already limited surface water supply. Water rights claims now being adjudicated introduce an element of uncertainty over the future rights to water from local rivers. Court decisions on these rights may not be rendered for 20 years.

Like most Western states, Arizona granted water rights to land owners who first claimed and used water for beneficial purposes. Today, rights to water long associated with certain properties are being challenged.

Recent Indian water rights claims, in particular, could reduce the water available to Phoenix. Subject to this adjudication are rights to water from the Gila River, which flows into the Colorado River near Yuma. The Salt and Verde rivers are tributaries of the Gila River, and thus the Salt River Project (SRP) could lose considerable amounts of water if claims are successful. Water rights claims filed by the United States on behalf of several Arizona Indian tribes in January 1985 were 219,000 acre feet. These tribes have claimed an even greater amount on their own behalf. Even a partial award of these claims will dimish the Valley's water supplies.

Reservoirs Too Small for Runoff

Precipitation is often insufficient, but sudden increases in watershed runoff, occurring up to one year in three, can overflow the present reservoir capacity. Some of this overflowing water replenishes the groundwater supply, but most of it flows downstream out of the Salt River Basin. It is thus lost for local beneficial use unless it can be used to artificially recharge aquifers.

The Central Arizona Project (CAP) Plan 6 is a proposed partial solution to the reservoir capacity problem. When Plan 6 is completed, new storage space will be added at Roosevelt Dam, allowing some of the water now lost during wet years to be saved for drier years. A cost-sharing agreement between the federal government and valley cities will entitle local cities to use the additional water stored behind these dams.

As part of the Plan 6 agreement, the City of Phoenix is purchasing 134,000 acre feet at the modified Roosevelt Dam on the Salt River.

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WHAT ARE THE RESULTS OF CURRENT CONSERVATION MEASURES?

Current demand management measures have already cut 6 percent off of the 1980 per capita consumption rate. Measures which have contributed significantly to the water demand reduction are:

- Public awareness and education program
- Water rate increases and rate structure revisions
- Building codes requiring water conserving fixtures
- An Emergency Plumbing Fixture Retrofit Program

The public awareness program, initiated in 1982, educates businesses and individuals on wise water use. Water use programs are now being developed to educate industry representatives on water-saving technologies. Information about low water use landscaping and irrigation is being disseminated to homeowners and developers. Residential water customers receive tips on home water conservation practices.

Rate increases and rate structure revisions remain the most effective demand management tool. In 1982, Phoenix raised its rates and revised its water rate structure to encourage water conservation among high-use water customers. The water rate structure changed from an almost flat rate to an increasing block rate schedule. The increased block rate structure and rate increases saved an estimated 10,000 acre feet per year (9 mgd) of water by 1985.

Building Code revisions, implemented in 1980, were intended to reduce sewer flows; however, these revisions to the 1980 code also conserved water. In 1990, partial compliance with the building code is saving Phoenix approximately 2,000 acre feet per year (2 mgd).

In 1985, through an Emergency Retrofit Plumbing Fixture Program, low-flow shower devices and toilet dams were installed in 41,000 Phoenix homes. The program was an emergency action intended to reduce wastewater flow into the city sewers and thereby to allow time for the construction of a relief sewer in the area. This program used simple, effective water-conserving plumbing devices which were free to the residents in the emergency target neighborhood. The retrofit program is estimated to save Phoenix 2,000 acre feet per year (2.4 mgd) of water.

These conservation programs have reduced water demand by about 21,000 acre feet per year (18 mgd); however, more needs to be done if Phoenix is to achieve its water supply and use goals.

WHAT HAS BEEN DONE TO AUGMENT WATER RESOURCES?

McMullen Valley Land Purchase

In December 1986, Phoenix purchased approximately 14,000 acres of land and leased an additional 2,000 acres of state trust land in the McMullen Valley in Western Arizona. However, water production and delivery from this land should not be needed for off-project lands until the year 2010. Phoenix anticipates that the delivery rate from this source will be 30,000 acre feet per year (27 mgd).

Initial capital investment costs for the land and for transmission facilities will total approximately $69 million. Cost estimates include construction of approximately 25 miles of pipeline and canal facilities to transport the water from the McMullen well fields to Phoenix. Phoenix is now pursuing an agreement with the Central Arizona Project to use the aqueduct to transport the water to Phoenix area treatment plants.

Plan 6

Historically, much of the river water flow during wet years has been lost because of the limited storage capacity of the SRP system. CAP Plan 6 will reduce this problem by adding height to Roosevelt Dam. This will increase reservoir capacity and thus create "new conservation space." Much of the water that would have otherwise flowed down the Salt and Verde rivers during unusually wet years will be "conserved" for use during drier years.

On April 15, 1986, the City of Phoenix and the cities of Glendale, Scottsdale, Tempe, Mesa, and Chandler entered into the Plan 6 funding agreement with the United States Secretary of Interior. This agreement called for local contributions toward the construction of the proposed Cliff Dam on the Verde River and modification of the Roosevelt Dam on the Salt River as part of the Central Arizona Project (CAP). However, Cliff Dam has been deleted from Plan 6 due to environmental concerns. Plan 6 now includes:

- Enlargement of Roosevelt Dam to provide flood control and additional conservation storage and to handle the maximum flood on the Salt River safely.
- Modifications of Stewart Mountain Dam on the Salt River to ensure safe handling the maximum possible flood on the Salt River.
- Replacement water for that water which would have been made available by Cliff Dam. Studies are now underway by the federal government to locate replacement supplies.

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- Construction of New Waddell Dam on the Agua Fria River to provide regulatory storage for Central Arizona Project (CAP) water.

In order to improve the reliability of water from the new Roosevelt Dam, the city plans to restrict its total annual use from the new conservation space to 13,750 acre feet per year (12.3 million gallons per day). The Phoenix Water Resources Plan--1990 assumes that the new conservation space will be on-line by 1998. Up to an additional 20,000 acre feet per year would be made available to Phoenix through Cliff Dam replacement supplies.

WILL PHOENIX HAVE ENOUGH WATER FOR ITS FUTURE?

With increasing pressures upon the water supply, will Phoenix have enough water for the future? The answer to this question depends on the measures taken and how soon they are taken. Without conservation and resources management, Phoenix will be at the mercy of the elements. To understand what action must be taken, water consumers need to become aware how pressures such as climate combine with demand, population growth, conservation, quantities of available surface and groundwater, and other factors to influence the amount of water available to this desert metropolis.

The Water Supply Under Normal Weather Conditions

With current supplies and water consumption rates, the City of Phoenix water service area will not suffer water shortages in the off-project and nonmember area until after the year 2002, unless a drought occurs. By the year 2040, however, the city will be 195,000 acre feet per year (174 mgd) short of the water needed for these areas. No deficit is projected in the on-project area, where Salt River Project supplies are projected to be sufficient to meet projected demands.

How Much Water Will Phoenix Have Under Drought Conditions?

Dependence on Salt River Project (SRP) and Central Arizona Project (CAP) supplies will increase in the future as Phoenix complies with the goals of the 1980 Groundwater Management Act. Forecasts suggest that these supplies may not be sufficient to meet on-project demand if a drought were to occur after 1995.

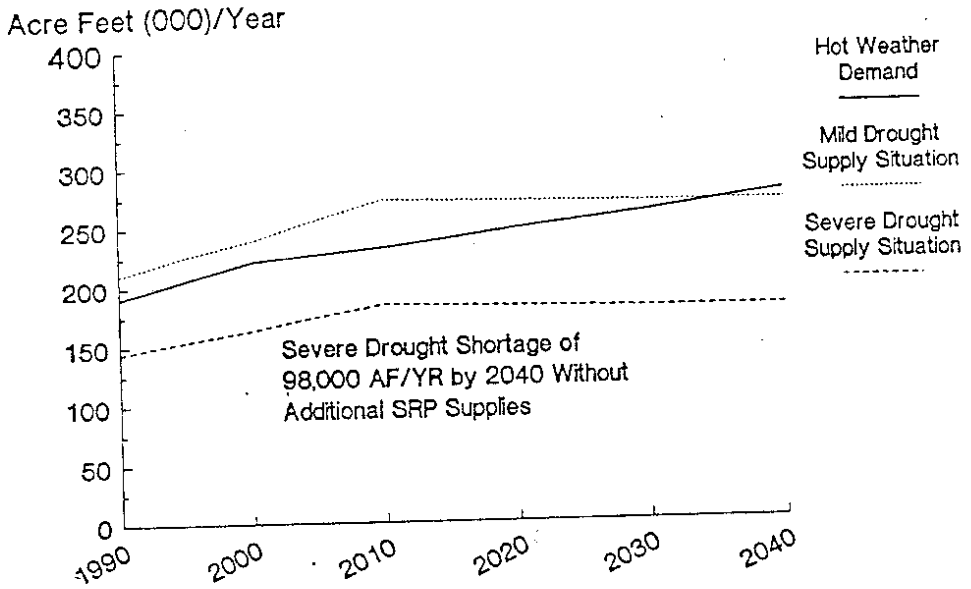
The Phoenix Water Resource Plan--1990 defines a mild drought as one that would occur on the average once every ten years and last three years. Such a drought would deplete all of the water anticipated to be available in the new Roosevelt Dam conservation space (Plan 6) and deplete gatewater credits (available through a contract with the Salt River Project) for off-project areas.

A severe drought is defined as one that will occur once every 100 years and last for seven years. A severe drought could reduce SRP supplies to 66 percent of the normal year water allocation. After the year 2015, CAP supplies could be reduced to 40 percent of normal during a severe drought.

The United States Bureau of Reclamation believes that the CAP will not suffer shortages from drought until after the year 2015. However, temporary CAP canal outages lasting up to one month could occur sooner due to natural disasters. The Salt River Project, however, asserts that the SRP supply is subject to a drought at any time.

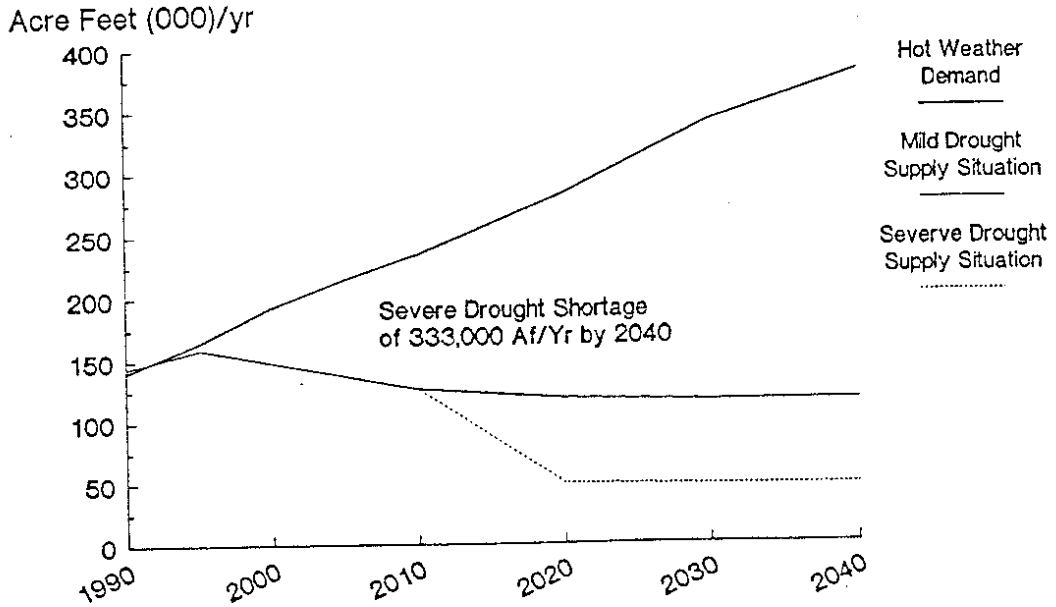
Phoenix could offset drought-caused shortages in on-project areas until 1995 by transferring Central Arizona Project (CAP) water to the on-project area. If water use continues at the current per capita rate, however, new supplies must be obtained and emergency conservation measures must be established to meet on-project demand after 1995. To ensure adequate supplies during droughts, Phoenix developed a draft Drought Management Plan in 1989. It is anticipated that this plan will be adopted in 1990.

On-Project
CURRENT SUPPLY AND DEMAND DURING A DROUGHT



Shortages could occur on-project at any time if drought conditions prevail.

Off-Project and Nonmember
CURRENT SUPPLY AND DEMAND DURING A DROUGHT



Drought conditions would deplete off-project and nonmember supplies even more drastically than on-project supplies.

WHY ACT TODAY IF THE SUPPLY IS SECURE FOR 15 YEARS?

People may ask, "If we have 10-15 years before a supply crisis hits, why initiate conservation and resources actions now?" The answer is that conservation and new resource projects require that action be taken in the near future if it is to be effective when needed.

The positive effects of water conservation are cumulative and therefore must be implemented today while there is still time to avert a supply crisis and delay the need for costly emergency supply measures.

Resources augmentation measures generally require much time to conduct geological and engineering surveys, to obtain capital for investment and construction, and time to build facilities. Time is also required for intergovernmental negotiations. In addition, because land prices and construction costs are likely to inflate with time, capital investments today may be much less expensive than they will be in the future.

Phoenicians should also remember that the arena of competition for water resources is regional, extending beyond city and state boundaries. Other western cities will also need additional water supplies.

PHOENIX MUST CONSERVE AND DEVELOP NEW RESOURCES TO SECURE THE FUTURE

Although some factors which influence the amount of water available are beyond the control of the city, Phoenix can exercise control over its water resources' destiny through effective planning strategies and timely action.

Phoenix and its water customers can work together to preserve the city's standard of living. Three approaches must be pursued to ensure that the City of Phoenix will have enough water for the future: first, water consumers must conserve water, second, Phoenix must augment its water resources, and third, we must reuse treated wastewater to the maximum extent feasible.

The Conservation Approach for Normal Years

The first approach, water conservation, has been planned to secure our water future. The full implementation of the Phoenix Water Conservation Plan--1986 will help Phoenix ensure adequate water supplies throughout the 50-year planning period.

Conservation or demand management programs increase the efficiency of water use by educating consumers, changing water rates, and implementing other residential and commercial programs.

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Demand management measures multiply water choices for the future. Through the implementation of such measures, Phoenix can delay purchasing costly new resources to augment supplies. Managing demand will also buy time for technologies to develop better, more cost-effective methods of treating and reclaiming wastewater and preventing water contamination.

Conservation is the least expensive and often the easiest way to balance supply and demand. If Phoenicians conserve water by taking shorter showers, installing low-flow plumbing devices, maintaining low water use landscapes, using the best available water saving technology in industry, and practicing other water-saving techniques, millions of gallons of water can be saved each day. It costs the water user little to turn down the tap, but it could cost millions to the Phoenix economy if water is not conserved.

Water Conserving Plumbing. In 1980, a building code went into effect requiring low water use toilets (3.5 gallon per flush) and showers in new developments. This program is estimated to save about 7,000 acre feet of water per year in 1990. Much more could be saved if the building code were amended to require more water efficient toilets, showerheads, dishwashers and clothes washers. A draft "ultra low- flow" ordinance with 1.6 gallon per flush toilets was proposed in 1989 and will be in the public review stage in 1990. Savings from this program would reach 6,800 acre feet per year by the year 2000 and 32,800 acre feet per year by 2040. Water can also be saved in existing buildings by installing devices to reduce water use in toilets and showers. This program was begun in 1989 when 6,000 homes were retrofitted. Installing these devices throughout the city will cost over $3,000,000 but will save 7,500 acre feet per year by 2000.

Water Conserving Landscaping. With the high proportion of water used for landscaping in Phoenix, more water efficient landscaping in new developments offers tremendous opportunities for saving water. Programs outlined in the Water Conservation Plan--1986 could save 23,000 acre feet per year by 2040 by achieving more efficient water application in large turf areas and by reducing the amount of turf used in new developments. In 1989, a draft ordinance that would limit the amount of water intensive landscaping in new developments was prepared. The measure is undergoing public review. Phoenix now has a turf irrigation specialist on staff to work with managers of large turf areas like golf courses to help them reduce water waste. Another important part of this program involves educational seminars on "Xeriscaping" or low water use landscaping techniques.

Water Rates. Studies have shown that one of the best methods of encouraging efficient water use is the way customers are charged for water. Economists have shown that consumers respond more to changes in their bill than to the average bill. If

customers increasing their use are charged what it costs to provide that additional amount of water, they are likely to be more prudent before they increase their use again. A water rate structure designed to increase efficiency of use is projected to save 11,000 acre feet per year by the year 2000 even if average prices were to stay the same. During 1988-89, a citizens water rate advisory committee met with City staff to develop a new conservation rate structure. A recommendation for implementing a new rate structure will be made in 1990.

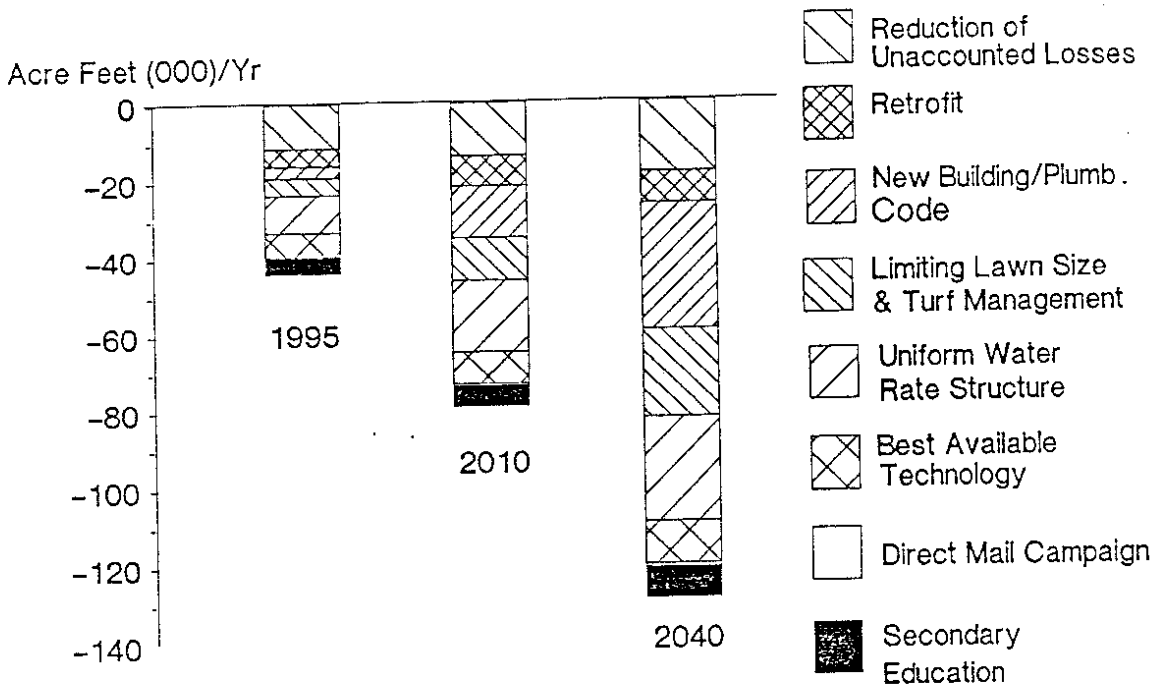
Other Conservation Techniques. The Water Conservation Plan--1986 and its amendments include additional programs to reduce water waste and develop a conservation ethic among the public. These include a program to increase the use of best available water conserving technologies in commercial and industrial enterprises, a direct mail program, enhancement of a program to control water flows onto streets, reduction of lost and un-accounted for water and expansion of current educational programs to include secondary school students. Additional staff were acquired in 1988 to implement these programs. Combined, these additional programs are projected to reduce water demand by 24,500 acre feet per year in the year 2000.

What Are the Combined Effects of Conservation in Normal Years? In the future, demand management could reduce the projected on-project demand by 47,600 acre feet per year (43 mgd). Demand in this area will thus rise to only 250,300 acre feet per year (223 mgd) by 2040, remaining below the predicted Salt River Project (SRP) normal year water supply of 268,000 acre feet per year (239 mgd) available to Phoenix.

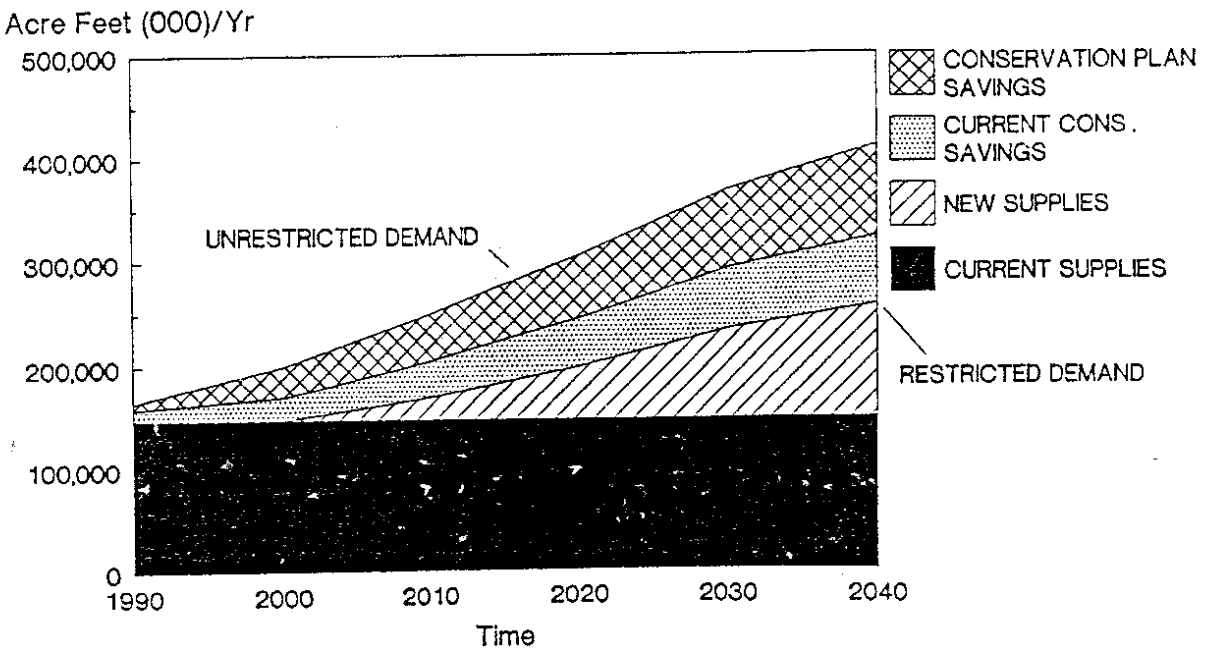
With the implementation of all of the conservation plan features, existing water supplies could be sufficient to meet projected off-project and nonmember demands only until 2007 during normal years. The expected off-project conservation savings increase from 5,900 acre feet per year (5 mgd) in 1990 to 81,400 acre feet per year (73 mgd) in 2040. Water saved through conservation efforts is a new "supply" that could provide more than a one-third of the water supply for the off-project and nonmember area.

Implementation of the conservation plan alone, however, will not prevent projected normal year demands from exceeding known supplies by 107,000 acre feet per year (96 mgd) in 2040. Other approaches must be pursued to meet future water needs. However, conservation can greatly reduce the need for expensive new water rights and reclaimed water projects.

WATER SAVINGS BY CONSERVATION MEASURE



OFF-PROJECT
COMPONENTS OF FUTURE SUPPLY



Resource Augmentation Approaches for the Future

Because conservation alone will not enable Phoenix to meet future water needs, water resources must also be augmented. Phoenix has studied several new resource alternatives which will help the city meet demand future water demands. Resource actions needed include recharging groundwater, purchasing land for associated water rights, and reusing treated wastewater.

Recharging Groundwater. The 1980 Groundwater Management Act severely limits pumping of unrecharged groundwater after the year 2025. However, the Groundwater Recharge Act of 1986 permits the withdrawal of water from aquifers, geologic formations containing water, which have been "recharged." Recharged means that the water tables have been replenished by injecting water into the ground or by diverting water into spreading basins where it will seep through surface layers of earth.

Under this law, the Arizona Department of Water Resources (DWR) will issue storage and recovery permits and will allow recharged water to be pumped on a credit basis. DWR will maintain records on the amount of water which has been recharged into an aquifer. Only that amount which has been credited to an account may be withdrawn. When Central Arizona Project (CAP) and Salt River Project (SRP) water is abundant, Phoenix can capture this water and store it in an aquifer for later use. Thus, when CAP or SRP water shortages occur, Phoenix will have a credit reserve of water stored underground to pump for later needs and will still meet the goals of the Groundwater Management Act.

Feasibility studies have identified several stream beds as potential sites for groundwater recharge. The Agua Fria River bed has been selected as one site for the initiation of a recharge project. In 1989, a design for the facility and state permitting work was completed. Phoenix will begin recharging surplus water at this site in 1990. Another potential site under consideration is the Salt River bed downstream of the Granite Reef Dam. This recharge project will be a multi-agency effort, including the Salt River Project and other valley cities.

Purchasing Resources. Phoenix may need to acquire new water resources by purchasing land outside the State-designated Phoenix Active Management Area (AMA). Although the Groundwater Management Act limits the pumping of unreplenished groundwater in this AMA, the Act also provides for the purchase of historical groundwater rights outside of the AMA and the transportation of a portion of those rights for use within the AMA. The most cost-effective method of delivering the water to Phoenix is through the Central Arizona Project (CAP) aqueduct, if an agreement can be reached with the Central Arizona Water Conservation District (CAWCD). Phoenix has already purchased 14,000 acres of land in McMullen Valley in western Arizona for this purpose.

Recycling Resources. Phoenix can also increase its water supply by recycling treated wastewater for turf irrigation, agricultural exchanges, and for drinking water.

Two developments, Tatum Ranch and the Foothills, recently completed construction of wastewater reclamation facilities to fill artificial lakes and to irrigate large turf areas, such as golf courses. Phoenix also has plans for building two water reclamation plants to serve the growing areas of the city north of the CAP canal. Depending on the rate of development, these plants will be constructed around the year 2000. Implementation of state laws and stronger city ordinances can provide further incentives for development corporations to work with the city on water recycling projects. Current Phoenix policy is to require that new private golf courses be irrigated with non-City of Phoenix water, preferably reclaimed wastewater.

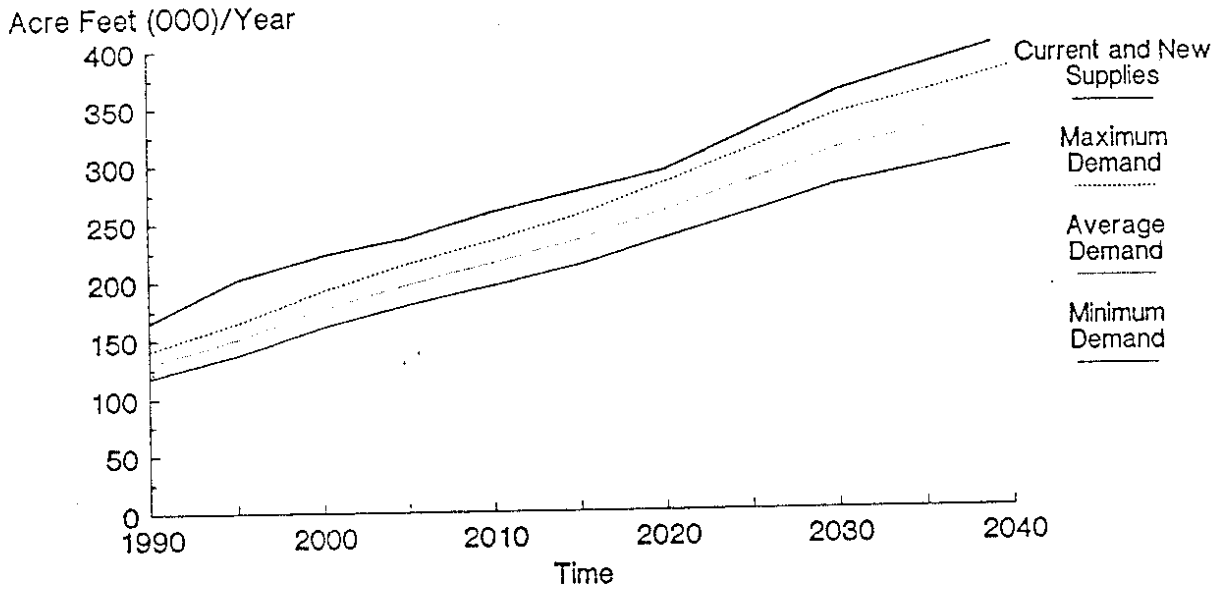
Phoenix will soon be able to take advantage of one of the most economical system for supplementing potable supplies - an agricultural exchange of treated wastewater for surface water. This exchange will take place among the City of Phoenix, the Roosevelt Irrigation District (RID) and the Salt River Project (SRP).

In this exchange, the 23rd Avenue Wastewater Treatment Plant, conveniently located near the RID canal, will treat wastewater to standards suitable for use on edible crops and deliver it to the RID canal. In turn, RID will deliver groundwater to SRP, which will then provide surface water to Phoenix for use anywhere within the city's system. This plan will produce up to 20,000 acre feet of water per year for Phoenix. Ultimately, the reclaimed water from this system could be used to meet future nonpotable industrial and irrigation needs in the Estrella Planning Area.

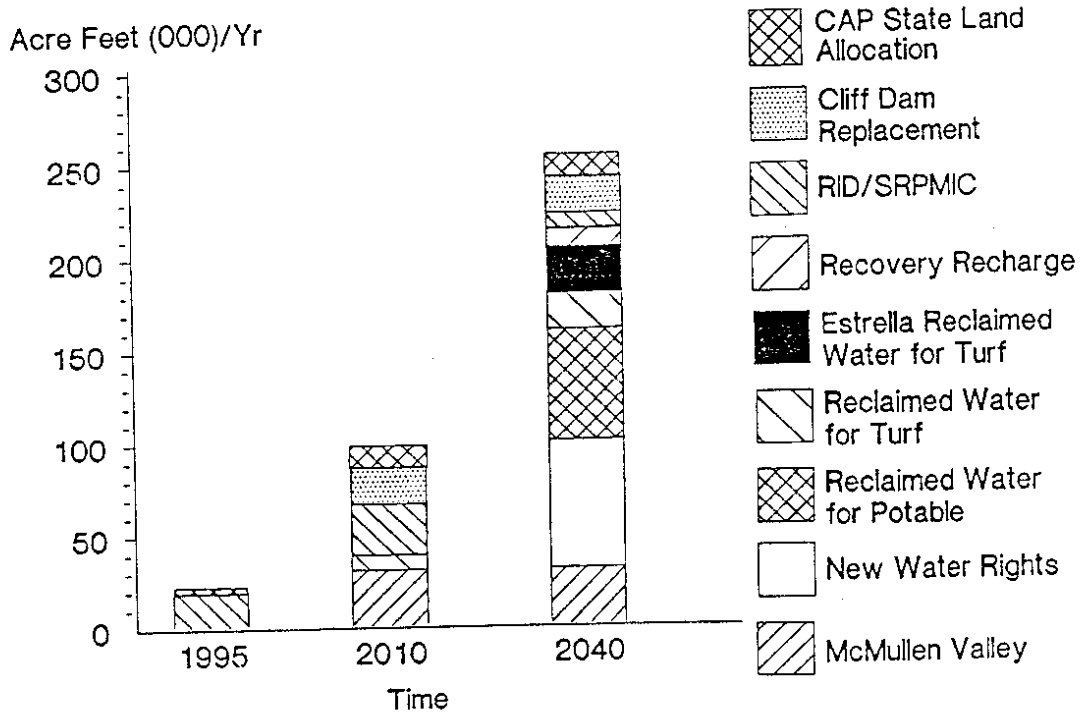
Phoenix may also follow the example of other cities which have built advanced wastewater treatment plants that treat water to potable, or drinking water, quality. The City of El Paso, Texas, for example, has been introducing treated wastewater into groundwater and then indirectly into the city water supplies since mid-1986.

Denver has a demonstration plant for turning wastewater into potable water and plans to provide 100 MGD of that water to their potable system by 1995; however, the water is not now used for that purpose. Some California cities have also successfully reclaimed wastewater for direct introduction into potable groundwater supplies.

Off-Project and Nonmember
SUPPLY AND DEMAND-CURRENT CONS., NEW SUPPLIES



Off-Project and Nonmember New Supplies



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The idea of drinking reclaimed water may seem objectionable to some people. In spite of the psychological objections, water from an advanced wastewater treatment facility can meet and exceed all present and anticipated federal and state water quality requirements. Cost remains the greatest obstacle to consider in wastewater reclamation projects.

The Phoenix Water Resources Plan--1990 calls for the city to begin using reclaimed wastewater for potable supplies on a significant scale beginning in the year 2020. However, the plan calls for a small pilot demonstration plant to be built in the 1990s, because increasingly stringent state and federal water quality standards regulating groundwater recharge and irrigation uses of reclaimed water may make potable reuse more attractive from a cost stand point sooner than 2020.

THE IMPACT OF CONSERVATION ON FUTURE WATER RATES

Future water resource alternatives such as new water rights, reclaimed water for irrigation, and reclaimed water for potable use are extremely expensive compared to current supplies. Engineering and planning studies indicate acquiring these new supplies will cost from five to eight times what Phoenix currently pays for water. Water conservation savings, however, can "provide" new supplies at an average cost that is far less than even the least expensive current water supplies obtained from the Salt River Project. Conservation can provide water at a cost only one-twentieth that of new water rights or reclaimed water.

Successful water conservation programs will have a significant impact on future water rates. Implementation of the Phoenix Water Conservation Plan can eliminate the need for new water rights and significantly reduce the need for potable use of reclaimed water during the 50-year planning period. In addition, the acquisition of other expensive sources could be delayed. By reducing the need for costly supplies through conservation, consumer water bills for Phoenicians will increase at a much slower rate in the future than if water use remains at current levels. Although conservation may involve minor lifestyle changes, the alternative of significantly higher water bills suggests that any changes in water use habits will be well worth the investment.

WHAT IS PROPOSED FOR DROUGHT EMERGENCIES?

The Phoenix Water and Wastewater Department has drafted plans to help the city meet water demand in the event of a drought. After careful analysis of several possible emergency measures, it was determined that the most effective plan would be to use

recharged groundwater, a drought surcharge on water rates, and a drought emergency education program. In 1989, Phoenix developed a draft Drought Management Plan. The major elements of this plan, in the public review stage in 1990, are discussed below.

A Drought Surcharge Can Cover Emergency Costs and Reduce Demand

Current water rates are set to recover costs of providing water during periods of normal demand and supply. During a drought period, a drought surcharge will be needed to recover the cost of pumping more groundwater and operating the emergency education program. Use of recharged groundwater would enable Phoenix to set the surcharge at between 10 and 25 percent of normal water rates, the minimum level necessary to cover costs.

A Drought Emergency Education Program Can Limit Demand

The intensive public education program which Phoenix would implement during a drought would cost approximately $1,000,000 per year in 1990. This program would alert customers to the need to conserve water and provide information on methods of conserving. Emergency education and the drought rate surcharge could reduce demand by 30,000 acre feet per year in 1990 and 47,000 acre feet per year in 2040 through implementation of this program.

Recharged Groundwater Can Supplement Drought Depleted Supplies

Groundwater, the most cost-effective emergency supply, would become the primary supply supplement during a drought. The Groundwater Management Act will severely limit pumping of unreplenished groundwater. Therefore, plans to use groundwater during an emergency depend greatly upon the implementation of current groundwater recharge plans.

If Phoenix replenishes its groundwater tables with excess Central Arizona Project (CAP) water while these supplies are still available, the ability to meet water needs during a drought will be better assured. To be prepared for emergency groundwater production, Phoenix must maintain and improve its present well system.

Additional Drought Supplies Still Needed

Even with the emergency conservation programs discussed above and emergency pumping of existing Phoenix wells, additional supplies will be needed for both the on-project and off-project and nonmember areas. In the on-project area, potential sources of additional supplies are the Salt River Project and additional Phoenix groundwater production capacity above current levels.

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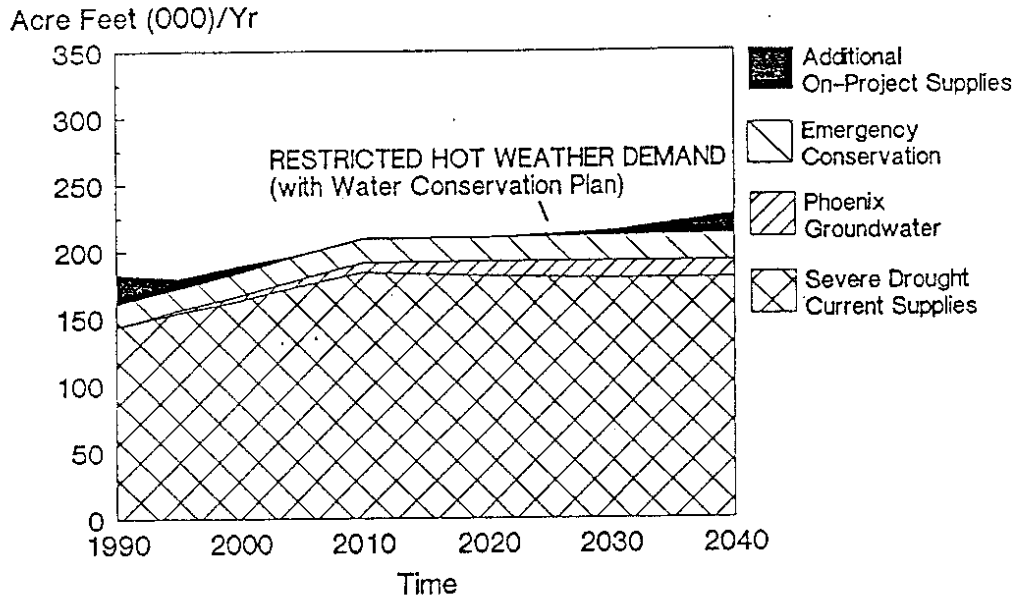
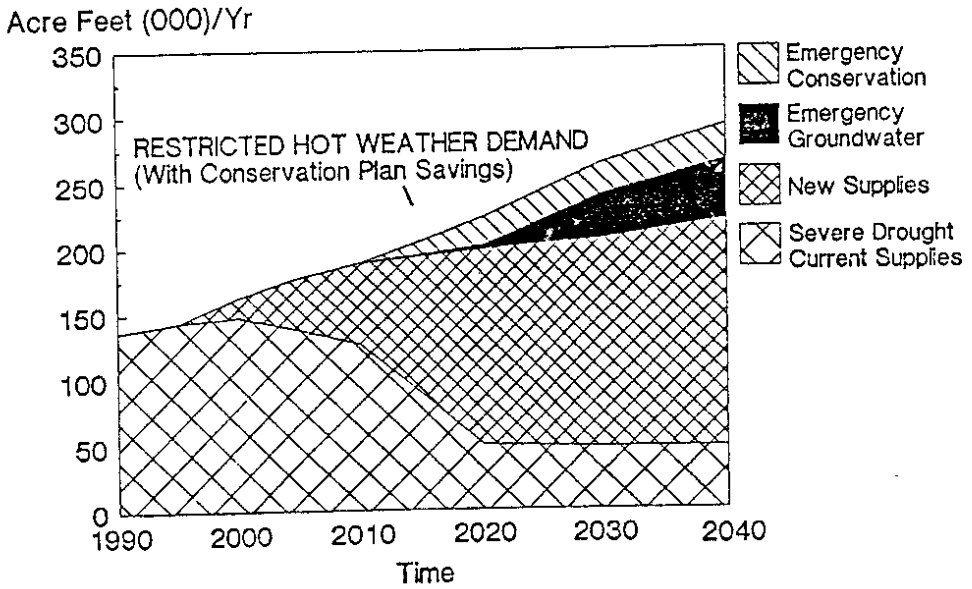
On-Project
DEMAND AND SUPPLY DURING A DROUGHT



Off-Project and Nonmember
DEMAND AND SUPPLY DURING A DROUGHT



Hot, dry weather results in increases in demand.

Two studies now underway will determine the source of this additional supply. The Phoenix Groundwater Production Capacity Study will determine what well improvement actions are necessary to ensure adequate drought supplies under different drought conditions. The Salt River Project is now in the process of developing a water resources plan which is expected to address its role in augmenting existing water supplies for the on-project area. Regardless of the source of additional supply, water savings achieved through implementation of the 1986 Water Conservation Plan could reduce the amount of additional water needed by over 40,000 acre feet per year.

In the off-project and nonmember area, much of the additional supply needed will come from the long-term conservation and resource augmentation projects already discussed. Additional groundwater production capacity will also be needed in the off-project and nonmember area.

If emergency groundwater supplies and the two emergency conservation programs described are not sufficient to balance water supplies with demands during a severe drought, more restrictive mandatory water demand reduction measures such as lawn sprinkling restrictions and price rationing would have to be implemented.

WHAT ARE THE CONSEQUENCES OF INACTION?

Consequences of Inaction Under Normal Weather Conditions

Under normal weather conditions, and with continuing population growth, Phoenicians would be able to maintain their current water-intensive lifestyles until after the beginning of the next century. However, if water consumers fail to conserve water now and support resources augmentation, more drastic water use restrictions will have to be imposed after the year 2000. In addition, if the city does not adopt a conservation ethic, Phoenicians can expect significant increases in water bills and development impact fees as expensive new resources are acquired.

In the off-project and nonmember planning area, the significant deficit between projected demand and known supplies must be remedied. After the year 2001, the Arizona Groundwater Management Act will prohibit development in areas which lack an assured 100-year water supply. In the future, growth as well as roses may have to die in the off-project area unless aggressive conservation and resources augmentation measures are pursued today.

Consequences of Inaction Under Drought Conditions

Today's failure to conserve, to augment supplies and to maintain and improve groundwater pumping capacity would have more severe consequences during a drought. Drought conditions without emergency supplies could require emergency water use reductions which would demand radical changes in lifestyle and result in substantial economic losses. Studies indicate that a 50 percent cutback in industrial water supplies would cost the Phoenix economy over $5.5 million in payroll and profit per week. The same 50 percent cutback in supplies would cost the nonmanufacturing commercial sector approximately $21 million per week.

During a drought, residential customers would not be able to maintain a water-intensive lifestyle. Consumers would be forced to cut back consumption, especially for outdoor and recreational use.

These estimates depict a "worst-case" scenario of drought conditions without prior conservation and supply augmentation. This hypothetical picture is rather like saying, "What will happen if I don't put on my car brakes before I get to the brick wall?" Naturally, citizens and governmental officials have a choice and will do <u>something</u> before it's too late. When action is taken--and the kind of action that is taken--before Phoenix careens into a water supply crisis, will determine the future quality of life and the price that Phoenicians will have to pay to maintain that quality.

Proposed Conservation Actions

- Propose new water rates emphasizing conservation to the City Council in early 1990.
- Accelerate current retrofit program to install low flow plumbing devices citywide in houses built before 1980. (Increase from current 6,000 homes per year to 30,000 homes per year in 1990.)
- Adopt proposed zoning ordinances restricting lawn sizes in 1990.
- Adopt Drought Management Plan in 1990. Begin development of emergency drought education program in 1990.
- Continue the Direct Mail Campaign, a summer water use public education project, in 1990 at a cost of $75,000 per year.
- Initiate in 1990 a secondary school water conservation program at $73,000 per year in 1990 increasing to $200,000 per year.
- Implement ultra low-flow device plumbing code in 1991.
- Implement the "Best Available Technology" program to save water in industry and commerce.
- Expand the Water Waste Control Program ($100,000 per year).
- Implement accelerated meter repair and billing system and accounting changes to reduce lost and unnaccounted for water losses.

Proposed Resources Augmentation Actions

- Initiate design and construction of facilities to utilize the Roosevelt Irrigation District, Salt River Project, and City of Phoenix Water Exchange Project.
- Encourage developers to construct wastewater reclamation plants for turf irrigation or industrial use.
- Begin recharging surplus CAP water in the Aqua Fria riverbed in 1990.

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- Continue support for Plan 6, at a rate of $4 million per year.
- Design and construct potable reuse pilot demonstration plant during 1991-92.
- Begin construction in 1990 of additional wells and facilities recommended by the groundwater production capacity study.

CALL TO ACTION

The potential for shortages resulting from population growth, undependable river flows, Indian water rights awards, legislative restrictions on groundwater use and reservoirs too small to contain runoff impels Phoenix to aggressively seek ways of ensuring the future water supply.

Historically, from the Hohokam civilization to the present, Valley residents have sought engineering solutions to this desert's water problems. But, engineering advances cannot produce water from overcommitted supplies. Water providers must change from water developers to water managers implementing plans for the most efficient use of water.

Additional augmentation of the City of Phoenix water resources and implementation of water conservation programs are necessary to provide adequate water supplies beyond the year 2002. Resources augmentation activities, such as purchasing land to acquire associated water rights, reclaiming wastewater, and recharging groundwater will be expensive. To lessen the burden of the expense associated with resources augmentation, Phoenicians must conserve water today.

Water conservation and resources augmentation remain the key components in the plan to secure the water future for Phoenix. Good water management can help to preserve the outdoor and recreational lifestyle which makes Phoenix an attractive city in which to live and work. But, city government alone cannot secure the Phoenix water supply. Every municipal water user, from residential customers to the commercial and industrial consumers, must make efforts to reduce water use and support efforts to augment water resources.

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