Investment Strategy for California Water

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A Project of
Water For California

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Executive Summary

California's growing population, our $1.4 trillion economy and our natural resources all require clean, reliable and affordable water. At the same time with extremely limited federal, state and local budgets we cannot afford to make investment decisions that will not produce results.

This *Investment Strategy for California Water* identifies the most cost-effective, environmentally beneficial and socially acceptable water management strategies. It directs public investments to locally planned and implemented programs to increase regional water self-sufficiency. This *Investment Strategy* will serve as our framework for sponsorship and support of the next state water bond.

The *Investment Strategy* analyzed a wide range of management options, all the way from conservation and recycling to transfers, desalination and building new dams. The *Strategy* was developed in a fully open and inclusionary process. All drafts were posted for comment on the PCL website. Input from two public workshops helped guide development of the *Strategy*. Each of the recommendations is fully documented by multiple, credible sources.

The table below demonstrates that we can more than meet California's water supply needs with the *Strategy's* identified priority investments.

Additional Needs	million acre-feet
Population Increase	2.0-2.4
Environmental Restoration	1.0
Total additional needs	**3.0-3.4**

First Priority Options	million acre-feet
Urban Water Conservation	2.0-2.3
Agricultural Water Conservation	At least 0.3-0.6
Recycled Water	1.5
Groundwater Treatment and Desalination	At least 0.29
Total First Priority Potential	**At least 4.09-4.69**

In addition there are other options that are being considered to meet California's water needs.

Water transfers will continue to be a significant strategy for meeting needs. However, they can also harm third parties and the environment. Therefore the

Investment Strategy sets forth conditions needed to ensure transfers will not harm areas of origin, areas through which the water is conveyed, and areas receiving the water.

The *Investment Strategy* looked at current proposals to increase reliance on additional exports from the Sacramento-San Joaquin Bay Delta Estuary. The recent study done for the Bay Delta Authority demonstrated that there is a 64% chance that the Bay-Delta will experience abrupt changes resulting from flooding or seismic activity within the next fifty years. A reasonable level of investment needs to be made to protect the Delta including existing export capability. However, it is not prudent to risk California's economy and water supply by relying on increased exports from such a fragile system.

Water storage is another strategy that was reviewed. Groundwater storage, frequently done as part of a conjunctive use program, can have significant benefits as long as the sources of the water are protected.

There is much rhetorical support for new surface water reservoirs. However despite tens of millions of taxpayer dollars spent studying the proposals in the CALFED Record of Decision, not one has been found to be cost effective or environmentally acceptable.

Furthermore not one of the potential beneficiaries of the proposed surface reservoirs has offered to use their own money to pay for their benefits. The *Investment Strategy* includes recommendations on how to protect taxpayers by implementing the "beneficiary pays" principle.

Desalination is another option that was reviewed. Groundwater desalination is a cost effective and environmentally beneficial method for restoring groundwater storage capacity and providing additional water supplies. However, unscreened ocean water desalination perpetuates the loss of marine species. Until adequate screening can be accomplished, that type of desalination is not recommended.

Potential effects of global climate change on water supply were analyzed. The first priority recommendations - conservation, recycling and groundwater treatment – all meet the criteria as "no regrets actions" (strategies that make sense whatever the impacts of global climate change.)

The *Strategy* also sets forth important priorities to provide water quality, environmental restoration, social equity, a strong economy, viable agriculture and preservation of open spaces, as well as integrated resource management.

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Introduction

California's growing population, our $1.4 trillion economy and our natural resources all depend on clean, reliable, and affordable water. However, limited federal, state, and local budgets strain our ability to meet these needs.

The CALFED program is under-funded by more than $15 billion dollars to complete projects originally envisioned in the CALFED Record of Decision (ROD).[1] State general funds are in deficit. Voter-approved bonds (Propositions 13 and 50) that provide state funding for water programs will soon run out.

In addition, research indicates that California's water system will be significantly impacted by global climate change.[2] Data shows more precipitation is coming in the form of rain versus snow, and the snow pack is melting earlier in the spring. Flooding is more severe and frequent. Low-lying Sacramento-San Joaquin Delta levees are even more prone to failure.

However, state and federal water planning fails to properly account for these new realities. These agencies remain focused on trying to increase exports from Northern California and the Bay-Delta Estuary and constructing new dams for the State Water Project (SWP) and the Central Valley Project (CVP), even as evidence of the potential for cost-effective improvements in water-use efficiency grows.

With limited funding, we must make choices that maximize public benefits. While there is a growing need to address water demands and climate change impacts, there simply is not enough money to pursue ineffective projects.

Recently, innovative thinking at the local and regional levels has resulted in highly cost-effective, multi-benefit solutions to water management challenges. Local water management solutions including conservation, recycling and groundwater treatment have the potential to meet the additional needs of California through more efficient utilization of water resources.

This *Investment Strategy* calls for directing public funding to locally planned and implemented programs that will increase regional water self-reliance. These programs are more prudent and reliable than proposals dependent on increased water exports from Northern California and the Bay-Delta Estuary.

This *Investment Strategy* analyzed a wide range of management options to meet the following seven objectives:

- Provide reliable water to meet California's growing needs
- Provide safe water for all Californians
- Restore and sustain a healthy environment
- Preserve viable agriculture and protect open spaces

- Ensure social equity for all Californians
- Enable a strong economy
- Implement integrated resources management

Investment priorities are given to those management options that maximize cost-effectiveness. Additional weight is given to those priorities that help California adapt to climate change, improve water quality, enhance the environment, protect the public trust, and are consistent with multi-objective integrated resource planning currently being implemented in many regions around the state.

This *Investment Strategy* will be used as a guide for development of the next water bond. It establishes a framework for implementation of the "beneficiary pays" principle. It is also a useful guide for informing local decision makers as they choose which management options can provide the largest return for local investments.

Investment Objectives

Provide Reliable Water to Meet California's Growing Needs

California's Growing Needs

An essential requirement for a healthy California is a reliable water supply for all beneficial uses. Water needs to be available not only in wetter years but also in California's recurring droughts.

Each region in California has its own needs, constraints and opportunities. It would be presumptuous for this *Investment Strategy* to suggest the right mix for each area. That comes from the integrated resources planning that more and more regions are now undertaking.

Nevertheless, it is possible to look at aggregate needs and opportunities. This can be a useful tool for informing California's water investments.

Additional Population

The California Department of Finance projects that the state's population will increase by about 12 million people by the year 2030.[3] Much, but not all, of this increase will be accompanied by newer, more water efficient housing. Anticipating their water use will be somewhere between 5 percent and 20 percent less than the current average water use; they will use 2.0 to 2.4 million acre feet per year.

Environmental Restoration

The second increased need is for environmental restoration. Like all other water users, managers of environmental resources, such as managed wetlands, need to be as efficient as practical. However, the reality is that river ecosystems do not function when there are insufficient flows, or in some cases no flows at all. As an approximation, about 1 million acre feet of water needs to be returned to the environment.

Total Additional Needs for Population Increase and Environmental Restoration- 3.0 to 3.4 million acre feet

How Can We Adapt to Global Climate Change?

It is now recognized that global climate change is affecting California's water supply. Data show more precipitation is in the form of rain versus snow, and the snow pack is melting earlier in the spring.[4] Larger year to year variations in precipitation are very likely over most areas where an increase in mean precipitation is projected.[5]

The Bay-Delta levees, already vulnerable to seismic activity, land subsidence, and inadequate maintenance will be further jeopardized by the rising sea water levels. It is estimated that between 1990 and 2100 global average sea level may rise between 3.5 to 35 inches as a result of climate change.[6]

Although a few countries began adapting as early as the 1980's, California lacks a program to ensure safe, reliable water in the face of impacts of climate change.

What can be done to increase reliability?

Investment should be increased immediately in cost-effective "no regrets" actions that maintain reliable water supplies using already available technology. According to the National Academy of Sciences "no regrets" actions are those that provide benefits whether an abrupt climate change ultimately occurs or not.[7] As recommended in other sections, water conservation, water recycling, and groundwater treatment programs will remain cost-effective and optimize water resources. Investing in these programs will also reduce dependence on vulnerable and over-allocated water systems such as the Bay-Delta Estuary.

In addition to investing in "no regrets" actions, the state should implement a two-stage approach to plan for the effects of climate change in water forecasts. The first stage should consist of a study performed by the University of California to analyze several scenarios for state and regional water supplies under different climate conditions for the next several decades. This study should include alternate hydrologies under various temperature and precipitation predictions, and it should include a cost-benefit analysis comparing various adaptation strategies.

The results of these analyses will allow local, regional, and state water suppliers and users to incorporate climate change scenarios into their water resource planning.

This is the approach the United Kingdom is already using to adapt to global climate change. [8]

How does global climate affect other options?

State Water Project and Central Valley Project water deliveries are dependant on a vulnerable system with over 1,100 miles of Delta levees.

Forty-five Delta levees have failed and 37 Delta islands have flooded since the State Water Project began pumping out of the Bay-Delta Estuary in 1971.[9] Sea level rise, inadequate levees, increased flood flows and land subsidence behind the levees will increase the number of levee failures and disrupt water deliveries.

It should also be noted that the 2004 levee break on Lower Jones Tract occurred in the summer with no flooding or earthquake. Moreover, the location of the levee break was never identified as an area of concern, and in fact the area had just been inspected.[10]

Until we can be assured of the resiliency of the Delta from flooding, sea level rise and earthquakes, we should not increase our dependency on exports from the Bay-Delta Estuary.

The cost-effectiveness, reliability and environmental acceptability of increasing surface water storage for meeting California's water needs were also considered. California already has over 1,300 major dams and reservoirs that can store over 35 million acre feet of water.[11] Although they have helped develop water supplies for our uses, they have also had profound impacts on California's natural resources.

Already, 40 percent of natural freshwater flows on average are diverted before reaching the San Francisco Bay.[12] Many of the major runs of salmonid fish species are threatened, endangered or, in some watersheds, extinct. Eighteen species in the Bay-Delta Estuary are listed as endangered or threatened.[13] With global climate change these environmental impacts will increase.

Another result of climate change is larger variations in precipitation.[14] This can reduce the "yield" of proposed new surface water reservoirs.

In addition, none of the CALFED studies to date has identified a new surface water reservoir whose benefits would exceed its costs. Furthermore, potential beneficiaries have not been willing to pay for new surface storage or even the costs for studies necessary for new surface storage.

As outlined in the next section there are many more cost-effective actions California can take to maintain water supply reliability without increasing damage to our environment.

Where Will the Water Come From?

Water agencies have begun to successfully invest in diversified portfolios of programs and projects to maintain water supply reliability. This *Investment Strategy* emphasizes those programs that have proven to be cost-effective, maximize regional self-sufficiency, and are capable of being implemented.

Strategies such as water conservation, recycling, and groundwater treatment including desalination are also the most reliable during drought periods.

Invest in First Priority Water Supply Reliability Options

These are the most cost-effective, environmentally and socially positive actions. They utilize existing, proven technologies and are already part of many regional integrated water management plans. They are also part of a responsible "no regrets" strategy to adapt to climate change.

Urban Water Conservation – 2.0 to 2.3 million acre feet

Urban water conservation by existing residents will continue to be the leading source of water for California's growing population. Water conservation is one of the main reasons that urban areas have been able to accommodate the last two decades of growth with about the same amount of water they used in the 1990's.[15]

However, there is still much more that can be accomplished with existing, readily available technology. This includes low-flow toilets and showerheads, efficient clothes washers, weather-based irrigation controllers, more efficient commercial and industrial cooling equipment, etc.

Like all water management strategies, urban conservation faces implementation challenges. However, these challenges are less than those faced by other more costly and environmentally damaging options. Greater communication and collaboration among local agencies and stakeholders, as well as focused support from state and federal agencies will help to overcome these challenges. While these implementation challenges do need to be addressed, the high yield from conservation justifies significantly increased investments.

The California Department of Water Resources estimates that an additional 1.5 to 2.5 million acre feet of urban conservation is achievable.[16] In a more detailed report, the Pacific Institute estimated the potential as 2.0 to 2.3 million acre feet.[17] Over half of that savings can be achieved at a cost of $200 per acre foot or less and at least 85 percent of the total potential can be realized for less than $600 per acre foot.[18]

For purposes of comparison the rate Metropolitan Water District of Southern California charges its member agencies for treated water is projected to be $417 in 2004, increasing to $488 to $530 by 2009.[19]

Agricultural Water Conservation – Very conservatively 300,000 to 600,000 acre feet

Quietly and with little fanfare, farmers have achieved major efficiency improvements. Largely in order to maximize profits, they have increased crop production per acre foot of water by 50 percent since the 1980's.[20] An extremely conservative estimate is that by the year 2030 farmers will continue to conserve another 300,000 to 600,000 acre feet.[21] That is less than a 2 percent total increase in efficiency over 25 years.

Another incentive for farmers to increase their irrigation efficiency will be the continued need to reduce Total Maximum Daily Loads (TMDL's) of contaminants. More efficient irrigation reduces runoff of pesticides and fertilizers. Just as in the past three decades, these conservation investments will actually increase farmers' net profitability.

In addition, new technologies such as Regulated Deficit Irrigation actually reduce the amount of water some tree and vine crops use. The University of California has estimated a maximum potential of about 1 million acre feet of water use reduction, however some of fraction of that is probably already being achieved by innovative farmers.[22]

Improved efficiency will also be a major way that agriculture will deal with their groundwater overdraft. Agriculture cannot afford to pay for new surface water facilities to make up for their overdraft, and public funding is unavailable for further agricultural water subsides.

Water Recycling – 1.5 million acre feet

Similar to conservation, water recycling is an extremely reliable strategy in all years including droughts. California generates about 5 million acre feet of municipal wastewater per year. Currently California recycles only about 10 percent of this wastewater, or 450,000 to 580,000 acre feet per year. Recycled water provides a substitute source for many water supply demands, such as industry, landscape and agricultural irrigation.

The Department of Water Resources has recently identified 1.5 million acre feet of additional recycling potential at an average unit cost of about $600 per acre foot.[23]

Groundwater Treatment including Groundwater Desalination – 290,000 acre feet just for groundwater desalination; additional amount from other groundwater treatment currently unknown

Between 25 and 40 percent of California's water supply in an average year comes not from surface streams or reservoirs but rather from beneath the ground. Groundwater resources can be effectively diminished if they become contaminated to such a degree that the water remaining in the aquifers is rendered unusable.[24]

In several groundwater basins there is water that is saline or has other constituents that prevent the water from being safely used. This is a particular issue for those communities, frequently low-income, entirely reliant on groundwater.

From 1984 to 2001, more than 4,000 wells were removed from the drinking water system,[25] and the coding of those wells in the Department of Health Services Drinking Water Database implies that contamination may have motivated the closure of many, if not most, of them.[26]

Treatment technologies can allow this water to be safely used. Cleaning up groundwater basins also allows them to be used for storage as part of a conjunctive use program.

Because the salinity of groundwater is less than ocean water, the cost of groundwater desalination is less than ocean water desalination. In addition it does not have the impacts on fish and larvae associated with unscreened ocean water desalination. Environmentally acceptable methods exist for disposing of brine water associated with groundwater desalination.[27]

The State of California Desalination Task Force found that there is a potential for 290,000 acre feet of additional groundwater desalination at costs that range from $130 to $1,250 per acre foot.[28]

Stormwater Infiltration - amount currently unknown

Capture and groundwater storage of in-basin precipitation has the potential to provide increased management flexibility and self-sufficiency to many regions in California.

For instance, annual water use in the Los Angeles Basin[29] is estimated at 1.6 million acre-feet. The annual runoff volume to the ocean in this area averages about 550,000 acre-feet, nearly a third of the total amount needed to meet the Basin's demands. In addition, there are nearly 2 million acre feet of unused storage in regional groundwater basins.[30] Capturing some of this runoff for infiltration could help this and many other regions become more self-sufficient.

In addition to water supply benefits, local capture and storage can provide improved water quality in streams and the ocean, reduced flood risk, and many environmental benefits through the reduction of non-point source runoff and storm water retention.

Potential for local storage of stormwater has not yet been quantified, and thus no estimate of yield or costs can be provided.

Total Water Available From First Priority Actions to Meet the Needs for Population Increase and Environmental Restoration – at least 4.09 to 4.69 million acre feet

MEETING CALIFORNIA'S GROWING NEEDS

The following chart summarizes how California can more than meet our additional needs with cost-effective and environmentally friendly conservation, recycling and groundwater treatment including desalination. Federal, state, and local investments should focus on these programs.

Additional Needs	
	million acre-feet
Additional Population	2.0-2.4
Environmental Restoration	1.0
Total additional needs	**3.0-3.4**

First Priority Management Options	
	million acre-feet
Urban Water Conservation[31]	2.0-2.3
Agricultural Water Conservation[32]	at least 0.3-0.6
Recycled Water[33]	1.5
Groundwater Treatment and Desalination[34]	at least 0.29
Total First Priority Potential	at least **4.09-4.69**

Second Priority Water Supply Reliability Options

It is recognized that with uncertainties surrounding global climate change, the state's available water supply might be reduced. Therefore, a set of second priority options can be considered by communities that have fully implemented their "no regrets" actions - conservation, recycling and groundwater treatment including desalination. Very few communities have yet approached full implementation of these programs.

Second priority actions need to be evaluated on a case-by-case basis. While they can provide a water supply, they are not as environmentally sound or cost-effective as first priority options listed above. These actions can also cause adverse impacts that must be mitigated.

Water Transfers

Responsible, voluntary water transfers are one of the diverse strategies for increasing flexibility in water management. Water transfers are useful tools to meet many of the various needs of California. While agriculture to urban transfers are common, transfers from agriculture or urban areas to the environment should also be considered as a management option.

In some cases water transfers that match water quality to use can better utilize existing supplies. Highest quality water can be used for potable uses and other water can be used for cooling, irrigation, etc.

When the transferred water is from conservation, it actually stretches the supplies. When transfers are from selective fallowing or land retirement they reallocate water. In some cases this can be a net benefit to California.

For instance paying farmers to retire 200,000 acres of land on the west side of the San Joaquin Valley with serious drainage problems can reduce water pollution, help farmers meet TMDL requirements, and make the water available for other purposes.

While a useful management tool, water transfers and land retirements can have unintended impacts. Appropriate transfer conditions are needed to help ensure that local leaders in both source areas and receiving areas have adequate information to make informed investments, as well as ensure that third parties are protected.

The following conditions should be set to ensure that transfers are appropriate:

- Fallowing should be limited to prevent unreasonable impacts on local farming communities;

- Transfers based on groundwater substitution should not impact other users of the groundwater or impair groundwater aquifers;
- Urban areas should be required to first maximize conservation and recycling before seeking transfers from agriculture.
  This is consistent with the recommendations of the Governor's Advisory Drought Planning Panel. The Panel recommended that for urban areas to be eligible for drought transfers they must be implementing applicable urban best management practices.[35] In addition, California Water Code 10656 requires urban areas to complete an Urban Water Management Plan (UWMP) in order to receive drought assistance from the state.[36] Urban water agencies are also required to have a current UWMP to be eligible for funding administered by the Department of Water Resources;[37]

- Only areas currently implementing development consistent with state planning priorities should be eligible to seek additional water transfers, (see Implement Integrated Resources Management section below);

- For transfers of water from north of the Sacramento San Joaquin Bay-Delta Estuary to south of the Estuary, firm assurances need to be in place that such transfers will not impede progress towards improving Bay-Delta Estuary water quality or environmental restoration of the Estuary.

- Permits to use California's water have been granted to allow specific uses of the state's water in specific places. Transferring water used in one area for a specific purpose to another area for a different use can have significant impacts on the environment in the place of origin. Therefore, when transfers of water result in a change of place and a change of use, a significant portion of the transferred water should to go to the environment for restoration.

These provisions should be monitored and enforceable to ensure additional impacts from transfers do not increase over time. The Department of Water Resources has estimated that an additional 300,000 to 700,000 acre feet of water can potentially be transferred.[38]

Conjunctive Use

Agencies throughout California are actively pursuing opportunities to store water underground. New groundwater storage can complement existing surface storage to provide increased reliability. There are millions of acre feet of groundwater storage available in California. Under Proposition 13 there were proposals for several hundred million dollars in projects. One of the reasons

conjunctive use is so popular is that it often avoids many of the contentious issues that accompany proposals for new surface water storage.

However, one issue that needs to be addressed for each proposal is the source of the water to be stored and the impacts of transporting it from its origin to storage.

Investments in developing local ability to capture and store local water can provide the flexibility associated with conjunctive use and avoid the impacts from using transferred water. The Department of Water Resources projects an additional 500,000 acre feet of water from conjunctive use.[39]

Ocean Water Desalination Using Beach Well Intakes

Desalination using beach well intakes can augment a local water supply. Beach well intakes use the sand to safely filter out organisms, avoiding the environmental impacts associated with unscreened ocean intakes. However, these intakes are limited in the amount of water they can extract. In addition, the desalination process is still very energy intensive and costly. Some coastal areas may choose to use beach well intake desalination in order to add diversity to their regional water supply portfolio.

Additional Promising Management Options

There are other promising strategies that could increase water supply reliability. These include watershed restoration projects such as the one promoted by Plumas Watershed Forum that retain water in the winter and slowly release it in the spring and summer. Systems that allow re-use of gray water and reservoir re-operation also can increase water reliability. Preliminary estimates of potential water supply from these sources are promising. Therefore, these options should be pursued and researched in order to quantify the benefits and identify the beneficiaries.

Potential Water Supply Reliability Strategies that are Not Reliable, Cost-effective, or Environmentally Acceptable

New Surface Water Reservoirs

Additional surface water reservoirs would be costly to study and construct. The November, 2004 Draft California Bay-Delta Authority Finance Plan estimates that construction of the surface storage reservoirs proposed by the CALFED Record of Decision (ROD) would cost over $4 billion.[40] The Department of Water Resources and the Bureau of Reclamation have spent tens of millions of taxpayer dollars trying to justify the five proposals identified for study in the ROD.[41] According to the Department of Water Resources annual costs for the In

Delta Storage reservoir proposal would be $60 million and annual benefits would be only $30 million.[42] After four years they have not been able to find a single beneficiary willing to cost-share for these projects.

All of the surface water storage proposals being promoted are based on major subsidies from the general public,[43] but they have little if any general public benefit. Despite political support from some water users for new surface water reservoirs, no one has offered to pay for the water.

New surface water reservoirs also have significant adverse environmental impacts and they will yield only a fraction of the water that can be achieved from the less costly, more environmentally sound options outlined above.

Increased Reliance on Exports from the Sacramento - San Joaquin Bay-Delta Estuary

It is not responsible to risk California's future by increasing reliance on exports from the fragile Sacramento - San Joaquin Bay-Delta Estuary. In addition to the history of levee failures, land subsidence, inadequate maintenance and the additional impacts of global climate change discussed above, the Delta levees are also highly vulnerable to earthquakes.

According to a recent analysis by Dr. Jeffery Mount for the CALFED Science Program, the Bay-Delta Estuary is undergoing significant changes on multiple scales, including changes that significantly increase the pressure on Delta levees.[44]

Dr. Mount's study found that there is a 64 percent chance that the Bay-Delta will experience abrupt changes resulting from flooding or seismic activity within the next fifty years.[45] These changes would permanently alter the hydrology, water quality and ecosystem of the Estuary. Furthermore, Dr. Mount found that there is no institutional capacity to address these permanent changes.

Sustaining even the current level of exports from the Bay-Delta Estuary will require significant federal, state and local investments in levee maintenance and improvement. In addition, there are significant unresolved water quality, environmental, and financial questions associated with current pumping levels. These are the same issues that have plagued proposals to increase exports from the Bay-Delta Estuary for the past three decades. As the comparison of future water needs and opportunities shows, implementing feasible strategies will eliminate the need to increase exports.

Desalination Using Unscreened Ocean Intakes

Desalination using unscreened open ocean water intakes is also not recommended for investment at this time. Although new reverse osmosis filters and improved systems have reduced energy demand and costs, in most areas

ocean water desalination is still among the most expensive and energy intensive water management options. The cost-effectiveness of ocean water desalination is also susceptible to likely increases in energy costs.

In the United States there has never been a desalination plant built on the scale of those currently being considered by some California coastal communities. In fact, the desalination plant built in Tampa Bay, Florida in 2003, which is only half the size of the large projects proposed in California, has yet to provide the water originally envisioned. [46]

Furthermore, the cost reductions promised by proponents have not yet been realized in operational plants. California coastal communities thus take a high financial risk if they attempt to rely on unscreened ocean desalination.

In addition to the financial risks, there are unacceptable environmental impacts. There is currently no effective way to screen out fish and larvae. Results of a study of the impacts of impingement at a Morro Bay cooling water intake facility conducted from 1999 to 2000, reported a yearly rate of impingement of 55,000 invertebrate individuals and 78,000 fish.[47] The study further found that up to 32% of the larvae in the Morro Bay area were being killed due to entrainment at the intake.[48] Proposed unscreened ocean desalination would use intakes like the one at Morro Bay. Linking desalination plants to existing coastal power plant cooling intakes helps perpetuate intake systems that negatively impact the environment.[49]

Technology and research may in the future reduce environmental impacts and economic costs. However, for the near term, unscreened ocean desalination has unacceptable environmental impacts and is not as cost-effective as other available options.

Provide Safe Water for All Californians

Prevent groundwater pollution and treat contaminated groundwater

Local areas can maximize local water supplies and management flexibility by using groundwater and groundwater storage if these resources are not polluted.

The Department of Water Resources Bulletin 118, California's Groundwater Update 2003, found that poor land use decisions can reduce the amount of groundwater in local storage basins and degrade the quality of groundwater.[50]

Local land use agencies that invest in protecting natural groundwater recharge areas and wellhead zones will prevent costly clean up and will be able to

optimize their local groundwater resources. Non-point source reduction efforts such as storm water capture and reduced use of contaminants will help prevent groundwater pollution. Planning agencies can maximize groundwater quality and quantity by directing development away from recharge areas and ensuring that development incorporates porous surfaces.

However, many groundwater basins are already contaminated. Naturally occurring contaminants such as arsenic and radon prevent some groundwater from being safely used as potable water. Man-made contaminants such as MTBE and perchlorate have polluted many other groundwater aquifers. Local and public investments in treating contaminated groundwater help to diversify water supplies and enable more flexible water use, including conjunctive use.

Prevent surface water pollution and treat contaminated surface water

Polluted runoff and direct discharges into streams decrease water quality for local users, the ecosystem, and downstream water users. This degraded water quality increases treatment and mitigation costs. While water treatment processes remove many of these contaminants from drinking water, others stay in the environment and degrade beaches, rivers and other ecosystems. Investments in programs to reduce runoff and pollution, as well as investments in stormwater treatment will significantly reduce environmental impacts, improve water quality and reduce costs of water treatment. With proper management, runoff can be used to refill groundwater basins, increasing regional water supply reliability.

Local government and water agencies can reduce pollution and protect the sources of their water by developing source water protection plans based on the statewide source water assessments recently compiled by the California Department of Health Services (DHS).[51]

The DHS source water assessment program evaluated public drinking water sources to determine the human-caused activities to which water sources are most vulnerable.[52] Local agencies can use this information to take proactive measures to minimize those activities likely to cause contamination of the local water source. Effective source water protection plans will help ensure public health and reduce water treatment costs.

Investments in implementation of best management practices in urban areas and efficient water management practices for agricultural water users will both reduce costs of clean up and maximize available water supplies throughout a watershed.

Investments should increase where necessary to treat man-made and naturally occurring contaminants found in drinking water supplies. These investments are necessary in order protect public health.

Invest in water quality monitoring, assessment, and research

It is important to both public health and to planning efforts to know whether local and statewide water supplies can be safely used. Investments in integrated statewide monitoring, information assessment and scientific research will enable better identification of, and quick response to contaminants that threaten water sources, public and ecosystem health.

The State Water Resources Control Board should fully implement the groundwater contamination and water quality monitoring program as outlined in AB 599. This program would establish a comprehensive monitoring program capable of assessing each groundwater basin in the state.[53]

Identifying and addressing pollution at an early stage will reduce clean up costs and minimize the loss of important water supplies. Because of the broad public and local benefit of this information, state, federal and local funds should be increased for such programs.

Retire unsustainable agricultural lands

Some agricultural lands in the westside of the San Joaquin Valley have severe drainage problems. Highly saline and toxic tail water from these lands contributes to the salinization of soil and contamination of surface and ground waters. Retiring these lands will return benefits including improved water quality and quantity, reduced clean up costs, and a healthier environment. Local farmers have expressed interest in selling this unsustainable agricultural land. Investments should be made to buy this land and take it out of agricultural production.

If tax dollars are invested in taking this land out of production, taxpayers should be assured they will benefit, especially the surrounding communities. The local community should receive an investment that will allow for a diversification of its economy. Furthermore, the water saved from the retirement of this land should be dedicated to improving water quality and the environment for the entire state.

Enforce the polluter pays principle

Various pollutants have contaminated surface and ground waters of the state. When taxpayers pay for the clean up of polluted waters dischargers have no incentive to stop polluting. For instance, MTBE has polluted many California waters. MTBE clean up is expensive and difficult. Yet, MTBE producers have aggressively fought against taking financial responsibility for water supply clean ups.

Enforcement of the polluter pays principle should focus on removing and eliminating the maximum amount of the pollutant in question from the environment and public water supplies.

Enforcing a polluter pays principle will encourage industries and other dischargers to ensure pollution never reaches water sources and thus, save taxpayers hundreds of millions of dollars.

Restore and Sustain a Healthy Environment

Investments in our environment return substantial benefits to all Californians. Functioning ecosystems provide increased groundwater recharge, improved water quality, multiple recreational opportunities, and increased flood protection at a reasonable cost. Healthy rivers, beaches and other natural landscapes contribute significantly to California's $75 billion tourism industry. Ecosystem investments such as those identified below should be a part of a balanced investment package.

Restore California's rivers and freshwater ecosystems to a sustainable and attractive status consistent with the public trust

California's second largest tributary to the Bay-Delta Estuary, the San Joaquin River, is completely dry for long stretches. Up to ninety percent of the Trinity River flows, formerly one of the most productive salmon nurseries in California, have been diverted south. These are two examples of the many California rivers that need to be restored.

Recent court decisions have confirmed that both the Trinity and San Joaquin Rivers have been misused. These rivers could once again support recreation, provide habitat for fish and other wildlife and continue to be a part of California's water supply system.

Even with court mandates for river restoration, actual implementation could be delayed for years. Restoration of these and other rivers will take dedicated leadership from the state and local public agencies. Investments and support directed to river restoration efforts, such as those for the Trinity and San Joaquin Rivers will benefit all Californians, including future generations.

Invest in the removal of unnecessary barriers to fish passage

A limited number of dams across the state no longer serve their original functions. These dams impede fish passage, damage river ecosystems and create safety hazards for downstream communities. Removal of these dams will eliminate downstream safety concerns, create new recreational opportunities, contribute to restoration of functional river systems, and help to revitalize commercial and cultural fishing industries.

Provide adequate freshwater for the Bay-Delta Estuary to restore its health and sustainability

The Bay-Delta Estuary supports over 750 native species of animals and plants and contains 90 percent of the remaining coastal wetlands.[54] While the Bay-Delta ecosystem is complex and intricate, it is recognized that the ecosystem requires varying amounts of freshwater depending on season and tides.[55]

This unique habitat has been severely impacted by development, including water development. On average about 40 percent of natural freshwater flows are diverted before reaching the San Francisco Bay.[56] Eighteen species in the Bay-Delta Estuary are listed as endangered or threatened.[57] Water quality continues to be a problem for both the Bay-Delta ecosystem and downstream water users. Invasive species continue to push out and threaten native species. Increased development and pumping from this already over-allocated system would increase these problems.

With adequate freshwater, proper management and focused restoration efforts many of the ecological functions of the Bay-Delta Estuary will be revitalized. Benefits from a healthy Bay-Delta Estuary will include increased water reliability and water quality and preservation of California's biodiversity.

Preserve Viable Agriculture and Protect Open Spaces

California is home to some of the most productive agricultural lands and diverse open spaces in the world. California's agriculture industry grows more than half of the nation's total of fruits, nuts and vegetables.[58] Open spaces provide habitat for California's unique wildlife. Other benefits derived from agricultural lands and open spaces include flood management, improved ecosystem health, increased groundwater recharge, and improved water quality.

Yet, with the pressures of increased population and demand for water in urban areas, California's open spaces and agricultural lands are shrinking. The Farmland Conversion Report states that more than 91,000 acres of farmland were urbanized throughout the state from 1998 to 2000 - a 30 percent increase from the 1996 to 1998 period.[59]

Two factors that contribute to the loss of open spaces and agricultural lands are development pressure and demand for water transfers from agriculture to urban areas. Investments in urban conservation, recycling and groundwater treatment including desalination will ease the pressure for transfers of agricultural water to urban areas and ensure that the benefits derived from these lands are recognized.

Other sections of this *Investment Strategy* include recommendations that will also help to preserve these important lands. For instance, the Enable a Strong Economy section recommends better planning in California's urban areas that will help to slow urban sprawl and thus help preserve agriculture and open spaces.

Invest in preserving and maintaining the many functions of the Sacramento - San Joaquin Bay-Delta Estuary

The Sacramento - San Joaquin Bay-Delta is the largest estuary on the entire west coast of the United States. The Bay-Delta Estuary is also home to a successful agricultural industry. Residents of urban areas surrounding the Estuary enjoy access to recreation and fishing. The Estuary also provides the means by which to transfer water from Northern California to the south through the Central Valley Project and the State Water Project pumps. This array of demands has severely stressed the Estuary. It is simply over-allocated.

Proposals to increase reliance on the Bay-Delta Estuary will only result in increased risks. In order to limit new demands on the Estuary, other regions of the state need to become more self-sufficient. Integrated resource management, including conservation and recycling, along with greater use of local water supplies will reduce the need for increased demands on the Estuary. Urban boundary lines that prevent development of the Estuary will protect the ecosystem and ensure people are not placed in an area with very high flood risk.

The levee system that protects the agriculture and urban residents of the Bay-Delta Estuary, CVP and SWP facilities, and the ecosystem is in need of maintenance and improvement. While the risk of levee failure cannot be eliminated, it can be reduced through investments in levee maintenance and improvement, as well as enhanced emergency response capability.

The agricultural users of the Bay-Delta Estuary have provided a level of maintenance of the Delta levees. However, when Delta levees fail all statewide

users of water diverted from the Bay-Delta Estuary are affected. Urban areas surrounding the Estuary can be affected by decreased water quality and increased flood risk. The water pumps for the SWP and CVP must reduce, or completely stop pumping water to the south.

The most recent Delta levee break at Jones Tract in June 2004 resulted in $98 million in damages.[60] Levee maintenance and repair are significantly less expensive strategies, at an estimated cost of $410 to $740 million over ten years.[61]

Agricultural users can pay for a portion of levee maintenance, but they do not have the financial capacity to perform necessary levee improvements and they are not the only beneficiaries of levee protection. The State Water Project and the Central Valley Project should also contribute to the maintenance and improvement of those levees necessary for the conveyance of water through the Bay-Delta Estuary. In addition, there may be other levees whose maintenance can provide environmental benefits. Through cost-sharing, public and other user funding should be invested in levee improvements to maintain and restore the functions of the Bay-Delta Estuary.

However, public funds should not be used to enable further urban development of this fragile and valuable Californian resource. Urban development degrades the Bay-Delta ecosystem, magnifies water quality issues and increases the cost of levee maintenance, improvement, and repair. Urban development also places people in an area highly vulnerable to flood; a threat that has increased as a result of climate change.

A voluntary flood easement program would allow willing agricultural land owners to receive public funding to improve levees up to the protection needed for agriculture (one foot levee freeboard in a 1 percent flood).[62] In return, the public would receive assurances that frequency and costs associated with levee failures would be reduced, and that lands will remain in agriculture or as conservation easements.

Invest in programs that reduce the impacts of long-term agriculture to urban water transfers

Because agriculture uses nearly 80 percent of the developed water in California, many cities look to agriculture as a reserved water supply. Investments in urban water conservation and recycling programs will help urban areas meet demands and reduce the need to transfer water from agriculture.

As the recent transfer from the Imperial Valley has demonstrated, when urban areas need water they will get it from agriculture. The Imperial Valley transfer also demonstrates that large transfers of water impact farmers, ecosystems, and local economies.

While water transfers can and will be used to provide flexibility to water managers, without proper planning and well-thought transfer conditions unintended and harmful impacts of these transfers will occur. Without transfer conditions, situations like the battle over Colorado River water will increase and the results will be the similar to those experienced in the Imperial Valley.

Two of the conditions previously set forth in the water transfers section of this *Investment Strategy* will help protect agricultural communities and ensure that cities do not see agriculture water as the first option when demand increases. Urban areas should be required to first maximize water conservation and recycling before seeking transfers from agriculture. Secondly, only areas currently implementing development consistent with state planning priorities should be eligible to seek agricultural water transfers.

Invest in floodplain management

Open spaces and land along rivers and streams provide essential and low-cost flood management. These lands can be utilized as flood easements. An example of a successful agricultural easement is the Yolo Bypass, which has for decades provided the Sacramento area flood protection while over the same time remaining a productive agricultural area in non-flood years.

Compensating farmers and open space land owners who agree to participate in flood easement projects will provide increased security for urban and rural communities, and also help California adapt to the flooding impacts of climate change. These investments will also highlight the value of both agriculture and open spaces, contributing to the preservation of these important lands.

Ensure Social Equity for All Californians

Recommendations in the other sections of this *Investment Strategy* will improve water management for all Californians. Recognizing that low-income communities and communities of color are often disproportionately impacted by inadequate water management, the following recommendations are provided to reduce the negative impacts specific to these communities.

Ensure all Californians have access to clean, reliable and affordable water for drinking, recreation, and fish consumption

According to the California Department of Health Services, about 250,000 Californians suffer water outages; 4 million residents have drinking water that is unfiltered surface or well water that has fecal or e.coli contamination; and 1 million rely on water systems that do not adequately treat sewage.[63] Rural and economically disadvantaged communities make up the largest portion of those

without safe or clean water.[64] Ensuring that quality water is available for drinking and other life requirements is a necessary investment if California is to achieve social equity.

The affordability of drinking water for essential health and safety purposes is also an issue for low-income communities, including many communities of color. Tiered water pricing, including life-line water rates, should be part of all local agency pricing schemes.

Ecosystem degradation also affects low-income and people of color more than other communities and presents an additional water quality problem. Many people in these communities rely on subsistence fishing for food and cultural practices, and public beaches and streams for recreation.[65] Contaminants, such as mercury, that affect these environmental resources are often different than those that affect drinking water quality. When these resources are polluted, the people who rely on them are exposed to high levels of toxins. In order to adequately protect public health, it is important that California ensures ecosystems remain healthy and accessible for all Californians.

Condition transfers and land retirements to protect third parties

Water is a community resource. Water transfers from agricultural and other rural communities affect all members of the community. Improper substitution of groundwater for transferred water can deplete the water supply for dependant communities.

Low-income residents of agriculture-dependant communities are often severely impacted when water transfers result in land fallowing. Impacts on these residents are not limited to loss of jobs, but also include health impacts when fallowing results in increased dust and reduced air quality.

Transfer pre-conditions that protect groundwater basins and require proper mitigation for third party impacts will provide greater social equity in California.

Ensure all Californians have equitable rate of recovery from flood disasters

While it is important that new residential development be kept out of flood prone areas, it is recognized that many people, including low-income and people of color, already live in those areas. The less affluent a neighborhood, the slower it recovers from a flood.[66] Hence, flood relief and recovery assistance should be targeted to low-income, non-insured or under-insured communities in order to ensure a more equitable response and recovery time.

Furthermore, for a neighborhood to recover, it is the relative loss that is important. A poor family need not lose much to be profoundly harmed. It is

necessary to provide comprehensive relief to low-income families. In areas subject to repeated flooding, assistance should include development of alternate low-income housing outside the floodplain and relocation assistance.

Ensure that all Californians can participate in water management planning

Water management planning needs to be a more inclusive process. State and local agencies should engage members of affected communities, under-represented communities, communities of color and low-income communities in all planning efforts. Local water boards should be made up of people representative of the demographics of the areas served. Greater representation will result in more equitable investments.

Enable a Strong Economy

California's economy has prospered due in part to the innovation, investment, and hard work dedicated to water management and infrastructure improvements. Now virtually all of the state's water supplies are already allocated or in many cases over-allocated. To support California's economy in the next fifty years, investments need to focus on the restoration, management, and efficient use of California's water systems.

The investments recommended in the other sections of this *Strategy* are the most cost-effective package for meeting California's water needs. There are three additional recommendations that will minimize taxpayer costs and maximize benefits.

Minimize taxpayers' liability for flood losses

Recently, a California court ruled that all taxpayers throughout California are responsible for damage incurred at a small Yuba County community due to levee breaks during the 1986 flood.[67] Taxpayers throughout California are required to pay damages of $800 million to $1.5 billion from the already over-burdened general fund.[68]

Remarkably, a new development of 12,000 homes has been approved in the same area in Yuba County, even while it is known that the levees are still unsafe. Similar developments throughout the state represent a high financial risk for taxpayers and reduce the funds available for other important programs. In order to reduce the risk to taxpayers and to help local agencies make informed decisions, conditions for development in active and minimally protected floodplains should be mandated.

The state should also invest in educating the public about the limitations of misnamed "100-year" flood protection and risks associated with living in areas 'reasonably likely' to flood. Increased risks of flooding due to global climate change impacts and risks of living behind marginal levees should also be better known and disclosed.

Many new developments have been proposed for areas with incomplete or out-of-date flood risk maps. Investments should be accelerated to map areas reasonably likely to flood. Flood risk maps should be completed and updated before developments in these areas are approved. These maps should incorporate increased flood risks resulting from additional planned development in the watershed and the impacts of climate change.

Providing mapping and education to the public will also allow people to make smarter decisions when choosing to invest in a home. When used to guide responsible land-use decisions at the local level, these maps will also reduce taxpayer liability.

Implement the beneficiary pays principle

The beneficiary pays principle requires that costs, to the extent possible, be paid by the beneficiaries of the program actions.[69] According to the California Legislative Analyst's Office, the beneficiary pays principle has not been implemented.[70] With California's current budget problems it is unreasonable to ask the taxpayers to pay the high costs for projects that benefits a select few or for mitigation that is the responsibility of a specific group. Costs and benefits for all proposed actions should be determined in an open and public process. Those who are beneficiaries of projects should contribute their share.

The Environmental Water Account (EWA) is largely a mitigation project for the Central Valley Project and the State Water Project, providing these projects assurances that Endangered Species Act requirements will not curtail their water deliveries. Yet taxpayers, not project contractors, are paying for this multi-million dollar program.

Taxpayers have paid the entire cost of the EWA for the past four years, totaling over $168 million.[71] Estimates indicate that the EWA will cost over $400 million over the next ten years.[72] Even while the Legislative Analyst's Office has called for water users to pay for part of the EWA[73], a recent draft finance plan for the EWA proposes that taxpayers continue to fully fund this expensive program for the next three years.[74]

The water user beneficiaries should pay their share of the costs of this project. It is inappropriate for taxpayers to continue to pay the water users' share of the EWA for three more years. Water users should be required to pay for the benefits they are receiving beginning this year.

Studies of surface water storage projects are another example of taxpayers being required to subsidize projects that are intended to benefit a select group. Seventy million taxpayer dollars[75] have been spent to pursue projects that are not economically justified. Yet, no beneficiaries have been required to cost-share in these studies. These scarce funds should be directed to programs with greater economic and environmental cost-benefit ratios, such as conservation and recycling.

Estimated costs for completing the five surface storage studies now underway total $87 million.[76] If studies of surface water storage proceed, despite evidence that it is not needed, potential beneficiaries should be required to pay for these studies and to reimburse the state for those funds already spent. Because the Bureau of Reclamation has already indicated that all benefits from additional storage on the San Joaquin River would go to water supply, all costs for that study should be paid by those water districts intending to receive that supply. This recommendation is consistent with the Legislative Analyst's Office recent recommendations on funding surface storage and surface storage investigations.[77]

The State Water Project and the Central Valley Project benefit from secure Delta levees.[78] The SWP and the CVP should contribute to the maintenance and improvement of those levees that are necessary for the conveyance of water through the Bay-Delta Estuary.

Watershed management is another example of where beneficiary pays and cost sharing should be implemented. The benefits of watershed management and restoration frequently extend beyond local areas. Those who realize water supply and water quality benefits should pay for those benefits.

Ensure sufficient reliable water supplies are available prior to approving development

To minimize the likelihood of shortages and to prevent degradation of water quality, reliable water supplies should be identified and secured prior to approval of development in California. Failing to plan appropriately has resulted in over-allocated systems, groundwater overdraft, fallowing of farmland, environmental degradation and other negative impacts. Many Urban Water Management Plans do not have complete or accurate data.

Investments in accurate and reliable data on water availability will facilitate responsible and intelligent planning. More reliable water availability data based on historical records, current research, climate change impacts, and some modeling information should be supplied from the state to local agencies. Investments should be made to develop new models and to calibrate existing models. The state should communicate the limitations of existing models such as

CALSIM II and provide guidance on the appropriate use of model information for local agencies.

Local agencies should ensure that development and future growth is not dependent on supplies that are unreliable. Water that is interruptible or insecure, such as non-permanent transfers and surplus water deliveries, should not be considered reliable or permanent supplies.

In a recent report on protecting water resources, the U.S. EPA recommended implementation of policies making adequate water a prerequisite of additional growth in order to maintain water quality and supply.[79] Consistent with this recommendation, California should ensure that all planning and development is based on reliable and secure water supplies. Recent legislation (SB 221 and SB 610) requires planning agencies to coordinate somewhat with water agencies to ensure water supplies are available for new development projects over 500 units.

While these laws are a first step toward responsible planning, they do not apply to the many development projects in California that are under 500 units. Legislation mandating that all general plans contain a water element would help ensure that local agencies understand water supply availability, and encourage more responsible development in California.

Implement Integrated Resources Management

Effective water management integrates water quality, water quantity, groundwater, surface water, water temperature, timing, reliability, flood planning, and ecosystem restoration. Water management is also most effective when integrated with management of other resources including energy and land use.

For instance, transporting and treating water makes up over 6 percent of California's entire electrical demand.[80] Consequently, water conservation not only saves water, but also energy.

By integrating management of multiple resources there are also greater opportunities for cost sharing among many agencies to achieve multiple benefits. For instance, flood managers and water districts can jointly fund projects to use storm water to recharge groundwater basins, reduce flood risk, increase wetland habitat, and increase water supply and reliability.

Many regions and local agencies throughout California including the Metropolitan Water District of Southern California and the Inland Empire Utilities District have taken the lead in integrated resource management. These agencies are seeing positive results including increased regional self-sufficiency.

Invest in watershed management

Watershed management employs both large and small scale projects to improve the overall health of an entire watershed. This management approach is a cost-effective means to efficiently achieve multiple benefits.

It is applicable to individual watersheds as well as larger areas such as the Sierra Nevada which is the source for much of the state's water supply. Healthy watersheds reduce "flash runoff" and allow more infiltration.

In rural areas of origin watershed management investments improve water quality and reliability for the entire state. In urban areas watershed restoration results in improved regional water quality, while also providing healthy ecosystems that can be enjoyed by city residents, including low-income communities and communities of color.

Overall benefits of watershed management include increased water quality and reliability, habitat for native wildlife, multiple recreational opportunities, and preservation of California's unique, valuable and diverse landscapes. Watershed management can also reduce the costs of water treatment and ecosystem restoration.

Watershed management also benefits energy generation. For instance, Pacific Gas & Electric's (PG&E) Rock Creek and Cresta hydro-electric dam reservoirs had lost half of their original storage capacities in the 1990's due to sedimentation, significantly reducing energy generation potential. Investments from PG&E along with local efforts have reduced sedimentation entering those reservoirs by 50 percent.[81] This investment in watershed restoration resulted in energy generation and ecosystem restoration benefits.

The public, local residents, and downstream water users are all beneficiaries who should invest in watershed management.

Ensure water planning processes are more open, transparent and inclusive of all stakeholders

Past closed-door water deals lead to distrust and long, costly legal battles that delayed progress for all Californians. Water resource planning should be an open and collaborative process inclusive of all governmental and non-governmental stakeholders. Public funding should go only to those projects that are developed in open, transparent and inclusive processes.

The state's water management should serve as a model for inclusive and transparent public processes. Open processes will result in more complete and realistic water management strategies, prevent bitterness, build trust and save

the state millions of dollars. Most importantly, it will lead to programs that actually get implemented.

Invest in water projects that are consistent with state planning priorities

Taxpayer dollars should be directed to those programs that maximize overall benefits for dollars spent. Therefore, public funding should be invested in water projects consistent with legally mandated state priorities which support infill development and redevelopment, cultural and historic resources, environmental and agricultural resources, and efficient development patterns.

Government Code section 65041.1 sets forth these priorities:

> "The state planning priorities, which are intended to promote equity, strengthen the economy, protect the environment, and promote public health and safety in the state, including in urban, suburban, and rural communities, shall be as follows:
> (a) To promote infill development and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by transit, streets, water, sewer, and other essential services, particularly in underserved areas, and to preserving cultural and historic resources.
> (b) To protect environmental and agricultural resources by protecting, preserving, and enhancing the state's most valuable natural resources, including working landscapes such as farm, range, and forest lands, natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands, recreation lands such as parks, trails, greenbelts, and other open space, and landscapes with locally unique features and areas identified by the state as deserving special protection.
> (c) To encourage efficient development patterns by ensuring that any infrastructure associated with development that is not infill supports new development that uses land efficiently, is built adjacent to existing developed areas to the extent consistent with the priorities specified pursuant to subdivision (b), is in an area appropriately planned for growth, is served by adequate transportation and other essential utilities and services, and minimizes ongoing costs to taxpayers."[82]

Implementing these priorities will result in reduced polluted runoff, reduced per capita water and energy use, increased groundwater recharge, improved air quality reduced costs of infrastructure, and reduced traffic congestion.[83]

For more information about the *Investment Strategy for California Water* please contact Mindy McIntyre, Water Policy Specialist at the Planning & Conservation League at (916) 313-4518 or at mmcintyre@pcl.org.

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[1] May 2004 CALFED Draft Finance Options Plan
http://www.calwater.ca.gov/FinancePlanning/Draft_Finance_Options_Report_5-11-04.pdf

[2] Emissions pathways, climate change, and impacts on California. June 23, 2004.
http://www.pnas.org/cgi/reprint/101/34/12422.pdf
Intergovernmental Panel on Climate Change 2001; Summary for Policymakers
http://www.grida.no/climate/ipcc_tar/wg1/008.htm
The Effects of Climate Change on Water Resources in the West: Introduction and Overview pp. 1-11 Tim Barnett, Robert Malone, William Pennell, Detlet Stammer, Bert Semtner, Warren Washington
Draft of paper: http://cirrus.ucsd.edu/~pierce/crd/globalwarming/ACPI-ClimaticChange.12-12-02.pdf
Mid-Century Ensemble Regional Climate Change Scenarios for the Western United States pp. 75-113 L. Ruby Leung, Yun Qian, Xindi Bian, Warren M. Washington, Jongil Han, John O. Roads http://www.pnl.gov/atmos_sciences/Lrl/Leung-3.pdf
Changes in Snowmelt Runoff Timing in Western North America under a `Business as Usual' Climate Change Scenario pp. 217-232 Iris T. Stewart, Daniel R. Cayan, Michael D. Dettinger
http://tenaya.ucsd.edu/~dettinge/stewart_acpi.pdf
Mitigating the Effects of Climate Change on the Water Resources of the Columbia River Basin pp. 233-256 Jeffrey T. Payne, Andrew W. Wood, Alan F. Hamlet, Richard N. Palmer, Dennis P. Lettenmaier
http://www.tag.washington.edu/publications/papers/payne_CC_final_080503.pdf
Potential Implications of PCM Climate Change Scenarios for Sacramento–San Joaquin River Basin Hydrology and Water Resources, pp. 257-281 Nathan T. VanRheenen, Andrew W. Wood, Richard N. Palmer, Dennis P. Lettenmaier
http://www.tag.washington.edu/publications/papers/VanRheenen-etal.2004.ClimChg.62,257-281.pdf
Simulated Hydrologic Responses to Climate Variations and Change in the Merced, Carson, and American River Basins, Sierra Nevada, California, 1900–2099, pp. 283-317 Michael D. Dettinger, Daniel R. Cayan, Mary K. Meyer, Anne E. Jeton
http://tenaya.ucsd.edu/~dettinge/sierra_change.pdf
http://sfbay.wr.usgs.gov/access/bibliography/pdf/dettinger_2004_climate_change.pdf
Elevational Dependence of Projected Hydrologic Changes in the San Francisco Estuary and Watershed, pp. 319-336 Noah Knowles, Daniel R. Cayan
http://sfbay.wr.usgs.gov/access/bibliography/pdf/knowles_2004_sf_estuary.pdf
The Effects of Climate Change on the Hydrology and Water Resources of the Colorado River Basin, pp. 337-363 Niklas S. Christensen, Andrew W. Wood, Nathalie Voisin, Dennis P. Lettenmaier, Richard N. Palmer
Draft of paper: http://www.hydro.washington.edu/Lettenmaier/Publications/ACPI/Christenson_CC_final_0801.pdf
http://ftp.hydro.washington.edu/pub/niklas/paper_sep26_2.pdf
VanRheenen, N.T., Palmer, R.N., and Hahn, M.A. (2003). "Evaluating Potential Climate Change Impacts on Water Resources Systems Operations: Case Studies of Portland, Oregon and Central Valley, California." Water Resources Update, 124, 35-50.
http://www.tag.washington.edu/publications/papers/VanRheenen-etal.2003.WaterResourcesUpdate.124,35-50.pdf

Spring onset in the Sierra Nevada--When is snowmelt independent of elevation?, by Lundquist, Cayan, and Dettinger, Journal of Hydrometeorology, 5, 325-340, http://tenaya.ucsd.edu/~dettinge/Lundquist_synchmelt.pdf
Brekke, L.D. , N. L. Miller, K.E. Bashford, N.W.T. Quinn, and J.A. Dracup. 2004: Climate change impacts uncertainty for water resources in the San Joaquin River Basin, California, J. Amer. Water Resources Assoc., 149-164. http://www-esd.lbl.gov/ESD_staff/miller/pubs/brekke_2004.pdf
Miller, N.L., K.E. Bashford, E. Strem, 2003: Potential Impacts of Climate Change on California Hydrology, J. Amer. Water Resources Assoc., 771-784. http://www-esd.lbl.gov/ESD_staff/miller/pubs/miller_jawra2003.pdf
Kim, J., T-K Kim, R W Arritt and N L Miller 2002: Impacts of increased CO2 on the hydroclimate of the western United States, J. Climate, 15, 1926-1942 http://www-esd.lbl.gov/ESD_staff/miller/pubs/kim_jclimate2002.pdf
"The transboundary setting of California's water and hydropower systems--Linkages between the Sierra Nevada, Columbia, and Colorado hydroclimates" by Cayan, Dettinger, Redmond, McCabe, Knowles, and Peterson, 2003, book chapter, pdf.
http://tenaya.ucsd.edu/~dettinge/transboundary.pdf
Climate Change Sensitivity Study of California Hydrology: A Report to the California Energy Commission. LBNL Technical Report No. 49110. November 2001. Norman L. Miller and Kathy E. Bashford California Water Resources Research and Applications Center Lawrence Berkeley National Laboratory, University of California and Eric Strem
California-Nevada River Forecast Center
NOAA-National Weather Service
http://www-esd.lbl.gov/RCC/outreach/Miller-Bashford-Strem.pdf

[3] Population Projections by Race/Ethnicity for California and Its Counties 2000-2050,California Department of Finance, May, 2004
http://www.dof.ca.gov/HTML/DEMOGRAP/DRU_Publications/Projections/P-1_Tables.xls

[4] Emissions pathways, climate change, and impacts on California. June 23, 2004.
http://www.pnas.org/cgi/reprint/101/34/12422.pdf

[5] Intergovernmental Panel on Climate Change 2001; Summary for Policymakers
http://www.grida.no/climate/ipcc_tar/wg1/008.htm

[6] Intergovernmental Panel on Climate Change 2001. Climate Change 2001: The Scientific Basis. Technical Summary. p. 75.

[7] Abrupt Climate Change: Inevitable Surprises, National Academy of Sciences, 2004
http://dels.nas.edu/abr_clim/adapting.shtml

[8] Potential UK adaptation strategies for climate change, May 2000. United Kingdom Department of Environment, Transport and Regions
http://www.erm.com/ERM/news.nsf/0/a28988fb502f6a608025694a005e0580/$FILE/Climate.pdf

[9] Delta levee information provided via email by David Lawson, Department of Water Resources Bay-Delta Offices staff

[10] "Local and state flood control officials were at a loss to explain why a privately maintained levee on the 11,000-acre Jones Tract, an island west of Stockton, had failed during the dry season." The Sacramento Bee, Associated Press, June 4, 2004 www.sacbee.com

[11] Laypersons Guide to California Water. The Water Education Foundation. 2000.

[12] The San Francisco Bay Institute, http://www.bay.org/about_the_bay.htm

[13] The San Francisco Bay Institute, http://www.bay.org/about_the_bay.htm

[14] Intergovernmental Panel on Climate Change 2001; Summary for Policymakers
http://www.grida.no/climate/ipcc_tar/wg1/008.htm

[15] Draft California Water Plan Update 2003, California Dept. of Water Resources, June 7, 2004 Vol.1 pg 4
http://www.waterplan.water.ca.gov/b160/B160.Draft.June.7.2004/Vol_1/Findings%20%20Recommended%20Actions%20_06-07-2004_.pdf

[16] Draft California Water Plan Update 2003, California Dept. of Water Resources, June 7, 2004, vol.1 pg 10

http://www.waterplan.water.ca.gov/b160/B160.Draft.June.7.2004/Vol_1/Findings%20%20Recommended%20Actions%20_06-07-2004_.pdf

[17] Waste Not, Want Not: The Potential for Urban Water Conservation in California, Pacific Institute, 2003 http://www.pacinst.org/reports/urban_usage/

[18] Waste Not, Want Not: The Potential for Urban Water Conservation in California, Pacific Institute, 2003 http://www.pacinst.org/reports/urban_usage/

[19] 2004/05 Budget, Metropolitan Water District of Southern California, June, 2004 pg 12 http://www.mwdh2o.com/mwdh2o/pdf/finance/Exec2004web.pdf

[20] Draft California Water Plan Update 2003, California Dept. of Water Resources, June 7, 2004 vol.1 pg 2 http://www.waterplan.water.ca.gov/b160/B160.Draft.June.7.2004/Vol_1/Findings%20%20Recommended%20Actions%20_06-07-2004_.pdf

[21] Draft California Water Plan Update 2003, California Dept. of Water Resources, June 7, 2004 vol.1 pg 10 http://www.waterplan.water.ca.gov/b160/B160.Draft.June.7.2004/Vol_1/Findings%20%20Recommended%20Actions%20_06-07-2004_.pdf

[22] Draft California Water Plan Update 2003, California Dept. of Water Resources, June 7, 2004, vol.4 pg 31 http://www.waterplan.water.ca.gov/b160/B160.Draft.June.7.2004/Vol_4/Agriculture.pdf

[23] Water Recycling 2030, California Dept. Of Water Resources, 2003 http://www.owue.water.ca.gov/recycle/docs/TaskForceReport.htm

[24] California's Contaminated Groundwater: Is The State Minding The Store?, April 2001 Natural Resources Defense Council. http://www.nrdc.org/water/pollution/ccg/ccg.pdf

[25] Data from the Department of Health Services (DHS) Drinking Water Database (1984–2000); compiled by LFR

[26] California's Contaminated Groundwater: Is The State Minding The Store?, April 2001 Natural Resources Defense Council. http://www.nrdc.org/water/pollution/ccg/ccg.pdf

[27] Desalination Task force, California Department of Water Resources, 2003 http://www.owue.water.ca.gov/recycle/desal/desal.cfm

[28] Desalination Task force, California Department of Water Resources, 2003 http://www.owue.water.ca.gov/recycle/desal/desal.cfm

[29] Defined as the Los Angeles, San Gabriel Rivers and Santa Monica Bay Watersheds

[30] Source: Suzanne Dallman, Manager of Stormwater Programs for the Los Angeles & San Gabriel Rivers Watershed Council; specific references available upon request.

[31] Waste Not, Want Not: The Potential for Urban Water Conservation in California, Pacific Institute, 2003 http://www.pacinst.org/reports/urban_usage/

[32]Draft California Water Plan Update 2003, California Dept. of Water Resources, June 7, 2004 vol.1 pg 10 http://www.waterplan.water.ca.gov/b160/B160.Draft.June.7.2004/Vol_1/Findings%20%20Recommended%20Actions%20_06-07-2004_.pdf

[33] Water Recycling 2030, California Dept. Of Water Resources, 2003 http://www.owue.water.ca.gov/recycle/docs/TaskForceReport.htm

[34] 290,000 acre-feet represents the potential of groundwater desalination only, the potential for groundwater treatment is currently unknown. Desalination Task force, California Department of Water Resources, 2003 http://www.owue.water.ca.gov/recycle/desal/desal.cfm

[35] Critical Water Shortage Contingency Plan, Governor's Advisory Drought Planning Panel, December 29, 2000. http://watersupplyconditions.water.ca.gov/pdf/Contingency_Plan-text.pdf

[36] California Water Code Section 10656 http://www.owue.water.ca.gov/docs/UWMPAct_8-1-03.pdf

[37] California Water Code Section 10657 (a). http://info.sen.ca.gov/pub/01-02/bill/sen/sb_0601-0650/sb_610_bill_20011009_chaptered.pdf

[38] Draft California Water Plan Update 2003, California Dept. of Water Resources, September 30, 2003. http://www.waterplan.water.ca.gov/b160/workgroups/chapterreviewgroup.htm

[39] Draft California Water Plan Update 2003, California Dept. of Water Resources, September 30, 2003. http://www.waterplan.water.ca.gov/b160/workgroups/chapterreviewgroup.htm

[40] Draft California Bay-Delta Authority Finance Plan, November 2004 p 92
http://calwater.ca.gov/FinancePlanning/CALFED_Finance_Plan_11-10-04.pdf
[41] CALFED Draft Finance Options Report May 2004
http://calwater.ca.gov/FinancePlanning/Draft_Finance_Options_Report_5-11-04.pdf
[42] Draft Executive Summary In Delta Storage Feasibility Studies - January 2004
http://calwater.ca.gov/Programs/Storage/InDeltaStorageReports_2003/Executive%20Summary/Draft_In-Delta_Executive_Summary_1-30-04.pdf
[43] Draft California Bay-Delta Authority Finance Plan, November 2004 p 89
http://calwater.ca.gov/FinancePlanning/CALFED_Finance_Plan_11-10-04.pdf
[44] Subsidence, Seismicity and Sea Level Rise: Hell AND High Water in the Delta; presented by Dr. Jeffery Mount to the California Bay-Delta Authority October 14, 2004.
http://calwater.ca.gov/CBDA/AgendaItems_10-13-14-04/Presentation/Item_13_6_Subsidence_Seismicity_Sea_Level_Rise.pdf
[45] Subsidence, Seismicity and Sea Level Rise: Hell AND High Water in the Delta; presented by Dr. Jeffery Mount to the California Bay-Delta Authority October 14, 2004.
http://calwater.ca.gov/CBDA/AgendaItems_10-13-14-04/Presentation/Item_13_6_Subsidence_Seismicity_Sea_Level_Rise.pdf
[46] "Tampa Bay Desalination Plant, Florida, USA." Water Technology Webpage, September 30, 2004 http://www.water-technology.net/projects/tampa/
[47] Estimation of ecological impacts due to use of seawater in a desalinization facility (in a NEPA / CEQA context) Impingement, Entrainment. Dr. Pete Raimondi, Professor and Chair, Dept of Ecology and Evolutionary Biology, UC Santa Cruz
http://www.owue.water.ca.gov/recycle/desal/Docs/Entrainment_impingement.pdf
[48] Estimation of ecological impacts due to use of seawater in a desalinization facility (in a NEPA / CEQA context) Impingement, Entrainment. Dr. Pete Raimondi, Professor and Chair, Dept of Ecology and Evolutionary Biology, UC Santa Cruz
http://www.owue.water.ca.gov/recycle/desal/Docs/Entrainment_impingement.pdf
[49] Desalination Task force, California Department of Water Resources, 2003
http://www.owue.water.ca.gov/recycle/desal/desal.cfm
[50] Bulletin 118-Update 2003 California's Groundwater, Department of Water Resources, pg. 3
http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/Bulletin118_Entire.pdf
[51] California's Drinking Water Source Assessment and Protection (DWSAP) Program
http://www.dhs.ca.gov/ps/ddwem/dwsap/DWSAPindex.htm
[52] California's Drinking Water Source Assessment and Protection (DWSAP) Program
http://www.dhs.ca.gov/ps/ddwem/dwsap/DWSAPindex.htm
[53] California Assembly Bill 599
http://www.swrcb.ca.gov/gama/docs/ab_599_bill_20011005_chaptered.pdf
[54] The San Francisco Bay Institute, http://www.bay.org/about_the_bay.htm
[55]Michael Dettinger, William Bennett, Daniel Cayan, Joan Florsheim, Malcolm Hughes, B. Lynn Ingram, Noah Knowles, Frances Malamud-Roam, David Peterson, Kelly Redmond, and Lawrence Smith, "Climate Science issues and needs of the CALFED Bay-Delta Program." presented at the 83rd American Meteorological Society (AMS) Annual Meeting, February 2003
http://meteora.ucsd.edu/cap/AMS_dettinger_preprint.pdf
[56] The San Francisco Bay Institute, http://www.bay.org/about_the_bay.htm
[57] The San Francisco Bay Institute, http://www.bay.org/about_the_bay.htm
[58] California Department of Food & Agriculture, California Agricultural Directory 2002. p 28
http://www.cdfa.ca.gov/card/card_new02.htm
[59] California Department of Conservation webpage: Urbanization Rate Picks Up in San Joaquin County, August 3, 2004
http://www.consrv.ca.gov/index/news/2004%20News%20Releases/NR2004-20_San_Joaquin_FMMP.htm
[60]Levee break losses go into the tens of millions, *Ag Alert* Kristen Souza, June 16, 2004
http://www.cfbf.com/agalert/2004/06_16_04_1_aa.cfm
[61] CALFED Draft Finance Options Report May 2004 pg. 73
http://calwater.ca.gov/FinancePlanning/Draft_Finance_Options_Report_5-11-04.pdf

[62] Public Law 84-99, Act of 1955 (as amended), Flood Control, Emergency Authority
[63]Department of Water Resources Water Planning October 2003 pg 2 http://www.waterplan.water.ca.gov/landwateruse/wateruse/Urban/Potable%20Water/CALIFORNIANS%20WITHOUT%20SAFE%20WATER_final100703.doc
[64] Department of Water Resources Water Planning October 2003. pg 2 http://www.waterplan.water.ca.gov/landwateruse/wateruse/Urban/Potable%20Water/CALIFORNIANS%20WITHOUT%20SAFE%20WATER_final100703.doc
[65]Promoting Quality, Equity, and Latino Leadership in California Water Policy. pg 10 Latino Issues Forum June 2003. http://www.lif.org/publications/water_report/water_report2003.pdf
[66] January 1997 Floods", Assembly Water, Parks & Wildlife Committee, California Research Bureau, Dennis O'Conner
[67] Paterno v. State of California (2003) 114 Cal.App.4th 308d Dec. 24, 2003. No. C040553, Paterno v. State of California (2003) 114 Cal.App.4th 308d
[68] Western Water Magazine July/August 2004. Water Education Foundation
[69] CALFED Bay-Delta Program Record of Decision August 28, 2000: p 34 http://calwater.ca.gov/Archives/GeneralArchive/rod/ROD.pdf
[70] Legislative Analyst's Office: February 2004 Analysis of the 2004-05 Budget Bill CALFED Bay-Delta Program: At a Funding Crossroads http://www.lao.ca.gov/analysis_2004/resources/res_02_cc_calfed_anl04.htm
[71] Legislative Analyst's Office: February 2004 Analysis of the 2004-05 Budget Bill CALFED Bay-Delta Program: At a Funding Crossroads http://www.lao.ca.gov/analysis_2004/resources/res_02_cc_calfed_anl04.htm
[72] Draft 10-Year Finance Plan Program Element Issue Papers September 2004, California Bay-Delta Authority http://calwater.ca.gov/FinancePlanning/Draft_BDPAC_10_Year_Finance_Issue_Papers_9-7-04.pdf
[73] Legislative Analyst's Office: February 2004 Analysis of the 2004-05 Budget Bill: CALFED Bay-Delta Program: At a Funding Crossroads http://www.lao.ca.gov/analysis_2004/resources/res_02_cc_calfed_anl04.htm
[74] Draft California Bay Delta Authority Finance Plan November 2004, pg 41 http://calwater.ca.gov/FinancePlanning/CALFED_Finance_Plan_11-10-04.pdf
[75] Draft 10-Year Finance Plan Program Element Issue Papers September 2004, California Bay-Delta Authority http://calwater.ca.gov/FinancePlanning/Draft_BDPAC_10_Year_Finance_Issue_Papers_9-7-04.pdf
[76] Draft California Bay Delta Authority Finance Plan November 2004, pg 88 http://calwater.ca.gov/FinancePlanning/CALFED_Finance_Plan_11-10-04.pdf
[77] Legislative Analyst's Office: February 2004 Analysis of the 2004-05 Budget Bill: CALFED Bay-Delta Program: At a Funding Crossroads http://www.lao.ca.gov/analysis_2004/resources/res_02_cc_calfed_anl04.htm
[78] Draft California Bay Delta Authority Finance Plan November 2004, pg 82 http://calwater.ca.gov/FinancePlanning/CALFED_Finance_Plan_11-10-04.pdf
[79] Protecting Water Resources With Smart Growth, U.S. EPA, May, 2004 http://www.epa.gov/smartgrowth/pdf/waterresources_with_sg.pdf
[80] Water Energy Use In California, California Energy Commission , 2003 http://www.energy.ca.gov/pier/iaw/industry/water.html
[81] "California Utility Invests in Watershed Restoration." *Non-Point News-Notes*, issue number 46, October 2003 http://notes.tetratech-ffx.com/newsnotes.nsf/0/89014cc560f27e698525666a005048cc?OpenDocument
[82] California Government Code section 65041.1
[83] Protecting Water Resources With Smart Growth, U.S. EPA, May, 2004 http://www.epa.gov/smartgrowth/pdf/waterresources_with_sg.pdf