US Army Corps of Engineers®

Water Supply

Value to the Nation

Value to the Community and Individuals

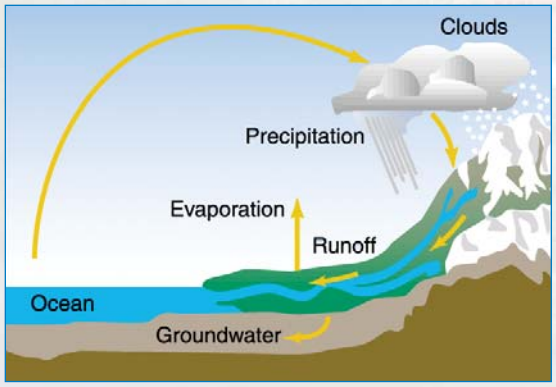
How can the Corps Help?

The Corps "Water Supply Handbook" is a comprehensive desktop reference publication and a valuable introduction to the Corps authorities and capabilities relative to water supply. An electronic copy is available at: http://www.iwr.usace.army.mil/iwr/pdf/96ps4.pdf

Water supply studies typically require analysis of 10 to 100 years of streamflow quantity records. Computers are ideally suited to the processing of these vast amounts of data. Computer programs produced by the Corps Hydrologic Engineering Center are the standard applications used by private engineering firms, government agencies and universities for water supply studies. More information is available at: http://www.hec.usace.army.mil/

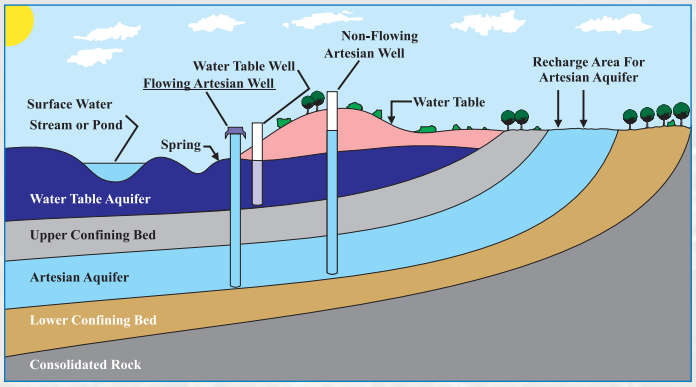
The Corps has offices throughout the United States that can provide information and assistance. Contact information is included at the end of this brochure. The Corps' Institute For Water Resources (IWR) has reports, software, databases, and other information that provide more detail on the Corps authorities and capabilities for water supply. Much of the information is available electronically at the website: http://www.iwr.usace.army.mil/.

Where does water come from and how is it used



Water moves constantly through a vast global hydrologic cycle. It: (a) evaporates from oceans, lakes, rivers and land, (b) condenses into clouds, (c) precipitates as rain or snow, (d) percolates into the soil or runs off into streams, and, (e) flows back to the ocean. The sun is the source of energy that drives this cycle.

People temporarily divert part of the water from this cycle for special purposes. Some uses return the water to the source. This is described as non-consumptive use. Examples are hydropower generation and water used for cooling coal fired and nuclear electrical power generation facilities. Many users, such homes, businesses, manufacturers, crop irrigators, ranchers, and miners withdraw water that is used offstream and not directly returned to the source. That portion of water not returned to the source is described as consumptive use. In the United States approximately 80 % of consumptive use water is drawn from streams and lakes and 20 % is drawn from wells



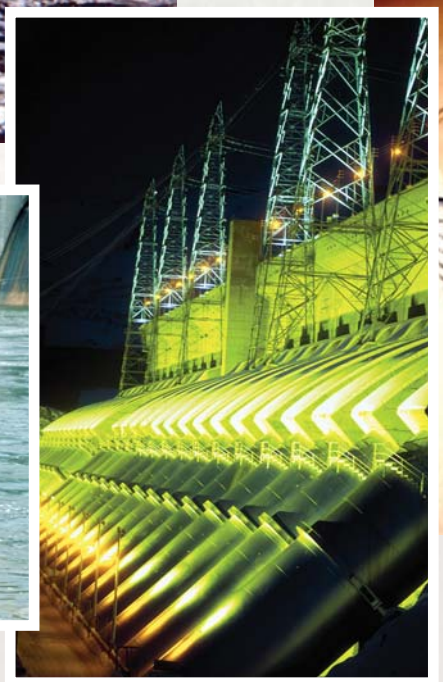
Also, water may be temporarily stored in reservoirs and later released during periods of low natural flow to improve fish and wildlife habitat, improve water quality and for other consumptive and non-consumptive uses. Many Corps reservoirs provide these benefits and most have potential to increase benefits by storage reallocation.

Water Demand, Consumption and Conservation

A person's water requirement can be measured in different ways. Daily intake by the body averages about 0.3 gallon. Amount used in a household varies depending on efficiency, seasonal lawn watering, and other factors, but on average is in the 50 to 85 gallons per day (gpd) range. Municipalities typically must supply about 150 gpd for each person. Total offstream use per person is about 1270 gpd. This includes water gathered for all uses including irrigation, manufacturing, electrical generation, public uses, and other purposes.

Seasonal lawn watering is the largest water use outside the typical home, as toilet flushing is the largest water use in it. New, low flow toilets can cut the use per flush from a 4-7 gallon level to as low as 1.5 gallons. Typical use distribution within the home is toilet ~40%, bath and shower ~32%, laundry ~14%, dishwashing ~6%, cooking and drinking ~5%, and bathroom sink ~3%.

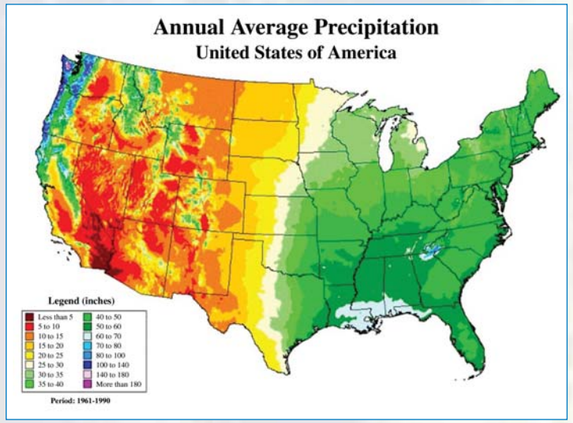
Irrigation systems for production of crops are well developed in the United States. Extensive use of irrigation allows us to enjoy an abundance of high quality food that is available for both domestic use and export. However, agricultural production accounts for 80 percent of the nation's consumptive use of water. Increased efficiency in use of irrigation has been a major factor in the overall reduction in consumptive use of water in the U.S. in the last 20 years. Further adoption of efficient methods and reallocation is expected to cause continued decrease in water used for irrigation. The Department of Agriculture provides much information on agricultural on its website: http://www.ers.usda.gov



Water Supply *Value to the Nation*

Water is Important to Life

Next to the air we breathe, water is the most critical commodity necessary to keep us alive. A person can typically survive for several weeks without food but will die in a few days without water. Most scientists believe that life cannot exist on any planet without water.



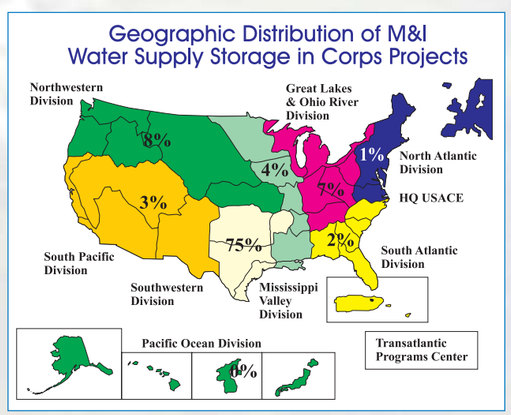
The Earth is blessed with an abundance of this essential liquid. It covers over two-thirds of the Earth's surface. However, the supply of fresh water is relatively small. About 97 % of the water is found in the oceans. Of the 3 % of the supply remaining, 2 % is locked in the ice caps that cover the Earth's polar regions. Much of the remainder is deep underground, temporarily stored in the atmosphere or of such poor quality that it is not practical to utilize it. The water effectively available from lakes, streams, and wells for our uses is only about 0.3 % of the world supply.

The United States as a whole has an abundant supply of water. On average about 1,400 billion gallons a day are available while withdrawal for use is about 380 billion gallons per day. However, the average numbers do not tell the whole story as severe shortages are experienced because of seasonal variation in supply and especially because the eastern portion of the country is wet compared to the arid west.

The Corps has a role in sharing the water supply challenge

The U.S. Army Corps on Engineers (Corps), as the nation's largest water management agency, plays a major role in assuring the nation's water supply. Water controlled by the Corps is used for homes, industry, irrigation, recreation, flow augmentation for improved fish habitat and water quality, and many other uses.

Municipalities generally have primary responsibility for municipal and industrial (M&I) supply. However, the Corps has operated the supply and primary distribution system for Washington D.C. and some of the surrounding area since 1863. Corps reservoirs supply water to many municipalities, especially in the states of Texas and Oklahoma and in the southeastern United States.



The Corps operates approximately 600 reservoirs with over 200 million acre-feet of storage space. Much of this space is dedicated to control floods and hydropower generation; however; about 9.5 million acre-feet in 117 reservoirs are dedicated to municipal and industrial water supply.

Agricultural water supply can also be included in Corps reservoir projects in the Western states under repayment agreements between the Bureau of Reclamation and the local sponsors. To date approximately 57 million acre-feet of storage has been dedicated in 50 projects for irrigation and/or for joint use with other purposes. Approximately 84 percent of the storage is in the states of Montana, and North and South Dakota in the Upper Missouri River Basin

The Corps has authority to reallocate existing reservoir storage to water supply and to include water supply along with other purposes in newly constructed projects. Reallocation of storage in existing projects has the greatest potential because few new storage projects are being considered. Reallocation includes:

- Dedicating reservoir space not presently being used.
- Transferring space from other uses to water supply.
- Physical modification of dams to provide more storage.
- Other changes to optimize the benefits from existing projects.

Some of the other areas where the Corps can provide technical assistance are drought management and regulatory and planning issues related to water supply.

WATER SUPPLY

Summary of Reallocations 1965-1998

Reallocated From	Number of Reallocations	Storage Reallocated (acre-feet)
Hydropower	17	103,000
Flood Control	13	120,000
Conservation	8	63,000
Other	12	130,000
Total	50	416,000

Drought Assistance

An extended period of below normal precipitation that results in water supply shortage is known as a drought. Droughts can be the result of normal variations in weather; however, some scientists believe these variations are being affected by global warming and climate change.

The Corps has extensive experience in drought management acquired through operation of its existing projects and drought-related research such as the National Drought Study. Some ways the Corps can act to help alleviate the effects of drought are:

- Supply drought contingency water.--The Corps can coordinate with state or other political subdivision to temporarily withdraw water from Corps projects to supplement normal needs. This often involves coordination with various water resource agencies to optimize the utilization of regional water resources.
- Planning assistance to states.--States may obtain Corps water resources planning expertise in 50-50 cost shared studies
- Emergency provision of clean water.--Water can be provided to a locality when contaminated water is causing or likely to cause threat to public health.
- Emergency well construction and water transport.--Wells can be constructed or water transported when farmers, ranchers or political subdivisions are determined to be drought distressed.

U.S. Army Corps of Engineers

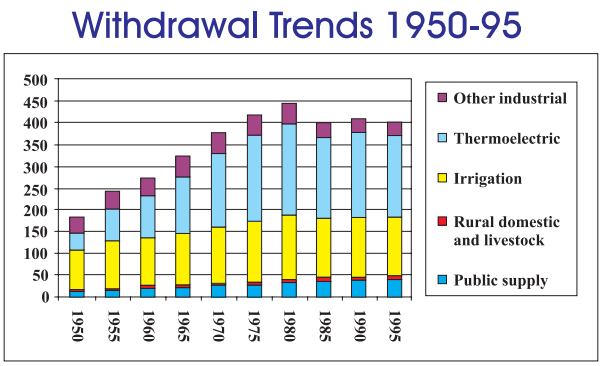
Value to the Economy

Our Cities Will Need to Increase Water Supply

The population of many cities in the Unites States is growing at a rate that requires municipalities to develop new sources of water supply. Although we are using water more efficiently, population growth is more than offsetting the efficiency savings. A further complication is that some of the greatest areas of growth are in the arid Western U.S., especially the Southwest. The rate of growth in some western and southwestern states during the past 10 years illustrates the need:

- Nevada, 66 percent
- Arizona, 40 percent
- Colorado, 31 percent
- Utah, 30 percent
- Idaho, 29 percent

Historically, development of water supply for irrigation has been greatest in the West. Total withdrawal of water for all purposes in the U.S. has been decreasing principally because of decrease in water use for irrigation and mining. In some areas this creates the opportunity for reallocation of water previously reserved for those uses to municipal and industrial supply.



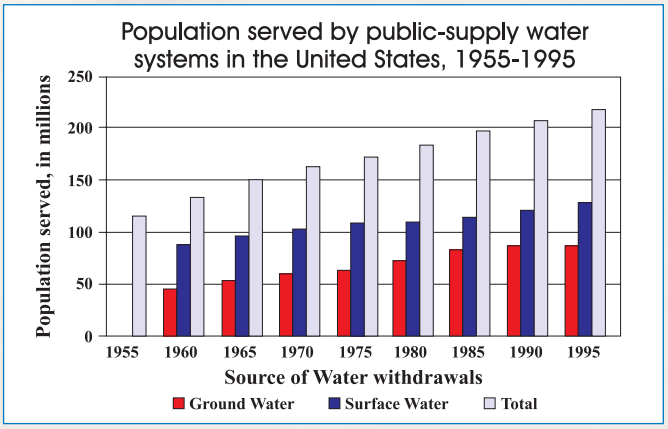
1. There is a water supply problem for some Americans

Aging Infrastructure

The reservoirs, diversion structures, wells, pipelines, treatment plants, local distribution lines and other major parts of a water supply system are known as the infrastructure. In many localities in the U.S., major components of this infrastructure are 50-100 years old or even older and need to be replaced or modernized. Rehabilitation of the infrastructure presents many challenges. Obviously it will be very expensive. Additionally careful study will be required to build efficient systems that assure dependable quantity and quality of supply with minimum adverse environmental impacts.

However, the upgrading of the infrastructure also presents many opportunities including:

- Conserving water through more efficient conveyance and treatment systems.
- Establishment of incentives to conserve water.
- Achievement of economy of scale by combining small systems in to regional systems.
- Improved security of the system against chemical and biological threats.



Except for the Washington D.C. system and the systems on military installations, local governments have primary responsibility for most of the infrastructure. However, the Corps can participate in storage reallocation studies that sometimes include planning level design and cost estimates of other parts of the water distributions system. Reallocation is often especially appropriate when potential exists to combine systems using a regional approach. The American Water Works Association is the primary provider of guidance on water system infrastructure. Information can be accessed on their webpage, http://awwa.org.

Economic Benefits

- $775 million in annual benefit to the nation is estimated to be attributable to 3.1 trillion gallons of water stored by 117 Corps projects.
- At 750 gallons per person per day, 3.1 trillion gallons equates to enough water to fulfill the M & I needs of each American for 17 days.
- Corps projects facilitate the supply of 18.5 trillion gallons of water for irrigation and joint use for other purposes.

Value to the Environment

Ecosystem Restoration is a Reality

Congress has provided the Corps with new authorities that encourage interagency cooperation to identify projects that provide environmental benefit. Habitat for fish and game can often be improved by reallocation of water supply or revision of dam operating plans. Many restoration projects have been studied, approved and implemented. Exciting opportunities exist to redirect the utilization of water resources in existing dams and reservoirs for positive environmental impact.

Water Supply Security

The terrorist attacks of September 11, 2001 raised the level of concern about all aspects of the nation's security including our vital water supply. The good news is that our nation's drinking water is safe and not nearly as vulnerable to terrorist attack and contamination as it may first appear.

In part this is true because security has always been a high priority in the design, management and operation of water systems. Virtually all systems that serve more than an individual household are subject to testing and quality standards. Stringent testing and treatment standards are prescribed by the Environmental Protection Agency to assure high water quality.

The quantity of water processed by most municipal systems is so large that it would take many tanker loads of biological or chemical substances to overcome the effects of dilution and treatment. Physical barriers such as fences, security monitoring systems and frequent water quality testing make it highly unlikely that contaminants could be placed in the system without detection.

The Corps is very aware that it is responsible to safeguard over 600 dam/reservoir projects that it operates. The Corps is actively involved in a comprehensive review of security at all projects including:

- Specialized training of project personnel and technical support staff.
- Reevaluation of security requirements at each project.
- Upgrading physical facilities at projects such as fences, gates and electronic monitoring systems where needed.
- Coordination of security plans with local and national law enforcement agencies.

Future Challenges to Assure U.S. Water Supply

- Cities and states need increased supply.
- Drought management needs to be more efficient.
- Infrastructure needs modernization and replacement.
- Environmental protection must be integrated in water supply system planning.
- The water supply system must be secure to assure reliable quality and quantity of water.

While cities and other local government entities have primary responsibility for water supply, the Corps can often actively participate by furnishing expertise and resources.

The Corps Can Provide More Information and Assistance

The Corps is organized geographically into 8 divisions in the US and 41 subordinate districts throughout the US, Asia and Europe. Additionally, the Corps has several laboratories and research facilities that assure the availability of state-of-the-art technology. Planning and development of the Nation's water resources have long been major missions.

You can learn more about the Corps and get information necessary to contact a Corps office either from the website http://www.hq.usace.army.mil/hqhome/ or by writing to:

U.S. Army Corps of Engineers, Attn: CEPA
411 G Street NW
Washington DC 20314