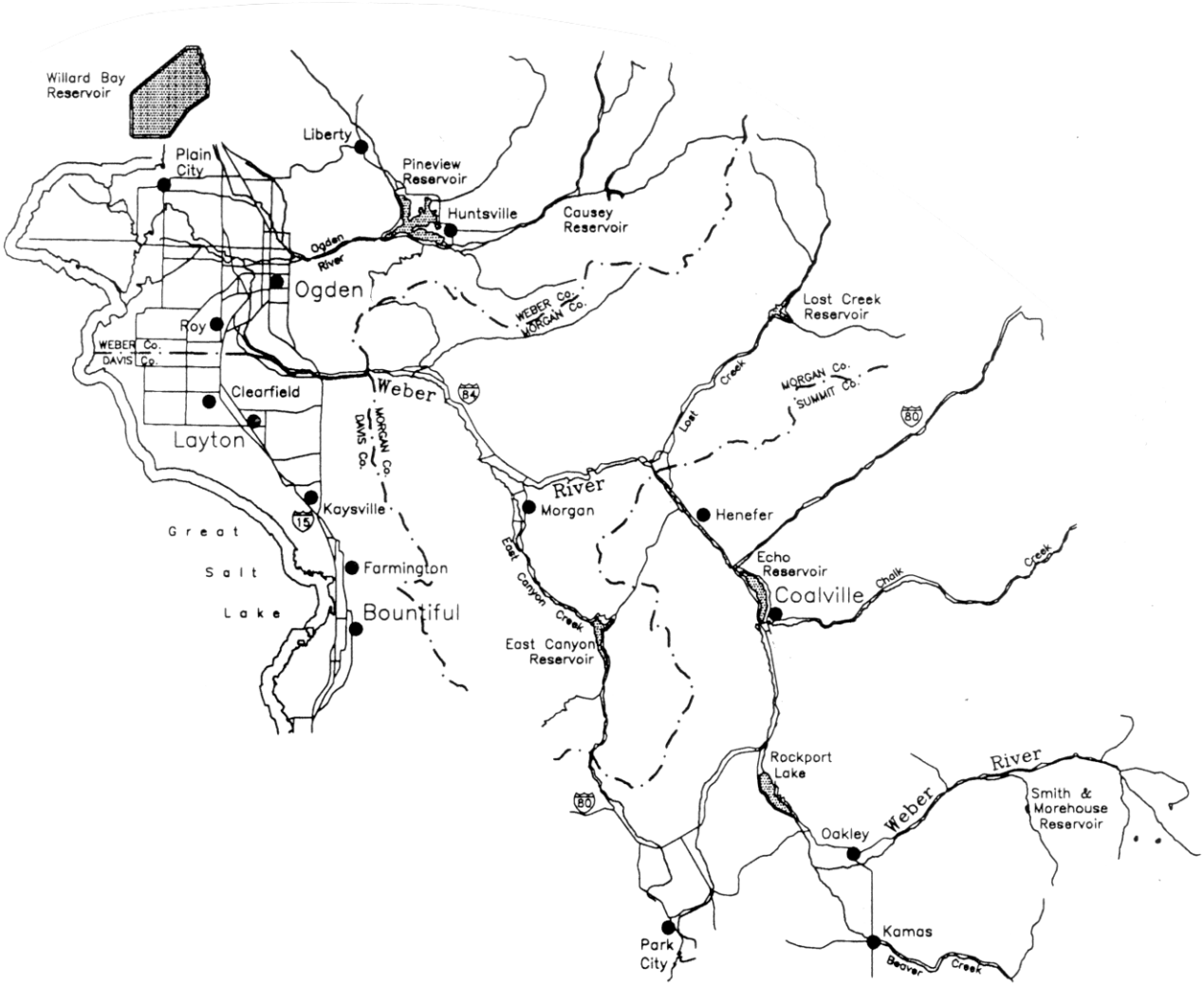
Utah
State Water Plan
Weber River Basin

May 1997



Utah Division of Water Resources
Utah Department of Natural Resources

Utah State Water Plan - Weber River Basin

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State Water Plan
Weber River Basin

Utah Board of Water Resources
1594 West North Temple, Suite 310
Box 146201
Salt Lake City, UT 84114-6201

May 1997

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SECTION

Foreword

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The *State Water Plan* distributed in early 1990 established the foundation for state water policy. As part of the state water planning process, more detailed plans are prepared for each of the 11 hydrologic basins in the state. The *Weber River Basin Plan* is one of these. This plan covers all aspects of Utah's water resources. It identifies alternative ways to solve problems and meet demands. Final decisions on selecting alternatives to implement will rest with local decision makers.

The *Weber River Basin Plan* will help disseminate valuable water-related public information; encourage community and economic growth; provide opportunity for local, state and federal cooperation; identify water supplies and needs; and promote local involvement in water planning. It will also help achieve the Department of Natural Resources mission to "conserve, protect and develop Utah's natural resources."

Planning needs the active participation of people who have a stake in how the plan is accomplished. If the voices of local and regional publics are heard in the early stages, broader support can be achieved for actions recommended in the plan.

Acknowledgment

The Board of Water Resources gratefully recognizes the dedicated efforts of the State Water Plan Steering Committee and Coordinating Committee in preparing the *Weber River Basin Plan*. This work was spearheaded by the planning staff in the Division of Water Resources, with valuable assistance from individual coordinating committee members representing state agencies with water-related missions. Their high standards of professionalism and dedication to improving Utah's natural resources base are essential ingredients of this basin plan.

We also appreciate ideas, information and opinions from state and federal cooperating agencies and local and basin planning advisory groups which provided expertise from a broad spectrum of Utah's population.

We sincerely thank those who attended meetings and provided oral and written comments on the plan. In endorsing this plan, as with previous basin plans, we reserve the right to consider water projects on their own merits. This plan is an important guide for water conservation and development in the Weber River Basin. ❖

M. Karlynn Hinman, Ph.D., J.D.
Dr. M. Karlynn Hinman, Chair

Cleal Bradford
Cleal Bradford, Vice Chair

Ruth L. Novak
Ruth L. Novak

Lucille G. Taylor
Lucille G. Taylor

Larry S. Ross
Larry S. Ross

Harold Grant Shirley
Harold Shirley

Warren Peterson
Warren Peterson

Joseph A. Beykirch
Joseph A. Beykirch

Section 2 Contents

2 Executive Summary

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Sections A and B, not summarized, are appendages to this river basin plan. Section A provides explanations of acronyms and abbreviations used throughout the document and definitions of commonly used words or terms associated with the use and development of water resources. Section B lists references used to prepare the document. In addition to this document's 19 sections, the *State Water Plan* contains Section 20, *River Basin Summaries*, and Section 21, *Status Reports*. Although the following discussions present the basic information contained in the document, the reader is urged to refer to individual sections for detailed information and data on specific water- related topics.

2.1 Foreword

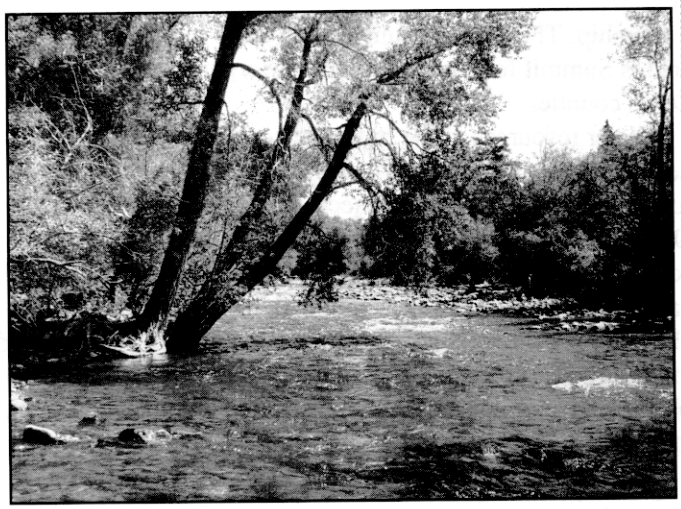
State water planning is a two-phased process. The first phase included the distribution of the *State Water Plan* in 1990 that addresses water resources issues on a statewide basis. Individual *River Basin Plans* are prepared to provide a detailed analysis and report on water related issues, data, and information for the 11 major hydrological river basins within the state. To date, three river basin plans have been completed: Bear River, Kanab Creek/Virgin River and Cedar/Beaver. This *Weber River Basin Plan* is the fourth to be completed.

2.3 Introduction

Section 3 of the basin plan provides a general overview of water development in the basin. The section provides discussions on water planning, a historic account of water development and information about the basin's geophysical make-up.

The state legislature has directed the Board of Water Resources to plan for the future development of the state's waters. The preparation of the *Weber River Basin State Water Plan* is a significant element of the state's water planning process. Basin plans are prepared with the overriding goal of providing accurate and timely information to all individuals and agencies involved with the use and development of water within a given drainage basin.

Summer temperatures in the lower basin can exceed 100 ^{0} F with winter temperatures well below zero in the upper basin. The average annual temperature in the lower basin is slightly over 50 ^{0} F,



Weber River

and the upper basin averages near 42^{0} F. Average annual precipitation in the basin is near 21 inches.

The lower basin is a geologic remnant of ancient Lake Bonneville consisting of large sedimentary deposits. The upper basins are considered high mountain valleys with sedimentary deposits created during the high water stages of Lake Bonneville. The lower and upper basins are connected by two rugged canyons through the Wasatch Range: the Weber and Ogden rivers canyons.

The lower basin is home to a considerable amount

of irrigated agriculture. In 1987 just over 138,600 acres of land were under irrigation, primarily associated with the production of vegetables, small grains, forage crops and pasture for livestock. The urbanization of the basin in recent years, however, has established a trend that indicates substantial declines in acreages under irrigation. The current rate of decline has been estimated between 1,000 and 1,500 acres per year.

Areas with a high rate of urbanization include Davis and Summit counties. Davis County has experienced a high rate of population growth in the areas immediately adjacent to the Salt Lake City metropolitan area. Summit County is a popular outdoor recreational area with emphasis on outdoor recreation and the winter ski industry. Of primary interest is the Snyderville Basin and Park City Area which, in recent years, has proven to be among the fastest growing regions of the state with growth rates nearly double the overall basin and state average.

The 1.5 million acres encompassed by the basin's boundaries is divided into 1,214,100 acres of private, 36,800 acres of state and 249,100 acres of federal ownership. The largest county in the basin in land area is Summit followed by Weber, Morgan and Davis counties.

Water resources in the basin are considered fully developed as a result of the completion of three large federal water reclamation projects. The Weber River, Ogden River, and Weber Basin projects were completed over roughly a 50-year period from the early 1920s to late 1960s. Combined, these projects allowed for the construction of seven large multipurpose reservoirs, four culinary water treatment plants, and complex systems to distribute municipal, industrial and agricultural water.

Water supplies are distributed to various domestic end users by over 320 water provider agencies. These agencies typically include water conservancy and subconservancy districts, canal and ditch companies, public works departments, and a variety of small water companies and service districts.

2.4 Demographics and Economic Future

Section 4 provides information and data regarding current and projected population and economic growth. As is the case with most of the state, the four counties encompassed by the Weber River Basin are currently experiencing moderate to rapid growth in residential and commercial development. Weber, Davis and Morgan counties have growth rates near 2.0 percent. Summit County, however, is one of the state's most rapidly growing areas with a current and projected growth rate of nearly 4.0 percent. The rapid growth in Summit County is primarily in the Snyderville Basin and Park City Area. The current population in the basin is 420,000, which is expected to grow to nearly 700,000 by the year 2020.

Park City and the Snyderville Basin are located within an isolated high mountain valley directly east of metropolitan Salt Lake City. The area offers its residences a desirable lifestyle that includes an alpine-mountain environment and access to quality year-around outdoor recreation. The lifestyle and relative close proximity to major metropolitan areas are the main factors for the area's rapid rate of growth.

Employment opportunities and overall economic growth in the basin are expected to sustain moderate growth after a number of years of stagnation associated with the recent downsizing of local government facilities. In fact, service and trade sectors are expected to overtake government within the next 10 years as the basin's largest employers. Other sectors of the local economy are projected to show moderate growth for local job opportunities, including real estate, manufacturing, construction, finance, insurance, transportation, community service, public transportation, agricultural and mining. Total basin employment is projected to grow from approximately 173,800 jobs currently to over 303,000 jobs by the year 2020.

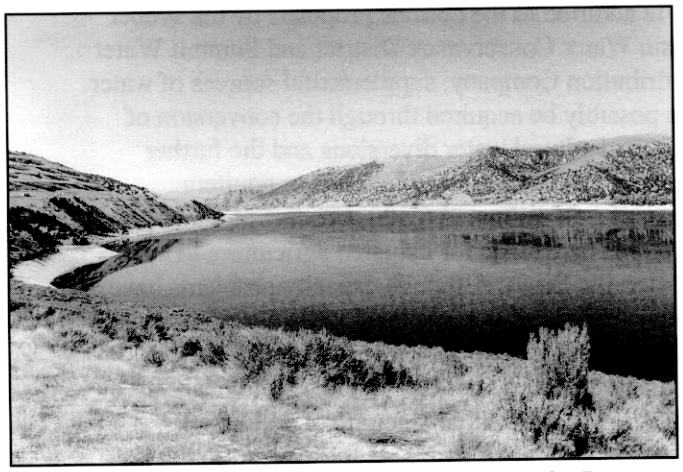
2.5 Water Supply and Use

Section 5 of the basin plan discusses the current level of water supply and use. The basin's total water supply is generally presented in terms of average annual water yield based on the most recent water budget analysis conducted by the Division of Water Resources. Levels of water use are summarized by various categories including municipal and industrial (M&I) culinary, M&I secondary, agricultural, and water use by natural vegetation (wetland and riparian).

The basin's water resources are considered fully developed. Seven major storage reservoirs have been constructed as primary elements of the Weber River, Ogden River, and Weber Basin projects. An additional major reservoir was constructed by the Weber Basin Water Conservancy District. The combined active storage of these reservoirs is

estimated at 525,900 acre-feet, which is over 50 percent of the basin's average annual water yield of 979,400 acre-feet per year.

The current (1992) level of M&I water use is estimated at 92,000 acre-feet and 80,000 acre-feet for culinary and secondary uses respectively. The current (1992) total annual diversions for irrigated agriculture is estimated to be 446,400 acre-feet. Combined, wetland and riparian acreages in the basin account for an estimated 270,000 acre-feet of water use annually. Reservoir annual net evaporation is estimated at 45,000 acre-feet.



Echo Reservoir

2.6 Management

The proper or prudent management of the basin's water supplies is a significant and complex undertaking. Diversions are made to thousands of end users as culinary, secondary and agricultural irrigation water. The accounting of these diversions combined with the daily operation and maintenance of treatment, storage and diversion facilities to provide the indicated water service is accomplished by hundreds of water provider organizations. The role of these organizations, their respective responsibilities and a number of problems and needs associated with water management are discussed in Section 6.

2.7 Regulation/Institutional Considerations

As discussed in Section 7, the responsibility for the regulation of the state's water resources rests primarily with the Division of Water Rights and the Department of Environmental Quality. The roles of these agencies and various environmental concerns are discussed in this section. Dam safety programs are also discussed.

2.8 Water Funding Programs

Section 8 provides information on funding programs offered through a number of state and federal agencies regularly involved with the development of water projects. Funding programs include loans and grants associated with the design, construction and study of viable water development projects. Funding is generally offered to local water provider and reclamation agencies for the expansion or construction of water-related facilities. These often include water conveyance, storage and treatment facilities.

2.9 Water Planning and Development

Perhaps one of the most important aspects of the overall water planning process is the projection of future water demand. Section 9 offers detailed information and data regarding current and projected water demand including a number of issues impacting water demand that are unique to the Weber River Basin.

The Weber River Basin is currently experiencing a moderate to rapid rate of population growth; the result of which is a marked increase in the overall urbanization of the basin. Areas that have historically supported irrigated agriculture are rapidly being converted to residential and commercial developments. This situation is typical throughout the state, but somewhat more pronounced in Weber, Davis and Morgan counties.

As a result of the basin's current trend toward the urbanization of agricultural areas, the demand for M&I water has increased at rates that roughly parallel the growth in population. The 1992 annual rate of M&I water use is estimated at 172,000 acre-feet. This total includes 92,000 acre-feet and 80,000 acre-feet associated with the use of culinary and secondary water respectively. Total annual M&I culinary and secondary water demands are projected to increase to 142,900 acre-feet and 188,900 acre-feet respectively by the year 2020.

Although the demand for M&I water is increasing, the overall, basin-wide demand for water is projected to remain at or near its current level for the next 25 years. The overriding basis for this projection is the conversion of water historically used for irrigated

agriculture to M&I uses. With the replacement of agricultural land to residential and commercial developments, roughly 4,000 to 5,000 acre-feet of agricultural water becomes available annually for possible conversion to M&I uses. In addition, 25,000 to 30,000 acre-feet of active storage within Willard Reservoir is currently earmarked for conversion to M&I use in the lower basin.

The annual demand for agricultural irrigation water in 1987 was 472,700 acre-feet. However, with the steady decline of irrigated agriculture, these diversions are expected to be reduced to an estimated 328,200 acre-feet by 2020. Most of the reduction is expected to be converted to M&I use.

The Snyderville Basin and Park City Area is currently experiencing a 4.0 percent rate of growth that is twice the basin average. This high growth rate is also driving a significant increase in the demand for M&I water throughout the area. This relatively high increase in water demand, coupled with substantial infrastructure limitations by a number of local and regional water supplies, has created a water shortage problem that requires a solution within the immediate future. Of major interest are two projects proposing the importation of supplemental water from Smith and Morehouse and East Canyon reservoirs.

The Weber Basin Water Conservancy District has completed a preliminary study to deliver up to 6,000 acre-feet of water held in storage within Smith and Morehouse Reservoir. The project calls for the construction of a diversion structure immediately downstream of Wanship Dam with associated treatment, storage and conveyance facilities that would ultimately deliver upper Weber River water to Keetly Junction east of Park City. Final distribution of the supplemental water would require the construction of redundant pipelines, storage tanks and booster pump stations or the negotiation of an agreement with local water distribution companies to use existing distribution and storage facilities.

A second option of providing supplemental water has been proposed by Summit Water Distribution Company. Summit's project would distribute water currently stored in East Canyon Reservoir to local end users via their existing distribution system. An agreement being finalized between the Davis and Weber Counties Canal Company and Summit Water Distribution Company would obligate up to 5,000 acre-feet of annual water supplies to be distributed throughout the Snyderville Basin and Park City Area. Summit's proposal could be implemented immediately with a gradual increase in actual water deliveries over an extended period of time. The project requires the development of a few initial wells adjacent to East Canyon Creek, on an as-needed basis, discharging pumped water into Summit's existing distribution system. Subsequent wells would be brought on-line as needed. Ultimately, to develop the entire 5,000 acre-feet of supplemental supply, a treatment plant may be constructed at East Canyon Reservoir with treated culinary water pumped into the extended Summit conveyance system up East Canyon to the Snyderville Basin and Park City Area.

In addition to the options proposed by the Weber Basin Water Conservancy District and Summit Water Distribution Company, supplemental sources of water can possibly be acquired through the conversion of local agricultural water diversions and the further development of existing groundwater aquifers. Currently, an estimated 6,300 acre-feet of annual diversions are made for irrigated agriculture in the Snyderville Basin. Although capacity problems have been experienced in some local wells during times of peak demand, preliminary investigations by the Division of Water Rights and U.S. Geological Survey indicate that substantial amounts of additional groundwater may be available for distribution in the Snyderville Basin and Park City Area. A study will be completed in the near future to better quantify the indicated amount of supplemental groundwater that may be provided by local aquifers.

2.10 Agricultural Water

Section 10 of the basin plan focuses on items relating to the current and projected demand for agricultural irrigation water. These items are primarily centered on the overall decline of irrigated agriculture in the basin and the conversion of unused irrigation water rights to M&I uses. The Weber River Basin has long been recognized as one of the most prominent agricultural areas in the state. The abundance of fertile soils, water and a relatively mild climate in the lower basin has allowed for exceptional farming and ranching opportunities. In 1987 irrigated agriculture diverted 472,700 acre-feet of the basin's total annual yield of 979,400 acre-feet. However, annual diversions for irrigated agriculture are on the decline. The current rate of acreage loss to urbanization is estimated between 1,200 to 1,500

acres annually. The current (1992) rate of water use by irrigated agriculture is 446,400 acre-feet per year.

2.11 Drinking Water

Section 11 discusses current levels of drinking water use, pertinent state and federal regulations, and issues that impact drinking water quality. Public drinking water service is currently provided by 76 community and 95 non-community distribution systems within the basin. The system includes six surface water treatment plants and an estimated 350 well systems owned and operated by a combination of private individuals, municipal public works departments and various water provider agencies. Four of the treatment plants were initially constructed as major elements of the federal Weber Basin Project. Three of the four Weber Basin plants are currently owned and operated by the Weber Basin Water Conservancy District, with the remaining project plant owned and operated by Ogden City. The other non-project treatment plants are owned and operated by Bountiful City and Park City Corporation. Culinary water demand in 1992 was 92,000 acre-feet, of which 35,900 acre-feet was provided by surface water sources.

Regulations to maintain adequate water quality for drinking water have been established by state and federal safe drinking water acts. Combined, these laws provide for 1) adequate drinking water standards, 2) monitoring programs over the construction of water treatment facilities, 3) protection of watersheds for raw drinking water sources, 4) administration of various funding programs to construct new treatment and distribution facilities, 5) training programs for the owners and operators of drinking water systems, and 6) administration of programs aimed at enforcing all state and federal drinking water quality standards.

2.12 Water Quality

Section 12 of the basin plan addresses issues, presents regulations, and discusses the responsibility of various state and federal organizations to maintain an acceptable level of water quality throughout the basin.

Although water quality is a concern throughout the basin, of paramount concern is the quality of surface water and groundwater in the upper Weber and Ogden rivers drainages, specifically Ogden Valley, Snyderville Basin and the Park City area. These areas of the upper drainage are currently experiencing unprecedented growth rates and associated increases in the discharge of wastewater effluent to existing river and storage systems.

The current level of water quality in Ogden Valley is within all state and federal standards for drinking water sources and recreation, but the increased load of nutrients to underlying groundwater aquifers will eventually create a marked decrease within local surface water and groundwater systems. Of particular concern is the potential contamination and eutrophication of Pineview Reservoir.

Two wastewater treatment plants owned and operated by the Snyderville Basin Sewer Improvement District (SBSID) have, in recent years, discharged various contaminants (primarily phosphorus and some heavy metals) to the upper Weber River system resulting in a marked degradation of water quality in local streams and reservoirs. Significant amounts of nutrients (primarily phosphorus) have been discharged to the lower East Canyon Creek which flows into East Canyon Reservoir. The Silver Creek plant has discharged effluent with relatively high concentrations of zinc resulting in a reassessment of the lower Silver Creek system as not meeting state Class 3A standards for a cold water fishery.

The deterioration of the Chalk Creek watershed is another area of concern in the upper Weber River drainage. In recent years, poor land use practices by oil and gas exploration companies and local livestock ranchers have effectively destroyed the natural vegetation and overall drainage characteristics within the watershed. The deterioration of the watershed has resulted in excessive sediment loads conveyed from the upper Chalk Creek drainage to the lower Weber River system. However, an ongoing state administered nonpoint source program has been implemented in the drainage with positive results. Critical areas of the drainage have been revegetated with a measured decrease in sediment loads to the lower Weber River.

2.13 Disaster and Emergency Response

Section 13 offers information regarding water-related natural disasters, including various programs offered by state and federal agencies to effectively deal with the prevention and management of these disasters.

Flooding is perhaps one of the most prominent of all natural disasters. The Weber River Basin, as recent history shows, is not immune from flood-related disasters. The floods of the mid-1980s resulted in tens-of-millions of dollars in damage to homes, farms and a number of commercial businesses. Flooding in the basin has occurred in two ways: out of bank flows from local rivers and streams, and the steady rise of water surface elevations within the Great Salt Lake. Flooding along existing river and stream alignments has caused substantial property damage primarily to residential homes throughout the basin. Of concern are the reaches of the Ogden and Weber rivers in the upper drainages and the numerous small streams along the western side of the Wasatch Front. These streams and rivers are subject to severe flooding due to excessive snow pack runoff and flash floods generated from localized thunder storms.

The rising waters of the Great Salt Lake also have been responsible for substantial property damage in western Weber and Davis counties. During the 1987 water year, the lake reached the estimated 100-year record level of 4211.60. Resulting property damage and loss of commercial and industrial business amounted to well over $40 million. Property damage to local farms and ranches was measured in the hundreds-of-thousands of dollars.

The possibility of a dam failure due to a major seismic or hydrologic event exists throughout the basin, and must be accounted for in comprehensive emergency planning efforts. Dams constructed with federal water reclamation projects are reviewed and evaluated for structural integrity by the Bureau of Reclamation. All other dams fall under the jurisdiction of the Utah Division of Water Rights. As a result of the bureau's dam safety program, Pineview Dam in the Ogden Valley was recently retrofitted with structural fill at the dam's base to provide an additional factor of safety against failure by liquefaction during an earthquake. The remaining dams in the basin are currently under investigation by either the Division of Water Rights or Bureau of Reclamation for needed structural improvements.

2.14 Fisheries and Water-Related Wildlife

Section 14 offers information relating to the status of fisheries and water-related wildlife throughout the basin. Discussions center around the types of species found in the basin, including threatened and endangered species and the condition of their habitat. Information is also provided on state and federal agencies charged with the responsibility to administer various programs aimed at managing and maintaining fish and wildlife populations in the basin.

The Weber River Basin features an abundance of wildlife and includes a considerable amount of quality wildlife habitat. From a recent inventory, it has been estimated that 247 species of mammals, 46 species of reptiles, 13 species of amphibians, 436 species of birds and over 40 species of fish are found in the four county area encompassed by the basin's hydrologic boundaries. Of the stated number of species, only the Peregrine falcon and Whooping crane are included in the federal endangered category. The Bald eagle is also found in the basin, but it is only categorized as threatened.

In terms of habitat, the basin is home to four large wildlife or waterfowl management areas, hundreds of miles of quality fishing streams, eight major reservoir-fisheries, and hundreds-of-thousands of acres of private and public range land for all species of game and nongame animals. Major waterfowl facilities include the Harold S. Crane, Ogden Bay, Farmington Bay and Howard Slough wildlife management areas.

Management of the basin's wildlife habitat and water-related wildlife management areas is provided primarily by the Division of Wildlife Resources, U.S. Fish & Wildlife Service and, to some extent, the Bureau of Reclamation. The Division of Wildlife Resources operates and maintains the basin's wildlife management areas. The U.S. Fish & Wildlife Service is responsible for the administration of all federal regulations associated with the Endangered Species Act.

Of concern is the quality of water in the upper basin reservoir-fisheries. Pineview and East Canyon reservoirs are directly downstream of areas of high residential and commercial growth. In recent years, additional nutrient loading (primarily phosphorus) has resulted in a degree of eutrophication within East Canyon Reservoir. Water quality in the reservoir has been degraded resulting in adverse affects on the reservoir and stream fishery. In a recent basin-wide water quality study, the Division of Water Quality identified need for additional tertiary treatment at the East Canyon wastewater treatment plant.

Although the current water quality within Pineview Reservoir is adequate for recreational uses and subsequent treatment to drinking water standards, concern is expressed for the reservoir's water quality in future years. Continued use of septic tanks and drain fields for the disposal and treatment of domestic wastewater in the Ogden Valley creates a high potential for a marked reduction in groundwater and surface water quality. This is a potential problem for the fishery in Pineview, and for water recreationist and operators of downstream culinary water treatment plants.

2.15 Water-Related Recreation

Section 15 presents information relating to water-related recreational opportunities in the basin including discussions on facility management and current issues associated with the operation and management of existing campgrounds, parks, streams, rivers and reservoirs.

The Weber River Basin includes thousands of acres of reservoirs and hundreds of miles of streams and rivers, all of which offer prime outdoor recreational opportunities to native Utahns and thousands of out-of-state visitors. The basin's reservoirs, rivers and streams provide recreation in the form of cold and warm water sport fishing, boating on eight major reservoirs with modern camping and boating facilities, rafting and kayaking down the early spring rapids of the Ogden and Weber rivers, and the simple enjoyment of hiking through any one of the basin's many river or stream canyons to enjoy exceptional high mountain scenery and solitude.

Past water development projects have produced eight large reservoirs in the basin that include modern camping and boating facilities. Campgrounds, boat ramps and marinas exist at Willard, Pineview, Causey, Lost Creek, East Canyon, Echo, Wanship and Smith and Morehouse reservoirs. The Division of Parks and Recreation operates campgrounds and boating facilities at Willard, Lost Creek and East Canyon reservoirs, and Rockport Lake. The U.S. Forest Service operates similar facilities at Pineview and Smith and Morehouse reservoirs.

Issues associated with water-related recreation generally include the overcrowding of existing reservoirs by boating traffic, vandalism, and abuse of campgrounds and private property immediately adjacent to reservoir recreation sites, and the long-range management of existing campgrounds. The number of recreational boaters has steadily increased in recent years to a point where boating safety is an urgent and immediate concern at many popular reservoirs. To address the issue, the Division of Parks and Recreation offers classes on boating safety with the goal of making significant reductions in the number of boating accidents throughout the state.

One of the more isolated campgrounds and boating facilities in the basin is Lost Creek Reservoir. The reservoir was constructed in an extreme upper-most reach of the overall Weber River drainage. Due to its remote and isolated location, Lost Creek Reservoir is somewhat unique when compared with other reservoirs in the basin. Most of the campgrounds, boating ramps and access roads surrounding the reservoir are immediately adjacent to private property. The combination of the reservoir's isolation from populated areas and relative close proximity to private property with off-road and hunting opportunities has caused instances of substantial vandalism and abuse to public and private property in and around the reservoir. The Bureau of Reclamation has recently completed a *Resource Management Plan* to address these issues and develop measures to better manage the overall activities of recreationists at the reservoir.

With the escalating popularity of basin reservoirs as outdoor recreation sites, the need to expand and improve upon existing campgrounds and boating facilities is readily apparent. The demand for camping and boating facilities has grown in nearly direct proportion to the population. The managers/ administrators of these facilities, including the Division of Parks and Recreation and the U.S. Forest Service, need to develop long-range plans for recreational sites and implement programs to construct needed facilities as demand dictates.

2.16 Federal Water Planning and Development

Section 16 discusses the overall involvement of the federal government in the development and planning of the basin's water resources. Federal agencies involved with the planning and development of water have changed roles in recent years. The emphasis has changed from the design and construction of reclamation projects to the conservation and preservation of the general environment. At the same time, the need for design

and construction funding and expertise on water projects has been left to state agencies.

Current federal funding and assistance programs are presented for 12 agencies including the Bureau of Reclamation; Bureau of Land Management; Cooperative Research, Education and Extension Service; Corps of Engineers; and the Environmental Protection Agency. Others are the Farm Service Agency, Federal Emergency Management Agency, Fish and Wildlife Service, Forest Service, Geological Survey, Natural Resources Conservation Service, and Rural Development.

2.17 Water Conservation /Education

The ongoing need for water conservation is a concept accepted by nearly all local, state and federal agencies involved with the development, planning and distribution of a basin's water resources. Section 17 discusses the need for water conservation and provides recommendations, programs and the means by which substantial amounts of water may be conserved for all typical domestic uses.

Irrigated agriculture is the single largest user of water in the basin with current (1992) diversions estimated at 446,400 acre-feet per year. It is apparent that improvements to existing land application methods and water conveyance systems can reduce annual diversions by thousands of acre-feet. Improvements to irrigation efficiencies can be made through the conversion of flood to sprinkler irrigation application methods, or by optimizing widely used flood irrigation methods that incorporate proven engineering concepts for furrow and border irrigation.

Although irrigated agriculture is the basin's current largest user of water, the demand for M&I water is the fastest growing component of total water use. As a result, the main target of current water conservation programs and policies has focused on M&I water users; or more specifically, the outdoor use of secondary water and the installation of low-flow plumbing fixtures.

An evaluation of the potential implementation of water conservation measures in Davis and Weber counties by the Wasatch Front Demand/Supply Model indicates that over 13 percent of all M&I diversions can be conserved by the year 2020. This level of conservation is mainly affected by the replacement over time of conventional to low-flow plumbing fixtures in new residential and commercial construction. Other factors affecting water conservation include conservation landscaping and water pricing .

2.18 Industrial Water

As presented in Section 18, the basin's major industrial water users generally include oil refineries, various rock product providers (concrete and asphalt plants), some mining operations, metal finishing plants, two industrial parks and one mineral processing plant adjacent to the Great Salt Lake. The mineral processing plant uses 20,200 acre-feet per year of potable and non-potable water, and the other industrial plants combined use an estimated 5,700 acre-feet per year. The total industrial water demand is expected to increase to an estimated 42,200 acre-feet per year by 2020.

Future levels of industrial water use are difficult to predict. Water demand that can be generated by industry varies over a considerable range depending on the type of product manufactured or the overall process required to produce a given product. An example of this in the Weber River Basin would be the comparison of water demand at the Weber Industrial Park versus mineral mining processes adjacent to the Great Salt Lake. Both operations employ hundreds of people, but the mineral processing industry requires hundreds, if not thousands, of times as much water. Generally, however, the demand for industrial water is projected to parallel the rate of population growth at roughly 2.0 percent.

2.19 Groundwater

Section 19 provides hydrogeologic data and information for the basin's six groundwater basins. Information and data given include brief descriptions of existing geology, groundwater yield in terms of annual pumpage and various problems associated with each basin.

The groundwater basins encompassed by the overall hydrological boundaries of the Weber River Basin can be divided into lower and upper groundwater systems. The lower groundwater basin is located west of the Wasatch Front with the remaining upper groundwater basins east of the mouths of Ogden and Weber canyons. In terms of overall surface and groundwater hydrology, the Weber River Basin is considered closed with very little of its annual water supply derived from outside imports. Groundwater flows, therefore, are generated from

annual precipitation primarily in the form of snowpack in the upper drainages.

The largest groundwater basin is found in the East Shore Area. This area includes all of Weber and Davis counties lying between the east shore line of the Great Salt Lake and the western slopes of the Wasatch Front. The aquifer is highly stratified consisting of various layers of clays, silts and gravels deposited by several hydrogeologic phases associated with the development and decline of ancient Lake Bonneville. The average annual recharge to the aquifer is estimated at 121,000 acre-feet with a current rate of annual pumpage of 68,000 acre-feet per year. The balance of groundwater flow in the aquifer is discharged to local surface water channels, springs or to the Great Salt Lake.

The subsurface geology of the Ogden Valley groundwater aquifer is similar to that of the East Shore Area. The aquifer consists of a number of stratified material layers allowing for the development of shallow or confined aquifer systems. Groundwater is the main supply of culinary water in the valley and accounts for an estimated 17,700 acre-feet of annual pumpage from either conventional or artesian wells. The shallow and confined aquifers are recharged from direct precipitation and from the infiltration of spring runoff along the benches of the surrounding mountain ranges.

Groundwater aquifers in the upper Weber River drainage include the Central Weber Valley, Park City, Rhodes Valley and Weber Valley above Oakley. With the exception of Park City, the aquifers in the upper drainage consist of shallow alluvial materials that are directly impacted by surrounding surface water streams and rivers. Groundwater elevations in these aquifers fluctuate in nearly direct correlation with flows in surrounding surface water systems. Little information is available regarding bedrock conditions in these aquifers. As a result, the water yielding or hydraulic characteristics of the deep aquifer are not known. Shallow wells in these aquifers average an estimated 5,900 acre-feet annual production primarily for culinary water uses.

The Park City aquifer consists of an unknown combination of consolidated and unconsolidated materials. Unconsolidated aquifers are primarily made up of alluvial deposits while the consolidated portions of these aquifers consist of fractured bedrock materials. Combined local well production is over 5,600 acre-feet per year for culinary water. In addition, and with the current rate of growth in the Snyderville Basin and Park City Area, the annual pumpage is projected to increase at a substantial rate. Capacities of some wells in the area, however, have declined to levels prompting the State Engineer to invoke a moratorium on future well development. ❖

Section 3 Contents

3 Introduction

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

River basin planning is the process by which policies and overall direction are given to wisely develop the limited water resources for future generations.

3.1 Background

The responsibility of comprehensive water planning has been legislated to the Division of Water Resources. As a result, the *Weber River Basin Plan* has been prepared under the direction of the Utah Board of Water Resources by division staff in close cooperation with a number of local, state, and federal agencies and individuals directly involved with water development and use.

Formulating a *State Water Plan* is an ongoing and dynamic process designed to address the changing nature of water development and use. Plans will be updated as needed. In areas (basins) of rapid change, plans could be updated as often as every five years. In areas where small changes occur, updates may be made at 10- or 15-year intervals.

State water plans establish and implement the basic framework of the state's water policy as it relates to the physical, environmental, economic and sociological aspects of water use within individual drainage basins. These aspects are described in the 19 sections of the *State Water Plan*.

3.2 Planning Guidelines

The *State Water Plan* and basin plans offer comprehensive assessments of current and projected water conditions. This basin plan provides the basis and background to assess the current and projected status of the basin's water resources.

3.2.1 Principles

The *Weber River Basin Plan* is based on a number of principles including:

- All waters, whether surface or subsurface, are held in trust by the state as public property, and their use is subject to rights administered by the State Engineer. The doctrine of prior appropriation has governed Utah water law since statehood.
- Water is essential to life. It is our responsibility to leave good quality water to meet the needs of the generations to follow.
- The diverse present and future interests of Utah's residents should be protected through a balance of economic, social, aesthetic and ecological values.
- Water uses for which beneficiaries are difficult to identify, such as recreation and aesthetics, should be included in program evaluations.
- Public input is vital to water resources planning.
- All residents of the state are encouraged to exercise water conservation and implement wise use practices.
- Water rights owners are entitled to transfer rights in free market conditions.
- Water resources projects should be technically, economically and environmentally sound.

- Water planning and management activities of local, state and federal agencies should be coordinated.

- Local governments, with state assistance as appropriate, are responsible for protecting against emergency events such as flood and droughts.

- Designated water uses and quality should be improved or maintained unless there is evidence the loss is outweighed by other benefits.

- Educating Utahns about water is essential. Effective planning and management requires a broad based citizen understanding of water's physical characteristics, potential uses and scarcity values.

3.2.2 Purpose

The main purpose of any basin water plan is to identify issues and describe alternatives to adequately provide for current and future water needs. Poorly conceived and irreversible commitments could be very costly and prevent the fulfillment of these needs.

3.2.3 Organization

State water planning is the responsibility of the Division of Water Resources under the auspices of the Board of Water Resources. Other state agencies with major water-related missions have been included in the development of the *Weber River Basin Plan.*

The coordinating committee represents 12 state agencies involved to various degrees in the regulation, development and planning of water resources in the state. This committee provides input to the basin planning process from a statewide perspective.

The steering committee consists of the chair and vice chair of the Board of Water Resources, executive director of the Department of Natural Resources, and director and assistant director of the Division of Water Resources. This committee provided policy guidance, resolved issues and approved this plan prior to acceptance by the Board of Water Resources.

Federal and other state agencies with some water-related objectives participated as cooperating entities. These agencies have particular expertise in various fields to assist with plan development. Also, a statewide local advisory group representing organizations and special interest groups has assisted with input and plan review. This group represents a spectrum of various interests and geographical locations.

The local Basin Planning Advisory Group for the Weber River Basin provided input by way of advice, review and decision making. Most of the members of this group reside within the basin or are directly involved in its affairs. They represent various local interests and provide geographical representation.

3.2.4 Process

The overall review process for the *Weber River Basin Plan* includes four drafts: the in-house, committee, advisory, and public review drafts. Upon completing all revisions associated with these documents, the final basin plan is made available to the general public as the *State Water Plan* for the Weber River Basin.

3.3 Basin Description

The Weber River Basin includes a significant share of the rugged Wasatch and Unita mountain ranges with peaks over 11,200 feet high. The total watershed area is estimated at 1.5 million acres of land within Weber, Davis, Morgan and Summit counties, excluding portions of the Great Salt Lake west of the 4200 foot shoreline elevation. The hydrologic boundaries of the basin are shown on Figure 3-1.

The basin has an average annual water supply of 979,400 acre-feet from surface water and groundwater sources. It also supports about 130,000 acres of irrigated agriculture, 420,000 people, and related municipal, commercial and industrial developments.

3.3.1 Drainage Area and Topography

The overall drainage area and related topography of the Weber River Basin consists of a transition from high mountain valleys with steep mountain ranges to flat spreading plains near the Great Salt Lake. The plains are more commonly known as the East Shore Area, which primarily consists of flat, fertile lake beds formed by alluvial deposits from ancient Lake Bonneville. Several terraced benches mark the different lake levels. The mouth of Weber Canyon is known as the Weber River Delta. The elevation varies from 4200 feet above mean sea level

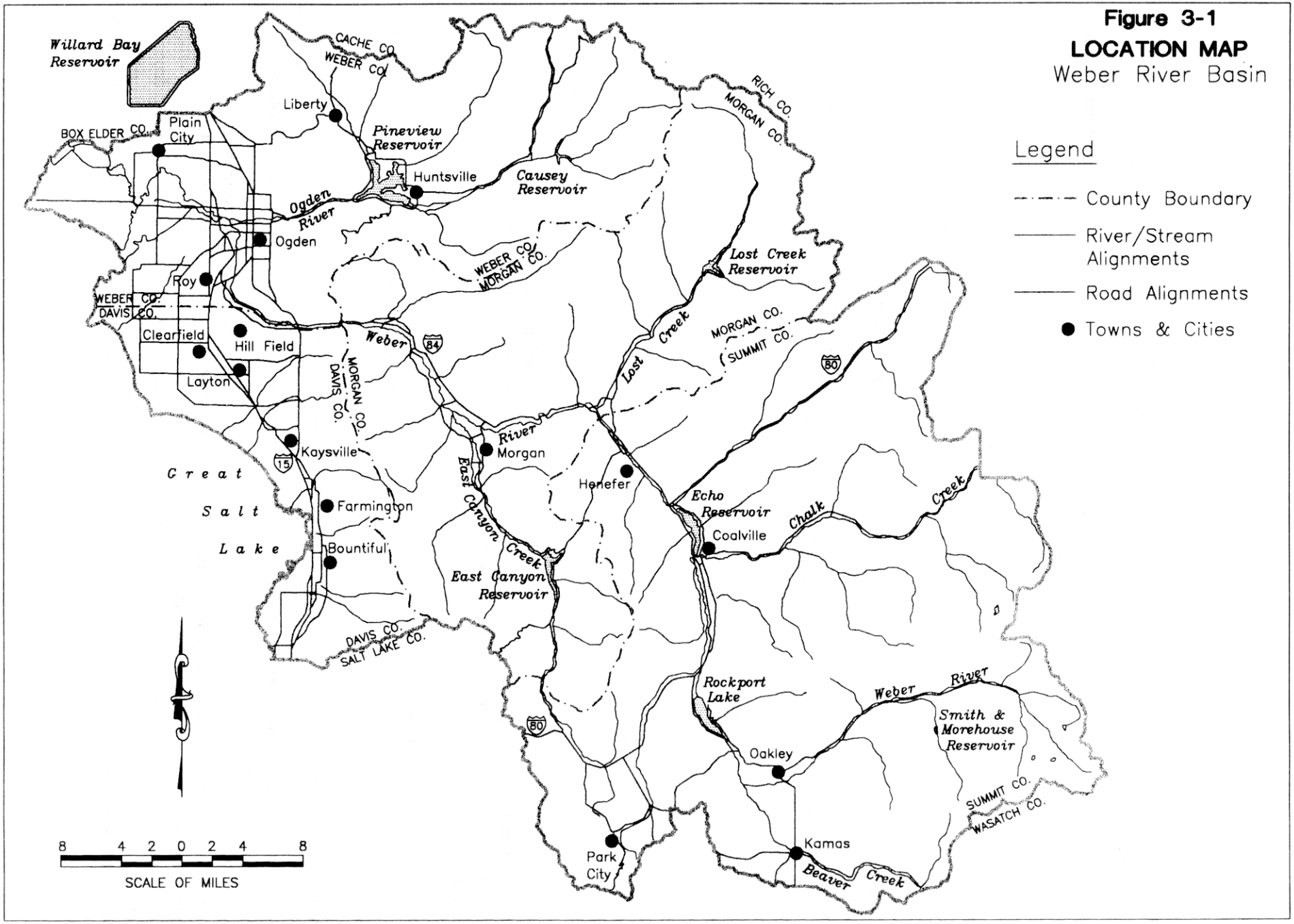


Figure 3-1
LOCATION MAP
Weber River Basin

at the Great Salt Lake to over 11,200 feet at a number of peaks within the Uinta Mountains.

The basin's mean elevation is 6700 feet. About 50 percent of the area ranges from 5900 feet to 7450 feet. Only 16 percent is less than 5000 feet. As a result, most of the upper basin consists of relatively high mountain valleys, mountain ranges and high bench areas with limited agricultural potential. The remaining 16 percent, or low-basin area, supports a fertile agricultural plain that has proven to be one of the largest producers of food and livestock in the state.

Rising abruptly from the valley floor of the East Shore Area, the rugged Wasatch Range runs in a north-south direction separating flat valley lands of the lower basin from the rolling hills and mountain valleys of the upper Weber and Ogden rivers drainages. The upper Weber River drainage in the Kamas and Oakley areas extends beyond local mountain valleys to the high peaks of the Uinta Mountains.

The major tributaries to the Weber River are Beaver Creek, Chalk Creek, Lost Creek, East Canyon Creek and the Ogden River. The largest is the Ogden River which joins the Weber River in the lower basin valley just prior to the point of discharge to the Great Salt Lake. The Ogden River drains what was once an arm of Lake Bonneville. The Ogden River drainage is now made up of three branches which traverse Ogden Valley and eventually discharge into Pineview Reservoir. The three branches of the Ogden River include the North, South and Middle forks.

From the basin divide in the Uinta Mountains to the Great Salt Lake, the Weber River drops from 11,200 feet to 4200 feet in 125 miles producing an average slope of 58.4 feet per mile. Within the East Shore Area, the slope averages 10 feet per mile. The relative steepness of the Weber and Ogden rivers generally produces high velocity flows during peak spring runoff periods.

3.3.2 Climate

The fluctuation of annual precipitation can be severe over an extended period of time as evidenced by the floods of the mid-1980s and the extended drought years of the late 1970s and early 1990s. Within the Weber River Basin, easterly migrating storm patterns encounter the 10,000-foot plus elevations of the Wasatch Range. The resulting effect is significant accumulations of precipitation in the high mountain watersheds. However, based on the general relationship of storm patterns to existing topography, precipitation is somewhat erratic and changes rather drastically from location to location. Annual precipitation ranges from 12 to 30 inches within 20 miles. The average annual precipitation is estimated at 21 inches.

Average annual temperatures in the Weber River drainage vary depending on elevation. In general, high mountain valleys are cooler and have shorter growing seasons than the lower East Shore Area. The upper mountain valleys, such as Ogden and Morgan, have an average growing season of nearly 95 days, while the growing season in the lower valleys west of the Wasatch Range is over 160 days. The average summer temperature is about six degrees cooler in the mountain valleys than at lower elevations west of the Wasatch Front. The cropping practices are, therefore, much different in the two areas. The mountain valleys are used primarily for forage crops and small grains, while the East Shore Area produces a wide variety of row crops, pasture grasses and a number of orchard crops. Mean annual temperatures for selected areas are summarized in Table 3-1.

3.3.3 Physiography and Geology

The Weber River Basin is composed principally of sedimentary deposits. The Paleozoic formations which form the basal complex consist chiefly of massive limestone, dolomite and shale with various mixtures of quartzite, sandstone and chert. The Mesozoic rocks are composed principally of sandstone, siltstone and shale. In the Wasatch Front region, there are some Pre-Cambrian deposits consisting mainly of metamorphosed rocks of schist, gneiss and quartzite. Some igneous rocks occur in the Park City area near the southern boundary of the drainage and extend westward into Little Cottonwood Canyon. These are later formations classed as Tertiary granitoid rocks.

The later Cenozoic formations (Tertiary and Quaternary) composing the mantle are generally weathered expressions of the basal unit. Because of this, these deposits do not generally occur as massive cemented rocks, but rather as broken fragments, porous conglomerates, or fine textured sands and gravels.

The principal tertiary deposit within the Weber River Basin is the Knight conglomerate which contains minor amounts of sand and silt. Extensive tuffaceous and limey beds of Tertiary deposits also occur there. The Quaternary formation consists chiefly of alluvial deposits along the stream beds, lacustrine deposits in the valley once occupied by Lake Bonneville and glacial deposits in the areas of highest elevation. The Quaternary deposits are generally fine textured sands, silts, clays and gravels.

Table 3-1
CLIMATOLOGICAL DATA FOR SELECTED BASIN WEATHER STATIONS

Weather Station	Average Mean Temp	Record Low Temp. (Degrees F)	Record High Temp	Normal Ann. Precip.	Record Month. Precip. (Inches)	Normal Ann. Snow	Record Month. Snow
Coalville	44.8	-33	99	16.42	6.13	73.0	78
Farmington	51.2	-14	102	22.73	7.94	52.1	41
Kamas	43.7	-31	100	18.00	9.22	86.7	84
Ogden	50.7	-26	106	16.84	5.62	25.0	47
Park City Summit	36.0	-17	80	26.98	8.49	316.3	103
Ogden Valley	43.7	-39	100	30.85	12.91	118.4	116
Riverdale	50.3	-25	104	19.94	6.95	29.0	44
Wanship	43.9	-37	98	16.61	6.18	63.8	53

Source: *Utah Climate*, Utah Climate Center, Utah State University; Logan, Utah, 1992.

In a broad sense, the absorptive nature of the mantle rock corresponds with its geologic age. In general, the older Precambrian, Paleozoic and Mesozoic rocks are the least permeable because of their massive, solid structure. The only source of water storage within these formations is in cracks and seams, along fault lines or other fractured areas, and in solution caverns. The most permeable are the Cenozoic group which includes the Quaternary alluvial and glacial deposits, and the older Tertiary deposits which are generally uncemented or unconsolidated.

The Weber River Basin contains undifferentiated geologic age groups. Those in the headwater areas of the Weber River contain extensive deposits of Quaternary glacial material. The highly permeable Quaternary material retains a considerable amount of water during high runoff. The retained water is eventually discharged later in the year and helps maintain base flows. The Quaternary material in the East shore Area supports all of the agricultural and most of the other cultural pursuits. Groundwater conditions also vary considerably in these formations.

3.3.4 Land Use

The area is diverse in terms of naturally occurring landscapes and land use practices. The high mountain areas are used extensively for a broad variety of outdoor recreational purposes and the production of agricultural crops, livestock and timber. The upper basin contains six ski resorts, seven major reservoirs, a matrix of cross-country hiking trails, and a number of streams utilized by sport fishermen, rafters and kayakers. Livestock production in the high mountain valleys is primarily limited to dairy and meat producing livestock, mink, and a few fish farms. Irrigated agriculture generally includes varieties of pasture grasses, alfalfa, small grains, some orchard crops and a variety of vegetables.

With the exception of the Snyderville Basin and Park City Area, populated areas in Summit County generally consist of small rural towns with small commercial businesses. The Snyderville Basin and Park City Area is one of the fastest growing in the state. The area primarily includes residential developments with a high percentage of the populace working in the Salt Lake Valley. The area supports major commercial and industrial concerns including ski resorts, tourism, a major manufacturer's outlet and a number of manufacturing businesses.

The lower Weber River area is a mixture of more populated towns and cities, farms and ranches, military installations, and a wide variety of commercial and industrial businesses.

The Ogden Valley area consists of three small rural communities with little or no commercial businesses outside of a few restaurants, convenience stores and three ski resorts. Pineview Reservoir is a recreational attraction for boating and outdoor camping enthusiasts.

Davis County has highly developed residential, commercial and industrial areas. Several cities have registered significant residential population growth rates in recent years. The northern part of the county supports a number of small family farms, while the southwestern part supports large industries including oil refineries and manufacturing facilities. Northeastern Davis County also supports municipal and residential developments with related small commercial businesses.

Agriculture is the largest single land use. This includes irrigated and dry cropland, rangeland and timber production.

3.3.5 Land Status

The Weber River Basin encompasses 1.5 million acres in Weber, Davis, Summit and Morgan counties. The federal government is responsible for administrating about 17 percent of the total land area. The state of Utah administers less than 1 percent. Eighty-three percent is in private ownership. The breakdown of land ownership and administration is shown in Tables 3-2 and 3-3.

3.3.6 Davis County

All of the drainages and related streams within Davis County are not directly tributary to the Weber and Ogden rivers, but a percentage of all water used in the county is diverted from the Weber River. In short, the county is highly dependant on water from the upper Weber River.

3.4 Water-Related History

The Weber and Ogden rivers have long been a source of water for various agricultural, municipal and commercial uses. Historically, the greatest demand has been for the irrigation of agricultural cropland on numerous small family farms and ranches. During early development from the mid-1800s to the turn of the century, annual flows of the Weber and Ogden rivers were more than sufficient to meet the needs of most agricultural interests. However, it became apparent a considerable percentage of the basin had exceptional soils and climate that could support irrigated agriculture on a much larger scale. As a result, the demand for additional irrigation water grew quite rapidly. By the late 1890s, local canal and irrigation companies were constructing reservoirs in the upper reaches of the Ogden and Weber rivers.

This started the era of large-scale water development projects within the Weber River Basin. The early water projects were initially pursued to provide supplemental water for irrigated agriculture. In subsequent years, multipurpose water projects were constructed to provide water for residential, commercial, recreational, industrial, agricultural and flood control purposes.

3.4.1 Early Pioneer Projects

Early pioneer projects generally included attempts to construct dams and conveyance systems for irrigated agricultural purposes. These projects were initiated by groups of small irrigation and canal companies whose demand for water eventually exceeded water supplies taken by direct river diversions. Of significance was the initial construction of East Canyon Dam by the Davis and Weber Counties Canal Company in 1894. Although the dam has been enlarged four times, the project was the first attempt by an organization of water users to construct a major water project. The initial East Canyon Reservoir had a total storage capacity of 3,800 acre-feet. Subsequent enlargements by the Bureau of Reclamation as part of the Weber Basin Project have provided a current active water storage capacity of 48,100 acre-feet.

3.4.2 Weber River Project

In addition to East Canyon Reservoir, the Weber River Water Users, in association with the Bureau of Reclamation, constructed Echo Reservoir in 1930 as the main feature of the Weber River Project. The primary goal was to provide supplemental water to the growing number of farms and ranches throughout the basin. The construction of Echo Reservoir has provided an additional active water storage capacity of 74,000 acre-feet.

Irrigation water stored in Echo Reservoir is used for agricultural crop production throughout the basin, including the drainage above the reservoir. Water used above the reservoir is considered exchange water or storage water that is exchanged for direct river diversions above the reservoir. Combined annual storage and direct diversions associated with Echo Reservoir provide the main source of water for more than 50 small irrigation companies in Morgan, Weber and Davis counties. The Weber River Water Users Association is the operation and maintenance agency for the Weber River Project.

The main features of the Weber River Project are shown on Figure 3-2.

3.4.3 Ogden River Project

The Ogden River Water Users Association was organized in 1933 to sponsor construction of the Ogden River Project. Project facilities impound and distribute

Table 3-2
SUMMARY OF LAND OWNERSHIP AND ADMINISTRATION

Status	County				Basin Total
	Weber	Davis	Morgan (acres)	Summit	
Private	267,900	92,400	344,700	509,100	1,214,100
State	1,300	na	3,800	4,500	36,800
Federal	84,100	48,600	11,800	104,600	249,100
Total	353,300	141,000	360,300	618,200	1,500,000

Table 3-3
FEDERAL LAND ADMINISTRATION

Agency	County				Basin Total
	Weber	Davis	Morgan (acres)	Summit	
Forest Service	76,400	39,200	10,100	99,700	225,400
Bureau of Land Management	100	300	600	1,200	2,200
Bureau of Reclamation	3,900	Neg	1,100	3,700	8,700
Department of Defense	3,700	9,100	0	0	12,800
Total	84,100	48,600	11,800	104,600	249,100

water from the Ogden River to farm and ranch lands within Weber and Box Elder counties. The project was substantially completed in 1937, and water began to flow in the South Ogden Highline and Ogden-Brigham City canals.

As shown on Figure 3-3, the major features of the project were the construction of Pineview Reservoir, a 75-inch diameter woodstave pipeline down Ogden Canyon, and two water delivery canals. One canal flows north servicing the North Ogden to Brigham City areas (Ogden-Brigham City Canal). The other flows south servicing the South Ogden area (South Ogden-Highline Canal).

Pineview Reservoir was enlarged in 1957 from an initial capacity of 44,175 acre-feet to 110,200 acre-feet as part of the Weber Basin Project. A woodstave pipeline was recently replaced with funding provided by the Bureau of Reclamation. Current average annual deliveries from project facilities have been estimated at over 38,600 acre-feet.

3.4.4 Weber Basin Project

The multipurpose Weber Basin Project service area extends into Box Elder, Davis, Morgan, Summit and Weber counties. The original project, completed in 1969, was constructed by the Bureau of Reclamation with the primary objectives of: 1) Developing all the water resources to the fullest extent possible in the four county area, and 2) enhancing the operation of existing projects through the enlargement of existing storage facilities and by constructing new storage and distribution systems. The project is managed by the Weber Basin Water Conservancy District.

Current annual deliveries from the Weber Basin Project are in excess of 200,000 acre-feet to various municipal, industrial and agricultural water users within the 86,000-acre service area.

In addition, the initial project incorporated a number of features to provide flood control and

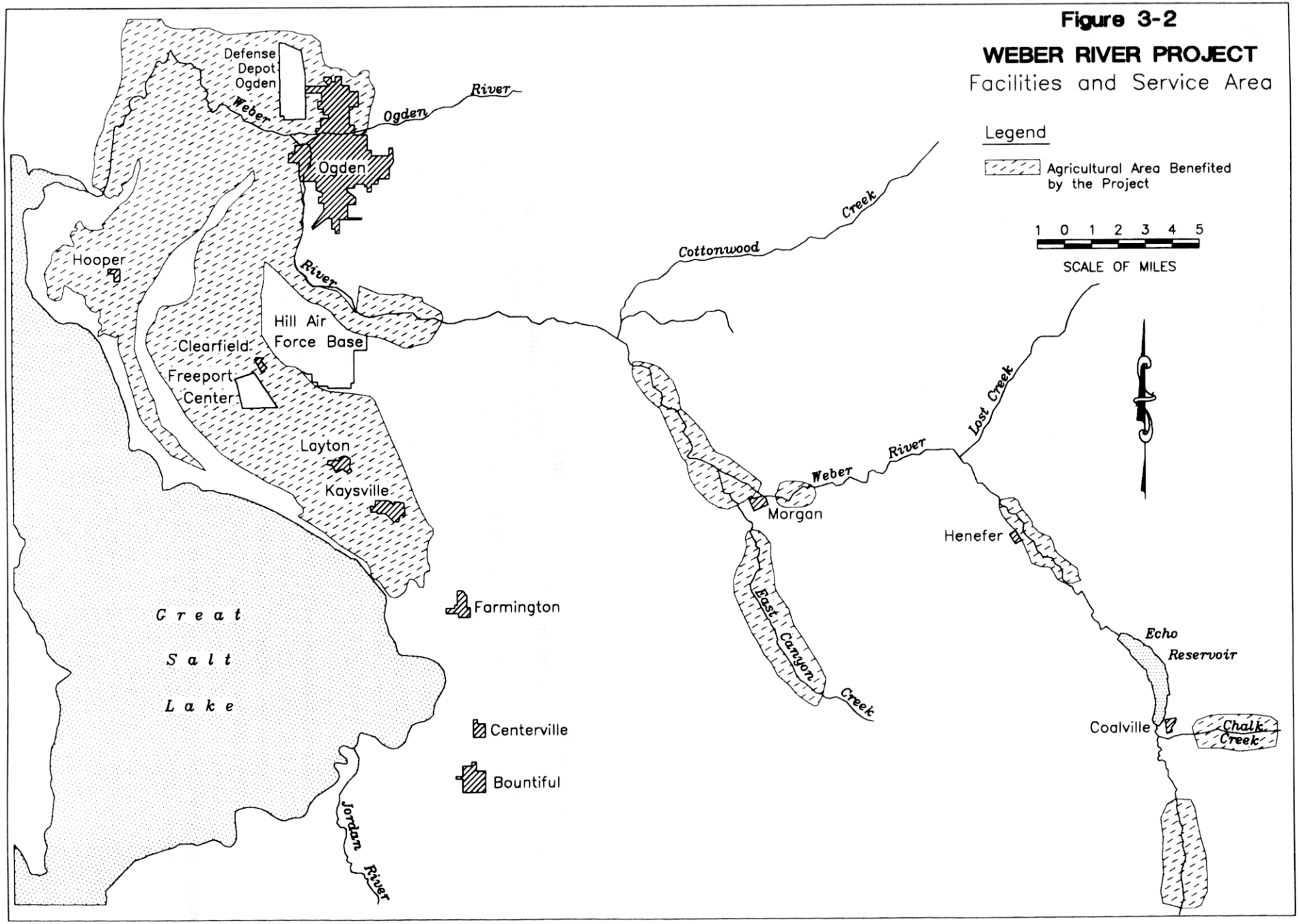
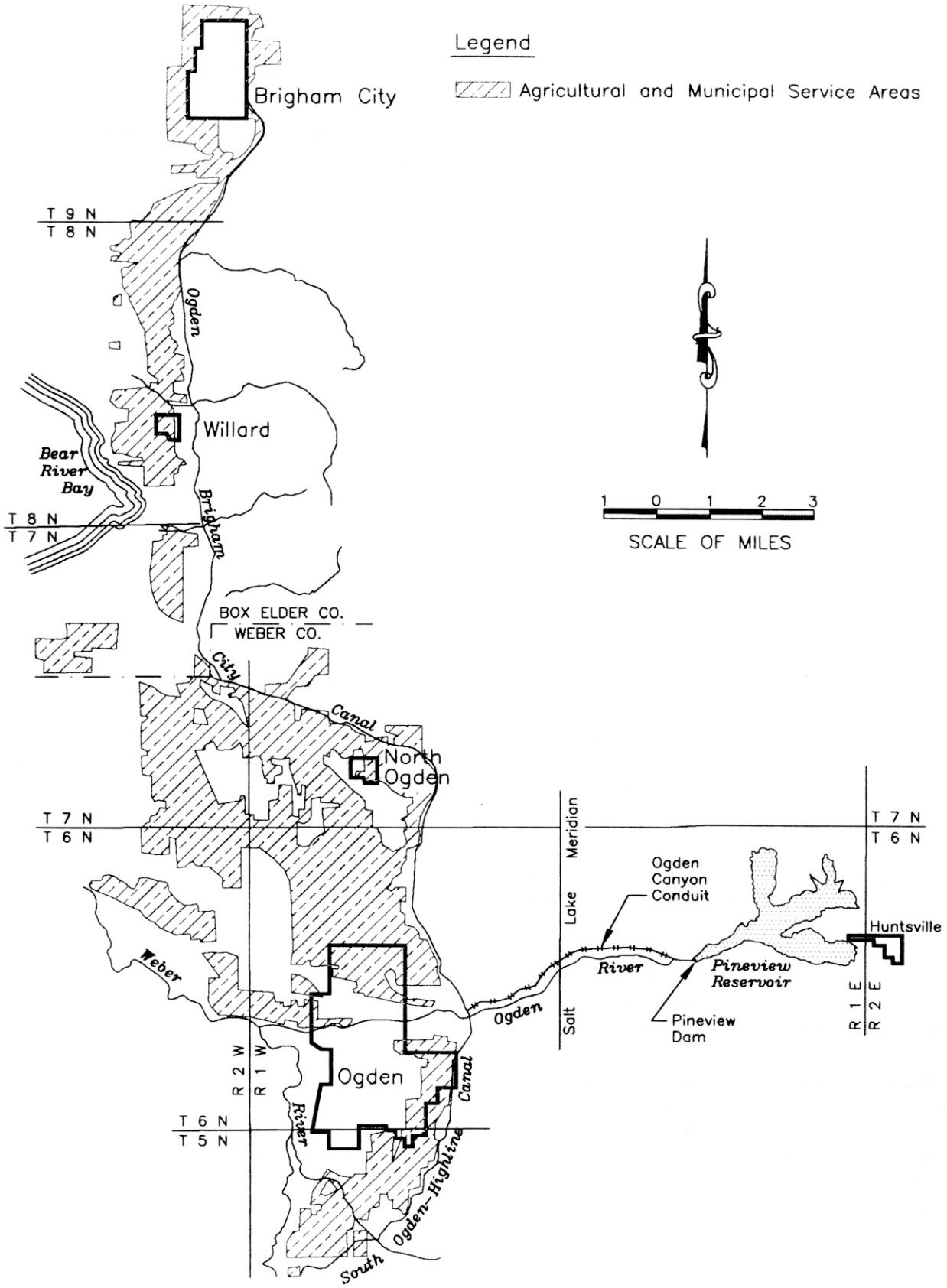


Figure 3-2
WEBER RIVER PROJECT
Facilities and Service Area
Legend
Agricultural Area Benefited by the Project
1 0 1 2 3 4 5
SCALE OF MILES
Defense Depot Ogden
Weber River
Ogden River
Ogden
Hooper
Hill Air Force Base
Clearfield
Freeport Center
Layton
Kaysville
Great Salt Lake
Farmington
Centerville
Bountiful
Jordan River
Cottonwood Creek
Lost Creek
Weber River
Morgan
Henefer
East Canyon Creek
Echo Reservoir
Coalville
Chalk Creek

Figure 3-3

OGDEN RIVER PROJECT

Facilities & Service Area



recreational opportunities at major project facilities. These features include provisions to maintain adequate fish and wildlife habitat through the establishment of minimum instream flows for the Ogden and Weber rivers. The largest wildlife habitat areas include the Harold S. Crane, Howard Slough and Ogden Bay wildlife management areas. The Weber Basin Project included six major reservoirs with a combined active storage capacity of over 444,900 acre-feet of active storage, 120 miles of distribution canals, 140 miles of distribution laterals, 11 pumping plants, nine domestic wells, and four culinary water treatment plants (one operated by Ogden City) with a combined capacity of over 117 cubic feet per second.

Major facilities added to the project since its initial construction include Smith and Morehouse Dam and Reservoir; several deep wells for municipal, industrial and agricultural water uses; a major expansion to the Layton and Ogden culinary water treatment facilities; and major revisions to the Gateway Canal and Tunnel to mitigate escalating canal seepage and slope instability, primarily in Morgan County. The entire project, including its major facilities and service area, is shown on Figure 3-4.

3.4.5 Small Canal, Ditch and Water Companies

Water is also supplied to farms, ranches, cities, towns, and commercial and industrial businesses by over 230 small water provider organizations typically described as canal, ditch or water companies. These smaller organizations obtain water supplies from a variety of sources including larger water districts and water user associations, wells, and small surface diversions from existing streams and rivers.

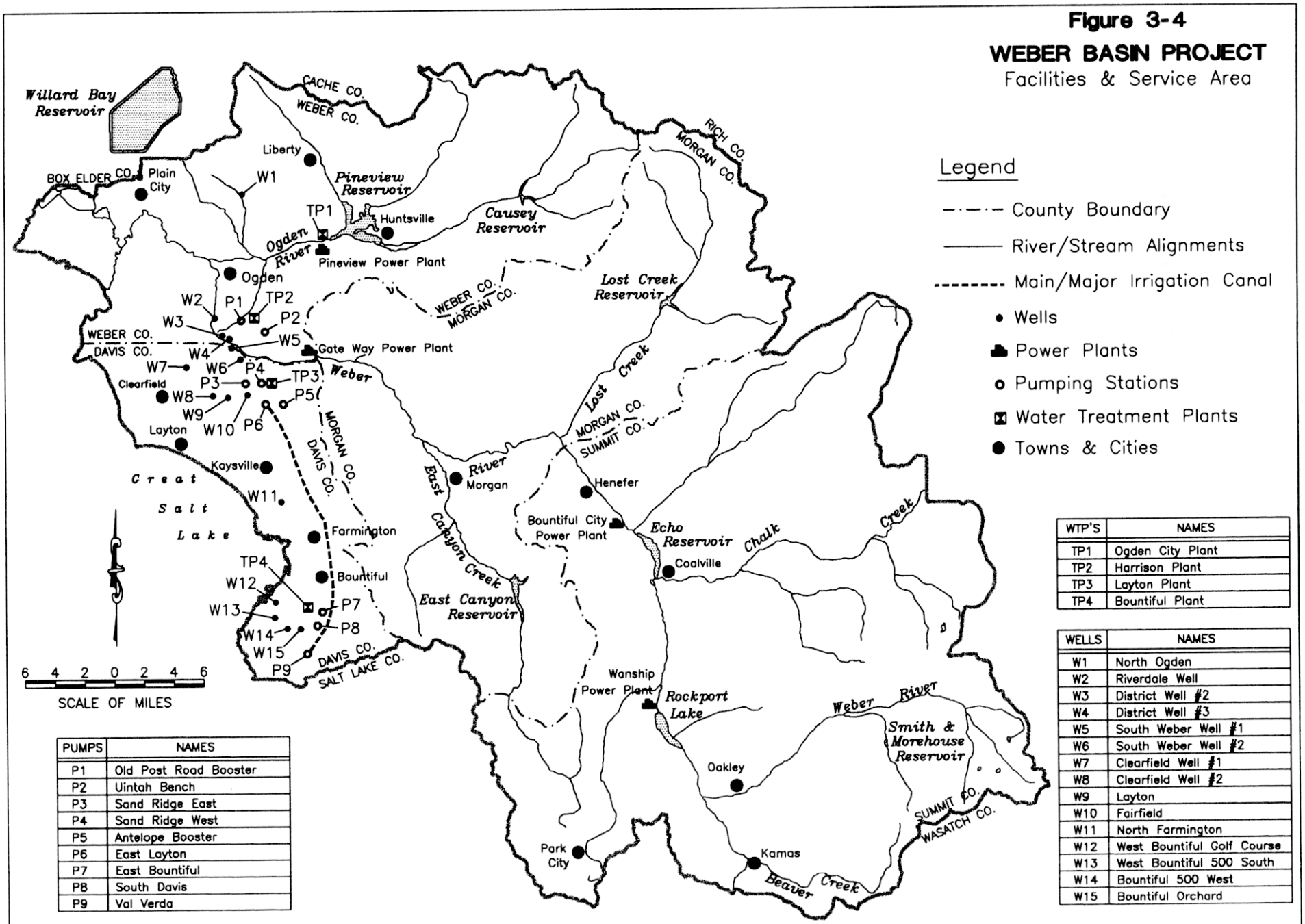
3.4.6 Possible Surface Water Storage Facilities

Three reservoirs sites have been studied as possible future water storage development projects. These sites include 1) Magpie Dam on the South Fork of the Ogden River above Pineview Reservoir, 2) Larrabee Dam on the upper Weber River above the confluence with Smith and Morehouse Creek, and 3) Davis Pond, a smaller version of Willard Reservoir to be located in Farmington Bay. Water would be available for storage at these new reservoir sites only in very wet years. To be effective, they would require large volumes of holdover storage. The unavailability of a dependable water supply for these reservoirs, and with the available developed storage already meeting present and near future projected needs, it is unlikely any of these potential reservoirs will be built.

Diking of portions of the Great Salt Lake to create fresh water reservoirs for a water supply to the Wasatch Front Area has been proposed. Lake Wasatch would be created by diking from the south shore of the Great Salt Lake to the south end of Antelope Island, from the north end of Antelope Island to the south end of Fremont Island, and from the north end of Fremont Island to Promontory Point. Water from the Bear, Weber and Jordan rivers would flow into Lake Wasatch.

Davis Lake, also called Bonneville Bay, would be created by diking from the south shore of the Great Salt Lake to the south end of Antelope Island, and from the north end of Antelope Island to Syracuse along the present Syracuse Causeway. The major inflow to the proposed Davis Lake would be the Jordan River.

Lake Wasatch and Davis Lake were investigated in the mid-1980s as Great Salt Lake flood control alternatives along with Bear River water development and the West Desert Pumping Project. The Great Salt Lake Development Authority was created by the Utah Legislature in 1989 to further study the feasibility of Lake Wasatch. After a year and a half of study and public hearings, the Great Salt Lake Development Authority reported Lake Wasatch did not appear to be economically or environmentally feasible and did not merit further consideration. But the Great Salt Lake Development Authority recommended further study and evaluation to determine if the proposed Davis Lake could be used for recreation and/or water storage. Studies have shown the water in the proposed Davis Lake would require desalting before it would be useable for a water supply project. Some interest still exists in Davis County for the Davis Lake Project for recreation and land development. ❖



PUMPS	NAMES
P1	Old Post Road Booster
P2	Uintah Bench
P3	Sand Ridge East
P4	Sand Ridge West
P5	Antelope Booster
P6	East Layton
P7	East Bountiful
P8	South Davis
P9	Val Verda

WTP'S	NAMES
TP1	Ogden City Plant
TP2	Harrison Plant
TP3	Layton Plant
TP4	Bountiful Plant

WELLS	NAMES
W1	North Ogden
W2	Riverdale Well
W3	District Well #2
W4	District Well #3
W5	South Weber Well #1
W6	South Weber Well #2
W7	Clearfield Well #1
W8	Clearfield Well #2
W9	Layton
W10	Fairfield
W11	North Farmington
W12	West Bountiful Golf Course
W13	West Bountiful 500 South
W14	Bountiful 500 West
W15	Bountiful Orchard

Section 4 Contents

4

SECTION

Demographics and Economic Future

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The Weber River Basin consists of Davis, Morgan, Summit and Weber counties. Over 90 percent of its residents live along the Wasatch Front in Davis and Weber counties.

4.1 Introduction

This section discusses employment and population projections for the Weber River Basin. Davis County has the largest 1994 population with 210,948, and Weber County is home to 172,047 residents. Summit, a rural county where Park City is located, has experienced a 39 percent population growth since 1990. This compares to 9 percent for Weber County, 12 percent for Davis County and 14 percent for Morgan County.

The economy is characterized by moderate growth in population and employment. Summit County stands out because of its national status as an arts and recreation center where world class ski slopes and alpine environment are valuable resources. Summit County is expected to continue its rapid growth as its still rural atmosphere draws increasing numbers of people from the more crowded Wasatch Front communities and from out of state. The 2002 Winter Olympics will have a significant impact on Summit County through construction of Olympic facilities and intensified private investments in residential and commercial projects.

4.2 Demographics

Although Utah's overall growth rate is expected to be 1.99 percent annually through 2020, Summit County is expected to grow 3.98 percent annually, Davis County at a rate of 2.08 percent, Morgan County at 2.0 percent, and Weber County by 1.87 percent. The 1994 population in the Weber River Basin was 410,307. By 2020 the basin will grow in population to just under 700,000 for an overall growth rate of 2.57 percent.

The largest city in the basin is Ogden, Weber County, with 67,763 people. Layton, Davis County, has 49,200 people. Bountiful, also in Davis County, has 37,076. Roy, Weber County, has 27,369. Most of Summit County's population of 21,526 is located in unincorporated areas; 6,188 people live in Park City. Morgan City is the only unincorporated community in Morgan County with a 1994 population of 2,324. See Table 4-1 and Figure 4-1. Additional extrapolations were made to aid in estimating long-range M&I water demands. Assuming a constant growth rate beyond the year 2020 of about 2.1 percent, the population of the basin would increase to over 1.3 million by the year 2050. See Table 4-2.

Ogden, South Ogden, Roy areas

Table 4-1
BASIN POPULATION PROJECTIONS

NAME	1990	1994	2020
DAVIS COUNTY			
Bountiful	36,147	37,076	50,554
Centerville	11,500	13,779	21,143
Clearfield	21,435	23,345	28,252
Clinton	7,945	8,915	16,324
Farmington	9,049	10,160	18,774
Fruit Heights	3,903	4,510	8,285
Kaysville	13,961	16,869	25,425
Layton	41,784	49,200	91,277
North Salt Lake	6,464	7,294	11,146
South Weber	2,863	3,716	8,619
Sunset	5,128	5,347	6,030
Syracuse	4,658	5,270	12,080
West Bountiful	4,477	4,827	9,568
West Point	4,258	4,871	16,717
Woods Cross	5,384	5,378	10,271
Unincorporated	8,985	10,391	20,576
COUNTY TOTAL	187,941	210,948	355,041
WEBER COUNTY			
Farr West	2,178	2,425	7,046
Harrisville	3,019	3,605	7,486
Huntsville	561	588	a
North Ogden	11,593	13,081	24,035
Ogden	63,943	67,763	88,304
Plain City	2,722	2,948	7,043
Pleasant View	3,597	4,297	6,811
Riverdale	6,419	6,867	10,451
Roy	24,580	27,369	37,035
South Ogden	12,105	12,972	22,643
Uintah	760	838	2,176
Washington Terrace	8,189	8,742	10,429
West Haven	2,172	2,380	15,238
Unincorporated	16,492	18,174	a
COUNTY TOTAL	158,330	172,047	284,172
SUMMIT COUNTY			
Coalville	1,065	1,461	1,800
Henefer	554	569	a
Kamas	1,061	1,469	1,843
Oakley	522	708	1,031
Park City	4,468	6,188	14,339
Unincorporated	7,467	10,599	a
COUNTY TOTAL	15,137	20,994	50,012
MORGAN COUNTY			
Morgan	2,023	2,324	3,654
Unincorporated	3,505	3,994	6,715
COUNTY TOTAL	5,528	6,318	10,369
BASIN TOTAL	366,936	410,307	699,594

[a] Not available

Table 4-2
LONG RANGE POPULATION ESTIMATES (Rounded figures)

County	1990	2020	2050
Davis	187,940	355,040	656,760
Weber	158,330	284,170	516,860
Morgan	5,530	10,370	18,750
Summit	15,140	50,010	124,490
TOTAL	366,940	699,590	1,316,860

Table 4-3
BASIN EMPLOYMENT PROJECTIONS

Industry	1990	1995	2000	2010	2020
DAVIS COUNTY					
Agriculture	925	914	935	885	815
Mining	35	146	152	180	216
Construction	2,550	4,809	5,669	6,767	8,247
Manufacturing	7,523	10,222	11,821	13,654	15,548
TCPU	2,418	2,209	2,720	3,662	4,486
Trade	14,073	18,052	21,532	28,303	34,036
FIRE	1,297	2,769	3,337	4,326	5,214
Services	10,740	14,219	17,974	25,633	32,345
Government	21,546	17,663	20,149	23,343	26,099
Non-farm Proprietors	14,570	17,267	20,739	28,408	34,708
TOTAL DAVIS EMPLOYMENT	75,677	88,270	105,028	135,161	161,714
Non-ag W&S Employment[1]	59,803	69,676	82,933	105,424	125,732
MORGAN COUNTY					
Agriculture	417	413	423	400	368
Mining	0	0	0	0	0
Construction	67	215	243	281	328
Manufacturing	210	275	303	332	364
TCPU	8	12	13	15	17
Trade	345	415	473	590	680
FIRE	18	26	30	37	43
Services	50	82	98	133	162
Government	302	358	365	437	510
Non-farm Proprietors	495	581	665	865	1,014
TOTAL MORGAN EMPLOYMENT	1,912	2,377	2,613	3,090	3,486
Non-ag W&S Employment	1,000	1,383	1,526	1,825	2,104
SUMMIT COUNTY					
Agriculture	595	590	604	571	526
Mining	111	121	131	160	198
Construction	384	789	1,050	1,220	1,536
Manufacturing	418	964	1,169	1,350	1,577
TCPU	266	310	409	542	685
Trade	1,968	3,921	4,856	6,531	8,132
FIRE	1,038	1,067	1,312	1,751	2,179
Services	2,790	3,485	4,676	6,367	8,181
Government	1,108	1,520	1,763	2,322	2,895
Non-farm Proprietors	2,738	3,945	4,892	6,893	8,708
TOTAL SUMMIT EMPLOYMENT	11,416	16,712	20,862	27,707	34,617
Non-ag W&S Employment[1]	7,991	12,078	15,261	20,129	25,263
WEBER COUNTY					
Agriculture	1,179	1,163	1,190	1,126	1,037
Mining	7	7	7	9	11
Construction	2,107	4,061	4,808	5,752	7,061
Manufacturing	11,217	12,586	14,458	16,472	18,799
TCPU	2,101	2,192	2,623	3,394	4,086
Trade	14,182	17,376	20,727	27,157	32,901
FIRE	2,177	2,737	3,291	4,262	5,175
Services	16,614	20,533	26,005	37,189	47,458
Government	18,171	19,265	20,242	25,766	29,919
Non-farm Proprietors	11,352	12,787	15,379	20,995	25,822
TOTAL WEBER EMPLOYMENT	79,107	92,707	108,730	142,122	172,269
Non-ag W&S Employment[1]	66,121	78,261	91,657	119,469	144,858
TOTAL BASIN EMPLOYMENT	168,112	200,066	237,233	308,080	372,086
Non-ag W&S Employment	134,915	161,398	191,377	246,841	297,957

Non-agriculture wage and salary and agriculture include agricultural services

Figure 4-1
WEBER BASIN POPULATION PROJECTIONS

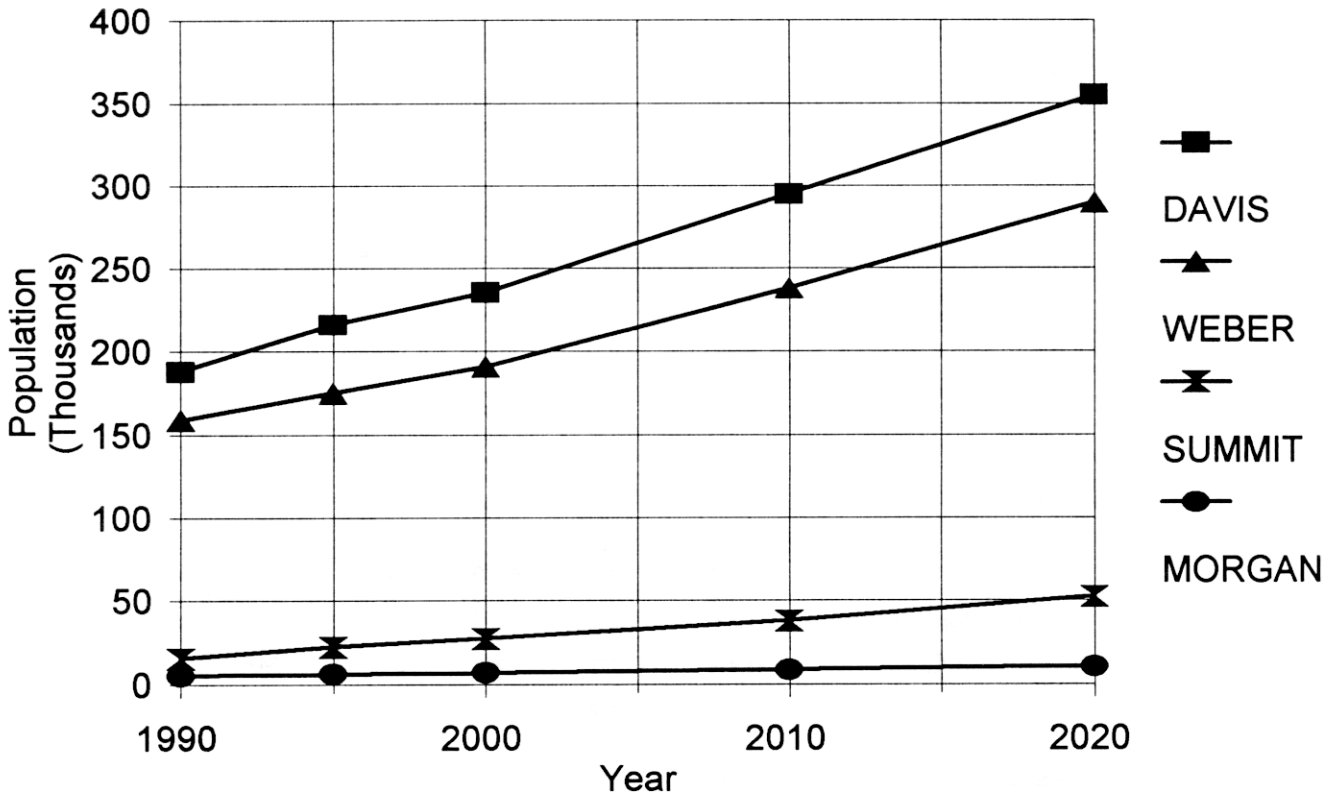
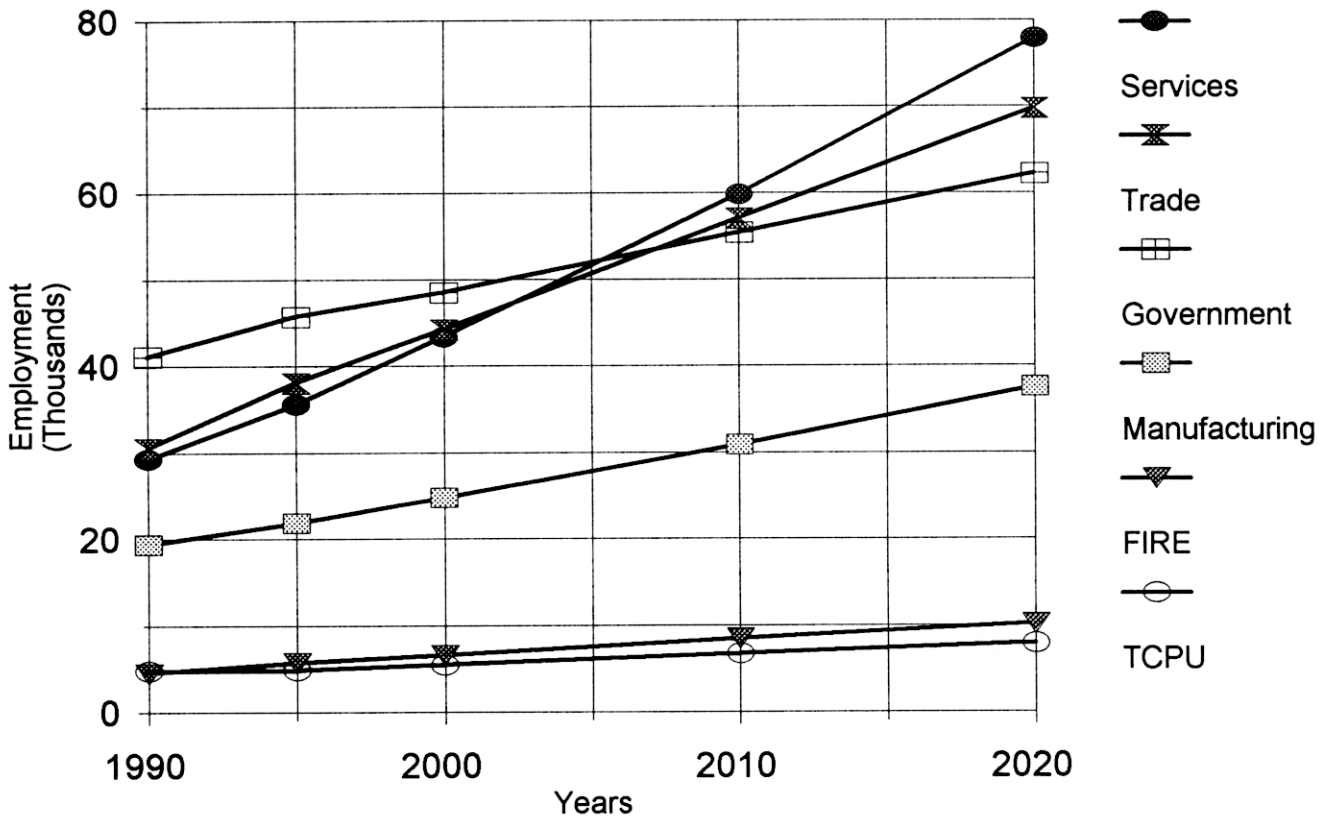


Figure 4-2
WEBER BASIN EMPLOYMENT PROJECTIONS



The Wasatch Front Regional Council prepares city-level projections for Salt Lake, Weber, Davis, Morgan and Tooele counties with extensive review and comment from local communities. These projections are controlled to county-level projections prepared by the Governor's Office of Planning and Budget and voted on by the Regional Council's board of directors. Once approved, they are used to meet transportation planning requirements of the Metropolitan Planning Organization. Projections are only to the year 2020 because that is the long-term horizon from which transportation decisions are made and modeled. These city-level projections, coupled with the Governor's Office of Planning and Budget's county-level projections, provide consistent, systematically reviewed data for infrastructure planning along the Wasatch Front.

4.3 Employment

Government, the leading employment sector in 1990, is now second to trade and almost even with services as of 1995. Non-farm proprietors occupy fourth place, and manufacturing is the fifth leading employment sector.

In Morgan County, non-farm proprietors are presently the largest sector for employment, followed by trade, agriculture, government and manufacturing. In Summit County the non-farm proprietors sector is presently leading trade and services. Government is fourth and Financial Insurance and Real Estate (FIRE) is providing 1,067 jobs placing it fifth in jobs. Weber County is also seeing significant growth in service employment. Government currently is in second place. Trade is the leading employer in Davis County. Government is in second place, with non-farm proprietors in third and services in fourth. See Table 4-3 and Figure 4-2.

The Utah Process Economic and Demographics (UPED) projection model takes into account many variables regarding the demographics and industry mix of an area. The model projects historical employment growth rates into future growth patterns, along with assumptions regarding labor force participation rates, nonemployment related migration rates, and constant age-specific fertility and survival rates. The transient and part- time population occupying the relatively large number of hotel rooms and condominiums in Summit County are not counted in UPED.

4.4 Economic Future

Looking to the future, service and trade sectors in the basin are predicted to outpace government employment throughout the 1995-2020 period. Manufacturing will show steady growth, but it will remain in fourth place as a provider of jobs.

In Davis County, government will be the premier employer until 2010 when trade will provide more jobs. Services will grow rapidly but remain in third place. Manufacturing will grow steadily to over 15,000 jobs by 2020.

In Morgan County, trade surpassed agriculture in 1995 as agriculture held steady at about 400 jobs. Government employment will increase during the remainder of the projection period. Manufacturing will provide over 400 jobs in Morgan County by 2020.

Services and trade will continue leading the employment field in fast growing Summit county. Government and FIRE will provide significant employment, increasing only slightly throughout the planning period. Agriculture and agricultural services in Summit County will likely maintain or slightly increase in the number of jobs provided.

The service sector in Weber County, currently the number two source of employment, will surpass government by the year 2000. Trade and manufacturing will remain in third and fourth place respectively. ❖

Section 5 Contents

5

SECTION

Water Supply and Use

UTAH STATE WATER PLAN - WEBER RIVER BASIN

Water supply and use are among the primary considerations for the overall planning and development of any drainage or region. The supply of water and its use, either current or projected, have a direct impact and limiting influence on an area's economic growth and overall quality of life.

5.1 Introduction

This section of the Weber River Basin Plan provides information and data relating to existing water supplies and current levels of water use by various domestic and commercial entities within the basin. Discussions are also given relating to interbasin diversions and water quality including their impact on overall water supply and use.

5.2 Background

The Ogden and Weber River drainages have experienced both extremes of the hydrological cycle: prolonged drought and excessive flooding. Although it is not uncommon for the basin to have individual years of below average precipitation in terms of snowpack, successive years of below average precipitation periodically occur causing moderate water shortages. An example was the drought year of 1977 which effectively depleted water storage within existing reservoirs to record lows making water rationing a reality in some areas of the basin.

At the other extreme of the hydrologic cycle, record high precipitation and snow pack levels combined with early high temperatures to produce massive flooding and related property damage in 1983-84. Floods along the Wasatch Front caused hundreds of millions of dollars in property damage and various other indirect costs.

Somewhere between the stated extremes of drought and flood, an average annual runoff occurs that can be stored and subsequently diverted for a number of beneficial uses within a given drainage. Although water supplies fluctuate within extremes, the Weber River Basin has a number of large reservoirs that effectively reduce the immediate impacts of drought and flood. These reservoirs also allow for a relatively constant and reliable water supply for water users in Weber, Davis, Morgan and Summit counties.

Water demand is somewhat diverse and includes an assortment of agricultural and municipal and industrial (M&I) uses. However, and with the current urbanization of agricultural areas, M&I water demand has steadily increased while the demand for agricultural irrigation water is on the decline.

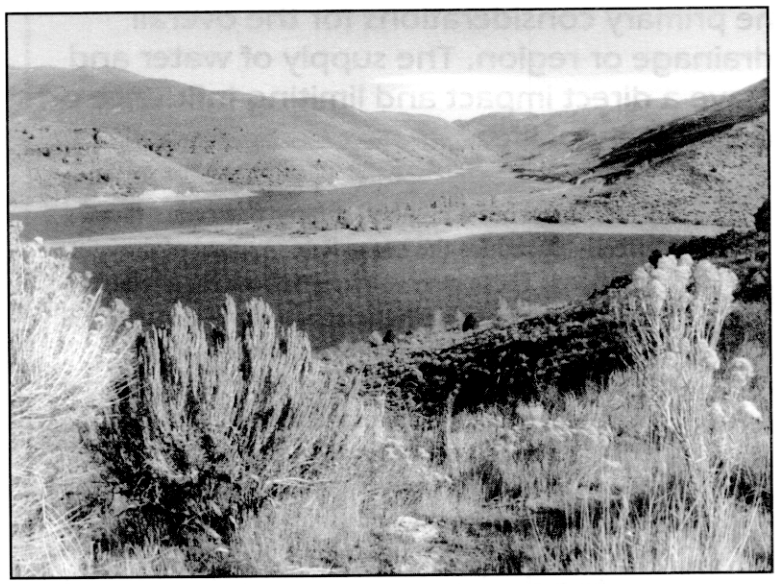
An evaluation of historical stream flow records for the 1961-90 time period indicates the average annual water yield is 979,400 acre-feet. Total diversions of existing water sources are 933,400 acre-feet annually. The diversions include water taken from surface and groundwater sources for all water uses. The total annual diversions account for over 95 percent of the average annual yield. Diversions for various uses in the upper basins (above Weber and Ogden canyons) are returned to the Ogden and Weber rivers to be rediverted, primarily in Weber and Davis counties. This double counting of diversions must be taken into consideration when assessing the remaining level of water supplies that can be developed.

The Weber River Basin is a dynamic area with residential and commercial developments replacing farms and ranches. Current demographic data confirm the four counties are experiencing high population growth and related increases in municipal and commercial construction. This has reduced the acreage of local farms and ranches. As a result, diversions for irrigated agriculture have decreased and are being

converted to M&I water use. A few major water provider agencies originally organized to service farms and ranches are currently in the process of converting existing storage and conveyance systems to provide secondary M&I water. This trend is expected to continue into the foreseeable future.

5.3 Water Supply

The Weber River Basin is considered a closed basin in terms of water source. The basin's water supply is provided almost entirely by the Ogden and Weber rivers drainages and other smaller drainages along the Wasatch Front from North Ogden to Bountiful. The exceptions are the flows from the Spiro Tunnel in the Snyderville Basin and a small diversion on the upper Provo River near Francis.



Lost Creek Reservoir

The old Spiro mining tunnel currently functions as an underground conduit for collected groundwater in western Summit and eastern Salt Lake counties. As a result, some groundwater from the Jordan River drainage finds its way to the upper Weber River drainage.

Water supplies are derived from surface and groundwater sources. As shown on Figure 5-1, the overall Ogden and Weber rivers are extensive and cover a four-county area. In addition, a number of small drainages existing along the western slope of the Wasatch Range from North Ogden to Bountiful also contribute to the overall water supply.

Groundwater supplies are provided by six local aquifers or groundwater basins. These basins are primary sources of culinary water throughout the drainage depending on the water quality of the underlying aquifer. Groundwater is a major factor in the overall supply and use of water in the Weber River Basin. More information and detailed discussions of groundwater development and use are provided in Section 19 Groundwater. The locations of each of the local aquifers is given on Figure 19-1.

5.3.1 Surface Water Supply

Agricultural and M&I surface water diversions (based on 92 water budget data) have been estimated at 521,200 acre-feet per year. A schematic presentation of the overall surface water diversions and average annual stream flows is given on Figure 5-2. A more detailed flow chart for the Snyderville Basin and Park City Area is shown on Figure 5-3.

Surface water supplies are determined from evaluations of historic stream flow data taken at selected gaging stations on the Weber and Ogden River systems. These gaging stations are typically maintained by the U.S. Geological Survey (USGS). The USGS records flow data at selected stations in cooperation with state agencies and publishes all data in annual summaries for distribution to the general public. Currently, 14 stream gaging stations are operating. Historically, and as shown on Figure 5-4, there have been 55 stream flow gaging stations in Weber, Davis, Morgan and Summit counties. Additional information regarding length of flow data, average annual flows, and USGS reference numbers for individual gaging stations is given in Table 5-1.

Annual flows at individual gaging stations fluctuate from year to year. These flows can vary to a significant degree depending on a number of hydrological factors and the existence of reservoirs upstream of a given gaging station. As an example of the extent of stream flow fluctuations, Figures 5-5 through 5-9 have been prepared as bar charts of annual flows for selected years of record. The locations of these gages are shown in Figure 5-4 and listed in Table 5-1.

Reservoirs are generally considered the backbone of most water reclamation projects. Seven major reservoirs have been constructed in or near the Weber River Basin as the main components of three federal water reclamation projects: Willard Bay, Causey, Lost Creek, East Canyon and Wanship reservoirs are generally associated with the Weber Basin Project; Pineview

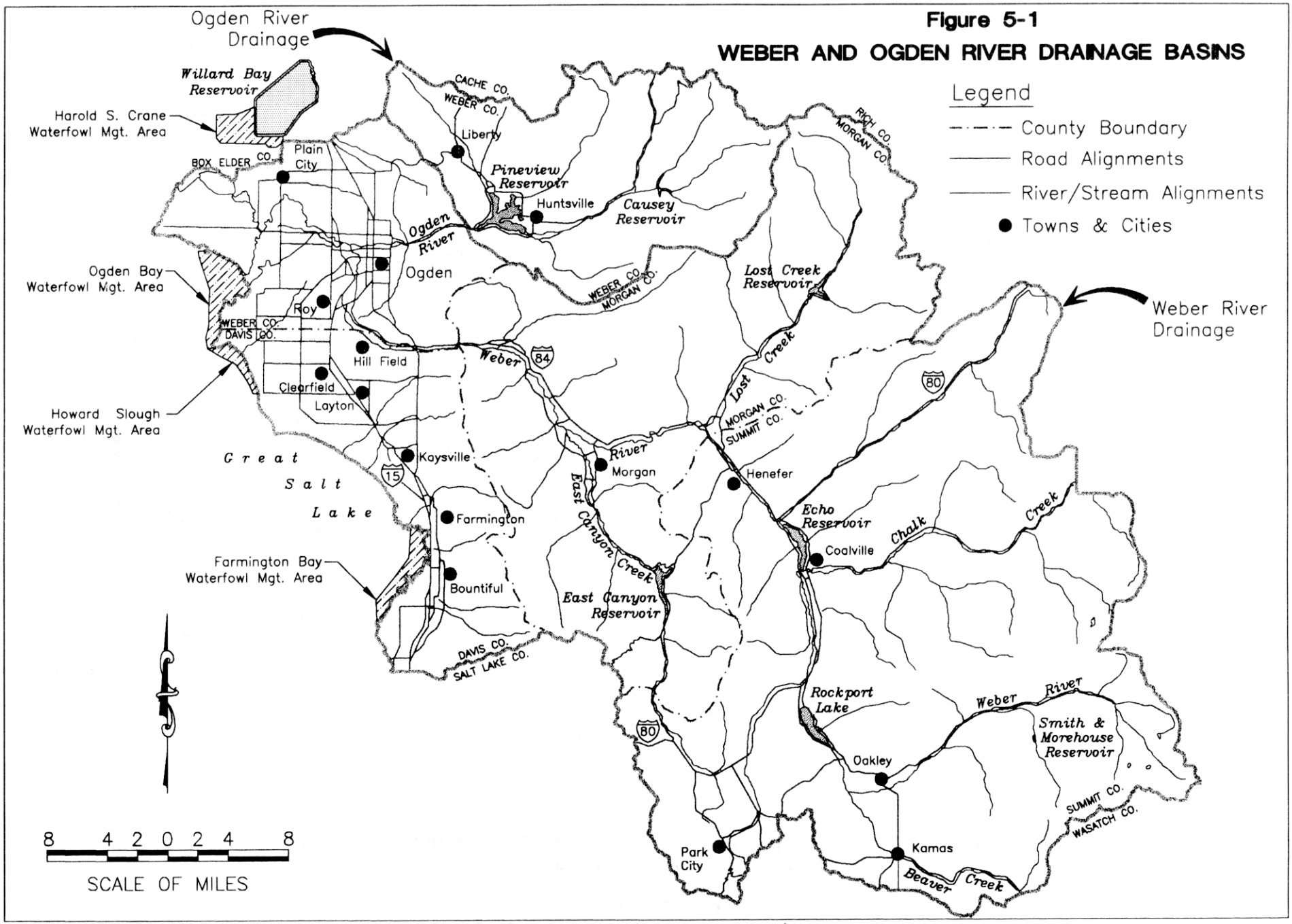


Figure 5-1
WEBER AND OGDEN RIVER DRAINAGE BASINS
Legend
County Boundary
Road Alignments
River/Stream Alignments
Towns & Cities
Ogden River Drainage
Weber River Drainage
Willard Bay Reservoir
Harold S. Crane Waterfowl Mgt. Area
Ogden Bay Waterfowl Mgt. Area
Howard Slough Waterfowl Mgt. Area
Farmington Bay Waterfowl Mgt. Area
Great Salt Lake
CACHE CO.
WEBER CO.
BOX ELDER CO.
RICH CO.
MORGAN CO.
DAVIS CO.
SALT LAKE CO.
SUMMIT CO.
WASATCH CO.
Liberty
Plain City
Pineview Reservoir
Huntsville
Causey Reservoir
Ogden River
Ogden
Roy
Hill Field
Clearfield
Layton
Kaysville
Farmington
Bountiful
Weber River
Morgan
East Canyon Creek
East Canyon Reservoir
Lost Creek Reservoir
Lost Creek
Henefer
Echo Reservoir
Chalk Creek
Coalville
Rockport Lake
Oakley
Smith & Morehouse Reservoir
Park City
Kamas
Beaver Creek
84
80
15
8 4 2 0 2 4 8
SCALE OF MILES

Figure 5-2

WEBER RIVER SYSTEM
AVERAGE ANNUAL STREAM FLOW AND DIVERSIONS (1961-1990)

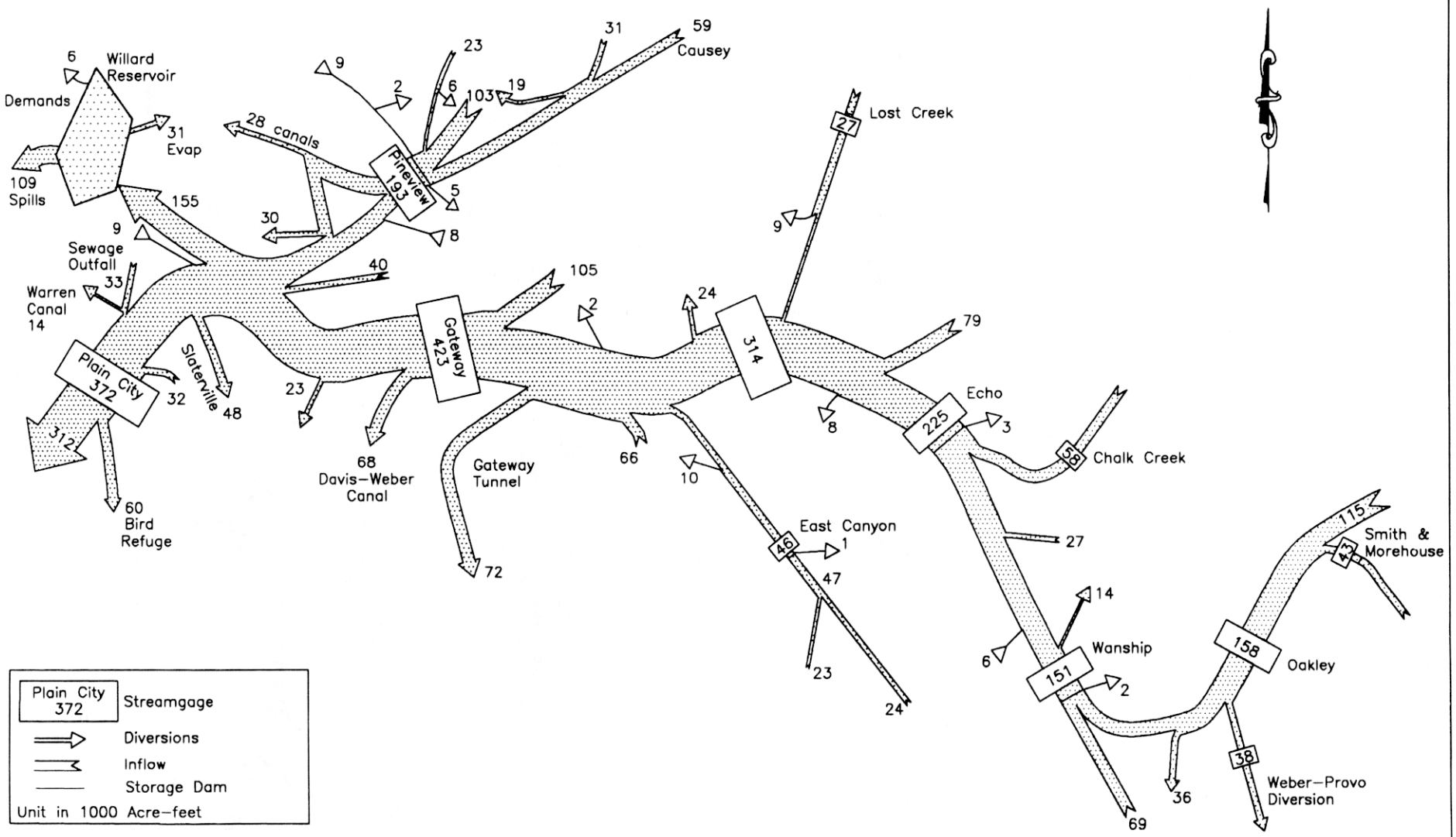


Figure 5-3

SNYDERVILLE BASIN AND PARK CITY AREA
AVERAGE ANNUAL STREAM FLOW AND DIVERSIONS

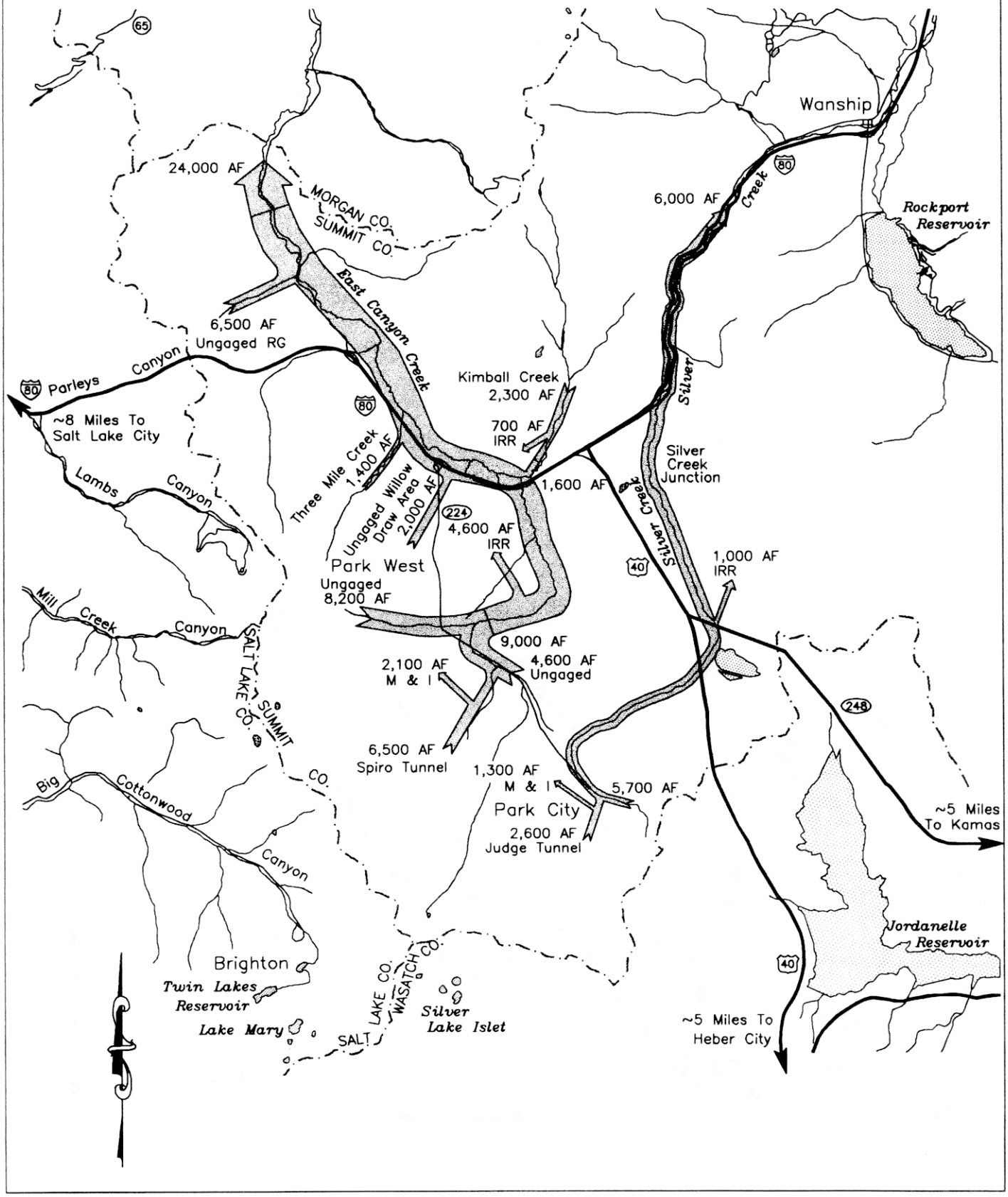
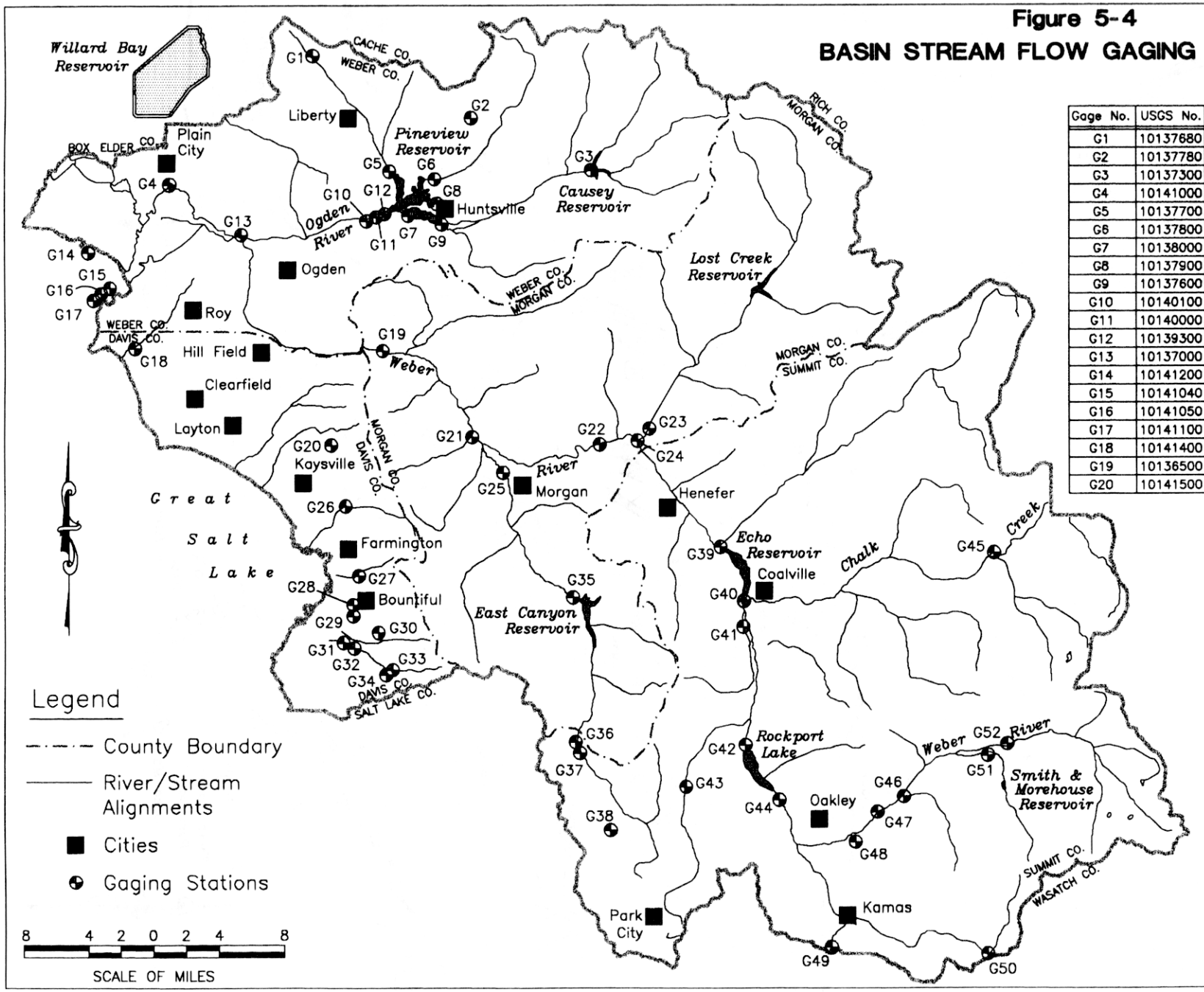


Figure 5-4
BASIN STREAM FLOW GAGING STATIONS



Gage No.	USGS No.
G1	10137680
G2	10137780
G3	10137300
G4	10141000
G5	10137700
G6	10137800
G7	10138000
G8	10137900
G9	10137600
G10	10140100
G11	10140000
G12	10139300
G13	10137000
G14	10141200
G15	10141040
G16	10141050
G17	10141100
G18	10141400
G19	10136500
G20	10141500

G21	10136000
G22	10133500
G23	10132900
G24	10133000
G25	10135500
G26	10142000
G27	10142500
G28	10143000
G29	10143500
G30	10144000
G31	10145126
G32	10145125
G33	10144500
G34	10145000
G35	10134500
G36	10133900
G37	10133895
G38	10133700
G39	10132000
G40	10131000
G41	10130500
G42	10129500
G43	10130000
G44	10129300
G45	10130700
G46	10128200
G47	10128500
G48	10129000
G49	10154500
G50	10154000
G51	10128000
G52	10127500

Table 5-1
AVERAGE ANNUAL FLOW AT GAGING STATIONS

Reference Number	Number	Stream Gage Name	Years of Record	Annual Flow (acre-feet)
G52	10127500	WEBER R AB SMITH & MOREHOUSE CR NR OAKLEY, UT	1947	77,530
G51	10128000	SMITH & MOREHOUSE CREEK NEAR OAKLEY, UT	1947,1976-1987	44,689
G46	10128200	SOUTH FORK WEBER RIVE NR OAKLEY, UT	1965-1974	18,537
G47	10128500	WEBER RIVER NEAR OAKLEY, UT	1905-1995	159,113
G48	10129000	WEBER PROVO DIV CANAL AT OAKLEY, UT	1932-1969	32,028
G44	10129300	WEBER RIVER NEAR PEOA, UT	1957-1977	126,584
	10129350	CRANDALL CREEK NEAR PEOA, UT	1964-1973	3,375
G42	10129500	WEBER RIVER NEAR WANSHIP, UT	1951-95, 1957-60, 1989-95	125,237
G43	10130000	SILVER CREEK NEAR WANSHIP, UT	1942-46, 1982-86, 1990-95	5,461
G41	10130500	WEBER RIVER NEAR COALVILLE, UT	1927-1995	152,848
G45	10130700	EAST FORK CHALK CREEK NEAR COALVILLE, UT	1965-1974	25,074
G40	10131000	CHALK CREEK AT COALVILLE, UT	1928-1995	49,272
G39	10132000	WEBER RIVER AT ECHO, UT	1927-60, 1989-95	190,732
	10132500	LOST CREEK NEAR CROYDON, UT	1921-24, 1941-74, 1976, 1989-93	22,001
G23	10132900	LOST CREEK AT CROYDON, UT	1966-1967	11,232
G24	10133000	LOST CREEK AT DEVIL'S SLIDE, UT	1905-06, 1921-33	40,076
G22	10133500	WEBER RIVER AT DEVIL'S SLIDE, UT	1905-1955	314,272
	10133540	KIMBALL CR ABV E CYN CR NR PARK CITY, UT	1990-1992	494
G38	10133700	THREE MILE CREEK NEAR PARK CITY, UT	1964-74,1982-84	1,633
G37	10133895	E CYN CR AB BIG BEAR HOLLOW NEAR PARK CITY, UT	1990-1995	21,604
G36	10133900	EAST CANYON CREEK NEAR PARK CITY, UT	1982-1985	43,755
G35	10134500	EAST CANYON CREEK NEAR MORGAN, UT	1932-1993	40,750
G25	10135500	EAST CANYON CR BLW DIVERSIONS NR MORGAN, UT	1951-1955	51,925
G21	10136000	WEBER RIVER NEAR MORGAN, UT	1951-1955	368,990
G19	10136500	WEBER RIVER AT GATEWAY, UT	1890-02, 1919-93	406,796
G13	10137000	WEBER RIVER AT OGDEN, UT	1951-1958	259,111
G3	10137300	S FRK OGDEN R BLW CAUSEY DAM NR HUNTSVILLE, UT	1966-1967	48,085
	10137500	SOUTH FORK OGDEN RIVER NEAR HUNTSVILLE, UT	1922-1995	82,407
G9	10137600	SOUTH FORK OGDEN RIVER AT HUNTSVILLE, UT	1960-1965	56,361
G1	10137680	NORTH FORK OGDEN RIVER NEAR EDEN, UT	1964-1974	8,756
G5	10137700	NORTH FORK OGDEN RIVER NEAR HUNTSVILLE	1960-1965	25,559
G2	10137780	MID FRK OGDEN R ABV DIV NR HUNTSVILLE, UT	1964-1974	23,063
G6	10137800	MIDDLE FORK OGDEN RIVER AT HUNTSVILLE, UT	1958-1965	15,060
G8	10137900	SPRING CREEK AT HUNTSVILLE, UT	1958-65,1986-87	6,951
G7	10138000	MIDDLE FORK OGDEN RIVER NEAR HUNTSVILLE, UT	1925-1927	13,265
G12	10139300	WHEELER CREEK NEAR HUNTSVILLE, UT	1959-1995	7,242
G11	10140000	OGDEN R BY PINEVIEW DAM NEAR OGDEN, UT	1937-1959	64,165
G10	10140100	OGDEN RIVER BLW PINEVIEW RES NR HUNTSVILLE, UT	1989-1995	56,996
G4	10141000	WEBER RIVER NEAR PLAIN CITY, UT	1908-1995	435,112
G15	10141040	HOOPER SLOUGH NEAR HOOPER, UT	1975-78,1979-83	9,655
G16	10141050	SOUTH FORK WEBER CANAL NEAR HOOPER, UT	1972-1975	19,261
G17	10141100	SOUTH FORK WEBER RIVER NEAR HOOPER UT	1972-1975	293,105
G14	10141200	NORTH FORK WEBER RIVER NEAR HOOPER, UT	1972-1975	183,550
G18	10141400	HOWARD SLOUGH AT HOOPER, UT	1972-1984	21,175
G20	10141500	HOLMES CREEK NEAR KAYSVILLE, UT	1951-1966	2,671
G26	10142000	FARMINGTON CR ABV DIV NR FARMINGTON, UT	1950-72,1976-79	9,111
G27	10142500	RICKS CR ABV DIVERSIONS NR CENTERVILLE, UT	1951-1966	1,608
G28	10143000	PARRISH CR ABV DIVERSIONS NR CENTERVILLE, UT	1950-68	1,139
G29	10143500	CENTERVILLE CR ABV DIV NEAR CENTERVILLE, UT	1950-1980	2,188
G30	10144000	STONE CREEK ABV DIV NEAR BOUNTIFUL, UT	1951-1966	2,287
G33	10144500	MILL CREEK NEAR BOUNTIFUL, UT	1914	6,627
G34	10145000	MILL CR AT MUELLER PARK NR BOUNTIFUL, UT	1951-1986	4,659
G32	10145125	STORM DRAIN E OF ORCHARD DR AT BOUNTIFUL, UT	1984-1986	1,743
G31	10145126	STORM DRAIN TO MILL CR, 620 S 200 W, BOUNTIFUL, UT	1984-1986	879
G49	10154500	WEBER PROVO CANAL NEAR WOODLAND, UT	1932-69,1989-95	30,155

Figure 5-5

ANNUAL FLOWS

Weber River near Oakley

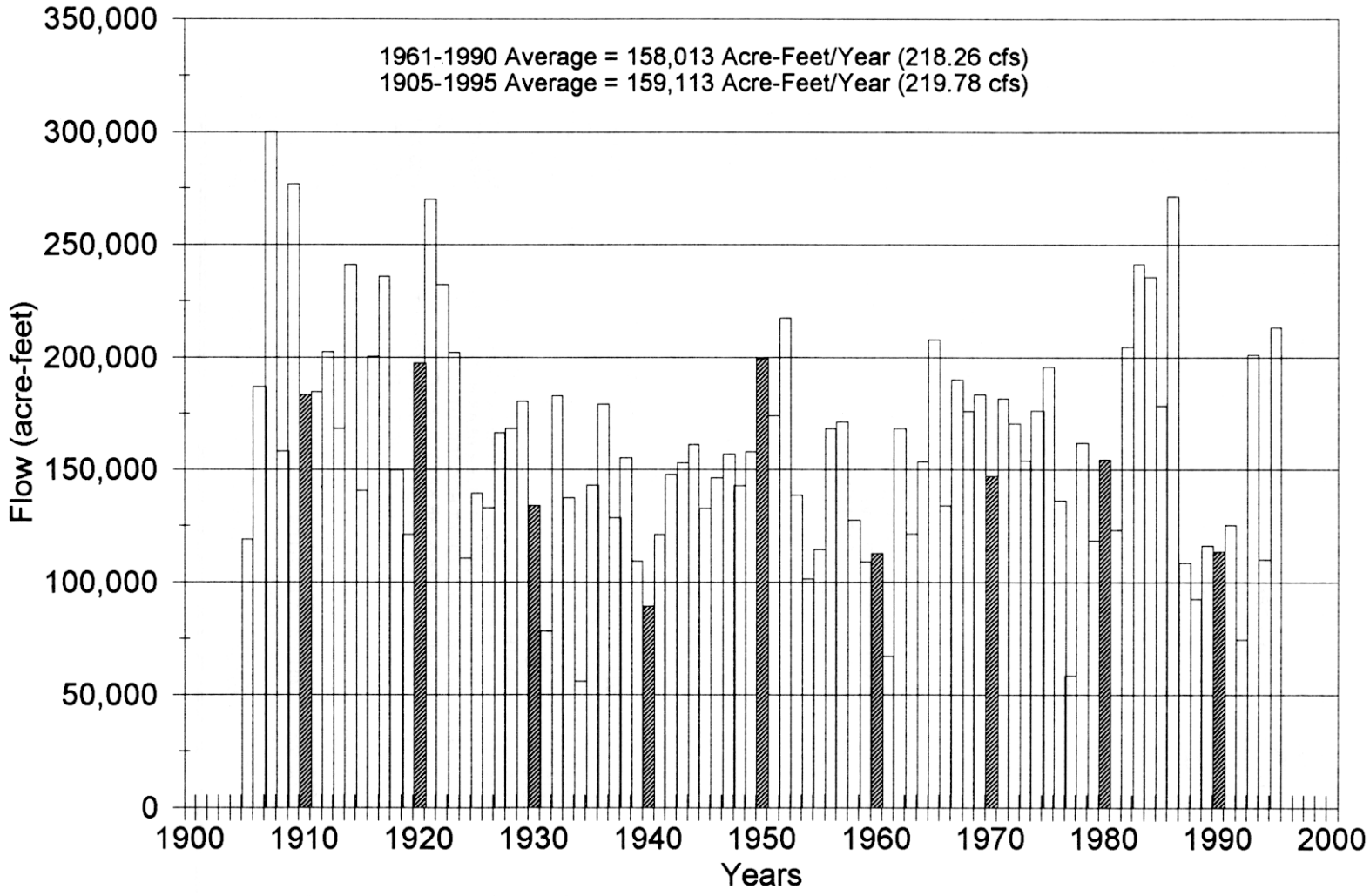


Figure 5-6
ANNUAL FLOWS
Weber River at Gateway

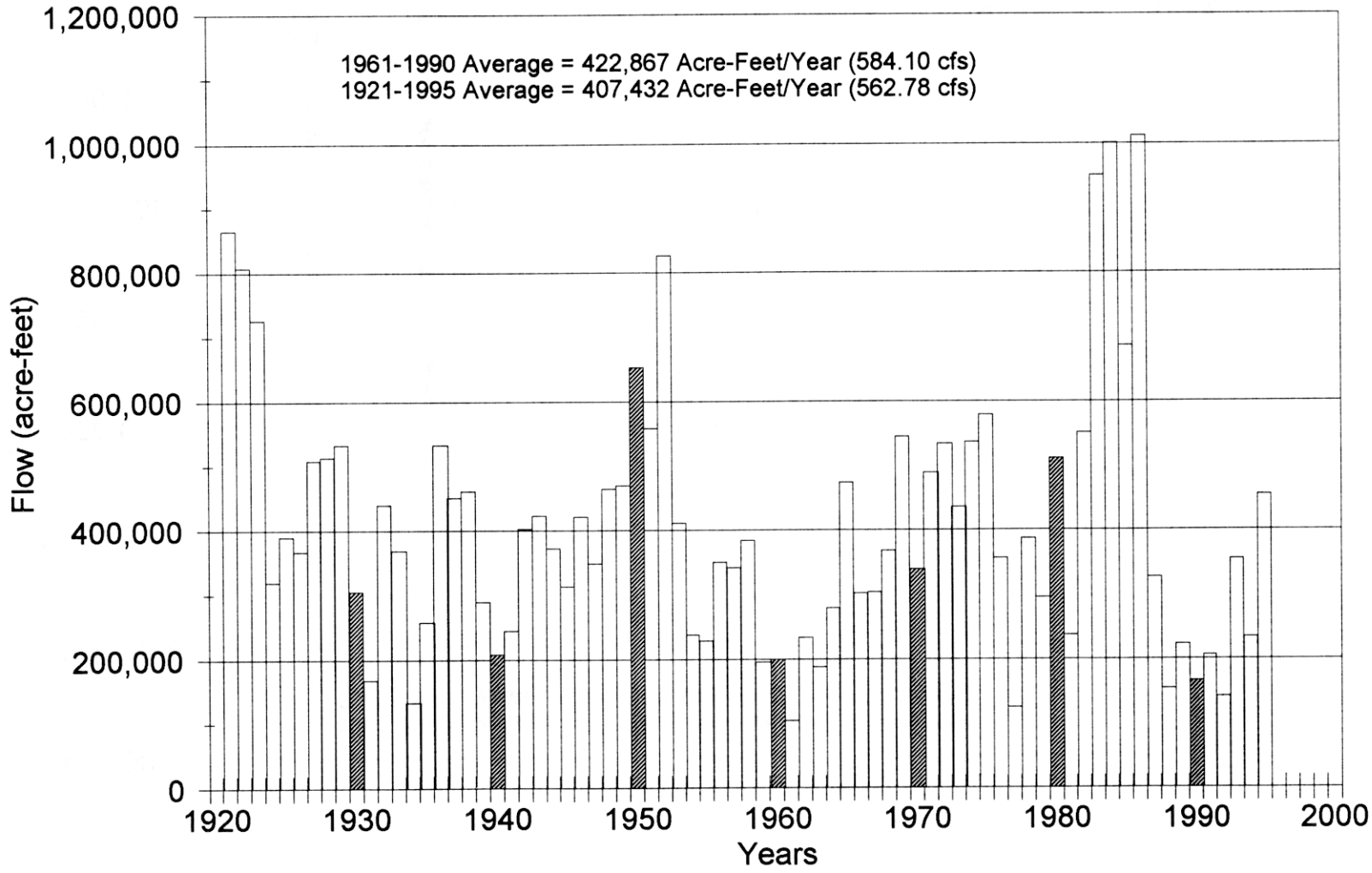


Figure 5-7

ANNUAL FLOWS

Weber River near Plain City

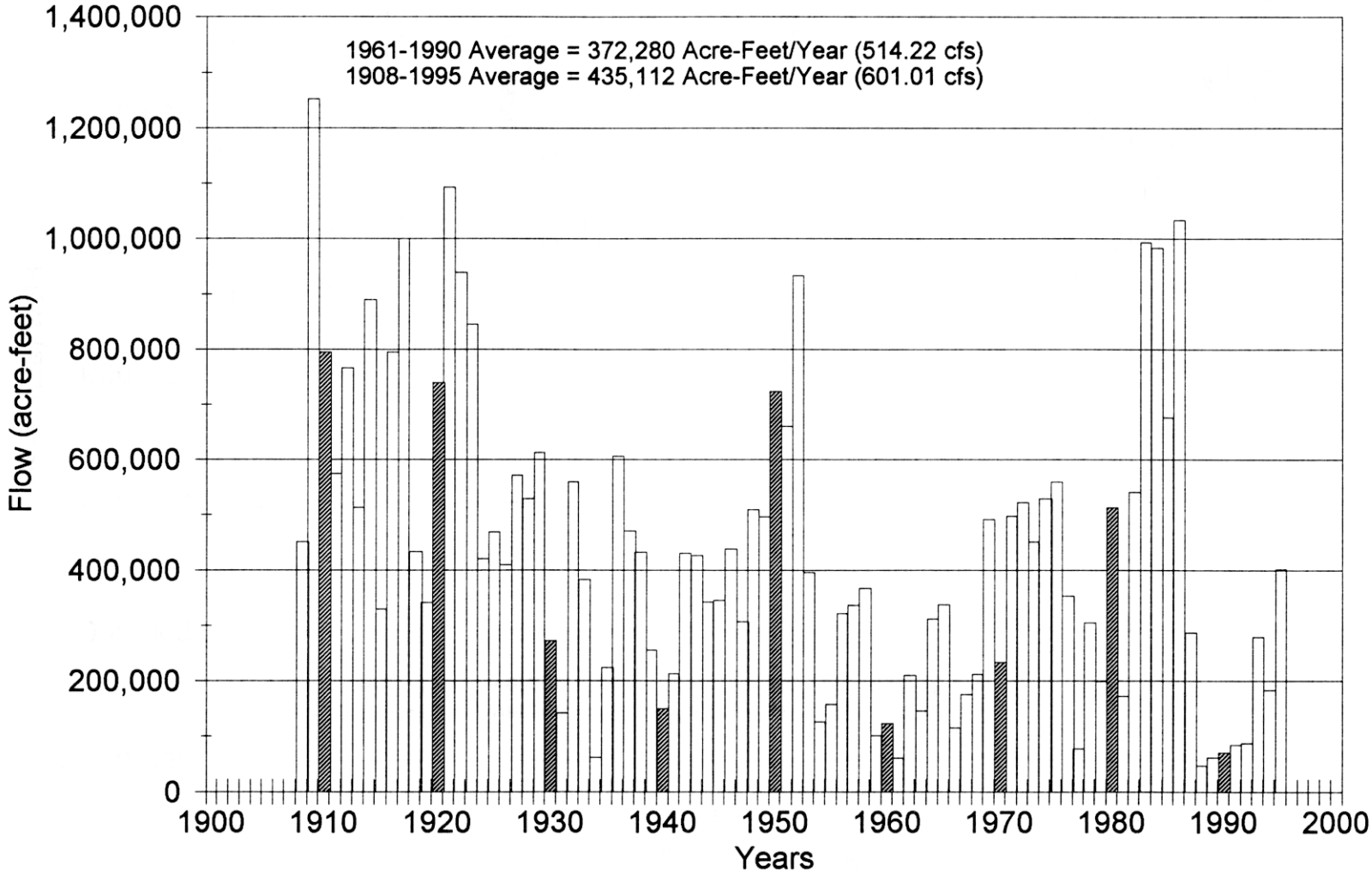


Figure 5-8
ESTIMATED ANNUAL FLOWS
Ogden River Below Pineview Reservoir

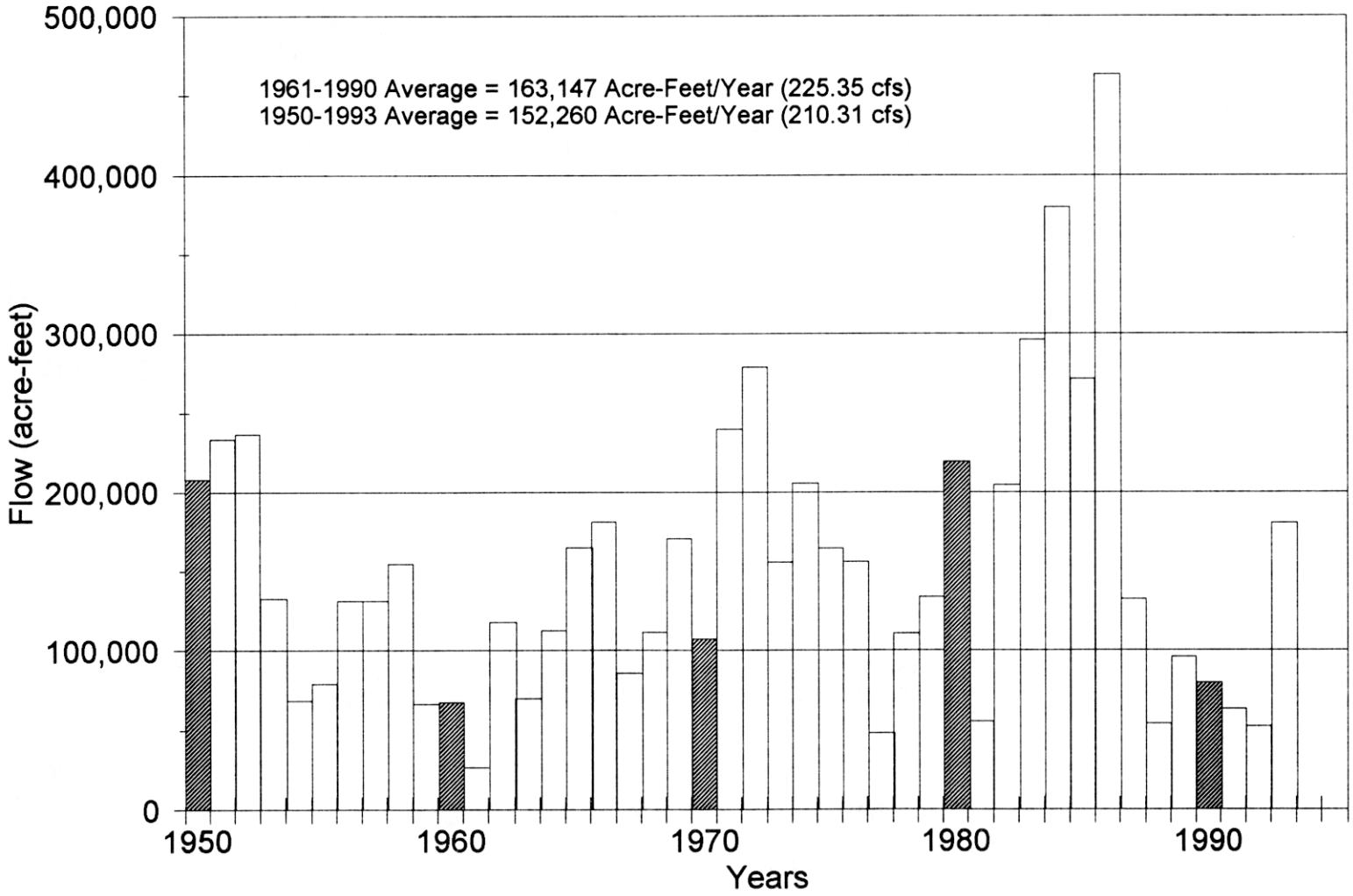


Figure 5-9

ANNUAL FLOWS

South Fork Ogden River near Huntsville

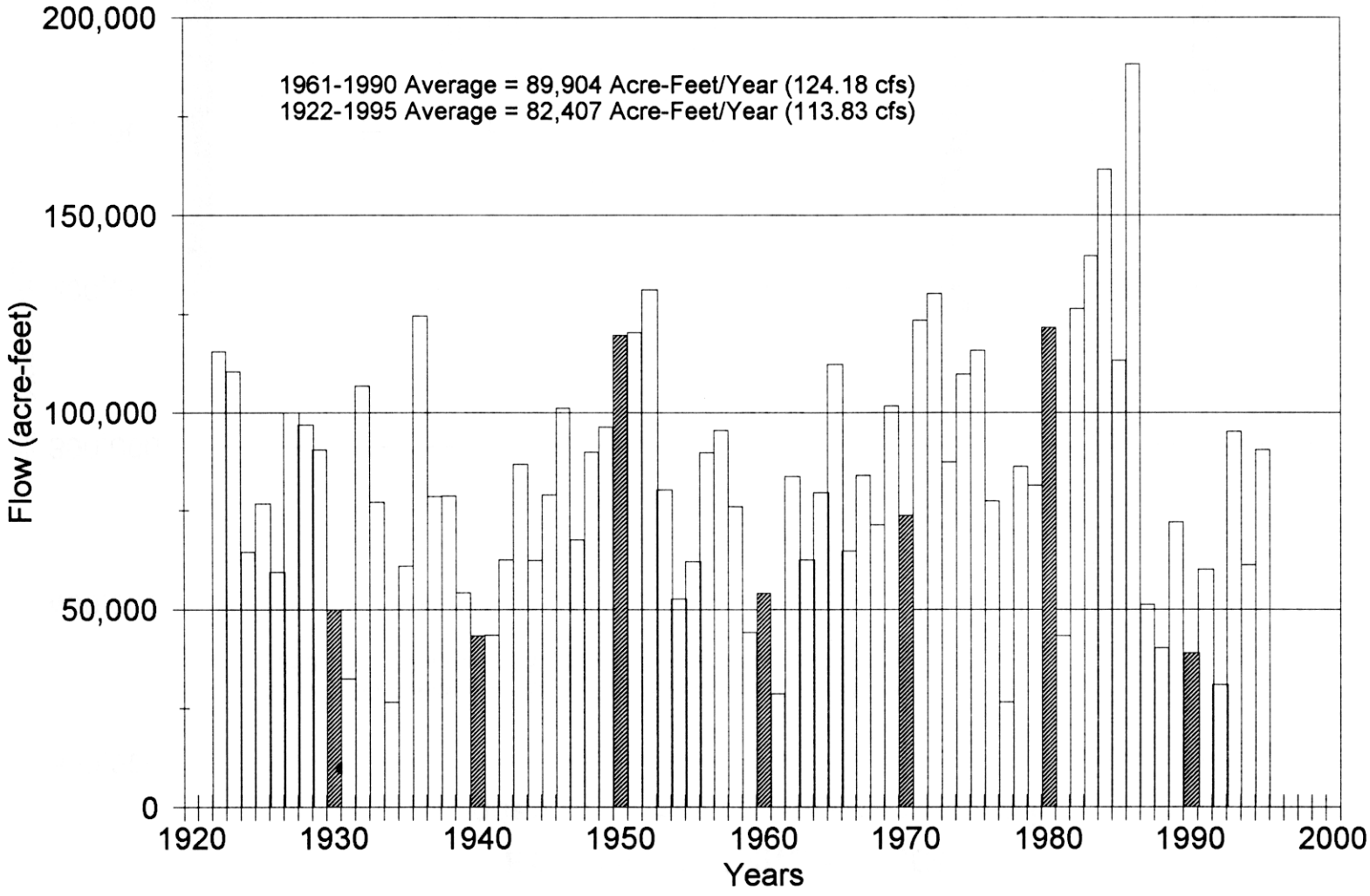


Table 5-2
ACTIVE STORAGE CAPACITIES
IN MAJOR RESERVOIRS

Reservoir	Active Storage (acre-feet)
Smith and Morehouse	7,600
Rockport Lake (Wanship Dam)	60,900
Echo	74,000
Lost Creek	20,000
East Canyon	48,100
Causey	6,900
Pineview	110,200
Willard (A.V. Watkins Dam)	198,200
Total Active Storage	525,900

Reservoir was initially constructed as the main component of the Ogden River Project; with Echo Reservoir was constructed as part of the Weber River Project. The last major reservoir within the Weber Basin was constructed by the Weber Basin Water Conservancy District on Smith and Morehouse Creek approximately 10 miles east of Oakley in Summit County.

Water resources in the Weber River Basin are generally considered fully developed. As summarized in Table 5-2, the combined active storage capacities of these reservoirs totals 525,900 acre-feet. When compared with the average annual basin yield of 979,400 acre-feet, it is seen that local water provider agencies can store 54 percent of the basin's potential water supplies during an average water year.

5.3.2 Groundwater Supply

The Weber River Basin contains six groundwater basins; the East Shore Area, Ogden Valley, Central Weber Valley, Park City, Rhodes Valley and the Weber River above Oakley. The groundwater basins east of the Wasatch Front (upper basins) are generally considered to be independent aquifers when compared with the East Shore Area (lower basin) groundwater basin. The upper and lower groundwater basins are hydraulically isolated by consolidated rock formations associated with the Wasatch Range. The upper groundwater basins, however, contribute to surface water flows near the mouths of Weber and Ogden canyons which are the primary source of recharge water for the lower East Shore Area aquifer.

Table 19-1 summarizes the current annual pumpage for each of the groundwater basins. Detailed discussions of groundwater hydrogeologic features are given in Section 19.

5.4 Water Use

The Weber River Basin has historically had a mixed economic base supported by irrigated agriculture, large federal military installations, commercial and industrial businesses. In recent years, the growth of residential developments encroached on local farms and ranches. The resulting conversion of agricultural lands to residential and commercial developments has also dictated a gradual conversion of basic water demand from irrigated agriculture to municipal and industrial uses.

5.4.1 Agricultural Water Use

Although it has been stated that irrigated agriculture is on the decline, it remains the single largest user of developed water supplies in the Weber River Basin. Estimates for 1987 indicate 472,700 acre-feet of water is diverted annually to basin farms and ranches. However,

the trend of replacing local farms and ranches with urban development has been established, and that trend that is expected to continue. The rate of decline of irrigated agriculture has been evaluated based on various landuse studies completed by the Division of Water Resources. The irrigated land in 1968 was estimated at 160,000 acres as compared with 138,600 acres in 1987. Over the same period of time, diversions for irrigated agriculture dropped from 643,500 acre-feet to 472,700 acre-feet. Water use and acreages associated with irrigated agriculture in 1987 are given in Table 5-3.

5.4.2 Municipal and Industrial Water Use

Municipal and industrial (M&I) water use includes all diversions to residential developments, commercial and industrial businesses, and various institutional facilities. Municipal and industrial uses include self-supplied private domestic, commercial and industrial users. Municipal and industrial diversions can be made from culinary (treated to drinking water standards) and secondary (nontreated) water systems. Culinary water is primarily used for "indoor" purposes, while secondary water is used for "outdoor" purposes. Current M&I demands are summarized in Table 5-4.

Indoor uses generally include water for cooking, drinking, bathing, personal sanitation, miscellaneous cleaning, and personal use inside the home and within commercial businesses. Outdoor uses generally include the irrigation of lawns, gardens, landscaping, and washing of driveways and automobiles.

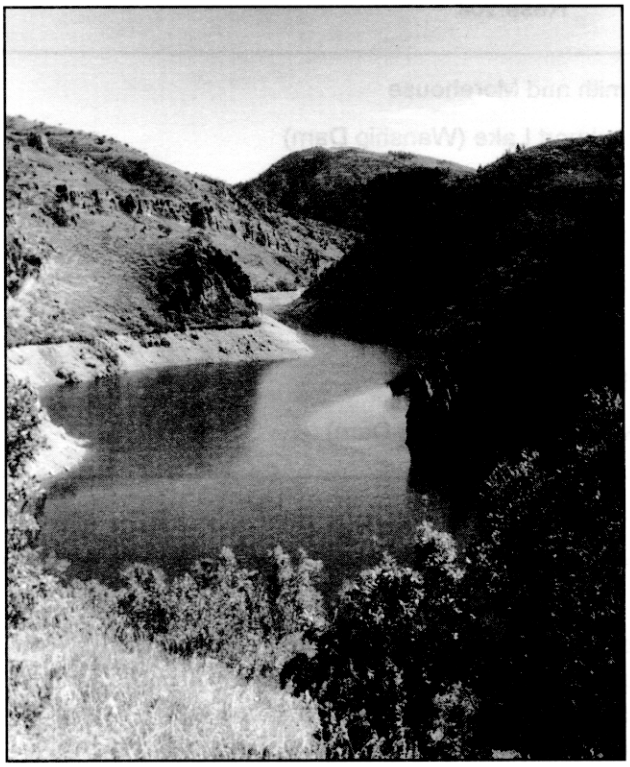
5.4.3 Wetlands and Riparian Water Use

Wetlands and riparian areas generally support water intensive vegetation as shown on Figure 5-10. These areas are associated with marshes and selected reaches of existing river and stream banks.

Managed wetlands include the Harold S. Crane, Ogden Bay, Howard Slough and Farmington Bay Waterfowl Management Areas. Total wetland and riparian water use for the basin has been estimated at 270,000 acre-annually.

5.4.4 Instream Flow Requirements

With the exception of Echo Reservoir, minimum instream flows are required (according to terms and conditions of exiting water right appropriations) on all reaches of the Weber and Ogden rivers between existing reservoirs and extending to the East Shore Area. The exception of a minimum instream flow requirement occurs immediately downstream of Echo Dam. The construction of Echo reservoir was completed in 1931. At that time, the establishment of minimum instream flows was not required to construct major federally sponsored water reclamation projects and related



Causey Reservoir

facilities. As a result, no minimum instream flow has ever been established for the Weber River downstream of Echo Reservoir. However, existing surface water right appropriations downstream of Echo Reservoir provide adequate habitat for all sport fish species common to the area. Additional information regarding minimum instream flows and fish habitat maintenance is given in Section 14, Fisheries and Water-Related Wildlife.

5.4.5 Recreation

Each reservoir is operated and managed to provide a reasonable degree of outdoor recreation by maintaining conservation pools for boating and fishing. Although recreation is an important aspect of any major water reclamation project or related facility, it is usually considered a secondary use when compared with flood control and water storage for agricultural, domestic and commercial uses. Recreational boating and fishing are regularly impacted by the need to operate and maintain reservoirs for flood control and water supplies. Water

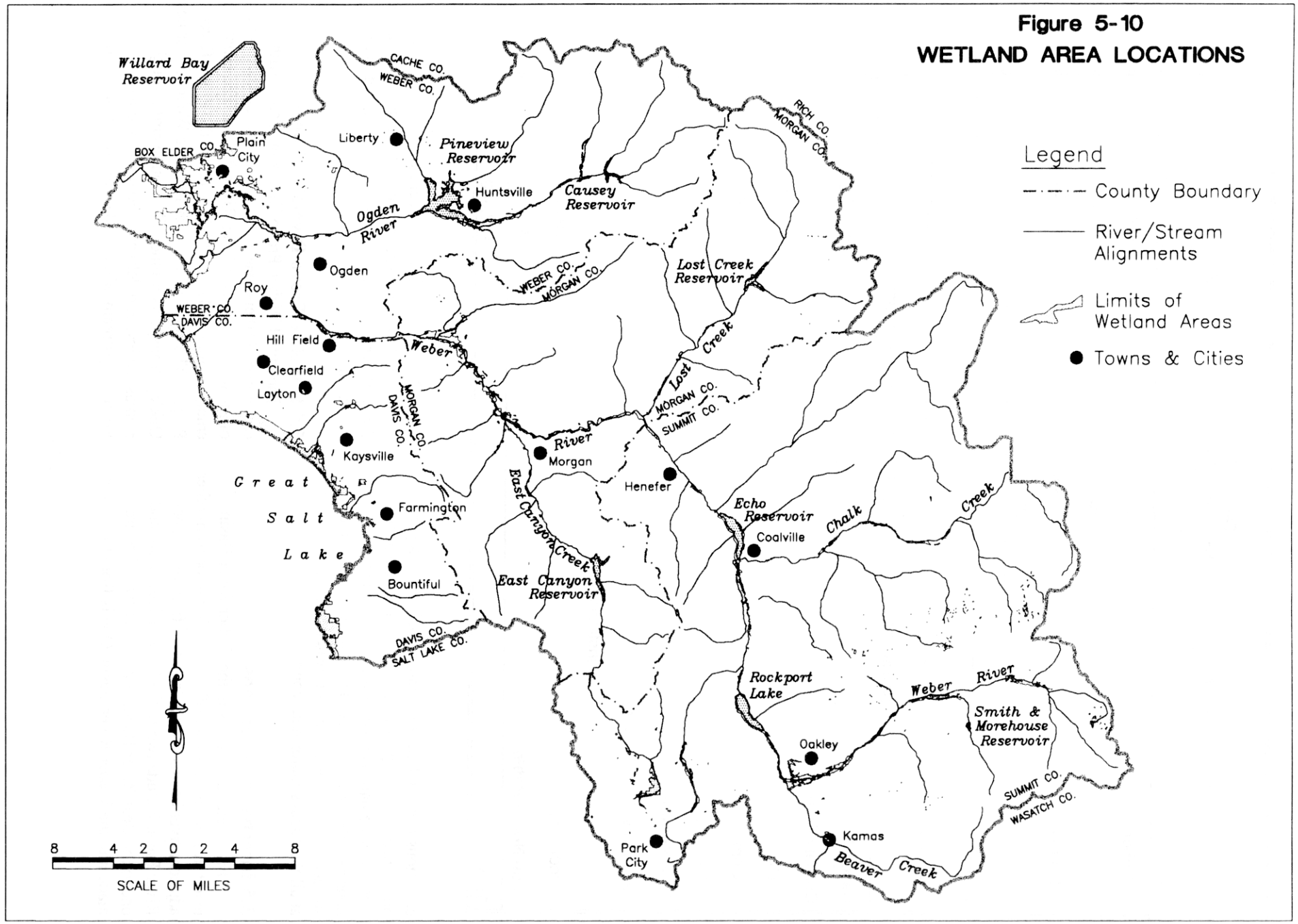


Figure 5-10
WETLAND AREA LOCATIONS
Legend
County Boundary
River/Stream Alignments
Limits of Wetland Areas
Towns & Cities
Willard Bay Reservoir
CACHE CO.
WEBER CO.
RICH CO.
MORGAN CO.
BOX ELDER CO.
Plain City
Liberty
Pineview Reservoir
Huntsville
Causey Reservoir
Ogden River
Ogden
Lost Creek Reservoir
Roy
WEBER CO.
DAVIS CO.
Hill Field
Weber
Clearfield
Layton
Lost Creek
MORGAN CO.
SUMMIT CO.
MORGAN CO.
DAVIS CO.
Kaysville
River
Morgan
Great Salt Lake
East Canyon Creek
Henefer
Echo Reservoir
Chalk Creek
Coalville
Farmington
Bountiful
East Canyon Reservoir
DAVIS CO.
SALT LAKE CO.
Rockport Lake
Weber River
Smith & Morehouse Reservoir
Oakley
SUMMIT CO.
WASATCH CO.
Kamas
Park City
Beaver Creek
8 4 2 0 2 4 8
SCALE OF MILES

Table 5-3
ACREAGES AND WATER USE FOR IRRIGATED AGRICULTURE (1987)

County	Acreages (acres)	Diversion (acre-feet)
Weber	61,900	214,900
Davis	36,200	125,700
Morgan	11,400	41,550
Summit	29,100	90,550
Total	138,600	472,700

Table 5-4
MUNICIPAL AND INDUSTRIAL WATER USE (1992)

Description	(acre-feet)
Culinary (Potable)	
Residential	53,100
Commercial/Institutional	33,220
Industrial	5,700
Total Potable	**92,000**
Secondary (Non-Potable)	
Residential, Commercial & Institutional	59,800
Industrial	29,200
Total Non-Potable	**80,000**
Total	**172,000**

elevations behind dams fluctuate significantly depending on the need to store projected runoff, meet seasonal water user demands and perform scheduled and nonscheduled maintenance. These unavoidable water surface fluctuations can inhibit water-related recreation at all the basin's major reservoirs.

5.5 Interbasin Diversions

Five water diversions in the Weber River Basin result in a limited transfer of water either to or from other adjacent river basins. Water transfers from the Weber River Basin include two to the Provo River Basin and one to the Bear River Basin. Two water transfers are made into the Weber River Basin. One is from the Jordan River Basin via the Spiro Tunnel connecting Salt Lake County to Park City. The remaining diversion is from the Provo River near Francis, part of which is used in the Kamas area.

5.5.1 Weber-Provo Diversion Canal

The initial Weber-Provo Diversion Canal, with a capacity of 210 cfs, was constructed in 1928-31 as one of the features of the Weber River Project. The canal was enlarged after 1942 to 1,000 cfs under the Provo River Project. The canal takes water from the Weber River near Oakley, transports it nine miles southward through Kamas Valley, and delivers it to the Provo River near Francis, upstream of the Jordanelle Reservoir. Along the

way, the canal intercepts and diverts water from Beaver Creek, a tributary of the Weber River. Diversions are made under an existing water right appropriated to the Provo River Water Users Association which allows for a maximum annual diversion from the Weber River of 136,500 acre-feet. For the 1961 to 1990 period, diversions ranged from 7,171 acre-feet to 88,440 acre-feet and averaged 38,000 acre-feet.

5.5.2 Ogden-Brigham City Canal

Construction of the Ogden River Project included the Ogden-Brigham City Canal that conveys up to 120 cfs of irrigation water from Pineview Reservoir north along the east bench area of Ogden to Box Elder County. For an average water year, 18,000 acre-feet of water is diverted to small farms and residential homes in Weber and Box Elder counties. About 11,000 acre-feet of the average annual diversion remains in the Weber River Basin (Ogden River drainage) with 7,000 acre-feet exported to Box Elder County.

5.5.3 Ontario Tunnel

The Ontario Tunnel was constructed as a drainage facility to alleviate excessive groundwater flows within existing mine shafts in and around the Park City area. The tunnel, constructed south of Park City, discharges an estimated 10,000 acre-feet of groundwater annually from the Weber River Basin to the reservoir pool behind Jordanelle Dam within the Provo River Basin.

5.5.4 Spiro Tunnel

The Spiro Tunnel was constructed as a major mining project in the Park City Mining District. The tunnel extends from its portal in Park City to several secondary tunnels within the Wasatch Mountain Range in western Summit County. The various alignments of the secondary tunnels extend to locations near the natural drainage divide between Salt Lake and Summit counties. In addition to providing basic access to a number of subsurface minerals in the Park City area, the main and secondary tunnels also collect significant flows from groundwater aquifers in the Weber and Jordan River drainage basins. Collected groundwater is discharged from the tunnel's main portal located near the southwestly corner of the Park City Municipal Golf Course. In recent years, the Park City Municipal Corporation constructed a water treatment plant immediately adjacent to the tunnel's point of discharge. The plant treats and distributes tunnel groundwater to various residential and commercial developments.

Due to the close proximity of secondary tunnel alignments to the dividing line separating the Weber and Jordan river drainages, some groundwater within the Jordan River Basin is collected and transported to the Weber River Basin through the tunnel system. The annual amount of groundwater collection from the Jordan River drainage was determined as a result of litigation between the United Park Consolidated Mines Company and Salt Lake City Corporation. Annual flows from the tunnel average around 6,500 acre-feet per year.

5.6 Water Quality

With the possible exception of areas subjected to sustained residential growth, water quality in the upper Weber and Ogden River basins is generally considered good to excellent. The treatment of raw surface water to drinking water standards typically requires only conventional filtration processes. The treatment of groundwater generally requires chlorination only.

Water quality in the lower reaches of the Weber River is considered moderate to poor by drinking water standards. However, judged by standards established for agricultural irrigation and general outdoor use, water in the lower basin is considered more than adequate for the irrigation of crops, livestock pastures, and as a source of residential secondary water.

Poor water quality in the lower basin has historically been the result of high concentrations of Biological Oxygen Demand, dissolved and suspended solids from slaughter houses, food processing facilities, metal finishing plants and sediment loadings associated with runoff (tailwater) from farms and ranches in western Weber County. Water quality in the lower basin, however, has improved in recent years primarily due to the closure of slaughter houses and agricultural produce processing plants in the Ogden area.

The variation in groundwater quality in the basin typically parallels that of surface water. Water pumped from aquifers in the upper drainages and the east bench areas of the Wasatch Front is considered to have good to excellent quality by drinking water standards. However, water quality within the East Shore Area deteriorates as well sites approach the Great Salt Lake. Wells in relative close proximity to the Great Salt Lake often produce high concentrations of dissolved solids (brackish water) including salts. A more detailed discussion of water quality, including monitoring and treatment, is given in Sections 11, Drinking Water; 12, Water Quality; and 19, Groundwater. ❖

Section 6 Contents

6 Management

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The wise and prudent management of water resources impacts nearly all aspects of growth and development within an entire drainage basin and/or region. Water influences the quality of life, the overall environment and, to a large degree, economic growth.

6.1 Introduction

This section of the Weber River Basin Plan presents information and data relating to the management of water resources and all related facilities to store, treat and distribute water to various end users. Discussions also outline the role of various water provider organizations and their individual responsibilities to provide a clean and reliable source of water to residential, commercial, industrial and agricultural demands within the basin.

6.2 Setting

The development of water resources requires a high degree of planning, commitment and cooperation between public and private entities. The construction and operation of dams and reservoirs, treatment plants and distribution facilities, including the commitment of labor and equipment, is a complex undertaking that must be managed effectively.

The Weber River Basin is one of the most developed hydrologic basins in Utah in terms of water storage, treatment and distribution. The basin has a total watershed area of over 1.5 million acres that yields an estimated 979,400 acre-feet of surface and groundwater annually.

The completion of several large water reclamation projects within the basin has resulted in the construction of eight major dams on the Weber and Ogden River systems. The combined storage capacity of these reservoirs totals 525,900 acre-feet or 54 percent of the average annual basin water yield. Other service facilities include six culinary water treatment plants and related distribution systems, hundreds of miles of irrigation canals and laterals servicing basin farms and ranches, and over 65 smaller reservoirs providing flood control, recreation and/or irrigation water to basin water users.

6.3 Management Entities and Systems

Water resources and related service facilities are managed by a variety of agencies and organizations. Annual water use summaries published by the Division of Water Rights indicate that 16 different types of water provider agencies exist in the basin. These agencies include small ditch and canal companies, larger water conservation and conservancy districts, and a number of public works departments associated with various larger municipalities.

Water provider organizations can generally be categorized based on their general legal designation, clientele base and type of service provided. However, a given category can provide different types of water service to several different types of clientele. As an example, there are 108 water provider organizations classified as irrigation companies. A relatively large percentage of these companies, however, provide water for irrigated agriculture and municipal secondary uses. In addition, large water conservancy districts, such as the Weber Basin Water Conservancy District, provide culinary, municipal, secondary and agricultural irrigation water direct to individual users and a number of other smaller provider organizations. Various data and information on file with the division of Water Rights have been evaluated for each type of water provider agency. The results are presented in Table 6-1 for 330 water provider organizations.

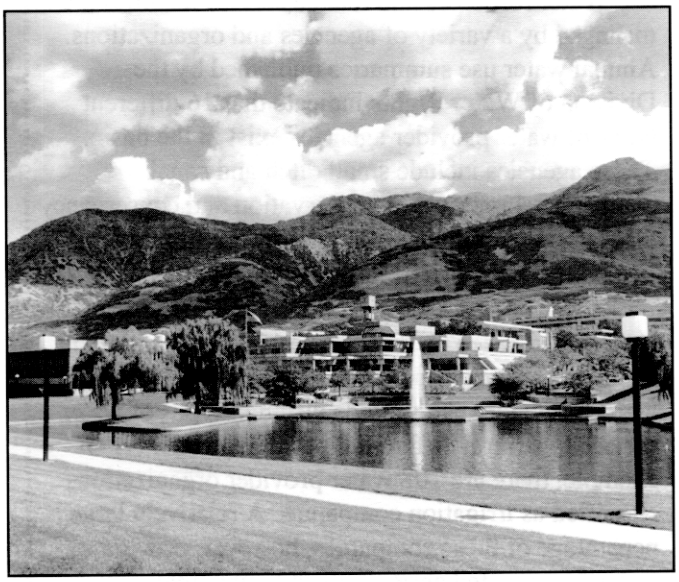
6.3.1 Agricultural

Agriculture water providers include conservation and conservancy districts, irrigation, ditch, canal and, in some cases, reservoir companies. They are generally small entities governed by boards of directors employing a part-time general manager with relatively small clerical and facility maintenance staffs. These organizations are generally financed through assessments on water shares owned by individuals.

Although farms and ranches are the largest users of agricultural water, a number of water provider agencies have converted substantial portions of existing irrigation water conveyance systems to accommodate secondary residential water demands. Individual secondary systems service from 100 to 1,000 acres of residential developments primarily in Weber, Davis and Morgan counties.

6.3.2 Municipal and Industrial

Municipal and industrial (M&I) water providers generally include water or public works departments of towns or cities. Large water conservancy districts and water user associations can also provide water for various M&I uses. Water diverted for municipal-culinary uses can be divided into indoor and outdoor for residential, commercial and industrial uses. Indoor diversions are generally associated with personal uses in private homes, miscellaneous uses in commercial businesses and industrial plants. Outdoor water is generally used to irrigated ornamental grass and landscaping.



Weber State University

The basin has 34 incorporated towns and cities. And not all of these municipalities have public works departments that operate and maintain their own culinary and secondary water distribution systems. Some of the municipalities that manage their own systems include Ogden, Layton, Clearfield, Roy, Bountiful, Park City, South Ogden, Riverdale, Kaysville, Farmington, Centerville and North Ogden.

6.3.3 Wholesalers/Multiuse Distributors

Water wholesalers are typically the largest water provider organizations within the basin. They generally have the responsibility to operate and maintain a considerable number of water conveyance, treatment and storage facilitates associated with large projects. Water wholesalers provide water for small canal and ditch companies, municipalities, and a number of large industrial and commercial businesses.

Pine View Water Systems -The Pine View Water systems (PVWS) is composed of three entities: The Ogden River Water Users Association, South Ogden Conservation District and the Weber-Box Elder Conservation District. Each of these entities is a corporation with a separate board of directors elected by water share-holders. A general manager is directly responsible to each board for the entire operation of the three organizations. An executive committee, composed of the president of each board and two additional directors, is established each year to coordinate management of the PVWS at the board level between the three organizations.

As the overriding management agency, PVWS is directly responsible for the operation and maintenance of a number of water storage and conveyance systems including Pineview Reservoir, the Ogden-Brigham City Canal, the South Ogden-Highline Canal and a number of pipelines, canals, and related structures associated with South Ogden and Weber-Box Elder Conservation districts. Deliveries from PVWS facilities are primarily used for irrigated agriculture or secondary residential irrigation water.

Weber Basin Water Conservancy District - The Weber Basin Water Conservation District is the operation and maintenance agency for the Weber Basin Project. The project was initially constructed by the Bureau of Reclamation over a 15-year period from the mid-1950s to late 1960s. The Weber Basin Project was designed as a multipurpose project providing flood

control, hydroelectric power and reliable water supplies for all the basin's needs. The project provides agricultural, municipal and industrial water to Davis, Morgan, Summit, Box Elder and Weber counties

The Weber Basin Water Conservancy District, through agreements with others, operates water storage and distribution facilities including seven major reservoirs, three diversion dams, two main distribution canals, two hydropower generation plants, nine groundwater supply wells, three culinary water treatment plants and over 60 miles of major water conveyance facilities that include various tunnels, aqueducts and canals. Annual diversions from project facilities average around 212,800 acre-feet for irrigated agriculture and various municipal and industrial (M&I) uses. Of the total supply, 162,800 acre-feet are designated for irrigated agriculture with the remaining 50,000 acre-feet for M&I needs. The Weber Basin Project provides culinary and secondary water for nearly all of the basin's populace.

In addition to extensive water treatment and conveyance facilities, the district also operates the Weber Basin Water Quality Laboratory which provides staff and equipment to evaluate and monitor water quality. The laboratory operates in strict accordance to state and federal regulations, and is fully authorized by state and federal water quality regulatory agencies as a water treatment training facility.

Weber-Box Elder Conservation District -The Weber-Box Elder Conservation District was formed to secure water from the Ogden River Project to provide irrigation water to lands lying below the Ogden-Brigham City Canal from Ogden Canyon to Brigham City in Weber and Box Elder counties. The district was formed and purchased its first water from the Ogden River Water Users Association in September 1934.

The district service area generally includes the communities of Ogden, North Ogden, Pleasant View, Plain City, Farr West, Harrisville, Perry, Willard, Brigham City, and unincorporated lands in Weber and Box Elder counties. Water is provided for the irrigation of agricultural crops associated with family farms including fruit orchards, grains, alfalfa, small gardens and residential yards. The conveyance system generally consists of small storage reservoirs with gravity flow systems for secondary water deliveries along the bench areas and onto the valley floor as well as a constant pressure system serving the Plain City and Farr West areas.

The district's annual diversions are taken from storage water rights held in Pineview Reservoir (an estimated 16,000 acre-feet)and water purchased from Weber Basin Water Conservancy District out of the Willard Canal (and estimated 2,100 acre-feet). The district is part of the Pine View Water Systems.

South Ogden Conservation District - The South Ogden Conservation District was organized in 1934, soon after the organization of the Weber-Box Elder Conservation District. The South Ogden-Highline Canal distributes storage water from Pineview Reservoir to eight small storage reservoirs. These storage reservoirs distribute the water to the gravity flow system that serves the residential developments in Ogden, South Ogden, Riverdale and Washington Terrace. The South Ogden-Highline Canal extends from the mouth of Ogden Canyon to Washington Terrace. The original open canal has been completely replaced with reinforced concrete pipe. The district also has two groundwater supply wells in Washington Terrace to provide supplemental water to that area.

Annual diversions from Pineview Reservoir currently average 7,000 acre-feet. The district is part of the Pine View Water Systems.

Bountiful Water Subconservancy District -The Bountiful Water Subconservancy District was initially formed to provide secondary irrigation water to small family farms and residential subdivisions, primarily within the city of Bountiful. The district purchases water from the Weber Basin Water Conservancy District through long-standing water service contracts. Secondary water is distributed via a network of reservoirs, small canals and ditches, pumping plants, gravity flow, and pressurized pipelines. Annual secondary deliveries currently average 13,000 acre-feet, primarily to residential developments.

Roy Water Subconservancy District -The Roy Water Subconservancy District was established in 1969 to provide secondary irrigation water to an estimated 3,500 acres of residential, commercial and agricultural land within the boundaries of Roy City.

The district's primary water supply is diverted from the Davis and Weber Counties Canal Company's main canal near the west entrance to Hill Air Force Base. The diversion terminates at the district's 120 acre-foot equalizing reservoir. Some water is then pumped and distributed as secondary irrigation water to residential and commercial subdivisions within Roy's city limits. The district currently averages an estimated 8,900 acre-

Table 6-1
COMMON WATER PROVIDER ORGANIZATIONS

Organization Category	Clientele-Service	Number[a]
Irrigation Companies	Sec-Irrigation Agr-Irrigation	108
Water Companies	M&I-Culinary Sec-Irrigation	62
Ditch Companies	Agr-Irrigation Sec-Irrigation	56
Canal Companies	Agr-Irrigation Sec-Irrigation	21
Reservoir Companies	Sec-Irrigation	4
Pipeline Companies	Sec-Irrigation	3
Irrigation Districts	Agr-Irrigation Sec-Irrigation	1
Water Improvement Districts	M&I-Culinary	4
Water Conservancy Districts	M&I-Culinary Sec-Irrigation Agr-Irrigation	1
Water Subconservancy Districts	M&I-Culinary Sec-Irrigation	2
Water Associations	M&I-Culinary Sec-Irrigation	12
Water User Associations	Agr-Irrigation Sec-Irrigation	6
Water Conservation Districts	Agr-Irrigation Sec-Irrigation	2
Ditches	Agr-Irrigation Sec-Irrigation	36
Pumps	Agr-Irrigation	2
Pipelines	M&I- Culinary Agr-Irrigation Sec-Irrigation	10
Total		330

[a] Indicates the total number of a given provider organization according to the latest state accounting.
Sec: Secondary irrigation, Agr: Agricultural irrigation, M&I: Municipal and Industrial.

feet of secondary water deliveries to residential subdivisions and various commercial businesses.

Although the district has historically provided irrigation water for small local farms, the sustained rate of residential growth in recent years has resulted in the near elimination of all farm land in the district's service area. Current water deliveries are almost exclusively to residential homes and local commercial businesses.

Farmington Area Pressurized Irrigation District - The Farmington Area Pressurized Irrigation District, created by Davis County in 1969, has been delivering pressurized irrigation water service since 1977 to Farmington, south Kaysville, south Fruit Heights and areas of unincorporated Davis County. This district replaced the services of five stock pioneer irrigation companies. The system utilizes the flows of four Wasatch Front Canyon streams supplemented by Weber Basin Water Conservancy District contracts to supply more than 3,300 users with pressurized irrigation for agriculture and M&I purposes.

6.3.4 River Basin Water Users Organizations

Water user organizations are agencies created by groups of canal and ditch companies for the purpose of administering water rights and accounting for diversions on a given river system or reservoir. These diversions are made throughout the water year to individual ditch or canal companies holding water rights or stock in an individual river system or reservoir. Two water user associations are in the Weber River Basin: the Weber River Water Users Association which administers water rights and diversions on the Weber River and within Echo Reservoir and the Ogden River Water Users Association which administers water rights and diversions on the Ogden River and within Pineview Reservoir.

Water user organizations or associations are between canal and ditch companies and water conservancy districts in terms of size of staff and primary responsibilities. Like other water provider agencies, however, water user associations are governed by boards of directors, with personnel to record water storage and diversion data.

Water user organizations, in most cases, are responsible for operating and maintaining dams and reservoirs, main canal systems and accounting for diversions from natural streams and rivers. As a result, water user associations employ various staff to administer, manage, operate and maintain their water service facilities.

Weber River Water Users Association - A number of small canal and ditch companies in Davis and Weber counties were created in the late 1800s. As the area expanded its agricultural base, the demand for irrigation water grew beyond existing supplies provided by direct river or stream diversions. The growing need for seasonal water storage dictated the construction of dams and reservoirs at selected sites on the Weber River drainage.

In 1894 the construction of East Canyon Reservoir was initiated on East Canyon Creek by the Davis and Weber Counties Canal Company, approximately 12 miles upstream of the East Canyon Creek confluence with the Weber River. The first dam constructed provided a total storage capacity of approximately 3,800 acre-feet. After four enlargements, the present reinforced concrete dam currently provides active storage capacity of 48,100 acre-feet. The Davis and Weber Counties Canal Company currently owns the first 28,000 acre-feet of storage, while the Weber Basin Project is entitled to the remaining 20,100 acre-feet.

To meet the increased demand for irrigation water beyond the storage capability of East Canyon Reservoir, the Weber River Water Users Association sought out and received funding through the Bureau of Reclamation to build a new dam at Echo. The resulting dam and reservoir were completed in 1931 and currently provides 74,000 acre-feet of active water storage for stock holders in the Weber River Water Users Association.

Stockholders in the Davis and Weber Counties Canal Company include a number of other small canal and ditch companies throughout Weber and Davis counties.

Ogden River Water Users Association - The Ogden River Water Users Association was organized in 1933 to sponsor the Ogden River Reclamation Project to impound and distribute the surplus waters of the Ogden River to agricultural land in Weber and Box Elder counties. The project was substantially completed in 1937, and water began to flow in the South Ogden Highline and Ogden-Brigham City canals.

Completed project facilities were formally turned over to the Ogden River Water Users Association in August 1937. The association is now responsible for the administration of the project including the operation and maintenance of Pineview Reservoir, a 75-inch steel pipeline in Ogden Canyon, and the South Ogden-Highline and Ogden-Brigham City canals.

The initial Ogden River Project remained unchanged until 1950 when the newly organized Weber Basin Water Conservancy District proposed the enlargement of

Pineview Reservoir. As a result, the Bureau of Reclamation and the Weber Basin Water Conservancy District entered into an agreement to enlarge Pineview Reservoir from its initial storage capacity of 44,175 acre-feet to its current active capacity of approximately 110,200 acre-feet.

Construction on the Pineview Dam enlargement started in 1955 and was completed in 1957. Shortly after its completion, an agreement was negotiated between the Weber Basin Water Conservancy District and the Ogden River Water Users Association stating that the Ogden River Water Users Association would operate and maintain the enlarged facility on a cost-share basis.

The Ogden River Water Users Association currently provides irrigation water for irrigated agriculture and secondary irrigation systems in Weber and Box Elder counties. Deliveries through the Ogden-Brigham City canal average around 18,000 acre-feet annually. Diversions in the South Ogden-Highline Canal average 7,000 acre-feet of annually.

The Ogden River Water Users Association represents and administers water rights through the issuance of stock for two water conservation districts, four municipalities and 17 irrigation companies, all of which are within Weber and Box Elder counties.

6.3.5 Waterfowl

Four large waterfowl management areas are maintained within the boundaries of the Weber River Basin. The Harold S. Crane Waterfowl Management Area is located immediately west of Willard Bay Reservoir and includes nearly 4,000 acres of water surface for migratory waterfowl. Howard Slough is located west of Clearfield with a management area of roughly 2,800 acres in Davis County. The Ogden Bay Waterfowl Management Area is located west of Kanesville and includes over 9,000 acres of waterfowl habitat. The Farmington Bay Waterfowl Management Area encompasses an estimated 11,400 acres of marshland at the southeastern limits of the Great Salt Lake. The waterfowl management areas are shown on Figure 14-1.

The four waterfowl management areas are operated by the Division of Wildlife Resources which has appropriated water rights to maintain adequate annual flows for wildlife habitat. The Harold S. Crane Waterfowl Management area has appropriated 29,000 acre-feet, primarily from 1st, 2nd and 3rd Salt Creeks near Willard Bay Reservoir. The Ogden Bay Waterfowl Management area is supplied 61,440 acre-feet of water according to an agreement with the federal government as part of the Weber Basin Completion Act. The Farmington Bay Waterfowl Management area is supplied water from the Jordan River drainage and several small tributaries in the Centerville, Bountiful and Farmington areas. Howard Slough is supplied water from local groundwater irrigation and streams.

6.3.6 Watershed

Nearly all of the major watersheds within the Weber River Basin are mountainous drainages with alluvial bottoms. These watershed areas are generally well managed by a mixture of private individuals and public agencies. Low-lying watershed areas are generally owned by private individuals with most of the mountainous or upper basin watershed areas under public ownership. These public lands are managed by either the Forest Service or Bureau of Land Management.

In general, watersheds in the basin are well managed. Recent investigations, however, by state and local water quality agencies have identified a number of areas in the upper Weber and Ogden River drainages that either have or will potentially have water quality problems if existing land use practices are not changed.

Rapid development in the Huntsville and Snyderville basins is radically changing water use patterns with a degree of negative impact on local water quality. Recent construction associated with oil and gas exploration, in addition to questionable grazing practices, have also created a marked degradation of water quality in Chalk Creek and reaches of the Weber River downstream from their confluence. These issues are discussed in Sections 11 and 12 dealing with drinking water and water quality.

6.4 Problems and Needs

Water managers face a number of problems in the Weber River Basin, primarily in the areas of water quality and groundwater supply. Isolated basins in the upper Weber River drainage have an exceptionally high rate of urban growth. This has resulted in greater diversions from existing water sources and greater domestic effluent discharges to surrounding streams. Increased pumping from groundwater aquifers in the East Shore Area and Snyderville Basin has resulted in substantial declines of groundwater levels at a number of existing well sites in these sub-basins.

The Snyderville Basin and Park City Area has been cited as one of the fastest growing areas of Utah with growth rates between 4 and 5 percent annually. Over 95 percent of all culinary water diversions in the area are

from existing groundwater wells, springs and tunnels. Surface water diversions from either Silver Creek or East Canyon Creek drainages are minimal and usually associated with the irrigation of surrounding livestock pastures or golf courses. As shown in Figure 9-1, the area supports 11 independent water companies, water districts and miscellaneous provider organizations, most of which have private culinary water systems servicing individual residential subdivisions or commercial developments.

Park City Corporation has multiple sources of culinary water including local wells, springs and discharges from surrounding mining tunnels. These sources are treated to culinary standards and distributed to various commercial businesses, ski resorts, municipal facilities and private residential developments within the corporation's service area.

The Summit Water Distribution Company (SWDC) has the largest service area of any water provider agency in the Snyderville Basin. This system provides culinary and irrigation water to the Winter Sports Park Olympic venue site, the Kimball Junction and Rasmussen Road commercial centers, and private residential developments extending along Highway U-224 to the Jeremy Ranch. The SWDC has eight water wells which produce a water supply that appears to be adequate for the near future. But to meet projected demands, SWDC has proposed the construction of a water treatment facility on East Canyon Creek. The proposed water treatment facility will add an additional 2,100 acre-feet of culinary water supply to the basin.

The water rights associated with SWDC's culinary water treatment plant has been approved by the State Engineer. Construction of the treatment plant has been postponed, however, because of a law suit filed by the Snyderville Basin Sewer Improvement District over the reduction of dilution water in East Canyon Creek that may result from the eventual operation of SWDC's culinary water treatment plant.

As Park City, the SWDC and the other independent water companies continue to expand and increase the supply of culinary water, increased demands will be placed on the Snyderville Basin Sewer Improvement District (SBSID) in treating the culinary wastewater effluent. The possible importation of culinary water supply from the Weber Basin Water Conservancy District (Smith and Morehouse Reservoir) or from the Davis and Weber Counties Canal Company (lower East Canyon water) will also impact SBSID's handling of domestic wastewater effluent. Of particular concern to the SBSID is the decreased flows in East Canyon Creek which have resulted from increased withdrawals of water supplies above SBSID's sewage treatment facility. This reduction in flow also reduces the flow of dilution water for the SBSID's discharge of treated domestic wastewater effluent. This potentially increases the concentration of discharged pollutants from the existing wastewater treatment facility owned and operated by the SBSID. To offset this, the SBSID may be required to add an estimated $5 to $10 million in tertiary treatment equipment and facilities in compliance with current federal and state NPDES discharge requirements.

Given the projected increase in the demand for culinary water, natural characteristics of the drainage, and established trends in residential and commercial development, the need for tertiary wastewater treatment seems inevitable. But the overall answer to growth and water development in the Snyderville Basin and Park City Area must be achieved via a comprehensive master plan taking into consideration the various issues mentioned above. The master plan should be pursued as a cooperative effort by the Summit County Planning Commission and all the water-related agencies in the area impacted by growth and the demand for additional culinary water supplies.

Overall pumping rates for culinary water distribution have gradually increased in the East Shore Area and the Snyderville Basin. Depending on the concentration of wells, the degree or severity of groundwater decline varies from location to location within both areas. In areas of concentrated pumpage, groundwater elevations have dropped by as much as 50-80 feet. This has increased power costs and decreased well capacities; in some cases to the point that further operation of existing wells is no longer feasible.

To provide guidelines or policies to better control the continued decline in groundwater levels, the Division of Water Rights (DWRi) is currently in the process of preparing resource management plans for both of the indicated areas. In conjunction with the DWRi's resource management planning efforts, the USGS is in the final stages of a comprehensive water resource study of the Snyderville Basin. Both documents will be subject to a public review process prior to final publication by both agencies.

6.5 Alternatives for Management Improvement

The water demand and quality issues currently impacting overall water development within the Park

City and Snyderville Basin are the concern of all 11 water provider agencies in the area. Although the need for additional culinary water and improvements in water quality vary from agency to agency, significant improvements in these areas can be achieved in a much more efficient and timely manner by one unified agency representing all of the individual water districts in the basin.

The potential for culinary water shortages in the area can be addressed through the development of new water supplies and/or the implementation of various conservation measures. These measures may include 1) reuse of treated wastewater effluent to irrigate golf courses, parks and other large open areas; 2) the implementation of water conservation measures for indoor and outdoor uses; and 3) by converting existing agricultural irrigation water to M&I water. In addition to the stated conservation measures, and as an alternate source of water, up to 6,000 acre-feet of culinary water supplies can be made available from the Weber Basin Water Conservancy District's Smith and Morehouse Reservoir. ❖

Section 7 Contents

7 SECTION

Regulation/Institutional Considerations

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Water is a highly sought after and valued commodity; and like all commodities of high value, complex laws and regulations are required to manage its ownership, use and consumption.

7.1 Introduction

This section of the *Weber River Basin Plan* presents information and data associated with state and federal water-related laws and regulations. Discussions in this section include the background and responsibilities given to state and federal agencies to administer these laws and regulations.

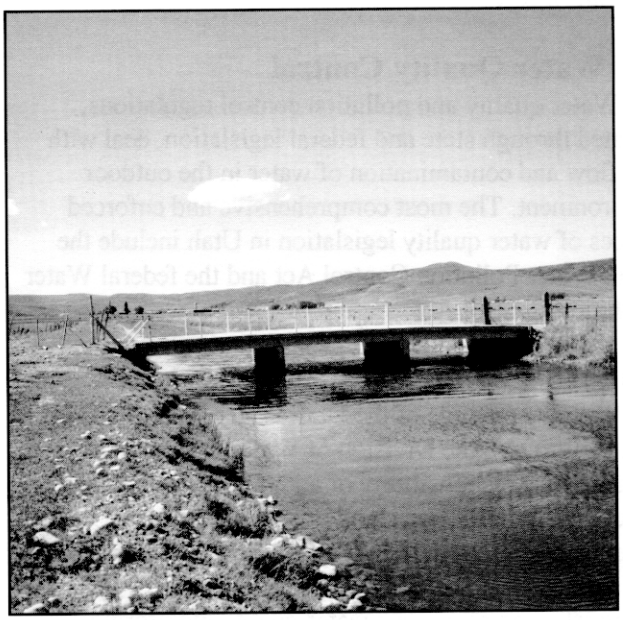
7.2 Setting

At the local level, water resources are generally managed by ditch and canal companies, water conservancy and conservation districts and municipal public works departments. These local agencies are involved with the day to day operation of the many storage, treatment and distribution systems that make it possible to deliver water from high mountain watersheds to the various agricultural, domestic, industrial and commercial users. Although local water agencies are responsible for the ultimate implementation or adherence to all state and federal water laws and regulations, they are generally not responsible for their creation or passage. Water laws and regulations are created by state and federal governing bodies that delegate enforcement or administration to a number of public water and environmental agencies.

7.3 Water Rights Regulation

The administration of water rights laws is the responsibility of state governments. In Utah, the Division of Water Rights is given this responsibility. The division is responsible for 1) processing water rights applications, 2) distribution of water, 3) adjudication of surface and groundwater rights, 4) dam safety programs, 5) regulation of alterations to streams and rivers, 6) licensing well drilling contractors and administering well drilling regulations, 7) studies to assess the extent of existing surface and groundwater supplies, and 8) the maintenance of all filed water rights records.

The process of verifying that actual surface and groundwater diversions are made in accordance with adjudicated water rights requires a considerable amount of field work. The State Engineer supervises all efforts to make field measurements of surface and groundwater diversions. In general, gaging stations



Weber-Provo Canal near Kamas

have been constructed at critical points on existing river systems. Flow measurements are taken on a schedule at these critical gaging points and at points of diversion from the river system by a river commissioner or deputy river commissioner. Groundwater diversions are determined by evaluating pumping data at selected wells.

The Weber River Basin has one river commissioner with seven deputy river commissioners assigned to various portions of the Ogden and Weber rivers. Assigned areas generally include the upper and lower Weber River, Synderville Basin, Coalville/Chalk Creek watersheds, Morgan County, and upper and lower Ogden River

At the end of each water year, the river commissioner prepares an annual report for the Weber and Ogden rivers. Both reports are submitted to the State Engineer as a permanent record of annual water deliveries to individual water right holders or to agencies with multiple water rights or water service agreements.

Although the Weber River Basin is considered to have ample water supplies for projected domestic and commercial uses, it is very close to being fully appropriated. Surface waters are fully appropriated. However, prospective water users can still make application to appropriate groundwater primarily within the East Shore Area.

7.4 Water Quality Control

Water quality and pollution control regulations, created through state and federal legislation, deal with the flow and contamination of water in the outdoor environment. The most comprehensive and enforced pieces of water quality legislation in Utah include the Utah Water Pollution Control Act and the federal Water Pollution Control Act.

7.4.1 Utah Water Pollution Control Act

With the passage of the Utah Water Pollution Control Act (UWPCA), the Division of Water Quality was assigned the responsibility of administering state and federal water pollution standards and regulations. These responsibilities include 1) review of construction plans for surface wastewater disposal systems, 2) administration of various water quality monitoring programs, 3) development and implementation of water quality management plans, 4) administration of state revolving wastewater construction loan programs, and 5) the enforcement of various effluent discharge permit requirements.

7.4.2 Federal Water Pollution Control Act

The Environmental Protection Agency (EPA) is the regulatory agency charged with the responsibility of enforcing the Water Pollution Control Act (WPCA) and two of its major amendments, the Clean Water Act (CWA) passed by Congress in 1977 and the Water Quality Act (WQA) passed in 1987. The enforcement effort, however, is in close cooperation with the Utah Department of Environmental Quality which has primacy and administers the issuance of discharge permits for point and non-point source pollution.

The WPCA generally includes regulations and programs designed to maintain a minimum standard of water quality in the outdoor environment. Minimum acceptable levels of water quality are monitored and regulated by a number of regulations or requirements including 1) establishment of maximum contamination levels (MCL) for raw drinking water sources, 2) issuing National Pollutant Discharge Elimination System (NPDES) permits to all entities responsible for point discharges to existing surface waters, and 3) controlling the dredging and related alterations to existing surface water courses including wetlands.

The need for water quality regulations for point source pollution is obvious with the existence of 14 wastewater treatment plants currently discharging treated effluent to the Weber River and Ogden River systems. Perhaps less obvious, but in some areas of the basin of equal importance, is the need to enforce regulations dealing with non-point source pollution. Continued development of the basin has converted hundreds of acres of farm and range land to residential and commercial developments. This transformation has changed the nature and characteristics of surface runoff within these highly developed sub-basins. The potential for significant non-point source pollution exists in these areas, particularly in rapidly growing Davis, Weber, Morgan and Summit counties, and programs need to be implemented to adequately monitor the impact of development on water quality by surface runoff.

7.5 Drinking Water Regulations

Regulations that provide for monitoring and maintaining public drinking water quality are primarily established and enforced by the EPA and Division of Drinking Water. The federal Safe Drinking Water Act specifically sets minimum acceptable standards for drinking water quality and provides funding for the construction of water treatment facilities. In general, the EPA delegates the responsibility of monitoring existing

drinking water quality and the administration of various drinking water funding programs to state agencies. As a result, the Division of Drinking Water is the agency responsible for all drinking water issues, projects and programs.

As prescribed by the Utah Safe Drinking Water Act, the division is responsible to maintain and enforce drinking water standards through 1) development and implementation of a comprehensive water monitoring program, 2) training or certification of treatment plant and distribution system operators, 3) reporting of water quality data to the EPA, and 4) general administration of a rating program to assess the overall effectiveness of existing treatment plants and distribution systems.

Approximately 76 community and 95 non-community culinary water systems are currently operating in the Weber River Basin, all of which are monitored by the Division of Drinking Water for water quality and adherence to state and federal drinking water regulations. These systems are supplied by six existing surface water treatment systems and over 350 public and private wells.

7.6 Environmental Considerations

The amount and quality of water dictates the characteristics of the natural environment and its ability to sustain most forms of life. Water for human consumption is regulated and treated to protect against the spread of water-born disease. Water to sustain fish and wildlife species must also be regulated to assure the maintenance of quality habitat in streams, lakes, reservoirs and wetlands.

Current federal regulations to protect fish and wildlife species can have direct and significant impacts on the development of future water supplies and the ongoing operation of existing water projects. Impacts on threatened and endangered species must be considered during early planning phases of any water resources related project. The Endangered Species Act (ESA) requires agencies, organizations or private individuals to consult with the U.S. Fish & Wildlife Service (FWS) to assess impacts a potential project may have on threatened and endangered species in a given area. The consultation requirement allows the FWS to become involved in early phases of a project to assist a developer or contractor to determine design or construction options that could minimize impacts on threatened and endangered species.

For projects that require the approval of a federal Clean Water Act 404 permit, developers or contractors are required to submit pertinent design and operation data to the U.S. Army Corps of Engineers. This information is reviewed and evaluated by a number of federal and state agencies for overall feasibility and potential impacts on fish and wildlife habitat. The FWS is the reviewing agency for fish and wildlife habitat issues.

7.7 Dam Safety

Over 70 regulated dams in the Weber River Basin system have been constructed for a variety of uses and/or reasons. These dams range in size from 198,200 acre-feet of active storage within Willard Reservoir to only a few acre-feet of storage at a number of smaller municipal reservoirs. Current uses of these dams include recreation; storage of culinary, secondary and irrigation water; wildlife and fish habitat; and flood control.

As the backbone of a water reclamation project, dams and reservoirs represent a vital and significant investment in the overall development of a basin's water resources. They also represent a potential loss of life and property in the event of catastrophic natural disasters. The State Engineer classifies dams throughout the state with high, medium, or low hazard ratings. Of the 74 dams currently subjected to regular inspections, 38 have been classified as high hazard. These dams and their hazard ratings are summarized in Table 7-1.

To minimize the threat of catastrophic dam failures, safety programs are actively administered by various state and federal agencies. The Division of Water Rights conducts safety inspections of all non-federal dams while the Bureau of Reclamation is responsible for the inspection and safety of all dams constructed under federal water reclamation projects. The Division of Water Resources participates in the inspection of non-federal dams constructed with funds provided by the Board of Water Resources. ❖

Table 7-1
SUMMARY OF BASIN DAMS AND RESERVOIRS

Name	Height (ft)	Crest Length (ft)	Primary Use	Hazard Rating	County	Owner/Operator
Joyce	27	440	Irrigation	Low	Summit	Chalk Creek-Hoytsville Irrigation
Kelly Canyon	40	350	Recreation	Mod	Weber	Green Hill Homeowners Assoc.
Lovenia Lake	16	152	Irrigation	Mod	Summit	Fish Lake Reservior Company
N. Ogden City Coldwater Canyon	38	1,200	Flood Control	High	Weber	North Ogden City
N. Ogden City Coldwater Desilting	20	325	Flood Control	High	Weber	North Ogden City
N. Ogden Orton Park/2100 North	8	2,340	Flood Control	High	Weber	North Ogden City
Northwest	36	800	Irrigation	High	Morgan	Northwest Irrigation Company
Ogden City-27th St. Debris Basin	12	230	Flood Control	Low	Weber	Ogden City Engineering
Ogden City-Sullivan Hollow	18	405	Flood Control	High	Weber	Ogden City Corporation
Ogden City-Waterfall Debris Basin	14	160	Flood Control	Low	Weber	Ogden City Engineering
Ogden City-Strongs Crk Debris Basin	19	220	Flood Control	Low	Weber	Ogden City Engineering
Pleasant View Reservoir	18	740	Irrigation	Mod	Weber	Weber-Box Elder Cons. District
Sand Lake	10	256	Irrigation	Mod	Summit	Fish Lake Reservation Co.
Sargent No. 1	36	600	Irrigation	Low	Summit	Elkhorn Ditch Co.
Seymore Lake	15	260	Irrigation	Mod	Summit	Fish Lake Reservior Co.
Silver Creek Estates (Upper)	19	175	Irrigation	Mod	Summit	Silver Creek Ranch Corp.
Silver Springs No. 1	13	NA	Recreation	Mod	Summit	Silver Springs Water Co.
Silver Springs No. 2	10	NA	Recreation	Mod	Summit	Silver Springs Water Co.
Smith & Morehouse	82	220	Irrigation	High	Summit	Weber Basin Water Cons. District
Sourdough Wilderness Ranch	33	600	Recreation	Mod	Weber	Sourdough Wilderness Ranch
Causey Reservoir	200	900	Multipurpose	High	Weber	Weber Basin Water Cons. District
East Canyon Reservoir [a]	245	436	Multipurpose	High	Morgan	Davis & Weber Counties Canal Co.
Echo Reservoir	158	1,890	Irrigation	High	Summit	Davis & Weber Counties Canal Co.
Lost Creek Reservoir	220	1,100	Multipurpose	High	Morgan	Weber Basin Water Cons. District
Pineview Reservoir	132	600	Multipurpose	High	Weber	Pine View Water Systems
Wanship Reservoir	156	2,000	Multipurpose	High	Summit	Weber Basin Water Cons. District
Willard Bay	36	90,500	Multipurpose	High	Box Elder	Weber Basin Water Cons. District
Wanship Reservoir			Multipurpose	High	Summit	Weber Basin Water Cons. District
Bear Hollow Access Road Pond	25	250	Irrigation	Mod	Summit	Summit Ranch Joint Venture
Alexander Canyon-Hall	20	175	Recreation	Low	Summit	Dorothy Hall
Alexander Cayon-Halliday	30	500	Recreation	Low	Summit	Herbert Halliday
Anchor Lake	12	157	Irrigation	Mod	Summit	Marchant Ext. Irrigation Co.
Bear Hollow Access Rd. Pond (Lower)	25	250	Irrigation	Mod	Summit	Summit Ranch Joint Venture
Bear Hollow Access Rd. Pond (upper)	28	175	Irrigation	Mod	Summit	Summit Ranch Joint Venture
Boyer Lake	45	850	Irrigation	Mod	Summit	Chalk Creek-Hoytsville Irrigation
Castle Lake	21	203	Irrigation	Mod	Summit	Beaver-Shingle Creek Irrigation
Cliff Lake	30	462	Irrigation	Mod	Summit	Fish Lake Reservior Co.
Fish Lake	21	239	Irrigation	Mod	Summit	Fish Lake Reservior Co.
Fourmile Creek	6	4,000	Irrigation	Low	Weber	Warren Irrigation Co.
Fourmile Debris Basin-Harrisville Dam	NA	NA	Flood Control	Mod	Weber	Harrisville City
Heiner's Creek	28	550	Irrigation	Mod	Summit	Skull Valley Co.
Hi-Ute Three Mile Canyon	30	250	Irrigation	Low	Summit	Hi-Ute Investment Co.
Jeremy Ranch	44	500	Irrigation	Mod	Summit	Jeremy Service Corp.
Joan E. Ranch-Perdue Creek	NA	NA	Irrigation	Mod	Summit	Barry Miller
South Ogden City Burch Creek	24	713	Flood Control	High	Weber	South Ogden City
South Ogden City Burch Creek Debris	56	330	Flood Control	High	Weber	South Ogden City
Unitah Mountain Stream	NA	NA	Irrigation	Mod	Weber	Unitah Mtn. Stream Irrigation Co.
Utaba Retarding	71	369	Flood Control	Mod	Weber	Weber County
Utah Power & Light [a]	17	73	Power Gen.	Low	Morgan	Utah Power & Light Co.
Wardell/Reservoir	15	960	Irrigation	Mod	Morgan	Wardell Family Ranch
Wilkinson (Harry)	53	524	Irrigation	High	Morgan	Harry Wilkinson
Haight Creek Reservoir (Lower)	27	420	Irrigation	High	Davis	Haight Creek Irrigation Co.
Rudd Creek Debris Basin	15	800	Flood Control	High	Davis	Farmington City
Sunset Pond	21	1,300	Irrigation	High	Davis	Weber & Davis Counties Canal Co.
Holmes Reservoir	70	400	Irrigation	High	Davis	Kyle Anderson
Parrish Creek Debris Basin	22	900	Flood Control	High	Davis	Davis County Flood Control
Deuel Creek Reservoir	20	1,200	Irrigation	High	Davis	Centerville Deuel Creek Irrigation Co.
Kaysville Reservoir	34	NA	Irrigation	High	Davis	Davis & Weber Counties Cannal Co.
Davis County Reservoir	140	500	Flood Control	High	Davis	Davis County Flood Control
Haight Creek Reservoir (Middle)	20	NA	Irrigation	Mod	Davis	Haight Creek Irrigation Co.
Barnard Creek Reservoir	9	100	Flood Control	Low	Davis	Davis County Flood Control
Layton Pond	16	1,800	Irrigation	High	Davis	Weber & Davis Counties Canal Co.
Hooper Draw Debris Basin	42	1,100	Flood Control	High	Davis	Davis County Flood Control
Haight Creek Reservoir (Upper)	100	1,400	Irrigation	High	Davis	Haight Creek Irrigation Co.
Dry Hollow Debris Basin	16	200	Flood Control	High	Davis	Fruit Heights City
Holmes Creek Debris Basin	22	900	Flood Control	High	Davis	Davis County Flood Control
Adams Reservoir	53	1,600	Irrigation	High	Davis	Kays Creek Irrigation Co.
Farmington Pond	32	400	Recreation	High	Davis	Davis County Flood Control
Shepard Creek Debris Basin	25	NA	Flood Control	High	Davis	Davis County Flood Control
Hobbs Reservoir	90	400	Irrigation	High	Davis	Kays Creek Irrigation Co.
Kaysville Reservoir	43	700	Irrigation	High	Davis	Kaysville Irrigation Co.
Davis County Reservoir	13	400	Flood Control	High	Davis	Davis County Flood Control
Deuel Creek Debris Basin	13	200	Flood Control	High	Davis	Davis County Flood Control
Stone Creek Reservoir	105	500	Flood Control	High	Davis	Davis County Flood Control

Table Notes.
[a] denotes concrete dam construction

Section 8 Contents

8 Water Funding Programs

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The level of funding required to operate and construct water development projects and related service facilities is considerable. Funding from public programs is necessary to construct needed water-related public works projects.

8.1 Introduction

This section of the *Weber River Basin Plan* presents information and data relating to basic funding programs administered through local, state and federal agencies ear-marked for the development and implementation of water resources related projects and programs.

8.2 Background

The complexity and size of today's water projects and related service facilities dictates that large sums of money are needed to meet a growing demand for water. The capability, however, to fund needed system enlargements or improvements is typically beyond the means of individual water provider agencies. As a result, state and federal agencies provide a number of funding programs to assist local water provider agencies to improve existing water service facilities. The construction costs associated with the basin's three large federal water reclamation projects are given in Table 8-1.

8.3 State Funding and Assistance Programs

Table 8-2 presents state funding expenditures for recent years. Table 8-3 presents the eight state agencies administering programs that provide various levels of funding to plan and construct water resource-related projects.

8.4 Federal Water Funding Programs

Table 8-4 presents federal funding expenditures for water related projects. Table 8-5 summarizes the types of funding programs associated with seven federal agencies.

8.5 Local Water Funding Programs

Because of the involvement of larger water districts (wholesalers) in the overall use and distribution of water, local funding programs are, in some cases, made available to smaller water provider agencies to improve or expand existing storage and distribution facilities. Funds facilities are made available on a case by case basis. ❖

Table 8-1
MAJOR BUREAU OF RECLAMATION PROJECTS

Project Data/Feature	Weber River Project	Ogden River Project	Weber Basin Project
Initial Design/Construction	Bureau of Reclamation	Bureau of Reclamation	Bureau of Reclamation
Operating Agency	Weber River Water Users Association	Ogden River Water Users Assn.	Weber Basin Water Conservancy District
Type of Project	Water Storage	Water Storage and Distribution	Multipurpose
	M&I-Agricultural Irrigation Water	Agricultural Water	M&I-Agricultural Water
	Recreation-Sport Fishery	Power Generation	Power Generation
		Recreation-Sport Fishery	Recreation-Sport Fishery
			Flood Control
Dates of Construction	November 1927 to December 1931	September 1934 to June 1937	1956 to 1969
Initial Construction Cost	$3,230,800	$19,787,900	$127,782,000
River System	Upper Weber River	Upper Ogden River	Upper and Lower Ogden/Weber River System
Area of Service/Clientel Base	109,000 acres - Weber, Davis, Morgan and Summit counties	25,000 acres - Weber and Box Elder counties	90,500 acres farmland - Weber, Davis, Morgan and Summit counties
			38 Water Provider Agencies
			21 Towns and Cities
			21 Commercial-Industrial Businesses
Major Features	Echo Dam and Reservoir	Pineview Dam/Reservoir	Arthur V. Watkins Dam and Reservoir
	Weber-Provo Diversion Canal	Ogden Canyon Transmission Line	Willard Canal and Pumping Station
	City of Bountiful Hydroelectric Power Plant	Ogden-Brigham City Canal	Slaterville and Stoddard Diversion Dams
		South Ogden Highline Canal	Layton Canal, Plumping Plant and Distribution
		UP&L Hydroelectric Power Plant	Pineview Dam Enlargement
			Causey Dam and Reservoir
			Weber and Davis Aqueducts
			Gateway Canal and Power Plant
			East Canyon Dam Enlargement and Reservoir
			Lost Creek Dam and Reservoir
			Wanship Dam, Rockport Lake and Power Plant
Annual Deliveries	57,100 acre-feet - 1994	55,000 acre-feet - 1994	141,800 acre-feet - 1992

Table 8-2
STATE WATER-RELATED FUNDING EXPENDITURES

Funding Agency	Grants	Loans ($1,000)	Period
Board of Parks and Recreation			
Land and Water Conservation Fund	4,405		1993-96
Riverway Enhancement Program	430		1993-96
Board of Water Resources			
Cities Water Loan Fund	0	11,035	1974-95
Conservation and Development Fund	0	26,437	1978-95
Revolving Construction Fund	0	7,977	1947-95
Dam Safety Studies/Repairs			
Wildlife Board			
Wallup/Breaux Bill			
Community Development			
Community Development Block Grant	18,400		1986-95
Permanent Community Impact Board			
Permanent Community Impact Fund			
Disaster Relief Board Fund			
Safe Drinking Water Board			
Financial Assistance Program	250	7,600	1983-96
Soil Conservation Commission			
Agriculture Resource Development Loans		780	1984-96
Non-point Source Program	823		1992-93
Water Quality Board			
State Loan Program	12,464		1984-85
State Revolving Loan Program	29,509		1988-95
Federal Construction Grants	7,331		1972-88
EPA 314 Clean Lakes Program			

Table 8-3
STATE FUNDING PROGRAMS

Entity/Program	Contact	Purpose	Type
Board of Parks and Recreation	Div. Of Parks & Rec.		
Land and Water Conservation Fund		Recreation facilities	Cost-Share
Riverway Enhancement Program			
Board of Water Resources	Div. of Water Res.		
Revolving Construction Fund		Small irr./cul. projects	Loans/Grants [a]
Cities Water Loan Fund		Municipal cul./systems	Loans
Conservation and Development Fund		Large water projects	Loans
Community Development Block Grants	Div. of Comm. Dev.		
Block Grants		Rural living envir. impact	Grants
Perm. Community Impact Board	Div. of Comm.Dev.		
Permanent Community Impact Fund		Rural living envir. impact	Grants/Loans
Disaster Relief Board Fund		Disaster repair	Grants
Drinking Water Board [b]	Div. of Drinking Water		
Financial Assistance Program		Drinking water system	Loans Grants
Soil Conservation Commission	Dept. of Agriculture		
Agri. Resources Development Loan		Improve private ag. land	Loans
Non-Point Source Program		Watershed improvement	Grants
Wildlife Board	Div. of Wildlife Res.		
Wallup/Breaud Bill		Fish Management. Boating	Grants
Water Quality Board	Div. of Water Quality		
Revolving Construction Loan Program		Wastewater treat. facilities	Loans
Federal Construction Grants		Wastewater treat. facilities	Grants
State Loan Program		Wastewater treat. plant	Loans
EPA 314 Clean Lakes Program			

a Grants given for studies of high hazard dams; loans and grants are provided for dam repairs.
b The 1996 Safe Drinking Water Act Reauthorization allows the Utah Drinking Water Board to utilize federal funding provided by the act for drinking water projects.

Table 8-4
FEDERAL WATER-RELATED FUNDING EXPENDITURES

Funding Agency Program	Cost Share	Grants	Loans ($1,000)	Period
Farm Service Agency				
Agricultural Conservation Program		1,100		1990-96
Conservation Reserve Program				
Emergency Conservation Program				
Bureau of Reclamation[a]		150,801		1927-69
Corps of Engineers				
Civil Works				
Continuing Authority Program	650			1965-72
Emergency Activities	810			1985-86
Flood Plain Management Services	70			1996
Rural Development				
Community Development		730	4,000	1946-96
Federal Emergency Management Agency				
Presidential Declared Disaster		13,363		1983-84
Flood Plain Management				
Natural Resources Conservation Service				
Watershed Protection & Flood Prevention		300		1965-95
Emergency Watershed Program		64		1993-95

a Construction costs for three major basin water reclamation projects from 1927 to 1969.

Table 8-5
FEDERAL FUNDING PROGRAMS

Agency	Program	Purpose	Type
Department of Agriculture			
Farm Service Agency	Agricultural Conservation Program	Soil, Water, Energy Conservation	Grants
	Emergency Conservation Program	Rehabilitation of Farmland Damaged by Disasters	Grants
	Conservation Reserve Program	Reduce Erosion/Maintain Wetlands	Grants
Rural Development	Rural development	Water Supply/Wastewater Disposal	Grants/Loans
	Resources Conservation & Development	Multi-Purpose Water, Land, Conservation Facilities	
Natural Resources Conservation Service	Watershed Protection & Flood Prevention	Flood Control and Water	Grants
	Resource Conservation and Development	Multi-Purpose Water and Related Facilities	Grants/Cost Share
	Emergency Watershed Program	Reduce Sedimentation and Flooding	Grants/Cost Share
Department of the Army			
Corps of Engineers	Civil Works	Flood Control Water Supply , Recreation	Cost Share
	Continuing Authorities	Flood Control and Protection	Cost Share
	Emergency Activities	Flood Control and Protection	Grants
Environmental Protection Agency	Non-Point Source Program	Water Quality	Grants
Department of the Interior			
Bureau of Reclamation	Investigation Programs	Water Storage, Delivery	Loan
	Loan Programs	Small Multipurpose Projects	Loan
Federal Emergency Management Agency	Presidential Declared Disaster	Damage Mitigation	Grants
	Flood Plain Management	Structural Acquisition-Flood Plains	Grants

Section 9 Contents

9 SECTION

Water Planning and Development

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

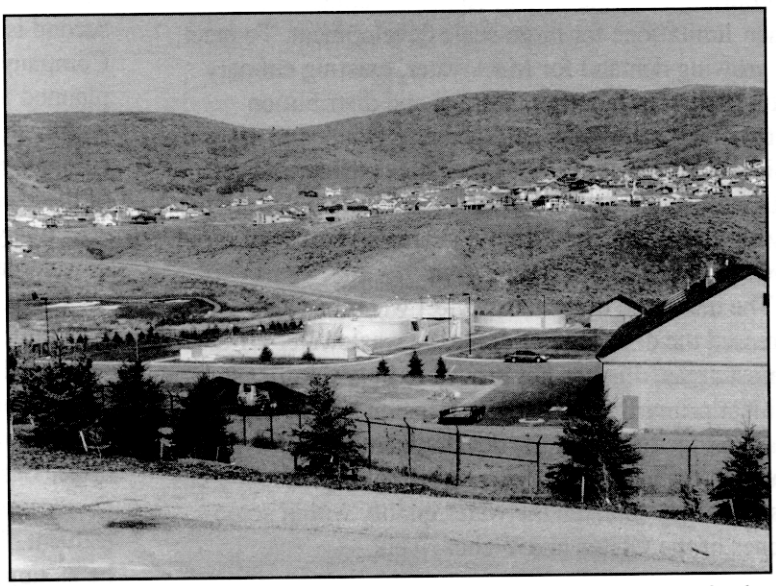
Historically, water supplies in the Weber River Basin have been more than adequate to meet local needs. Although this trend is expected to continue into the foreseeable future, short-term water shortages could be experienced due to the lack of adequate infrastructure.

9.1 Introduction

This section of the *Weber River Basin Plan* presents an assessment of current data and projections of future water supply and demand. Some supply and demand data are repeated from other sections to better understand the overall process of projecting water use. Information is offered on most all aspects of water use, including municipal and industrial (M&I), agricultural, outdoor recreation, and a number of environmental uses and demands.

9.2 Background

The Weber River Basin has changed from a collection of small rural farming communities to one of the most urbanized areas of the state. Initially, the area was recognized as a prime location for irrigated agriculture. With the outbreak of World War II and construction of major military bases in the area, the overall demographic makeup began a permanent change. Densely populated urban communities began to replace small family farms and ranches. As a result, water planning and development strategies began to included the construction and operation of large municipal and industrial culinary water systems and facilities.



Snyderville Basin Sewer Improvement District facility

9.2.1 Past Water Planning and Development

With the influx of immigrants in the mid-1800s and later, the need for raw agricultural produce and irrigation water grew at a substantial rate. By the turn of the century, the demand for irrigation water outgrew the supply provided by direct-seasonal diversions from local streams. The need for supplemental water storage became a critical factor in supporting the continued growth of irrigated agriculture. To address this need, an era of large water development projects began that featured construction of major reservoirs and water conveyance facilities. From the first reservoir at East Canyon, with an initial storage capacity of 3,800 acre-feet, to the Smith and Morehouse Project, eight major reservoirs are in the basin with a combined 525,900 acre-feet of active water storage capacity.

9.2.2 Current Water Planning and Development

The Weber River Basin is generally considered fully developed in terms of water supply. With the indicated reservoirs in place, over 50 percent of the basin's 979,400 acre-feet of average annual yield can be stored. Once the reservoirs are filled, the basin's water supply is considered adequate to meet local needs for two consecutive years.

The relatively high percentage of storage to annual yield has provided a plentiful supply of water over the years for a broad range of domestic and commercial uses. Planners and managers are now faced with the challenge of providing an adequate water conveyance and treatment infrastructure to meet a growing and changing demand for water. The demand for M&I water is increasing at a rate comparable to population growth. At the same time, the use for agricultural irrigation water is on the decline as residential and commercial developments encroach on farms and ranches.

9.3 Water Resources Problems

Perhaps the largest problem facing local water provider agencies is the lack of infrastructure associated with the growing demand for M&I water. Surface water rights throughout the basin are closed to further appropriation. Groundwater rights are either closed or under limitations for large-scale development. To meet the growing demand for M&I water, existing culinary water treatment facilities, storage and distribution systems will have to be enlarged or expanded to areas of rapid growth; in some cases they are considerable distances from existing infrastructure. Examples are the Snyderville Basin and Park City Area and areas of rapid growth along the East Shore Area.

The increased demand for M&I water has also increased the discharge of domestic wastewater effluent. In most areas, this has not proved to be a significant problem primarily due to the expansion of existing treatment facilities and the development of improved treatment technologies. However, isolated problem areas exist that may threaten the water quality within some reaches of the Ogden and Weber rivers.

9.3.1 Ogden Valley Sewage Disposal and Water Quality at Pineview Reservoir

Ogden Valley currently relies on small lagoons, drainfields and septic tanks to dispose of domestic sewage. The resulting discharge of leachate to underlying groundwater aquifers ultimately migrates to Pineview Reservoir which is a primary source of culinary and secondary water to a number of local municipalities including the metropolitan Ogden area.

To address a number of water quality issues in Ogden Valley, a *Clean Water Act, Section 314 Clean Lakes Study* was conducted by the Weber Basin Water Quality Council in cooperation with the Division of Water Quality. Although this study determined that existing water quality within Pineview Reservoir was adequate for public culinary use with proper treatment, concern was expressed regarding the impact on future water quality by the continued use of septic tanks and drain fields to dispose of domestic sewage.

The continued use of domestic septic tanks and drain-fields in the Ogden Valley should be the subject of future studies, including groundwater monitoring programs beyond the scope of work initially addressed in the clean lakes study. This study should determine the impact of drain-field effluent discharge on water quality within the reservoir and assess the need for local sewage collection and treatment.

9.3.2 Culinary Water/Wastewater Treatment Conflict on East Canyon Creek

Two culinary water treatment plants are in the Snyderville Basin and Park City Area. One plant is owned and operated by the Park City Corporation. The second is owned and operated by the Community Water Company in Park West. A third treatment plant is planned by Summit Water Distribution Company. Although the need to develop additional sources of culinary water is immediate for the basin, the operation of these culinary water treatment facilities could effectively reduce the flow of dilution water to downstream wastewater treatment plants.

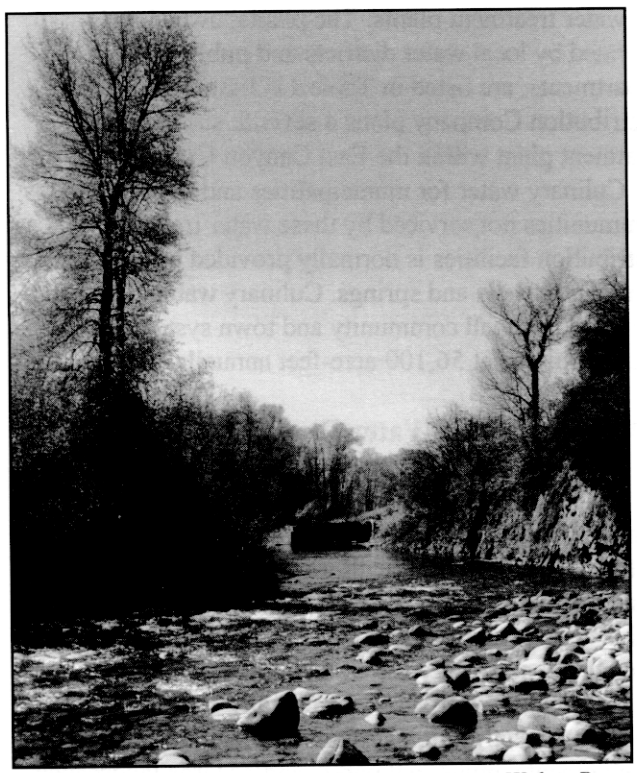
Pressure to increase surface water diversions appears inevitable to meet the growing need for culinary water generated by increased residential and commercial development in the area. As the demand for culinary water grows, surface and groundwater diversions in the upper East Canyon Creek drainage may increase, thereby decreasing the flow of dilution water for wastewater effluent. The solution to the dilution water problem may be an upgrade in treatment at the Snyderville Basin Sewer Improvement District's (SBSID) wastewater treatment plant and/or the implementation of growth restrictions in the overall Snyderville Basin and Park City Area. Growth restriction in the basin is unlikely because Summit County has approved hundreds of building permits.

To treat the increased flow of domestic wastewater and to meet current National Pollution Discharge Elimination System (NPDES) water quality standards, the SBSID may have to incorporate costly tertiary treatment processes at its wastewater plants. Construction costs have been estimated at $5 million to $10 million per plant.

9.3.3 East Shore Area of the Great Salt Lake Groundwater Pumping Restrictions

Groundwater diversions have increased throughout the basin. The most marked increases have occurred in the East Shore Area with current annual pumpage of 68,000 acre-feet. As a result, steady declines in local groundwater levels have been measured with the most severe recorded in the North Ogden, South Weber and Layton areas.

To limit, or perhaps manage, the continued trend of groundwater decline, the State Engineer's office, in cooperation with the US Geological Survey, has completed a comprehensive groundwater study including the publication of a groundwater management plan. The plan presents a number of policies and recommendations to local opeators of municipal water systems and private individuals to better manage remaining groundwater.



Upper Weber River

Major elements of the plan include:

- Establish an upper limit on the five-year moving average of basin pumpage at 75,000 acre-feet per year with a maximum one-year pumpage of 100,000 acre-feet.
- New wells created by change applications can not impact existing wells with earlier priority dates by increasing established drawdown levels by more than 15 ft.
- All existing wells should be operated in a responsible manner to minimize groundwater interference between adjacent wells and impairment of prior rights.
- All wells with the potential to pump over 100 acre-feet on an annual basis shall be equipped with a flow meter with the annual pumpage reported to the State Engineer's office.
- Water quality data taken at existing wells should be submitted to the State Engineer's office on a voluntary basis.
- Change applications will receive a higher level of review to determine the impact on critical areas of the basin with recent declines in groundwater levels.
- New appropriations for individual domestic wells will be limited to 1.0 acre-foot of annual pumpage in areas not served by public culinary systems. When public water delivery is possible, the well will be sealed and water right terminated.
- Combined annual pumpage will not exceed 6,000 acre-feet within a one-mile radius at any given location within the basin unless reliable and accurate data can be provided to demonstrate that higher withdrawal rates will not aversely effect underlying groundwater levels.

9.3.4 M&I Infrastructure Needs

The growing demand for M&I water has dictated that significant changes need to be made in water treatment, storage and distribution infrastructure. The most pressing needs include the enlargement of existing and the construction of new culinary water treatment plants, transmission systems, culinary wells and secondary water distribution systems.

9.3.5 Capping Abandoned Artesian Wells

Groundwater aquifer conditions are rather complex throughout the basin. A number of areas, primarily in the East Shore Area, have combinations of shallow

unconfined aquifers over the top of substantial confined aquifers. These confined aquifers have been developed with hundreds of artesian wells for most domestic uses including culinary, livestock and irrigation water.

Development of artesian wells in the East Shore Area has been a common practice for over 60 years. With the gradual conversion of agricultural lands to residential and commercial developments, a considerable number of local artesian wells have been abandoned and replaced as a water source by municipal systems owned and operated by established water provider agencies. A considerable number of these wells have not been capped or sealed properly. The flow of water from these wells has often been left unmanaged, and they generally return to the natural surface drainage. As more agricultural land is replaced by urban developments, the unmanaged flows from these wells have proven to be a major problem to developers and municipalities.

A program should be in place to assess the scope of the problem and develop measures to systematically cap and seal abandoned artesian wells. The program could be administered by the Division of Water Rights in cooperation with local city and county agencies involved with flood control or drainage issues.

9.4 Water Use and Projected Demands

The projection of future water demand is based on data and information from a number of sources including 1) diversion records of water provider agencies, 2) various water and land use inventory studies, and 3) the evaluation of consumptive use data.

9.4.1 Municipal and Industrial (M&I) Water Demand

Due to urbanization, M&I water demand will increase at roughly the rate of population growth. The trend in M&I water demand is summarized in Table 9-1.

As a means to forecast water demand, the Wasatch Front Water Demand/Supply Computer Model (WFCM) was developed specifically for the Wasatch Front. The WFCM forecasts future municipal and industrial water needs and evaluates the availability of water supplies along the Wasatch Front including Weber and Davis counties. Table 9-2 summarizes the results of the model evaluation.

As indicated from the table, Davis and Weber counties have sufficient water supplies to meet anticipated needs beyond the planning year of 2020. The following assumptions were used with the WFCM:

- Current developed supplies will continue to be available.
- New secondary systems will convert approximately 92,000 acre-feet of agricultural water to secondary use as agricultural land becomes urbanized.
- New wells constructed by various water suppliers will yield 18,000 acre-feet of groundwater for M&I use.
- At least 25,000 acre-feet of unsold water in Willard Reservoir will be for M&I use.
- Necessary infrastructure improvements will be made in a timely manner.
- Water conservation measures were not included in the initial running of the model. This created a base line from which the impacts of the various conservation measures could be evaluated. The model was then run including various conservation scenarios. The efforts of water conservation are expected to reduce the projected water use by nearly 14 percent (16,200 acre-feet by the year 2020). Water conservation is discussed in Section 17.

The majority of culinary water is provided by groundwater aquifers, but about 35,900 acre-feet per year of surface water is treated to culinary standards by six water treatment plants. The plants, owned and operated by local water districts and public works departments, are listed in Table 11-2. Summit Water Distribution Company plans a seventh surface water treatment plant within the East Canyon Creek drainage.

Culinary water for municipalities and rural communities not serviced by these water treatment and distribution facilities is normally provided by individual community wells and springs. Culinary water supplies provided by small community and town systems have been estimated at 56,100 acre-feet annually.

9.4.2 Secondary Water Demand

The transition of using agricultural irrigation water for urban secondary water needs has started on a relatively large scale. Water provider agencies that have historically provided agricultural irrigation water to basin farms and ranches are actively constructing storage and distribution systems to provide residential and commercial secondary water.

Secondary water systems generally consist of pressurized distribution systems servicing residential developments, municipal parks, and/or large landscaped

Table 9-1
1992 CULINARY (M&I) WATER USE AND PROJECTED DEMAND

Year	Weber	Davis	County Morgan (acre-feet)	Summit	Total Diversion
1992					
Residential	22,000	24,500	1,700	4,900	53,100
Commercial/ Institutional	15,500	16,200	300	1,200	33,200
Industrial	1,600	3,200	800	100	5,700
Total	**39,100**	**43,900**	**2,800**	**6,200**	**92,000**
2000					
Residential	20,900	25,600	1,900	6,200	54,600
Commercial/Institutional	16,500	17,300	400	1,500	35,700
Industrial	1,800	3,500	900	100	6,300
Total	**39,200**	**46,400**	**3,200**	**7,800**	**96,600**
2010					
Residential	26,400	32,000	2,200	8,700	69,300
Commercial/Institutional	19,500	19,600	400	2,100	41,600
Industrial	2,200	3,800	1,100	100	7,200
Total	**48,100**	**55,400**	**3,700**	**10,900**	**118,100**
2020					
Residential	32,400	39,000	2,700	12,000	86,100
Commercial/Institutional	23,000	22,200	500	2,800	48,500
Industrial	2,600	4,100	1,400	200	8,300
Total	**58,000**	**65,300**	**4,600**	**15,000**	**142,900**

Table 9-2
PROJECTED CULINARY (M&I) DEMAND AND SUPPLY
DAVIS AND WEBER COUNTIES[a]

Year	Demand	Supply (acre-feet)	Surplus (+) Deficit (-)
1992	78,000	160,000	+82,000
2000	80,900	160,000	+79,100
2010	99,700	160,000	+60,100
2020	118,700	160,000	+41,300

Source: Wasatch Front Water Demand/Supply Model, November 1996.
a Does not include Ogden Valley in Weber County.

areas associated with commercial businesses and public buildings. Current and projected levels of secondary water demand for residential, institutional, commercial and industrial (M&I) users are summarized in Table 9-3.

More than 50 percent of residential homes in the basin are presently provided with secondary irrigation water. This percentage is expected to increase in the near future.

9.4.3 Agricultural Water Demand

Although irrigated cropland has steadily decreased over recent years, irrigated agriculture remains the single largest user of water. Based on the most recent 19 years of record (1968 to 1987), the rate of decline in irrigated agricultural land was 1,142 acres per year or 21,700 acres total. An evaluation of urban growth and overall trends in land development indicate the total acreage associated with irrigated agriculture will decline from the current (1995) total of 133,600 acres to 98,500 acres by the year 2020. The indicated loss of 35,100 acres for the 25 year period is expected to account for approximately 80 percent of all land requirements for projected residential, commercial and industrial growth.

The projected decline in demand for agricultural irrigation water is summarized in Table 9-4.

With few exceptions (water amusement parks such as Lagoon, Cherry Hills and Wild Water), water demand for recreation is limited to providing small amounts of culinary water at campgrounds. The Division of Parks and Recreation operates five state parks, and two campgrounds are operated by the Forest Service. Four of the state parks are water-related or located adjacent to reservoirs including Lost Creek, East Canyon, Rockport and Willard Bay. The two campgrounds are located at Pineview Reservoir in the upper Ogden River drainage and Smith and Morehouse Reservoir in the upper Weber River drainage. More discussion on water-related recreation is given in Section 15.

9.4.5 Environmental Water Uses

Water projections associated with state and federal environmental regulations can be substantial. In general, environmental water may be required to maintain wet and open areas, minimum instream flows for fish habitat and waterfowl management areas

An estimated water supply of 270,0000 acre-feet (natural and diverted) is used by the basin's 74,400 acres of wet and open water areas. The direct depletion from wet and open areas has been estimated at 185,300 acre-feet per year. These depletions occur from river and stream channels, lakes, ponds, marshes and waterfowl and wildlife areas. It is assumed the current rate of water use by wet and open areas will remain constant.

These numbers do not include the eight major reservoirs shown in Table 5-2. These reservoirs cover

Table 9-3
1992 SECONDARY (M&I) WATER USE AND PROJECTED DEMAND

Year	Weber	Davis	County Morgan (acre-feet)	Summit	Total Diversion
1992					
Residential, Commercial & Institutional	28,000	28,500	500	2,800	59,800
Industrial	19,900	300	0	a	20,200
Total	**47,900**	**28,800**	**500**	**2,800**	**80,000**
2020					
Residential, Commercial & Institutional	76,300	71,100	800	6,800	155,000
Industrial	32,000	1,900	0	a	33,900
Total	**108,300**	**73,000**	**800**	**6,800**	**188,900**

a Value less than 50.

9.4.4 Recreational Water Demand

Actual water demand for the sole purpose of outdoor recreation is small in comparison to other basin uses, but existing storage reservoirs and connecting natural rivers are used extensively for recreational purposes.

Table 9-4
IRRIGATED AGRICULTURAL WATER DEMAND

Year	County				Total Diversion
	Weber	Davis	Morgan (acre-feet)	Summit	
1987	214,900	125,700	41,600	90,500	472,700
1992	202,100	114,100	41,800	88,400	446,400
2000	194,800	102,600	41,400	86,200	425,000
2010	177,800	79,900	41,000	81,800	380,500
2020	158,500	52,400	40,700	76,600	328,200

approximately 22,100 acres which include 9,900 acres for Willard Reservoir. The total reservoir net evaporation is estimated to be 45,000 acre-feet of which 31,000 acre-feet is from Willard Reservoir.

9.4.6 Water Use and Projected Demand Summary

The total water demands and depletions for 1992 to 2050 for the Weber River Basin are shown in Table 9-5. This includes a summary of previously discussed projections for 2020 and additional extrapolations to 2050 for M&I, irrigation, wet/open areas and net reservoir evaporation. The Wasatch Front Water Demand and Supply Model was used to project the demands using population projections presented in Section 4. In general, the demand for municipal and industrial water parallels population growth rates. However, a number of factors can affect actual M&I water demand including the migration of water-intensive industry, the implementation of long-term water conservation programs within residential and commercial developments, changes in lifestyles, and a number of socio-economic considerations.

9.5 Alternatives for Meeting Water Needs

In terms of overall needs, the Weber River Basin is projected to have sufficient water through the year 2020 if agricultural water is converted to M&I use. The significant water needs in the basin center around groundwater management, water quality, changes in traditional water uses, infrastructure and competition between supplier agencies for long-term water service agreements in areas of potentially high water demand.

9.5.1 Water Supply Management

To provide additional M&I water supplies, the Weber Basin Water Conservancy District petitioned Congress in the mid-1980s for a change in storage/use classification at Willard Reservoir. This effort resulted in the reclassification of over 30,000 acre-feet of water initially ear-marked for irrigated agriculture to a general classification for all uses. The reclassified water is expected to be treated to culinary standards or exchanged for better quality water in the upper Weber and Ogden rivers for M&I use.

In addition to increasing the supply of culinary water, a few major water provider agencies are actively converting agricultural irrigation conveyance facilities to residential secondary systems. The Davis and Weber Counties Canal Company and Pine View Water Systems have expanded secondary irrigation systems in both Davis and Weber counties.

9.5.2 Groundwater Management

The acquisition of additional groundwater for increased culinary water demand is difficult. Most of the groundwater pumped is currently being treated and distributed as culinary water. However, groundwater aquifers in highly populated areas have experienced large declines in groundwater levels over recent years.

To address these concerns and as mentioned subsection 9.3.3, the Division of Water Rights, in cooperation with the U.S. Geological Survey, has been involved in various groundwater studies in the more populated areas. A groundwater management plan has been produced for the East Shore Area that delineates a number of actions and discusses policies aimed at

Table 9-5
WEBER BASIN TOTAL WATER DEMAND AND DEPLETIONS

Year	1992		2020		2050	
	(acre-feet)					
Use	Diversion	Depletion	Diversion	Depletion	Diversion	Depletion
Municipal and industrial (subtotal)	172,000	72,600	331,800	146,700	575,000	252,960
Culinary	92,000	27,600	142,900	40,700	249,000	69,760
Secondary	80,000	45,000	188,900	106,000	326,000	183,200
Irrigation	446,400	212,000	328,200	164,100	147,000	76,440
Wet/Open Areas	270,000	185,300	270,000	185,300	270,000	185,300
Reservoir Net Evaporation	45,000	45,000	45,000	45,000	45,000	45,000
Basin Total	933,400	514,900	975,000	541,100	1,037,000	559,700

managing the continued decline of groundwater levels in Weber and Davis counties. Groundwater data collection is also being continued in the Snyderville Basin to quantify the available supply in the area. The State Engineer has set a moratorium on new well development in the Snyderville Basin until the affects of additional pumping within existing aquifers can be reasonably determined.

9.5.3 Cloud Seeding

Studies indicate annual accumulations of precipitation can be significantly increased by the seeding of winter clouds. Some estimates indicate that snowpack accumulations and subsequent runoff increases by an average of 10-15 percent as compared with runoff from similar unseeded watersheds.

Local water provider agencies have periodically sponsored cloud seeding projects. The Board of Water Resources typically provides one-third to one-half of the required funding for most cloud seeding projects with the project sponsor funding the remaining portion.

9.5.4 Conservation

As an overall water management objective, water managers must consider the implementation of conservation programs or policies allowing reductions in per capita or per acre water consumption. Once implemented, these water conservation programs and policies should provide standard system operational criteria and policy to assure that reasonable levels of water consumption are maintained throughout a given service area. Water conservation programs and policies generally encourage, and in some instances require, per acre or per capita consumption levels that are consistent with overall goals or water demand objectives. A comprehensive discussion on water conservation is given in Section 17 of this report.

9.5.5 Bear River Development

The Bear River has long been viewed as an available water resource. An average of over 1.0 million acre-feet flows annually from the river to the Great Salt lake. But based on the river's flow pattern (water is available for development only during the winter and spring months) and poor water quality, it has remained an untapped resource.

During the flooding of the early 1980s, the Division of Water Resources was directed by the legislature to investigate Bear River water storage options that would help control the level of the Great Salt Lake. A joint legislature gubernatorial Bear River task force was created in 1990 to look at water development options on the Bear River. The Bear River Task Force apportioned the state's Bear River water rights to Cache and Box Elder counties, Weber Basin Water Conservancy District and Salt Lake County Water Conservancy District. Counties would get 60,000 acre-feet each and the districts would get 50,000 acre-feet each.

The division was directed by the task force to prepare a plan for delivering the apportioned water right. The *Bear River Pre-Design Report* was published in 1991. It

identified a plan for development that had four major parts. First, development of a water storage reservoir in the upper basin to provide replacement for groundwater withdrawals. Second, a diversion from the Bear River to move water via canal or pipeline to Willard Bay Reservoir. Third, the construction of transmission facilities to move project water from Willard Bay Reservoir south to Davis, Weber, and Salt Lake counties. And fourth, construction of a reservoir on the lower Bear River. The current plan has been modified to constructing a pipeline or canal from the Bear River to Willard Bay Reservoir, a water treatment facility in Weber County, and the necessary conveyance facilities to get finished water to its point of use. The projected cost of that project is approximately $300 million.

The Bear River Task Force introduced legislation that further defines the state's role in the development of the river. The 1991 Bear River Development Act states the Division of Water Resources shall construct a state project that may include the construction of reservoirs on the Bear River and a pipeline or canal to Willard Bay Reservoir. All facilities constructed to deliver water to potential users from those facilities will be the responsibility of the water purchaser.

The Salt Lake County Water Conservancy District (SLCWCD), in cooperation with the Weber Basin Water Conservancy District (WBWCD), is proposing the construction of a water treatment plant in central Weber County. Currently, SLCWCD is purchasing land for the plant. Also, in cooperation with the WBWCD, the SLCWCD is investigating pipeline alignment alternatives to convey Bear River water from the proposed plant south to Salt Lake County and the east shore area of Davis and Weber counties. This pipeline will deliver needed water to SLCWCD as well as alleviate an infrastructure problem for WBWCD in the east shore area of Davis and Weber counties. These proposed facilities provide the infrastructure to move water south from the Bear River to Salt Lake County, and also the opportunity for various Weber Basin water suppliers to lease surplus water to the SLCWCD.

9.5.6 Snyderville Basin and Park City Area

The Snyderville Basin and Park City Area, a historic mining area, is located in the upper Weber River Basin portion of southwest Summit County approximately 10 miles east of Salt Lake City. The combination of world class ski facilities, lifestyle, mountain atmosphere and close proximity to a major metropolitan city, has made the area a desirable location to live.

In recent years, growth in the area has not been limited to any significant degree by the availability of land or water. But this has changed significantly. Pressure to preserve local wetlands and the overall rapid growth in residential and commercial development has significantly reduced the acreage that can be developed in the area. The resulting increase in demand for M&I water has stressed the capacities of local sources of culinary water to their limits during the summer months.

Over 90 percent of the culinary water in the Snyderville Basin and Park City Area is derived from local groundwater aquifers. In recent years, groundwater levels in some of the most developed areas of the basin have declined and pumping rates have been significantly reduced to maintain adequate hydraulic conditions at individual wells. To stabilize existing groundwater conditions, the State Engineer's office has imposed a moratorium on new "changes" and "exchanges" involving the movement of East Canyon Reservoir water to the Snyderville Basin and Park City Area. Currently, exchange contracts can only be issued for single family building lots with a total annual diversion limitation of one acre-foot. The one acre-foot limitation is expected to remain in force until a comprehensive groundwater study has been completed.

The current culinary water use in the area has been estimated at 5,600 acre-feet annually. With a population growth rate of 4 percent, culinary water demand is expected to reach 14,900 acre-feet by the year 2020. However, the recent award of the 2002 Winter Olympic Games has generated concerns regarding the short term increase in water demand over and above the 4 percent growth rate. It is expected the games will draw tens-of-thousands of spectators to the Snyderville Basin and Park City Area over an approximate one-month period during February of 2002. From now until 2002, water demand in the Snyderville Basin and Park City Area is expected to increase 1-2 percentage points above the long-term average. Nearly all of the spectators and participants to the games will be housed in local hotels and motels or other facilities along the Wasatch Front. However, a number of new motel and condominium complexes are planned for construction in the Snyderville Basin and Park City Area. Also, a proposal for a major development has recently been made to the Summit County Commission which could double the population projected in this area.

Although long-term water demand is a major concern in the area, the issue of providing adequate fire protection also needs to be addressed by local water

planners. Summit Water Distribution Company is currently constructing a number of concrete storage tanks to meet current and projected water requirements.

Until the current groundwater situation is resolved, continued development of the area is dependant on existing surface and groundwater reserves held by each individual water company or district. The reserves are not considered sufficient to meet long-term culinary water demands, so additional culinary water supplies must be acquired or developed. Possible sources include 1) purchase of local surface water rights in East Canyon and Silver creeks, 2) groundwater, 3) reuse of wastewater effluent, 4) importation of storage water from Smith and Morehouse Reservoir, and 5) transfer of water from Davis and Weber Counties Canal Company.

Purchase of Local Surface Water Rights in East Canyon and Silver Creeks - Historically, culinary water supplies have been developed by purchasing existing direct flow or storage water rights and converting them to culinary water supplies through approved "change" or "exchange" applications. As farms and ranches are converted to residential use, these agricultural water rights ought to be converted to culinary water supplies. The conversion occurs by either retiring the surface use in exchange for withdrawing a like quantity of water from an underground well or by treating the surface flows.

Groundwater - Although unlikely, the State Engineer's groundwater study may locate many new sites for large groundwater wells. The geology of the Snyderville Basin and Park City Area does not lend itself to the types of water wells found in other parts of the state, and large water wells are relatively rare. Many wells start out with production over 1,000 g.p.m. only to be drawn down over time to produce substantially less on a sustained basis.

Re-use of Wastewater Effluent - The re-use of sewage effluent and creation of a secondary water system is one way to extend culinary water supplies. Culinary water which would otherwise be used to irrigate golf courses, lawns and parks could be preserved for culinary uses.

The reuse of wastewater effluent, however, involves a number of water right issues that need to be addressed prior to the application of effluent on public or private land. Water rights associated with wastewater are generally held by the municipality that made the initial diversion for culinary water use. In the event a given municipality treats domestic wastewater flow generated from its own culinary water users, the municipality generally retains all water rights for treated wastewater and, as a result, is free to reuse it. If domestic wastewater is treated by an independent sanitation or sewer district, the ownership of treated effluent is a more complex issue and must be evaluated on a case by case basis. Nevertheless, reuse of wastewater in all cases is generally considered a wise and prudent use of water resources.

Importation of Smith and Morehouse Reservoir Water - Figure 9-1 shows various options that have been developed to provide up to 6,000 acre-feet of Smith and Morehouse Reservoir storage water to the Snyderville Basin and Park City Area.

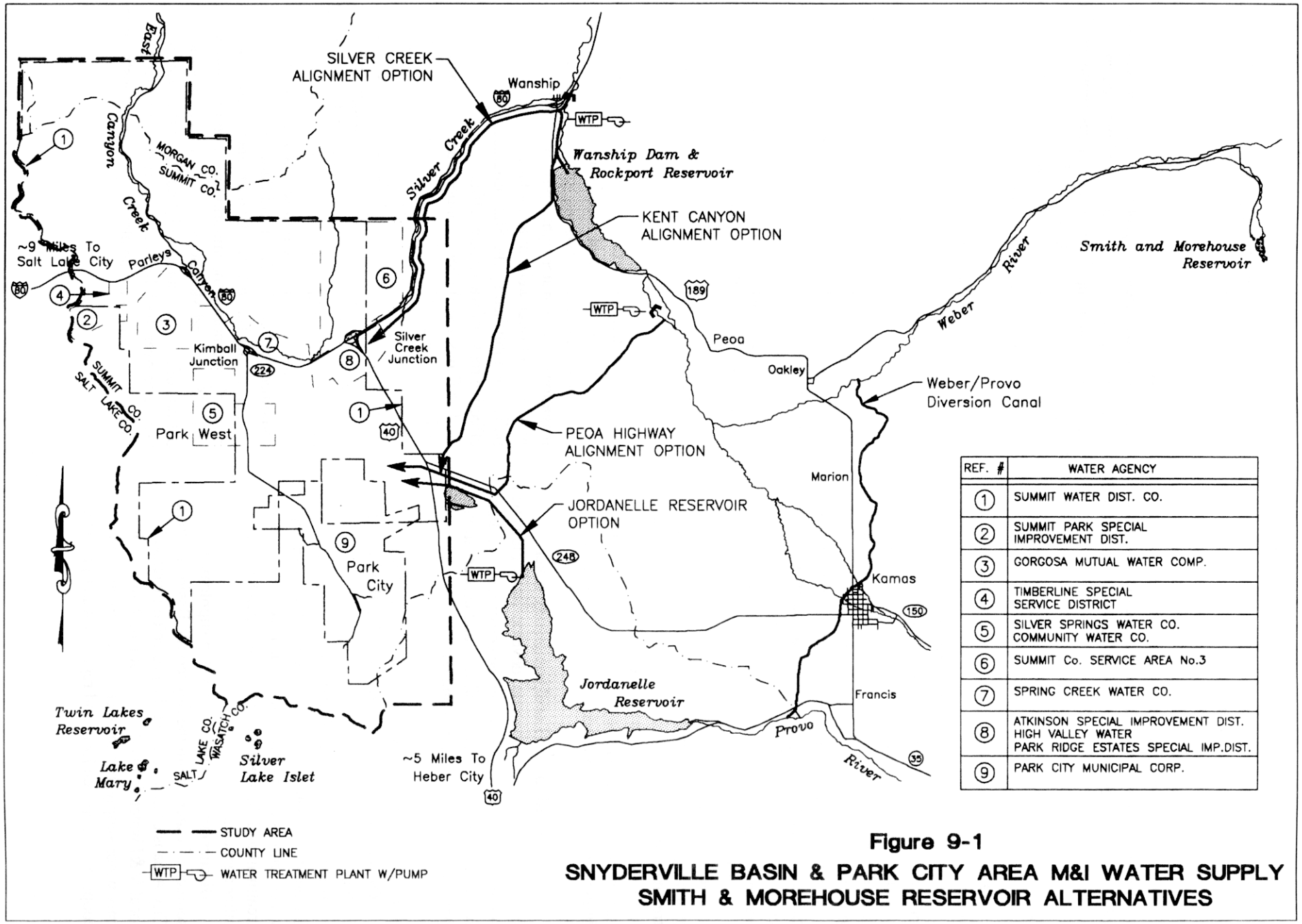
These options were evaluated by the Division of Water Resources and other water agencies taking into consideration a number of basic factors such as the constructability within major-existing highway corridors, the possible utilization of existing water conveyance systems to minimize pipeline construction, and the utilization of Jordanelle Reservoir as an equalizing pool for a potential pumping station and treatment plant.

Transfer of Water from Davis and Weber Counties Canal Company - Although the State Engineer has imposed a moratorium on transfers of East Canyon Reservoir water to the Snyderville Basin and Park City Area, the opportunity to develop non-moratorium water involving East Canyon Reservoir may still exist. The Davis and Weber Counties Canal Company has offered to sell between 3,000 and 5,000 acre-feet of new water supplies for distribution to the Snyderville Basin and Park City Area

The available water from East Canyon Reservoir (by exchange) would be pumped from wells within East Canyon downstream of the existing moratorium boundary established by the State Engineer. Summit Water Distribution Company proposes the development of multiple wells and associated pumping facilities that would discharge exchange East Canyon Reservoir water into their existing trunk line for distribution throughout the Snyderville Basin.

9.6 Issues and Recommendations

The Weber River Basin is unique when compared to other river basins in the state in terms of the adequacy of existing water supplies to meet projected demands. Although the basin is experiencing high to moderate growth rates, the basin is projected to have a surplus of water to the planning year of 2020. Isolated areas of water shortages exist due only to the lack of infrastructure and/or water service agreements to meet these demands.



REF. #	WATER AGENCY
①	SUMMIT WATER DIST. CO.
②	SUMMIT PARK SPECIAL IMPROVEMENT DIST.
③	GORGOSA MUTUAL WATER COMP.
④	TIMBERLINE SPECIAL SERVICE DISTRICT
⑤	SILVER SPRINGS WATER CO. COMMUNITY WATER CO.
⑥	SUMMIT Co. SERVICE AREA No.3
⑦	SPRING CREEK WATER CO.
⑧	ATKINSON SPECIAL IMPROVEMENT DIST. HIGH VALLEY WATER PARK RIDGE ESTATES SPECIAL IMP.DIST.
⑨	PARK CITY MUNICIPAL CORP.

Figure 9-1

SNYDERVILLE BASIN & PARK CITY AREA M&I WATER SUPPLY
SMITH & MOREHOUSE RESERVOIR ALTERNATIVES

The basin is in need of long-range master planning that addresses a number of issues including infrastructure needs in areas of high growth, transfer of water rights from traditional agricultural to M&I uses, consolidation of culinary water distribution facilities in areas serviced by multiple water provider agencies, and the possibility of exporting water to adjacent river basins with projected water shortages.

9.6.1 Long-Term Local Water Planning and Conservation

Issue - Many communities are not adequately planning for growth.

Discussion - Although the Weber Basin has been projected to have adequate water supplies for a 25-year planning period (the exception being the Snyderville Basin), the water resources in the basin are limited, and proven conservation measures should be incorporated into long-range and responsible water planning efforts. Some state and municipal agencies advocate that communities prepare 50-year water plans incorporating various conservation measures when possible.

The major water issue in the Weber River Basin is providing adequate infrastructure and effectively planning for the systematic construction of new water treatment and distribution facilities to meet demands in areas of high growth. In many areas of the basin, substantial projects will have to be constructed within the immediate future to provide water service when it is needed.

Recommendation - Local community water planners should, as a minimum, develop water plans with immediate objectives including the construction and/or replacement of undersized facilities and conservation policies aimed at residential and commercial water users.

9.6.2 Coordinated Water Planning and Development in the Snyderville Basin and Park City Area

Issue - The majority of water provider agencies in the Snyderville Basin and Park City Area are developing water sources and planning the construction of various treatment and distribution systems independently of other agencies.

Discussion - The need to develop supplemental sources of water within the Snyderville Basin and Park City Area is critical to meet the projected increase in local M&I water demand. The problem, however, is not only water supply, but the lack of infrastructure and cooperation between local and regional water provider agencies to consolidate existing and projected storage distribution, and treatment facilities for the common good of local residents and commercial businesses.

To date, no single entity has stepped up to provide the needed coordination to begin the process of solving the area's water development problems. Yet, it appears the necessary ingredients to provide a well planned and dependable water supply exist. The pieces simply need to be put together in a coordinated fashion.

There is a compelling public interest in resolving the differences of individual agencies in favor of the long-term common interests of local water consumers. Moreover, developing water supplies and constructing related service facilities independent of a coordinated master plan will ultimately result in costly duplications.

The need for additional water supplies within the area has been evaluated by the Division of Water Resources. Estimates of the area's culinary water show that over 90 percent of the area's culinary water is derived from local groundwater sources. In recent years, groundwater levels in some areas have declined and pumping rates have been reduced to maintain adequate hydraulic pumping conditions. Municipal and industrial water demand in the area currently stands at 5,600 acre-feet per year and is projected to increase to 14,900 acre-feet per year by 2020.

Supplemental water can be derived from a number of sources including importation of water currently held in storage at either Smith and Morehouse or East Canyon reservoirs, purchase of existing (primarily agricultural irrigation) surface water rights, possible installation of more groundwater wells in accordance with criteria and policies established by the State Engineer's office, and effective reuse of wastewater effluent.

The Davis and Weber Counties Canal Company estimates that 3,000 to 5,000 acre-feet of new water could be developed and pumped into the area based on its storage rights in East Canyon Reservoir. The canal company is in the process of finalizing an agreement with Summit Water Distribution Company to develop up to 5,000 acre-feet of East Canyon water utilizing their existing distribution system to service most of the combined Snyderville Basin and Park City Area.

The Weber Basin Water Conservancy District is currently promoting the importation of up to 6,000 acre-feet of Smith and Morehouse storage water via various options of high pressure trunk lines from the Wanship Dam area over the Johnson International property to Keetly Junction. The plan also proposes the construction

of related water treatment plants and a number of elevated storage reservoirs.

The implementation of either plan to import water to the area would require a review by impacted state agencies and the overall support of all water provider agencies in the area. Major considerations include consolidating existing water service facilities to provide an efficient, reliable, safe, and cost effective source of water to local residences and businesses; water right conversions (exchanges); overall system management and operation; impacts on water quality due to increased wastewater effluent discharge to existing stream and reservoir systems; and the coordination or evaluation of water development issues with the overall population and economic growth of the area.

Recommendation - Summit County, with the cooperation of all local water provider agencies, should accelerate its planning efforts to prepare a master plan for the Snyderville Basin and Park City Area in order to secure a dependable water supply for their long-term needs. Impacted water provider agencies and water user organizations should conduct a comprehensive study to evaluate various alternatives for importing water to the Snyderville Basin and Park City Area. Appropriate state agencies should assist as needed.

9.6.3 Lease of Weber Basin Surplus Water to Salt Lake Valley Users

Issue - A water surplus exists in the Weber River Basin.

Discussion - The Weber River Basin has been evaluated as having a water surplus well into the 21st Century. As a result, various Weber Basin water suppliers may have the institutional ability and the available surplus water supply to lease water to the Salt Lake County Water Conservancy District until that water is needed in the Weber River Basin.

The proceeds from the lease of water could potentially be used to pay for needed water infrastructure improvements and expansion that will be necessary to accommodate projected growth. The potential lease could also postpone the need to develop and move Bear River water south for several years.

Recommendation - The Weber Basin water suppliers should evaluate the benefits and risks of leasing surplus water to the Salt Lake County Water Conservancy District. ❖

Section 10 Contents

10 Agricultural Water

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The Weber River Basin is known for its highly productive farms and development of irrigated agriculture. Historically, agriculture has been the single largest use of water in the Weber River Basin. With the current rate of urban development, agricultural water is now being converted to other domestic and commercial uses.

10.1 Introduction

This section evaluates the overall status and various aspects of agricultural water use within the Weber River Basin. Specific topics include 1) current and projected agricultural land use and cropping practices, 2) irrigation water requirements, 3) water conservation from on-farm irrigation practices and off-farm water conveyance systems, and 4) drainage of excessive groundwater from irrigated crop lands.

10.2 Background

The sustained growth of irrigated agriculture made the construction of major water reclamation projects feasible. Completion of the Ogden River, Weber River and Weber Basin projects has increased the diversions for irrigated agriculture from a few thousand acre-feet to 472,700 acre-feet in 1987.

Historically, the development of water has been synonymous with the growth and development of small farming communities. The first major diversions for irrigated agriculture were made immediately upon the arrival of the first pioneers in the basin during the late 1800s. The first diversions of water from the Weber and Ogden rivers were made to small family farms to produce a food supply for the winter months and to begin a local agricultural based economy.

Although the early settlers enjoyed an abundance of water for all domestic uses, the rapid demand for irrigation water soon out-grew the annual supplies. It became apparent that large water storage structures were necessary to capture early season runoff from the high mountain watersheds for late season irrigation use. To fill this need, an era of large reclamation project construction resulted in the completion of the Weber River, Ogden River, and Weber Basin projects. These projects constructed seven major reservoirs with a combined active storage capacity of 518,300 acre-feet; thousands of miles of canals, aqueducts and ditches; three major culinary water treatment plants; and a number of flood control improvements.

More recently, the Smith and Morehouse Reservoir was reconstructed and enlarged to an active storage capacity of 7,600 acre-feet.

10.3 Agricultural Lands

Factors that influence the use of water for irrigated cropland include soil characteristics, climate and crop water requirements. Soil characteristics determine water storage within root zones while the type of crop determines water use. Climate defines the potential for water consumption. Irrigated agricultural lands include a broad range of soil conditions, climates and a variety of cropping practices. As a result, the demand for irrigation water varies significantly.

10.3.1 Soil and Climate Characteristics

The basin is divided into three general agricultural areas primarily defined by climate, soil conditions, and physical-hydrological conditions. These subareas and irrigated cropland are shown on Figure 10-1. The lower drainage includes the East Shore Area while the upper drainage includes the upper reaches of the Weber and Ogden rivers east of the Wasatch Range.

Upper Weber River Drainage - The upper drainage of the Weber River generally includes all of Morgan and Summit counties within the hydrological boundaries of the Weber River Basin. The area is characterized as high mountain valleys with elevations ranging from 4,900 to 11,500 feet above mean sea level. Agriculture in the area is limited, primarily due to short growing seasons and the existence of soils with moderate to poor tillage characteristics to support common row and forage crops. Water quality for agricultural purposes is good to excellent. The growing season generally starts in June and runs to early September with an average of about 90 frost free days per year.

Generally, the soils found in the upper basin are capable of supporting irrigated agriculture. The lands include alluvial fan soils, alluvial river bottom soils and old river terrace or bench land soils. Soil deficiencies generally include excessively rocky profiles, limited water holding capacities, rolling topography, slopes ranging from 4 percent to 10 percent, and clay lenses that limit vertical drainage.

Salinity and alkalinity are not a problem. Water and soil samples taken during the initial planning phases of the Weber Basin Project indicate the average soluble salt contents were well under 10 percent and soil pH readings were below the 8.4 level.

Ogden Valley - Ogden Valley has the same climatological features as the upper Weber River Basin with elevations ranging between 4,900 to 9,700 feet above mean sea level. Agriculture is limited by a short growing season and soil conditions. Water quality for agricultural purposes is considered good to excellent with no limitations regarding salinity or excessive heavy metals concentrations. The growing season in Ogden Valley runs from about June through September, with about 90 frost free days.

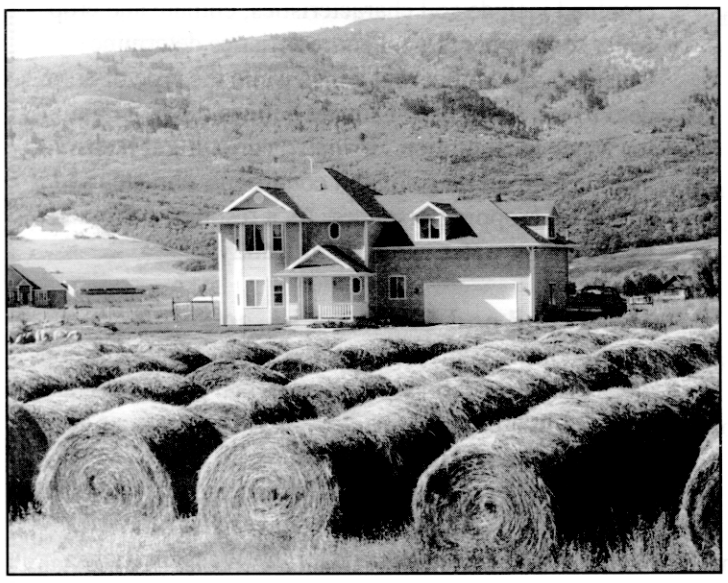
The valley has approximately 8,900 acres of irrigated land. Of this total, roughly 7,000 acres have optimal conditions for irrigated agriculture. The soils currently under irrigation have moderate to steep slopes ranging from 1 percent to 10 percent. They are predominantly heavy loams with relatively high water holding capacities and good drainage. After 100 years of irrigated agriculture, Ogden Valley has not been hampered by excessive soil alkalinity or salinity.

East Shore Area -The East Shore Area includes that portion of Weber and Davis counties west of the Wasatch Front and east of the shores of the Great Salt Lake. It is the largest of the agricultural subareas with elevations ranging from 4,200 to 9,700 feet above mean sea level.

The climate within the East Shore Area allows for an extended growing season ranging from 120 to 200 days with an annual average temperature of 50.7°F. Although some areas have moderate to severe drainage problems, a relatively large percentage of the area has exceptional agricultural soils.

In general, extensive clay lenses exist at locations where ancient lake levels were high and excessive water depths allowed for the gradual deposition of heavy clay material. These areas are primarily found within the limits of the Great Salt Lake and extend several miles toward the Wasatch Range.

As ancient Lake Bonneville lowered, flow from existing canyons deposited layers of silt, sand and clay in the flood plains of the Ogden and Weber rivers. The soils currently under irrigation in the East Shore Area are generally mixtures of sandy-silt loams with various mixtures of clay. These soils have excellent tillage characteristics with exceptional water holding capacities. In areas adjacent to the Great Salt Lake, however, the soils consist mainly of clay material and exhibit poor drainage characteristics. As a result, the western portions have moderate to severe salinity problems limiting the practice of irrigated agriculture.



Near Eden

10.3.2 Irrigated Cropland

Most crops such as alfalfa, corn, small grains, potatoes and a variety of vegetables are grown. These crops account for approximately 40 percent of

the total irrigated acreage. Various types of pasture grasses account for the remaining irrigated acreage. Orchards account for less than 1 percent of the total irrigated acreage and are generally located on valley benches. Pastures are found throughout the basin including areas with poorly drained soils. A summary of irrigated land by crop type is given in Table 10-1.

It has been estimated that more than 70 percent of all the irrigable land is flood irrigated with furrow and border application methods the most common. Furrow irrigation is used for the production of row crops such as grain or silage corn, potatoes and most vegetable crops. Border irrigation usually applies to the irrigation of alfalfa, pasture grasses and various forage crops. Flood irrigation efficiencies range from a low of near 40 percent to a maximum of over 70 percent for well-designed and operated level borders.

Sprinkler irrigation systems commonly used are either hand-move, solid set or wheel-line systems. Center pivot systems are normally utilized on large farms of 160 acres in size. Most farms and ranches are substantially under the 160-acre limit for the feasible operation of center pivots. Sprinkler irrigation efficiencies range from a low of 50 percent to a high of 70 percent when operated correctly and according to localized evapotranspiration data. Irrigation diversions, depletions and per acre diversions, and evapotranspiration for the major agricultural areas for 1987 are summarized in Table 10-2.

10.3.3 Dry Cropland

A small percentage of the agricultural lands are dry farms or dry cropland. Most of the agricultural lands that do not receive irrigation water are above existing canals and ditch systems. The dry farms that do exist are located in the upper Weber and Ogden rivers and normally grow small grains, pasture and alfalfa. The Division of Water Resources has estimated the acreage of dry land crops near existing irrigated lands including 500 acres of small grains, beans, and seed crops; 1,200 acres of alfalfa; 2,600 acres of pasture; and 100 acres of fallow lands in their dry land classification.

10.3.4 Range and Forest Land

The Wasatch-Cache National Forest, managed by the U.S. Forest Service, covers part of the Weber River Basin. It includes several boating and camping facilities at Pineview Reservoir and a campground at Smith and Morehouse Reservoir. Forest Service responsibilities include the overall management of all watersheds within the national forest boundaries. Of primary importance is the prevention of soil erosion caused by excessive flood runoff, protection of existing natural resources such as timber and wildlife habitat, livestock grazing management, and development and maintenance of adequate outdoor recreational facilities.

10.4 Agricultural Water Problems and Needs

Water historically used for irrigated agriculture is gradually being transferred to municipal and industrial uses. Conversion of agricultural water is effectively offsetting the need to develop new sources of water for M&I uses. Agricultural water is being converted primarily to M&I secondary water to service residential and commercial developments constructed on irrigated farms and ranches.

10.4.1 Cropland Conversion

The amount of irrigated cropland has declined in recent years as land has been converted to residential and commercial developments. Water-related land use mapping in 1968 and 1987 shows a decline of 21,700 acres during this 19 year period. If this decline continues, less than 100,000 acres of irrigated cropland will remain by the year 2020. Table 10-3 shows current and projected irrigated cropland by county.

10.4.2 Irrigation Water Conservation in Ogden Valley

Like other areas of the basin, the Ogden Valley was initially settled by farmers and ranchers who utilized flood irrigation practices to apply water to small family farms and ranches. The valley's source of irrigation water is generally from the upper drainages of the Ogden River. Initially, water was diverted from the north, south and middle forks of the Ogden River by a system of small canals and ditches. With the completion of the Weber Basin Project, a major diversion structure for irrigated agriculture was constructed on the South Fork of the Ogden River. The diversion provides up to 80 cfs of water for irrigated agriculture throughout the valley.

Although the addition of the South Fork diversion and canal provided additional water for irrigation, Ogden Valley farmers and ranchers still experience periods of water shortages during exceptionally hot irrigation seasons with less than average precipitation.

A need exists for the conversion from traditional flood to sprinkler irrigation practices. Conversion would

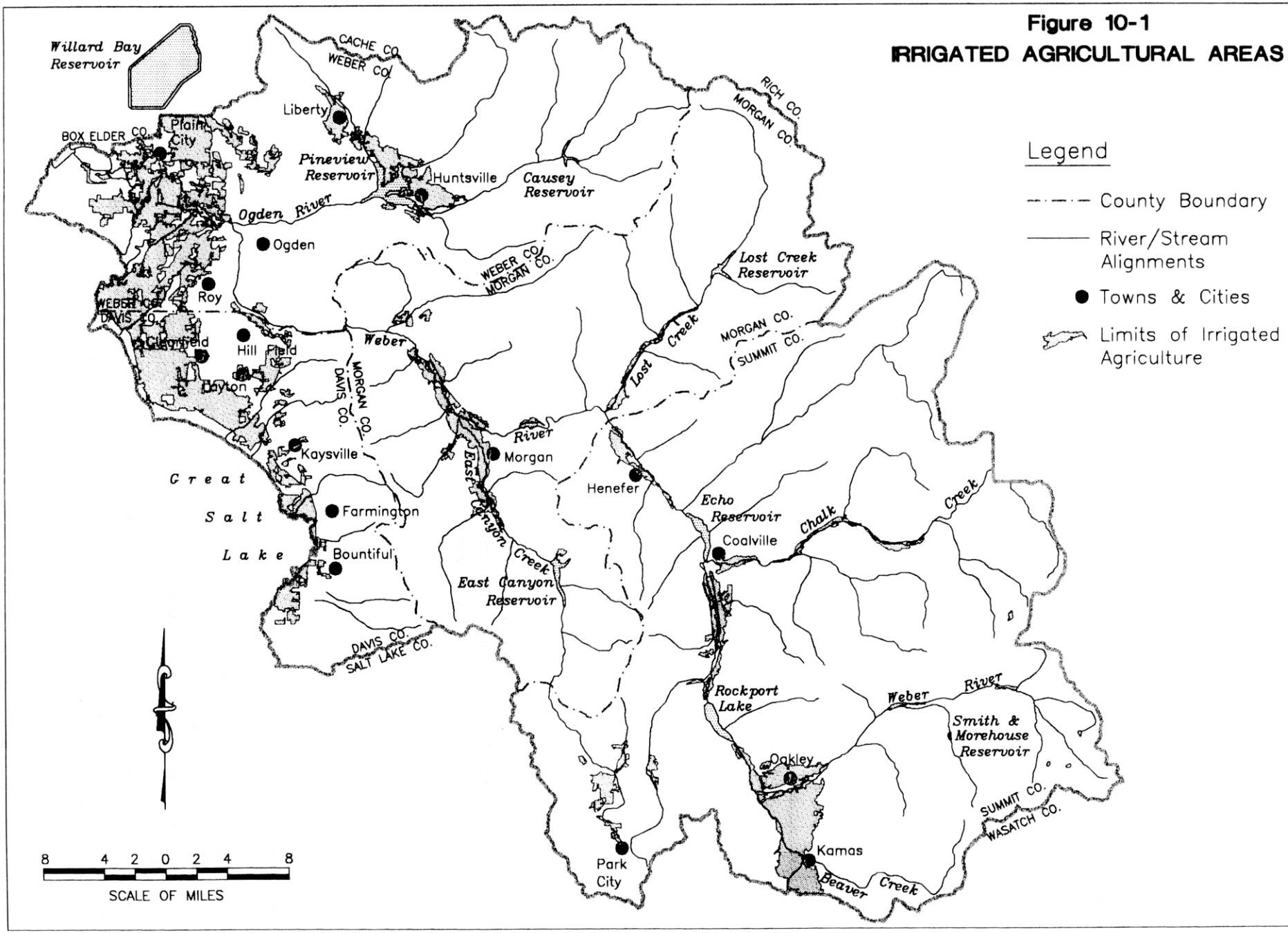


Figure 10-1
IRRIGATED AGRICULTURAL AREAS

Table 10-1
IRRIGATED LAND BY CROPS AND COUNTY (1987) [a]

Crop	Davis	Weber	County Morgan (acres)	Summit	Total
Fruit	383	440	1	2	826
Other Hort.	39	0	0	0	39
Grain	4,603	5,826	1,862	844	13,135
Corn	5,157	6,277	757	0	12,191
Vegetables	2,157	387	6	0	2,707
Potatoes	2,314	23	0	0	196
Onions	173	85	0	0	344
Beans	259	272	0	0	272
Other Row	0	24	0	0	24
Alfalfa	0	12,515	4,594	4,540	28,330
Grass Hay	6,681	2,523	1,154	9,589	14,354
Grass/Turf	1,088	32	34	298	548
Pasture	184	15,653	2,285	12,904	39,598
Subirrigate	8,756	17,860	707	957	26,066
Total	6,542	61,917	11,400	29,134	138,630

Source: Division of Water Resources Land Use Inventory.
a Does not include idle and fallow land.

Table 10-2
IRRIGATION DIVERSIONS AND DEPLETIONS (1987)

Consumptive Use	Upper Weber	Ogden Valley	East Shore	Totals Averages
Crop Diversion (CD in acre-feet)	132,100	28,800	311,800	472,700
Net Depletions (ND in acre-feet)	50,400	12,600	161,500	224,500
Total Irrigated Acreages (TIA in acres)	37,600	8,900	92,100	138,600
CD/TIA (acre-feet/acre)	3.5	3.2	3.4	3.4
ND/TIA (acre-feet/acre)	1.3	1.4	1.8	1.6
Gross Irrigation Efficiency (percent)	38.2	43.8	51.8	47.5

Table 10-3 CURRENT AND PROJECTED IRRIGATED CROPLAND CHANGES[a]					
County	1987	1995	2000 (acres)	2010	2020
Davis	37,800	32,700	29,400	22,900	15,000
Weber	63,100	60,700	58,500	53,400	47,600
Morgan	11,800	11,700	11,600	11,400	11,200
Summit	29,400	28,500	27,800	26,400	23,700
Basin Total	142,100	133,600	127,300	114,100	98,500
a Includes idle and fallow lands.					

promote water conservation during periods of water shortages. Other benefits would include the lowering of high water tables in some critical areas of the valley with relatively high densities of domestic septic tanks and drain fields, a reduction in surface runoff to lower subdrainages including Pineview Reservoir, and an increased availability of water for other domestic uses.

10.5 Conservation and Development Alternatives

Estimates of water loss in most open channel water conveyance systems range from 10 to 50 percent. Typical water losses from pipelines are less than 10 percent. With current (1992) agricultural diversions of 446,400 acre-feet, considerable water can be conserved through the implementation of conservation measures.

The best and most effective means of conserving water in any conveyance system is replacement of existing canals and ditches with pipelines. Another means of conserving water in open channels is to line interior surfaces with impermeable materials including concrete, synthetic membranes and various clay materials with low permeabilities.

The decision to install pipe or line an open channel is usually based on economics, although non-economic factors should also be considered. Non-economic considerations include the effect of seepage on groundwater quality, potential use of land over piped conveyance facilities and safety issues.

Water is applied to cropland by either flood or sprinkler irrigation methods. Of the two methods, flood irrigation is the most widespread. Factors favoring flood irrigation include the relatively high equipment and operational costs to install more efficient irrigation systems and the general compatibility of existing soils and topography to flood irrigation practices. Even though flood irrigation has worked well for over 140 years, some water saving can be realized by converting to sprinkler irrigation.

10.6 Agricultural Drainage

Although the main objective of most water projects is the development of additional water supplies, occasionally the situation is reversed. High water tables must be lowered in agricultural lands to make lands productive for normal cropping practices.

As part of the initial Weber Basin Project, a number of investigations were conducted by the Bureau of Reclamation to identify areas with high groundwater conditions that would adversely affect projected cropping practices. These investigations identified considerable acreage of agricultural land with existing and potential high groundwater levels, mostly in the East Shore Area.

Taking into consideration a number of factors including land use, optimum soil conditions for agricultural cropping practices, soil drainage potential, length of growing season, farming economics and ability to repay projected construction costs, the Bureau of Reclamation identified 37,200 acres of farmland in the East Shore Area to be drained over a period of roughly 50 years. Drainage would allow continuation of irrigated agriculture in the area and the eventual partial repayment of construction costs by increased annual assessments.

The extent of the bureau's initial drainage system included 65 miles of buried drains and 117 miles of open drains that would potentially discharge into the Great Salt Lake and/or surrounding wetlands. Because of the gradual decline of irrigated agriculture, only 35 miles of buried and open drains were actually constructed.

Future plans for drainage of irrigated agricultural land have, for all intents and purposes, been abandoned. Current federal environmental regulations requiring the preservation of wetlands and the general decline of agriculture have made drainage projects impractical and infeasible. ❖

Section 11 Contents

Tables

11 Drinking Water

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

All public water systems complying with state and federal safe drinking water regulations supply safe drinking water to their customers.

11.1 Introduction

This section of the *Weber River Basin Plan* provides information and data associated with the treatment, distribution and regulation of public drinking water supplies.

11.2 Setting

Currently, 76 community and 95 non-community public culinary water distribution systems operate in the basin, and all are monitored by the Division of Drinking Water for adherence to state and federal drinking water regulations. These systems produce culinary water from an estimated 350 wells and six surface water treatment plants. The Division of Drinking Water maintains a current record of all public water system ratings.

The basin's annual M&I culinary water use in 1992 was 92,000 acre-feet. The projected increase in culinary water demand is expected to parallel population growth rates. A summary of public community water supply and use by supplier in 1992 is given in Table 11-1.

11.3 Organizations and Regulations

Regulations pertaining to public drinking water sources are enforced and/or administered by public agencies at the local, state and federal levels. These agencies have a regulatory responsibility to insure that the general public is provided with safe and reliable sources of drinking water.

11.3.1 Local Facility Owners and Operators

Federal, state, and local agencies are responsible for establishing and administering safe drinking water regulations and programs. Owners and operators of individual treatment and distribution systems are directly responsible for the quality of water delivered to the public within their respective service areas. The day-to- day operation of drinking water treatment facilities must assure compliance with state and federal water quality standards.

Verification that a treatment facility is operating within state and federal drinking water standards is through various monitoring programs established by state and federal regulations.

The *State of Utah Rules for Public Drinking Water Systems* specifically outlines the procedures plant operators must adhere to regarding the taking of water samples and the documentation of subsequent water quality analyses for submission to the Division of Drinking Water. Table 11-2 is a summary of currently operating water treatment plants. Weber Basin Water Conservancy District plans to upgrade plants 3 and 4 to nearly double current capacity.

Public water systems that, for any reason, pose a threat to public health must be reported to the Division of Drinking Water. This report generally includes the scope and nature of the threat with all necessary improvements to restore adequate water service. Follow up evaluations are conducted and used to revise system operational policies aimed at minimizing the likelihood of similar situations in the future.

11.3.2 State Drinking Water Regulations and Programs

Title 19, Chapter 4, of the Utah Code Annotated is referred to as the Utah Safe Drinking Water Act (USDWA). The act created the Drinking Water Board

Table 11-1
PUBLIC CULINARY WATER SUPPLY AND USE (1992)

Water Supplier	Population Served	Total Connections	Source	M&I Water Use (acre-feet)	Per Capita Use (GPCD)
WEBER COUNTY					
WASATCH FRONT AREA					
Bonta Vista W.I.D.	14,875	3,481	Spring/Wells/Wholesale	3,038	182
Hooper W.I.D.	8,106	1,700	Wells/Wholesale	1,596	176
North Ogden	12,766	1,375	Spring/Wells	1,574	110
Ogden	59,879	19,985	Surface/Wells/Wholesale	18,426	175
Pleasant View	4,062	820	Spring/Wells	835	184
Riverdale	6,630	1,476	Wells/Wholesale	2,563	345
Roy	24,216	6,849	Wells/Wholesale	3,144	116
South Ogden	10,229	3,962	Exchange/Wholesale	1,615	141
Taylor West Weber	6,630	1,123	Wells/Wholesale	2,525	340
Uintah	888	288	Spring/Wholesale	300	302
Uintah Highland	4,219	691	Springs/Wells/Wholesale	349	74
Washington Terrace	8,192	2,433	Well/Wholesale	1,164	127
OGDEN VALLEY					
Casey Acres	36	9	Well	2	42
Cole Canyon Water Co.	160	27	Spring	24	133
Eden Water Works Co.	1,215	292	Springs/Well	135	99
Green Hill Water & Sewer	126	35	Well	17	123
Huntsville Municipal Water Sys.	561	226	Springs	91	144
Lakeview Corp.	110	44	Well	16	132
Liberty Pipeline Co.	650	158	Spring/Well	102	140
Nordic Valley Water Co.	550	162	Wells	154	250
Pineview West Water Co.	40	13	Wells	2	54
Spring Mountain	100	30	Spring	18	158
Willow Creek Subdivision	45	9	Well	8	163
Wolf Creek County Club	478	231	Spring/Well	60	112
DAVIS COUNTY					
Bountiful	36,404	9,030	Spring/Wells/Surface/Wholesale	4,633	114
Centerville	13,310	3,000	Wells/Wholesale	1,837	123
Clearfield	13,961	6,068	Wells/Wholesale	4,754	304
Clinton	7,952	2,000	Well/Wholesale	1,693	190
Farmington	10,851	2,500	Wells/Wholesale	1,173	96
Fruit Heights	4,854	968	Springs/Well/Wholesale	491	90
Hill Air Force Base	5,148	1,814	Wells/Exchange/Wholesale	5,154	894
Kaysville	13,541	3,500	Exchange/Wholesale	1,719	113
Layton	46,758	10,882	Spring/Wells/Wholesale	8,760	167
North Salt Lake	8,667	1,303	Spring/Wells/Wholesale	2,650	273
South Davis W.I.D.	4,825	1,944	Springs/Wells/Wholesale	626	97
South Weber	3,788	781	Well/Wholesale	788	186
Sunset	5,816	1,590	Well/Wholesale	1,684	258
Syracuse	8,168	1,315	Wells/Wholesale	832	91
West Bountiful	4,588	1,090	Well/Wholesale	1,080	210
West Point	3,830	882	Wells/Wholesale	1,198	279
Woods Cross	6,182	1,369	Wells/Wholesale	1,600	231
SUMMIT COUNTY					
COALVILLE AREA					
Cluff Ward Pipeline Co.	148	52	Springs	21	128

Table 11-1 (Continued)
PUBLIC CULINARY WATER SUPPLY AND USE (1992)

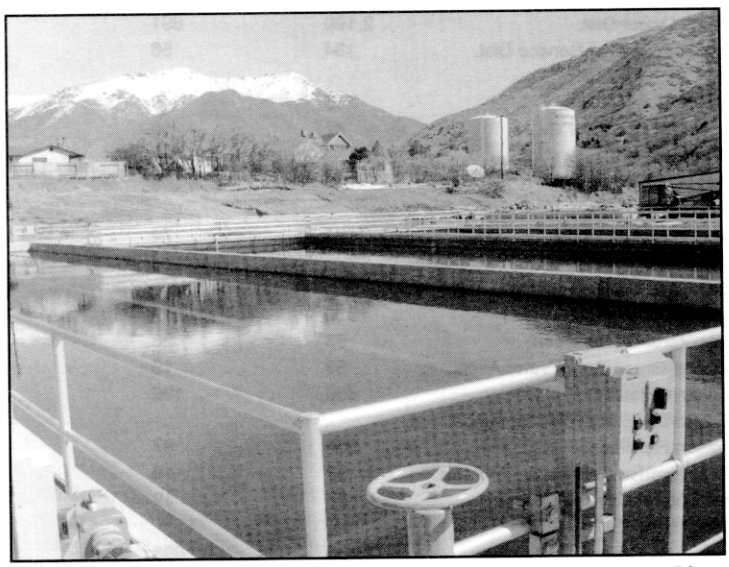
Water Supplier	Population Served	Total Connections	Source	M&I Water Use (acre-feet)	Per Capita Use (GPCD)
Coalville Culinary Water	1,065	450	Spring/Wells	309	259
Hoytsville Culinary Water	345	132	Well	73	189
Wanship Cottage Sites	28	25	Well	2	57
Questar Pipeline Co.	17	6	Wells	4	202
ECHO					
Echo Mutual Water Co.	52	32	Springs	8	135
HENEFER					
Henefer Pipeline Co.	570	205	Spring	73	114
KAMAS					
Kamas Culinary Water System	1,061	426	Spring/Wells	699	588
MARION					
Marion Waterworks Co.	350	76	Springs	63	160
OAKLEY					
Oakley Culinary Water	550	220	Springs	194	315
PARK CITY AREA					
Atkinson Special Improvement Dist.	350	86	Well	54	137
Community Water Co.	1,000	185	Surface/Wells	224	200
Gorgoza Mutual Water Co.	2,420	605	Spring/Wells	335	124
High Valley Water Co.	520	130	Spring	128	220
Park City Culinary Water	5,500	3,112	Springs/Wells/Tunnel	2,657	431
Silver Springs Water, Inc.	1,388	475	Springs	251	162
Spring Creek Water Co.	120	31	Well	14	106
Summit County Service Area #3	108	43	Well	20	167
Summit Park Special Service Dist.	1,500	368	Wells	144	86
Summit Water Dist.	2,100	691	Wells	658	280
Timberline Special Service Dist.	134	56	Wells	12	77
PEOA AREA					
Peoa Pipeline Co.	215	48	Springs	25	102
Wooden Shoe Water Co.	42	16	Spring	5	110
UPTON					
Upton Water Works	10	5	Springs	1	121
WANSHIP					
Wanship Mutual Water Co.	184	74	Springs/Well	41	198
MORGAN COUNTY					
MOUNTAIN GREEN AREA					
Highlands Water Co.	550	122	Springs/Well	58	95
Monte Verde Water Assn.	93	28	Wells	34	324
Mountain Green Sub. Water Assn.	59	19	Wells	15	233
Wilkinson Water Co.	450	136	Wells	119	236
PETERSON/ENTERPRISE AREA					
Peterson Pipeline Co.	350	97	Wells	85	217
V.P. Enterprise Estates Water Assn.	82	19	Wells	12	130
West Enterprise Water Assoc.	27	12	Wells	4	116
MORGAN AREA					
Morgan City Corp.	2,100	698	Spring/Wells	740	315
Richville Pipeline co.	100	33	Well	33	292
South Littleton Water Co.	36	12	Well	7	167
South Robinson Spring Water Users	30	12	Springs	16	485
CROYDON AREA					
Croydon Pipeline Co.	56	15	Spring/Well	13	201

Table 11-2
SUMMARY OF WATER TREATMENT PLANTS

Water Treatment Facility	Operating Agency	Location	Hydraulic Capacity (cfs)	Current Deliveries (acre-feet)
Water Treatment Plant No. 1	Ogden City Corp.	Ogden Canyon at Pineview Res.	23.2	4,700
Water Treatment Plant No. 2	Weber Basin WCD	Ogden East of Harrison Blvd-Old Post Rd.	40.0	11,300
Water Treatment Plant No. 3	Weber Basin WCD	Layton at District Headquarters	40.0	13,700
Water Treatment Plant No. 4	Weber Basin WCD	Bountiful at Davis Blvd.	10.0	4,200
Bountiful Package Plant	Bountiful City	Bountiful/Mill Creek	2.0	1,000
Park City	Park City	West Park City	2.2	1,000
Totals			117.4	35,900

with power and authority to regulate and protect the quality of all public drinking water supplies in the state. The USDWA authorized the Drinking Water Board to 1) establish standards for drinking water quality; 2) establish standards and regulations for the design and construction of new and expanded water treatment and conveyance facilities; 3) protect watersheds and other sources of raw public water supplies; 4) provide technical and financial assistance to local water provider agencies to promote clean water programs, train treatment plant and/or system operators, construct new treatment and distribution facilities to meet expanding drinking water demands, and/or renovate existing treatment and distribution facilities to improve on existing treatment processes; 5) administer federal programs that provide technical and financial assistance to local water provider agencies; 6) implement emergency plans in the event of natural disasters resulting in the contamination of public drinking water supplies; and 7) provide enforcement of state and federal drinking water regulations.

The Division of Drinking Water acts as the staff of the Drinking Water Board. In general, state drinking water regulations are consistent with comparable federal regulations. State regulations can be more stringent than federal regulations where the Board and Division of Drinking Water feel federal regulations do not adequately protect the health and well-being of the state's populace. Public drinking water systems are categorized as "community," "non-transient, non-community" and "non-community" systems. "Community" water systems are treatment and/or distribution facilities which serve a minimum of 15 connections or regularly serve 25 or more residents on a year-round basis. "Non-transient, non-community" are systems that are not community systems and that regularly serve at least 25 of the same persons over six months of the year. "Non-community" systems are not community systems or non-transient, non-community systems.



Weber Basin Water Conservancy District Plant

"Primary" maximum contaminant levels (MCLs) have been established for a number of contaminants. These primary standards are designed to establish treatment requirements to protect public health and safety. In addition, "secondary" standards exist which deal with aesthetics such as taste, odor and the staining of plumbing fixtures. "Secondary" standards are considered recommendations and not requirements.

The Division of Drinking Water takes an active role in promoting the quality and quantity of drinking water supplies. For example, the division 1) previews and approves engineering plans for drinking water systems prior to construction, 2) administers a loan program for drinking water projects, 3) conducts inspections of drinking water systems, 4) maintains a water system rating system, 5) issues administrative orders to non-complying systems, 6) issues variances and exemptions when federal rules are inappropriate, and 7) administers a source protection program to safeguard the state's drinking water sources.

11.3.3 Federal Drinking Water Programs

With the passage of the federal Safe Drinking Water Act (SDWA) in 1974, the federal government established national drinking water regulations to protect the public from water borne diseases. Congress expanded and strengthened the SDWA in 1986. Amendments to the Act (in 1986 and 1996) significantly increased the responsibility of the Environmental Protection Agency (EPA) to:

- Establish maximum levels of contamination for established pollutants;
- set compliance deadlines for owners/operators of treatment facilities that violate federal regulations;
- regulate surface water treatment associated with lead removal and wellhead disinfection;
- strengthen the enforcement of all regulations in the initial act;
- create federal funding for state revolving loans;
- expand the universe of water systems required to have certified operators;
- require public water systems to annually provide consumers a consumer confidence report;
- grant states authority to examine the financial, technical and managerial capabilities of water systems.

Chemical, physical, radiological and bacteriological substances in drinking water which pose a health risk to the public are regulated by the EPA under provisions given in the SDWA. The EPA has established an extensive list of maximum contaminant levels (MCLs) for most common organic and inorganic contaminants.

The SDWA has also established a strict schedule to determine reasonable MCLs for a number of additional contaminants. As a result, additional contaminants are identified on a regular basis by the EPA and subject to new regulations.

To control and improve the aesthetic quality of drinking water supplies, the SDWA also includes a list of secondary maximum contamination levels (SMCLs) for water aesthetics such as taste, odor and color. Although the evaluation of these qualities is subjective, the measurement of SMCLs has allowed for a reasonable level of consistency in water aesthetics determinations from one supply to another.

The SDWA also requires state and local water provider agencies to monitor a specified list of both regulated and unregulated contaminants. The selection of contaminants is dependant on the number of people served, the water supply source and contaminants likely to be found. The standardized monitoring frame work is administered over three, three-year compliance cycles for a nine-year total monitoring period beginning in 1992. The completion of the first nine-year monitoring period shall be followed by a second nine-year period.

The SDWA reauthorization has granted the EPA to change the standardized monitoring framework to cover a longer period of time. EPA and state officials will have a proposed new framework prepared in late 1997.

The 1986 amendments to the SDWA require all states to develop wellhead protection programs. The Division of Drinking Water has created the Drinking Water Source Protection Rule (DWSPR) outlining the general requirements to protect wellheads from outside surface contamination. Requirements of the DWSPR include the preparation of a Drinking Water Source Protection Plan for each groundwater source and providing proof of ownership and maintenance of all land in and around wellheads where surface water contamination may occur.

The 1996 amendments to the Safe Drinking Water Act provided more than $12 billion of federal funds to implement a number of new drinking water programs for the fiscal years of 1997 through 2003. The Division of Drinking Water expects to receive about $ 12.5 million annually from these federal funds.

New capacity development provisions are added to the Act. The EPA must complete a review of existing state capacity development efforts and publish information to assist states and public water suppliers.

11.4 Drinking Water Problems

Water-related problems in the Weber River Basin are generally associated with the contamination of both surface and groundwater supplies because of poor watershed planning/management, growing urbanization, leaking underground storage tanks, and poor management of hazardous waste land fills.

11.4.1 Surface Water

Water quality in the upper Weber River is generally considered good to excellent. However, problems exist in isolated reaches of drainages of the upper Weber and Ogden rivers. The rapid urbanization of the Snyderville Basin and Park City Area has, in turn, increased the rate of secondary wastewater effluent discharged to both East Canyon and Silver Creek drainages. In recent years, this increase in effluent discharge has resulted in additional nutrient loadings to East Canyon Reservoir and, to a lesser degree, the lower Weber River system.

The Summit Water Distribution Company has proposed the construction of a surface water treatment facility on East Canyon Creek immediately upstream of an existing wastewater treatment facility. The wastewater treatment plant owned and operated by the Snyderville Basin Sewer Improvement District is currently discharging treated effluent to East Canyon Creek within existing federal NPDES permit regulations. But construction of the water treatment plant would effectively reduce flow in East Canyon Creek and increase the concentration of regulated contaminants currently discharged from the wastewater treatment plant. Both agencies are currently in litigation to resolve the issue.

In recent years, the Weber River Basin Water Conservancy District has experienced excessive organic loadings to their Layton and Ogden water treatment facilities from the upper Weber River. The problem is created by seasonal fluctuations in the natural river channel that allows cycles of algae growth and deterioration. As a result, the treatment plant at Layton is subject to considerable levels of seasonal organic loading resulting in the periodic plugging of standard filtration treatment processes.

Water quality in the upper Ogden River is currently rated as good to excellent. However, the recent rate of urban growth in Ogden Valley threatens to contaminate groundwater aquifers that feed the reservoir and Ogden City's culinary water treatment plant.

A recently completed *EPA 314 Clean Lakes Study* determined current water quality in Pineview Reservoir conforms with state and federal regulations for culinary and recreational uses. Although there is not a current threat to public safety, continued use of septic tanks in lieu of sanitary sewers may ultimately degrade water quality in the reservoir to levels violating state and federal drinking water standards.

11.4.2 Groundwater

Six basic groundwater areas are within the basin, including the East Shore Area, Central Weber Valley, Park City, Rhodes Valley, Weber Valley above Oakley and Ogden Valley. Water quality in these aquifers varies depending on location. In general, the groundwater quality in the upper Weber and Ogden rivers drainages is good to excellent. Groundwater quality in the lower basin declines as groundwater flows to the Great Salt Lake due to salt and mineral contamination. A detailed discussion of groundwater characteristics, including water quality, is given in Section 19 Groundwater.

The long-established practice of dumping hazardous waste into open trenches and pits at Hill Air Force Base has contaminated groundwater within and outside existing base boundaries. Base officials have addressed the problem in a number of reports and studies that have determined the extent of contamination in terms of water quality and the geographic spread of contaminated groundwater plumes. These reports and studies have also identified a number of remedial actions to effectively confine the further spread of contaminated plumes and treat existing portions of localized contaminated aquifers.

Culinary water in the Ogden Valley is derived entirely from local groundwater aquifers. Well pumpage and spring diversions in 1992 account for an estimated 630 acre-feet of annual diversions for culinary water. Although not as pronounced as in the Snyderville Basin and Park City Area, the Ogden Valley is currently experiencing a moderate 2 percent growth rate that may approach the 4 percent rate currently estimated for southwestern Summit County.

Annual groundwater diversions are made primarily from the existing shallow aquifers up gradient from Pineview Reservoir. As the demand for culinary water increases, the number of wells and spring diversions will also increase. A relatively high percentage of existing wells are privately owned and operated. These wells are not monitored by local health agencies and may be subject to contamination by surrounding septic tanks and drain fields as the number of residential developments increase. The Weber County Health District needs to

actively educate the owners and operators of these private wells and spring diversions regarding the need and procedures for monitoring water quality.

To address the growing demand for culinary water, Weber County, with assistance from the Division of Drinking Water, and local water districts and companies has begun the process of preparing the Ogden Valley Water Management Plan. The plan will attempt to quantify the short and long-term demand for culinary water. The hydraulic limitations of the existing aquifer must be assessed to determine when and if the development of supplemental surface water sources is needed. The assessment of the existing aquifer should also include the impact on groundwater quality by the continued use of septic tanks and drain fields to dispose of domestic wastewater.

11.5 Culinary Water Use and Projected Demand

The Weber River Basin has an overall population growth rate estimated at approximately 2.1 percent. Summit County is expected to grow at a rate of nearly 4.0 percent, and Davis, Weber and Morgan counties are expected to grow at 2.1, 1.9 and 2.0 percentages respectively. The demand for drinking water is also expected to grow in roughly the same proportion as the population growth rate. The projection of drinking water demand for major water suppliers is summarized in Table 11-3.

11.6 Alternative Solutions

Local, state and federal agencies are actively engaged in a number of studies to identify feasible and practical solutions to the various drinking water problems previously mentioned. The most prominent of these problems include the continued contamination of surface water sources by organic and domestic wastes within the upper Weber and Ogden River drainages, the steady decline in groundwater levels within highly populated areas of the basin, and the potential spread of contaminated groundwater from the Hill Air Force Base area.

The Weber Basin Water Conservancy District has, in recent years, modified the filtration process at its Layton and Ogden water treatment plants to more effectively remove suspended organic contaminants generated from upper Weber River flows. To solve the long-term problem, the district has developed a watershed management practices plan to minimize the generation of organic loads in the upper Weber River system.

In recent years, the Weber Basin Water Quality Management Council, in cooperation with the Bureau of Reclamation and the Utah State Water Research Laboratory, has developed a river management model to help determine criteria to operate the entire river system. The model's objective is to determine the impact of differing river operational schemes and projected organic loads on existing treatment facilities.

The Division of Water Rights has recently completed a management plan for the East Shore Area Groundwater Aquifer (ES-GWA) in two basic areas: the Weber Delta and the Bountiful Subareas. Although the ES-GWA is extremely large in terms of gross water storage, pumping activities within the aquifer have reached levels resulting in excessive decreases in groundwater elevations in the northern to central portions of the overall groundwater basin. To address the issue, the Division of Water Rights and the U.S. Geological Survey (USGS) have created and executed a computer model of the overall aquifer system (including both groundwater subareas) to predict future groundwater level changes for a number of pumping and aquifer management scenarios.

Based on the aquifer's hydraulic characteristics and a continuation of historic pumping rates, the model has predicted significant declines in groundwater levels. Although this scenario will not pose a problem in regard to aquifer storage capacities, the projected decline in groundwater levels will create additional pumping lifts and may dry up some local wetlands and other water-related ecosystems.

To control, or better manage, the possible decline of groundwater levels in these areas, the completed groundwater management plan for the East Shore Area includes two objectives. One is to establish a policy for all new water appropriations and change applications for existing water rights. The other is to protect existing groundwater resources from over-utilization. A copy of the plan can be obtained from the Division of Water Rights in its Salt Lake City offices.

Within the Snyderville Basin and Park City Area, the Division of Water Rights, in cooperation with the U.S. Geological Survey and Utah Geological Survey, has begun a groundwater study with the objective of determining the impact on groundwater levels and storage created by increased pumping. The study was initiated as a response to the growing need for M&I water sources within the Snyderville Basin. The study is in its early stages with basic geologic and hydrological data being collected.

11.7 Issues and Recommendations

Drinking water issues within the Weber River Basin generally revolve around water quality and the contamination of existing streams, reservoirs and groundwater aquifers by domestic wastewater effluent and poor land use practices. These issues, although important to drinking water supplies, are discussed in other sections. Water quality issues dealing directly with streams and reservoirs are discussed in Section 12, Water Quality, while groundwater quality issues are discussed in Section 19, Groundwater. ❖

Table 11-3
CURRENT AND PROJECTED CULINARY WATER DEMAND FOR MAJOR WATER SUPPLIERS

Water Supplier	1992 M&I Use (Acre-feet)	2020 M&I Use (Acre-feet)
WEBER COUNTY		
Bona Vista W.I.D.	3,040	4,200
Hooper W.I.D.	1,600	4,400
North Ogden	1,570	2,400
Ogden	18,430	1,990
Pleasant View	840	1,300
Riverdale	2,560	4,700
Roy	3,140	4,400
South Ogden	1,620	2,800
Taylor West Weber	2,530	7,700
Uintah	300	500
Uintah Highland	350	600
Washington Terrace	1,160	1,300
Ogden Valley Suppliers	630	2,800
WEBER COUNTY TOTAL	**37,770**	**54,460**
DAVIS COUNTY		
Bountiful	4,630	5,400
Centerville	1,840	3,300
Clearfield	4,750	8,000
Clinton	1,690	4,400
Farmington	1,170	2,900
Fruit Heights	490	1,500
Hill Air Force Base	5,150	5,150
Kaysville	1,720	3,000
Layton	8,760	13,200
North Salt Lake	2,650	4,300
South Davis W.I.D.	530	900
South Weber	790	1,500
Sunset	1,680	2,100
Syracuse	830	1,200
West Bountiful	1,080	1,700
West Point	1,200	1,900
Woods Cross	1,600	2,600
DAVIS COUNTY TOTAL	**40,560**	**60,050**
SUMMIT COUNTY		
Coalville Culinary Water	310	770
Kamas Culinary Water System	700	1,780
Park City Culinary Water	2,660	7,230
Summit Water District	660	2,760
Other Summit County Supplies	1,690	2,360
SUMMIT COUNTY TOTAL	**6,020**	**14,900**
MORGAN COUNTY		
Morgan City Corp.	740	930
Other Morgan County Suppliers	400	1,970
MORGAN COUNTY TOTAL	**1,140**	**2,900**
WEBER BASIN TOTAL	**85,490**	**132,310**

Section 12 Contents

12 Water Quality

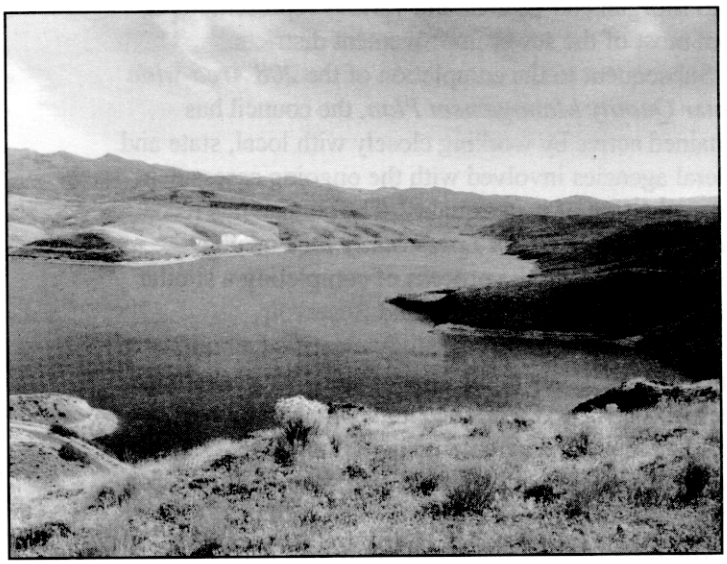
SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The quality of life, to a large extent, is dependant on the quality of water within a given area or region of consideration. Water is not only a basic element of life, it dictates the quality of the environment that supports all living things.

12.1 Introduction

This section of the *Weber River Basin Plan* presents discussions and information relating to water quality. Included are discussions regarding the administration and enforcement of water pollution control regulations, current and future status of water quality, and pertinent issues and problems.



East Canyon Reservoir

12.2 Setting

Until the mid-1950s when the growing size of residential and commercial developments began to require large-scale sewage collection and treatment, water quality was not much of an issue. Prior to the construction of major military bases and large-scale urban development, the basin primarily consisted of sparsely populated rural communities with individual wells for culinary water and septic tanks with drain fields providing a means of sewage disposal. Public sewage collection and treatment facilities existed only in larger municipalities along the Wasatch Front, mostly in Weber and Davis counties.

With the establishment of Hill Air Force Base, the Defense Depot Ogden, and a significant increase in railroad activity, the basin's population grew at a relatively rapid rate from the early 1940s to the late 1960s. To accommodate this growth, public works facilities were expanded to service a number of rural towns, cities and commercial districts. As a result, existing wastewater treatment facilities were upgraded to provide secondary treatment with enlarged sanitary sewers and culinary water distribution systems.

12.3 Organizations and Regulations

The responsibility of protecting the basin's water quality falls primarily with the Division of Water Quality. Other federal and local agencies also have strong interests and responsibilities concerning the water quality. These agencies include the Environmental Protection Agency (EPA) and Weber Basin Water Quality Council (WBWQC). The EPA administers federal water quality law and regulations including the Clean Water Act. The Division of Water Quality, through the state legislature and Water Quality Board, establishes the state's water quality regulations in accordance with federal law and regulations. The WBWQC generally works in close

cooperation with the Division of Water Quality to monitor and assess the existing status of water quality throughout the basin.

12.3.1 Weber Basin Water Quality Management Council

The Weber Basin Water Quality Management Council is considered the lead agency in the basin regarding water quality in both the Weber and Ogden rivers. The council was initially organized in the mid-1970s to complete an EPA funded *208 Area-Wide Water Quality Management Plan* for the Weber and Ogden rivers. The initial members of the council included commissioners from Weber and Morgan counties; mayors from Centerville, Layton, Bountiful, Morgan, Roy and Harrisville; local town/city officials from Morgan and Ogden; and various representatives from most of the sewer improvement districts.

Subsequent to the completion of the *208 Area-wide Water Quality Management Plan*, the council has remained active by working closely with local, state and federal agencies involved with the ongoing assessment and evaluation of water quality. The council has recently completed a *314 Clean Lakes Study* for Pineview Reservoir and is in the process of completing a similar study for East Canyon Creek and Reservoir.

The Pineview Reservoir study identified a number of water quality issues in the upper Ogden River drainage. These issues include the potential contamination of surface and groundwater from agricultural field runoff and the infiltration of wastewater from residential septic tanks and related drain fields.

The East Canyon Reservoir study will assess water quality in the upper East Canyon Creek drainage. The study will also identify requirements to reduce current levels of nutrient contamination to East Canyon Creek and East Canyon Reservoir.

12.3.2 Utah Water Quality Regulations

Utah has long been aware of the importance of maintaining adequate levels of surface and groundwater quality. With the passage of the Utah Water Pollution Control Act of 1953 (UWPCA), a Water Pollution Control Committee (later changed to Water Quality Board) was created and given a number of responsibilities including the power to adopt, enforce and administer regulations designed to protect the state's water quality.

Surface Water - The Division of Water Quality has classified surface streams, rivers and reservoirs primarily based on minimal acceptable levels of water quality for various intended uses. Six basic water use classifications have been established ranging from treatable water for culinary use to water sources unsuitable for human contact. These water use classifications are summarized in Table 12-1 for basin streams and reservoirs/lakes respectively.

Waters subject to the Anitdegradation Policy of the "Standards of Quality for Waters" for the State of Utah are broken into two categories. No Category 2 waters are named for the Weber Basin. Category 1, high quality waters are all surface waters geographically located within the boundaries of the Wasatch-Cache National Forest whether on public or private lands, with the following exceptions:

- Weber River from the Town of Uintah to the Town of Mountain Green,
- Weber River and tributaries from U.S. 189 (near Wanship) to its headwaters,
- Burch Creek and tributaries from Harrison Boulevard in Ogden to its headwaters,
- Hardscrabble Creek and tributaries from confluence with East Canyon Creek to its headwaters,
- Chalk Creek and tributaries from U.S. Highway 189 (at Coalville) to its headwaters,
- Holmes Creek and tributaries from U.S. Highway 89 to its headwaters,
- Sheppard Creek and tributaries from Height Bench diversion to its headwaters,
- Farmington Creek and tributaries from Height Bench Canal diversion to its headwaters, and
- Steed Creek and tributaries from U.S. Highway 89 to its headwaters.

Since the initial passage of the UWPCA, 14 wastewater treatment facilities have been constructed in the Weber River Basin. These facilities include eight plants employing some form of mechanical secondary treatment and six plants employing facultative lagoon systems. A summary of the plants and their respective treatment processes is presented in Table 12-2.

From regulations established in the federal CWA, the Division of Water Quality is responsible for the enforcement of regulations dealing with point source discharges. Regulations cited in the CWA, state that ".....the discharge of any pollutant directly into the waters of the United States from a new or existing point source is prohibited unless the point source has a valid and active National Pollutant Discharge Elimination System (NPDES) permit...."

Table 12-1
STATE SURFACE WATER USE CLASSIFICATIONS

Class	Designated Use	Stream Reach
Class 1	Raw culinary water sources.	
Class 1C	Domestic use with prior treatment.	WR&TR: Stoddard Diversion to headwaters. SCC&TR: National Forest boundary to headwaters. BC&TR: Harrison Blvd. at Ogden to headwaters. SC&TR: National Forest boundary to headwaters. WC: Ogden River confluence to headwaters. PR: All tributary streams and rivers.
Class 2	Instream recreational use and aesthetics.	
Class 2A	Primary human contact-swimming.	All major reservoirs including: Smith and Morehouse, Rockport, Echo, Lost Creek, East Canyon, Causey, Pineview and Willard Bay.
Class 2B	Secondary human contact-boating, wading, etc.	WR: Great Salt Lake to Slaterville Diversion. WR&TR: Slaterville Diversion to Stoddard Diversion. WR&TR: Stoddard Diversion to headwaters. SCC&TR: National Forest boundary to headwaters. BC&TR: Harrison Blvd. at Ogden to headwaters. SC&TR: National Forest boundary to headwaters. OR&TR: Weber River confluence to Pineview Dam. WC: Ogden River confluence to headwaters. PR: All tributary streams and rivers.
Class 3	Instream use by aquatic wildlife.	
Class 3A	Habitat maintenance for cold water game fish, water-related wildlife and food chain organisms.	WR&TR: Slaterville Diversion to Stoddard Diversion. WR&TR: Stoddard Diversion to headwaters. SCC&TR: National Forest boundary to headwaters. BC&TR: Harrison Blvd. at Ogden to headwaters. SC&TR: National Forest boundary to headwaters. OR&TR: Weber River confluence to Pineview Dam. WC: Ogden River confluence to headwaters. PR: All tributary streams and rivers.
Class 3B	Habitat maintenance for warm water game fish, water-related wildlife and food chain organisms.	Not used in the Weber River Drainage.
Class 3C	Habitat for non-game fish, water-related wildlife and food chain organisms.	WR: Great Salt Lake to Slaterville Diversion.

Limits on loading rates by certain pollutants are usually established by state agencies with consideration given to EPA guidelines. However, state agencies can adopt more stringent limits. Wastewater treatment plants and/or industrial businesses discharging pollutants into Utah waters are issued a Utah Pollutant Discharge Elimination System permit (UPDES). Generally NPDES/UPDES permits are valid for a five-year period and must be renewed for a re-evaluation of pollutant limitations. Enforcement of NPDES/UPDES permit requirements is accomplished by effluent monitoring programs established and supervised by the Division of Water Quality. To this end, an intensified monitoring effort, consisting of 63 water quality monitoring sites, was put in place from April 1993 to June 1994. As shown in Figure 12-1, the 63 sites include 20-long term sites in operation prior to 1993. Data collected from this intensive monitoring project were used to produce the *September 1995 Weber River Basin and Farmington Bay Area Stream Assessment* by the Division of Water Quality.

Groundwater - Groundwater accounts for approximately 50 percent of all culinary water diversions in the basin. Although this percentage is expected to decrease as new surface water treatment plants are constructed or as existing plants are expanded, groundwater will remain a major source of culinary water indefintely. As such, it is important that the quality of groundwater be maintained through the continued implementation of monitoring programs.

Table 12-1 (Continued)
STATE SURFACE WATER USE CLASSIFICATIONS

Class	Designated Use	Stream/Reach
Class 3D	Habitat for waterfowl, shore birds, water-related wildlife and food chain organisms.	WR: Great Salt Lake to Slaterville Diversion.
Class 4	Agricultural-livestock and irrigation water.	WR: Great Salt Lake to Slaterville Diversion. WR&TR: Slaterville Diversion to Stoddard Diversion. WR&TR: Stoddard Diversion to headwaters. SCC&TR: National Forest boundary to headwaters. SC&TR: National Forest boundary to headwaters. OR&TR: Weber River confluence to Pineview Dam. WC: Ogden River confluence to headwaters. PR: All tributary streams and rivers.
Class 5	Great Salt Lake general use-primary and secondary human contact, water-related wildlife and mineral extraction.	Great Salt Lake and surrounding waterfowl and wildlife management areas..
Class 6	General use restricted and/or governed by environmental and health standard limitations.	Not used in the Weber River drainage.

Table acronyms: WR-Weber River; WR&TR-Weber River and Tributaries; SCC&TR-Strongs Creek and Tributaries; BC&TR-Burch Creek and Tributaries; SC&TR-Spring Creek and Tributaries; OR&TR-Ogden River and Tributaries; WC&TR-Wheeler Creek and Tributaries; PR-Pineview Reservoir.

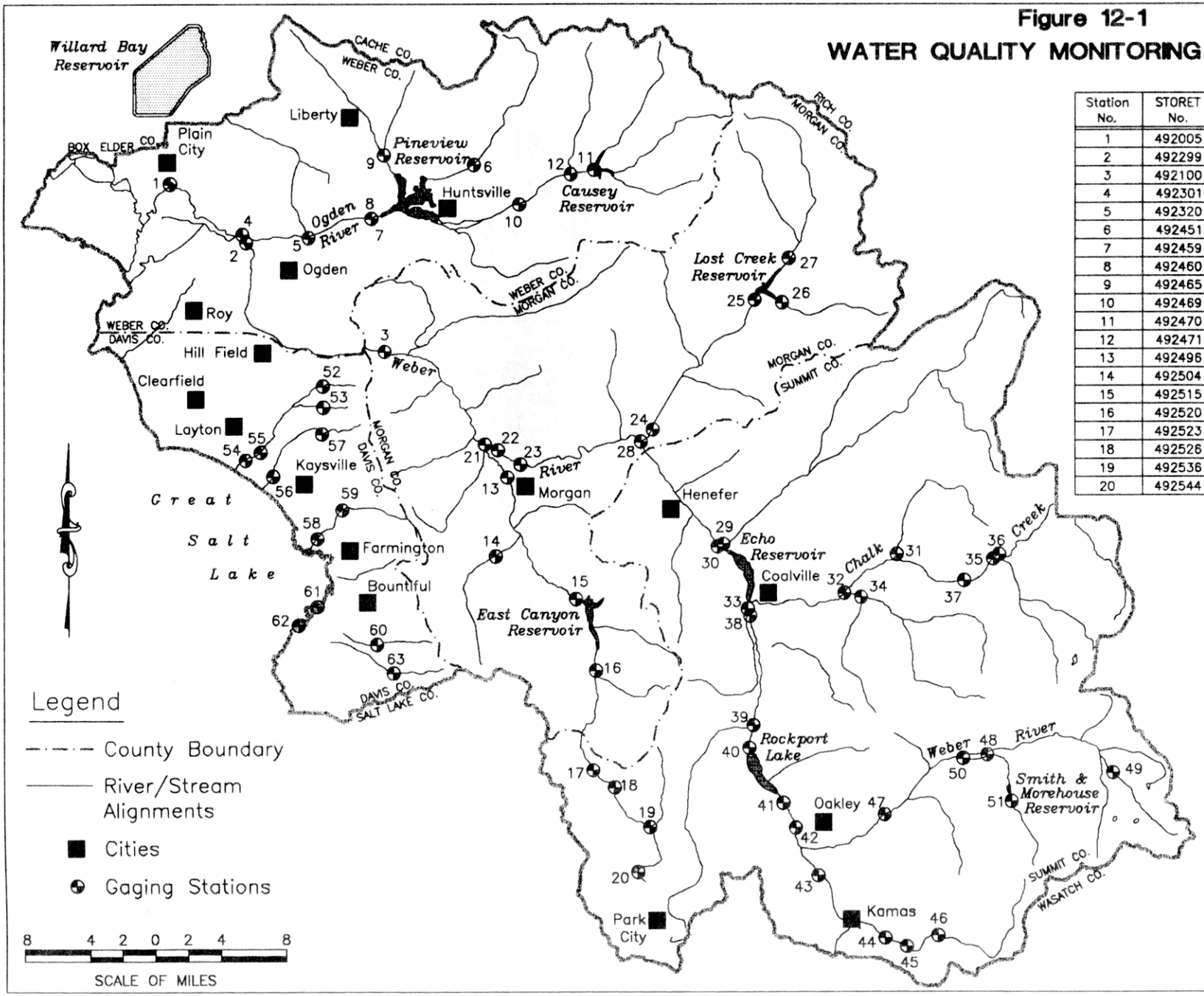
Table 12-2
WASTEWATER TREATMENT PLANT SUMMARY

Facility	Process	Point of Discharge	Est. Annual Discharge (acre-feet)
South Davis South	Trickling Filter	Great Salt Lake	7,300
South Davis North	Trickling Filter	Great Salt Lake	8,000
Central Davis	Oxidation Ditch	Great Salt Lake	5,400
North Davis	Oxidation Ditch	Great Salt Lake	18,000
Snyderville EC	Oxidation Ditch	East Canyon Creek	1,800
Snyderville SC	Oxidation Ditch	Silver Creek	1,600
Central Weber	Trickling Filter	Irrigation Canal	44,800
Coalville City	Oxidation Ditch	Chalk Creek	300
Plain City	Facultative Lagoon	Dix Creek	1,000
Mt. Green	Facultative Lagoon	Weber River	100
Henefer Town	Facultative Lagoon	Weber River	100
Kamas City	Facultative Lagoon	Weber River	400
Oakley City	Facultative Lagoon	Weber River	100
Morgan City	Aerated Lagoon	Weber River	200
Total Average Annual Effluent Discharge			89,100

Point Source Pollution - Fourteen wastewater treatment facilities currently discharge secondary effluent to the basin's surface waters including the Great Salt Lake. In addition to domestic wastewater, 12 industrial businesses are subject to UPDES effluent regulations. These industrial businesses include mineral mining plants near the shores of the Great Salt Lake, petrochemical processing plants, specialty processing and manufacturing facilities, large retail and wholesale warehouses, cement and rock products processing plants, and Hill Air Force Base.

Non-Point Source Pollution (NPS) Programs - As required by Section 319 of the CWA, the Division of Water Quality administers a non-point source pollution program to assess NPS water pollution issues. In cooperation with various state and federal agencies, the Division of Water Quality prepares a non-point source management plan and a watershed best management

Figure 12-1
WATER QUALITY MONITORING STATIONS



Station No.	STORET No.
1	492005
2	492299
3	492100
4	492301
5	492320
6	492451
7	492459
8	492460
9	492465
10	492469
11	492470
12	492471
13	492496
14	492504
15	492515
16	492520
17	492523
18	492526
19	492536
20	492544

21	492551
22	492552
23	492554
24	492576
25	492590
26	492593
27	492595
28	492596
29	492607
30	492610
31	492626
32	492629
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practices plan. The Division of Water Quality has also established a priority list of critical watersheds with water quality related problems or issues. The Weber River Basin is included on this list.

In addition to assessing pollution issues and preparing management plans, the NPS program also allows for the implementation of on-site projects to effectively improve water quality in drainages impacted by poor land management practices. The Utah Department of Agriculture and Utah Non-Point Source Task Force play significant roles with the administration of these on-site projects.

12.3.3 Federal Clean Water Act

In 1972, Congress passed the federal Water Pollution Control Act (FWPCA) to establish regulations and programs designed to make significant improvements regarding the quality of the nation's waters. The FWPCA was amended in 1977and became the Clean Water Act (CWA). The CWA amendments provided additional regulations to deal with the growing national toxic water pollutant problem. The act further refined EPA's enforcement priorities and substantially increased the authority to enforce new federal mandates.

In the mid-1950s, the federal government began offering funding programs to state water pollution control agencies to assist in the ongoing construction of wastewater treatment facilities. These early grants provided funding to cover 30 to 55 percent of all construction costs for a given wastewater treatment facility. These federal grants, along with monies provided through the Utah Water Pollution Control Act (UWPCA), funded the construction and expansion of a number of wastewater treatment facilities in the Weber River Basin. From 1972 to 1989, federal and state water quality program grants have provided over $50 million dollars for the construction of wastewater treatment facilities.

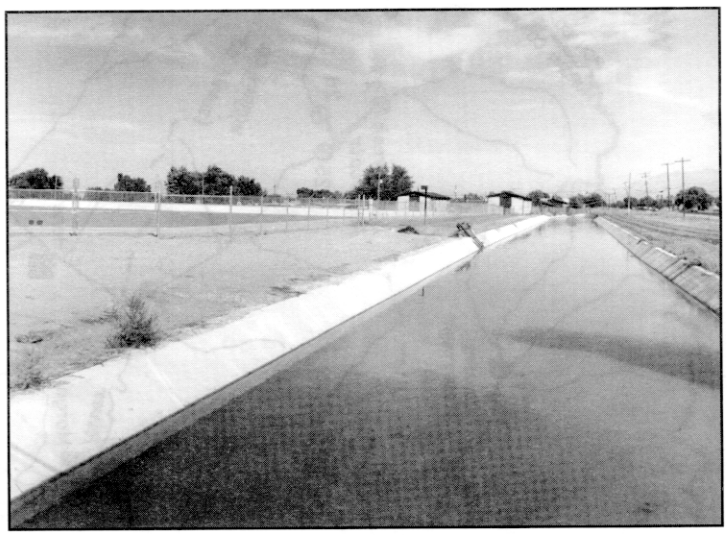
Public expenditures for public works projects drastically decreased by 1990, and most federally sponsored grant programs for the construction and upgrading of wastewater treatment facilities were eliminated. Currently, federal wastewater treatment facility funding is only available through revolving loan programs administered through individual state water quality agencies. State funding, through the Division of Water Quality, has averaged nearly $4 million per year in recent years to construct and improve existing wastewater treatment facilities.

12.4 Water Quality Problems and Needs

Surface and groundwater quality is primarily determined by contaminant loadings from point source and non-point source discharges. Point source pollution comes from wastewater treatment facilities and large industrial processing plants. Non-point source pollution generally comes from natural sources such as runoff from agricultural fields, commercial and residential developments, industrial plants, silvicultural sites, construction sites, and underground septic tanks.

12.4.1 Surface Water Quality

Urbanization of the Weber River Basin has increased the discharge of domestic and industrial wastewaters to surrounding streams and underlying groundwater aquifers. In most cases, these discharges are in full compliance with state and federal regulations. Some areas of rapid growth, however, have generated wastewater return flows that pose potential problems.



Davis-Weber Counties Canal

Surface water quality is monitored at 20 sites located at strategic locations along existing streams, rivers and reservoirs. Water samples taken at these monitoring sites are evaluated for a number of physical, biological and chemical parameters. Results of these water quality evaluations are used to assess the quality of surface waters by the Division of Water Quality. Violations of discharge permit regulations are determined from the results of these evaluations.

Weber River-Lower Reach Below Weber Canyon-The reach of the Weber River from the Great Salt Lake to the Slaterville Diversion generally provides

water quality sufficient for non-game fish, water- related wildlife and food chain organisms, and is classified as 3C and 3D waters. The remainder of this reach provides water quality to support cold water game fish and is classified as 3A.

Recent studies completed by the Bureau of Reclamation and the Division of Water Quality have indicated lower Weber River water is treatable to culinary water standards. However, the cost of treatment, may be too high to support the construction and operation of a water treatment plant at this time. In the event lower basin water is treated to culinary standards, the beneficial use class would need to be changed to Class 1C according to state classification regulations.

Weber River-Weber Canyon to Echo Reservoir - In most instances, the water quality in this reach of the Weber River is considered good to excellent and in compliance with Class 1 uses. But water quality in this reach is threatened by an increased loading of nutrients from the discharge of treated domestic and industrial wastewater from upstream towns and communities.

Wastewater treatment facilities at Mountain Green, Morgan, Henefer and the Snyderville Basin have all experienced substantial increases in collected wastewater flows in recent years. The most acute case of nutrient contamination currently exists in East Canyon Creek and Reservoir. The entire stream is classified as impaired for Class 3A standards. Discharge of treated wastewater with relatively high concentrations of some nutrients by the Snyderville Basin Sewer Improvement District has reduced the dissolved oxygen in portions of the East Canyon drainage. As a result, some eutrophication within East Canyon Reservoir has occurred.

Weber River-Echo Reservoir to Rockport Lake- The water quality between Echo Reservoir and Rockport Lake meets Class 1C and 4 water quality standards, although it is impaired for Class 3A standards. Major water quality concerns include the deteriorated state of Chalk Creek which does not meet Class 3A standards and its impact on downstream reaches of the Weber River. Significant levels of zinc contamination occur in the Silver Creek drainage which has impaired its Class 3A rating. However, Silver Creek does meet the Class 1C drinking water standard with proper treatment.

Data taken from Chalk Creek indicate severe sediment and phosphorous loads are generated from poor land use practices throughout the upper drainage. Overgrazing of agricultural rangeland and the poor maintenance of service roads to existing oil exploration and pumping facilities have contributed to the degradation of water quality and overall condition of the watershed. As a result, the volume and frequency of direct surface runoff events to Chalk Creek have increased substantially.

The Ogden River System-One of the major sources of pollution to Pineview Reservoir is the loading of nutrients from existing irrigation canals and runoff from irrigated fields. The diversion of irrigation water from one drainage to another changes the seasonal flow regimes and inflows to the reservoir. As a result, water quality and nutrient loadings from sub-basin sources increase by comingling watershed runoff with agricultural return flows before discharging to the reservoir.

The most significant threat to water quality at Pineview Reservoir is the migration of shallow contaminated groundwater to the reservoir. Most of the groundwater in the immediate area is subject to infiltration of effluent from residential and commercial septic tanks. Although current water quality in Pineview Reservoir is adequate for culinary treatment and boating-related recreation, the potential for excessive nutrient loading exists and should be evaluated on a regular basis.

12.4.2 Groundwater Quality

The contamination of existing groundwater aquifers has become an issue at Hill Air Force Base (HAFB). Toxic and carcinogenic elements have been found in groundwater samples taken within base boundaries. The level of contamination to the immediate and surrounding groundwater aquifer has been evaluated by private consultants and the Army Corps of Engineers. Currently, HAFB site-environmental personnel are in the process of implementing a number of long-term solutions to manage the extent and spread of existing groundwater contaminants. These solutions include the construction of a slurry trench to cut off the further spread of contaminated groundwater to surrounding communities, the construction of underground drainage systems to intercept contaminated groundwater, and the installation of extraction wells to control groundwater gradients. The clean-up program is expected to require 50 years to achieve total confinement of on-base contaminated groundwater.

12.4.3 Great Salt Lake Basin Water Quality Study

The U.S. Geological Survey started the *Great Salt Lake National Water Quality Assessment (NAWQA)* study in 1996. The program is funded by the federal

government and includes the drainage basins of the Bear, Weber and Jordan rivers. The long-term goals of the NAWQA program are to describe the status of and trends in the quality of a large, representative part of the nation's surface and groundwater resources. The program is intended to produce a wealth of water-quality information that will be useful to policy makers and managers at the federal, state and local levels.

12.5 Alternative Solutions

Water quality problems in the Weber River Basin are well documented in various studies and reports by local, state and federal regulatory agencies. These reports and studies have outlined a number of actions that can be taken to improve or mitigate existing problems associated with declining water quality. The final solution of existing water quality problems requires the implementation of the recommendations given in these studies.

12.6 Issues and Recommendations

Water quality issues in the Weber River Basin are centered around poor land management practices and the overall urbanization of the basin. Significant issues include continued overgrazing of rangeland, excessive return flows to existing streams from irrigated agricultural lands, excessive contaminant discharge from existing wastewater treatment facilities, deterioration of existing stream channels, and poor land management practices associated with oil and gas exploration and mining.

12.6.1 Excessive Nutrient Loadings at East Canyon Reservoir

Issue-Increased domestic wastewater outflow and watershed runoff from the Snyderville Basin has caused a measurable decline in water quality and created some eutrophication in East Canyon Reservoir.

Discussion-Within the Snyderville Basin, increased residential growth has resulted in excessive nutrient loads to local wastewater treatment facilities. Although domestic wastewater is treated to full secondary standards, excessive nutrient loads have been passed from local treatment facilities to East Canyon Creek and Reservoir. This increase in nutrient loading has resulted in reduced dissolved oxygen and eutrophication in East Canyon Reservoir. The severity of the problem is currently under study through a joint effort between the Weber Basin Water Management Council and the Division of Water Quality. Preliminary data indicate a continuation of current nutrient loading rates to East Canyon Creek will eventually result in a deterioration of the existing fishery at East Canyon Reservoir and degradation of water quality within the lower watershed.

The Snyderville Basin Sewer Improvement District may be required to install tertiary treatment facilities at its two wastewater treatment plants discharging to the East Canyon and Silver Creek drainages.

Recommendation-The Weber Basin Water Quality Management Council and the Division of Water Quality should develop an action plan to monitor the nutrient impact on East Canyon Creek.

12.6.2 Chalk Creek Land Use Management and Water Quality

Issue- Sediment loading has reduced water quality in Chalk Creek to levels in violation of state standards established for Class 3 cold water fisheries.

Discussion-The Chalk Creek drainage has been identified as a critical watershed by a recent non-point source management plan (NPSMP) prepared through a cooperative effort of several local, state and federal water quality agencies. The NPSMP identified a number of water quality problems including 1) the loss of watershed cover through overgrazing of rangeland by livestock and wildlife, 2) construction and poor maintenance of access roads and facility installations associated with oil and gas exploration activities, and 3) erosion of existing channel banks due to inappropriate channel maintenance activities. Current land use practices and mining activities have resulted in excessive sediment loads. Sediment loading rates in Chalk Creek and deposits in Echo Reservoir need to be reduced so thatwater quality will meet state Class 3 standards.

Recommendation-The Chalk Creek Steering Committee and other appropriate entities should accelerate the implementation of the *Coordinated Resource Management Plan* to reduce sediment loads.

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Section 13 Contents

Figures

13 SECTION

Disaster and Emergency Response

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Natural disasters strike with little or no notice; and, in too many instances, result in significant property damage and loss of life. However, the extent of damage and personal injury can be minimized through adequate preparation.

13.1 Introduction

Natural disasters are random events that can occur at any point in time and location. As random events, major natural disasters are too often associated with the distant future. As a result, there can be a sense of false security between private individuals and some public agencies regarding the timing, location, and level of damage that may be generated from a major disaster.

Coordinated disaster response programs need to be established by local, state, and federal agencies that provide basic life supporting services in times of extreme emergencies. These programs should be constantly reviewed and upgraded to deal with the ever-changing potential of property damage and personal injury.

This section of the *Weber River Basin Plan* discusses the extent of existing emergency response programs including basic disaster related information and data pertinent to the Weber River Basin. Specific discussions include 1) most common, or probable, types of disasters associated with the construction and operation of water related facilities; 2) organizations and programs that provide public assistance in the event of major disasters; and, 3) measures that can be taken to lessen the extent of property damage and personal injury.

13.2 Background

The history of "water-related" natural disasters in the Weber River Basin includes a number of major flood and drought events. The floods of the early 1980's resulted in millions of dollars in property damage to homes, businesses and a number of public utilities. In recent memory, the drought year of 1977 resulted in record low water levels within a number of basin reservoirs; which subsequently threatened the implementation of restrictions on a number of domestic and commercial water use primarily in Weber and Davis counties.

Although the floods and droughts of the recent past have caused significant property damage, inconvenience and in some cases, personal suffering, future disasters of even greater magnitude and scope of destruction have a very real possibility of occurrence. The flood and drought events that have occurred in recent years have all been considered as roughly 100-year events. However, it is not statistically out of the question to expect disasters exceeding 100-year events within the immediate and foreseeable future. Most construction standards and design criteria require major dams with a high potential for property damage and loss of life to withstand natural catastrophic disasters. However, such high levels of protection for other flood control measures are often cost and/or environmentally prohibitive to build.

Although flood and drought are most commonly associated with major disasters within the intermountain area, perhaps the greatest potential for an extreme disaster is from the failure of one or more dams in the event of a severe earthquake. Northern Utah is home to a number of faults that have been relatively quiet for a number of years with the exception of the 1962 Cache Valley quake that resulted in more than $1.0 million in property damage. Although the Cache Valley event was significant in terms of property loss, it was not significant in terms

of intensity. The quake was measured at 5.2 on the Richter scale which is generally considered as below a level of intensity that may potentially cause extensive damage to large dams and other public works facilities.

The lack of significant seismic activity in the recent past cannot be considered as a sign of minimal or insignificant activity in the foreseeable future. Although no one can accurately predict seismic activity, it is commonly accepted that as time progresses with little or no activity, the likelihood of a major seismic event in the immediate future escalates. The occurrence of a major seismic event with the intensity sufficient to cause structural damage to basin dams is not beyond what can be expected given existing geologic conditions.

Most public agencies and private organizations have developed comprehensive emergency response and management plans that effectively incorporate the combined resources of local, state and federal agencies when major disasters strike. Where there are no plans, definitive action should be taken at the earliest point in time to develop them. The development of a natural disaster plan usually starts with aggressive public awareness campaigns designed to generate the support of all citizenry impacted by a potential natural disaster.

13.3 Organizations and Regulations

The Division of Comprehensive Emergency Management (CEM) is responsible for generating interest and developing emergency response and management plans. Under the direction of CEM, towns, cities and counties are to prepare emergency response and management plans that are comprehensive in scope but allow for effective and close cooperation with state and federal agencies in the event of a major disaster beyond local capabilities. CEM also works closely with other state and federal agencies to assure needed manpower, equipment, materials and funding reach areas seriously impacted by a major disaster.

The initial response to a natural disaster is the responsibility of local city and county agencies. Other agencies, including state and federal agencies, get involved after the initial response. These agencies are normally responsible for the long term management of a natural disaster and work within established procedural guidelines and organizational structures. State and federal support agencies include the Federal Emergency Management Agency (FEMA), the Governor's Office, and the heads of all state departments and divisions.

Of particular importance is the National Flood Insurance Program (NFIP) administered by FEMA. The NFIP facilitates the ability of private insurance companies to reconstruct damaged or destroyed personal property after major flooding events. Although the NFIP offers considerable benefits to local communities, participation in the program is not mandatory. Communities that do not participate in the NFIP make it difficult, if not impossible, for business entities and private individuals to secure federal flood insurance and loans on municipal and commercial developments.

Communities in the Weber River Basin currently participating in the National Flood Insurance Program (NFIP) include the cities of Bountiful, West Bountiful, Centerville, Clearfield, Farmington, Fruit Heights, Kaysville, Layton, North Salt Lake, Woods Cross, Morgan, Coalville, Kamas, Oakely, Park City, Ogden, North Ogden, Plain City, Pleasant View, Riverdale, Roy, South Ogden, and Uintah. In addition, all four of the counties actively participate in the NFIP.

Other individuals, agencies, public and private organizations that wish to be covered under the program should initiate the process by expressing their concerns to local public officials. To obtain flood insurance under the NFIP, counties or cities must pass FEMA approved flood plain ordinances. When these ordinances are in place, private insurance companies can sell flood insurance at lower rates.

13.3.1 Local

To provide an effective "first response" to a natural disaster, local governments have been directed by both state and federal disaster management agencies to:

- prepare an operations plan for the coordination of local and county emergency responses with appropriate federal and state agencies;
- provide the necessary resources (including special supplies and equipment) to support natural disaster emergency relief operations and list these resources, indicating the procedures to be followed for obtaining the assistance and/or use of resources in the emergency operations plans;
- assign and train personnel required to perform natural disaster relief functions;
- provide the State Disaster Coordinating Officer (SDCO) with copies of current emergency operations plans; and
- recommend changes to state and local government emergency disaster relief procedures and assigned functions whenever deemed necessary.

In the event of a disaster, assistance is first rendered by local agencies with additional assistance provided by state and federal agencies as needed. The first local response is directed by the assigned Local Disaster Coordinating Officer who is responsible for coordinating all efforts by local fire departments, police, emergency medical staff and utility agencies. The Local Disaster Coordinating Officer will establish a local operations center from which to direct all emergency and first response efforts and to report the status of all assistance and relief efforts to state and federal authorities.

13.3.2 State

As part of the Utah's overall disaster response plan, selected state agencies should develop individual plans compatible and consistent with their full-time assigned responsibilities. The plan should outline specific procedures offering assistance and aid to reconstruct or reestablish damaged facilities.

In the event property damage and personal injury exceed the capability of local agencies, the governor, at his discretion, can declare a "State of Emergency" and provide state assistance and request federal assistance. Once a "State of Emergency" is declared, the Governor's State Disaster Coordinating Officer (SDCO) assumes all responsibility over the process of distributing both state and federal assistance to local disaster victims. The SDCO will work with, and generally manage, the activities of local disaster coordinators so assistance and aid are properly distributed to disaster victims in an efficient and timely manner.

The SDCO also serves as the governor's primary point of contact for all disaster related correspondence and general information between the Federal Coordinating Officer and state and local government disaster management officials.

13.3.3 Federal

The National Flood Insurance Program (NFIP) was created by Congress in 1968 to reduce the loss of life and property and rising disaster relief costs resulting from severe flooding events. The program was designed to achieve a number of objectives to lessen the impact of a major natural disaster. A more detailed discussion about the NFIP is offered in the State Water Plan.

When a state of emergency is declared by the governor, additional assistance can be requested at the federal level. At this point, the President can declare a "Federal Emergency" or "Major Disaster." This makes the impacted state eligible for federal emergency assistance through FEMA programs under Public Law (PL) 93-288. The assistance is generally distributed to individuals and public agencies in immediate need of help.

A "federal emergency" is limited to funding that may be required to save lives, protect property, restore essential public services that threaten public health, or reduce the threat of further loss of property and personal injury. A "Major Disaster" provides funding to restore both public and private damaged property and to change existing conditions, either manmade or natural, that would contribute to future disasters of the type and magnitude previously experienced.

Aid and assistance from these federal disaster programs must be distributed under the direction of the Federal Coordinating Officer in direct cooperation with both the Federal Emergency Management Agency (FEMA) and the State Disaster Coordinating Officer (SDCO). At the local level, administration and distribution of assistance will be the responsibility of state and federal personnel assigned to the disaster field offices.

13.4 Flooding

The most common natural disasters within the Weber River Basin are flooding events. Major flooding has occurred from its initial settlement to the most recent events of the mid-1980s. The Weber and Ogden rivers are prone to regular flooding ranging in magnitude from localized short duration and manageable flows to major out-of-bank events. Flooding has occurred throughout the basin in both the upper and lower drainages. Major flooding has resulted in substantial property damage in Morgan, Coalville, Snyderville Basin and Kamas within the upper Weber River drainage. The lower drainage is prone to major flooding events primarily within small and isolated drainages along the western foothills of the Wasatch Front.

13.4.1 Weber and Ogden River Systems

The completion of three major water reclamation projects in the Weber and Ogden rivers have effectively reduced the frequency of major flooding events in the lower portions of the drainage. However, isolated instances of flash flooding and high releases from local reservoirs have occurred during years with exceptionally high runoff. Property damage that can be associated with periodic high releases from basin reservoirs can be minimized through the passage of stricter zoning

ordinances and scheduled improvements to critical drainages with hydraulic deficiencies.

The reclamation projects completed within the Weber River Basin include multipurpose dams and reservoirs which provide flood control. The combined annual flood storage within the major basin reservoirs is in excess of 300,000 acre-feet which has had a significant impact on the magnitude of flooding in the lower Weber River system.

In general, flood maps and regulations dealing with the commercial and residential development of land within known flood plains are based on 100-year events. The 100-year flood event for the Weber River has been estimated by the Corps of Engineers at 8,300 cfs upstream of the Ogden River confluence and 8,500 cfs downstream of the confluence. Figure 13-1 shows the 100-year flood plain from the mouth of Weber Canyon to its intersection with U.S. Highway 89. More details are given in FEMA maps provided for the NFIP.

Although the construction of major water storage and flood control dams and reservoirs have reduced the potential for major flood events, the danger of significant property damage and personal injury still exists. As an example, flash floods in the low lying East Shore Area have occurred in recent years causing significant property damage. These storms are typically caused by intense, isolated rainfall events, or by the rapid melt of snow packs at moderate to low elevations within the upper watersheds of the basin. Flooding in these areas usually results in the spreading of flood flows over a relatively wide area. The exceptionally wet springs of 1983 and 1984 resulted in excess flood flows in both the Ogden and Weber rivers causing millions of dollars in property damage.

Before the completion of Pineview and Causey reservoirs in 1957 and 1964 respectively, periodic flooding on the Ogden River downstream of the mouth of Ogden Canyon generally ranged in magnitude from 1,000 to 3,000 cfs. Major flooding occurred on February 5, 1907 and April 24, 1936 with recorded peak flows at the mouth of Ogden Canyon near 3,300 and 3,700 cfs, respectively.

Flooding on the Ogden River occurs within Ogden Canyon and along its existing alignment through residential and commercial areas within Ogden City. Flooding within the canyon is generally confined within existing river banks and may encroach on several homes within existing flood sections of the river. Flooding within Ogden City may cause damage to homes, commercial businesses, and city operated parks adjacent to the river. A flood plain map of the Ogden River 100-year flood event is shown on Figure 13-2.

13.4.2 Great Salt Lake

Historically, the Great Salt Lake has reached elevations at or near the indicated record of 4211.6 over two extended time periods: a 10-year period from 1868 to 1878 and a brief two-year period from 1986 to 1987. The approximate one-hundred year period between the historic high water levels was marked by a considerable amount of agricultural, commercial and residential development along shore lines established by lake elevations considerably lower than the stated historic high water level. As a result, significant property damage occurred during the runoff years of 1986 and 1987. Some of the most severe damage occurred in western Weber County. Over $40 million property damage was documented at industrial plants owned and operated by Western Zirconium and Great Salt Lake Mineral companies.

13.5 Drought Problems

The Weber River Basin can be subjected to extended drought periods that potentially threaten basin water supplies to agricultural, municipal, commercial and industrial users. Extended droughts have occurred on a somewhat regular basis since the turn of the 19th century; the most severe of which occurred during the 1930s, early 1960s and mid 1970s. Primarily due to the carry-over storage capacities of the major reservoirs, rationing has never been required to meet domestic and commercial water demands in the basin.

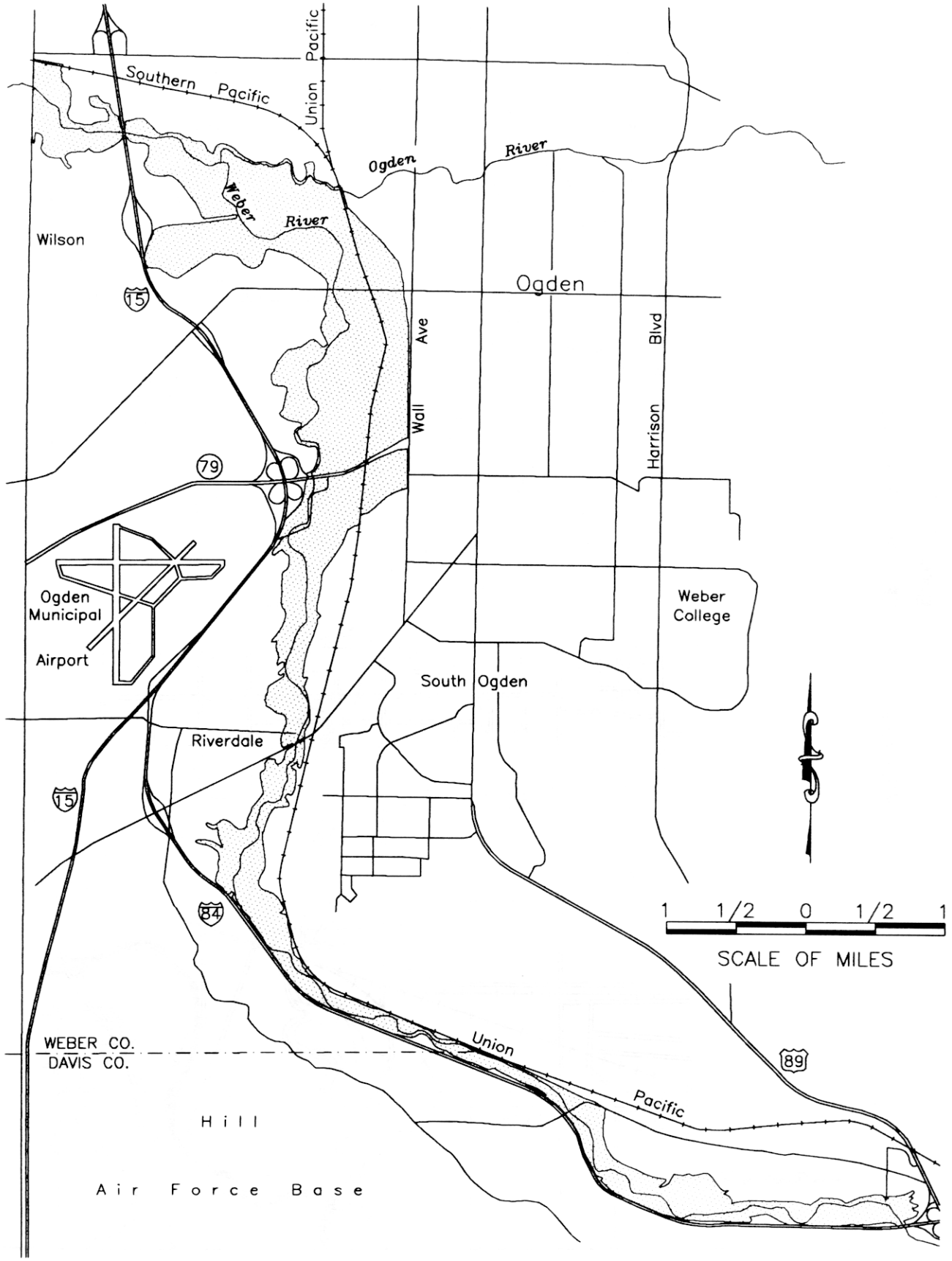
In consideration of the current rate of growth in the state, and need for reliable sources of water in times of drought, the state has drafted a drought response plan to manage the impacts of an extended drought. The plan requires the cooperation of all state and local water-related agencies to achieve a number of common drought management objectives. More information regarding the various organizations involved with the plan, their individual responsibilities, and overall objectives can be obtained from either the Division of Water Resources or through the Department of Public Safety, Division of Comprehensive Emergency Management.

13.6 Earthquakes

Perhaps the most threatening natural disaster in the Weber River Basin is the possibility of a major earthquake. Not only would a major seismic event create a substantial loss of basic utility and transportation

Figure 13-1

LOWER WEBER RIVER 100-YEAR FLOOD PLAIN



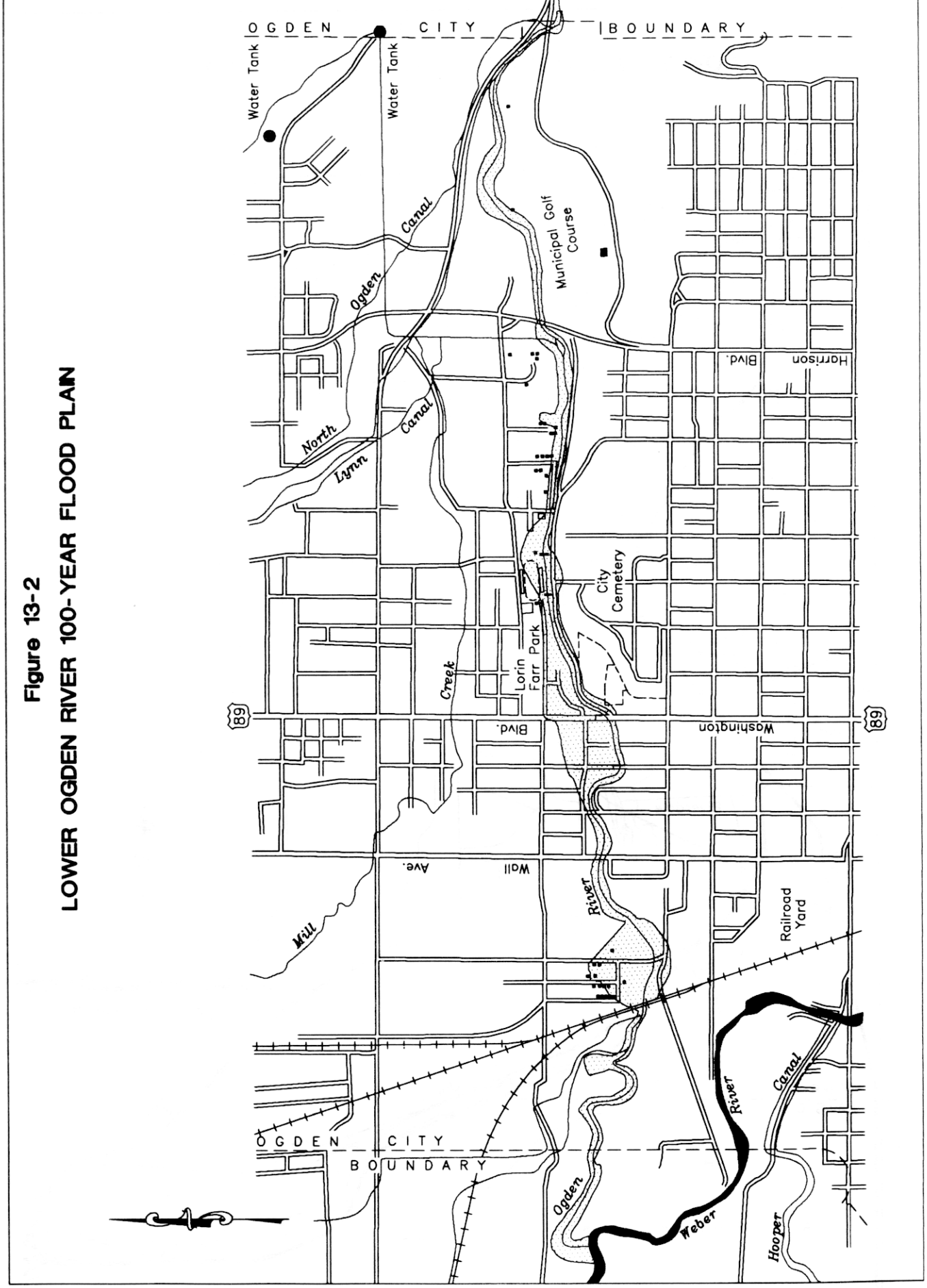


Figure 13-2
LOWER OGDEN RIVER 100-YEAR FLOOD PLAIN

service, but more significantly, it would possibly threaten the structural integrity of a significant number of local dams. With the exception of Smith & Morehouse Dam, the initial design of all existing dams on the Weber and Ogden rivers did not take into consideration failure by extreme seismic activity. Recent studies have shown the loss of one dam on either the Weber or Ogden River system would cause deaths in the range of 5,000 to 10,000 people with little or no warning.

To address the issue of seismic-related dam failures, the Bureau of Reclamation is currently re-evaluating the structural integrity of all federal dams within the basin against possible failure by extreme seismic events. These investigations have resulted in both recommendations for structural improvements and actual modifications to existing dam facilities. The most recent structural modification occurred at Pineview Dam in the Ogden Valley in 1992. Bureau investigations determined that additional fill was needed at the base of the existing dam to reduce the probability of failure by liquefaction.

Structural modifications may be required at other basin dams depending on the findings of the bureau's ongoing investigations. Major fault lines occur throughout the basin and within relative close proximity to most of the major dams. Figure 13-3 is a graphical representation of these fault lines and their relative locations to existing major dam sites.

13.7 Drought Damage Reduction Alternatives

Drought reduction alternatives generally fall in two categories: precipitation augmentation and water conservation in drought years. The former actively promotes programs to increase the amount of snow pack by cloud seeding. The later attempts to establish minimum carry-over storage goals or guidelines within existing reservoirs during extended drought periods.

It has been shown that effective cloud seeding programs increase the average annual snowpack within most watersheds by 10 to 15 percent. In the Weber River Basin, the stated increase can amount to tens-of-thousands of acre-feet of additional water supplies per water year. A more detailed discussion of cloud seeding in terms of individualized programs and projected effectiveness can be found in Section 9 Water Planning and Development.

Water conservation should always be practiced regardless of the potential for drought. Until a method is devised to accurately predict drought, managers and planners of public water systems need to actively promote water conservation within their respective service areas. This promotional effort should address water use by industrial and commercial businesses in addition to typical conservation programs for residential developments. More information on water conservation including established programs aimed at conserving water for most domestic and commercial uses are given in Section 17 Water Conservation/Education.

13.8 Mitigation Alternatives

In order to minimize the loss of life and property damage associated with major natural disasters, emergency response teams must be totally informed regarding the scope and magnitude of all possible disasters that could potentially impact a given area and be prepared to effectively execute emergency response plans within very limited time frames.
As a minimum, emergency response teams should:

- work with local, state, and federal agencies to maintain an adequate level of knowledge regarding the scope and magnitude of potential water related disasters;
- actively recruit the involvement of local, state and federal agencies to formulate emergency response plans and to take an active role in implementing emergency response plans when the need arises;
- continually assess the need to incorporate new and more effective telecommunication, medical, evacuation and general survival equipment and/or hardware with the overall execution of response plans; and
- actively promote education programs designed to inform private citizens on how to prepare for and survive during a major disaster.

13.9 Issues and Recommendations

The main issue associated with natural disasters and the execution of related emergency response plans is generally associated with the level of preparedness and/or training of emergency response personnel. Of primary importance is the development and execution of flood management plans design to mitigate excessive property damage and personal injury.

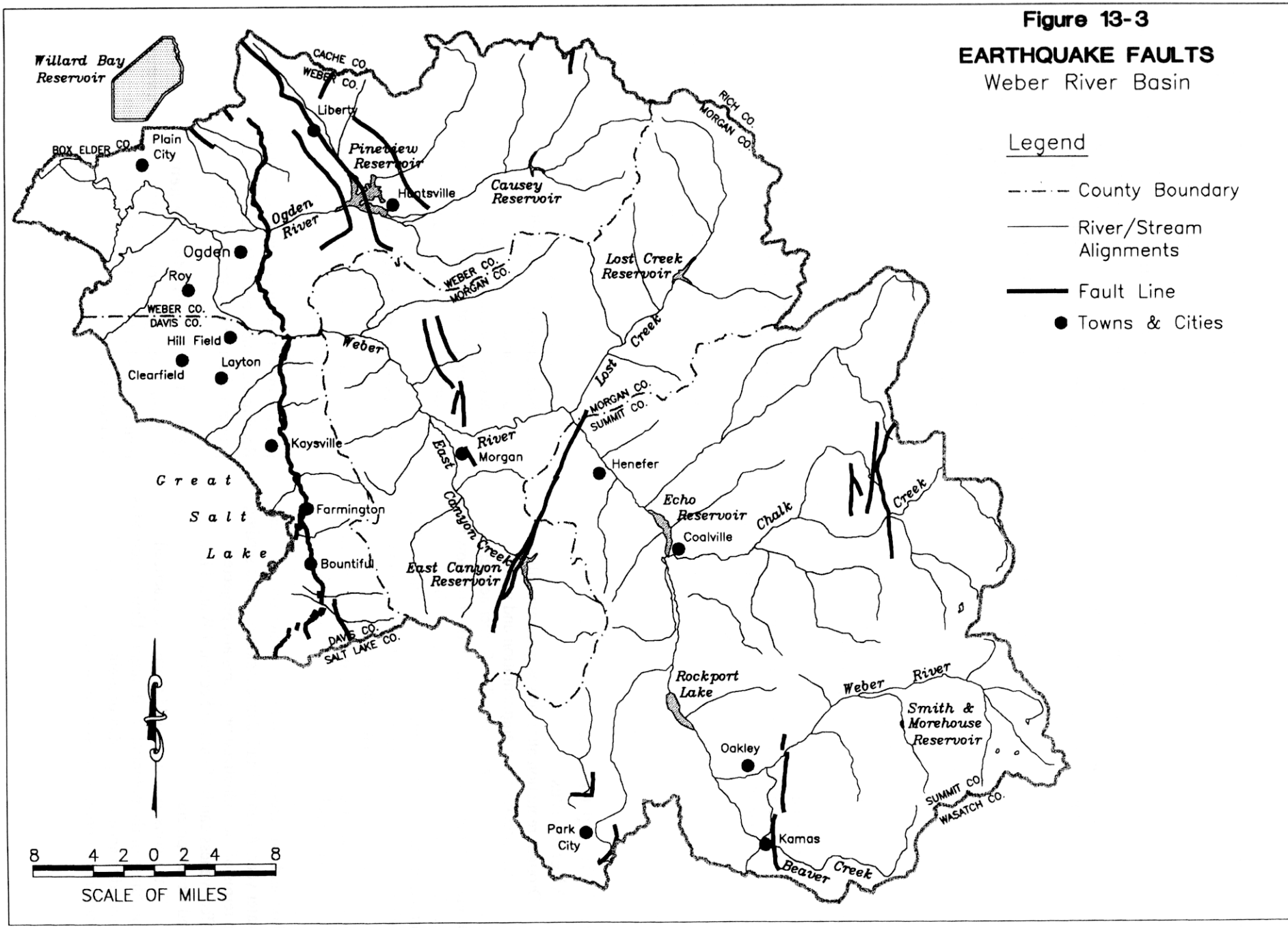
13.9.1 Flood Plain Management

Issue-Local governments need to become aware of their responsibilities as it relates to flood plain management.

Figure 13-3

EARTHQUAKE FAULTS

Weber River Basin



Discussion-The National Flood Insurance Program (NFIP) was established by Congress in 1968 as a result of large federal outlays for structural regulations within established flood plains and disaster relief. Its purpose is to reduce flood loses; prevent unwise development in flood plains; and provide affordable flood insurance to the public. Local entities should conduct educational programs on flood hazard awareness and the benefits of participation in the NFIP.

In the event a community agrees to enact and enforce minimum floodplain management requirements as stated in the Code of Federal Regulation (CFR) Part 60.3, NFIP flood insurance is made available to private citizens to offset costs associated with a major flood.

State and federal agencies have been assigned the responsibility of assisting local communities to develop and implement comprehensive flood insurance programs. The Division of Comprehensive Emergency Management is the State Coordinating Agency for the NFIP. In this capacity, the division can assist local participating communities in the implementation of the floodplain management objectives defined by the NFIP. In addition, the Corps of Engineers, through its Flood Plain Management Program, can develop or update flood plain boundary maps at no cost for those communities in need.

Recommendation-Non-participating local entities should become qualified to participate in the National Flood Insurance Program. The Division of Comprehensive Emergency Management and Corps of Engineers can assist communities to obtain these objectives.

13.9.2 Disaster Response Plans

Issue-All communities should have a disaster response plan.

Discussion-Local governments need to increase their ability to respond to natural disasters and emergencies. Emergency Operations Plans (EOPs), also referred to as Disaster Response Plans, address disaster response and recovery activities. These plans should be prepared ahead of time allowing counties, cities and towns to coordinate efforts and define responsibilities. Decisions should be made on leadership positions and activation of response activities. Emergency Action Plans (EAPs) have also been developed, or are in the process of being developed, for all dams in the state. The Division of Comprehensive Emergency Management reviews the private dam EAPs to ensure an adequate call down list is incorporated. This review is done in cooperation with the Office of the State Engineer, Dam Safety Section.

The Division of Comprehensive Emergency Management has the statewide responsibility of planning for, responding to, recovering from and mitigating emergencies. They have developed statewide plans for disaster response. This agency can assist local entities prepare response plans for emergency situations.

Recommendation- Local communities should develop disaster response plans with the assistance of the Division of Comprehensive Emergency Management. ❖

Section 14 Contents

14 SECTION

Fisheries and Water-Related Wildlife

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The value of maintaining adequate populations of fish and wildlife species can be measured in terms of preserving the ecological balance and, perhaps just as important, in terms of providing quality recreational opportunities.

14.1 Introduction

This section of the *Weber River Basin Plan* discusses the current and projected status, or quality, of fisheries, wildlife and related habitat. Discussions presented also include a number of recommendations to optimize the development and use of water resources in a manner that promotes the long-term well-being of fish and wildlife.

The Weber River Basin is the home of hundreds of miles of rivers and streams, eight major reservoirs, thousands of acres of wetlands and four major waterfowl management areas. As a result, there is truly an abundance of quality habitat for fish and water-related wildlife.

The value of fish and water-related wildlife is difficult to measure. Some studies have indicated that hunting, fishing and a number of other water-related outdoor activities contribute millions of dollars to the local economy. Economics, however, is not the full measure of value associated with fish and wildlife. Maintenance of existing fish and wildlife populations and related habitat is of equal importance.

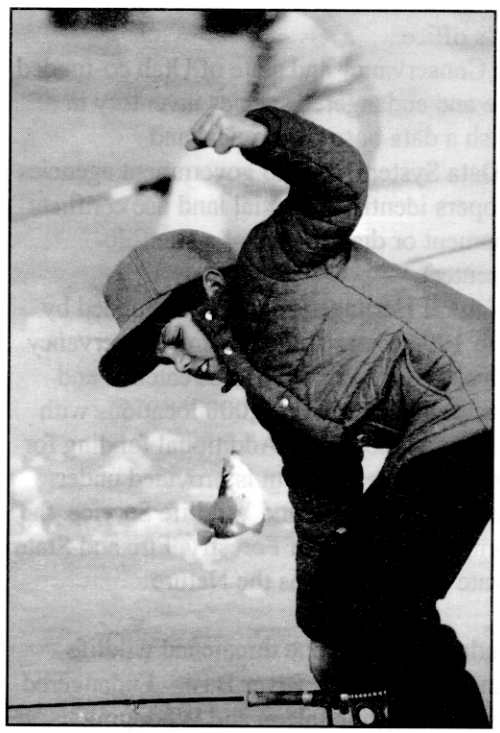
14.2 Setting

The Weber River Basin includes a variety of landscapes and habitat for fish and wildlife species common to northern Utah. The physical characteristics vary from high mountain valleys with cold winter months and high accumulations of snow to low-lying plains with relatively hot summer months and moderate precipitation.

14.2.1 Fish and Wildlife Species

Recent estimates indicate that 247 species of mammals, 46 species of reptiles, 13 species of amphibians, 436 species of birds and nearly 40 species of fish are found in the Weber River Basin. Of the total 782 species, nearly all require constant access to water-related environments.

Species of fish are categorized as warm or cold water and sport or non-sport. Figure 14-1 lists the warm and cold water sport fish and identifies reaches of streams, rivers and reservoirs where each



Ice Fishing at Willard Reservoir

species can be found. Birds species common to the Weber River Basin can be categorized into three basic groups: upland game birds, waterfowl and non-game birds. Several naturally occurring species of hunted game are in the basin.

Of primary interest, or concern, are fish and wildlife species categorized as "threatened and endangered." These species have been judged as in danger of extinction throughout all or a significant portion of its range. As such, threatened and endangered species are protected by federal and some state regulations. The Endangered Species Act (ESA) strictly prohibits any person or agency to "take" (killing or harassment) any federally listed threatened or endangered species.

The ESA does not directly apply to the operation of non-federal water projects or the development of water by non-federal organizations as long as the related operations and water development activities do not require federal permits. In general, owners and operators of non-federal water projects and facilities are not subjected to restrictions regarding the impact on fish and wildlife during the normal and ongoing operation of a given project. Exceptions to this rule include all activities that result in the "taking" of threatened and endangered species and certain limitations on development associated with the River Keeper Program developed by Weber County. Details regarding the River Keeper Program can be obtained from the Weber County Commissioner's office.

The Nature Conservancy and state of Utah co-funded a statewide rare and endangered species inventory in 1988 to establish a data base (Biological and Conservation Data System) to help government agencies and land developers identify potential land use conflicts prior to development or disturbance of a site (bio-diversity data center).

The Utah Natural Heritage Program was funded by the legislature in 1990 to assist the Nature Conservancy and the state identify sites sensitive to threatened and endangered species. To date, over 2,000 locations with rare species have been identified. Additional funding for the Utah Natural Heritage Program is provided under partnerships with the U.S. Fish and Wildlife Service, the State Arboretum, the Division of Forestry, Fire and State Lands and private entities such as the Nature Conservancy.

Only two endangered and one threatened wildlife species are found in the Weber River Basin. Endangered species include the Peregrine falcon and Whooping crane. The Bald eagle is the only threatened species of the group. Candidates for official listing as either threatened or endangered species include the Mountain plover, Ogden Rocky Mountain snail and Spotted frog.

In addition to prohibiting the general "taking" of a threatened or endangered species, the ESA can require any individual, private organization or public agency involved in the development and use of water within a given drainage basin to implement a broad range of actions to mitigate any and all potential negative impact on a threatened or endangered species or any species considered as a candidate for threatened or endangered status.

In the event federal permits are required to develop a water source or make revisions to existing system operations, the Fish and Wildlife Service (FWS) will review the scope and overall intent of the proposed project or change in operations to assess the impact on fish and wildlife within the immediate area.

14.2.2 Fisheries

The Weber River Basin supports one full-time state operated fish hatchery located at Kamas that produces cold water sport fish stock for a number of reservoirs in and outside the basin boundaries. The basin also supports a number of rivers, streams and reservoirs that are considered prime fisheries for cold and warm water sport fish. Cold water sport fish include most species of trout and a few species of salmon. Warm water sport fish species include walleye, common species of perch, bass, crappie, blue gill, catfish and others. Locations of fish species are shown in Figure 14-1.

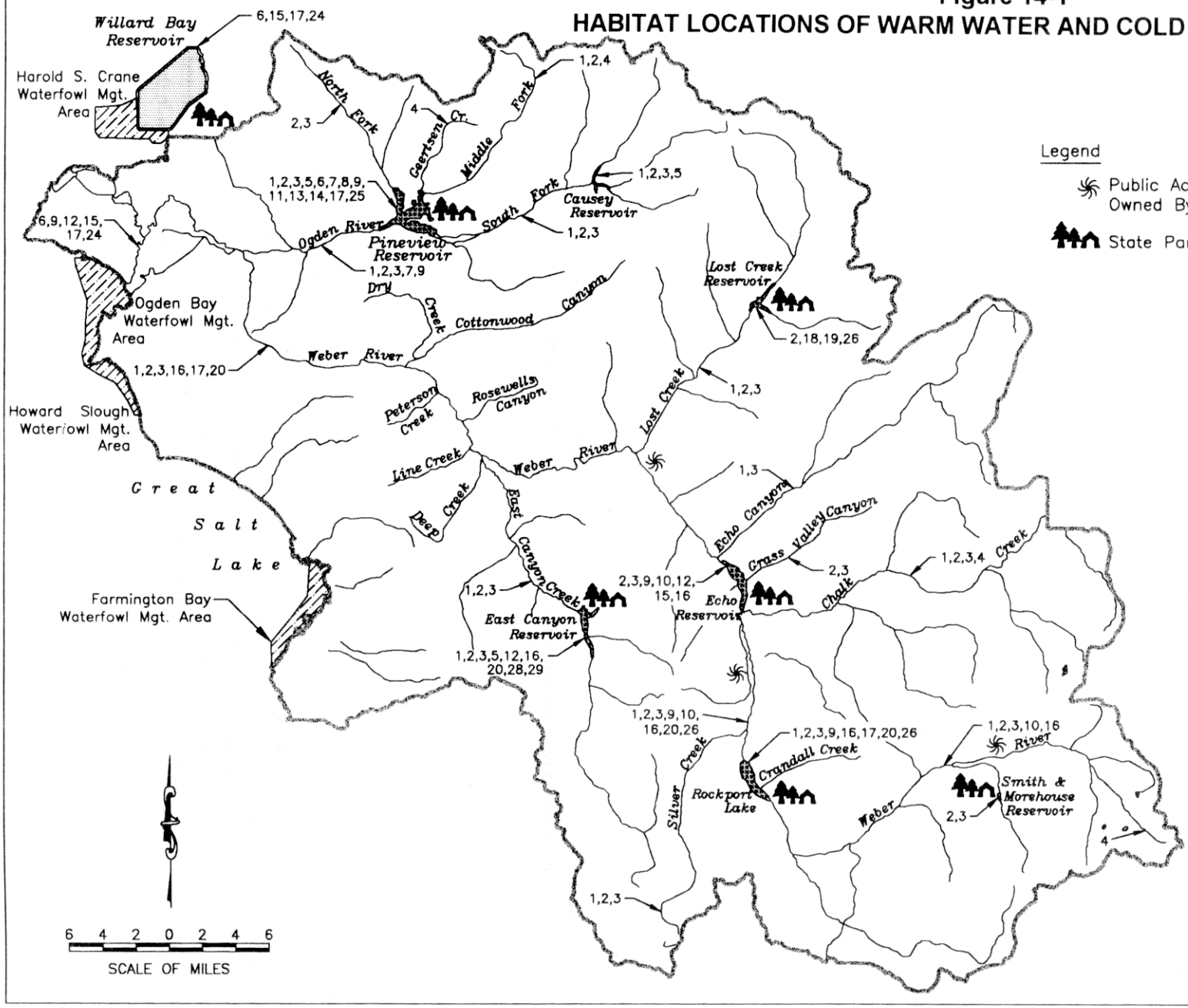
14.2.3 Waterfowl Management Areas

The Weber River Basin is noted for its exceptional waterfowl habitat, especially along the shores of the Great Salt Lake. To develop this resource to its fullest potential, four waterfowl management areas have been established within the marshes and wetlands along the shores of the Great Salt Lake from Plain City to West Bountiful. These areas are managed by the Division of Wildlife Resources and include Harold S. Crane, Howard Slough, Ogden Bay and Farmington Bay.

14.2.4 Habitat

The single most important factor in maintaining healthy and substantial populations of fish and wildlife is the condition of their environment or habitat. The overall habitat is influenced by the existing ecological system, level of domestic and commercial contamination and level of human intrusion.

Figure 14-1
HABITAT LOCATIONS OF WARM WATER AND COLD WATER SPORT FISH



Ref. #	Names
1	Brown Trout
2	Rainbow Trout
3	Cutthroat Trout
4	Bonneville Cutthroat
5	Kokanee Salmon
6	Walleye
7	Yellow Perch
8	Largemouth Bass
9	Smallmouth Bass
10	Mountian White Fish
11	Bluegill
12	Crappie
13	Black Crappie
14	Bullhead Catfish
15	Channel Catfish
16	Utah Sucker
17	Carp
18	Bear Lake Cutthroat
19	Mountian Sucker
20	Redside Shiners
21	Spottail Shiners
22	Sand Shiners
23	Log Perch
24	Gizzard Shad
25	Tiger Musky
26	Utah Chub
27	Cutbows
28	Snake River Cutthroat
29	Green & Flannel Mouth Suckers

The natural climate, abundance of water and construction of water storage facilities have created exceptional habitat for a wide variety of fish and wildlife. However, the continued growth and resultant demand for water and land is in direct conflict with the needs of some fish and wildlife species.

The legislature passed *Title 73-3-3, Utah Code Annotated* in 1987 allowing the Division of Wildlife Resources to file for minimum instream flow rights for the preservation of fish species. The legislation further allows the division to file requests for permanent changes and use of an existing water right in order to preserve critical fish habitat and to generally provide for the permanent enhancement of the state's stream and river fisheries. Table 14-1 provides instream flow data.

Most of the state's fish and wildlife are protected by law. As a result, it is critical that planners and managers of water projects cooperate with fish and wildlife specialists to find workable solutions to fish and wildlife habitat problems. This could include the establishment of instream flows in rivers and streams, water rights for wetlands, and water quality standards in all fisheries.

14.3 Organizations and Regulations

Several local, county, state and federal agencies are involved in fish and wildlife issues, laws, regulations and management of water-related facilities. These public agencies also work very closely with a number of private organizations to protect fish and wildlife and related habitat.

14.3.1 Local

Local agencies involved with the maintenance of fish and wildlife generally include a number of city and county agencies or subdivisions of water districts.

Weber Basin Water Conservancy District- The district's primary function is to provide water to agricultural, municipal and industrial water users. In so doing, the district also has the responsibility to operate and maintain major project water storage, distribution and treatment facilities.

By various agreements involving the Bureau of Reclamation, Division of Wildlife Resources, U.S. Fish and Wildlife Service and Ogden River Water Users Association, the district provides 1) instream flows within most reaches of both the Ogden and Weber rivers downstream of existing project reservoirs, 2) minimum annual diversions to the Ogden Bay Waterfowl Management Area, and 3) support efforts by state and federal agencies to maintain acceptable levels of water quality in the reservoir fisheries.

By contract with the Bureau of Reclamation, the district is required to provide 60,500 acre-feet annually to the Ogden Bay Waterfowl Management Area. The diversion is made from the Weber River at the district's Slaterville diversion.

14.3.2 State

The state of Utah is home to an abundance of game and non-game species of fish and wildlife. The populations of all fish and wildlife are closely monitored and managed by the Division of Wildlife Resources. The division is legislatively charged with the responsibility to protect, propagate, manage, conserve and distribute protected wildlife throughout the state. The division prepares proclamations establishing annual fishing and hunting guidelines. The division is also responsible for the management of major state-funded waterfowl management areas. These areas include Harold S. Crane, Ogden Bay, Howard Slough and Farmington Bay waterfowl management areas in the Weber River Basin.

14.3.3 Federal

The completion of three federal reclamation projects have created or enhanced a number of exceptional fisheries in the Weber River Basin. In cooperation with several local water provider agencies, the Bureau of Reclamation has designed and constructed seven major reservoirs on the Ogden and Weber rivers that created warm and cold water sport fisheries. The operation of these reservoirs has also allowed for the maintenance of minimum instream flows that effectively enhance fish habitat within existing rivers and streams. These fisheries include Pineview, Causey, East Canyon, Lost Creek, and Echo reservoirs; Rockport Lake; and Willard Bay.

Federal fish and wildlife regulations are administered primarily by the U.S. Fish and Wildlife Service (FWS). However, the Bureau of Reclamation, in cooperation with local operation and maintenance agencies, is responsible for the condition and quality of fisheries within federally constructed reservoirs.

Fish and Wildlife Service- The Fish and Wildlife Service has responsibility for protecting and promoting federal interests in fish and wildlife issues, laws and regulations. The FWS's involvement in fish and wildlife issues is required under provisions given in the Fish and Wildlife Coordination Act (48 Stat. 401, as amended;

Table 14-1
MINIMUM INSTREAM FLOW REQUIREMENTS AND RIVER CLASSIFICATION INFORMATION

Reservoir	River	Min. Flow (cfs)	River CLASS Above Res.	River CLASS Below Res.
Pineview	Ogden	8.0	V	I (6 mi.)
Rockport Lake	Weber	25.0	II	II (10 mi.)
East Canyon	East Canyon	5.0	III	II (10 mi.)
Echo	Weber	0.0	II	II (15 mi.)
Lost Creek	Lost Creek	8.0	III	II (12 mi.)
Causey	S. Fk. Ogden	25.0	III	I (7 mi.)
Smith and Morehouse	Morehouse Creek	5.0		

Table Notes
- River Class above Res./River Class below Res.: Stream classification above and below the indicated reservoir as determined by the Utah Division of Water Quality.
- Mileage given for river classification below the indicated reservoir indicates the distance of the classification to the next reservoir or point of confluence with another stream or river.
- Echo had no minimum instream flow requirement due to its early date of construction.

16; U.S.C. 661 et. seq.). The act requires consultation with the FWS and the wildlife agency of any state wherein the water of any stream or other water body are proposed or anticipated to be impounded, dewatered, channelized, or otherwise controlled or modified by any public or private entity.

In the Weber River Basin, the FWS has conducted a number of investigations under the authority of the Fish and Wildlife Coordination Act. The FWS investigations have primarily been associated with facilities designed and constructed by the Bureau of Reclamation, miscellaneous power projects that require a permit from the Federal Energy Regulatory Commission and work in wetlands that requires a permit from the Army Corps of Engineers or the Environmental Protection Agency.

The FWS is also responsible for the administration of the federal Threatened and Endangered Species Act. All activity that potentially threatens or endangers a protected fish or wildlife species is investigated (assessed) by the FWS. The indicated activity can include the construction, operation and maintenance of water development facilities.

Bureau of Reclamation-The Bureau of Reclamation acts in cooperation with other local, state and federal agencies to actively promote the development of fish and wildlife recreational opportunities at all reservoirs originally designed and constructed under federal reclamation law. Seven of the eight major reservoirs were designed and constructed through federal water reclamation acts.

Willard Reservoir, an off-steam storage facility on the lower Weber River system, is considered a warm water fishery with populations of blue gill, black crappie, catfish, carp, northern pike and some species of bass. Other bureau reservoirs, including East Canyon, Lost Creek, Wanship, Pineview and Causey, are considered cold water fisheries and support most species of trout native to Utah waters.

To promote sport fishing and to optimize recreational opportunities, the Bureau of Reclamation has completed a facility management plan for Lost Creek Dam and Reservoir. The plan addresses a number of issues relating to the use and operation of the reservoir by outdoor recreationists. Significant issues include the lack of adequate roads to access boat ramps, fish cleaning facilities, camping and picnic areas, the establishment of boundaries or buffer zones between existing and proposed recreational areas and private land surrounding the reservoir, excessive visitor traffic and congestion, water quality within the reservoir, and the maintenance of adequate fish populations for existing and proposed fishing activity.

14.4 Problems and Needs

The current and potential degradation of water quality in the upper Weber and Ogden rivers has posed a threat to stream and reservoir fisheries. The measured and potential decline of surface and groundwater quality in these areas has been shown to be the product of agricultural runoff and domestic wastewater flow from local residential and commercial developments. The increase in effluent nutrients comes from residential septic tanks, irrigation runoff from agricultural land and effluent from municipal wastewater treatment facilities. This has threatened or created a limited degree of eutrophication in local reservoirs.

Two areas where the water quality is of concern to the fisheries and which can become more of a problem as population growth and recreational activities increase are Pineview Reservoir and the East Canyon and Silver Creek drainages. More information is given in Section 12, Water Quality.

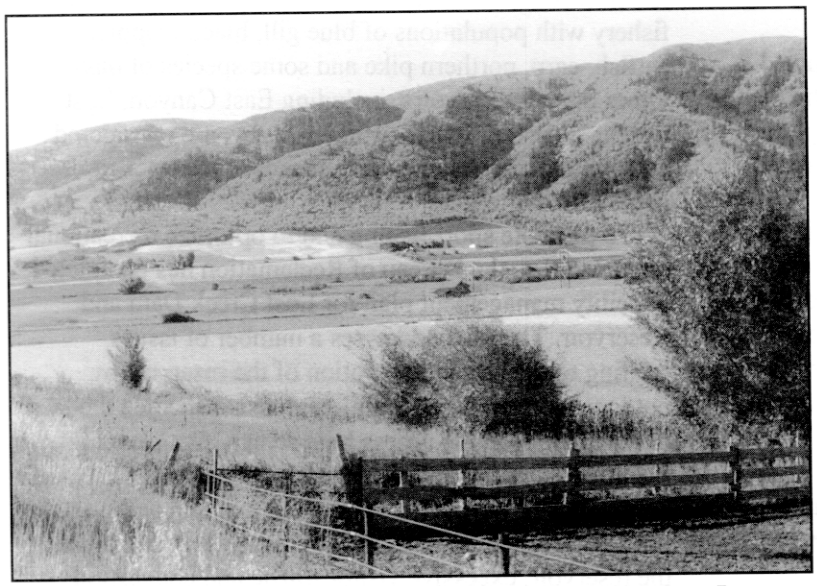
14.5 Alternative Solutions or Actions

Pineview Reservoir supports a large number of warm and cold water sport fish species and a considerable level of fishing activity by anglers throughout the northern Utah area. The fishery, however, is potentially threatened by the continued use of domestic septic tank waste disposal systems within the upper Ogden River drainage.

Water quality problems currently associated with the East Canyon drainage have been addressed by the Division of Water Quality. The division's recently completed *Water Quality Management Plan* presents several recommendations to improve on existing water quality in East Canyon Reservoir and Creek. These recommendations include the implementation of additional (tertiary) treatment at the existing wastewater treatment facility currently owned and operated by the Snyderville Basin Sewer Improvement District.

14.6 Issues and Recommendations

The significant fish and wildlife related issues in the Weber River Basin generally center around the decline of water quality within existing reservoir fisheries. Of particular importance is Pineview and East Canyon reservoirs and East Canyon Creek. These issues are extremely important to the overall well being of the upper basin fisheries. The subject of water quality is discussed in Section 12, Water Quality. The reader is referred to this section for additional information regarding water quality issues in this and other areas of the basin. ❖



At Pineview Reservoir

Section 15 Contents

15 SECTION

Water-Related Recreation

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

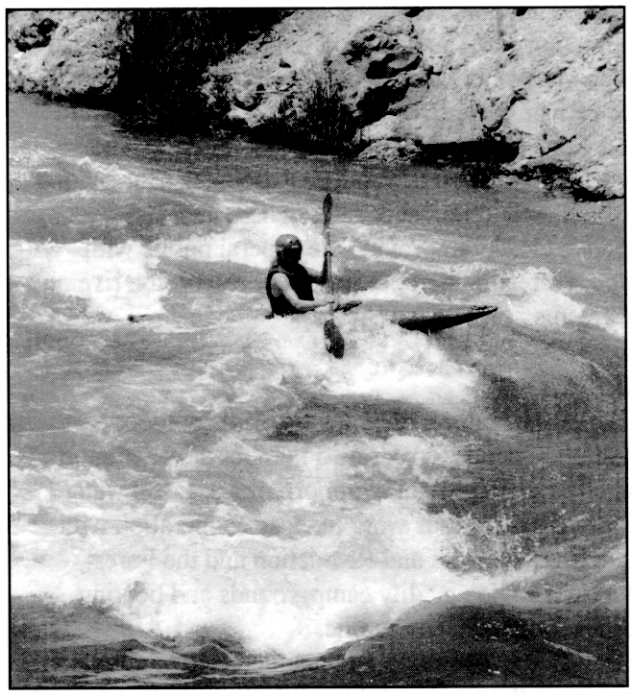
Recreation is a vital part of the human experience. One must invest time away from work responsibilities to enjoy life, family, or to simply recuperate from stress.

15.1 Introduction

This section discusses the extent of outdoor water recreation within the Weber Riven Basin and its impact on the local economy, general quality of life and the environment. Outdoor water recreation has historically been a desirable by-product of water reclamation projects. Reservoirs were constructed and designed with a considerable amount of attention given to optimizing the potential for water-related recreation. Minimum instream flows have been provided throughout the basin for sport fishing by regulating discharges through existing dam outlet works and/or spillways. Other water-related recreation includes boating, rafting, kayaking, camping at reservoir campgrounds, and a variety of other activities associated with the simple enjoyment of the out-of-doors.

15.2 Background

The Weber River Basin has six major ski resorts, over 400 miles of streams and rivers, in excess of 500 miles of hiking and backpacking trails, 225,400 acres of national forest land and a number of major reservoirs. Several studies have determined the most popular outdoor activities are those associated with reservoirs, streams and rivers. The Division of Parks and Recreation has conducted a series of in-park and statewide public opinion surveys from early 1990s to 1995. The results indicate Utahns have strong opinions concerning outdoor recreation and the operation of outdoor recreational facilities. They are oncerned about better access and staging areas for fishing, the development of more camping areas, improved access to remote hunting areas, more extensive hiking and biking trails, more nature study areas, and various improvements to beach areas accommodating general outdoor recreation and sun-bathing.



Weber River kayaking

A 1995 opinion survey conducted by Utah State University concluded that 67 percent of Utahns support limiting the number of people at more popular outdoor parks and camping grounds consistently subject to over crowding, 84 percent support prohibiting the removal of rocks and vegetation from park sites, 81 percent support acquisition of additional park lands, over 87 percent felt it is inappropriate to

sell quality state park lands for private development, and over 90 percent of the state population have visited a Utah State Park at some time.

A statewide park-system plan is being developed for the Division of Parks and Recreation by a steering committee and customer input process. The plan stresses the enhancement of quality of life through parks, people and programs. The plan also identifies 15 major issues centered around the need for additional facilities and parks to meet the recreational needs of Utah's growing population.

15.3 Organizations and Regulations

Decisions regarding the management, operation, improvement and development of outdoor recreational facilities must take into consideration the need for personal recreation and enjoyment of the outdoors and, just as important, consideration of the business aspects of outdoor recreation.

The responsibility of managing and operating the outdoor recreational facilities generally belongs to a combination of local, state and federal agencies. These include the Weber River Water Users Association, Ogden River Water Users Association, Weber Basin Water Conservancy District, Division of Parks and Recreation, Division of Wildlife Resources, Bureau of Reclamation and Forest Service. These agencies cooperate closely to provide the general public with outdoor recreational opportunities at reservoirs, rivers and streams.

15.3.1 Local

All of the major reservoirs are prime outdoor recreational facilities offering a number of water sports in addition to sport fishing opportunities. Local water provider organizations work in close cooperation with the Division of Parks and Recreation and the Forest Service to provide quality campgrounds and boating facilities for the general public.

Day-to-day operation and maintenance of all major reservoirs is the responsibility of the basin's four largest water provider agencies. A summary of operation and maintenance responsibilities for all of the basin's major reservoirs is given in Table 15-1.

In addition to large reservoirs, the basin also supports a number of water-related amusement parks featuring large swimming pools and water slides. These parks include Lagoon amusement park in Farmington, Wildwaters slide park in Ogden, Cherry Hills water slide in Farmington, Swim and Surf in Layton, and Classic Water Slide in Riverdale.

15.3.2 State

The Division of Parks and Recreation is responsible for the management and operation of all state funded parks including six in the Weber River Basin. These parks are located at East Canyon Reservoir, Lost Creek Reservoir, Rockport Lake, Willard Bay, Fort Buenaventura in Ogden, and Union Pacific State Trails Park in the Park City area. Combined, these parks account for over 2,700 acres of land, 12,000 acres of surface water and over 1.0 mile of recreational beaches.

The Division of Parks and Recreation maintains a staff of park rangers at most of the parks. Typical responsibilities include the general maintenance of park facilities, assistance to park visitors and enforcement of Utah's boating regulations. Campsite reservations at state parks can be made at individual parks or through the Division of Parks and Recreation.

The Division of Parks and Recreation develops and publishes the *State Comprehensive Outdoor Recreation Plan* (SCORP) from grants provided by the Department of the Interior and National Park Service. The SCORP is a fundamental planning document supported and produced in cooperation with the general public, outdoor activist groups and organizations, the legislature and various state departments involved directly or indirectly with outdoor recreation.

The SCORP is a dynamic document, published periodically (usually every five years) to incorporate or reassess new developments and issues relating to outdoor recreation. The latest version (published in 1992) of the SCORP investigates and generally discusses a comprehensive array of outdoor activities, issues, programs and management polices relating to the overall management and operation of the state's parks, campgrounds and reservoirs.

Within the SCORP, a survey was conducted asking randomly selected Utahns to list and identify which outdoor recreational activities they regularly participated in and enjoyed the most. From the survey, it was determined that water-related activities were among the most popular forms of public recreation.

Estimates indicate more than 1.25 million visitor days are spent within the Weber River Basin enjoying water-related recreational activities in reservoirs, streams and rivers. Pineview Reservoir is the most popular with an estimated 400,000 visitor days spent annually; visitor

Table 15-1
RESERVOIR O&M AGENCIES

Agency	Reservoir
Weber Basin Water Conservancy District	Willard Bay
	Causey
	Lost Creek
	Rockport
	Smith & Morehouse
Pine View Water Systems	Pineview
Weber River Water Users Association	Echo
Davis and Weber Counties Canal Company	East Canyon

days for other popular reservoirs have been estimated at 35,000 for Causey, 30,000 for Smith and Morehouse and 85,000 for Echo.

The cost to operate and maintain the basin's six state parks is estimated at just under $1.0 million or roughly 80 cents per visitor day. The operation and maintenance costs generally include the salaries of division staff directly assigned to individual parks, supplies and materials to keep park grounds in a clean and acceptable condition for public occupation, miscellaneous vehicle costs, and a number of other incidental administrative costs.

15.3.3 Federal

An agreement with the Bureau of Reclamation in the late 1950s gave the Forest Service the responsibility of operating and maintaining a public facility at Pineview Reservoir in Ogden Valley. The park is considered part of the Wasatch-Cache National Forest and subject to federal regulations regarding management of campsites and boating facilities. The public park at Pineview Reservoir includes an overnight campground with paved access roads, culinary water service and improved modern toilets. The Forest Service also maintains camping facilities at Causey and Smith and Morehouse reservoirs.

15.4 Outdoor Recreational Facilities and Use

Water-related recreation occurs at all eight of the major reservoirs and along the many miles of the Weber and Ogden rivers and their tributaries. These are shown on Figure 15-1.

15.4.1 Local

A number of smaller parks are owned and operated by various local organizations to provide recreational sites for local residents and special interest groups. These parks generally include small camping grounds, swimming pools and picnicking areas, athletic fields for adult and youth sports programs, biking, and walking trails and golf courses.

Currently, Weber County has eight small general-use public parks. General-use parks are typically located adjacent to rivers and streams to take advantage of fishing opportunities and to enhance the overall natural environment of each individual park. These parks include North Fork Park, Weber County Memorial Park, Wolf Creek Park, Middle Fork Trail Camps, Evergreen Park, Huntsville City Park, a Nature Park along the North Fork of the Ogden River near Pineview Reservoir, and the Ogden River Parkway.

Summit, Davis and Morgan counties currently have no parks or outdoor recreational facilities. However, the larger towns and cities within these counties operate and maintain a number of municipal parks and outdoor recreational facilities to enhance the overall community setting and provide outdoor recreational opportunities.

15.4.2 State

The Division of Parks and Recreation operates and maintains six state parks. Campsites and limited boating facilities are available at five locations: Echo, Willard, East Canyon, Lost Creek reservoirs and at Rockport Lake.

The state parks within the basin are very popular with recreationists, not only from the state of Utah but from surrounding states and foreign countries as well. The most popular water-related recreation generally includes various fishing and boating activities. To

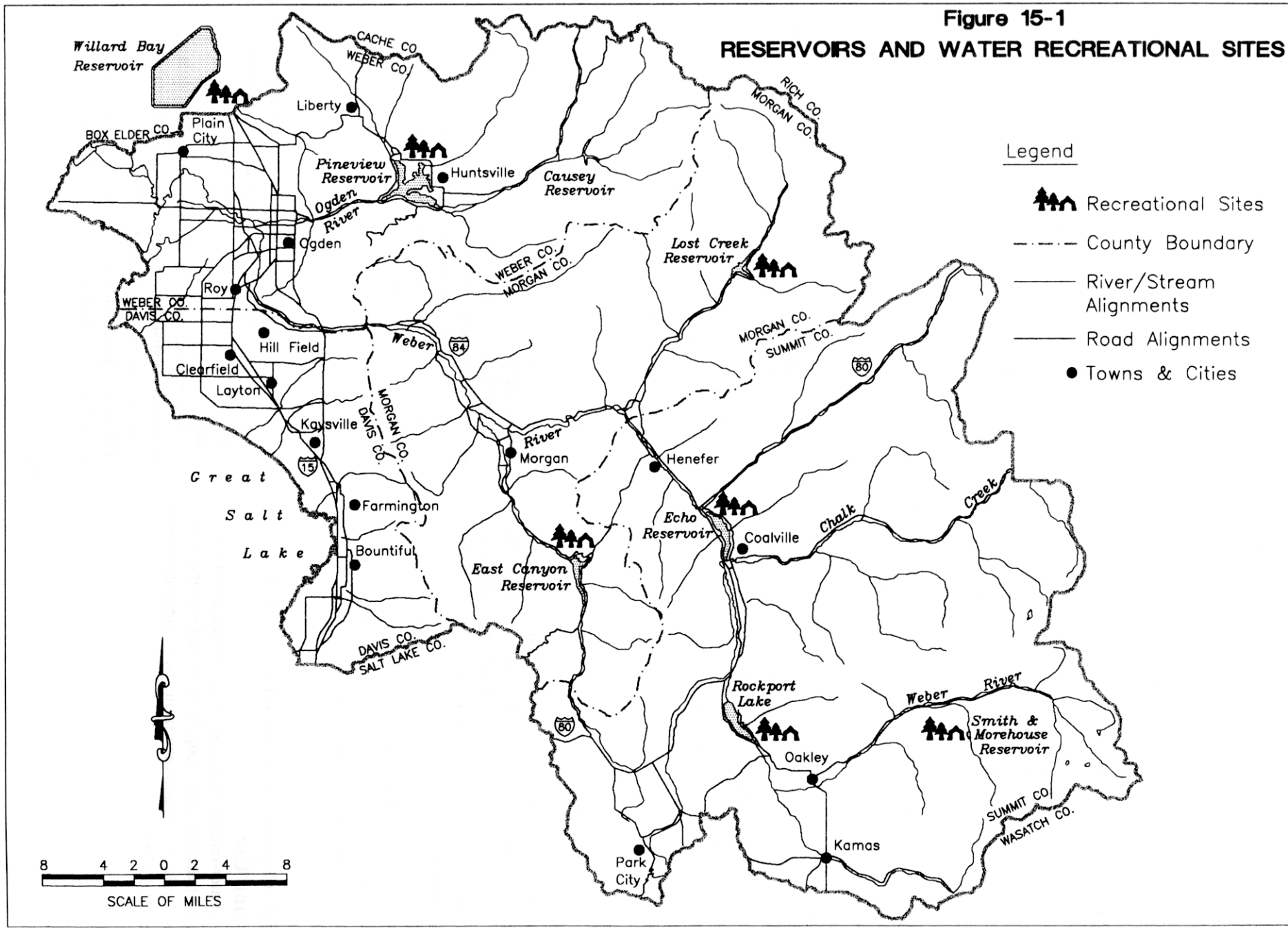
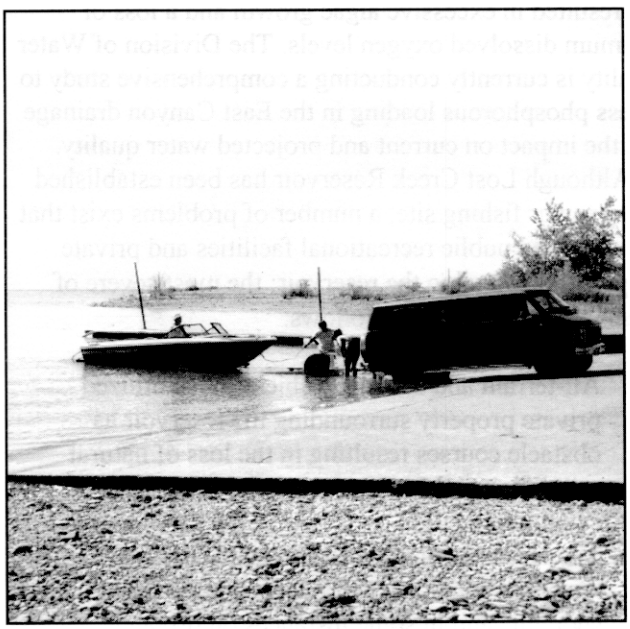


Figure 15-1
RESERVOIRS AND WATER RECREATIONAL SITES
Willard Bay Reservoir
CACHE CO.
WEBER CO.
RICH CO.
MORGAN CO.
Liberty
Plain City
BOX ELDER CO.
Pineview Reservoir
Huntsville
Causey Reservoir
Ogden River
Ogden
Lost Creek Reservoir
WEBER CO.
MORGAN CO.
Roy
WEBER CO.
DAVIS CO.
Hill Field
Weber
84
MORGAN CO.
SUMMIT CO.
80
Clearfield
Layton
Kaysville
DAVIS CO.
MORGAN CO.
River
Morgan
Henefer
15
Great Salt Lake
Farmington
Echo Reservoir
Coalville
Chalk Creek
Bountiful
East Canyon Reservoir
DAVIS CO.
SALT LAKE CO.
Rockport Lake
Weber River
Smith & Morehouse Reservoir
80
Oakley
SUMMIT CO.
WASATCH CO.
Park City
Kamas
Legend
Recreational Sites
County Boundary
River/Stream Alignments
Road Alignments
Towns & Cities
8 4 2 0 2 4 8
SCALE OF MILES

accommodate boating enthusiasts, most of the reservoirs in the basin operate and maintain concrete launching ramps, loading docks, related parking lots, camping and picnic grounds, modern restroom facilities, showers and public trash repositories. The parks at East Canyon, Rockport and Willard reservoirs offer mooring and dry dock storage in addition to the accommodations listed above.

Echo Reservoir is one of the oldest water storage facilities within the basin. It was initially constructed as the main feature of the Weber River Project to provide additional irrigation water storage for farms and ranches in Weber and Davis counties. The reservoir also has proven to be a major fishery and popular outdoor recreation site since its construction in the mid-1930s. Echo Reservoir offers over 1,400 acres of water surface and supports five species of sport fish. A number of privately-owned amenities are offered including a convenience store, boat ramps, camping sites, and storage facilities for boats and personal camping gear. Camping sites at the reservoir include water and electrical power for trailers, modern restroom facilities, showers and playground areas for volleyball.



Boat ramp at Willard Reservoir

With over 200,000 recreationists visiting the reservoir annually, Willard Reservoir has established itself as one of the most popular outdoor recreation sites. The reservoir is noted for its 9,000 acres of water surface, well-maintained beaches, camping facilities and warm water sport fishing opportunities. The Division of Parks and Recreation operates two parks at the reservoir which feature campgrounds with 62 campsites, two marinas, modern rest rooms, hot showers, sewage disposal, fish cleaning stations, seasonal/transient boat slip rentals and one maintained sand beach.

East Canyon Reservoir is a 1,000-acre outdoor recreation facility noted for exceptional boating facilities and year-around fishing opportunities. Although water skiing is allowed on the reservoir, the activity is strictly regulated due to the reservoir's relatively small water surface area and negative impact on fishing. East Canyon is primarily a cold water fishery. Outdoor recreational facilities include a concrete boat launching ramp, paved parking area, modern rest rooms, showers, a fish cleaning station and a 31-unit campground.

Lost Creek Reservoir offers limited boating activities, but it has outstanding fishing for a number of cold water sport fish. Convenience facilities include a campground and restrooms with vaulted toilets.

Rockport Lake provides recreationists with the most common water sport activities including fishing, waterskiing, swimming, windsurfing and sailboating. Rockport Lake State Park includes nine campgrounds and a cross-country ski trail. In addition, a concessionaire provides boat rentals, gasoline and other personal supplies during most of the regular summer vacation months. Rockport Lake is classified as a cold water fishery.

Fort Buenaventura State Park is the site of the first permanent Anglo settlement in the state. The fort was initially established by Miles Goodyear in the early 1840s as the mountain man era in the Wasatch Range of the Rocky Mountains came to a close. The site of the original fort is now a state park that includes a reconstructed stockade and replicas of cabins commonly found in the area. The park also includes a number of modern day accommodations such as a visitor center, group camping grounds, picnic facilities, canoe course in the adjacent Weber River and walking trails throughout the park.

With partial funding from state river enhancement programs, a new river park was constructed along the Ogden River from the mouth of Ogden Canyon to the Washington Boulevard river bridge. The Ogden River Parkway was constructed with the primary objective of enhancing the Ogden River as an asset to the community and to provide needed recreational facilities in the Ogden area.

Prior to the completion of the enhancement project, the impacted reach of the Ogden River was inaccessible to all but a few fishermen willing to walk substantial distances through thick brush and river bank undergrowth. The completion of the river enhancement project has provided a number of improvements designed to open the river to a wide spectrum of recreation including picnicking, camping, fishing and simply walking the river bank to enjoy the surrounding environment. Improvements available through the river enhancement projects include the construction of walking and jogging trails/paths, youth soccer fields, covered picnic table areas, restrooms and water service, major re-landscaping of the south river bank and limited camping sites.

A similar river enhancement project is currently being pursued on the Weber River near the mouth of Weber Canyon. The various communities in the immediate area, including Morgan, Mountain Green and South Weber, are combining resources to establish a riverway path along the Weber River from the mouth of the canyon to the stated communities. A committee has been formed and several hearings have followed to acquire a path alignment and open space for riverain habitat. The objective of the parkway is to promote the natural setting of the river in this area and to limit the spread of commercial and residential development at the mouth of the canyon.

15.4.3 Federal

Boundaries of the Weber River Basin include the Wasatch-Cache National Forest (WCNF) which is managed by the Forest Service. As a result, three of the basin's major reservoirs include campgrounds that are within, or immediately adjacent to, the WCNF. As part of the national forest system, these campgrounds fall under the jurisdiction of the federal government and the management of the Forest Service. The three campgrounds are located at Pineview, Causey and Smith and Morehouse reservoirs.

15.5 Recreational Activity Problems and Needs

During 1990, the Division of Parks and Recreation contracted with a consultant to conduct the Utah Motorboat Survey. This report suggested implementing several recommendations to improve existing boating problems. As determined in the report, boating in Utah is primarily a family or social group activity with most boaters opposed to additional regulations.

In addition to estimating boating use statistics, the report identified major or most common problems expressed by boating recreationists. They are 1) lack of accessibility to existing reservoir facilities; 2) less than adequate condition of some boat ramps and parks; 3) lack of security at all campsites and picnicking areas; 4) inadequate sanitation facilities, campsites and picnic areas; and 5) the lack of boating safety courses.

Water-related recreation at Willard Reservoir (boating and fishing) may suffer somewhat due to the possibility of unprecedented withdrawals from the reservoir to meet a growing demand for municipal and industrial (M&I) water. From studies completed by the Bureau of Reclamation, the water surface at Willard Reservoir could reach elevations well below the recommended level in the event projected M&I water demands on the reservoir are realized. At low levels, the reservoir would not be able to support the present populations of warm water sport fish.

In recent years and with the increased urbanization of the general Snyderville Basin and Park City Area, water quality within East Canyon Reservoir has been degraded and has some degree of eutrophication. Increased nutrient loading from residential and commercial sources has resulted in excessive algae growth and a loss of optimum dissolved oxygen levels. The Division of Water Quality is currently conducting a comprehensive study to assess phosphorous loading in the East Canyon drainage and the impact on current and projected water quality.

Although Lost Creek Reservoir has been established as a popular fishing site, a number of problems exist that has degraded public recreational facilities and private property surrounding the reservoir; the most severe of which are summarized as follows:

- All-terrain and off-road vehicles have utilized private property surrounding the reservoir as obstacle courses resulting in the loss of natural vegetation and moderate to severe scaring of existing hillsides.
- The lack of well-marked campsites has resulted in haphazard camping throughout the reservoir's shoreline and in some instances on private property.
- The lack of fencing separating private from public property has resulted in private livestock and big game interfering with recreation activities.

The Division of Parks and Recreation, in cooperation with the Bureau of Reclamation, has recently completed

a *Resource Management Plan* outlining measures to improve on the operation and management of existing recreational facilities at the reservoir. The plan addresses the concerns listed above and other operational issues including needed improvements to existing sanitation facilities, the redesign and surfacing of day use areas, improved fencing and off-reservoir watering systems for livestock, closure of under vegetated buffer areas along shorelines, the revegetation and installation of vehicle barriers, and the possible closure of the area to OHVs.

Although Pineview Reservoir continues to be a popular outdoor recreational facility, there is concern that water quality within the reservoir may deteriorate to unacceptable levels. As a result, the Weber County Planning Commission initiated a *Clean Water Act Section 314 Clean Lakes Study* to evaluate the impacts of development and recreation on the current and projected water quality in the reservoir. Although the study indicated the general water quality within the reservoir still meets all state and federal regulations for a raw culinary water source and general recreational use, it was also stated that increased residential growth in the valley could reduce water quality to unacceptable levels.

15.6 Issues and Recommendations

Water-related recreation issues include the overuse of campgrounds and boating facilities and water-based recreation safety.

15.6.1 Increased Boating Activities at Basin Reservoirs

Issue-The overcrowding of reservoirs has created concerns with local and state recreation agencies regarding boating safety and protection of water sport recreationists.

Discussion- Boating is one of the most popular outdoor recreation activities in the state. In consideration that over one-third of the state's population live and work in the northern portion of the state, it becomes apparent the larger reservoirs in the Weber River Basin have a tendency to be overcrowded with boats and water sport enthusiasts during the summer months.

To better manage boating traffic on all the state's reservoirs, the Division of Parks and Recreation is currently in the process of conducting a boating capacity study at a number of reservoirs in the Weber River Basin. The study is expected to determine appropriate capacity limitations for individual reservoirs to promote boating safety and to create an enjoyable experience for all boaters.

Recommendation- Local reservoir operators and law enforcement officials should continue to cooperate with the Division of Parks and Recreation to promote boating safety and enjoyment. The recommended safety courses should be promoted and conducted through a joint effort.

15.6.2 Infrastructure Needs

Issue- A number of the older state parks at existing Bureau of Reclamation reservoirs are in need of major infrastructure improvements.

Discussion- The recent population growth in the overall northern Utah area has resulted in a marked increase in outdoor water-related recreation activities. The increased recreation traffic and use has left a number of state parks in need of expansion and improvements to existing facilities. The Bureau of Reclamation has conducted studies at a number of basin reservoirs to determine the scope of work and improvements needed at federally constructed reservoirs. As a result, the bureau is providing funds to redesign and reconstruct heavily used boating facilities and campgrounds Major improvements are scheduled for Lost Creek, Rockport Lake and East Canyon reservoirs within the Weber River Basin.

Recommendation- Improvement of water-related recreation facilities should continue through cooperative efforts between the Bureau of Reclamation, Division of Parks and Recreation, local communities, landowners and operators of individual reservoirs. ❖

Section 16 Contents

16 SECTION

Federal Water Planning and Development

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Federal agencies have been major players in the overall development, planning and management of the basin's water resources.

16.1 Introduction

This section of the *Weber River Basin Plan* briefly describes the current roles or level of responsibility of the 12 federal agencies involved directly or indirectly with the planning and development of water resources within the basin. Their roles vary from the regulation, planning, design and construction of water reclamation projects to the protection of water quality, the environment, and habitat for various fish and wildlife species.

16.2 Background

The general and overall role of the federal government in the area of water resources has changed significantly over the years. From the late 1930s to as recently as the early 1970s, federal agencies were involved in the planning, design and construction of major water and land reclamation projects. Most of these projects are responsible for providing affordable and reliable water sources for agricultural and M&I users.

The current involvement in the development of water by some federal agencies has been significantly reduced. As a result, water provider organizations, municipalities and some private industries are relying more on state agencies to replace federal water project development expertise and related funding programs.

16.3 Federal Programs and Future Water Planning and Development

The following are brief descriptions of federal agencies and their programs.

16.3.1 Bureau of Land Management

The Federal Land Policy and Management Act gives the Bureau of Land Management (BLM) authority for inventory and comprehensive planning for all public lands and resources under its jurisdiction. The quantity and quality of water resources are key factors in managing terrestrial and aquatic resources on public lands in the Salt Lake District. The BLM manages riparian habitats of springs, seeps, streams, lakes, reservoirs and ponds to help provide high quality water resources for beneficial downstream uses.

Only small and insignificant parcels of land in the Weber River Basin are managed by the BLM. As a result, the BLM has only a minor impact and influence on the planning and development of water.

16.3.2 Bureau of Reclamation

Within the Weber River Basin, the Bureau of Reclamation has served as the design and construction management agency for the construction of seven major dams and reservoirs including Causey, Pineview, Wanship, Echo, East Canyon, Lost Creek and Willard (see Section 5).

In the future, the bureau's responsibilities will likely change more to the study of water quality, recreation and dam safety issues at its major facilities within the basin.

The bureau has completed a study to determine the general quality of outdoor recreation at Lost Creek Reservoir. Issues in the bureau's study include 1) fish habitat and the management of the overall fishery resources; 2) the condition, accessibility and adequacy of camping facilities; 3) recreational boating and its impact on existing and projected fishing activities;

4) general recreational activity in and around private lands surrounding the reservoir; and 5) the possibility of placing substantial restrictions on visitor numbers to both improve the overall recreation experience and to mitigate historic damage to private property and livestock.

The bureau is also cooperating with the Weber Basin Water Quality Council and the Utah Water Research Laboratory at Utah State University in conducting a total organic loading study on the upper Weber River system. The study is aimed at determining the extent of current organic loading rates to downstream culinary water treatment plants and the impact on loading rates caused by seasonal stream flow variations. A major product of the study will be the development of a system operations model to optimize the future operation of the entire river and reservoir system.

16.3.3 Cooperative Research, Education and Extension Service

This agency is assigned responsibility for all cooperative state and other research programs presently performed by the Cooperative State Research Service, all cooperative education and extension programs presently performed by the Extension Service, and such other functions related to cooperative research, education and extension as may be assigned.

16.3.4 Corps of Engineers

Local interests can petition Congress for assistance from the Corps of Engineers (COE) if they cannot cope with water resources problems. The COE can investigate economic and technical feasibility and social and environmental acceptability of remedial measures. When the problems cover an entire river basin, it is studied as a unit. Close coordination is maintained with local interests, the state and other federal agencies.

The COE has constructed several projects within the basin. The most recent was built in 1985 at the South Davis Wastewater Treatment Plant to raise the levees which protect the facility from the Great Salt Lake. Because the water continued to rise, the levees were further raised and strengthened in 1986.

The COE implemented a small flood control project of 4.5 miles of channel enlargement along Kays Creek. The project extends from Fort Lane Street in Layton downstream to the Great Salt Lake and provides flood protection to the City of Layton and surrounding areas. The flood control facilities are currently maintained by Davis County.

The COE, in cooperation with the Bureau of Reclamation and Weber Basin Water Conservancy District, established criteria and policies to operate five of the Weber Basin Project reservoirs during flooding and excessive watershed runoff periods. Flood management criteria and procedures have been established for Rockport Lake and Lost Creek, East Canyon, Pineview and Echo reservoirs.

The Energy and Water Development Act of 1984 directed the COE to conduct special flood control studies in Utah to determine specific ways and means to alleviate future flooding. Included in this study were all the streams and rivers originating in the small canyons along the western slope of the Wasatch Mountain Range from North Ogden to Bountiful.

The Water Resources Act of 1986 authorized the COE to undertake a reconnaissance study of the Weber River and its tributaries. The study was initiated in March of 1990 basically to address the potential of federal participation in the development of water resources and in the mitigation of property damage caused by extreme flood events.

The reconnaissance study evaluated the main reaches of the Weber and Ogden rivers and a number of smaller tributary streams. The study addressed historic and projected flooding problems. The study screened 18 damage centers (developed areas) adjacent to the Weber River and its tributaries for flood concerns. Of those, three locations were ultimately studied in detail - Riverdale, South Weber/Uintah and Coalville. The overall findings generally indicated the construction of additional flood protection facilities was not federally justified at this time with the exception of Chalk Creek near Coalville. Flooding events in Chalk Creek are significant enough to warrant further study and the possible construction of flood control facilities. But the town decided not to pursue further investigations.

16.3.5 Environmental Protection Agency

The mission of the Environmental Protection Agency (EPA) is to allow a coordinated effort between federal, state and local governmental agencies to effectively abate and control pollution within the environment. Of particular interest are the federal regulations and programs associated with the Federal Water Pollution Control Act of 1972, the Safe Drinking Water Act of 1974 and the Clean Water Act of 1987. The regulations to implement these acts have set limitations on contaminants.

Point source pollution is normally associated with effluent discharges from industrial and domestic sources. Non-point source pollution is caused by excessive runoff from a variety of surface conditions including agricultural crop land, open rangeland, urban land and all other surfaces that generate flows to existing stream and river courses.

Point source pollution programs include the National Pollutant Discharge Elimination System (NPDES) program, Pretreatment and Municipal Pollution Prevention Program, National Sludge Management Program and Enforcement Program. The NPDES program requires that all wastewater treatment facilities meet or exceed limitations placed on certain water contaminants.

The Pretreatment and Municipal Pollution Prevention Program applies to industrial businesses that discharge effluent to domestic sanitary sewers with extreme concentrations of certain toxic pollutants. To effectively reduce the problems, the program offers technical and financial assistance.

The National Sludge Management Program pertains to the management and disposal of wastewater sludges or biosolids. Sludges often contain toxic pollutants and require specialized treatment and handing procedures for ultimate disposal.

Initially, the Construction Grants Program provided construction funds for most levels of municipal wastewater treatment facilities. The program was phased out and replaced with a revolving state loan program administered by the Division of Water Quality, Department of Environmental Quality.

The EPA programs designed to offer technical and financial assistance include Clean Water Act (CWA) 104 Grants to promote and support research, investigations and training programs; CWA 106 Grants to assist states in the overall administration of individual state water quality management programs; state revolving funds supported by capitalization grants to construct and renovate publicly owned treatment works-facilities; Pilot Grants and Technical Assistance; Municipal Technology Programs; a number of Small Community Assistance Programs; and Section 319 funds for implementing basin management plans associated with non-point source pollution problems.

Federal regulations associated with Section 319 of the CWA provide standards aimed at improving the overall quality of water within a given watershed in accordance with established water use designations. These improvement generally include the construction of flow control structures or measures to reduce sediment loads within existing streams and rivers, and the reduction of surface discharges contaminated with animal waste and nutrient residues from farm and ranch lands.

In 1974, congress passed the Safe Drinking Water Act (SDWA). The act set up a regulatory program to help ensure the provisions of the SDWA are implemented and enforced.

Through the Division of Drinking Water and EPA, state safe drinking water standards and regulations are enforced on community systems. This also includes the three major surface water treatment facilities managed by Ogden City and the Weber Basin Water Conservancy District.

16.3.6 Farm Service Agency

The Farm Service Agency (FSA-formerly the Agricultural Stabilization and Conservation Service) administers farm commodity, crop insurance, and conservation programs for farmers and ranchers. As of October 1995, FSA also administers the farm ownership and operating loans formerly provided by the Farmers Home Administration.

The FSA's conservation programs include the Agricultural Conservation Program (ACP), the Emergency Conservation Programs (ECP) and the Conservation Reserve Program (CRP). The ACP is a comprehensive program designed to reduce soil erosion, mitigate water pollution, protect and improve the condition of cropland and pastures, conserve water, preserve and enhance wildlife habitat, and where possible, encourage the conservation of energy. Projects are evaluated at the local level on a case-by-case basis to determine consistency with the overall ACP objectives. The ACP is administered by state and county committees that are made up of local farmers and ranchers.

The ECP provides emergency cost-share funding for a number of farm related disasters that include, but are not limited to excessive wind erosion, floods and extended periods of extreme drought conditions. The CRP was established to encourage farmers through contracts and annual payments to reduce soil erosion and to put fragile lands into permanent cover. In addition, CRP eligibility has been expanded to promote the preservation and maintenance of wetlands, wildlife habitat and water quality.

The Natural Resources Conservation Service, Forest Service, and the Division of Forestry, Fire and State Lands provide technical program guidance. The USU-

Cooperative Extension Service provides educational support.

16.3.7 Federal Emergency Management Agency

The National Flood Insurance Program (NFIP) is administered by the Federal Insurance Administration (FIA), a component of the Federal Emergency Management Agency (FEMA), an independent agency. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and the NFIP Reform Legislation of 1994.

The NFIP is a federal program enabling property owners to purchase insurance protection against losses from flooding. The insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

Participation in the NFIP is based on an agreement between the local communities and the federal government. The agreement states that if a community will implement and enforced measures to reduce future flood risks to new construction in special flood hazard areas, the federal government will make flood insurance available within the community as a financial protection against flood losses which do occur.

The FEMA is the federal coordinating agency for emergency response, disaster relief funding and, mitigation and preparedness planning. The agency provides technical assistance through loans and grants following declared disasters.

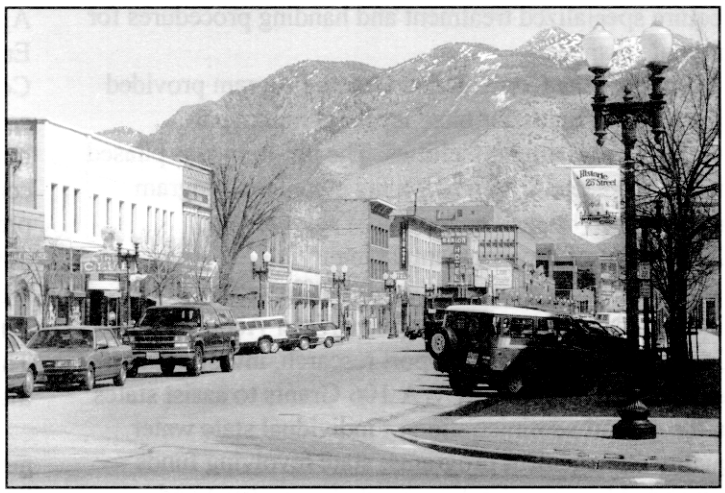
Presidential Declared Disaster - After a presidential declaration of a major disaster, usually after a state request, grants are available to state and local governments for mitigation of disaster-related damage.

Assistance Grants -The FEMA can provide grants on a matching basis to help the state develop and improve disaster preparedness plans and develop effective state and local emergency management organizations. Also, grants are available to develop earthquake preparedness capabilities.

Flood Plain Management - The FEMA provides technical assistance to reduce potential flood losses through flood plain management. This includes flood hazard studies to delineate flood plains, advisory services to prepare and administer flood plain management ordinances and assistance in enrolling the National Flood Insurance Program. The FEMA can assist with the acquisition of structures in the flood plain subject to continual flooding. Currently, 21 cities and towns within the basin participate in the NFIP program including flood control districts representing Weber, Davis and Morgan counties.

16.3.8 Fish and Wildlife Service

The Fish and Wildlife Service is the federal agency with responsibility for ensuring the long-term conservation and protection of certain federal trust resources including threatened and endangered species, migratory birds, wetlands, and fish and wildlife resources that may be impacted by federally permitted or funded projects. Additionally, the FWS manages fish and wildlife habitat in the National Wildlife Refuge system. The FWS's authorities come from the Endangered Species Act, the Clean Water Act, the Migratory Bird Treaty Act, the Bald Eagle Protection Act, the Fish and Wildlife Coordination Act, the National Environmental Policy Act and the National Wildlife Refuge System Administration Act.



25th Street in Ogden

16.3.9 Forest Service

Water-related programs of the Forest Service include watershed management; special use authorization for water development projects and coordination with local,

state and federal agencies. They also manage wilderness areas located on national forest lands.

Watershed Management - Watershed protection insures that activities do not cause undue soil erosion and stream sedimentation, reduce soil productivity or otherwise degrade water quality. Water yields may be affected primarily through snowpack management as a result of timber harvest using well-planned layout and design. Potential increases may approach one-half acre-foot per acre for some treated areas, but multiple-use considerations and specific on-site conditions may limit actual increases.

Special Use Authorization - Construction and operation of reservoirs, conveyance ditches, hydropower facilities, and other water resources developments require special use authorization and usually an annual fee. Authorization contains conditions necessary to protect all other resources use. Coordination of water developments by others requires communication early in the planning process to guarantee environmental concerns are addressed.

16.3.10 Geological Survey

The Geological Survey (USGS) was established by an act of Congress in 1879 to provide a permanent federal agency to conduct the systematic and scientific classification of the public lands and examination of the geological structure, mineral resources and products of the national domain. A number of publications have been completed by the USGS in recent years regarding water quality and groundwater storage. A list of USGS publications addressing water resources information can be acquired from the agency's Salt Lake City office.

Ongoing USGS activities include the gathering of additional water resources related data and the maintenance of existing data bases for various water agencies to plan, design, operate and manage existing and potential water projects within the basin. The USGS is currently monitoring 14 active stream and river gaging stations and three reservoir stage recorders. An itemized summary of all water resources data can be attained from the annual USGS report entitled *Water Resources Data for Utah*. The costs to install and operate a majority of the active stream gaging stations are shared on a 50-50 basis between state and federal agencies utilizing data from these stations.

16.3.11 Natural Resources Conservation Service

The National Resources Conservation Service (NRCS) provides technical and financial assistance to conserve soil, water and related resources on non-federal land through local soil conservation districts. In addition to working with individual landowners and units of government, NRCS administers the following programs.

Published soil surveys contain descriptions of an area's soils, their use and management, and maps depicting the extent of these soils. The Davis-Weber and Morgan Area soil surveys give information for all non-federal lands in the three counties. Soils in Summit County have been surveyed, but the report has not been published.

Through the snow survey program, NRCS measures snow water equivalent and precipitation at 14 locations ranging in elevation from 6,000 to 9,600 feet. These data are available to the public electronically. Basin outlook reports, published monthly, compare current snowpack, precipitation and reservoir storage to average amounts and forecast stream flows for nine locations.

River basin studies, technical and financial assistance for watershed protection and flood prevention, and the emergency watershed programs were all authorized by the Small Watershed Protection and Flood Prevention Program (PL 83-566). Implementation of the *North Fork Ogden River Watershed Work Plan* was completed in 1965. Maintenance of the watershed has been turned over to the local sponsors (Weber County and local irrigation companies).

A river basin study, the *Northern Wasatch Front Hazard Mitigation Study*, is being conducted in Weber and Davis counties. The study is quantifying the amount of sediment that can be expected from each of the small canyons resulting from storms with existing vegetation and with vegetation destroyed by fire.

The emergency watershed program provides immediate technical and financial assistance to relieve hazards to life and property resulting from conditions created by natural disasters.

Resource Conservation and Development (RC&D) areas are locally organized, sponsored and directed projects to help care for land use and natural resources to improve their community's economy, environment and living standards. Technical and financial assistance to RC&D areas, authorized by the Food and Agriculture Acts of 1962 and 1981, is provided by the NRCS.

The Wasatch Front RC&D, organized in 1994, covers Weber, Davis and Morgan counties within the Weber

River Basin as well as Salt Lake and Tooele counties outside the basin.

16.3.12 Rural Development

Rural Development (formerly the Farmers Home Administration) is authorized to provide financial assistance for water and waste disposal facilities in rural areas and towns of up to 10,000 people. Priority will be given to public entities in areas smaller than 5,500 people to restore, improve or enlarge a water facility. To be eligible for loan and grant funds, water or waste disposal systems must be consistent with state or subdivisions development plans and regulation. Loans for RC&D projects are also available. ❖

Section 17 Contents

17 SECTION

Water Conservation/Education

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Water conservation programs and policies can result in decreased water use for some residential, commercial, industrial and agricultural applications.

17.1 Introduction

This section of the *Weber River Basin Plan* discusses and presents water conservation policies, practices, measures and ideas. The discussions and presentations generally focus on conservation relating to residential, commercial, industrial and agricultural water uses.

17.2 Background

Whenever water is discussed at any level or in any forum, the term conservation will most likely be included; especially in the arid west. Water is a finite resource and the demands on its use and consumption are growing at unprecedented rates. However, future water shortages in this location will more likely be the product of long-term drought and infrastructure problems than the product of dramatic increases in domestic and commercial water demands.

The basin is currently experiencing a moderate increase in population growth. The related increase in water demand is offset, to a large extent, by the conversion of high quality irrigation water to residential, commercial and industrial developments. Considering the data presented in Section 9, water shortages are not expected to occur through the year 2020 in most of the basin. The exceptions may be in upstream tributaries such as the Park City and Snyderville Area in Summit County.

The basin has experienced several droughts where annual water supplies have been less than 50 percent of the average annual runoff. The most notable were the drought years of 1961, 1977 and the early 1990s, when local reservoirs were drained to record low levels. Due to sufficient water in storage and careful management, however, few if any water users suffered significant impacts.

17.3 Water Conservation Opportunities

The initial and major use of water was primarily for irrigation of agricultural crops and to support various ranching operations. The current trend is toward the replacement of agricultural-related water uses with municipal and industrial (M&I) demands. This necessitates changes in not only storage, treatment and distribution facilities, but changes in water use practices as well.

17.3.1 Agricultural Water

Although irrigated agriculture is declining, it remains as the largest single water use. Current estimates indicate irrigated agriculture diverts over 446,400 acre-feet. As a result, conservation programs applied to irrigated agriculture have the highest potential of conserving water.

Agricultural water conservation measures are evaluated from two standpoints: one to consider the overall conveyance of water supplies from various sources to individual farms, and a second standpoint to evaluate on-farm methods of applying irrigation water to crops.

Agricultural Water Conveyance Systems - Distribution systems provide water to farms and ranches in addition to a variety of residential, commercial and industrial water users. Efficiencies vary depending on the individual elements making up the overall system.

Open channels are the most common method of conveying water to irrigated agriculture primarily due to their low initial cost of construction. But

operation and maintenance costs are higher to remove weeds and debris from within water conveying channel sections. Excessive water loss can also be a problem resulting in poor overall water conveyance efficiencies. Seepage from open channels can be effectively managed by lining earthen channel sections with concrete or a number of synthetic liners. The amount of water saved by lining open channel or ditch sections may be considerable. Each case is different, however, and must be evaluated on an individual basis.

In recent years, the Weber Basin Water Conservancy District has replaced a number of open channel conveyance facilities within the Weber Basin Project including the Farmington Spillway and other minor ditches. The Ogden River Water Users Association has recently completed a major project to effectively eliminate excessive seepage losses from their Ogden-Brigham City Canal. The project replaced over 5.2 miles of open channel with large diameter concrete pipe primarily in the Ogden and North Ogden bench areas.

Agricultural On-Farm Irrigation Practices - Early settlers applied water to farm and ranch lands by flood irrigation or by using furrow or border irrigation. Recent studies have established the range of efficiency for all irrigation practices at a high of 90 percent to a low of near 40 percent. Irrigation efficiencies can be improved in some cases by optimizing the operation and layout of existing sprinkler or flood irrigation practices.

17.3.2 Municipal and Industrial Water

Municipal and industrial (M&I) water includes institutional, residential, commercial and industrial uses by individual city, county, and private entities or developments. All of these uses are supplied by culinary (potable) and secondary (non-potable) water at a current estimated rate of 172,000 acre-feet per year.

Institutional Water Uses - This includes water for municipal and public recreational buildings and facilities such as schools, health care facilities, golf courses and major landscaped areas such as parks, cemeteries and athletic fields. Water consumption by these facilities may account for 10 to 15 percent of all M&I uses.

An evaluation of water losses from municipal conveyance systems begins with an audit of existing pipelines, canals, ditches and all related hydraulic structures and appurtenances. As field measurements have substantiated, leakage from pipes and open water distribution systems ranges from 5 percent, which is acceptable, to 20 percent, when corrective action should be taken.

Water systems audits effectively identify areas of excessive loss. These audits include 1) an accounting of diversion and delivery records, 2) pressure testing of pipe systems, and 3) installation of groundwater observation wells to assess open channel seepage. Audits can assess overall system efficiencies, locate and determine severe losses, and provide information to develop short-and long-term system rehabilitation and water conservation programs. Annual examinations can update results of previous audits.

Additional conservation measures include audits of existing indoor and outdoor distribution systems, use of sprinkler and drip irrigation systems, and replacement of extensive landscaped areas with minimal water-consuming shrubbery. Some areas can be graveled or hard-surfaced to reduce water needs.

Students panning gold at a Water Fair

Irrigation of large areas such as parks, cemeteries and golf courses can be more efficient and conserve water through use of automated sprinkler systems with moisture probes. This can reduce over application of

water as well as allow irrigation at night, thus reducing evaporation losses.

Residential Water - Residential uses include culinary (potable) and secondary (non-potable) water. Potential residential water savings range from 5 to possibly 50 percent in some cases.

Indoor water demand accounts for about 50 percent of all residential uses. Indoor water use can be reduced by 1) conducting regular inspection of existing toilets, fixtures and plumbing; 2) replacing old high flow toilets with a low flush units; 3) installing low flow shower heads; 4) taking shorter showers; and 5) shutting off faucets while brushing teeth, minimizing flows when using kitchen garbage disposals, and by washing all dishes and clothes in fully loaded machines.

Outdoor water use for landscape irrigation accounts for over 50 percent of all residential demands. This is supplied from either culinary or secondary water. Secondary water should be used for outdoor uses when ever possible. This will reduce the demand for the more expensive culinary water.

Flood irrigation of lawns, gardens and shrubbery is inefficient and results in water loss beyond established root zones. Use of more efficient methods such as sprinkler and drip irrigation systems should be considered. The total amount of water applied per irrigation depends on the time and rate of application. Most residential users are not aware of the amount required or how much is applied. As a result, efficiencies are often low. Evaporation losses can be minimized by irrigating between the hours of 6:00 pm and 10:00 am. An example of the water savings is shown by a study in the Bountiful area. Beginning in 1991, the Bountiful Sub-Conservancy District prohibited the hours of secondary watering between 10:00 am and 6:00 pm. The Division of Water Resources studied the water use in Bountiful for the 10-year period before and 5-year period after the restrictions. They found a 17 percent average decrease in water used after restrictions were implemented.

A significant amount of water can be conserved by making changes in residential landscaping schemes. The Extension Service at Utah State University has information on low water consuming plants and vegetation. Water can be conserved by reducing planted areas or replacing existing landscaping with "hardscapes" such as decks, patios, walkways and play areas for children. Grassed areas should be designed so they are easy to care for and can be irrigated efficiently. Other common outdoor uses include washing of vehicles, driveways, sidewalks and exterior portions of the home. These practices should be reduced as much as possible. In times of drought, outdoor water uses are the first subjected to water restrictions.

Outdoor conservation measures include 1) inspection and repair of outdoor plumbing, 2) use of brooms to clean driveways, sidewalks and patios, 3) elimination of continuously flowing water hoses when washing vehicles, and 4) when children are prone to leave water running, remove handles from outside hose bibs.

Commercial Water - Commercial water uses include those by small retail businesses such as grocery stores and gas stations. The largest commercial water users are restaurants, laundries, linen suppliers, hotels, commercial office buildings and car washes. Conservation measures include water audits of existing distribution and handling systems, replacement of high volume fixtures with more efficient models, recycling where possible and reduction of high use landscaped areas.

Industrial Water - Each industrial business or facility has its own unique water use and related in-plant process characteristics and so must be evaluated on a case by case basis. Water conservation measures currently used in similar situations should be put into practice to the extent possible. Many of the water conservation measures applicable for commercial businesses apply to industry. Water audits are effective in identifying losses, and they should be conducted on a regular basis. Specific improvements to conserve water should be identified and implemented as part of an overall program to improve manufacturing processes.

17.3.3 Wastewater Reuse

Effluent from wastewater treatment facilities represents a significant source of secondary irrigation water that is available. In other regions of the United States, wastewater is routinely utilized to irrigate golf courses, landscaped strips along state and federal highways, municipal parks and other isolated public landscaped areas.

Utilizing treated wastewater as a source of secondary irrigation water allows for a more efficient use of the overall water supply by freeing up substantial volumes of higher quality water for culinary uses. The potential for wastewater utilization as irrigation water should be investigated to determine the criteria, requirements, and costs to install pumping stations, upgrade treatment and

distribution systems from each of the existing treatment facilities.

Current state and federal regulations limit the use of treated wastewater in situations that would result in direct human contact, either by aerosols generated from sprinkler discharges or by ingestion of foods irrigated with wastewater effluent. However, state and federal regulations allow treated wastewater effluent to be used as irrigation water as long as the stated conditions are met regarding human contact.

Fourteen wastewater treatment facilities are currently operating with an estimated total effluent discharge of over 89,100 acre-feet per year. The Central Weber Sewer Improvement District discharges treated effluent into a local agricultural irrigation canal. Other treated wastewater effluent is discharged to either the upper Weber River system or directly to the Great Salt Lake.

Table 17-1
IMPACTS OF CONSERVATION ON M&I WATER DEMANDS
DAVIS AND WEBER COUNTIES

Conservation Scenarios	1992	Demand 2000	2010	2020	Change 2000	2010	2020
		(acre-feet)				(percent)	
Base Case	78,300	82,200	98,800	117,300	5.0	26.1	49.7
Plumbing		79,200	91,300	105,100	-3.7	-7.6	-10.4
Xeriscaping		82,100	98,300	116,000	-0.1	-0.5	-1.1
Pricing 10%		80,000	96,000	114,000	-2.7	-2.7	-2.7
Combination		77,000	88,400	101,100	-6.3	-10.5	-13.8

Source: Wasatch Front Water Demand/Supply Model, November 1996.

17.3.4 Water Conservation Impacts

The Wasatch Front Water Demand/Supply Model was used to project future water demands using current conservation trends along the Wasatch Front area in Weber and Davis counties. These projections are presented in Table 17-1.

17.3.5 Water Conservation Advisory Board

The recent publication of various water conservation recommendations by the Utah Water Conservation Advisory Board offers a number of programs and means to effectively conserve a substantial percentage of M&I water. These recommendations include 1) the development of water management and conservation plans by major water provider agencies, 2) the reduction of secondary water by replacing high-water consuming landscaping with landscaping that uses less water, 3) better overall management of water intensive businesses and large conveyance systems, 4) the implementation of water pricing measures/policies, and 5) the use of low flow water fixtures within new residential homes and commercial buildings.

17.4 Conservation Requirement on Federal Water Reclamation Projects

By federal law (Public Law 97-293), all agencies charged with the operation and maintenance responsibilities of a federal water reclamation project are required to submit an *Annual Water Conservation Plan* (AWCP) to the Bureau of Reclamation. In the Weber River Basin, AWCPs are submitted by the Weber Basin Water Conservancy District as the agency for the Weber Basin Project and by the Ogden River Water Users Association as the agency for the Ogden River Project. To meet these water conservation requirements, each agency must include the following in their individual AWCP: definite goals, appropriate water conservation measures, and a time schedule for meeting established water conservation objectives.

Water conservation projects recently undertaken by the Weber Basin Water Conservancy District include the reconstruction of the Gateway Canal; piping of miscellaneous irrigation laterals on the Willard Reservoir distribution system; and scheduled maintenance and replacement of impervious linings at existing open ditches, laterals and canals on an as-needed basis.

The Ogden River Water Users' Association has recently completed a number of conservation projects, including the replacement of 5.2 miles of 75-inch steel

piping in Ogden Canyon, replacement of approximately 27,900 feet (5.3 miles) of the concrete-lined Ogden-Brigham City Canal with 48-to 78-inch reinforced concrete pipe, and replacement of 12 measuring weirs delivering water to irrigators. These projects replace old piped or open channel conveyance systems that have moderate to severe leakage problems.

17.5 Issues and Recommendations

Water conservation issues center around the implementation of various water conservation programs and the continued systematic replacement of old water distribution facilities prone to excessive water loss.

17.5.1 Efficient Distribution Systems

Issue - Old, deteriorated and inefficient water conveyance and distribution systems lose significant amounts of water.

Discussion - Large distribution systems convey hundreds of thousands of acre-feet of water to various residential, commercial and agricultural end-users throughout the Weber River Basin. As a result, the improvement of conveyance efficiencies by only a few percentage points would account for thousands of acre-feet of water savings annually.

An annual water system accounting of water produced or purchased compared with water delivered to customers and system uses should give an indication of systems efficiency. Water system accounting requires measuring all water uses and the collection and use of this data.

Recommendation - All water utilities should set standards (best management practices) for an annual water system accounting that will quantify water systems losses and trigger repair, replacement and maintenance programs.

17.5.2 Water Pricing Incentives

Issue - Water pricing may promote conservation.

Discussion - Water pricing is an effective tool in promoting water conservation by providing an incentive to decrease water consumption. Currently, most water pricing structures incorporate a constant volume with the basic rate and constant overage charges for use above this rate. If rates are very low, water users will not feel the need to carefully use water as the cost is insignificant in their minds.

Some water providers fear that raising rates will decrease water sales and thus revenues for the utility. In the range of prices for water, the price-demand relationship is not very elastic. While water use may decrease with increased rates, a 10 percent increase in rates may only result in a 2 percent decrease in use and the net effect may be a small increase in revenues. Developing a pricing structure that takes this into account may result in a natural revenue neutral picture while still encouraging conservation.

Water pricing for conservation focuses on reducing demand through various pricing mechanisms. The primary mechanism available for conserving water is to structure the way water providers charge for water so that an incentive exists for customers to use less. The least effective water rate structure for inducing conservation is one where the price gets less as the amount of water used increases. This is called a decreasing block rate. More effective is the rate structure that charges the same amount (price) for all units, i.e., 1,000 gallons. This is called a flat rate. Most effective is the rate that increases as usage increases. This is called an increasing block rate. Under this approach, the customer is allotted enough water to serve the average family's indoor needs at some base price per 1,000 gallons. Any usage beyond the base allotment is priced at a higher rate. Some providers set prices at higher rates for additional increments of water to assure that those who place the highest demand on the delivery system pay a larger share of the operating and capital costs.

The increasing block rate has been used at Kaysville in Davis County to encourage residents to use the pressurized irrigation system and reduce the use of treated water from the culinary system. People can still use culinary water to irrigate lawns and gardens, but at a much higher cost than they would pay if using cheaper irrigation water from the secondary system. Examples of the stated rate structures are given in Figures 17-1 and 17-2.

Recommendation - Local provider agencies should implement a pricing structure that encourages water conservation. ❖

Figure 17-1
COMMON RATE STRUCTURES

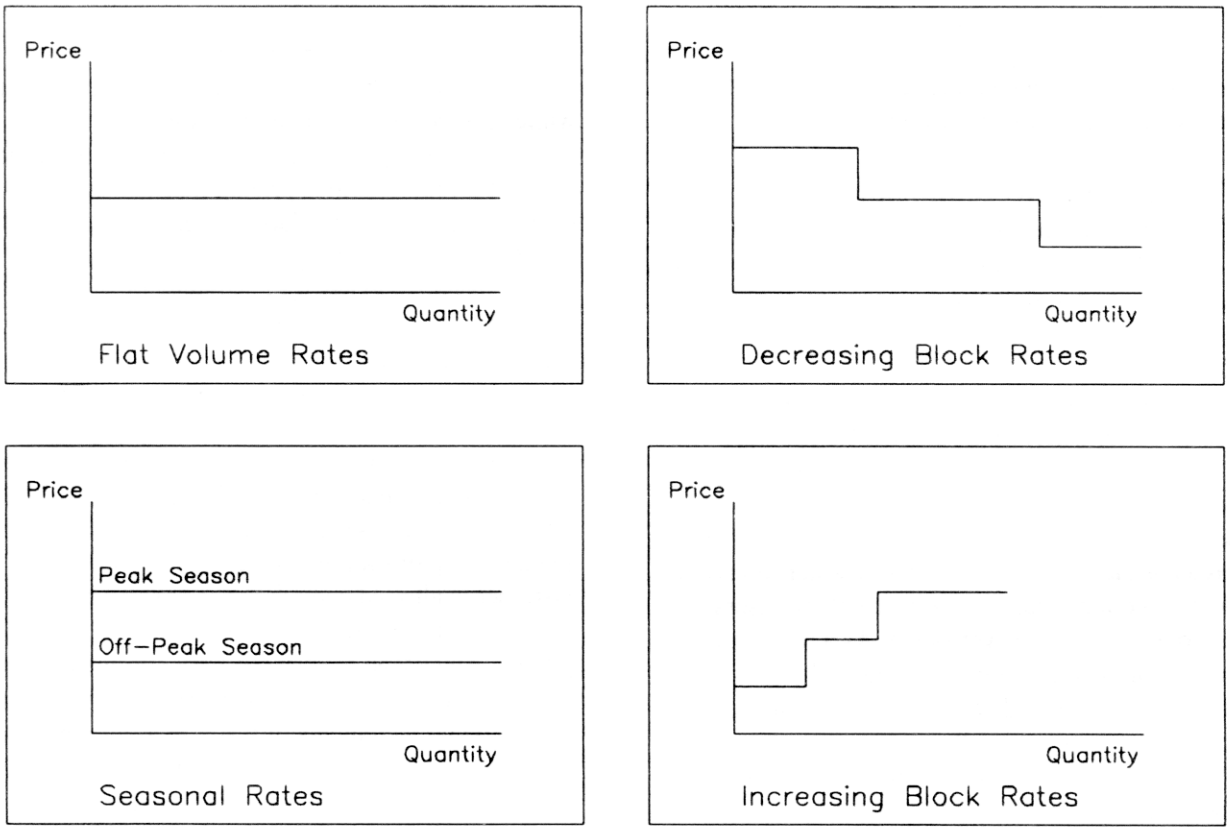
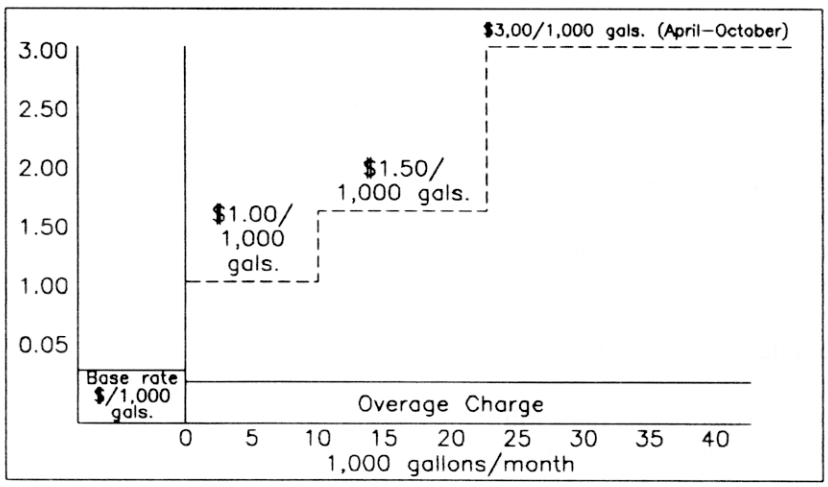


Figure 17-2
KAYSVILLE INCREASING BLOCK RATE



Section 18 Contents

18 SECTION

Industrial Water

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Although the Weber River Basin has had a strong economic base, the area is currently in a state of transition from an economy driven by large military installations to one driven by private investment.

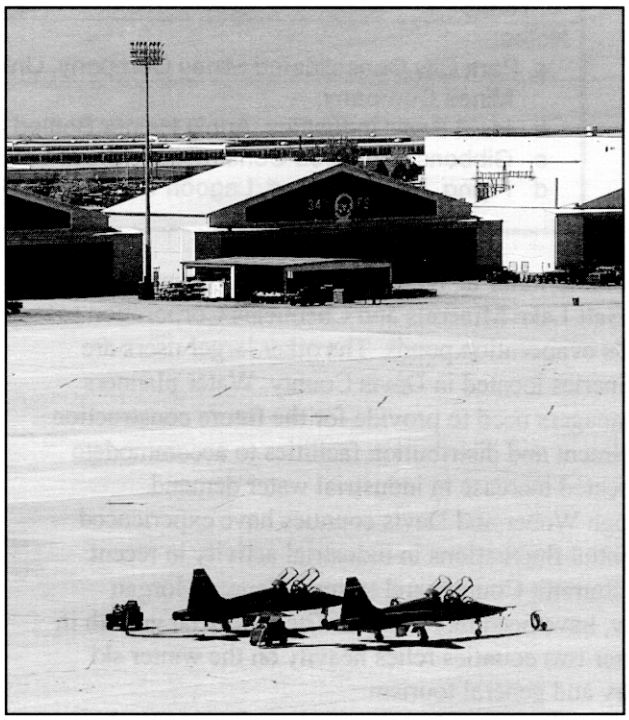
18.1 Introduction

This section of the *Weber River Basin Plan* presents industrial water use data and information taken from several studies on municipal and industrial (M&I) water use. Current and projected water use is presented for most of the major public operations and private industries.

18.2 Background

The Weber River Basin has historically enjoyed a robust and growing economy. The sustained growth in agricultural businesses and military installations over the years provided tens-of-thousands of jobs and related growth in other businesses. However, the closure of the Defense Depot at Ogden (DDO) and downsizing of Hill Air Force Base (HAFB) have negatively impacted the overall local economy and growth of industrial business activity.

To effectively manage the recent change in economic climate, local business organizations are in the process of attracting new business opportunities to the area. As an example, various business development organizations have successfully financed the reconstruction of major portions of the business district in Ogden. Existing industrial businesses in the area have also expanded due to an increasing demand for residential housing. Of particular importance are industries associated with oil refineries, commercial and residential construction, the processing of rock products, various mining operations, and chemical and mineral processing plants.



Hill Air Force Base

In the immediate future, industrial water demand is expected to remain constant or show modest declines. In the long term, the demand is expected to increase at a rate approximated by the projected growth in population.

18.3 Industrial Water Use

Table 18-1 shows a breakdown of estimated industrial water uses in 1992, with a total of 25,900 acre-feet. This includes potable and non-potable water supplies. The largest component is 19,900 acre-feet of

Table 18-1
INDUSTRIAL WATER USE BY COUNTY

County	Potable	Non-Potable (acre-feet)	Total Industrial
Summit			
Self-Supplied Industries[a]	0	15	15
Public Community Systems	60	0	60
Morgan			
Self-Supplied Industries[b]	827	0	827
Public Community Systems	13	0	13
Weber			
Self-Supplied Industries[c]	312	19,848	20,160
Public Community Systems	1,302	0	1,302
Davis			
Self-Supplied Industries[d]	1,882	292	2,174
Public Community Systems	1,307	0	1,307
Totals	5,703	20,155	25,858

Notes:
a Park City Consolidated Mines Company, Union Pacific Resources, United Park City Mines Company.
b Ideal Basic Industries, Annie Heiner Bottled Spring Water.
c Gibbons and Reed Construction, Great Salt Lake Minerals and Chemicals Corp.
d Flying J Incorporated, Lagoon Corp., Jack B. Parsons Co., Phillips 66.

non-potable water in Weber County. This is used by Great Salt Lake Minerals and Chemicals Corporation to flush its evaporation ponds. The other larger users are oil refineries located in Davis County. Water planners and managers need to provide for the future construction of treatment and distribution facilities to accommodate an expected increase in industrial water demand. Although Weber and Davis counties have experienced substantial fluctuations in industrial activity in recent years, Summit County, and to some degree Morgan County, have been more stable. The industrial growth in the latter two counties relies heavily on the winter ski industry and general tourism.

Projected industrial water use data are presented in Table 18-2. In contrast to residential and commercial water users, which grow in proportion with population, future industrial use is impossible to predict. If industrial water use grows at the same rate as the population, by the year 2020 it will increase to 42,200 acre-feet.

18.3.1 Water Use By Major Industries

The major industrial water users include two refineries operated by Big West Oil Company (Flying J, Inc.) and Phillips 66 Company at West Bountiful, rock product facilities operated by Jack B. Parsons Companies at South Weber, cement processing plant operated by Ideal Basic Industries at Croydon, various mining operations by Park City Consolidated Mines Company and United Park City Mines Inc. within the Snyderville Basin, miscellaneous railroad yard operations by Union Pacific Resources at Ogden, metal finishing and processing by Western Zirconium west of Ogden and various salt and trace mineral/ chemical processing operations by Great Salt Lake Minerals and Chemicals Corporation. In addition, two major plant facilities have located in the Weber County Industrial Park northwest of Ogden.

18.3.2 Hydroelectric Power Generation

Hydroelectric power generation plants require operational hydraulic head and significant volumes of water. This is a non-consumptive use and the water can be used downstream. Currently, five major hydroelectric power generation facilities operate in the basin. These are described in Table 18-3. All of the hydroelectric plants are operated based on water demands within existing river systems to optimize seasonal water storage within existing reservoirs. ❖

Table 18-2
PROJECTED INDUSTRIAL WATER USE BY COUNTY[a]

County	1992 (acre-feet)	2020
Summit	100	200
Morgan	800	1,400
Weber	21,500	34,600
Davis	3,500	6,000
Totals	25,900	42,200

a Includes potable and non-potable water use.

Table 18-3
SUMMARY OF BASIN POWER PLANTS

Facility	Operating Agency	Location	Average Annual Power Generation (kw-hr/year)
Gateway	Weber Basin WCD	Weber River at Gateway Diversion	6,500,000
Wanship	Weber Basin WCD	Weber River at Wanship Dam	4,900,000
Pioneer	Utah Power & Light	Ogden River at Ogden Canyon	a
Echo	Bountiful City	Weber River at Echo Dam	8,200,000
Weber	Utah Power & Light	Weber River at Mouth of Canyon	a
Pineview	Bountiful City	Ogden River at Pineview Dam	7,200,000

a Information declined by operating agency.

Section 19 Contents

19 Groundwater

SECTION

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

Groundwater is an important element of the overall hydrologic system in the Weber River Basin. Groundwater aquifers serve as large underground reservoirs providing substantial amounts of water for a variety of users.

19.1 Introduction

This section presents a comprehensive assessment of groundwater conditions in the Weber River Basin. It includes a description of geologic and hydraulic characteristics of existing groundwater aquifers, a general assessment of water quality associated with each groundwater basin, and discussions of groundwater management and supply issues. The groundwater basins are shown on Figure 19-1.

Groundwater is an important source of water for a broad range of uses including agricultural irrigation, secondary irrigation, municipal culinary water and industrial supplies. Currently, groundwater accounts for roughly half of all M & I water sources. Individual farmers and ranchers, municipalities, water districts, and companies and individual corporations all own and operate wells that withdraw an estimated 97,200 acre feet of water annually from the basin's six basic aquifer systems. A summary of pumpage by all uses for the East Shore Area is shown on Figure 19-2.

The aquifers within the Weber River Basin have unique geologic and hydraulic characteristics, water quality and current utilization practices. Each aquifer has distinct and differing capabilities of providing a reliable and safe water supply for the various beneficial uses.

In years past, groundwater supplies have been adequate to supplement surface water supplies to meet existing domestic and commercial water demands. But the recent increase in M&I water demand has dictated that new wells be developed. The need for additional groundwater withdrawals has also created water supply problems; the most dominant of which is the steady decline of groundwater levels in some of the most heavily pumped aquifers. In the East Shore Area, groundwater levels have declined between 50 and 80 feet since the mid-1950s.

19.2 Subsurface Geology and Aquifer Characteristics

As shown on Figure 19-1, the Weber River Basin consists of six groundwater basins which, although connected by surface flows, are generally considered geologically isolated.

The East Shore Area is the most fully developed groundwater basin in terms of annual pumpage for agricultural and M&I water demand. Except for the Park City area, groundwater is produced mostly from unconsolidated alluvium and lake deposits. No significant subsurface flow occurs between basins. Geological and hydraulic data for the six groundwater basins are summarized in Table 19-1.

9.2.1 East Shore Area Groundwater Basin

The East Shore Area is a string of coalescing alluvial fans and river deltas on the hanging wall of the Wasatch Fault. They are composed of multiple layers of sand and gravel deposited at the mouths of canyons, becoming finer westward into the Great Salt Lake Basin and sandwiched between clay layers deposited during high water levels of several ancient lakes. Interpretation of geologic data indicates unconsolidated or poorly consolidated deposits may be 9,000 feet thick near Ogden, and about 2,500 feet thick toward the north and south ends. The unconsolidated deposits are underlain at great depth by consolidated rock of Precambrian to Tertiary age whose properties have not been explored.

Figure 19-1

HYDROLOGIC SUBAREAS SHOWING GROUNDWATER BASINS

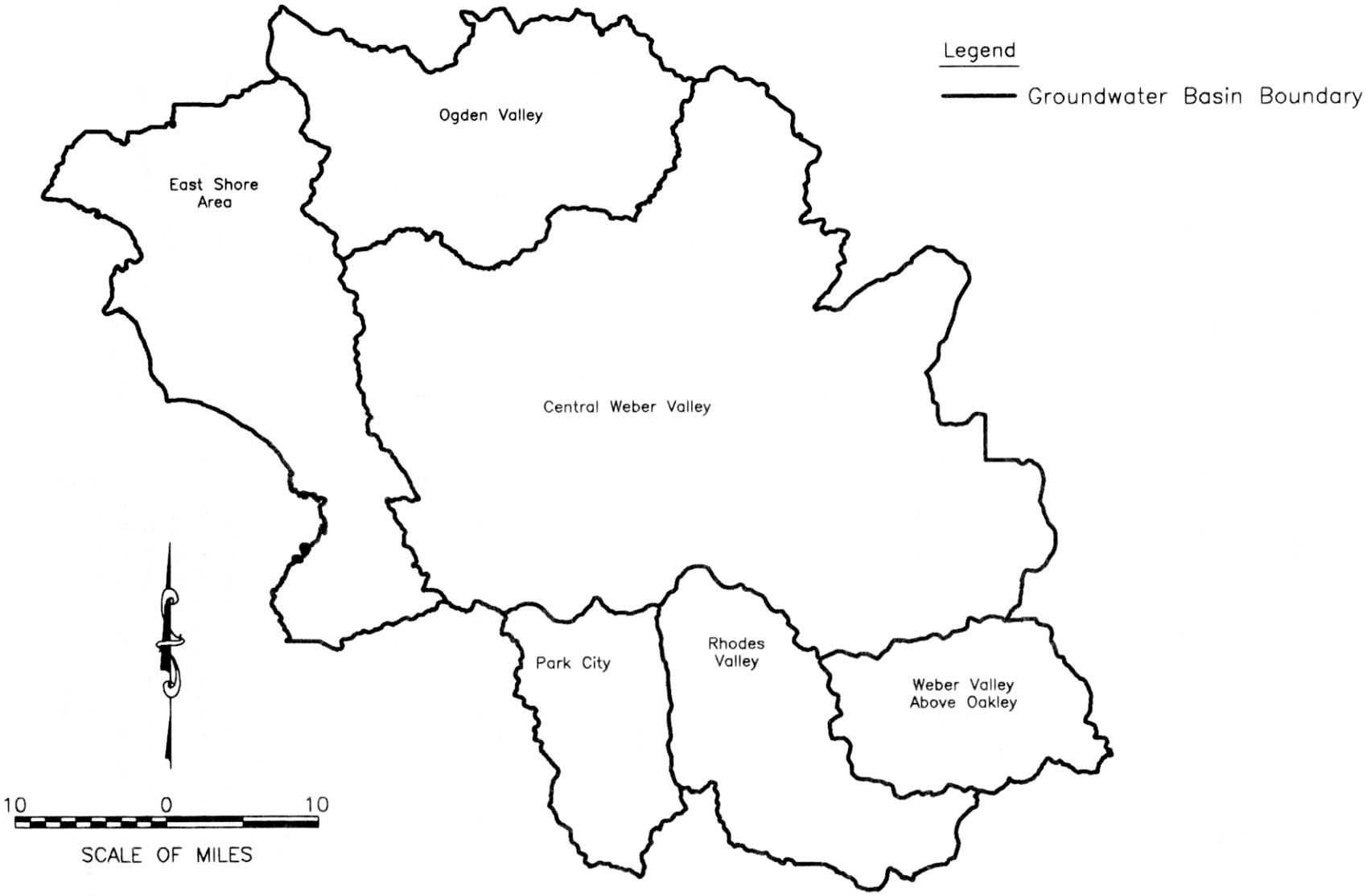


Figure 19 - 2

WEBER BASIN GROUNDWATER PUMPAGE

East Shore Area

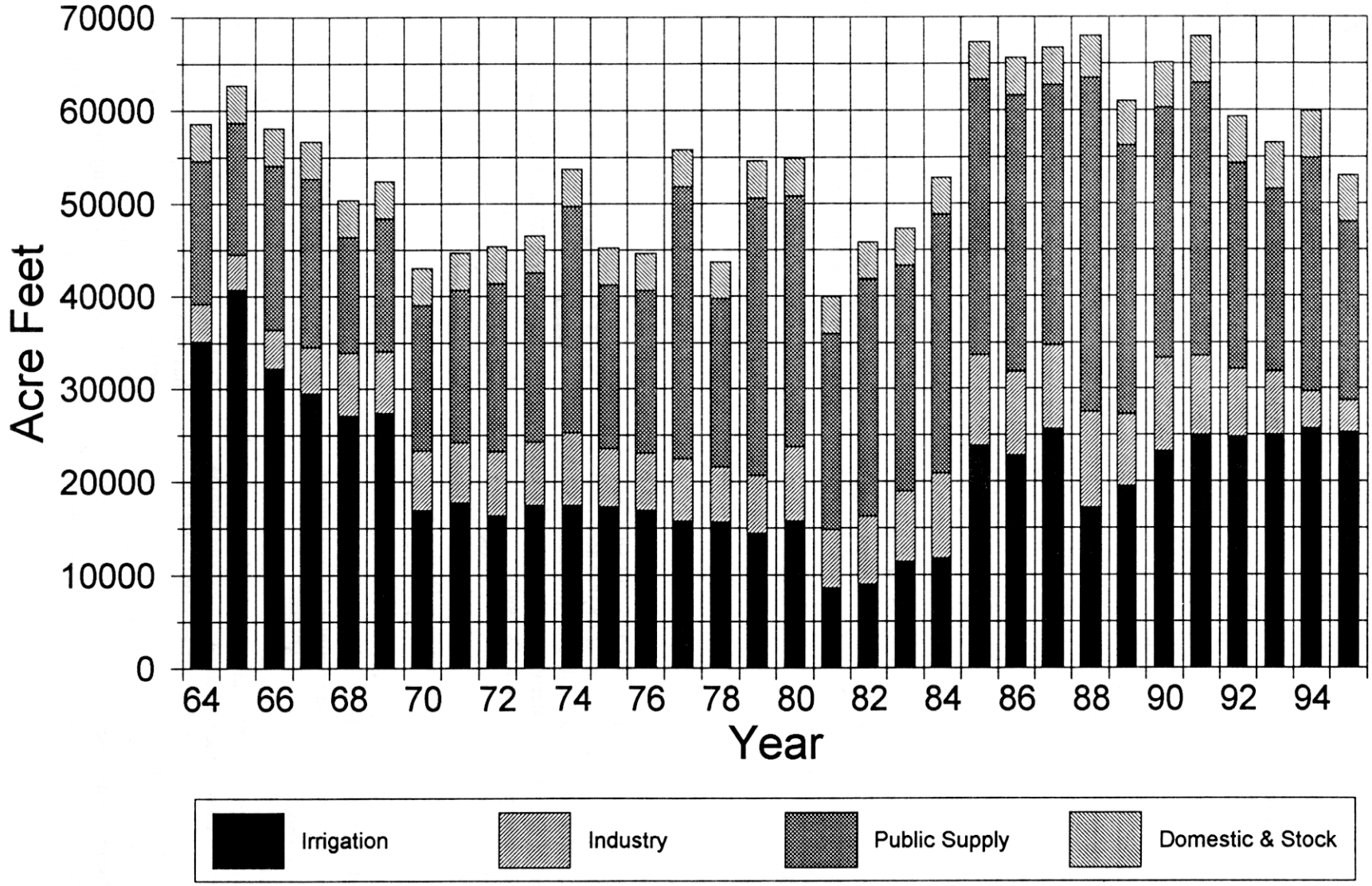


Table 19-1
AQUIFER CHARACTERISTICS-WEBER RIVER GROUNDWATER BASINS

Name	Aquifer	GW Model	Pumpage (acre-feet)	Chemical Quality	Water Right Status
East Shore Area	Alluvium/Lacustrine	Completed	68,000	Good[a]	Open
Central Weber Valley	Alluvium/Bedrock	Partial	3,000	Good[b]	Closed
Rhodes Valley	Alluvium	None	1,900	Good	Closed
Weber above Oakley	Alluvium	None	1,000	Good	Closed
Park City Area	Alluvium/Bedrock	In Progress	5,600	Good[c]	Closed
Ogden Valley	Alluvium	In Progress	17,700	Good	Closed
Totals			97,200		

a Some small areas of poor quality; potential for salt water intrusion from the Great Salt Lake.
b Some water from the Frontier and Wanship Formations near Coalville are "coally" with high dissolved iron.
c Some local problems with sulfate and heavy metals.

The USGS has recently completed groundwater models for the East Shore Area basin concentrating on the Weber River delta and Bountiful subareas. These models generally predict the consequences of various management strategies. A large volume of recoverable water appears to be in storage compared to the average annual discharge. This has given water managers some flexibility in managing the groundwater reservoir in conjunction with variable surface supplies.

Average annual discharge from the East Shore Area aquifer system is estimated to be 125,000 acre-feet. Discharge from wells accounts for 68,000 acre-feet, approximately half of the total. The remainder is 57,000 acre-feet of seepage to waterways and springs, the Great Salt Lake, uncapped artesian wells, and evapotransportation by surrounding wetlands.

Recharge to the East Shore Area aquifer is estimated to average 121,000 acre-feet per year. Of this, an estimated 48,400 acre-feet is infiltration from streams and canals with 60,500 acre-feet bedrock inflow. The remainder is 8,100 acre-feet from precipitation and 4,000 acre-feet from irrigation water applied to agricultural fields and residential lawns and gardens.

Because of the size and potential storage in the East Shore Area aquifer, additional water could be developed with several management options. This could include artificial recharge of surplus surface runoff near the mouth of Weber Canyon.

Water quality associated with the East Shore Area groundwater basin generally meets all state and federal standards for culinary water use. The highest quality of groundwater is typically found in the principle aquifers near the Weber and Ogden rivers deltas. These aquifers are also being recharged the most rapidly. However, in areas radially outward to the west of the two deltas, groundwater quality deteriorates as a function of depth. Groundwater quality generally decreases substantially below depths of 1,200 feet. In the northern part of the East Shore Area, pockets of brackish water exist that are possibly related to deep circulation of thermal water near Utah Hot Springs.

19.2.2 Central Weber Valley Groundwater Basin

The Central Weber Valley area is characterized by thin alluvial deposits along the Weber River and its tributary streams. In Morgan Valley, the alluvium depth has been approximated at 200 feet in most areas; however, actual thickness varies with location with some areas estimated at less than 100 feet. The alluvium is underlain by a variety of consolidated rock units ranging in age from Precambrian to Tertiary. The younger conglomerates and coarse clastic rocks, mainly the Echo Canyon, Evanston and Wasatch formations, are locally permeable and yield up to 560 gpm of good quality water to wells. Cretaceous sandstones around Coalville yield fresh to somewhat brackish water. The older formations have not been tested but probably have minimal permeability. Most of the groundwater is produced from the alluvium, which is hydraulically connected to and recharged by surrounding surface streams.

Most of the discharge is by pumping (3,000 acre-feet

per year) and seepage to streams. Most of the recharge is from infiltration of precipitation and snowmelt. Details of this subarea are given in Bates and others (1984).

Water quality generally meets culinary standards for dissolved solids. The alluvial aquifer, however, is so thin and well-connected to surface water supplies, bacterial contamination may be a problem. Little or no testing has been conducted to assess the level of agricultural related organic contaminants. Water from some of the bedrock formations, such as the rocks of Cretaceous age near Coalville, may be high in iron or other inorganic solids.

19.2.3 Rhodes Valley Groundwater Basin

Rhodes (Kamas) Valley is a north-south, nearly rectangular, structural basin nine miles long and three miles wide lying between the Keetly volcanic field on the west and the Uinta Mountains on the east. The Weber River flows across the north end of the valley and receives drainage from a substantial portion of the aquifer. The basin fill is composed of coalescing alluvial fans deposited by intermittent drainages heading in the Uinta Mountains. These interfinger toward the center of the valley with fluvial gravels deposited by the Weber River and ancestral Provo River.

These unconsolidated deposits, estimated to be at least 300 feet thick, constitute the most important hydrogeologic units in the area. There appear to be no well-defined or continuous multiple aquifers or aquitards and no artisan conditions. Therefore, the water in the unconsolidated deposits is more or less hydraulically connected with the surface water and development of groundwater may have an immediate effect on spring discharge, surface flow and wetland areas.

Little is known of the bedrock deeply buried beneath the basin fill. Based on its occurrence in both a 1973 Kamas test well and a 1969 oil test on the west side of the valley, it has been demonstrated that the Weber quartzite probably extends under the entire valley and, if well fractured, may constitute a more productive aquifer than the alluvial fill. The 1973 test well was drilled east of Kamas at the mouth of Beaver Creek under a cooperative agreement among the Division of Water Resources, the Beaver and Shingle Creek Irrigation Company and the Weber Basin Water Conservancy District. The well penetrated 60 feet of bouldery alluvium, which proved unproductive. Beneath the alluvium, the well penetrated 305 feet of fractured Weber quartzite to a total depth of 365 feet. The well yielded 4 cfs (1800 gpm) for 26.5 hours with a drawdown of 71 feet; a specific yield of 25.4 gpm/foot of drawdown.

Recharge to the groundwater system in Rhodes Valley was estimated to be 22,000 acre-feet per year. This is a minimum value based on the average annual change in storage. Recharge is derived primarily from the infiltration of excess irrigation water with additional supplies from snowmelt.

In general, the groundwater quality within the Rhodes Valley basin meets and, in most instances, exceeds standards established for drinking water. In a few isolated cases, excessive dissolved solids and bacterial counts have created problems.

19.2.4 Weber Valley Above Oakley Groundwater Basin

The Weber River Valley upstream from Oakley contains substantial thicknesses of very permeable alluvial and glacial sand and gravel. A Bureau of Reclamation test well at the Larrabee Dam site penetrated 287 feet of alluvium and estimated the transmissivity at 2 ft^2/minute (2880 ft^2/day). The volume of water stored in the narrow valley fill is small with the aquifer hydraulically connected to surface streams. Current pumping rate from the aquifer has been estimated at 1,000 acre-feet per year.

19.2.5 Park City Groundwater Basin

Development in the Park City area is extending beyond the valleys to surrounding hillsides. As a result, the development of groundwater has expanded beyond existing basin fill materials to higher consolidated rock formations which allow for large aerial boundary extensions, large aquifer volumes and substantial depths. Consolidated rock aquifers not only yield water to wells, but feed most of the local springs and drain tunnels.

The Snyderville Basin and Park City Area contains two alluvial basins: Parleys Park, which drains to the Weber River via East Canyon; and Richardson Flat, which drains to the Weber River via Silver Creek. The unconsolidated basin fill consists of a poorly sorted mixture of material ranging in size from clay to cobbles and averaging 200 feet thick in Parley's Park and 100 feet thick in Richardson Flat. As in Rhodes Valley, there appears to be no well defined beds of very high or very low permeabilities and no indications of the existence of artesian conditions. The unconsolidated deposits are saturated to within a few feet of land surface, and are apparently recharged in many places by seepage from the underlying rock.

The largest part of local groundwater discharge is accounted for as annual pumpage (5,600 acre-feet per

year), uncontrolled seepage or spring flow to surface streams. Consolidated rocks which yield water to wells include volcanic and volcaniclastic rocks, sandstone, limestone and shale. Compared to the unconsolidated valley fill, these rocks have comparatively high transmissivities and comparatively low storativities. Transmissivity is mostly due to fracturing. The more brittle the rock, the greater the probability it will sustain open fractures which will transmit water.

Transmissivities measured in boreholes and drain tunnels range from 3 ft^2/day in igneous rock, to several hundred ft^2/day in the Nugget sandstone and Weber quartzite, to several thousand ft^2/day in the Thaynes formation. Fracture permeability within a given rock unit is variable and depends upon the intensity of deformation. Vertical permeability is often as great as horizontal permeability. Wells in the Twin Creek limestone in the Summit Park-Timberline area show low production and large seasonal fluctuations in water level. This is an indication of local recharge through vertical fracture systems. Some artisan conditions are reported in the Nugget sandstone. The volcanic rocks are generally unproductive, but they may contain gravel channels or zones of brittle fractured rock which could be highly productive.

The Park City area is honeycombed with old mining tunnels and shafts that also serve as underground drainage conduits within local groundwater aquifers. Of primary importance are the Spiro, Ontario and Judge tunnels. The Spiro and Ontario tunnels are considered transbasin diversions while the Judge Tunnel collects and discharges groundwater entirely within the Snyderville Basin and Park City Area.

The Spiro Tunnel extends from the Snyderville Basin to the west side of the Wasatch Front. This physical alignment has resulted in the drainage of some groundwater from the Salt Lake County area to Park City. The resulting transbasin diversion has been subjected to litigation establishing damages to Salt Lake County water users for the loss of annual flow attributed to tunnel drainage.

The Ontario Tunnel collects groundwater in-and-around the northern limits of Park City and in the Snyderville Basin then discharges to the Jordanelle Reservoir. As a result, groundwater is collected in the Weber Basin and discharged to the Provo River Basin.

The Judge Tunnel is entirely contained within the Snyderville Basin and Park City Area. The tunnel collects groundwater from local basins and discharges to existing streams within Empire Canyon north of Park City.

The overall groundwater system in the Snyderville Basin and Park City Area is very complex and the primary source of water for nearly all municipal uses within the area. As a result of the relatively high rate of residential and commercial growth in recent years, a high demand has been placed on the basin's existing groundwater resources. This has prompted the U.S. Geological Survey, Utah Geological Survey and Division of Water Rights to conduct various surveys to better delineate and characterize various bedrock aquifers within the overall groundwater basin.

The groundwater in general meets culinary standards, but varies with source. In the unconsolidated valley fill, some springs test high for sulfate, chloride, manganese, iron or cadmium, elements which may come from mineralized bedrock or mining waste. Drain tunnels produce water high in sulfate which is an oxidation product of sulfide metal ore. Other tunnel drainage contains traces of heavy metals such as zinc, lead and arsenic in addition to substantial amounts of iron and manganese. Park City treats the Spiro drain water to remove arsenic, among other constituents.

19.2.6 Ogden Valley Groundwater Basin

The Ogden Valley groundwater basin is structurally bounded on both the east and west by faults that dip toward the middle of the valley. Basin fill consists of unconsolidated deposits of gravel, sand and clay at least 600 feet thick. Some areas of the lower basin have demonstrated instances of multiple confining clay layers creating artesian conditions in some isolated areas including Ogden City's culinary water well field. The well field has proven to be a major source of culinary water for Ogden City with an estimated annual production rate of 16,500 acre-feet per year. Studies of artisan aquifer conditions indicate that under normal water years, these aquifers fill to capacity every spring by natural recharge with partial depletion by the end of summer.

Springs around the margin of the valley produce some water for local culinary and municipal systems from consolidated rock. Consolidated rock units range in age from Precambrian to Tertiary and range in hydraulic conductivity from virtually zero to open channel flow in cavernous limestone. Few wells produce from bedrock.

19.3 Groundwater Problems and Alternatives in the East Shore Area

From groundwater models developed through a joint agreement between the Utah Division of Water Rights and the U.S. Geological Survey, it has been demonstrated that groundwater levels in the East Shore Area have experienced significant declines in recent years. Records taken from field measurements at various well sites have documented groundwater declines of up to 50-80 feet in densely pumped areas for the time period of 1958 to 1985.

The completion of the model has provided the Division of Water Rights with data and information to formulate a management plan for the East Shore Area groundwater basin. The management plan established various restrictions of pumping rates and the development of new wells. A copy of the management plan can be attained from the Division of Water Rights in its Salt Lake City offices.

19.3.1 Current and Projected Groundwater Conditions

Groundwater models have been developed to better quantify the current relationship of groundwater decline versus current and projected pumping rates within the East Shore Area aquifer. Each model has been run with a number of scenarios incorporating different combinations of pumping rates at differing locations throughout the groundwater basin. Results from the various computer evaluations of the existing aquifer/groundwater system seem to indicate that significant declines in groundwater elevations will be experienced in the event pumping rates continue at current or increased levels.

With the assumption that current pumping rates will continue indefinitely, it is predicted that groundwater elevations will drop an additional 15 to 80 feet by the year 2020.

However, the overall storage of water in the East Shore Area aquifer is large. As a result, the aquifer is not in danger of depletion. Local and state water planners have time to develop and implement effective management policies to better manage the existing groundwater resources.

Despite the general decline in groundwater elevations, artesian pressure still exists in some parts of the area. Unused, deteriorated and uncapped wells discharge water to surrounding drainages, thus wasting water and creating flood problems in some places. This problem probably will continue and perhaps worsen as wells become older and are abandoned.

19.3.2 Alternatives

The current trend of declining groundwater conditions in the East Shore Area can be reversed, or effectively managed through two basic approaches: 1) implement recharge projects to supplement existing groundwater supplies, and 2) enforce restrictions on pumping operations within the entire East Shore Area.

Studies around the mouth of Weber Canyon have identified areas of relatively large declines of up to 50 feet for original groundwater levels. However, the area has also been identified as very favorable or conducive to recharge from the Weber River. The subsurface conditions within the immediate area consists mostly of coarse unconsolidated alluvial deposits with high storativity and hydraulic conductivities. As a result, surface flows could be injected into local groundwater aquifers, stored and pumped at other locations within the overall aquifer system with a managed level of groundwater declines. Similar situations exist along the Wasatch Front in Davis and Weber counties that would allow for the effective management of groundwater elevations and annual pumping rates.

The Division of Water Rights has completed a groundwater management study for the East Shore Area to address declining groundwater levels in local aquifers. The study establishes policies, guidelines, and limitations concerning the installation and operation of new wells.

Deteriorated wells with artesian pressure need to be repaired. Unused wells could be capped or provided with control valves. Where repair is impractical, drains could be provided to reduce flooding and provide opportunity for beneficial use.

19.4 Issues and Recommendations

Groundwater issues generally include declining groundwater levels and related problems associated with pumping costs and groundwater availability. These issues are being addressed by a number of ongoing studies and field evaluations by state and federal agencies.

19.4.1 Groundwater Management

Issue - The overall groundwater supply is in jeopardy of significant depletions in terms of both water storage and pumping levels in critical areas of the basin.

Discussion - Five of the six groundwater aquifers in the Weber River Basin are closed to further

appropriations. The East Shore Area is not closed, but it is currently experiencing problems associated with prolonged periods where annual pumping rates exceed recharge rates.

A thorough and comprehensive study of groundwater problems in the Weber River Basin has begun by the Division of Water Rights with the ongoing preparation of a groundwater management plan for the East Shore Area and Bountiful Subarea. As the need for additional water grows, groundwater problems will likely develop in populated areas traditionally serviced by wells or major springs.

Recommendation - The Division of Water Rights should continue efforts to prepare and implement groundwater management plans, not only in the East Shore Area, but in other areas of interest such as Ogden Valley, Morgan County, and the Snyderville Basin and Park City Area. These management plans should provide criteria and policies to safeguard against uncontrolled reductions in groundwater levels and possible groundwater mining in severely impacted areas of the basin.

19.4.2 Artificial Groundwater Recharge/ Conjunctive Use

Issue - The M&I water within the East Shore Area supplied by wells is impacted by declining groundwater levels.

Discussion - If the East Shore Area continues to experience moderate to rapid levels of urbanization, local water providers will be faced with the necessity of either expanding existing surface water treatment and distribution facilities or increasing current groundwater pumping rates. The former option would require significant costs associated with the planning, design and ultimate construction of new and/or expanded treatment and distribution facilities. Construction of injection wells or infiltration beds strategically located near Weber and Ogden canyons would potentially recharge a relatively large area of the existing groundwater aquifer near the most populated portions of the East Shore Area. The recharged aquifer would then allow for increased pumping rates at existing well sites and help eliminate the need for the construction of large surface water treatment and distribution facilities.

Recommendations - Major water suppliers under the direction of Weber Basin Water Conservancy District, in cooperation with the Division of Water Rights and Division of Water Resources, should pursue the possibility of obtaining funds through the Central Utah Project Completion Act for groundwater recharge projects within the East Shore Area. ❖

A SECTION

Acronyms, Abbreviations and Definitions

A.1 Acronyms and Abbreviations

Many names, titles, programs, organizations, legislative acts, measurements and activities are abbreviated to reduce the volume of words and to simplify communications. A few of the abbreviations and acronyms used in the *Weber River Basin Plan* are listed below.

A.1.1 State and Local Agencies and Organizations

CEM	Division of Comprehensive Emergency Management
DWRi	Division of Water Rights
PVWS	Pine View Water System
SBSID	Snyderville Basin Sewer Improvement District
SLCWCD	Salt Lake County Water Conservancy District
SWDC	Summit Water Distribution Company
USU	Utah State University
WBWCD	Weber Basin Water Conservancy District
WBWQC	Weber Basin Water Quality Council
WID	Water Improvement District

A.1.2 Federal Agencies

BLM	Bureau of Land Management
COE	Corps of Engineers
DDO	Defense Depot of Ogden
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIA	Federal Insurance Administration
FSA	Farm Service Agency
FWS	Fish and Wildlife Service
HAFB	Hill Air Force Base
NRCS	Natural Resources Conservation Service
USGS	United States Geological Survey
WCNF	Wasatch-Cache National Forest

A.1.3 Programs/Acts

ACP	Agricultural Conservation Program
CFR	Code of Federal Regulations
CRP	Conservation Reserve Program
CWA	Clean Water Act

DWSPR	Drinking Water Source Protection Rule
ECP	Emergency Conservation Program
ESA	Endangered Species Act
FWPCA	Federal Water Pollution Control Act
NAWQA	National Water Quality Assessment
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
RC&D	Resource Conservation and Development
SCORP	State Comprehensive Outdoor Recreation Plan
SDWA	Safe Drinking Water Act
UPDES	Utah Pollution Discharge Elimination System
USDWA	Utah Safe Drinking Water Act
UWPCA	Utah Water Pollution Control Act
WPCA	Water Pollution Control Act
WQA	Water Quality Act

A.1.4 Measurements

cfs	Cubic Feet Per Second
ft	Feet
GPCD	Gallons Per Capita Day
gpm	Gallons Per Minute
hr	Hour
kw	Kilowatt
MCL	Maximum Contaminant Level
mg/l	Milligrams Per Liter
SMCL	Secondary Maximum Contaminant Level

A.1.5 Miscellaneous

AWCP	Annual Water Conservation Plan
EAP	Emergency Action Plan
EOP	Emergency Operations Plan
ESGWA	East Shore Groundwater Aquifer
FIRE	Finance, Insurance and Real Estate
M&I	Municipal and Industrial
NPS	Non-Point Source
NPSMP	Non-Point Source Management Plan
OHV	Off-Highway Vehicle
SDCO	State Disaster Coordination Officer
TCPU	Transportation, Communications and Public Utilities
UPED	Utah Process Economic and Demographic
WFCM	Wasatch Front Water Demand/Supply Computer Model

A.2 Water Resources Definitions

Many terms used in the water business have different meanings depending on the source, and are sometimes confusing. Some words are used interchangeably. A few commonly used water terms are defined for use in this document.

A.2.1 Water Use Terms

Water is often said to be "used" when it is diverted, withdrawn, depleted or consumed. But it is also "used" in place for such things as fish and wildlife habitat, recreation and hydropower production.

Cropland Irrigation Use - Water used for irrigation of cropland. Residential lawn and garden uses are not included.

Residential Use - Water used for residential cooking; drinking; washing clothes; miscellaneous cleaning; personal grooming and sanitation; irrigation of lawns, gardens and landscapes; and washing automobiles, driveways and other outside facilities.

Commercial Use - Uses normally associated with small business operations which may include drinking water, food preparation, personal sanitation, facility cleaning and maintenance, and irrigation of landscapes.

Institutional Use - Uses normally associated with general operation of various public agencies and institutions including drinking water; personal sanitation; facility cleaning and maintenance; and irrigation of parks, cemeteries, playgrounds, recreational areas and other facilities.

Industrial Use - Use associated with the manufacturing or assembly of products which may include the same basic uses as commercial business. However, the volume of water used by industrial businesses can be considerably greater than water use by commercial businesses.

Municipal and Industrial (M&I) Use - This term is commonly used to include residential, commercial, institutional, and industrial uses. It is sometimes used interchangeably with the term "public water use."

Private-Domestic Use - Includes water from private wells or springs for use in individual homes, usually in rural areas not accessible to public water supply systems.

Diversion - Water diverted from supply sources such as streams, lakes, reservoirs, springs or wells for a variety of uses including cropland irrigation and residential, commercial, institutional and industrial purposes. The terms diversion and withdrawal are often used interchangeably.

Withdrawal - Water withdrawn from supply sources such as lakes, streams, reservoirs, springs or groundwater. This term is normally used in association with groundwater withdrawal.

Depletion - Water lost or made unavailable for return to a given designated area, river system or basin. It is intended to represent the net loss to a system. The terms consumption and depletion are often used interchangeably, but they are not the same. For example, water exported from a basin is a loss or depletion to that system as it is not consumed within the basin. Water diverted to irrigated crops in a given system, but not returned for later use, is depletion. Precipitation that falls on irrigated crops is not considered a part of the supply like surface water and groundwater diversions. For this reason, precipitation falling on and consumed by irrigated crops is not considered as being a depletion to the system.

Consumptive Use - Consumption of water for residential, commercial, institutional, industrial, agricultural, power generation and recreational purposes. Naturally occurring vegetation and wildlife also consumptively use water. Water consumed is not available for other uses within the system.

A.2.2 Water Supply Terms

Water is supplied by a variety of systems for many uses. Most water supply systems are owned by an irrigation company or a municipality, but in some cases the owner/operator is a private company, or is a state or federal agency. Thus, a "public" water supply may be either publicly or privately owned. Also, systems may supply treated or untreated water.

Public Water Supply - Includes culinary water supplied by either privately or publicly owned community systems which serve at least 15 service connections or 25 individuals at least 60 days per year. Water from public supplies may be used for residential, commercial, institutional, and industrial purposes, including irrigation of publicly and privately owned open areas.

Culinary Water Supply - Water meeting all applicable safe drinking water requirements for residential, commercial and institutional uses. This is also known as potable water.

Municipal Water Supply - A supply that provides culinary grade water for residential, commercial, institutional and light industrial uses. The terms municipal, community and city are often used interchangeably.

Secondary Water Supply - Pressurized or open ditch water supplies of untreated water for irrigation of privately or publicly owned lawns, gardens, parks, cemeteries, golf courses and other open areas. These are sometimes called "dual" water systems. They provide water in addition to the culinary supply.

A.2.3 Groundwater Terms

Aquifer - A saturated body of rock or soil which will yield water to wells or springs

Groundwater - Water which is contained in the saturated portions of soil or rock beneath the land surface. Excludes "soil moisture" which refers to water held by capillary action in the upper unsaturated zones of soil or rock.

Mining - Long-term overdraft of groundwater in excess of recharge.

Phreatophyte - A "groundwater plant." A plant species which extends its roots to the saturated zone under shallow water table conditions and transpires groundwater. These plants are high water users and include such species as tamarisk, greasewood, willows and cattails.

Recharge - Water added to the groundwater reservoir or the process of adding water to the groundwater reservoir. Commonly occurs by infiltration of surface water into subsurface storage from precipitation, streamflow or irrigation.

Recoverable Reserves - The amount of water which could be reasonably recovered from the groundwater reservoir with existing technology. Recovery assumes mining, and may be associated with economic, environmental or social costs. It is often estimated as a percent of the total water in storage, or as the water which could be produced by dewatering an upper layer of aquifer or a given thickness, or by reducing aquifer pressure by some amount.

Safe Yield - In general, it indicates the amount of water which can be withdrawn from an aquifer on a long-term basis without serious quality, environmental or social consequences, or seriously depleting the reservoir.

Total Water in Storage - A volume of water derived by estimating the total volume of saturated aquifer and multiplying by the porosity (intergranular space containing water).

A.2.4 Other Water Terms

Some water terms are peculiar to the water industry. These are briefly defined in order to better understand the information presented.

Annual Water Yield - The statistical mean value for the annual volume of water yielded from the basin over the water years of record or the base period.

Call - The ability to order a quantity or flow of water at a given time and for a given period of time.

Carriage Water - Water needed for hydraulic operation of a delivery system.

Drinking Water - Water used or available for use as a culinary supply. The quality is typically the highest available in the locality.

Export Water - A man-made diversion of water from a river system or basin other than by the natural outflow of streams, rivers and groundwater. This is sometimes called a trans-basin diversion.

Instream Flow - Water flow maintained in a stream for the preservation and propagation of habitat and for aesthetic values.

Open Water Areas - Includes lakes, ponds, reservoirs, streams and other areas completely or partially inundated.

Potable - Water suitable for drinking or cooking purposes from both health and aesthetic considerations. The terms culinary and potable are often used interchangeably.

Reuse - The reclamation of water diverted from a wastewater conveyance system. The reuse can be either direct or indirect and may or may not be treated to bring it to acceptable standards. This water is recovered from municipal and industrial discharges. Irrigation runoff and hydroelectric power generationreturn flows are not included.

Riparian Areas - Land areas adjacent to rivers, streams, springs, bogs, lakes and ponds. They are ecosystems composed of plant and animal species highly dependent on water.

Watershed - The total area of land above a given point on a waterway that contributes runoff water to the flow at that point; a drainage basin or a major subdivision of a drainage basin.

Wetlands - Wetlands are open water areas surrounded by water loving vegetation. They also include areas where vegetation is associated with wet and/or high water table conditions.

B

SECTION

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Utah State Water Plan - Weber River Basin

Prepared by the State Water Plan Coordinating Committee

DEPARTMENT OF NATURAL RESOURCES
Ted Stewart, Executive Director
Howard Rigtrup, Deputy Director

DIVISION OF WATER RESOURCES
D. Larry Anderson, Director
Paul L. Gillette, Deputy Director
C. Eugene Bigler
Hal Christensen
Harold T. Brown
D. Gay Smith

DIVISION OF WATER RIGHTS
Robert L. Morgan, State Engineer
Jerry D. Olds
William Schlotthauer

DIVISION OF WILDLIFE RESOURCES
John M. Kimball, Director
Robert G. Valentine, Former Director
Bill Bradwisch

DIVISION OF PARKS AND RECREATION
Courtland Nelson, Director
Tharold (Terry) Green

DIVISION OF DRINKING WATER
Kevin W. Brown, Director
Timothy A. Pine

DIVISION OF WATER QUALITY
Don A. Ostler, Director
Jay B. Pitkin
Michael K. Reichert
James G. Christensen

GOVERNOR'S OFFICE OF PLANNING AND BUDGET
Lynne N. Koga, Director
Brad T. Barber
Natalie Gochnour

DEPARTMENT OF AGRICULTURE
Cary G. Peterson, Commissioner
Randy Parker

DIVISION OF COMPREHENSIVE EMERGENCY MANAGEMENT
Lorayne M. Frank, Director
John Rokich
Nancy A. Barr

UTAH WATER RESEARCH LABORATORY
Ron Sims, Director
David S. Bowles, Former Director
Trevor C. Hughes

DEPARTMENT OF ENVIRONMENTAL QUALITY
Dr. Diane R. Nielson, Director

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Printed on recycled paper using vegetable oil ink 1000 5/97