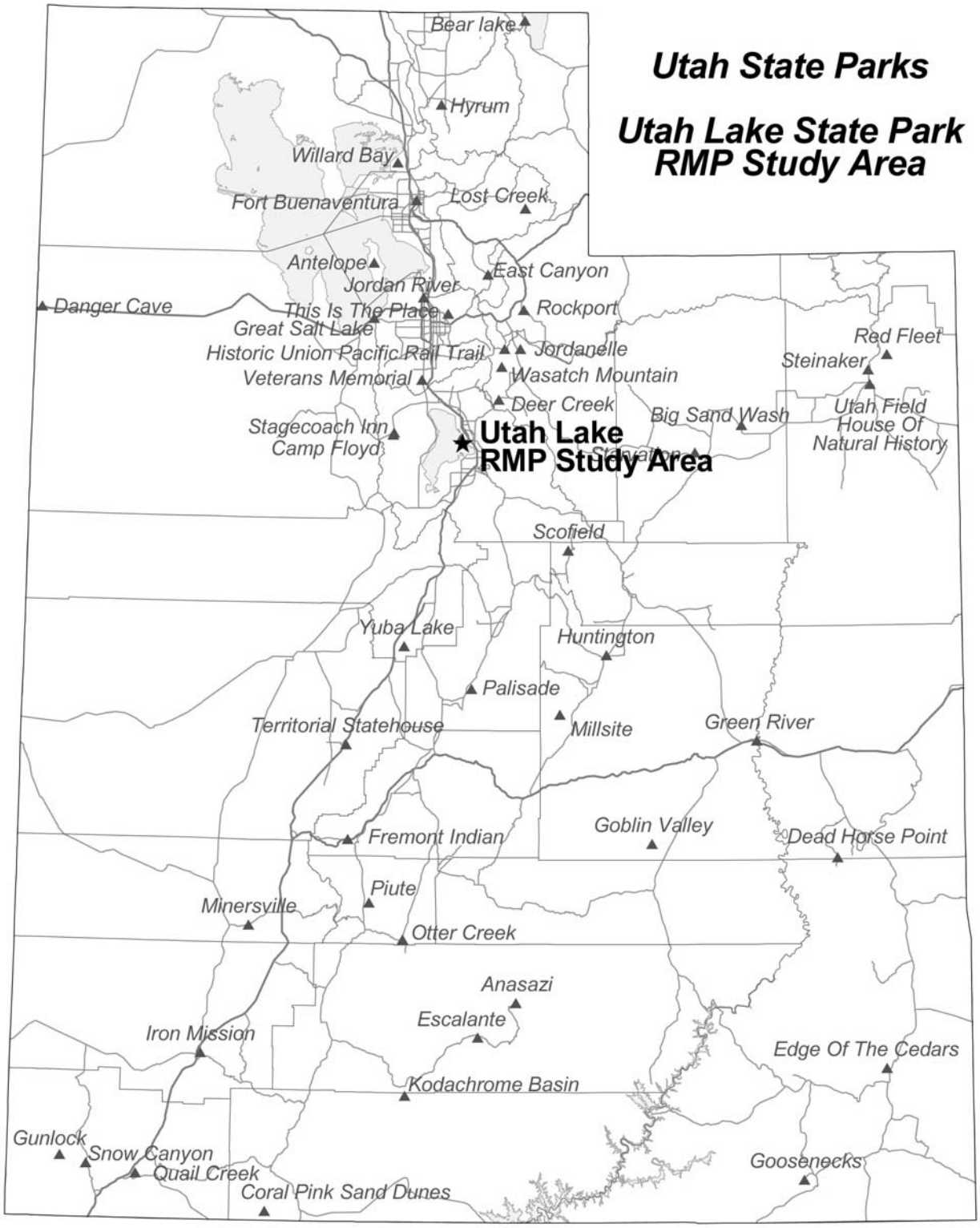
Utah Lake State Park

Resource Management Plan

September 2001


Utah State Parks
Utah Lake State Park
RMP Study Area
Bear lake
Hyrum
Willard Bay
Fort Buenaventura
Lost Creek
Antelope
East Canyon
Jordan River
Danger Cave
This Is The Place
Rockport
Great Salt Lake
Historic Union Pacific Rail Trail
Jordanelle
Red Fleet
Steinaker
Veterans Memorial
Wasatch Mountain
Deer Creek
Big Sand Wash
Utah Field
House Of
Natural History
Stagecoach Inn
Camp Floyd
Utah Lake
RMP Study Area
Scofield
Yuba Lake
Huntington
Palisade
Territorial Statehouse
Millsite
Green River
Goblin Valley
Fremont Indian
Dead Horse Point
Piute
Minersville
Otter Creek
Anasazi
Escalante
Iron Mission
Edge Of The Cedars
Kodachrome Basin
Gunlock
Snow Canyon
Quail Creek
Coral Pink Sand Dunes
Goosenecks

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Acknowledgements

Utah Lake State Park Resource Management Planning Team

Ron Chandler
Charlene Christensen
Kim Cody
Bob Foote
Jim Harland
Bill Loy, Sr.
John Pickup
Scott Strong
Scott Warren

Facilities and Development Subcommittee

Kim Cody, Planning Team Member
Bob Foote, Park Manager, Utah Lake State Park
Jim Harland, Northwest Region Manager, Utah Division of Parks and Recreation
Courtland Nelson, Director, Utah Division of Parks and Recreation
Dave Morrow, Deputy Director, Utah Division of Parks and Recreation
Gary Thorson, Facilities and Construction Section Manager, Utah Division of Parks and Recreation
Bill Maughan, Construction Operations Specialist, Utah Division of Parks and Recreation
Jamie Dalton, Research Consultant, Utah Division of Parks and Recreation
Rosalind Bahr, Parks Planner, Utah Division of Parks and Recreation

Other Participants

Terry Green, Planning Manager, Utah Division of Parks and Recreation
Susan Zarekarizi, GIS Consultant, Utah Division of Parks and Recreation
Jim Williams, Park Ranger, Utah Lake State Park
Chris Miller, Park Ranger, Utah Lake State Park
George Faust, Park Ranger, Utah Lake State Park
Doug Sakaguchi, Regional Habitat Manager, Utah Division of Wildlife Resources
Scott Root, Conservation Outreach Regional Manager, Utah Division of Wildlife Resources
Dick Buehler, Wasatch Front Area Manager, Utah Division of Forestry, Fire and State Lands
Edie Trimmer, Royalty Analyst, Utah Division of Forestry, Fire and State Lands
Dr. Joel Janetski, Anthropology Department Chair, Brigham Young University
Curt Allsop, Interested Citizen
Vic Deauvono, Interested Citizen
Kevin Smith, Interested Citizen

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Preface

Utah Lake State Park is one of Utah's most visited State Parks. In 2000, it ranked 4th in overall visitation. With access to 96,000 acres of water, the park provides excellent water-based recreation opportunities. However, flooding in 1983 destroyed and damaged many of the park facilities. Restoration and replacement of these facilities was ongoing until 1991. The high levels of use by park visitors, combined with the lingering effects of the flooding are increasing pressure on the park and park staff to provide a quality recreation experience and to meet the needs of park users.

Planning for this outstanding recreation park is required to facilitate high levels of use while providing a quality recreation experience. It is also necessary to ensure the efficient and effective expenditure of state and private funds. Planning also provides a unified management direction that coordinates facility development, recreation opportunity provision and community linkage. This coordinated effort is essential for the long-term protection of park resources and public enjoyment of the recreation opportunities that are available at the park.

This **Resource Management Plan (RMP)** is required by the Utah State Legislature and the Board of the Utah Division of Parks and Recreation to guide short and long term site management and capital development. The planning process recommends limits of acceptable change or modification, and a vision for the park. Specifically, the process: **(1) recognizes impacts will result from use and enjoyment of the site; (2) questions how much and what types of impacts may be accommodated while providing reasonable protection of the resources for future visitors; (3) seeks sustained quality and value; and (4) seeks to determine the conditions under which this can be attained.**

A Utah Lake State Park Resource Management Planning Team, consisting of community leaders, interested users, local residents and agency representatives was formed to develop a vision for the park, identify issues and provide managerial recommendations.

The team developed a vision to guide management actions at Utah Lake State Park. Under this vision, it was determined that the primary direction of the park should include the following actions and components:

1. Develop facilities that are well-designed, well-maintained, aesthetically pleasing and adequately meet the diverse water-based and shoreline recreation needs of users to the park.

2. Provide opportunities for a wide array of water-based and shoreline recreation activities and events.

3. Provide appropriate concession opportunities to meet the needs of various recreation users at the park.

4. Establish and maintain community linkages by providing needed facilities and opportunities.

5. Replace the negative stereotype previously associated with the lake and the park and develop a positive image.

6. Enhance customer service by ensuring the park staff has adequate equipment, support and opportunities to fulfill their responsibilities.

Team recommendations were reached by consensus and included input from the public and other government agencies. These recommendations will guide management of the park over the next two decades. They are intended to be dynamic

and will evolve concurrently with park and local community development and as individual portions of the vision statement are achieved. Recommendations contained within this plan will be implemented under the direction of the Utah Division of Parks and Recreation. This plan is intended to be a useful, workable document that will guide management of the park well into the 21st century.

List of Figures and Maps

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Maps

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Executive Summary

In November 2000, representatives from the Utah Division of Parks and Recreation met with community stakeholders from the Utah County area to initiate a resource planning effort for Utah Lake State Park. The planning process was based on public input and involvement. The Utah Lake State Park Resource Management Planning Team – a citizen-based team representing community leaders, interested users, local residents and agency representatives – was at the core of the process. The recommendations contained in this document represent several months of work by the team as well as direct public input.

The plan provides recommendations founded upon six primary vision elements that will guide future management of Utah Lake State Park. These elements focus on the following:

- Developing facilities that are well-designed, well-maintained, aesthetically pleasing and adequately meet the diverse water-based and shoreline recreation needs of visitors to the park.
- Providing opportunities for a wide array of water-based and shoreline recreation activities and events.
- Providing appropriate concession opportunities to meet the needs of various recreation users at the park.
- Establishing and maintaining community linkages by providing needed facilities and opportunities.
- Replacing the negative stereotype previously associated with the lake and the park and develop a positive image.
- Enhance customer service by ensuring the park staff has adequate equipment, support and opportunities to fulfill their responsibilities.

These objectives are geared toward improving and expanding the park's recreational opportunities, protecting its resources and providing the visitor with a safe, enjoyable experience. Achievement of these vision elements will require that continued support of users, legislative and community leaders and the Division of Parks and Recreation.

The planning team issued several specific recommendations in support of the plan's vision elements. Six issue areas form the basis of the team's recommendations. Each issue area with its accompanying recommendations is outlined as follows:

Facilities Development

- Develop a park operations center that meets the needs of visitors and park staff and improves access into the park.
- Complete a traffic flow study to minimize bottlenecks throughout the park and maximize lake access for visitors.
- Incorporate feasible elements of the traffic flow study into the final park design and development.
- Replace restrooms near the south ramps, replace and relocate restrooms near the north ramp and replace and relocate restrooms in the grassy day use area.
- Complete a jetty configuration study to determine the redesign options for minimizing siltation and implement as appropriate. Studies of lake circularity/littoral patterns along with potential recreation opportunities should be included.
- Develop and implement a regular dredging program commensurate with the jetty redesign.
- Install red and green navigational lighting as a component of the jetty redesign.
- Landscape the campground using trees and shrubs to improve the aesthetics of the area.

- Expand existing parking areas and pave the expansions.
- Relocate the maintenance/dry storage area to the park owned land across 4200 West.
- Construct appropriate day use facilities including shade shelters, group use pavilions, basketball courts, and sand volleyball courts.
- Remove the inoperative fish cleaning station and replace it with a new fish cleaning station sufficient to handle the number and type of fish cleaned at the park.
- Construct a self-serve concession/information center.
- Replace existing short and long-term rental slips and provide hookups.
- Replace concrete courtesy docks currently serving the north ramps.
- Upgrade the playground to meet current CPSC and ASTM standards for playground safety.
- Construct a group camping area with appropriate amenities in the northeast corner of the park.
- Install shade shelters at each site in the campground.

Natural Resource Management

- Design facilities to minimize damage in the event of a flood.
- Advocate with relevant authorities for water retention in the lake.
- Implement a regular dredging program to improve lake access.
- Coordinate activities and development to be in accordance with the June Sucker Recovery Plan.
- Facility design should prevent the creation of swallow habitat that could interfere with positive visitor experiences and completion of staff responsibilities.
- Evaluate and improve pest control efforts.

Education and Information

- Increase public relation efforts emphasizing the positive aspects of Utah Lake and Utah Lake State Park.
- Develop an effective educational display/program explaining lake conditions.
- Develop appropriate and well-maintained facilities at the park to provide a positive initial image.
- Develop educational programs and displays related to boating, fishing, safety, the lake, local and cultural history, natural resources and other appropriate attributes.
- Continue providing brochures with park, lake and boating safety information at the entrance station and park operations center.
- Seek available funding sources to assist with the costs of implementing interpretive recommendations.

Funding, Staffing and Operations

- Seek capital facility funds for major facility and construction projects through the State Park prioritization, budget and funding procedures.
- Seek federal boating monies to fund boating related improvements.
- Seek and utilize new funding sources and partnerships.
- Document and track funding sources and contacts to ensure future continuity.
- Maximize public relation events for relevant State Senators, State Representatives and other state, county and local officials.
- Complete a staffing needs analysis and staff accordingly.
- Provide the equipment and training necessary for park staff to properly perform their duties.
- Continue the use of volunteers whenever possible.
- Provide opportunities for local educational institutions to assist with park needs and operations.

- Apply for COPS grant to assist with funding law enforcement personnel.
- Cooperate with other entities for paid staff and volunteers to assist with visitors and educational efforts.
- Allocate law enforcement staff to maximize visibility and patrols.
- Upgrade exterior security lighting.

Land Management

- Explore possible land acquisitions and, if needed, implement a long-term plan for the acquisition of additional lands.
- Explore opportunities for acquiring additional marinas around the lake based on funding and staffing available for management of additional facilities.
- Support acquisition opportunities by private organizations to acquire a site for a competition waterski course.
- Apprise State Park Lands Coordinator and park staff of ownership issues within park boundaries should any arise.
- State Park Lands Coordinator should resolve land ownership issues within park boundaries.

Collaborative Partnerships/ Advocacy Beyond Park Authority

- Continue relationships with City and County Parks and Recreation Departments.
- Continue coordinating with federal, state, county, and local agencies as opportunities arise.
- Encourage the development of a park friends group.
- Provide hazard marking on recurring boating hazards. The boat owner is responsible for safe operation of his/her craft as it is not feasible with changing water levels to mark all hazard areas.
- Continue cooperative effort between law enforcement agencies.
- Support a Utah Lake advisory group with a park representative as a group member.
- Coordinate for trail opportunities around the lake with appropriate entities.
- Support efforts by private groups to develop a competition waterski course.
- Coordinate with Forestry, Fire, and State Lands to identify existing leases affecting the park.
- Manage existing leases as set forth in the lease.
- Obtain Forestry, Fire and State Lands general permits for any new leases affecting sovereign lands.
- Encourage Leasees to maintain the leased land in good condition.
- Coordinate lease agreements within the park with park staff, the Division Lands Coordinator, and Forestry, Fire and State Lands.

Implementing some of these recommendations will be dependent upon acquiring new funding sources. There may be keen competition for funding or other unforeseen priorities and contingencies that could affect implementation.

The plan's success is dependent upon the continued support of park stakeholders. Efforts must be made to preserve park resources, interact with local communities and strive to meet the expectations of park visitors. The recommendations contained within this plan were based upon an open and collaborative process. It is imperative this collaborative spirit continue as the plan's components are implemented.

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Mission and Vision Statements

Mission Statement:

The mission statement of Utah Lake State Park is to provide visitors a wide variety of safe and satisfying water-based and shoreline recreation experiences, preserve park resources, improve the image of the park and the lake held by the general public, and establish and maintain positive linkages with the community while providing superior customer service.

Mission Statement

Utah Lake State Park offers a variety of water-based and shoreline recreation activities. However, high levels of use combined with deteriorating facilities have created a need for facility development and renovation sufficient to meet visitor needs in a safe and satisfying manner. The team's mission is focused on fulfilling these needs. At the same time, the team recognizes that there are other essential components of providing quality customer service and meeting the needs of a variety of park users. Accordingly, the team will also address the protection of park resources and a need for establishing and maintaining a link with the community. Establishing the community linkage includes improving the image of the lake and the park, providing facilities that are in demand and providing superior customer service in all facets of park operation.

Vision Statement

A vision statement is similar to a compass; it charts a destination, sets the team on the correct course of action and provides the means to determine how closely team recommendations will follow that charted course. Utilizing the basic principles in the mission statement, the team developed a vision statement to guide development of the plan's recommendations. The vision statement establishes the foundation for recommendations to provide needed facilities, recreation opportunities, community linkages, superior customer service and develop a positive park and lake image.

Vision Statement

The future vision of Utah Lake State Park is to:

- Develop facilities that are well-designed, well-maintained, aesthetically pleasing and adequately meet the diverse water-based and shoreline recreation needs of visitors to the park.
- Provide opportunities for a wide array of water-based and shoreline recreation activities and events.
- Provide appropriate concession opportunities to meet the needs of various recreation users at the park.
- Establish and maintain community linkages by providing needed facilities and opportunities.
- Replace the negative stereotype previously associated with the lake and the park and develop a positive image.
- Enhance customer service by ensuring the park staff has adequate equipment, support and opportunities to fulfill their responsibilities.

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Resource Management Plan Purpose and Process

Purpose of the Plan

This Resource Management Plan is intended to help guide the Utah Division of Parks and Recreation's stewardship obligations for Utah Lake State Park. Planning for the park is essential given the deteriorating condition of many of the park structures and facilities and the high levels of visitation.

With its proximity to the Wasatch Front, the major population center for the state, Utah Lake State Park fulfills an important niche for the boating public and those interested in a variety of water-based activities. Providing access to 96,000 surface acres of water, the park does not need to address concerns about a water-based carrying capacity. The major concern is providing sufficient, high quality facilities to expedite the recreation experience of various park and lake users.

Many of the facilities at Utah Lake State Park are deteriorating rapidly. Situated in the valley bottom next to a natural lake, Utah Lake State Park is susceptible to lake level fluctuations. The park has been a victim of these fluctuations on several occasions including 1983 when the majority of the park was under water. The flooding that has occurred in the past coupled with the dramatic rise in visitation between 1991 and 1998 has taken its toll on the park facilities and structures.

Until recently, limited funding has been made available for use at the park through legislative appropriation and State Boating monies. With recent allocations earmarked for facility improvement, determining facility needs and prioritization of development and expenditures is essential to maximizing the available funding and constructing facilities in conjunction with long-term goals. A planning process will assist in the wise use of the available funds and increase the likelihood of obtaining additional development and renovation funds to complete team recommendations.

Pressure is being placed on current facilities, infrastructure and park staff to effectively meet visitor needs and protect park resources. It is essential that Utah Lake State Park plan for these dynamic changes. Failure to interdict problems through a planning process will only lead to more complex problems in the future.

A number of issues ranging from facilities development to collaborative partnerships were identified by various sources including input from planning team members and the public-at-large through public meetings and a visitor survey. Team members aggregated 26 major issues into six distinct categories addressing: facilities development; natural resource management; education and information; funding, staffing and operations; land management; and collaborative partnerships/advocacy beyond park authority. This plan addresses each of these issue areas. It will provide flexible guidelines for the management and development of the park over the next ten to twenty year period. More importantly, it will provide this direction on the foundation of continued public input and consensus of key stakeholders, rather than by the unilateral direction of the Division of Parks and Recreation.

The Planning Process

Planning for an outstanding recreation asset such as Utah Lake State Park is required to serve visitor needs, protect park resources and ensure the efficient and effective expenditure of state and private funds. It is necessary for the long-term protection and

public enjoyment of Utah Lake's diverse recreation opportunities that are of great interest to the recreating public in Utah and for out-of-state and international guests. This Resource Management Plan (RMP) is required to guide short and long-term site management and capital development.

The Utah Division of Parks and Recreation's master planning document, *Frontiers 2000*, delineates the required planning actions needed to effectively meet customer recreation and leisure needs as the agency moves into the new millennium. The document identifies resource management planning as an essential action to be completed for each park within the agency's system. Under guidance of *Frontiers 2000*, each RMP is to be designed around one core concept: meeting the needs and expectations of customers, citizens of the state of Utah and visitors, while protecting each park's unique resource base. In short, the process is "customer driven and resource based."

The planning process recommends limits of acceptable change or modification, and a future vision for the park. Specifically, the process: (1) recognizes impacts will result from use and enjoyment of the site; (2) defines how much and what types of impacts may be accommodated while providing reasonable protection of the resources for future visitors; (3) incorporates values of resource sustainability, quality facilities, education and interpretation for visitors; and (4) seeks to determine the conditions under which this can be attained.

In November 2000, Division representatives met with community stakeholders to familiarize them with the proposed process and the need for creating an RMP for Utah Lake State Park. During this meeting, the Division solicited the names of community members and various users with an interest and expertise in the park to serve as members of a Resource Management Planning Team. Team members were selected for a variety of reasons ranging from technical expertise to interest in the park. All team members participated on a voluntary basis and expressed a willingness to sacrifice a significant portion of their time and expertise to the process. Nine individuals were selected to serve on the planning team and several representatives from the Division served as staff to the team.

About the Park

Park History

Developed in the 1920's, Utah Lake State Park was originally the Provo Boat Harbor. It was donated to the State Park system in 1967. When it was donated to the state, an existing boathouse was renovated into a visitor center and an observation tower was built. In 1973 an ice rink was built and it remained open until 1998 when the need for major renovations made closure of the rink a more viable option than continued operation of the facility. In 1983 the park was flooded, destroying or damaging most of the park facilities. The park was closed from 1983 through 1985 for cleanup, repairs and renovations. While it was partially reopened in 1986, repairs, landscaping and renovation continued until 1991 when the park was fully functional again. In 1998 a new campground was built as a cooperative agreement that allowed the extension of a runway at the Provo Municipal Airport. Recently completed development at the park includes extending and resurfacing the boat ramps, improving the finger jetty and beach area, installing a group day use pavilion, and sealing and striping the roads and parking areas to improve traffic flow.

Physical Setting and Facilities

Utah Lake State Park is situated on the eastern shore of Utah Lake approximately five miles from Provo, the Utah County seat, and 30 miles south of Salt Lake City. Serving the metropolitan area of the Wasatch Front, Utah Lake State Park provides boater access to the largest natural freshwater lake west of the Mississippi River, along with a variety of other activities. Some of the other activities include fishing, swimming, pleasure boating, waterskiing, sailing, picnicking, camping, and bird watching among others.

The lake itself is large in area (96,000 acres), however it is shallow. Its depth averages 9.2 feet with the maximum depth being approximately 13.8 feet. Due to the shallow nature of the lake, the wave action stirs up sediments and gives the lake a muddy appearance. The Cedar Valley Mountains rise abruptly from the lakeshore on the west, and the majestic Wasatch Mountains provide panoramic vistas to the north and east. Sunsets across the lake are another scenic opportunity from the park. The Provo River flows into Utah Lake on the edge of the park and in conjunction with the lake itself provides a riparian and wetland landscape.

The park provides a variety of facilities and opportunities. The confluence of the Provo River and Utah Lake lends itself to exceptional water-based recreation opportunities. Sprawling lawns along the shoreline and visitor facilities along with the marina support year-round recreation. Facilities at Utah Lake include modern restrooms with hot water showers; a newly built campground with 52 sites for both RVs and tents; a marina that has recently had the launch ramps repaved and extended. Other facility improvements were recommended by the planning team and are discussed in the issues and recommendations section of this plan.

Climate

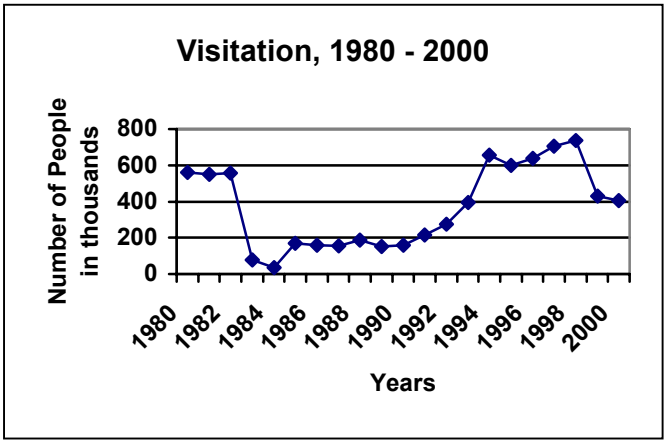
Utah Lake State Park is situated within a valley that is part of the Basin and Range geographical region. Utah Lake, the natural catchbasin for several rivers, fills the bottom of the valley. Situated on the edge of the lake, Utah Lake State Park's climate is typical of the semiarid climate prevalent throughout the state with a few minor differences in temperature and precipitation as a result of the lake. The area experiences well-defined climatalogical "seasons." Maximum temperatures (Fahrenheit) range

from about 93 degrees in July to 36 degrees in January. Average minimum temperatures range from 62 degrees in the summer to 18 degrees in the winter. Average annual precipitation is approximately 13 inches. The average annual snowfall is about 23.9 inches with over half of that typically occurring in December and January.

Park Visitation

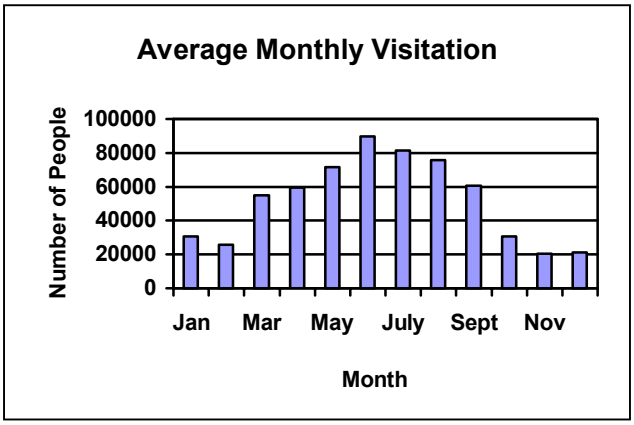
Beginning in the early 1980's the visitation trend at Utah Lake State Park was consistently around 555,000 people annually. However, visitation to Utah Lake was heavily impacted by flooding in 1983 that forced the closure of the park from 1983 to 1985. In 1986 the park was reopened on a limited basis. Repairs and restoration work were ongoing until 1991. After the park was partially reopened in 1986, specifically after the park was completely reopened in 1991, visitation increased dramatically. Utah Lake's visitation has a trend of continued growth throughout the 1990's. The only major change in that trend occurred in 1999. Visitation dropped by approximately 42%. During that year, the methods for calculating and reporting visitation changed to more accurately reflect the number of people entering the park specifically through the entrance gate. It should be noted that visitation dropped in many State Parks during 1999.

Figure 1: Utah Lake State Park Annual Visitation, 1980 – 2000



Most park visitation occurs between March and September with the highest levels of use occurring in June and July. Average monthly visitation, based on the past five years, for April and September is approximately 60,000. The average visitation for June during the same time frame was 89,824 people.

Figure 2: Utah Lake State Park Average Monthly Visitation



Monthly Visitation

Lake level fluctuations, specifically droughts, dictate levels of use in the later summer months. At times the lake level drops to a level that allows only a limited number of boats (those with a shallow ride in the water) to launch and leave the harbor.

Relationship to the Community and Surrounding Areas

Utah Lake and the Utah Valley have a long history of being inhabited. Archeological work suggests cultural patterns typical for the eastern Great Basin. The patterns consist of a period of hunting and gathering referred to as the Archaic and lasting from as much as 8000 B.C to about A.D 400. After a considerable period of transition, farming played an important role in the subsistence economy of eastern Great Basin peoples, and by A.D. 1000 Utah Valley and Utah in general were populated by small farming villages referred to as the Fremont.

By A.D. 1300, however, farming was rather abruptly dropped and hunting and gathering again became the primary means of subsistence. By the A.D. 1700s, the historic hunting and gathering Ute were well established in the valley. Whether their ancestors replaced the Fremont farmers or were the Fremont farmers is not known. Utah Lake was at one time an extremely productive fishery, and most known archeological sites near the lake and in the adjacent valley contain remains of the lake's native fish species including chubs, suckers and trout.

The Spanish explorers and Franciscan priests, Francisco Atanasio Dominguez and Silvestre Velez de Escalante led an expedition into the Utah Valley by way of Spanish Fork canyon in 1776. They met with some Ute Indians camped near Utah Lake. While there were no immediate follow-up expeditions to Utah, the map generated by Don Bernardo Miera y Pacheco and the diary kept by Father Escalante provided valuable information about the area.

Caucasian fur trappers were familiar with central Utah and specifically Utah Valley. They frequented the area through the nineteenth and early twentieth century. The city Provo was given its name in honor of an early trapper, Etienne Provost who established a trading post on the shores of Utah Lake.

Mormons (members of the Church of Jesus Christ of Latter Day Saints) settled Provo in 1849. It was the first Mormon colony in Utah outside of the Salt Lake Valley. The Mormon settlers experienced problems with the Indians that lived in the area. This was a result of the Indians, Utes, feeling that their homeland was being invaded. The settlers took land without any regard for Indian rights. The new settlers built the town into a defensive fort called Fort Utah. It was built as a stockade with exterior walls that were fourteen feet high. After the first year, the settlers set up homes outside of Fort Utah and made Provo a more comfortable city in which they could live. Provo was built up quickly as many members of the Mormon Church moved there from different parts of the world. They set up farms and industrial centers. Provo quickly became the second largest city in Utah. Provo soon became known as the "Garden City" because of its extensive fruit orchards, trees, and gardens. In the late 1860s, industrialization began with the creation of The Provo Woolen Mills. In the 1920s, the Ironton Steel Mill was established, and later the much larger Geneva Steel Plant was built near the city.

Because of its proximity to the large number of people along the Wasatch Front, Utah Lake State Park provides an important recreation opportunity to the surrounding communities.

Demographics and Socioeconomic Impact

Utah County is one of the fastest growing counties in the state. With a population of 353,136 people in 1999, Utah County is the second largest county in terms of populations. Utah County has grown at an annual rate of 3.2 percent throughout the 1990's. Provo with a population of 110,690 is the county's largest city followed by Orem.

Utah County's economy is service based accounting for 39 percent of total employment. Trade is another leading industry within the county. Utah County's major employers include Brigham Young University, Alpine and Provo School Districts, Utah Valley State College, Nebo Schools, the Fourth District Court, Geneva Steel, Utah Valley Regional Medical Center, Novell, Convergys, Nestle USA Prepared Foods Inc., and Utah Office Supply. While Utah County has more farms than any other county in the state the amount of land and size of the farms is smaller.

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Resource Data

It is essential that natural resources in and around Utah Lake State Park be understood prior to taking any management action associated with physical impact of the area. Clearly management decisions affecting the park's natural environment must be made upon the foundation of reliable scientific information about the park and surrounding resources. Utah Lake State Park is inextricably linked to the entire Utah Lake ecosystem. This section provides background data on geology, biology, water quality, cultural resources, and an analysis of risk management issues at the park.

Geological Data

Aside from its unique characteristic as the largest freshwater lake west of the Mississippi, the geologic characteristics of Utah Lake State Park are not unlike those found in other areas of the Great Basin. However, the park does lie in a seismically active area and may be prone to hazards from earthquake events. The following is a brief summary of the park's geologic characteristics. Also included is an analysis of potential geological hazards that should be considered for park facilities development and operation issues (a comprehensive geologic review of the park is contained in Appendix A).

Geologic Profile

Utah Lake State Park lies at the eastern edge of the Basin and Range physiographic province. The Basin and Range province is characterized by steep, narrow, north-trending mountain ranges separated by wide, sediment-filled valleys. These characteristics are a result of extensional stress (stretching of the earth's surface) and subsequent geological uplift and faulting events. Sediments shed from the adjacent ranges as well as residual deposits from intermittent lakes slowly fill the area's intervening valleys.

The geologic setting of Utah Lake State Park is exemplary of Basin and Range topography: the park is located in a sediment-filled delta formed by the Provo River near the floor of Utah Valley and is bounded by the Wasatch Range to the east and West Mountain and the Lake Mountain Range to the west.

Rock formations within the park's vicinity are predominantly Paleozoic-period, sedimentary types with limestone and quartz sandstone deposits of the Oquirrh Formation being most common. The park itself resides on unconsolidated, fine sediments deposited by the adjacent Provo River. According to the Utah Geologic Survey (UGS), the park is located at a point where Provo River flows decrease into the standing water of Utah Lake. Because of its decreased flow velocity, the river drops its sediment load forming a delta from the deposits. This delta is comprised of a thick sequence of valley fill sediments containing lenses and layers of clay, silt, sand and gravel including fine-grained river and shoreline deposits. According to UGS, one oil well drilled southeast of the park (near the Spanish Fork area) penetrated 13,000 feet of sediment without reaching bedrock.

These prolific sediment flows appear to infiltrate the park's jetty openings and flow back into the harbor area. Sediment build up on the harbor's shallow bottom often impairs navigation.

Geologic Hazards

The park lies within the Intermountain seismic belt. Two faults, the Wasatch to the east and the Utah Lake to the west, lie within 10 miles of the park and may pose potential earthquake hazards. While there are no faults within park boundaries, UGS notes that the geologically active Wasatch fault has the potential to cause ground shaking, liquefaction or park flooding. According to UGS, the probability of a large

earthquake (up to magnitude 7.5) occurring along this fault is approximately 16 percent within the next 50 years. Moderate earthquakes (5.5 to 6.5 magnitude) occur an average of once every 20 years along the fault.

Liquefaction appears to be the greatest threat due to the area's unconsolidated, water-saturated sediment-laden soils. Liquefaction can occur with earthquakes of magnitude 5 or larger and may result in partial settling or tipping of structures or the buoying up of lightweight buried objects such as underground storage tanks. However, the extent to which the park will experience liquefaction is dependent upon the quake's magnitude, epicenter location and subsurface conditions at the time of the event.

Seiche events (an earthquake-induced sloshing of water in an enclosed basin such as a lake) may result in park flooding. The ground movement caused by an earthquake can cause lake water to oscillate. This oscillation may build waves that can flood low-lying shoreline areas such as those found at the park.

Biological Data

Archaeological and ethnographic data suggest that the biology of Utah Lake remained basically unchanged for approximately 6,000 years prior to European settlement of the valley. Settlement and diverse use of the available resources led to changes in the ecosystem.

Flora, Fauna and Lake Environment During Prehistory

Descriptions of the lake and valley prior to settlement suggest that the lake was clear due in large part to the presence of water plants, such as pondweed that anchored to the bottom of the lake and held it firm. This reduced turbidity and allowed sunlight to filter into the water for plants. It also created a cooler environment for trout. The native fishes of Utah Lake present when the valley was settled in 1849 are the cutthroat trout, mountain whitefish, Utah chub, leatherside chub, least chub, longnose dace, Utah sucker, webug sucker, June sucker, mountain sucker, mottled sculpin, and Utah Lake sculpin.

Surrounding the lake large marsh areas were essential components of the environment and served many water-loving animals. The valley was described as broad and grassy with some sage along the eastern benches. Large stands of trees were present along the river corridors.

Settlement of the valley created large cultivated tracts and required irrigation to be diverted from the rivers. Thus river flows were changed and erosion and sedimentation increased.

Current Flora, Fauna and Lake Environment

Lake fluctuations have increased through upstream water diversions for irrigation and through utilization of the lake as an irrigation storage area for Salt Lake City. The fluctuations negatively impacted the plants anchored to the bottom of the lake allowing for increased turbidity. Utah Lake is currently considered hypereutrophic as it relates to water quality based on high levels of phosphorus and turbidity. However, the lake meets state standards in all other categories.

The change in water conditions along with the introduction of competitive fish species has changed the primary lake inhabitants. Introduced species are currently the most common in the lake with white bass, carp, black bullhead, and channel catfish as the most prevalent. A complete list of fish species found in the lake is available in Appendix B. The June Sucker, a native species, is federally listed as endangered.

The lake is still surrounded by many marshes with the valley primarily developed

or under cultivation. Based on inventories completed 1979 – 1982 and reviewed by Divison of Wildlife Resource staff in May 2001, There are currently 178 known species of birds that utilize Utah Lake as anything ranging from a permanent residency to a stop along a seasonal migration path. In the vicinity and within Utah Lake there are 49 species of mammals, 23 species of fish, 10 species of reptiles, 5 species of amphibians, and 451 species of plants. Lists of these organisms are contained in Appendix B

Endangered, Threatened and Sensitive Species

Utah Lake and the surrounding shoreline host a variety of plant and animal organisms. Along with a single federally endangered species, the June sucker, there are 29 species in and around the lake listed as sensitive according to state classifications. Of these 29 species, eight have been recorded in the vicinity of the park, including Ute ladies' tresses, Ferruginous hawk, Yellow-billed cuckoo, Least chub, Long-billed curlew, Black swift, American white pelican, and Blue grosbeak. A full list of the sensitive, threatened and endangered species along with a generalized location map can be found on Plate 3.

June sucker

The June sucker, a native fish of Utah Lake, was federally listed as an endangered species with critical habitat on April 30, 1986. Critical habitat for the June sucker is listed as the lower 4.9 miles of the Provo River. It is estimated that there are approximately 400 wild spawning adult June sucker in Utah Lake[1].

Adult June sucker range in age from 9 to 43 years and utilize the lower Provo River to spawn during May and June. They also seasonally utilize the portion of Utah Lake between the mouth of the Provo River, south along the airport dike to the south side of the Provo Bay and much of Provo Bay itself. After hatching from the spawning beds, the fry drift downstream. Their survival is threatened by interactions with nonnative fish, habitat alterations, and water development.

The primary purpose of the June Sucker Recovery Plan is to identify the actions needed to prevent extinction, downlist and eventually delist the species. Recovery actions have been outlined for addressing threats to the species. The major actions are listed below. The proposed June Sucker Recovery Implementation Program, a cooperative effort among state, federal and private entities, will provide the funding and mechanism to implement recovery actions. For each action listed below, specific steps are outlined in the recovery plan to achieve each.

- Conserve genetic integrity of the June sucker.
- Monitor status and trends of June sucker population in Utah Lake, the Provo River and other tributaries.
- Evaluate and minimize factors limiting recruitment of June sucker.
- Enhance June sucker population in Utah Lake and its tributaries.
- Develop and conduct interpretation and education highlighting the value of the Utah Lake ecosystem and the June sucker and associated recovery efforts.
- Implement measures to protect the June sucker during their spawning run.
- Further define criteria necessary for the recovery of June sucker.

Actions taken for development and improvement of Utah Lake State Park should take into consideration the presence of the June sucker. Appropriate contacts should be made to obtain necessary approval for any development or actions that could impact June suckers or June sucker habitat.[2]

[1] Personal Communication (2001), Krissy Wilson, Division of Wildlife Resources Central Region Native Aquatic Species Biologist.

[2] U.S. Fish and Wildlife Service (1999), *June Sucker (Chasmistes liorus) Recovery Plan*, pp.v, 24– 47.

Cultural Data

Two components of cultural resources are addressed in this document. The first was a determination of cultural sites within the park and appropriate actions to be taken in managing and developing the area. Ultimately no known sites were found within the park. The second aspect addressed is the idea that while no sites are specifically located within the park, historically the lake was an essential part of survival for early inhabitants of the valley. A discussion of the early inhabitants and their use of the lake is provided.

Cultural Resources Review

In preparation for the Utah Lake State Park Resource Management Plan planning process a complete archaeological survey of the park was deemed appropriate based on the level of projected facility development. Prior to beginning the survey, a file search was requested for the park area. The Utah State Historic Preservation Office reviewed their cultural resource files for the above mentioned project area and determined that Utah Lake State Park has been surveyed three times. The most recent survey, completed in 1993, covered the entire park. The results of the file search indicated a single site within the park. However it was noted with a question mark and Jim Dykmann, Compliance Archaeologist with State History believes it is no longer there. The location of the site was where the current harbor now sits. He states that, "No known cultural resources are located in the park based on the three surveys." Based on the number and completeness of previous surveys in the area, it was determined that completing another survey of Utah Lake State Park was unnecessary. However, if proposed construction activities encounter buried cultural resources during construction, work should cease and notification be made to appropriate entities.

Historic Use of the Area

In an article titled, "Utah Lake: Its Role in the Prehistory of Utah Valley, Joel C. Janetski provides an insightful view of the lake, the surrounding environment and the people who inhabited the valley. His work along with several others is summarized to provide an overview of the historic use of the valley, specifically in the vicinity of Utah Lake. Utah Lake and the surrounding river system created a unique environment that served as a center of human activity and settlement for at least 6000 years prior to European settlement in 1849[3]. The prehistory of Utah Valley generally breaks down into three main periods and people. They are the Archaic period (ca. 10,000 BP to 1,500 BP, the Fremont (1,500 BP to 650 BP, and the Late Prehistoric (650 BP to contact)[4].

Lake Environment, Flora and Fauna

The lake and surrounding environment stayed fairly consistent throughout all three periods. It was only after 1849 that the lake environment, flora, and fauna began to change. Traditionally, pondweed and other forms of vegetation grew thickly in sheltered coves and bays, providing habitat for the native fish populations and waterfowl as well as a buffer against turbidity. This vegetative growth was heavily impacted by the introduction of the Carp in the 1880's[5]. Based on bones and other remains in various digs throughout the valley, important plant and animal resources for the inhabitants include fish, waterfowl, water-loving mammals, shellfish, upland game, and various plants. The primary fish utilized by the inhabitants of the valley were the Bonneville cutthroat trout, various

[3] Joel C. Janetski, "Utah Lake: Its Role in the Prehistory of Utah Valley" in *Utah Historical Quarterly*.
[4] Jesse D. Jennings, (1978), *Prehistory of Utah and the Eastern Great Basin*, University of Utah Anthropological Papers No. 98.
[5] Richard A. Heckman, Charles Thompson, and David A. White, (1981), "Fishes of Utah Lake," in *Utah Lake Monograph*, Great Basin Naturalist Memoirs 5, p. 108.

suckers, Utah chub, and the mountain whitefish. Waterfowl in the area utilized by valley inhabitants include ducks, geese, swans, herons, and others. Also found in abundance around the lake were muskrat, beaver, mink, otter, and shellfish. Valley inhabitants utilized foothill and mountain resources seasonally. Animal resources included deer, mountain sheep, elk, rabbits, ground squirrels, antelope, and sage grouse. Plant resources included chokecherries, serviceberries, and pinyon nuts.

Archaeological findings from the two later periods confirm that fish from Utah Lake were a dietary staple. Evidence from the first period provides no direct evidence to the use of lake resource, but hints in that direction. Other resources were used as they were available.

Archaic Period

People living in Utah Valley and the Eastern Great Basin during this time survived primarily by hunting and gathering wild foods, specifically small seeds and nuts (grass seeds, pickleweed, bulrush, etc.) and both large and small animals (mountain sheep, deer, antelope, rabbits, ground squirrels, and others). Evidence from this time period is limited, and as such general knowledge of the inhabitants is also limited.

Fremont

A transition from strictly hunting and gathering to cultivating corn, beans, and squash as dietary supplements to the wild foods available is one of the cultural indicators of the Fremont period. Farming combined with continued dependence on hunting and gathering led to other cultural shifts including architecture. Architecture of the time period included pit houses along with adobe and masonry walled storage structures. Evidence from archeological sites demonstrates primary subsistence foods. Bones of fish, muskrats, rabbits, bison and deer were the most common with fish being the most consistent between the various sites. It appears from the data that fish provided a reliable source of food while upland game provided an abundant food supply on an irregular basis. It is interesting to note that harpoons were also found at several excavated Fremont sites indicating probable use as a fishing spear. Settlement sites were primarily centered on stream banks.

Late Prehistoric

A return to hunting and gathering characterizes the people of the Late Prehistoric period. It is believed that these people are the immediate ancestors of the historic Ute and Shoshone. Dietary components of the Late Prehistoric people are very similar to the Fremont in the dependence on fish, other wild animals and plants. Settlement patterns are centered around the lake during this period. Small encampments are found along beaches with multi-use sites located at the mouths of rivers. Long-term settlements are found near the lake with specialized sites further from the lake being occupied for shorter lengths of time. Some housing structures were built of bulrushes, another utilization of lake resources.

Archaeological evidence suggests that Utah Lake served large numbers of inhabitants during the period of prehistory. The specific uses of each group changed in some aspects and remained steady in others. Without regard to other changes in the area, Utah Lake consistently provided a reliable source of food.

It is essential to note that comparatively little is known about prehistory in Utah Valley and that each site excavated and each survey completed adds new, often unexpected, information. Protection of these sites is key to increasing knowledge of the prehistory and preserving unique cultural resources.

Water Quality Data

Utah Lake is often perceived as a polluted body of water unfit for recreational activities, much less for culinary use. Water quality experts classify the lake as hypereutrophic. This condition is most commonly characterized by excessive organic composition - algae growth and high nutrient loadings. However, it is non-organic suspended sediments that give the lake its bad reputation. These suspended sediments give the lake a brownish, turbid appearance. More importantly, they are the primary factors in its hypereutrophic classification and undeserved public reputation as an overly polluted lake unfit for human use. In fact, Utah Lake water is safe for a wide range of recreational activities. For example, anglers note that the lake's fishery is diverse and provides many opportunities for sport fishing. Moreover, fish are suitable for consumption and have no differentiable flavor from those caught in other fisheries.

While organic pollution (phosphorus loadings in particular) is a definite concern, Utah Lake meets State of Utah water quality standards in most of the critical testing categories. In terms of recreational use, the main concern with Utah Lake water quality may be more aesthetically based. A 1999 study, Diagnostic and Feasibility Report on Utah Lake, commissioned by the Environmental Protection Agency (EPA) as part of its Clean Lakes Study noted:

> "Improved water quality in all parameters except suspended solids will have little impact on the recreational use of Utah Lake. It is the suspended solids in the water that occur as a result of wave action on the shallow lake bottom that gives the lake an undesirable appearance."[6]

[6] United States Environmental Protection Agency, (1999), *Phase I EPA Clean Lakes Study, Diagnostic and Feasibility Report on Utah Lake*, p. 2-4.

Utah Lake's shallowness – average lake depth is 9.2 feet – allows fine calcium carbonate sediment particles to be easily stirred from the bottom as the wind blows. This causes lake waters to become noticeably turbid. Unfortunately, the public perceives this as a serious pollution problem. Likewise, algae growth (and the resulting odor from its decay) emanating from the shallow, nutrient-rich waters causes visitors to seek out other locations for water-based recreation activities.

Nevertheless, water quality experts agree that steps should be taken to improve lake water quality. They focus on reducing nutrient levels - phosphorous in particular – as the key to improving lake water quality. Eighteen point sources, including eight municipal sewage treatment plants, are responsible for most of the phosphorous discharge into the lake.[7] Nonpoint sources – agriculture, urban runoff, hydrologic modification, recreational use, wetland destruction – also contribute to lake pollution. While phosphorus concentrations are of no direct health concern, they are the key controlling factors in water quality. It should be noted that potential algal blooms from the phosphorus in the lake are inhibited by the turbid conditions preventing light from penetrating the water. Were the lake continually calm and no sediments stirred up, algae growth would increase dramatically. So it is paradoxical in that solids are the primary cause of the hypereutrophic classification and at the time prevent other conditions of excessive algae growth.

The study referenced earlier represents a jointly funded research effort by the EPA, the Utah Department of Environmental Quality (DEQ), Geneva Steel and the Mountainland Association of Governments. The report summarizes the results of field and laboratory monitoring of Utah Lake water quality during the early 1990s. It identifies lake pollution sources, defines

[7] ibid, p.vii

existing water quality conditions with an emphasis on key impacts such as nutrients. The EPA report focused on reducing nutrient loads – primarily phosphorous – as the most effective way to improve lake water quality. The following strategies were recommended to achieve improvement in lake water quality:

- Phosphorous removal from waste water treatment plants
- Phosphorous reduction from non-point sources such as urban runoff
- Reducing agricultural effluent (animal waste in particular)
- Dredging, erosion and sediment control strategies
- Wetland enhancement

However, the cost of fully implementing these strategies is not cheap. Approximately $228 million will be needed to achieve significant improvement in lake water quality through the employment of the above recommendations.[8]

Improving Utah Lake water quality for culinary use will become the most critical need as Wasatch Front populations continue to grow. However, significant reductions in phosphorous levels will probably have little noticeable effect on the lake's appearance. Consequently, efforts will be needed to educate the recreating public about the quality of Utah Lake water.

The purpose of this section is to provide an overview of Utah Lake water quality. The EPA Clean Lakes Study serves as an excellent source of information. A summary of the report's findings and recommendations are integrated below. Data and information from other relevant studies are also included to provide a survey of the lake, its water quality and relevant concerns, issues and recommendations.

About Utah Lake

Utah Lake was formed approximately 8,000 years ago as a remnant of Lake Bonneville. Covering approximately 150 square miles, it is the largest freshwater lake in the United States west of the Mississippi River. By volume, the lake contains approximately 900,000 acre feet of water – a relatively small amount with respect to its large area due to its shallow average depth of 9.2 feet. Because of its large surface area and shallow depth, the lake may lose up to 300,000 acre feet – approximately 30 percent of its volume – due to evaporation during some years.

Not only does Utah Lake provide recreation opportunities, it serves as an optional source of public water for both Utah and Salt Lake Counties. Lake damming was first initiated in the 1870s. Water control gates on the lake's Jordan River outlet add four additional feet of storage.

There is a long history of conflict over storage of Utah Lake water. The most recent conflict - a legal battle between Utah and Salt Lake Counties over the lake's maximum storage level - was resolved in 1988. Prior to this settlement, Salt Lake County argued for maximum lake storage levels during dry periods. However, the increased lake elevation caused damage to Utah County lands. The 1988 agreement redefined the "compromise" lake level originally determined one hundred years earlier to be at 4,489.04 feet. This level was deemed mutually beneficial to both parties.

Utah Lake Hydrology

The Utah Lake watershed covers approximately 2,700 square miles and includes over 50 tributaries that feed the lake. While most of these are small streams or drains, the Provo and Spanish Fork Rivers are the major tributaries. Both these rivers have their headwaters in the Wasatch and Uinta Mountains to the east.

[8] EPA Clean Lakes Study, p. 11-3

Annual precipitation and fresh/mineral ground water seeps and springs are the greatest hydrological contributors to the lake. Effluent from local wastewater treatment plants and Geneva Steel are also major inflow sources. Water experts note that basin hydrology is the key element in understanding long-term impacts on the lake's water quality.

Figure 3 Utah Lake Hydrologic Sources (% of total 1990-1992 inflows)

SOURCE	% OF TOTAL INFLOW
Precipitation	19.8%
Ground Water	18.7%
Provo River	14.9%
Spanish Fork River	11.0%
Wastewater Treatment/Geneva	9.5%
Other Drains	9.0%
Benjamin Slough	4.9%
Spring Creek	4.0%
Powell Slough	3.4%
Hobble Creek	3.0%
Mill Pond Drain	1.0%
Cannery Drain	0.6%

Utah Lake Water Quality

While Utah Lake's water quality may be problematic in specific areas, the image of widespread pollution rendering it unfit for human use or consumption is undeserved. The EPA Clean Lakes Study notes Utah Lake water meets specified state water quality standards for most of the categories measured. Nutrient loading from point sources - such as wastewater treatment - is the most significant cause of water quality impairment in Utah Lake. This is followed by sedimentation resulting from alterations in the flow of streams and sloughs. Nonpoint sources - agriculture, urban runoff, river/stream bed modification, habitat modification – are responsible for increased salinity levels and also contribute to the nutrient and sediment-based impairment of Utah Lake water. The EPA report also evaluated Utah Lake water quality for metal and chemical content. The salient points from these categorical water quality evaluations are summarized as follows.

Metals

The report notes that none of the lake's watershed sources contain metal concentrations that exceed state water quality standards. Researchers sampled watershed sources to determine the content of metals including arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver and zinc. Occasional metallic releases were detected during the study period that exceeded state water quality limits. However, none of these metals appear to be found in concentrations that would exceed state standards over the long term.

Physical/Chemical Content

Salinity was recognized as a water quality problem in the Benjamin Slough area where water quality standards for this parameter were exceeded. Irrigation return flows and high saline soils were the primary sources of salinity in this area.

Nutrients

Nutrient loads are the most significant cause of water quality impairment within Utah Lake. Phosphorous is the primary nutrient-based pollutant. The Clean Lakes Study found that phosphorous loadings exceeded state water quality standards in virtually every Utah Lake tributary.

Effluent from wastewater treatment facilities is the most significant long-run source of phosphorous. Sewage treatment facilities are found in virtually every community adjacent to the lake including Payson, Salem, Spanish Fork, Provo, Springville, Orem, American Fork and on the lake's west side. Fish hatcheries and agricultural production (primarily animal feeding operations) are the other major contributors to phosphorous loads.

Nutrients such as phosphorus lead to high levels of biological productivity, i.e., algae growth and can accelerate growth of organisms and often lead to the proliferation

of undesirable species. Although not considered harmful, algae often imparts undesirable tastes, odors and color to the water. Moreover, decaying algae reduces dissolved oxygen levels and may promote the growth of disease-causing organisms. Littoral zone regeneration is another source of phosphorous. Aquatic plants take up nutrients such as phosphorous in their root systems. However, at the end of the growing season, these plants die and the phosphorous is released as they decay.

Sediments

The geology of Utah Lake's watershed consists primarily of Paleozoic sediments: limestone, quartzite, sandstone and shale. These sedimentary rocks contain an abundance of nutrients. Utah Lake is a shallow, turbid, soft-bottomed lake with little rocky substrate.

The impact of erosion on lake water quality is negligible. The amount of inorganic or organic pollutants (fertilizers and herbicides) contained in erosion sediment is insignificant. However, sediments reduce the lake's aesthetic appearance. The lake's turbid appearance results from wave action stirring up fine lakebed sediments rather than from erosion flows. Calcium carbonate appears to be the principal constituent of lake sediment. Quartz, silica and clay minerals are the other major components. These sediments appear grayish in color.

The calcite layer comprises the upper layer of the lake floor and is approximately 15 to 30 feet thick. Sedimentation rates are approximately 2 mm per year. However, lakebed faults appear to be lowering the lake bottom at about the same rate as the sediments filling it.

Evaluation of Utah Lake Water Quality

The researchers concluded that Utah Lake is a warm, nutrient-laden body of water that is prone to algal growth and turbidity. However, there appears to be a paradox between biological productivity – more commonly known as algal growth, and the suspended sediments responsible for the lake's turbid appearance. These suspended sediments appear to inhibit sunlight essential for widespread algal growth.

Biological Productivity and Trophic Classification

Biological productivity is an indicator of overall lake water quality. Low productivity is most closely associated with cool, transparent waters, sandy or rocky shorelines/lakebed and low levels of taste or odor. On the other hand, high productivity is associated with warm, turbid waters containing algae blooms, large insect populations, and fluctuating water quality levels. Algae growth is the primary determinant in lake productivity. Lake productivity is classified by its trophic (i.e., nutrient-based composition) condition. Trophic classification typically falls into four categories which are – from lowest degree of productivity to highest - oligotrophic, mesotrophic, eutrophic and hyper-eutrophic. Phosphorous, nitrogen and sediment content are the major determinants of eutrophication. Water quality experts agree that Utah Lake is now in a hyper-eutrophic state.[9]

Since Utah Lake is shallow, wind-generated waves continuously stir up bottom sediments and other particulate matter. These suspended sediments reduce the water's transparency and inhibit solar penetration. Consequently, lake productivity is attenuated by these suspended particles that tend to limit the amount of light available for algal growth.

Suspended sediments - combined with shallow depth and heavy wave action - give Utah Lake its negative image as a polluted body of water. Lake sediments are also rich in nutrients such as phosphorous primarily because effective wastewater treatment efforts were not implemented until the 1950s and tertiary treatement (phosphorus

[9] EPA Clean Lakes Study, p.5-1

removal) is not performed in existing wastewater treatment facilities. Because of the lake's shallowness, wave action and even boat movement will stir lake sediments. These suspended calcium carbonate-laden sediments tend to give the lake its turbid, brownish-gray appearance, a phenomenon particularly noticeable during periods of heavy storm activity. It follows that such turbulence also contributes to the circulation of phosphorous within the lake.

Utah Lake Water Quality Improvement: Recommendations, Benefits and Costs

According to the EPA Clean Lakes Study, removal of the lake's nutrient (phosphorous) loadings should be the primary water quality enhancement objective. The report states that 50 percent of the lake's phosphorous load could be removed primarily by modifications to waste water treatment plants. Further nutrient reductions could be gained by better control of urban storm water runoff, erosion and agricultural management practices. A 50 percent reduction in phosphorous loads could possibly move Utah Lake from a hyper-eutrophic to a eutrophic classification.

The report listed several options to improve water quality including: biological and chemical phosphorous removal at wastewater treatment plants and from urban and agricultural runoff and stream sediments. Erosion control and wetland enhancement were other recommendations listed to improve water quality. Additionally, the study notes that large scale dredging may help improve water appearance. However, by reducing lake turbidity through dredging, the potential exists for additional sunlight penetration and subsequent increases in algal production. More importantly, the feasibility of lake-wide dredging is questionable given the biological constraints (impacts on endangered June sucker habitat) as well as the high costs (over $85 million).[10] In addition, resuspension of nutrients, sediments and trace elements could temporarily reach high concentrations. While such actions might eventually bring nutrient loading into compliance and could move the lake toward a eutrophic condition, they are costly – approximately $228 million - and would probably not result in any noticeable *visual* improvement to lake water quality due to the high algal growth and turbidity that would still occur.[11]

While improving Utah Lake water quality is beneficial and necessary, it is important to note that *currently*, Utah Lake water may not be as bad as commonly thought. Lake water is within the limits of most of the state's specified water quality standards. Nutrient loadings, while a problem, are not considered harmful. Consequently it is the aesthetic attributes of Utah Lake water - concerns such as algae growth and the associated undesirable water tastes, odors and color as well as the turbid nature of this shallow lake - that appear to be the major concerns, particularly with recreational users. Consequently, it is the aesthetic attributes of Utah Lake water which are of major public concern – particularly among recreational users. The primary concern in visual due to the turbid nature of the water. Additional concerns such as algae growth and undesirable water taste, odors and color are not consistent characteristics of the lake.

Hazards Inventory

In addition to geologic hazards, there are other safety and liability issues that should be addressed at the park. Many of these hazards are associated with facilities or structures that are dilapidated beyond repair or reasonable maintenance measures. A Divisional Risk Management Assessment found a number of potential safety issues that need to be addressed.

[10] EPA Clean Lakes Study, p. 10-5

[11] ibid, p.11-3

Inadequate Fencing

Park fencing is outdated, in disrepair or is damaged. As a consequence, the park may be exposed to liability issues associated with accidental/unauthorized entry or access.

Fish Cleaning Station is Inoperable, Unsightly and Hazardous

The park's fish cleaning station does not function properly and is damaged. Exposed wires and fencing near the structure may pose a hazard to visitors. Efforts to maintain the station in a functional condition have proved unsuccessful. The Utah Lake State Park Planning Team recommends the structure be removed and replaced with a new fish cleaning station sufficient to handle the type and number of fish cleaned at the park (*see Facilities Development section regarding day use facilities on p. 33*).

Harbor Jetties Contain Concrete and Other Debris that is Unsightly and Hazardous

The jetty banks contain demolished concrete as a result of emergency stabilization efforts during flooding events. However, these materials significantly reduce the harbor's aesthetic qualities. Moreover, much of this material contains protruding reinforcement bar or welded wire mesh that could seriously injure park visitors. The planning team recommends a study be completed to determine the needed configuration to minimize siltation in the harbor. This reconfiguration may provide opportunities for recreation on the jetties (for example, a fishing pier, picnic sites, etc.). The team acknowledges a need to improve the jetties whether the configuration is changed or not. The jetty improvements are expected to be included in the jetty reconfiguration with appropriate recreation uses determined once the configuration is known (*see jetty configuration/siltation pp. 31-32*).

Harbor Restrooms are Dilapidated, Inadequate

The restrooms adjacent to the north and south boat ramps are obsolete, dilapidated and insufficient to effectively meet visitor needs. The planning team recommends that both these facilities be replaced (*see Facilities Development section regarding restrooms on p. 31*).

Rental Slips are Unsafe

Planking on rental slip transition walkways is warped and buckled. This may cause visitors to trip and fall. The planning team recommends that the rental slips and the north concrete courtesy dock be replaced and upgraded to prevent such hazards (*see Facilities Development section regarding marina docks on p. 34*).

Current Entrance Station is Not Adequately Protected from Traffic

The park's current entrance booth does not contain effective curbing or bollards (concrete-filled steel posts) that protect the structure from errant traffic. Such safety features should be included as these facilities are upgraded. The planning team recommends that a new entrance station be built as a component of the Operations Center/Entrance Reconfiguration (*see Facilities Development section regarding new park operations center on p. 29*).

Excessive Siltation Results in Navigational Hazards

Boaters may become grounded near the harbor/jetty areas as a result of sediment build-up and shallow water. The planning team recommends that harbor jetties be redesigned and reconfigured to minimize siltation and provide for safer navigation of the harbor area (*see Facilities Development section regarding jetty configuration/ siltation on p.31*). Shallow areas outside of the marina should be effectively marked with buoys. A regular dredging plan is a component of the jetty redesign that should be implemented to alleviate portions of this hazard.

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Visitor Survey Results

The Division of Parks and Recreation administered a visitor survey during the peak visitor months of 2000. The survey was implemented to develop a better understanding of visitor needs, level of satisfaction with existing facilities and opportunities, and desired future development at the park. Survey results were incorporated into the planning process in the development of recommendations. It is important to note that the survey results reflect visitor use patterns during the study period (e.g., peak visitation period between May and August) only. Moreover, the survey results may exhibit a non-response bias due to the low response rate. Consequently, one must be careful in using the results to draw generalized conclusions about the population of users who visited Utah Lake during the study period.

Utah Lake State Park 2000 Visitor Survey Highlights:

- Utah Lake State Park Fulfills a Niche Serving Primarily the Boating Public.
- Most Visitors to Utah Lake State Park Make Multiple Visits to the Park Annually.
- Day Use Overwhelmingly Comprises the Majority of Use at the Park.
- Improvements and Development Recommended by Visitors Range from Boat Ramps to Shade Shelters to Concession Services.

Survey Highlights

With the above mentioned limitations in mind, respondents noted several items of interest. This information provides important insight about visitor use patterns, activities, needs and concerns.

Utah Lake State Park Fulfills a Niche Serving Primarily the Boating Public

Results from several questions lead to the concept of Utah Lake State Park's primary user group being the boating public. Almost 75% of respondents used a boat while at Utah Lake State Park. Within that group the preferred activities vary between waterskiing, pleasure boating, riding personal watercraft and fishing, however the common theme is that providing adequate boating related facilities is essential. Some of the facilities specifically mentioned as important for the park to provide and maintain in good condition are ramps, docks, restrooms and parking. The two primary reasons respondents gave for visiting Utah Lake State Park were the boating facilities and the proximity of the park to their home. Based on activity participation numbers and preferred activities, Utah Lake State Park is primarily a boating park. Other user interests such as picnicking, camping, swimming, and bird watching occur at the park. Some of these activities likely occur in conjunction with boating while others do not.

Most Visitors to Utah Lake State Park Make Multiple Visits to the Park Annually

Utah Lake State Park is a facility that is used repeatedly by most visitors. Almost 87% of visitors had been to Utah Lake State Park two or more times in a 12 month period. Approximately 38% of visitors stated they had visited ten times or more in the same time period and 4.3% of total respondents visited the park more than 50 times. This repeat use is likely facilitated by the fact that 92% of visitors are from the Wasatch Front, specifically Utah, Salt Lake, and Davis counties. It is also linked to responses which stated proximity of the park to their home (along with boating facilities) was one

of the primary reasons most respondents visited Utah Lake State Park.

Day Use Overwhelmingly Comprises the Majority of Use at the Park

Visitation at Utah Lake State Park is primarily day use. Of respondents, approximately 93% used the park for one day or less and only 4.2% stayed overnight. The remaining 2.8% did not answer the question. Activity participation in the park corroborates this data by showing the activities with the greatest levels of participation being primarily day use activities. The activities with the highest levels of participation were waterskiing, pleasure boating, swimming, sunbathing, picnicking and riding personal watercraft.

Improvements and Development Recommended by Visitors Ranges from Boat Ramps to Shade Shelters to a Concessionaire

A combination of questions was utilized to determine facility development and improvement needs. Responses indicated that boat ramps, parking areas and shade shelters were the priority facilities for improvement. The boat ramps have since been completely rebuilt, meeting the requests of visitors to improve the surface, traction, cleanliness, size, length and slope of the ramps. Comments stated that additional parking is needed and that it should be located as close to the marina as possible. Respondents' comments related to shade shelters included a need for the shelters throughout the day use area and beach area and a need for additional picnic tables. The overall outcome of the various facility questions was that respondents used facilities directly related to boating, such as boat ramps, restrooms, courtesy docks and parking, more than other facilities. Requests for additional facilities were highest for boating related improvements, although day use facilities were nearly as high.

Issues and Recommendations

A number of issues ranging from facility development needs to natural resource management to collaborative partnerships and advocacy efforts were addressed in the plan. Also addressed were issues related to staffing, funding and operations; land management; and education and information. Each of these issues was identified by various sources including input from planning team members as well as the public-at-large through a public meeting and a visitor survey. Team members and the general public identified 26 major issues that were aggregated into six distinct categories. An analytical technique used to determine the park's strengths, weaknesses, opportunities, and future threats (otherwise known as a "SWOT" analysis) helped develop these issues. A specific description or statement summarizing each issues or problem was constructed to clearly identify and articulate the problem at hand.

A number of constraints (e.g. available funding, sufficiency of staff, facility location and design, and federal regulations, etc.) will need to be addressed prior to issue resolution. Team members, planning staff and division experts identified some of the limiting factors that may hinder implementation of a specific team recommendation.

From these issues, and with the constraints in mind, the planning team developed specific recommendations. The team's recommendations were arrived at by consensus of opinion. Furthermore, team members emphasized that recommendations be consistent with the mission and vision statements.

The six issue areas forming the basis of the team's recommendations include: (1) facilities development; (2) natural resource management; (3) education and information; (4) funding, staffing and operations; (5) land management; (6) collaborative partnerships/ advocacy beyond park authority. A key recommendation that should be mentioned here involves the formation of a Utah Lake State Park Friends Group. Team members felt that such a group can provide valuable assistance in implementing recommendations as well as providing continued support for the park into the future.

The other major area that should be emphasized is facility development. This is a pressing need for the park and a priority of the team. The recommended facility development is discussed in two phases, however the order of actual development is subject to change based on available funding. Multiple sources of funding are available for different portions of the overall project, however, the timing of their availability is currently unknown. In order to expedite development and maximize fiscal efficiency, the Facilities and Construction Section will be responsible for implementing the recommendations in a manner that balances the listed prioritization while utilizing available funding opportunities.

Facilities Development

At the onset of the planning process, team members set a goal to develop well-designed, well-maintained and aesthetically pleasing facilities that adequately meet the diverse water-based and shoreline recreation needs of park visitors. Proposed facility development actions consistent with this goal include:

- A new Operation Center providing multi-lane access at the park's entrance.
- Redesigned/reconfigured boat ramps and harbor jetties.
- Improvements to traffic flow and parking throughout the park.
- New restroom facilities.
- A concession/information center.
- Significantly expanded day use and group areas providing shade, shelter and other recreation opportunities.
- Improved campground aesthetic qualities by implementing effective landscaping designs that provide visitors with more shade and privacy.

The team's facility development recommendations will increase park accessibility, reduce bottlenecks and significantly increase parking capacity for water-based users. Moreover, day-use opportunities will be greatly enhanced and visitors will be able to purchase necessary retail items and will be able to more easily access critical information about the area.

The planning team commissioned an adjunct group - the Utah Lake Facilities Development Subcommittee – to analyze park facilities issues and needs and to develop recommendations for the team's review and approval. This subcommittee included planning team members, design/construction experts from the Division's Facilities and Construction Section and members of the Division's administrative staff. The planning team reviewed this Subcommittee's findings and, after some minor amendments, adopted specific recommendations listed below.

Issue Area: Facilities Development

Key Issues:

- A new park operations center is needed.
- Current park traffic patterns create bottlenecks, congestion, and delays.
- Restrooms are dilapidated and should be replaced.
- Current jetty configuration may promote harbor siltation problems.
- The park's campground lacks sufficient shade and shelter.
- A critical need exists for additional parking.
- Relocation of maintenance and dry storage area is necessary.
- Additions and improvements to day use facilities are needed.
- Appropriate concession/information facilities are needed.
- Marina docks need replaced.
- Park playground equipment needs upgraded.
- The park lacks group camping facilities.

These recommendations address the broad goals listed in the team mission and vision statements. Moreover, they are congruous with public input: from user groups, opinion surveys and from the public-at-large.

A number of criteria - costs, available funding, land ownership and inter-agency coordination and approval – will need to be considered in the planning, development and implementation of each recommendation. The latter constraint is a key issue at Utah Lake State Park. For instance, any construction or development within the designated avigation easement (*see Plate 2*) requires approval by the Federal Aviation Administration (FAA) due to the close proximity of the park to the adjacent Provo

Airport. Other regulatory constraints - Endangered Species Act prohibitions, wetland mitigation measures – will likewise need to be considered. Costs and design feasibility may also impact the final product. Many of the team recommendations are conceptual in nature. The Division's Facilities and Construction Section will take these recommendations and work with a designated architectural/engineering firm to develop a formal design and construction program. During this transition from concept to design, conceptual modification may be required to feasibly implement specific recommendations.

Given the dilapidated condition of many park facilities, there is an urgent need to implement several of the facilities development recommendations to meet current visitor needs. Quick action must also be taken to capitalize on available funding sources. As a consequence, planning team members prioritized Facilities Development recommendations. Team members recommend a two-phase implementation plan for proposed development actions. It must be noted that the order of actual development is subject to change based on available funding. Multiple sources of funding are available for different portions of the overall project, however, the timing of their availability is currently unknown. In order to expedite development and maximize fiscal efficiency, the Facilities and Construction Section will be responsible for implementing the recommendations in a manner that balances the listed prioritization while utilizing available funding opportunities. For example donations or matching funds may provide an opportunity to install some shade shelters in the campground at an earlier phase of development than is currently outlined. Specific issues and recommendations adopted and prioritized by the team are listed in each implementation phase as follows:

Phase I – Development Issues and Recommendations

Issue: Develop a New Office/Operations Center

There is a critical need to develop a new office/operations complex at the park. The current office visitor center is dilapidated, costly to maintain and does not effectively serve park visitors. A new facility needs to be developed near the park's entrance to reduce current traffic bottlenecks and delays during peak-use periods. Moreover, there is a need to provide a facility that allows visitors to take care of many of their needs as they enter the park. It should also allow visitors to walk in and communicate with park staff, view park information, and purchase miscellaneous retail items. The facility should provide sufficient office space for park staff and should include meeting/classroom areas for training or other public purposes.

Recommendations

Team members adopted most of the Facilities Development Subcommittee recommendations concerning development of a new office/operations center. The team listed construction of this new facility as the top priority facilities development item. The current office/visitor center should be demolished and should be replaced with attractive, feasible landscaping designs congruent with nearby facilities. The team also felt that this new facility should be located near the park entrance to expedite the payment of fees to reduce traffic congestion. The Division's Facilities and Construction Section will evaluate similar designs found at Lake Mead, La Paz in Arizona and at Maumee Bay in Ohio as models. Specific components for this facility are recommended as follows.

1. **Construct an Operations Center located near the entrance of the park. Facility design should include the following attributes:**

A. Include 4 offices, 2 meeting/classrooms, restrooms, a visitor service/reception counter and sufficient space for effective informational displays about the park/lake.
B. A staffed resale area for miscellaneous retail sales (ice, drinks, etc.).
C. The facility should also serve as a contact/entrance station to minimize bottlenecks during peak periods
    - Align structure with adjacent entrance station (realign entrance station if necessary) to provide multiple traffic lanes for entering visitors; closure of the entrance station during slow or shoulder seasons; ability to barricade extra lanes during slow periods.
D. Provide sufficient short-term visitor parking.
E. Evaluate the feasibility of installing automated, self-pay entrance/fee collection gates.
F. Realign fencing to provide vehicle parking for staff and to provide quick response and emergency access to the park.
G. Upgrade exterior security lighting throughout the park.

Issue: Traffic Flow

Current park traffic patterns create bottlenecks, congestion and delays during peak periods. Water-based users are unable to efficiently launch and load their craft. This congestion leads to visitor dissatisfaction. Moreover, the park may be losing revenues from these delays and from potential visitors who prefer more favorable locations.

Recommendations

An evaluation of park traffic patterns should be conducted to explore necessary measures to minimize bottlenecks and improve flow, particularly near the northern ramps. An engineering design should incorporate the elements of this evaluation preparatory for construction. Specific recommendations follow.

1. **The Division's Facilities and Construction Section will be responsible for commissioning a formal traffic flow study of Utah Lake State Park; where possible, model potential design after other successful traffic flow design studies; the following concepts should be considered for feasibility within the traffic flow study:**
    A. Ramp approaches should be reconfigured to maximize boat launching and loading and ensure unobstructed access and flow to ramp areas, jetties and nearby parking.
        - Current ramp configuration results in obstructed traffic flow; ramp approaches are too narrow and result in blockage of traffic as boaters prepare, and maneuver (back-up/turn around) for launching or loading.
    B. Explore feasibility of connecting/consolidating the north ramps; relocate north restroom accordingly.
        - Ensure that courtesy docks are maintained or replaced and properly relocated with potential north ramp reconfiguration/ consolidation.
    C. A thru-lane should be designated near the north ramp providing unobstructed/continuous ingress and egress to the north ramps and jetty area
        - Explore the feasibility of striping or other delineation methods to enhance circularity utilizing means such as traffic loops to facilitate efficient access, launching and loading.
    D. Explore expanding the area road/parking area near the ramps on the north jetty to accommodate the above needs.

- Configure to include boat preparation/wipe down areas and restroom relocation.
- If needed, amend existing lease agreement with the Division of Forestry, Fire, and State Lands to incorporate land necessary for expansion.
- Determine if there will be wetland impacts with the expansion. If necessary, acquire 404 permit from the Corp of Engineers and take steps to mitigate the impact.
- Install a phone line for use with boat shows, etc. Connect to existing phone lines on old ice rink if possible.

2. **The Division's Facilities and Construction section should incorporate feasible elements of traffic flow study and submit as a formal Request For Proposal for design and construction.**

Issue: Restrooms

With the exception of new restroom facilities in the campground loop, all park restrooms are dilapidated, obsolete, difficult to maintain and do not meet visitor needs. Survey results indicate high levels of dissatisfaction with current restrooms – facilities that are second only to the boat ramps in terms of visitor use.

Recommendations

Three new restrooms should be constructed to replace existing facilities. Each should include more capacity and additional amenities to effectively accommodate visitor needs.

1. **Replace restroom located near the south ramps and beach area**.
   A. New structure should provide three toilets/urinals on each side with two sinks and provide an exterior shower.
2. **Replace and relocate restrooms located on the north jetty, near the north ramps.**
   A. New structure should provide three toilets/urinals on each side with two sinks and provide an exterior shower.
      - Relocate this restroom to the north east side of the jetty access road and coordinate location with jetty road, additional parking, boat prep/wipe down area, and ramp access.
3. **Replace and relocate restroom in the day use/grassy area. New structure should provide three toilets/urinals and two sinks on each side.**
   A. Relocation should be congruent with other new day use facilities and should be located in the northern section of the park's central grassy area.

Issue: Jetty Configuration/Siltation

Current jetty structures inadequately control – and may even promote – siltation of the harbor area. The jetties fail to prevent Provo River silt flows from entering the harbor. Likewise, the structures are ineffective against wave-generated silt deposits. Consequently, the harbor regularly "silts-up" to a point where boat access from the harbor to the lake is hindered. Moreover, the jetties are unsightly and contain materials and debris that detract from the harbor area's aesthetic qualities. Navigational lighting on the jetties is needed for many watercraft and must be visible from the water.

Recommendations

A thorough evaluation is needed to design and implement a jetty configuration that effectively inhibits harbor siltation and minimizes flooding. The new design should also enhance the park's aesthetic qualities. It should be noted that an additional function of the jetties is to minimize the impact of waves and ice pushed against the inner harbor. This purpose should also be considered and incorporated in the evaluation. The feasibility of jetty redesign and construction is dependent upon

available funding. Additionally, implementation will require the acquiescence of the U.S. Fish and Wildlife Service and the Army Corps of Engineers. Coordination with the June Sucker Recovery and Implementation Program will also be essential. Actions to achieve these objectives are as follows.

1. **The Division's Facilities and Construction Section should convene a jetty configuration study with the goal of developing redesign options that minimize harbor siltation and flooding.**
2. **The Facilities and Construction Section, working in conjunction with appropriate engineering/design firms, should also obtain/utilize existing studies regarding the lake's circularity/littoral flow patterns and incorporate relevant findings and impacts into potential design options.**
3. **Implement the most appropriate jetty design as determined by the study.**
4. **Develop and implement a regular dredging program commensurate with new jetty design.**
5. **Install new red/green strobe lights as aids to navigation.**
   A. Coordinate with FAA and Provo Airport to provide lights with sufficient power to be seen by users on the water, without interfering with air traffic.

Issue: Campground Landscaping and Shade

The park's campground lacks sufficient vegetative shade and shelter. More trees and shrubs are needed to improve the campground's aesthetic qualities and provide visitors with shade and privacy.

Recommendations

Provide additional landscaping as needed to improve campground aesthetics and provide visitors with a more satisfying experience. The team adopted the following actions to meet these objectives.

1. **Plant trees that are at least 2 inches in caliper to increase survival rates.**
   A. Planted trees should be robust and native to the area.
   B. Install appropriate signage to prevent tree/branch cutting.
2. **Identify areas where shrubbery and other vegetation should be placed to increase privacy and make the area more aesthetically pleasing.**
3. **Seek grants and/or donations to obtain (and install) trees, shrubs or other landscaping items.**

Phase II Development Issues and Recommendations

Issue: Parking

A critical need exists for additional parking to help alleviate congestion during peak periods. Parking issues mirror the park's current traffic flow problems, i.e., limited space and congestion. Moreover, insufficient and inadequate parking areas contribute to the delays encountered by boaters, watercraft users and those seeking jetty access (e.g. anglers).

Recommendations

Actions are needed to expand available parking and facilitate park traffic flows.

1. **Relocate maintenance/dry storage area to expand (paved) parking capacity.**
2. **Pave existing dirt/gravel areas east of the current lot.**
3. **Evaluate current design of traffic flow and determine areas of congestion, if any, for further analysis and redesign; quantify increases in parking capacity.**
   A. The Division's Facilities and Construction Section should incorporate parking analysis and design into proposed traffic flow analysis/design (*see Traffic Flow recommendations listed on p. 30*).

Issue: Maintenance and Dry Storage Areas

Opportunities exist to expand area parking by relocating the park's current maintenance building and adjacent dry storage areas. A concern with the relocation includes weather and safety of employees and those using the dry storage. The concerns focus on fog and the need to cross 4200 West to access the park. These concerns should be included in the final design and development of the new area.

Recommendations

Team members recommend the following actions regarding the current maintenance/dry storage areas:

1. **Relocate maintenance facilities and dry storage to existing park property across 4200 West (where ranger residence was formerly located); utilize area for additional parking and group camping (*See Group Camping Area recommendations, p. 35)*.**
2. **Construct new maintenance building.**
3. **Provide a gated entrance that allows access directly across 4200 West (for park personnel and emergency vehicles only) between the main park area and these new facilities; utilize existing fencing materials where possible.**

Issue: Day Use Facilities

Approximately 93 percent of park visitors stay at the park for one day or less. However, the park currently lacks adequate facilities - picnic tables, shade/shelter structures, etc. – to accommodate day use. Survey results show that a large number of visitors recommend additions or improvements to the park's day use facilities.

Recommendations

1. **Install shade shelters with picnic tables and grills (*refer to Plate 2 for specific locations*).**
   A. Locate and construct 12 shelters with amenities along the river area.
   B. Locate and construct 12 shelters with amenities in the park's central grassy area.
   C. Locate and construct 6 shelters along the inner harbor north of current visitor center.
   D. Locate and construct 8 shelters along both sides of the beach/finger jetty area.
2. **Develop basketball courts on the old ice rink. Locate appropriately to avoid conflict with the concession/information center (*see Concession/Information Center, p. 34)* and the group day use area (*see Group Day Use Facilities #5 below*).**
3. **Construct a sand volleyball court in the grassy area; Location should be congruent with adjacent day use facilities.**
4. **Provide day use opportunities where the visitor center is currently located; landscape to improve aesthetic values of the area; consider locating recommended picnic tables in close proximity to concession/information structure.**
5. **Provide group day use facilities**
   A. Complete group use pavilion currently under construction on the old ice rink.
   B. Construct an additional group use pavilion in the park's central grassy area. Location/siting should be consistent with other development in the area.
6. **Remove the inoperative fish cleaning station and replace it with a new fish cleaning station sufficient to handle the number and types of fish cleaned at the park.**
   A. Install a mechanized station that utilizes a grinder and is connected to the sewer system.
   B. Ensure that an adequate size grinder (7.5 HP or greater) is used to appropriately dispose of fish remains including catfish heads.

C. Seek partners and alternative funding sources to purchase, construct and install the this cleaning station (e.g. angling organizations, Wallop Breaux Matching Funds, etc.)

7. **Renovate or replace the fishing pier to improve access, ADA opportunities, and overall angling opportunities.**
   A. Locate and implement as appropriate based on jetty reconfiguration.

Issue: Concession/Information Center

When visitors were asked what item they would most like to see provided at the park, a majority listed concession facilities as the top item. Planning Team members recognized this need as they listed provision of appropriate concession opportunities as an essential goal within the team mission and vision statement. Presently, the park lacks adequate concession opportunities to meet visitor needs.

Recommendations

A low-maintenance, self-serve concession facility containing a broad array of items should be designed and constructed. The structure should also serve as an information center for visitors. Specific recommendations were adopted as follows.

1. **Construct a facility near the marina that provides "self-serve" concession and information opportunities.**
   A. Concession facilities should consist of a three-sided, lean-to type structure that contains self-service vending machines (pop, ice, snacks, bait and propane); the structure should include a roll-down door to secure vending machines at night or during off-peak times.
   B. The structure should also serve as an information center.
      - The structure's exterior surfaces should be designed for effective, aesthetically pleasing self-service display of relevant information/education items about the park and lake, including safety and regulatory information.
2. **Provide picnic tables with shade and shelter nearby.**
3. **Include a pay phone for emergencies, consider utilizing those already in place.**

Issue: Marina Docks

Rental slips (season, monthly and daily rentals) are obsolete, dilapidated and do not adequately provide services such as utilities and other hookups necessary for water-based users. The north ramps are serviced by an old concrete courtesy dock that needs replaced.

Recommendation

1. **Replace existing rental slips; include necessary utility hookups for relevant craft.**
2. **Replace concrete courtesy dock servicing the north ramp.**

Issue: Playground Area

The playground area on the park's south side is a widely used feature that provides recreation opportunities for children. However, the playground's equipment is old and in need of replacement. It does not currently meet all Consumer Product Safety Commission (CPSC) and American Society of Testing and Materials (ASTM) standards for playground safety.

Recommendations

1. **Upgrade playground with new equipment and appropriate material on the ground under the equipment to meet CPSC and ASTM standards.**
2. **Locate playground appropriately based on other facilities and the need to increase ease of adult supervision and access from other day use facilities.**
3. **Consider alternative funding sources, such as grants and donations to make this improvement during an earlier phase of development as appropriate.**

Issue: Group Camping Facilities

Camping opportunities should also be provided for large groups wishing to stay at the park for extended periods. Amenities such as pavilions, restrooms and adequate parking should be included with these group use/group camping facilities.

Recommendations

1. **Relocate current dry-storage facilities and construct a group camping area (*see Maintenance and Dry Storage, p. 32)*.**
   A. Facilities should include a 150-person pavilion with tables, a restroom with showers, appropriate hookups and necessary parking.

Issue: Campground Shade Shelters

Within the campground, no shelter is currently available for the picnic tables. A recommendation for landscaping with trees and shrubs to improve aesthetics and provide shade is included in Phase I However, shade shelters are a feature, that when added to the campground will provide visitors with a more satisfying experience.

Recommendations

1. **Install shade shelters within the existing campground areas. Alternative funding sources should be sought to complete this component as soon as possible without detracting from other priorities.**

Natural Resource Management

Utah Lake State Park has a very limited land base in relation to the lake and most of the park grounds have been disturbed at some time in the harbor's history. Management of natural resources is primarily dependent on the lake. The park is integrally linked to the lake and necessary provisions should be made to create opportunities and minimize problems specifically within the park and as the park relates to the lake.

Natural Resource Management:

Key Issues:

- Fluctuating lake levels create problems for year round launching and flooding of park facilities.
- The June sucker, a federally listed endangered species lives in the vicinity of the park.
- Swallows nesting near building entrances and bugs are pests to visitors and staff.

Issue: Fluctuating Lake Level

Use of Utah Lake as a storage facility for irrigation has created dramatic fluctuations in the lake level. This combined with varying annual climatic conditions creates the potential for park flooding. In response to the park flooding in 1983, dikes have been built to minimize flooding of facilities.

Recommendations

1. **Design facilities to minimize damage in the event of a flood.**
2. **Where possible coordinate/advocate for water retention in the lake with relevant authorities. (Note – This is primarily an advocacy role).**
3. **Coordinate with appropriate authorities to develop a regular dredging plan in areas around the harbor essential for boat access to the lake during low water years.**

Issue: Endangered Species – June Sucker

A federally listed endangered species, the June sucker, occurs within Utah Lake. Its preferred habitat for spawning is the lower portion of the Provo River *(see section on June sucker, p.15)*. Federal regulations must be followed and additional efforts made to avoid disturbing and/or negatively impacting the June sucker.

Recommendations

1. **Obtain required clearances from appropriate entities (e.g. U.S. Fish and Wildlife Service, Corp of Engineers, etc.) for all development and lakebed disturbing activities.**
2. **Coordinate activities and development to be in accordance with June Sucker Recovery Plan.**
   A. Coordinate with June Sucker Recovery Coordinator when appropriate.

Issue: Pest Management

Current facility design provides nesting habitat for swallows, which is both a nuisance and aesthetic concern to anyone entering the building. The parks proximity to the lake and wetlands is conducive to the presence of bugs.

Recommendations

1. **Facility design and development should take into account the presence of swallows and avoid providing nesting habitat in areas utilized by staff and visitors.**
2. **Evaluate and improve pest control methods.**
   A. Coordinate with appropriate entities to conduct evaluation and determine improved pest control methods (e.g. Division of Wildlife Resources, etc.).
   B. Consider the use of bat houses to naturally increase bat populations and decrease insect populations.

Education and Information

Education of visitors and the general public is crucial to creating a positive image of Utah Lake and Utah Lake State Park. Information dispersal is one mechanism for educating people. A variety of methods have been recommended by the team to improve the image of the park and lake and provide relevant and needed information to park visitors.

Education and Information:

Key Issues:

- A poor public image of the lake and park is prevalent.
- A need exists to provide information related to the lake and park.

Issue: Poor Public Image of Lake and Park

Utah Lake has a poor public image due to misconceptions regarding pollution, turbidity, and other environmental concerns related to water quality. For an accurate analysis of Utah Lake water quality, please see the Water Quality section on p. 18.

Recommendations

1. **Increase public relation efforts emphasizing the positive aspects of Utah Lake and Utah Lake State Park.**
   A. Initiate an ongoing public relations effort with Provo City (e.g. cable station).
   B. Periodically initiate press releases regarding the lake, including coordinating with media contacts as opportunities arise.
   C. Coordinate with user groups to utilize marketing opportunities in relationship to events (e.g. waterski competitions, etc.)
   D. Focus public relation efforts on opportunities to garner funding and legislative support.
   E. Seek to fulfill public relation recommendations with minimal cost (e.g. seek donations).
2. **Develop an effective educational display/program explaining lake conditions.**
   A. Identify and gather accurate information related to lake conditions.
   B. Determine appropriate locations for display and provision of interpretive information, including but not

limited to brochures, signs and displays.
    - Information should be displayed or presented in an effective, aesthetically sound manner and should be strategically located to reach as many visitors as possible.

C. Identify and coordinate with appropriate entities for implementation of interpretive efforts.

3. Develop appropriate and well-maintained facilities at Utah Lake State Park establishing a positive initial image.

Issue: Education and Information about the Lake

As a multiple use lake and park with a variety of resources, a need exists to provide information related to the lake and park. The information provided should relate to the lake, park and/or immediate area and should be relevant to the interests or needs of park visitors.

Recommendations

1. Develop educational programs and informational displays at the park related to boating, fishing, safety, the lake, local and cultural history, natural resources and other appropriate attributes.

A. Identify appropriate sites for effective display and dispersal of information.
    - Consider locating informational displays in the operations center, interpretive boards/kiosks around the marina and at the proposed concession/information center.

B. Develop displays that can be easily maintained.

C. Provide campfire programs for park visitors.

D. Implement Junior Ranger programs for children.

2. Continue providing brochures with park, lake, and boating safety information at the entrance station and park operations center.

3. Seek available funding to assist with implementing appropriate interpretive efforts.

4. Level of interpretive efforts implemented in the park is determined by the Park Manager.

Funding, Staffing, and Operations

Day-to-day operations of the park as well as the increased responsibilities outlined by the resource management plan create a need for additional funding and a Divisional evaluation of park staffing needs.

Funding, Staffing and Operations:

Key Issues:

- A need exists for adequate funding to maintain current park operations and fulfill the additional responsibilities outlined in this plan.
- A need exists to have sufficient staffing, proper equipment, and training.
- Increasing crime is a concern.

Issue: Need for Adequate Funding

Implementation of the resource management plan is largely contingent upon the Division's ability to obtain capital development funds, personnel funding, grants, partnership monies, private sponsorships or other funding sources. Such funding is constrained by legislative priorities; Division of Facilities, Construction and Maintenance priorities; Departmental priorities and the availability of external funding.

Recommendations

1. Seek capital facilities monies for major facility and construction projects through State Parks

prioritization, budget and funding procedures.

2. **Seek federal boating monies to fund boating related improvements.**
3. **Seek and capitalize on new funding opportunities, sources and partnerships.**
   A. Maintain government partnerships and seek additional collaborative opportunities as a means for increasing available funds (e.g. Utah County; Provo City; Forestry, Fire and State Lands; Wildlife Resources, etc.)
   B. Develop and enhance private partnerships (i.e. user groups such as the Utah Waterski Club, Provo Yacht Club, Angling Organizations, Scouting Groups, etc.)
      - Utilize groups for volunteer efforts, public support, facilities development, etc.
4. **Document and track viable funding sources/contacts to ensure continuity and simplify future funding searches.**
5. **Maximize events and opportunities for relevant State Senators, State Representatives, and other state, county and local officials to increase awareness of Utah Lake State Park's potential (e.g. upon completion of the new facilities –"ribbon-cutting" events, programs, and other significant events).**

Issue: Need for Adequate Park Staffing

It is essential to have sufficient staffing and the appropriate equipment to meet visitor needs, provide a safe experience and maintain the park in good condition. With the facility design changes recommended for Utah Lake State Park it is important to ensure that sufficient and efficient staffing is provided.

Recommendations

1. **Complete a staffing needs analysis and staff according to the recommendations from the needs analysis.**
   A. Include data regarding the tasks to be completed, the number of hours required to complete the tasks, and the skills required to complete the tasks.
   B. Include the additional responsibilities created through the recommendations in this plan.
2. **Provide equipment and training necessary to allow proper performance of job duties.**
3. **Continue utilization of volunteers whenever possible.**
4. **Provide opportunities for local educational institutions to assist with park needs and operations (e.g. internships, studies, etc.).**
5. **Apply for COPS (federal law enforcement) grant to add law enforcement staff.**
6. **Cooperate with other entities as opportunities arise for volunteers and/or paid staff to assist with visitors and education (e.g. county visitors bureau, forest service, local communities, etc.).**

Issue: Increasing Crime

Increases in crime have occurred recently and based on the park's proximity to several cities, there is increased potential for vandalism and other crimes.

Recommendations

1. **Allocate law enforcement staff to increase visibility and patrols** ***(see Need for Adequate Park Staff, p. 38).***
   A. Increase staff and equipment as is needed to provide a safe park for visitors and minimize property damage**.**
2. **Upgrade exterior security lighting throughout the park** ***(see New Office/Operations Center, p. 29)***

Land Management

In discussing needs and issues related to lands, the team noted that the top priority for Utah Lake State Park should be the development and improvement of existing facilities. Acquisition of additional lands/facilities, beyond what is needed to complete the facility development recommendations outlined in this plan, would be evaluated based on the opportunities to enhance lake recreation opportunities, available staffing and available funding.

Land Management:

Key Issues:

- Land acquisition was seen as a future possibility.
- Addressing any land ownership issues that may arise is a priority.

Issue: Potential Land Acquisition

Land acquisition was deemed a possibility for the future based on the availability of land, its appropriateness for inclusion in the state park, available funding and available staffing.

Recommendations

1. **Explore possible land acquisitions and, if needed, implement a long term plan for the acquisition of additional lands.**
   A. Coordinate with Forestry, Fire and State Lands and other appropriate entities to acquire lands for park expansion as it is needed.
      - Additional sovereign lands may be obtained for park use through general permit. Proposed use must be consistent with adjacent planned uses.

   B. Determine necessary funding/staffing levels to successfully manage any proposed land acquisitions.
   C. Acquire additional lands only if sufficient staffing and funding is available for management of the area(s).
2. **Explore opportunities for acquiring additional marina(s) around the lake contingent upon appropriate levels of staffing and funding.**
3. **Support opportunities by private organizations to acquire a site for a competition waterski park *(see Advocacy for Lake/Shoreline Management, p. 40).***

Issue: Land Ownership

Forestry, Fire and State Lands and the courts are currently resolving Land ownership issues around Utah Lake. Once ownership issues around the lake are resolved, a comprehensive management plan for Utah Lake will be initiated and completed by Forestry, Fire and State Lands. Recreation use around the lake will be a primary issue. Should issues arise within the park boundaries, it would be the responsibility of the State Park Lands Coordinator to resolve them.

Recommendations

1. **If land ownership issues arise within park boundaries, the State Park Lands Coordinator and park staff should be apprised.**
2. **For any land ownership issues that arise within the park boundaries, the State Parks Lands Coordinator will be responsible for addressing them.**

Collaborative Partnerships/Advocacy Beyond Park Authority

Utah Lake State Park is part of a larger ecosystem and social system due to its location and minimal land base on a large body of water. Forestry, Fire and State Lands has primary responsibility for the shoreline and lake itself. Wildlife is the responsibility of the Division of Wildlife

Resources. Other agencies also have jurisdiction and responsibility in their areas of expertise. This creates a need for participation in various planning processes and actions related to the lake, not specifically undertaken by the Division of Parks and Recreation. The team outlined several specific advocacy roles in which Utah Lake State Park staff and other Division personnel, as appropriate, should participate.

Collaborative Partnerships/ Advocacy Beyond Park Authority:

Key Issues:

- A need exists for interactive relationships between the park, government agencies, other organizations and private landowners.
- A need exists for advocacy efforts concerning management of the lake and shoreline.
- A need exists to manage leases within park boundaries and to ensure consistent lease policies.

Issue: Need for Interactive Relationships

The need exists for interactive relationships between Utah Lake State Park, local communities, relevant agencies, private landowners and local governments.

Recommendations

1. **Continue relationships with City and County Parks and Recreation Departments, specifically in developing joint programs.**
2. **Continue coordinating with federal, state, county and local agencies with jurisdiction, an interest, and/or a responsibility for Utah Lake or Utah Lake State Park as appropriate opportunities arise.**
   A. Participate in Forestry, Fire and State Lands planning efforts for the Utah Lake Comprehensive Management Plan.
3. **Encourage the development of a park friends group comprised of park users and other interested individuals and groups to provide support for efforts to improve the park.**
   A. Interested planning team members will serve as the organizers and core of this group during its development.
4. **Provide hazard marking of Bird Island, Lincoln Beach, Pelican Point and the mouth of Provo Bay. It must be signed and noted that it is impossible to mark all hazard areas based on lake fluctuations and the overall nature of the lake. It is the responsibility of the boater to use caution and boat safely**.
5. **Continue cooperative efforts between law enforcement agencies as needed and appropriate**.
   A. Follow existing protocol as the lead agency in search-and-rescue and assisting agency for find-and-recover operations on the lake.
   B. Coordinate with Provo City police on land based law enforcement efforts.
   C. Continue volunteer participation in search and rescue efforts by interested parties. (e.g. Coast Guard Auxiliary, Loy Fisheries, etc.).

Issue: Advocacy for Lake/Shoreline Management

A need exists for ongoing advocacy efforts concerning the management of the lake and shoreline; such issues may be beyond the jurisdiction of Utah Lake State Park.

Recommendations

1. **Support a Utah Lake advisory group with a park representative as a group member.**
2. **Coordinate with Forestry, Fire and State Lands, Provo City Parks and Recreation and Utah County to determine trail opportunities around**

the lake and potential linkages with existing trails.

3. **Support efforts by private groups to develop a competition waterski course.**
   A. Utilize opportunities available through marketing the competition waterski course to improve the park and lake image through the distribution of information.

Issue: Land Use – Leases

There is a need to determine how to manage areas of the park currently leased out to ensure consistent land use and lease policies.

Recommendations

1. **Coordinate with Forestry, Fire and State Lands to identify existing leases affecting Utah Lake State Park.**
2. **Manage existing leases as set forth in the existing lease and evaluate the lease agreement and uses for appropriateness prior to renewal of the lease.**
3. **Obtain Forestry, Fire and State Lands general permits for future leases affecting Sovereign Lands.**
4. **Encourage Leasees to maintain the leased land in good condition and in character with the park.**
5. **Coordinate all lease agreements within the park with park staff, the Division Lands Coordinator and Forestry, Fire and State Lands.**

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Conclusion

This plan is a blueprint to help implement the planning team's recommendations. As such, it outlines the initial steps to be taken in concert with park visitors, local communities and other interested users to properly develop facilities to meet diverse visitor needs, provide concession opportunities, replace the negative stereotype associated with the lake and park, and enhance customer service.

The recommendations contained in this plan conform to the team's mission of providing visitors a wide variety of safe and satisfying water-based and shoreline recreation experiences, preserving park resources, improving the image of the park and the lake and more fully integrating the park with the community at large. This mission statement was considered with the development of each recommendation.

The plan's recommendations effectively address the current needs for facility development, resource protection, park operations, land management, and cooperative efforts. However, it is crucial that adequate funding be received to implement these goals and accommodate visitor needs. The plan's success is dependent upon the continued support of stakeholders. Stakeholders must continue their efforts to support efforts for park improvements, preserve park resources, interact with local communities and strive to meet the expectations of park visitors in the midst of a rapidly growing community of recreation-oriented citizens. The recommendations contained within this plan were based upon an open and collaborative process. It is imperative that this collaborative spirit continue as the plan's components are implemented.

It is also imperative that the document be reviewed on a regular basis to ensure its viability, relevance and usefulness. This document has sufficient flexibility to be amended in response to changing resource conditions, visitor needs and expectations, community needs and agency priorities. Such amendments may occur under the auspices of the Division of Parks and Recreation. Any such changes will include input from park visitors, local citizens, community leaders, park management or other stakeholders with interests relevant to the operation and maintenance of the park.

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Maps

Plate 1: Utah Lake and Vicinity

Plate 2: Utah Lake State Park, Boundary, Avigation Easement, Recommended Facility Development

Plate 3: Sensitive Species In and Around Utah Lake

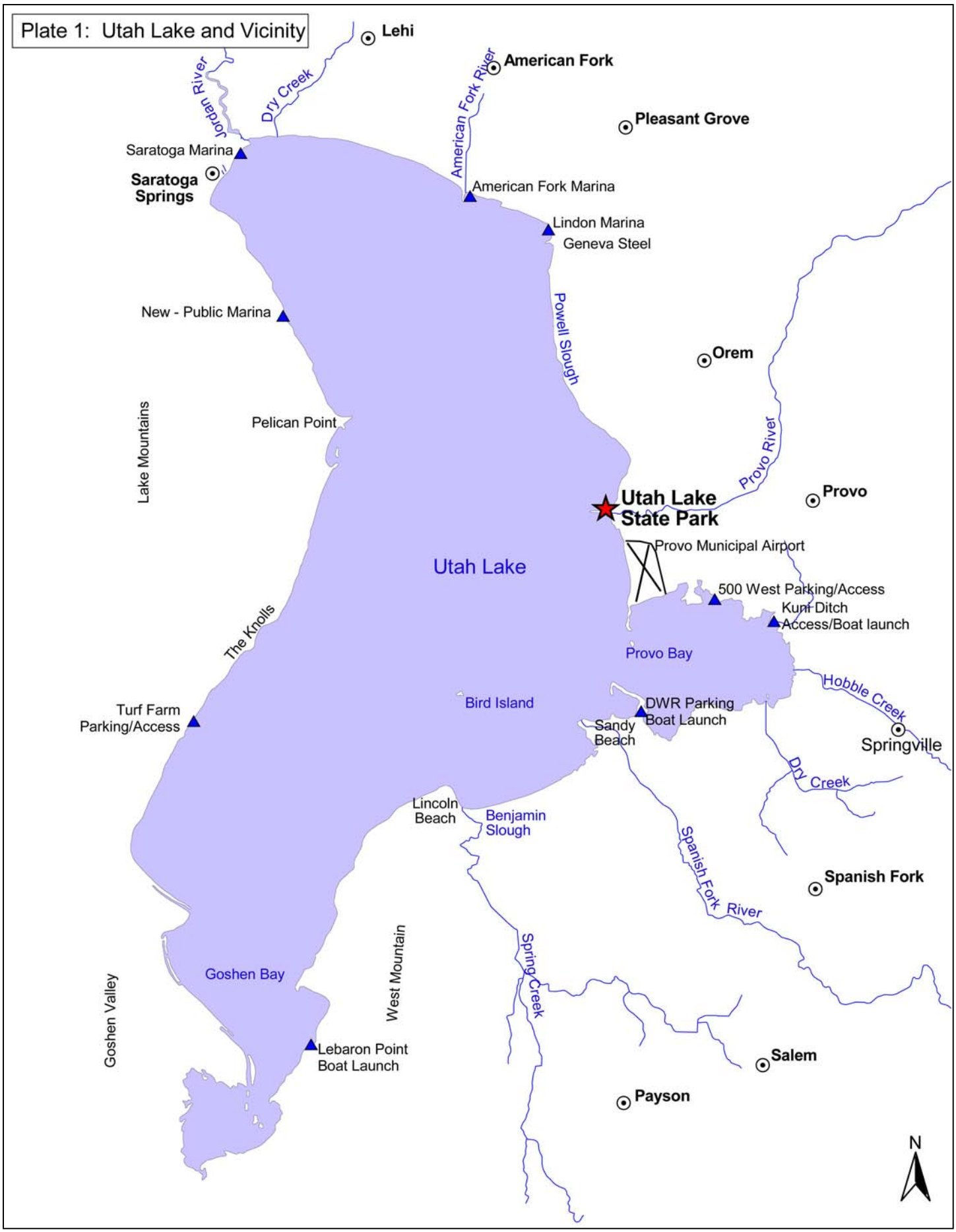
Plate 1: Utah Lake and Vicinity
Lehi
American Fork
Pleasant Grove
Jordan River
Dry Creek
American Fork River
Saratoga Marina
Saratoga Springs
American Fork Marina
Lindon Marina
Geneva Steel
New - Public Marina
Powell Slough
Orem
Lake Mountains
Pelican Point
Provo River
Provo
Utah Lake State Park
Provo Municipal Airport
Utah Lake
500 West Parking/Access
Kuni Ditch Access/Boat launch
The Knolls
Provo Bay
Hobble Creek
Bird Island
DWR Parking Boat Launch
Turf Farm Parking/Access
Sandy Beach
Springville
Dry Creek
Lincoln Beach
Benjamin Slough
Spanish Fork River
Spanish Fork
Goshen Bay
West Mountain
Spring Creek
Goshen Valley
Lebaron Point Boat Launch
Salem
Payson
N

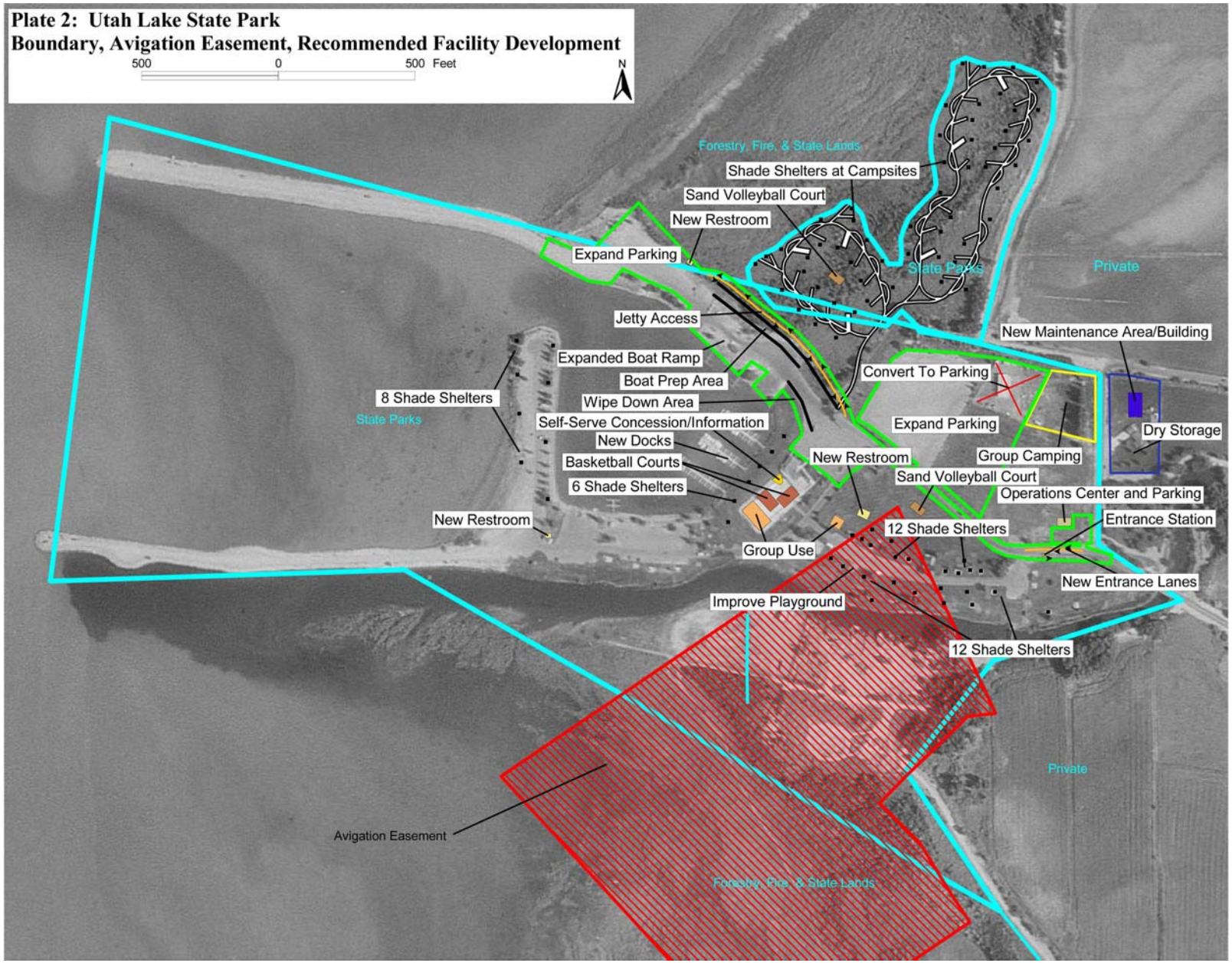
Plate 2: Utah Lake State Park
Boundary, Avigation Easement, Recommended Facility Development
500 0 500 Feet
N
Forestry, Fire, & State Lands
Shade Shelters at Campsites
Sand Volleyball Court
New Restroom
Expand Parking
State Parks
Private
Jetty Access
New Maintenance Area/Building
Expanded Boat Ramp
Boat Prep Area
Convert To Parking
8 Shade Shelters
State Parks
Wipe Down Area
Self-Serve Concession/Information
Expand Parking
Dry Storage
New Docks
Basketball Courts
6 Shade Shelters
New Restroom
Group Camping
Sand Volleyball Court
Operations Center and Parking
New Restroom
Entrance Station
12 Shade Shelters
Group Use
New Entrance Lanes
Improve Playground
12 Shade Shelters
Private
Avigation Easement
Forestry, Fire, & State Lands

Sensitive Species Map

To receive a copy of the sensitive species map, please contact Rosalind Bahr, Utah Division of Parks and Recreation at (801) 538-7340.

Appendices

Appendix A: Utah Lake State Park Geologic Review

Appendix B: Plants and Animals of Utah Lake

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Appendix A

Utah Lake State Park Geologic Review

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Utah Lake State Park Geologic Review

Prepared for: Division of Parks and Recreation
Utah Lake State Park Resource Management Plan

Prepared by: Mark Milligan, Utah Geological Survey

ABSTRACT

Utah Lake State Park lies in the floor of Utah Valley, which is bounded by the Wasatch Range to the east and partially bounded by Lake Mountains and West Mountain to the west. Specifically, the park is located on the delta built by the Provo River dropping its sediment load as it enters Utah Lake. However, both the river channel and lakeshore have been greatly altered by diking and dredging. In addition to fine-grained river and shoreline deposits, surface sediments found proximal to the park include clay, silt, sand, and gravel deposited in alluvial fans extending from the Wasatch Range and in ancient Lake Bonneville. These surface sediments are indicative of the tremendously thick sequence of valley fill sediments found beneath the park. Southeast of the park, a well penetrated 13,000 feet of sediment without reaching bedrock.

Utah Lake State Park lies within the Intermountain seismic belt, a zone with active faults and heightened earthquake activity extending from Montana to northern Arizona. The Wasatch fault, located 7 miles to the east, and the Utah Lake faults, located a couple of miles to the west, are examples of faults that may pose an earthquake threat to the park. Of particular concern is the Wasatch fault, which is geologically active and capable of generating large earthquakes (up to magnitude 7.5). An earthquake could cause ground shaking, liquefaction (resulting in a temporary loss of ground strength), or flooding at the park.

Utah Lake is Utah's largest natural lake with a surface area of approximately 150 square miles, but an average depth of only 9.2 feet. Since the 1860's, Salt Lake County residents have constructed dams and control gates on the Jordan River in an effort to control downstream flooding and utilize the lake as a storage reservoir. However, raising outflow elevation resulted in lakeshore flooding and a legal battle that was not resolved until 1986 when a final compromise lake level elevation was settled at 4,489.045 feet.

Lakeshore flooding has also been attributed to periods of above normal precipitation such as the mid-1980's wet years that resulted in over 14 million dollars of damage. Flooding in 1983 peaked above 4,494 feet and encroached as much as one mile beyond the previous shoreline. The Jordan River flood control project completed in 1986 is designed to limit future flooding to 4,493 feet.

The quality of lake water may be impacted by such factors as the lake's broad, shallow profile; lake-bottom springs high in dissolved solids; proximal heavy industry; residential and commercial runoff; and substantial alteration of the lake's ecosystem. However, water quality is beyond the scope of this report and should be addressed by the Utah Division of Water Quality.

INTRODUCTION

Utah Lake State Park is located approximately 5 miles west of Provo in Utah County. The park consists of 308 acres adjacent to the shore of Utah Lake and the Provo River. Situated at an elevation of approximately 4,490 feet above sea level, the site includes boat ramps, a marina, camping and picnicking facilities, and a visitor center/museum.

Although the park's primary asset is water-based recreation, the area is rich with geologic features. This report is intended to serve as a concise synopsis of the geology of the park and immediate area for the purpose of developing a resource management plan. This report does not in anyway attempt to evaluate or give recommendations regarding geologic hazards.

GEOLOGIC SETTING

Based on characteristic landforms, geologists and geographers divide the United States into areas called physiographic provinces. Utah Lake State Park lies at the eastern margin of the Basin and Range physiographic province, an area characterized by steep, narrow, north-trending mountain ranges separated by wide, flat, sediment-filled valleys (basins). This distinguishing topography started taking shape when older rocks were slowly uplifted and broken into huge fault blocks by extensional stresses. This extensional stress continues to stretch the earth's crust between the Sierra Nevada in California and the Wasatch Range in Utah. Sediments shed from the ranges are slowly filling the intervening wide, flat basins of the province. Many of the basins have been further modified by shorelines and sediments left by lakes that intermittently covered the valley floors.

Exemplary of basin-and-range topography, Utah Lake State Park lies within the broad, flat bottom of Utah Valley, which is bounded by the Wasatch Range to the east and partially bounded by the Lake Mountains and West Mountain to the west.

In the vicinity of Utah Lake, the rocks of the Wasatch Range, Lake Mountains, and West Mountain are predominantly Paleozoic (about 540 to 248 million years old) sedimentary, with limestone and quartz sandstone of the Late Mississippian to Early Permian (about 340 to 270 million years old) Oquirrh Formation being most common. The limestone and quartz sandstone that comprise the Oquirrh Formation are remnants of sediments deposited in an ancient sea that covered much of Utah hundreds of millions of years ago. Repetitive variations in the type and size of material composing these rocks creates the distinct layering that can be seen continuing up to the highest peaks of the Wasatch Range behind the city of Provo. This layering is a feature of the bedrock, not be confused with the horizontal shorelines left by ancient Lake Bonneville near the base of the mountains (discussed below).

SITE GEOLOGY

Except for abundant imported dike, rip rap, and other fill material, Utah Lake State Park is located on unconsolidated, fine-grained sediments recently deposited (within the past 10,000 years) by the Provo River flow into the lake (figure 1). The park is located where the velocity of the Provo River decreases as it flows into the standing water of Utah Lake, causing it to drop its sediment load and thereby build a delta into the lake (figure 2). This process has been greatly altered by channelization of the river, diking of the lakeshore, and dredging. In addition to these river deposits, surface sediments found in close proximity to the park include clay, silt, sand, and gravel deposited in and around Utah Lake, in alluvial fans extending from the Wasatch Range, and in ancient Lake Bonneville.

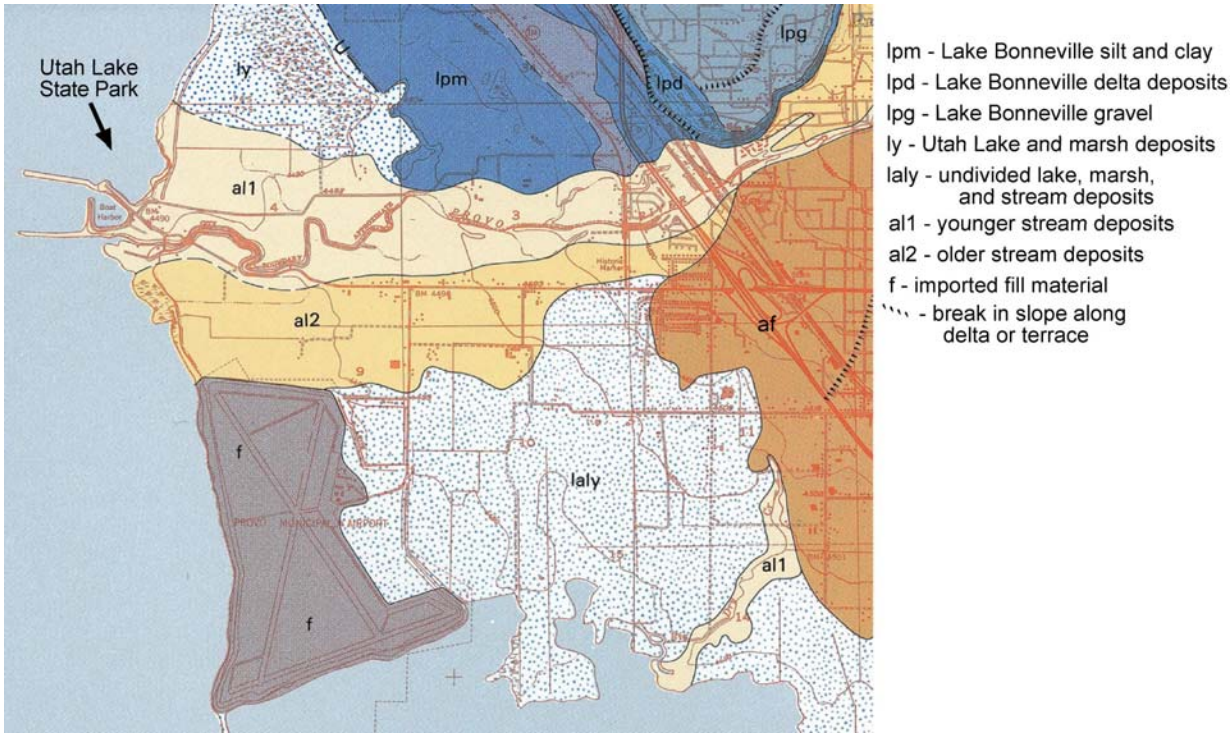

Figure 1. Geologic map of the greater Utah Lake State Park area (from Machette, 1992).

Figure 2. Aerial view of Utah Lake from the northeast. Photo by Rod Millar.

Lake Bonneville was a huge lake that existed from approximately 12,000 to 28,000 years ago covering about 20,000 square miles of western Utah and smaller parts of eastern Nevada and southern Idaho. A shift to wetter and colder weather conditions triggered its expansion. The lake started in the location of the present Great Salt Lake and eventually expanded into surrounding valleys reaching a maximum elevation of 5,090 feet (figure 3). A climatic shift to warmer and dryer conditions (similar to present) caused Lake Bonneville to shrink, leaving Great Salt Lake as a saline remnant and Utah Lake as a fresh water remnant. Seen from the park, the shorelines left by Lake Bonneville look like bathtub rings around the valley (figure 4).

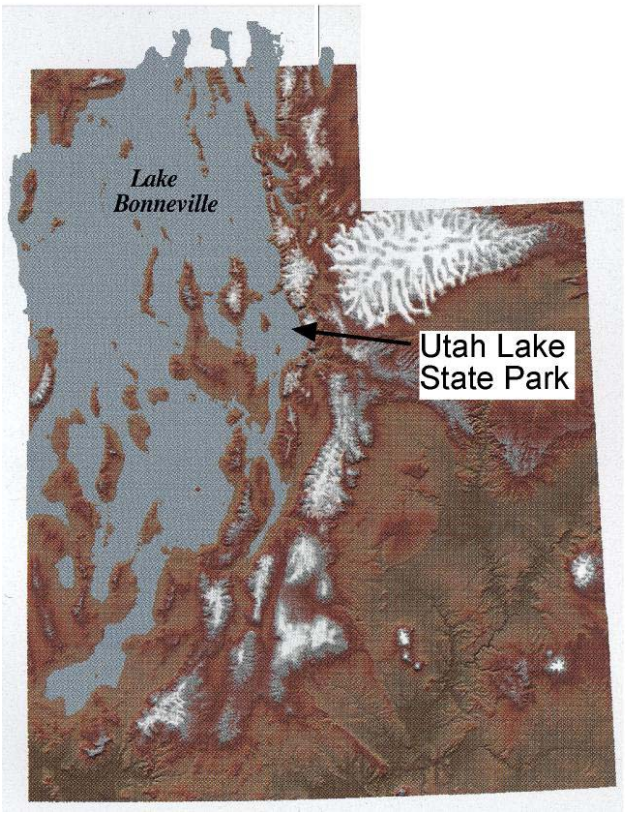

Figure 3. State of Utah with Lake Bonneville during its maximum extent approximately 14,500 years ago. During this time Utah Lake State Park was more than 600 feet under water. A wetter and colder climate created the expansive lake as well as glaciers in many of Utah's high mountains.

The surface sediments found in and near the park reflect those below the park. Layers and lenses of clays, silts, sands, and gravels constitute a tremendously thick sequence of valley-fill sediments. An oil well, drilled southeast of the park near Spanish Fork, penetrated 13,000 feet of sediment before being abandoned without reaching bedrock (or finding oil)!

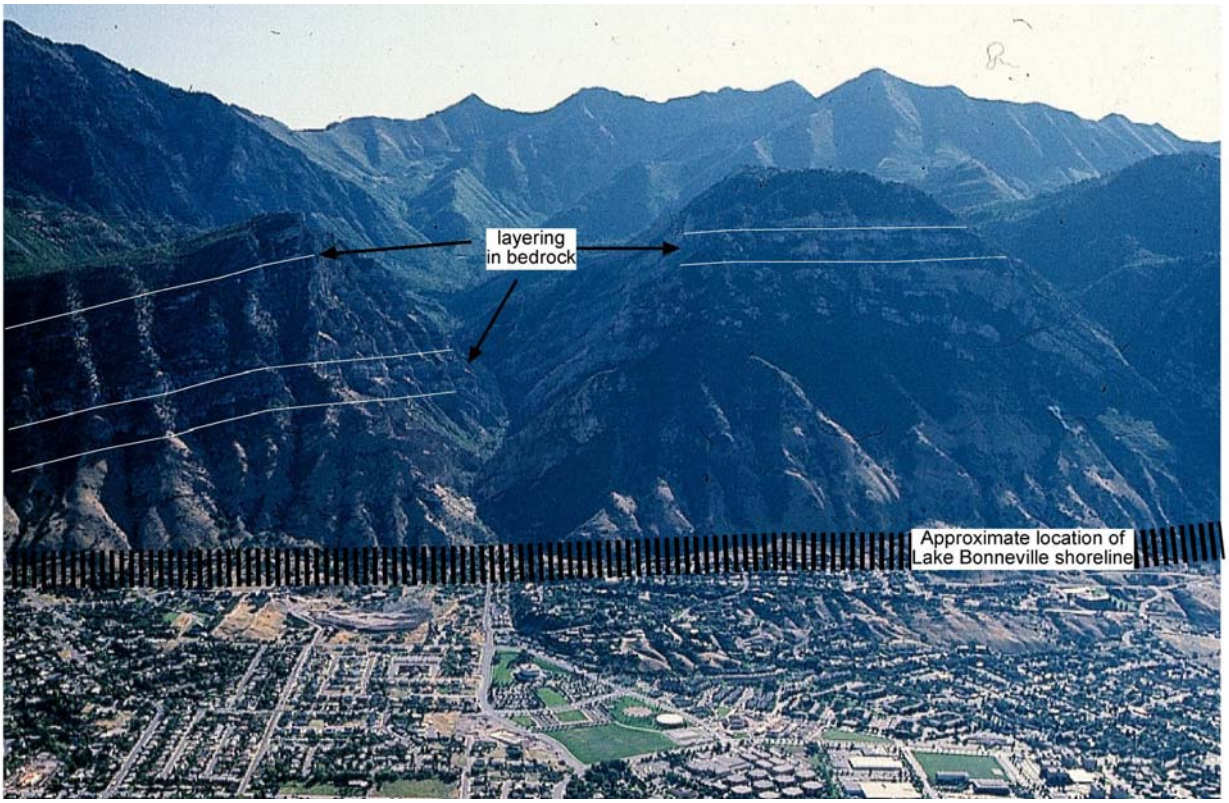

Figure 4. Aerial view of the Wasatch Range directly to the west of the park; Brigham Young University campus in foreground. Notice the horizontal Lake Bonneville shorelines vs. the sub-horizontal to inclined layering in the bedrock (bedding planes). Photo by Rod Millar.

QUATERNARY FAULTS

Utah Lake State Park lies within the Intermountain seismic belt, a zone of heightened earthquake activity that extends from Montana to northern Arizona. Earthquakes occur along faults, which are fractures with relative displacement of adjacent earth and rock. No faults have been found within the park; however, the Wasatch fault looms less than 7 miles to the east (figure 5) and the Utah Lake faults lie a couple of miles to the west (plate 1, Selected Critical Facilities and Geologic Hazards, Utah County, Utah). The Wasatch fault is geologically active and capable of generating large earthquakes (up to magnitude 7.5). The faults under Utah Lake may also be capable of generating earthquakes, but have not been studied in detail. In addition to earthquakes on these faults in the immediate vicinity, other parts of the Wasatch fault (to the north or south) and other faults could generate earthquakes large enough to affect the park. The probability of a large earthquake somewhere in the Wasatch Front area is approximately 16 percent in 50 years. The probability for a moderate earthquake is higher. Moderate earthquakes (5.5 to 6.5 magnitude) occur an average of once in every 20 years somewhere in the Wasatch Front area.

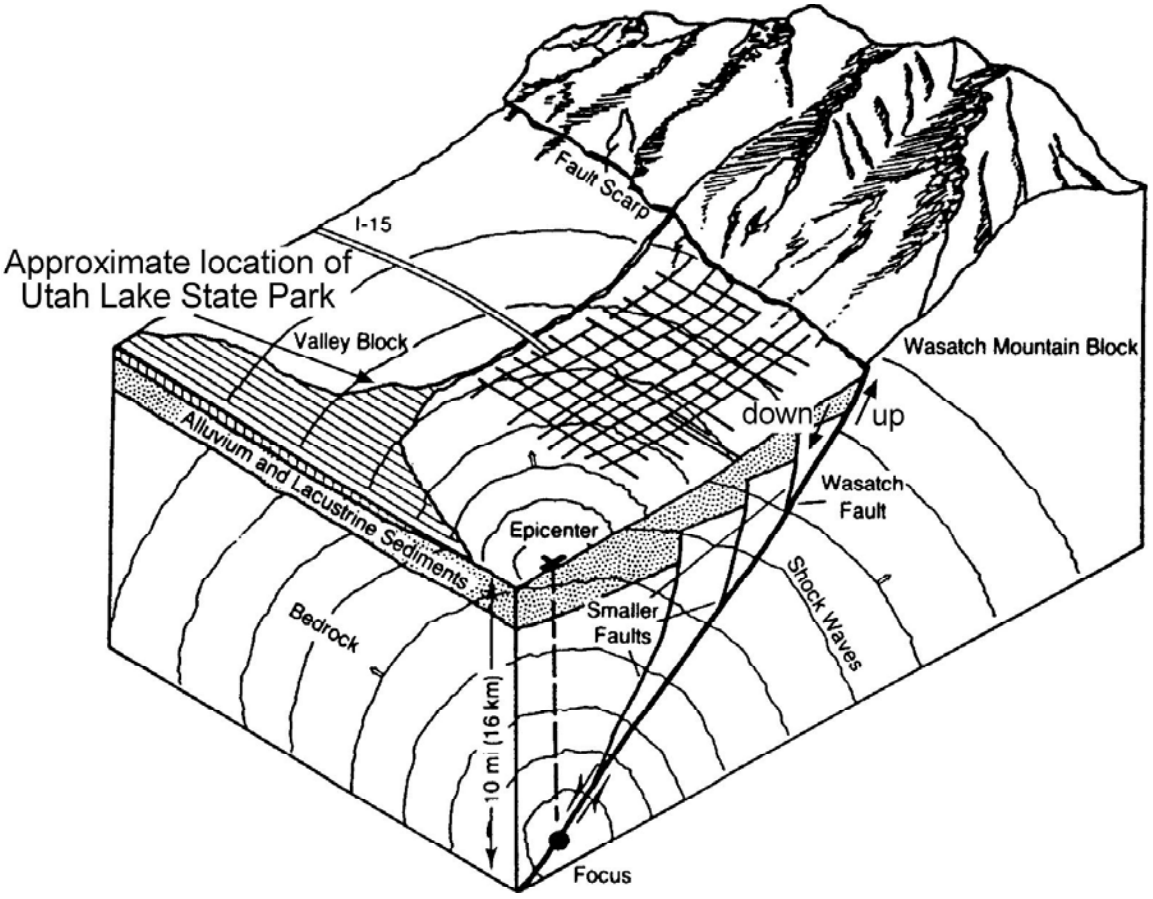

Figure 5. This block diagram is a simplified illustration the Wasatch fault in Utah Valley. Note the relative motion arrows, the valley block on the west (left) of the fault drops while the mountain block rises. The relative motion across the fault creates the surface scar, called the fault scarp. The tilting and dropping of the valley block is what can cause tectonic subsidence and resulting flooding on the eastern side of Utah Lake. Typically, earthquakes in this region occur approximately 10 miles under the earth's surface, thus placing the epicenter to the west of the fault scarp.

An earthquake could cause ground shaking, liquefaction, tectonic subsidence induced flooding, or seiche induced flooding at the park. The park lies within an area of the state (approximately Nephi to Brigham City) with the greatest hazard from ground shaking. The intensity of ground shaking at the park will depend upon the location and magnitude of the earthquake.

Shaking of sandy, water-saturated soil can cause it to temporarily loose strength and behave as a viscous fluid, a phenomenon called liquefaction. Liquefaction can be induced with magnitude 5 and greater earthquakes. The park lies within a zone of high liquefaction potential, meaning there is a 50% probability of having an earthquake within a 100-year period that will be strong enough to cause liquefaction (plate 1). Although the park is within a zone of high liquefaction potential, liquefaction generally occurs in localized areas. Which, if any, areas of the park will experience liquefaction will depend upon the magnitude and distance to the earthquake and specific local subsurface conditions at the time of the earthquake. The effects of liquefaction may include partial settling or tipping of buildings, the buoying up of light weight buried objects such as empty underground storage tanks, and the movement of soils on very gentle slopes (called lateral spreading).

Tectonic subsidence results from large earthquakes when a fault ruptures at the surface and causes the valley ground surface to drop, thereby tilting the valley floor side of the fault. Surface fault rupture to the east of the park on the Wasatch fault could cause the permanent tilting of Utah Lake resulting in flooding at the park and other areas along the eastern shore. The amount of flooding would be dependent upon the amount of tectonic subsidence and lake level elevation.

Lakeshore flooding may also be caused by seiches. A seiche is a sloshing of water in an enclosed basin such as a lake or bathtub. Rocking back and forth with the right period in a bathtub full of water can create a wave that will grow and overflow the bath. Similarly the ground movement of an earthquake can cause lake water to oscillate, building waves that flood shorelines. As an example, in 1959 Montana's 7.1 magnitude Hebgen Lake earthquake generated a seiche that continued for 11½ hours and was large enough to overtop Hebgen Dam.

UTAH LAKE

Utah Lake is Utah's largest natural lake. It covers approximately 150 square miles, but has an average depth of only 9.2 feet. Historically, lake elevation has varied over 17 feet from 4,477.22 feet in October 1935 to 4,494.74 feet in June 1984. Water level is primarily controlled by inflow from major streams flowing from the Wasatch Range and springs within the lake, and outflow through the Jordan River and evaporation.

Since the 1860's, dams and control gates have been in place to raise the outflow elevation of the Jordan River. Downstream residents in Salt Lake County constructed the dams as an effort to utilize Utah Lake as a water storage reservoir and control Jordan River flooding. However, since Utah Lake lies in such a shallow basin, a little change in lake level results in substantial shoreline flooding in Utah County. Thus the two counties have historically been at odds over lake level elevation. An early arbitration committee established a compromise level, but it continued to be disputed and misinterpreted until 1986 when the final compromise point was settled at 4,489.045 feet.

Lakeshore flooding has not been limited to disputes over the compromise level. Above-average precipitation in the mid-1980's resulted in over 14 million dollars worth of damage to harbors, recreation sites, farms, pastures, roads, businesses, and homes surrounding the lake. In 1983, flooding peaked above 4,494 feet and encroached as much as one mile beyond the previous shoreline. However, a Jordan River flood control project completed in1986 is designed to limit future Utah Lake flooding to 4,493 feet.

The United States Federal Government and the State of Utah historically disputed over legal ownership of lake bottom lands. In 1987, a federal court found in favor of the State of Utah. Legal wrangling continues between the State and private landowners over the boundary between lake bottom lands and private land surrounding the lake. For more information on land ownership issues, contact the Utah Division of Forestry, Fire & State Lands.

As part of the Central Utah Project, the U.S. Bureau of Reclamation devised an extensive diking plan for Utah Lake in the late 1970's and early 1980's. However, none of the proposed alternative diking plans were ever implemented or are currently under consideration.

Circumstances including, but not limited to, the lake's broad, shallow profile; lake-bottom springs high in dissolved solids; proximal heavy industry; residential and commercial runoff; and substantial alteration of the lake's ecosystem suggests a possibility for water-quality concerns in Utah Lake. However, water quality is beyond the scope of this report and should be addressed by the Utah Division of Water Quality.

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Appendix B

Plants and Animals of Utah Lake

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Plants and Animals of Utah Lake

Terrestrial wildlife list compiled from *Utah Lake Terrestrial Wildlife Inventory*, Utah Division of Wildlife Resources, 1982 prepared by Wesley C. Shields and Miles O. Moretti.

List of fish compiled from *Study of Fisheries, Vegetation and Terrestrial Wildlife of Utah Lake*, Utah Division of Wildlife Resources, 1979 prepared by Randy D. Radant and Douglas K. Sakaguchi.

Vegetation list compiled from Jack D. Brotherson's "Aquatic and Semiaquatic Vegetation of Utah Lake and Its Bays in *Great Basin Naturalist Memoirs: Utah Lake Monograph*. Provo, UT: Brigham Young University, 1981. It should be noted that some names from Brotherson's list do not appear in current literature.

Common vegetation names derived from *A Utah Flora* by S.L Welsh, N.S. Atwood, S. Goodrich, and L.C. Higgins, Provo, UT: Brigham Young University, Second Edition Revised, 1993.

Reference for bird names *The Audubon Society Field Guide to North American Birds, 1977.*

Passerine and Other Birds

American goldfinch, *Carduelis tristis*
American robin, *Turdus migratorius*
Bank swallow, *Riparia riparia*
Belted kingfisher, *Megaceryle alcyon*
Black-billed magpie, *Pica pica*
Black-capped chickadee, *Parus atricapillus*
Black-headed grosbeak, *Pheucticus melanocephalus*
Blue-gray gnatcatcher, *Polioptila caerulea*
Blue grosbeak, *Guiraca caerulea*
Bobolink, *Dolichonyx oryzivorus*
Brewer's blackbird, *Euphagus cyanocephalus*
Brewer's sparrow, *Spizella breweri*
Broad-tailed hummingbird, *Selasphorus platycercus*
Brown-headed cowbird, *Molothrus ater*
Chipping sparrow, *Spizella passerina*
Cliff swallow, *Petrochelidon pyrrhonota*
Common crow, *Corvus brachyrhychus*
Common flicker, *Colaptes auratus*
Common nighthawk, *Chordeiles minor*
Common raven, *Corvus corax*
Common yellowthroat, *Geothlypis trichas*
Dark eyed junco, *Junco hyemalis*
Downy woodpecker, *Picoides pubescens*
Eastern kingbird, *Tyrannus tyrannus*
European Starling, *Sturnus vulgaris*
Fox sparrow, *Passerella iliaca*
Grasshopper sparrow, *Ammodramus savannarum*
Gray-headed junco, *Junco caniceps*
Green-tailed towhee, *Pipilo chlorurus*

Hairy woodpecker, *Picoides villosus*
Horned lark, *Eremophila alpestris*
House finch, *Carpodacus mexicanus*
House sparrow, *Passer domesticus*
House wren, *Trogloytes aedon*
Lark sparrow, *Chondestes grammacus*
Lazuli bunting, *Passerina amoena*
Le Conte's sparrow, *Passerherbulus caudactus*
Lewis' woodpecker, *Melanerpes lewis*
Loggerheaded shrike, *Lanius ludovicianus*
Long-billed marsh wren, *Cistothorus palustris*
Mountain bluebird, *Sialia currocoides*
Northern oriole, *Icterus galbula*
Northern shrike, *Lanius excubitor*
Orange-crowned warbler, *Vermivora celata*
Oregon junco, *Junco oreganos*
Pine siskin, *Carduelis pinus*
Poor-will, *Phalaenoptilus nuttallii*
Red-winged blackbird, *Agelaius phoeniceus*
Rock wren, *Salpinctes obsoletus*
Rough-winged swallow, *Serripennis ruficollis*
Rufous-sided towhee, *Pipilo erythrophthalmus*
Sage sparrow, *Amphispiza belli*
Sage thrasher, *Oreoscoptes montanus*
Savannah sparrow, *Passerculus sandwichensis*
Say's phoebe, *Sayornis saya*
Snow bunting, *Plectrophenax nivalis*
Song sparrow, *Melospiza melodia*
Townsend's solitaire *Myadestes townsendi*
Townsend's warbler, *Dendroica townsendi*
Traill's flycatcher, *Empidonax traillii*
Tree sparrow, *Spizella arborea*
Tree swallow, *Tachycineta bicolor*
Vesper sparrow, *Pooecetes gramineus*
Violet-green swallow, *Tachycineta thalassina*
Virginia's warbler, *Vermivora virginiae*
Warbling vireo, *Vireo gilvus*
Water pipit, *Anthus spinoletta*
Western kingbird, *Tyrannus verticalis*
Western meadowlark, *Sturnella neglecta*
Western tanager, *Piranga ludoviciana*
White-crowned sparrow, *Zonotrichia leucophrys*
Wilson's warbler, *Wilsonia pusilla*
Yellow-breasted chat, *Icteria virens*
Yellow-headed blackbird, *Xanthocephalus xanthocephalus*
Yellow-rumped warbler, *Dendroica coronata*
Yellow warbler, *Dendoica petechia*

Upland Game Birds

California quail, *Callipepla californicus*
Chukar, *Alectoris chukar*

Hungarian partridge, *Perdix perdix*
Mourning dove, *Zenaidura macroura*
Ring-necked pheasant, *Phasianus colchicus*

Waterfowl

American coot, *Fulica americana*
American wigeon, *Anas americana*
Barrow's goldeneye, *Bucephala islandica*
Blue-winged teal, *Anas discors*
Bufflehead, *Bucephala albeola*
Canada goose, *Branta canadensis*
Canvasback, *Aythya valisineria*
Cinnamon teal, *Anas cyanoptera*
Common moorhen, *Gallinula chloropus*
Common goldeneye, *Bucephala clangula*
Common merganser, *Mergus merganser*
Gadwall, *Anas strepera*
Greater scaup, *Aythya marila*
Green-winged teal, *Anas crecca*
Hooded merganser, *Lophodytes cucullatus*
Lesser scaup, *Aythya affinis*
Mallard, *Anas platyrhynchos*
Northern shoveler, *Arus clypeata*
Pintail, *Anas acuta*
Red-breasted merganser, *Mergus serrator*
Redhead, *Aythya americana*
Ring-necked duck, *Aythya collaris*
Ruddy duck, *Oxyura jamaicensis*
Snow goose, *Chen caerulescens*
Tundra swan, *Cygnus columbianus*
White-fronted goose, *Anser albifrons*
Wood duck, *Aix sponsa*

Shorebirds, Wading Birds and Other Aquatic Birds

American avocet, Recuvirostra americana
American bittern, Botaurus lentiginosus
American white pelican, Pelecanus erythrorhynchos
Black-bellied plover, Plurialis squatarola
Black-crowned night heron, Nycticorax nycticorax
Black-necked stilt, Himantopus mexicanus
Black swift, Cypseloides niger
Black tern, Chlidonias niger
Bonaparte's gull, Larus philadelphia
California gull, Larus californicus
Caspian tern, Sterna caspia
Cattle egret, Bubulcus ibis
Common egret, Casmerodius albus
Common loon, Gavia immer
Common snipe, Gallinago gallinago
Common tern, Sterna hirundo

Double-crested cormorant, Phalacrocorax auritus
Dunlin, Calidris alpina
Eared grebe, Podiceps nigricollis
Forster's tern, Sterna forsteri
Franklin's gull, Larus pipixcan
Glaucous gull, Larus hyperboreus
Great blue heron, Ardea herodias
Greater yellowlegs, Tringa melanoleucus
Horned grebe, Podicps auritus
Killdeer, Charadrius vociferous
Least sandpiper, Calidris minutilla
Lesser yellowlegs, Totanus flavipes
Long-billed curlew, Numenius americanus
Long-billed dowitcher, Limnodromus scolopaceus
Marbled godwit, Limosa fedoa
Pied-billed grebe, Podilymbus podiceps
Red-necked phalarope, Lobipes lobatus
Red knot, Calidris canutus
Ring-billed gull, Larus delawarensis
Sanderling, Calidris alba
Sandhill crane, Grus canadensis
Semipalmated plover, Charadrius semipalmatus
Snowy egret, Leucophoyx thula
Snowy plover, Charadrius alexandinus
Solitary sandpiper, Tringa solitaria
Sora, Porzana carolina
Spotted sandpiper, Actitis macularia
Virginia rail, Rallus limicola
Western grebe, Aechmophorus occidentalis
Western sandpiper, Ereunetes mauri
White-faced ibis, Plegadis chihi
Willet, Catoptrophorus semipalmatus
Wilson's phalarope, Phalaropus tricolor
Wood stork, Mycteria americana

Raptors

American kestrel, *Falco sparverius*
Bald eagle*, Haliaeetus leucocephalus*
Barn owl, *Tyto alba*
Burrowing owl, *Athene cunicularia*
Cooper's hawk, *Accipiter cooperii*
Ferruginous hawk, *Buteo regalis*
Golden eagle, *Aquila chrysaetos*
Great horned owl, *Bubo virginianus*
Long-eared owl, *Asio otus*
Marsh hawk, *Circus cyaneus*
Merlin, *Falco columbarius*
Osprey, *Pandion haliaetus*
Peregrine falcon, *Falco peregrinus*
Prairie falcon, *Falco mexicanus*
Red-tailed hawk, *Buteo jamaicensis*

Rough-legged hawk, *Buteo lagopus*
Sharp-shinned hawk, *Accipiter striatus*
Short-eared owl, *Asio flammeus*
Swainson's hawk, *Buteo swainsoni*
Turkey vulture, *Cathartes aura*
Western screech owl, *Otus kennicotii*

Small Mammals

Botta pocket gopher, *Thomomys bottae*
Bushytail woodrat, *Neotoma cinerea*
Deer mouse, *Peromyscus maniculatus*
Desert woodrat, *Neotoma lepida*
Gray fox, *Urocyon cinereoargenteus*
Great Basin kangaroo rat, *Dipodomys microps*
Great Basin pocket mouse, *Perognathus parvus*
Harvest mouse, *Reithrodontomys megalatis*
House mouse, *Mus musculus*
Least chipmunk, *Eutamias minimus*
Long-tailed meadow mouse, *Microtus longicaudus*
Montane meadow mouse, *Microtus montanus*
Northern grasshopper mouse, *Onychoymys leucogaster*
Northern water shrew, *Sorex palustris*
Norway rat, *Rattus morvegicus*
Ord kangaroo rat, *Dipodomys ordii*
Meadow vole, *Mictrotus pennsylvanicus*
Pinon mouse, *Peromyscus truei*
Porcupine, *Erethizon dorsatum*
Rock squirrel, *Citellus variegatus*
Sagebrush vole, *Lagurus curtatus*
Townsend ground squirrel, *Citellus townsendii*
Uinta ground squirrel, *Citellus armatus*
Vagrant shrew, *Sorex vagrans*
Whitetail antelope ground squirrel, *Ammospermophilus leucurus*
Yellowbelly marmot, *Marmota flaviventris*
Beaver, *Caster canadensis*
Muskrat, *Ondatra zibethicas*

Predators

Badger, *Taxidea taxus*
Bobcat, *Lynx rufus*
Coyote, *Canis latrans*
Kit fox, *Vulpes macrotis*
Longtail weasel, *Mustela frenata*
Mink, *Mustela vison*
Raccoon, *Procyon lotor*
Shorttail weasel, *Mustela erminea*
Spotted skunk, *Spilogale putorius*
Striped skunk, *Mephitis mephitis*
Red fox, *Vulpes vulpes*

Bats

Big brown bat, *Eptesicus fuscus*
Big myotis, *Myotis lucifugus*
Brazilian freetail bat, *Tadarida brasiliensis*
Long-legged myotis, *Myotis volans*
Hoary bat, *Lasiurus cinereus*
Long-eared myotis, *Plecotus townsendii*
Silver-haired bat, *Lasionycteris noctivagans*
Spotted bat, *Euderma maculatum*

Rabbits

Black-tailed jackrabbit, *Lepus californicus*
Desert cottontail, *Sylvilagus auduboni*
Mountain cottontail, *Sylvilagus nuttallii*
Pygmy rabbit, *Sylvilagus idahoensis*

Large Mammals

Mule deer, *Odocoileus hemionus*

Amphibians

Bullfrog, *Rana catesbeiana*
Western chorus frog, *Pseudacris triseriata*
Western leopard frog, *Rana pipiens*
Western toad, *Bufo boreas*
Woodhouse's toad, *Bufo woodhousei*

Lizards

Great Basin whiptail, *Cnemidophorus tigris*
Northern sagebrush lizard, *Sceloporus graciousus gaciousus*
Northern side-blotched lizard, *Uta stansburiana stansburiana*
Horned lizard, *Phrynosoma douglasii*

Snakes

Desert night snake, *Hypsiglena torquata deserticola*
Great Basin gopher snake, *Pituophis melanoleucus deserticola*
Great Basin rattlesnake, *Crotalus viridis lutosus*
Red-sided garter snake, *Thamnophis sirtalis parietalis*
Wandering garter snake, *Thamnophis elegans*
Western yellow-bellied racer, *Coluber constrictor momon*

Fish

Black bullhead, *Ictalurus melas*
Black crappie, Pomoxis nigromaculatus
Bluegill, *Lepomis macrochirus*
Bonneville cutthroat trout, *Oncorhynchus clarki utah*
Brown trout, *Salmo trutta*
Carp,*Cyprinius carpio*
Channel catfish, *Ictalurus punctatus*
Cutthroat trout, *Salmo clarki*

Fathead minnow, *Pimephales promelas*
Golden shiner, *Notemigonus cryspleucas*
Green sunfish, *Lepomis cyanellus*
June sucker, *Chasmistes liorus*
Largemouth bass, *Micropterus salmoides*
Least chub, *Iotichthys phlegethantis*
Mosquitofish, *Gambusia affinis*
Mottled sculpin, *Cottus bairdi*
Mountain sucker, *Catostomus platyrhnchus*
Rainbow trout, *Salmo gairdneri*
Redside shiner, *Richardonius balteatus*
Utah chub, *Gila atraria*
Utah sucker, *Catostomus ardens*
Walleye, *Stizostedion vitreum*
Webug sucker, *Catostomus fecundus*
Whitebass, *Morone chrysops*
Yellow perch, *Perca flavescens*

Plants

Aceraceae – Maple Family

Big-tooth maple, *Acer grandidentatum*
Boxelder, *Acer negundo*

Aizoaceae – Carpetweed Family

Seapurslane, *Sesuvium verrucosum*

Alismaceae – Water-plantain Family

Water-plantain, *Alisma plantago-aquatica*
Arrowleaf, *Sagittaria cuneata*

Amaranthaceae– Amaranth Family

Prostrate pigweed, Amaranthus blitoides
Redroot pigweed, Amaranthus retroflexus

Anacardiaceae – Cashew Family

Poisen Ivy, *Toxicodendron rydbergii*
Skunkbush, *Rhus aromatica* var. *trilobata*

Apocynaceae – Dogbane Family

Dogbane, *Apocynum cannabinum*

Asclepiadaceae – Milkweed Family

Swamp milkweed, Aslepias incarnata
Showy milkweed, *Asclepias speciosa*

Betulaceae – Birch Family

Thin-leaf alder, *Alnus incana*
Water birch, *Betula occidentalis*

Boraginaceae – Borage Family

Yellow-eye cryptanth, *Cryptantha flavoculata*
Dwarf cryptanth, *Cryptantha humilis*
Houndstongue, *Cynoglossum officinalis*

Salt heliotrope, *Heliotropium curassavicum*
Western stickseed, *Lappula occidentalis*
Contra stoneseed, *Lithospermum ruderale*
Scouler's popcornflower, *Plagiobothrys scouleri*

Cactaceae - Cactus Family

Simpson's footcactus, *Pediocactus simpsonii*
Claretcup, *Echiocereus triglochidiatus*
Brittle pricklypear, *Opuntia fragilis*
Central pricklypear, *Opuntia polycantha*

Capparaceae – Caper Family

Yellow beeplant, *Cleome lutea*
Rocky Mountain beeplant, *Cleome serrulata*
Clammy-weed, *Polanisia dodecandra*

Caprifoliaceae – Honeysuckle Family

Black twinberry, *Lonicera involucrata*

Caryophyllaceae – Pink Family

Mouse-ear chickweed, *Cerastium fontanum*
Bouncing-bet, *Saponaria officinalis*
Salt sandspurry, *Spergularia marina*

Ceratophyllaceae – Hornwort Family

Common hornwort, *Ceratophyllum demersum*

Chenopodiaceae – Goosefoot Family

Iodine bush, *Allenrolfea occidentalis*
Shadescale, *Atriplex confertifolia*
Two-seeded orach, *Atriplex heterosperma*
Garden orach, *Atriplex hortensis*
Fathen saltplant, *Atriplex patula* var*. triangularis*
Basin saltbrush, *Atriplex gardneri* var. *tridentata*
Winterfat, *Ceratoides lanata*
Pigweed, *Chenopodium album*
Strawberry spinach, *Chenopodium capitatum*
Fremont's goosefoot, *Chenopodium fremontii*
Mapleleaf goosefoot, *Chenopodium simplex*
Oakleaf goosefoot, *Chenopodium glaucum*
Narrowleaf goosefoot, *Chenopodium leptophyllum*
Nettleleaf goosefoot, *Chenopodium murale*
Silvery goosefoot, *Chenopodium fremontii* var. *incanum*
Bugseed, *Coripsermum villosum*
Bassia hyssopifolium
Hopsage, *Grayia spinosa*
Halogeton, *Hologeton glomeratus*
Gray molly, *Kochia americana*
Summer cypress, *Kochia scoparia*
Poverty-weed, *Monolepis nutttalliana*
Utah samphire, *Salicornia utahensis*
Annual samphire, *Salicornia europaea*
Tumbleweed, *Salsola pestifera*

Greasewood, *Sarcobatus vermiculatus*
Broom seepweed, *Suaeda calceoliformis*
Not listed – classification likely changed since 1981, *Suaeda fruticosa*
Not listed – classification likely changed since 1981, *Suaeda nigra*
Western seepweed, *Suaeda occidentalis*

Compositae – Sunflower Family

Milfoil yarrow, Achillea millefolium
Common ragweed, *Ambrosia artemisiifolia*
Bur ragweed, *Ambrosia acanthicarpa*
Western ragweed, *Ambrosia psilostachya*
Mayweed, *Anthemis cotula*
Burdock, *Arctium minus*
Absinthe, *Artemesia absinthium*
Louisiana wormwood, *Artemisia ludoviciana*
Budsage, *Artemisia spinescens*
Big sagebrush, *Artemisia tridentata*
Ciliate aster, *Aster brachyactis*
Pacific aster, *Aster chilensis*
Easton's aster, *Aster eatonii*
Leafy aster, *Aster frondosus*
Nuttall's aster, *Aster perelegans*
Hooker's balsamroot, *Balsamorhiza hookeri*
Bur-marigold, *Bidens cernua*
Devil's beggarticks, *Bidens frondosa*
Pineapple weed, *Chamomilla suaveolens*
Douglas' dustymaiden, *Chaenactis douglasii*
Rubber rabbitbrush, *Chrysothamnus nauseousus*
Viscid rabbitbrush, *Chrysothamnus viscidiflorus*
Chicory, *Cichorium intybus*
Canada thistle, *Cirsium arvense*
Gray thistle*Cirisium undulatum*
Bull thistle, *Cirsium vulgare*
Horseweed, *Conyza candensis*
Modoc hawksbeard, *Crepis modocensis*
Meadow hawksbeard, *Crepis runcinata*
Pretty daisy, *Erigeron bellidiastrum*
Joe-Pye weed, *Eupatorium maculatum*
Cottonbatting cudweed, *Gnaphalium chilense*
Lowland cudweed, *Gnaphalium palustre*
Curly gumweed, *Grindelia squarrosa*
Snakeweed, *Gutierrezia sarothrae*
Meadow goldenweed, *Haplopappus lanceolatus*
Watson's goldenbush, *Haplopappus watsoni*
Common sneezeweed, *Helenium autumnale*
Common sunflower, *Helianthus annuus*
Nuttall's sunflower*, Helianthus nuttallii*
Prairie sunflower, *Helianthus petiolaris*
Hairy goldenaster, *Heterotheca villosa*
Slender hawkweed, *Hieracium gracile*
Stemless woollybase, *Hymenoxys acaulis*

Elecampane, *Inula helenium*
Poverty weed, *Iva axillaries*
Prickly lettuce, *Lactuca serriola*
Tidytips, *Layia glandulosa*
Showy rushpink, *Lygodesmia grandiflora*
Tansyleaf aster, *Machaeranthera tanacetifolia*
Stansbury's rockdaisy, *Perityle stansburyi*
Water groundsel, *Senecio hydrophilus*
Not listed – classification likely changed since 1981, *Senecio uintahensis*
Goldenrod, *Solidago canadensis*
Western goldenrod, *Solidago occidentalis*
Field sow-thistle, *Sonchus arvensis*
Spiny sow-thistle, *Sonchus asper*
Fewflower wirelettuce, *Stephanomeria pauciflora*
Tansy, *Tanacetum vulgare*
Common dandelion, *Taraxacum officinale*
Thorny horsebrush, *Tetradymia spinosa*
Showy townsendia, *Townsendia florifer*
Strigose townsendia, *Townsendia strigosa*
Yellow salsify, *Tragopogon dubius*
Oyster plant, *Tragopogon porrifolius*
Hairy goldeneye, *Viguiera ciliata*
Showy goldeneye, *Viguiera multiflora*
Mulesears, *Wyethia amplexicaulis*
Cocklebur, *Xanthium strumarium*

Convulvulaceae – Morning Glory Family

Bindweed, *Convolvulus arvensis*
Hedge bindweed, *Calystegia sepium*
No common given, *Cressa truxillensis*

Cuscutaceae – Dodder Family

Salt dodder, *Cuscuta salina*

Cornaceae – Dogwood Family

Red-osier dogwood, *Cornus sericea*

Cruciferae – Mustard Family

Tower mustard, *Arabis glabra*
Holboell's rockcress, *Arabis holboellii*
Rape, *Brassica compestris*
Black mustard, *Brassica nigra*
Falseflax, *Camelina microcarpa*
Shepherd's purse, *Capsella bursa-pastoris*
Muhlenberg's bittercress, *Cardamine pennsylvanica*
Whitetop, *Cardaria draba*
Hares-ear mustard, *Conringia orientalis*
Pinnate tansy-mustard, *Descurainia pinnata*
Flixweed, *Decurainia sophia*
Pretty wallflower, *Erysimum capitatum*
Lesser wallflower, *Erysimum inconspicuum*
Spreading wallflower, *Erysimum repandum*

Slenderweed, *Huchinsia procumbens*
Densecress, *Lepidium densiflorum*
Branch pepperplant, *Lepidium densiflorum var. ramosum*
Mountain pepperplant, *Lepidium montanum*
Peppergrass, *Lepidium perfoliatum*
Virginiacress, *Lepitidum verginicum*
African mustard, *Malcolmia africana*
Water-cress, *Nasturtium officinale*
Rydberg's twinpod, *Physaria acutifolia*
Island yellowcress, *Rorippa islandica*
Tumbling mustard, *Sisymbrium altissimum*
Wright's thelypody, *thelypodium wrightii*
Twistflower, *Streptanthus cordatus*
Arrowleaf thelypody, *Thelypodiopsis sagitta*

Cupressaceae – Cypress Family

Utah Juniper, *Juniperous osteosperma*

Cyperaceae – Sedge Family

Golden sedge, *Carex aurea*
Water sedge, *Carex aquatilis*
Awned sedge, *Carex atherodes*
Woolly sedge, *Carex lanuginosa*
Nebraska sedge, *Carex nebrascensis*
Liddon sedge, *Carex petasata*
Blackcreeper sedge, *Carex praegracilis*
Redroot flat-sedge, *Cyperus erythrorhizos*
Strigous flatsedge, *Cyperus strigosus*
Slender spikerush, *Eleocharis acicularis*
Bolander's spikerush, *Eleocharis bolanderi*
Common spikerush, *Eleocharis palustris*
Dwarf spikerush, *Eleocharis parvula* var. *coloradensis*
Fewflower spikerush, *Eleocharis pauciflora*
Torrey's spikerush, *Eleocharis rostellata*
Fimbristylis, *Fimbristylis spadicea*
Hardstem bulrush, *Scirpus acutus*
Olney's threesquare, *Scirpus americanus*
Not listed – classification likely changed since 1981, *Scirpus lacustris*
Alkali bulrush, *Scirpus maritimus*
Panicled bulrush, *Scirpus microcarpus*
Pale bulrush, *Scirpus pallidus*
Softstem bulrush, *Scirpus validus*

Dipsacaceae – Teasel Family

Teasel, *Dipsacus sylvestris*

Elaegnaceae – Oleaster Family

Russian olive, *Elaeagnus angustifolia*
Silver buffaloberry, *Shepherdia argentea*

Ephedraceae – Ephedra Family

Brigham tea, *Ephedra viridis*

Equisetaceae – Horsetail Family

Meadow horsetail, *Equisetum arvense*
Smooth scouringrush, *Equisetum laevigatum*
Not listed – classification likely changed since 1981, *Equisetum palustre*

Euphorbiaceae – Spurge Family

Ridgeseeded spurge, *Euphorbia glytosperma*
Thyme-leaved spurge*, Euphorbia serpyllifolia*

Fumariaceae – Fumitory Family

Golden corydalis, *Corydalis aurea*

Gentianaceae – Gentian Family

Great Basin centaury, *Centurium exaltatum*

Geraniaceae – Geranium Family

Storksbill, *Erodium cicutarium*

Gramineae – Grass Family

Crested wheatgrass, *Agropyron cristatum*
Not listed – classification likely changed since 1981, *Agropyron semiverticillata*
Redtop, *Agrostis stolonifera*
Shortawn foxtail, *Alopersurus aequalis*
Oats, *Avena fatua*
American sloughgrass, *Bechmannia syzigachne*
Japanese chess, *Bromus japonicus*
Smooth brome, *Bromus inermis*
Cheatgrass, *Bromus tectorum*
Bluejoint reedgrass, *Calamagrostis canadensis*
Slimstem, *Calamagrostis stricta*
Brookgrass, *Catabrosa aquatica*
Not listed – classification likely changed since 1981, *Cenchrus tribuloides*
Orchard grass, *Dactylis glomerata*
Tufted hairgrass, *Deschampsia caespitosa*
Desert saltgrass, *Distichlis spicata*
Barnyard grass, *Echinochloa crus-galli*
Canada wildrye, *Elymus canadensis*
Great Basin wildrye, *Elymus cinereus*
Alkali wildrye, *Elymus simplex*
Beardless wildrye, *Elymus triticoides*
Virginia wildrye, *Elymus virginicus var. submuticus*
Intermediate wheatgrass, *Elymus hispidus*
Tall wheatgrass, *Elymus elongatus*
Thickspike wheatgrass, *Elymus lanceolatus*
Quackgrass, *Elymus repens*
Western wheatgrass, *Elymus smithii*
Bluebunch wheatgrass, *Elymus spicatus*
Slender wheatgrass, *Elymus trachycaulus*
Stinkgrass, *Eragrostis cilianensis*
Teal, *Eragrostis hypnoides*

Mexican lovegrass, *Eragrostis mexicana*
Meadow fescue, *Festuca pratensis*
American mannagrass, *Glyceria grandis*
Meadow barley, *Hordeum brachyantherum*
Foxtail barley, *Hordeum jubatum*
Rabbit barley, *Hordeum murinum*
Rice cutgrass, *Leersia oryzoides*
Bearded sprangle-top, *Leptochloa fascicularis*
Ryegrass, *Lolium perenne*
Scratchgrass, *Muhlenbergia asperifolia*
Indian ricegrass, *Stipa hymenoides*
Witchgrass, *Panicum capillare*
Reed canary grass, *Phalaris arundinacae*
Timothy, *Phleum pratense*
Common reed, *Phragmities australis*
Annual bluegrass, *Poa annua*
Sandberg's bluegrass, *Poa secunda*
Kentucky bluegrass, *Poa pratensis*
Rabbitfoot grass, *Polypogon monspeliensis*
Nuttall's alkaligrass, *Puccinellia nuttalliana*
Hardgrass, *Sclerochloa dura*
Cultivated rye, *Secale cereale*
Yellow bristlegrass, *Setaria glauca*
Squirreltail, *Elymus elymoides*
Common name not given, *Elymus mulitsetus*
Alkali cordgrass, *Spartina gracilis*
Prairie wedgegrass, *Sphenopholis obtusata*
Alkali saccaton, *Sporobolus airoides*
Tall dropseed, *Sporobolus asper*
Sand dropseed, *Sporobolus cryptandrus*
Needle-and-thread grass, *Stipa comata*
Wheat, *Triticum aestivum*
Sixweeks fescue, *Festuca octoflora*

Haloragaceae – Water-milfoil Family

Naked-water milfoil, *Myriphyllem exalbescens*

Hippuridaceae – Marestail Family

Common marestail, *Hippurus vulgaris*

Hydrocharitaceae – Frogbit Family

Elodea, *Elodea canadensis*

Iridaceae – Iris Family

Not listed – classification likely changed since 1981, *Sisyrinchium halophilum*

Juncaceae – Rush Family

Wiregrass, *Juncus arcticus*
Toad rush, *Juncus bufonius*
Swordleaf rush, *Juncus ensifolius*
Longstyle rush, *Juncus longistylis*
Torrey's rush, *Juncus torreyi*

Juncaginaceae – Arrowgrass Family

Maritime arrowgrass, *Triglochin maritima*

Labiatae – Mint Family

Dead-nettle, *Lamium amplexicaule*
American bugleweed, *Lycopus americanus*
Rough bugleweed, *Lycopus asper*
Common horehound, *Marrubium vulgare*
Field mint, *Mentha avensis*
Spearmint, *Mentha spicata*
Smallflower dragonhead, *Dracocephalum parviflorum*
Catnip, *Nepeta cataria*
Marsh betony, *Stachys palustris*
American germander, *Teucrium canadense* var. *occidentale*

Leguminosae – Legume Family

Meadow milkvetch, Astragalus argophyllus var. argophyllus
Beckwith's milkvetch, Astragalus beckwethii
Canada milkvetch, Astragalus canadensis
Lesser rushy milkvetch, Astragalus convallarius
Egg milkvetch, Astragalus oophorus
Utah milkvetch, Astragalus utahensis
Licorice, Glycyrrhiza lepidota
Northern sweetvetch, Hedysarum boreale
Rydberg's sweetpea, Lathyrus brachycalyx
Black medic, Medicago lupulina
Alfalfa, Medicago sativa
White sweet-clover, Melilotus alba
Yellow sweet-clover, Melilotus officinalis
Black locust, Robinia pseudo-acacia
Golden pea, Thermopsis montana
Alsike clover, Trifolium hybridum
Red clover, Trifolium pratense
White clover, Trifolium repens
American vetch, Vicia americana var. hook

Lemnaceae – Duckweed Family

Lesser duckweed, *Lemna minor*
Ivy-leaf duckwed, *Lemna trisulca*
Valvid's duckweed, *Lemna valdiviana*
Spirodela, *Spirodela polyrhiza*

Lentibulariaceae – Bladderwort Family

Lesser bladderwort, *Utricularia minor*

Liliaceae – Lily Family

Acuminate onion, *Allium acuminatum*
Asparagus, *Asparagus officinalis*
Stellate smilacina, *Smilacina stellata*

Loasaceae – Stickleaf Family

Whitestem blazingstar, *Mentzelia albicaulis*
Not listed – classification likely changed since 1981, *Mentzelia decapetala*

Beautiful blazingstar, *Mentzelia laevicaulis*
Desert stickleaf, *Mentzelia multiflora*

Lythraceae – Loosestrife Family

Purple loosestrife, *Lythrum salicaria*

Malvaceae – Mallow Family

Hollyhock, Althaea rosea
Cheeses, Malva neglecta
Alkali mallow, Malvalla leprosa
New Mexico checker, Sidalcea neomexicana
Oregon checker, Sidalcea oregana
Common globemallow, Sphaeralcea coccinea
Gooseberry-leaf globemallow, Sphaeralcea grossulariaefolia
Monroe's globemallow, Sphaeralcea munroana

Moraceae – Mulberry Family

Red mulberry, *Morus rubra*

Nyctaginaceae – Four O'Clock Family

Not listed – classification likely changed since 1981, *Abronia salsa*

Nymphaeceae – Waterlily Family

Yellow pondlily*, Nuphar polysepalum*

Oleaceae – Olive Family

Velvet ash*, Fraxinus velutina*

Onagraceae – Evening-primrose Family

Northern willowherb, *Epilobium ciliatum*
Autumn willowherb, *Epilobium brachycarpum*
Willow gaura, *Gaura parviflora*
Lesser camissonia, *Camissonia minor*
Morning lily, *Oenothera caespitosa*
Hooker's evening-primrose, Oenothera elata
Not listed – classification likely changed since 1981, *Oenothera latifolia*
Pale evening-primrose, *Oenothera pallida*
Utah camissonia, *Camissonia scapoidea var. utahensis*

Orchidaceae – Orchid Family

Lady's slipper, Cypripedium calceolus var. pubescens
Helleborine, Epipactis gigantea
Hooded ladies-tresses, Spiranthes romanzoffiana

Orobanchaceae – Broomrape Family

Manyflower cancerroot, Orobanche multiflora

Papaveraceae – Poppy Family

Armed prickly-poppy, Argemone munita

Plantaginaceae – Plantain Family

English plantain, *Plantago lanceolata*
Broadleaf plantain, *Plantago major*
Purshes' plantain, *Plantago patagonica*

Polemoniaceae – Phlox Family

Small collomia, *Collomia linearis*
Scarlet gilia, *Gilia aggregata*
Floccose gilia, *Gilia inconspicua*
Common gilia, *Gilia leptomeria*
Capillary gilia, *Gilia tenerrima*
Desert phlox, *Phlox austrmontanta*
Longleaf phlox, *Phlox longifolia*
Annual Jacobsladder, *Polemonium micranthum*
Blue Jacobsladder, *Polemonium caeruleum*

Polygonaceae – Buckwheat Family

Changed since 1981 - unknown, Erigonum effusum
Redroot buckwheat, Erigonum racemosum
Sulfer buckwheat, Erigonum umbellatum
Water smartweed, Polygonum amphibium
Knotweed, Polygonum aviculare
Black bindweed, Polygonum convolvulus
Willow-weed, Polygonum lapathifolium
Ladysthumb, Polygonum pericaria
Bushy knotweed, Polygonum ramosissimum
Curled dock, Rumex crispus
Golden dock, Rumex maritimus var. fuegineus
Large-valve dock, Rumex venosus

Portulacaceae – Purslane Family

Purslane, Portulaca oleracea

Potamogetonaceae – Pondweed Family

Crisped pondweed, *Potamogeton crispus*
Filiform pondweed, *Potamogeton filiformis*
Leafy pondweed, *Potamogeton folisosus*
Longleaf pondweed, *Potamogeton nodosus*
Fennel-leaf pondweed, *Potamogeton pectinatus*
Whitestem pondweed, *Potamogeton praelongus*

Primulaceae – Primrose Family

Pretty shooting star, *Dodecatheon puchellum*
Sea milkwort, *Glaux maritima*
Fringed loosestrife, *Lysimachia ciliata*

Ranunculaceae – Buttercup Family

Anderson's larkspur, Delphinium andersonii
Tall buttercup, Ranunculus acris
Thread water-buttercup, Ranunculus aquatilis capillaceus
Marsh buttercup, Ranunculus cymbalaria
Macoun's buttercup, Ranunculus macounii
Mountain buttercup, Ranunculus oreogenes
Bur buttercup, Ranunculus testiculatus

Rosaceae – Rose Family

Serviceberry, *Ameliancher alnifolia*
Utah serviceberry, *Ameliancher utahensis*

River hawthorn, *Crataegus douglasii* var. *ribularis*
Green cinquefoil, *Potentilla biennis*
Glandular cinquefoil, *Potentilla glandulosa*
Slender cinquefoil, *Potentialla gracilis* var. *elmeri*
Contrary cinquefoil, *Potentilla paradoxa*
American plum, *Prunus americana*
Chokecherry, *Prunus virginiana* var. *melanocarpa*
Cliff-rose, *Purshia mexicana*
Bitterbrush, *Purshia tridentate*
Nootka rose, *Rosa nutkana*
Wood's rose, *Rosa woodsii*

Rubiaceae – Madder Family

Small bedstraw, *Galium trifidum*

Ruppiaceae – Ditchgrass Family

Ditchgrass, Ruppia maritima

Salicaceae – Willow Family

White poplar, *Populus alba*
Narrowleaf cottonwood, *Populus angustifolia*
Fremont's cottonwood, *Populus fremontii*
Lombardy poplar, *Populus nigra* var. *italica*
Balsam poplar, *Populus balsamifera* var. *trichocarpa*
Peach-leaf willow, *Salix amygdaloides*
Narrowleaf willow, *Salix exigua*
Crack willow, *Salix fragilis*
Whiplash willow, *Salix lucida*
Yellow willow, *Salix lutea* var. *watsonii*

Salviniaceae – Waterfern Family

Not listed – classification likely changed since 1981, *Azolla caroliniana*
Not listed – classification likely changed since 1981, *Salvinia rotundifolia*

Santalaceae – Sandalwood Family

Bastard toadflax, Comandra umbrellata *var.* pallida

Saxifragaceae – Saxifrage Family

Littleleaf alumroot, *Heuchera parvifolia*
Golden currant, *Ribes aureum*

Scrophulariaceae – Figwort Family

Common paintbrush, *Castilleja chromosa*
Annual paintbrush, *Castilleja exilis*
Not listed – classification likely changed since 1981,*Collinsia grandiflora*
Alkali birdsbeak, *Cordylanthus maritimus* var. *canescens*
Common monkey-flower, *Mimulus guttatus*
Low penstemon, *Penstemon humilis*
Woolly mullein, *Verbascum thapsus*
American brookline, *Veronica americana*
Water speedwell, *Veronica anagallis-aquatica*
Ivy-leaved speedwell, *Veronica hederaefolia*
Purslane speedwell, *Veronica peregrina*

Solanaceae – Potato Family

Matrimony vine, Lycium barbarum
Common ground-cherry, Phyusalis longifolia
European bittersweet, Solanum dulcamara
Black nightshade, Solanum nigrum
Cutleaf nightshade, Solanum triflorum

Sparganiaceae – Bur-reed Family

Emersed bur-reed, *Sparganium emersum*
Giant bur-reed, *Sparganium eurycarpum*

Tamaricaeae – Tamarisk Family

Tamarisk, Tamarix chinensis

Thyphaceae – Cattail Family

Common cattail, *Typha domingensis*
Broad-leaved cattail, *Typhy latifolia*

Ulmaceae – Elm Family

Netleaf hackberry, *Celtis reticulata*
American elm, *Ulmus americana*
Siberian elm, *Ulmus pumila*

Umbelliferae – Parsley Family

Cutleaf water-parsnip, *Berula erecta*
Water hemlock, *Cicuta maculata*
Poisen hemlock, *Conium maculatum*
Parsnip, *Pastinaca sativa*
Hemlock water-parsnip, *Sium suave*

Urticaceae – Nettle Family

Stinging nettle, *Urtica dioica* var. *procera*
Not listed – classification likely changed since 1981, *Urtica serra*

Verbenaceae – Vervain Family

Prostrate vervain, *Verbena bracteata*
Blue vervain, *Verbena hastate*
Not listed – classification likely changed since 1981, *Verbena stricta*

Violaceae – Violet Family

Bog violet, Viola nephrophylla

Zannichelliaceae – Horned Pondweed Family

Horned pondweed, Zannichellia palustris

Zygophyllaceae – Caltrop Family

Puncture vine, Tribulus terrestris