



Design + Planning

# Lake Tahoe Nevada State Park Sand Harbor Recreational Capacity Study

Prepared for  
Nevada Division of State Parks  
Lake Tahoe Nevada State Park

Prepared by AECOM  
December 2011



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**Lake Tahoe Nevada State Park**  
**Sand Harbor Recreational Capacity Study**

Prepared for

Nevada Division of State Parks  
Lake Tahoe Nevada State Park  
Incline Village, NV

Prepared by

AECOM  
South Lake Tahoe, California

with

Great Basin Institute  
Reno, NV

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December 2011

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## Summary

The Nevada Division of State Parks (State Parks) contracted with AECOM to conduct a Recreation Capacity Study at Sand Harbor on Lake Tahoe. The study was conducted between April 2010 and July 2011, with data collected on site throughout the 2010 summer season. The study area covers all lands and recreation facilities within the Sand Harbor Unit of Lake Tahoe-Nevada State Park (LTNSP), which includes the Sand Harbor and Memorial Point areas and Hidden Beach. The Sand Harbor Unit is the most heavily used portion of LTNSP, receiving 700,000 to 900,000 recreation visits annually. The unit is on State Route (SR) 28, designated as part of the Eastshore Drive Scenic Byway due to its outstanding scenic values.

The main purpose of the study is to determine the level of recreation activity that can be sustained at the Sand Harbor Unit of LTNSP during the peak summer season, when the greatest pressures on park facilities and resources occur. This determination is based on existing data as well as on-site visitor surveys conducted for the study, and an on-site assessment of facility and resource conditions and impacts from recreational use. The study also assessed visitor use levels to supplement vehicle count data collected at entrance stations and parking areas at the Sand Harbor Unit.

The study contains four separate capacity assessments focused on four capacity types or “indicators”:

- Physical/spatial capacity
- Facility capacity
- Ecological capacity
- Social capacity

In addition to these standard components of recreational capacity assessment, the study also incorporates a management capability assessment and transportation and pedestrian safety assessment.

Capacity conclusions are presented in qualitative terms: “below,” “approaching,” “at,” or “exceeding” capacity. In keeping with current professional practice, capacity levels expressed in maximum numbers of users or vehicles, for example, are not the focus of this assessment. The recreation management profession has moved away from attempts to define such numerical limits after recognizing the complexity inherent in the range of capacity types or factors, and the questionable utility and defensibility of such limits.

Recreational capacity conclusions are summarized based on the four capacity types, for each primary recreation use area within the Sand Harbor Area, for Sand Harbor as a whole, and for Memorial Point, as shown in the table below.

Overall, peak season recreation use in the Sand Harbor area is **exceeding** the recreational capacity of the area. During the summer recreation season, physical/spatial and facility capacity are the primary constraints on recreational capacity. Ecological capacity is also a concern for

the Main Beach and Diver’s Cove use areas. Given the popularity of those two use areas and the large percentage of visitor use they receive, ecological capacity can also be considered a constraint in the Sand Harbor area at this time. Social capacity is of most concern at Diver’s Cove at this time and may become a factor for the Sand Harbor area as a whole in the future; however, social capacity is not found to be a constraint overall. If management capability is also considered, the conclusion that the Sand Harbor area is exceeding its recreational capacity is reinforced. On a use area basis, overall, peak season recreational use is considered to be **exceeding** its capacity at the Main Beach, Diver’s Cove and Boat Ramp use areas, and **approaching** capacity at the Family Picnic Area.

Overall, peak season recreational use at Memorial Point is considered to be **at** capacity.

**Summary of Recreational Capacity Conclusions.**

Use Area	Capacity Types/ Indicators	Capacity Conclusion	Overall Capacity Summary <sup>1</sup>
<b>Sand Harbor</b>			
Main Beach	Physical/Spatial Facility Ecological Social	Exceeding Exceeding Exceeding Approaching	Exceeding
Family Picnic Area	Physical/Spatial Facility Ecological Social	Approaching Exceeding Approaching Approaching	Approaching
Diver’s Cove	Physical/Spatial Facility Ecological Social	Exceeding Exceeding At At	Exceeding
Boat Ramp Area	Physical/Spatial Facility Ecological Social	Exceeding Exceeding Below Approaching	Exceeding
<b>Overall Sand Harbor Area</b>			
	Physical/Spatial Facility Ecological Social	Exceeding Exceeding At/Exceeding Approaching/At	Exceeding
<b>Memorial Point</b>			
	Physical/Spatial Facility Ecological Social	Not assessed At Below Not assessed	At
<sup>1</sup> Indicates whether overall peak season recreational use is considered to be “below,” “approaching,” “at,” or “exceeding capacity” at this time based on a synthesis of the results for each capacity type or “indicator.”  Note: More detailed explanation of these capacity conclusions is provided in Chapter 10 of this report.  Provided by AECOM.			

Beach and other public shoreline recreation opportunities are in low supply at Lake Tahoe. The overall objective of capacity management at Sand Harbor is to balance the provision of these scarce and highly valued recreation opportunities with the preservation of the natural resource base within the park and high quality visitor experiences. This balancing is the essence of capacity management and is the fundamental management challenge at Sand Harbor addressed in this study.

Capacity management seeks to influence physical/spatial, facility, ecological, and social capacity by acting on limiting factors and specific variables within those factors. In effect, these actions may function to increase capacity, not necessarily so that more visitors may use the area but so that an undesirable or unacceptable level of impact and degradation of resources and visitor experiences is avoided. These actions can ensure that capacity status is maintained at a “below capacity” or “approaching capacity” level, rather than “at capacity” or “exceeding capacity.”

Policy and operational recommendations are presented in the concluding chapter of this report. The recommendations put forward a range of options for consideration to help State Parks meet or exceed capacity management goals at Sand Harbor, using a variety of capacity management strategies and tactics. In addition, a number of recommendations are offered for consideration to address transportation and pedestrian safety concerns, both within Sand Harbor and within the SR 28 corridor adjacent to the park.

Recommendations to address physical and facility capacity issues are focused on providing additional picnic sites, reconfiguration of existing picnic sites, reconfiguration of some existing restrooms, and reconfiguration of boat ramp parking. Recommendations to address social capacity issues are focused on the implementation of a visitor education and awareness program, and providing buffers between competing and conflicting uses. Recommendations to address ecological capacity issues are focused on implementing bank stabilization techniques, providing additional hardened pedestrian access, and/or reducing pedestrian access to sensitive areas.

Finally, transportation recommendations are focused on revisions to park entry and parking operations during the peak season and providing additional public information. These are intended to improve vehicle circulation into and out of Sand Harbor, and to reduce SR 28 congestion. Associated pedestrian and bicycle safety recommendations are focused on guiding bicycle and pedestrian use and trail development along SR 28 and within Sand Harbor (in cooperation with other agencies) such that safety is maintained or improved and capacity concerns within the park are ameliorated. Similarly, transit recommendations are focused on evaluation of transit options to serve Sand Harbor, in cooperation with regional agencies, to enhance transportation options while balancing concerns about increasing park use and capacity pressures.

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## Acronyms and Abbreviations

AADT	average annual daily traffic
ADA	Americans with Disabilities Act
BBQ	Barbeque
CDPR	California Department of Parks and Recreation
CIP	Capital Improvement Program
CMP	Corridor Management Plan
BPP	Bicycle and Pedestrian Plan
dbh	Diameter at breast height
DCNR	Department of Conservation and Natural Resources
DMR	Dwarf Mistletoe Rating
EIP	Environmental Improvement Program
FY	Fiscal year
GBI	Great Basin Institute
GIS	Geographic information system
GMP	General Management Plan
L&WCF	Land and Water Conservation Fund
LAC	Limits of Acceptable Change
LTBMU	Lake Tahoe Basin Management Unit
LTNSP	Lake Tahoe Nevada State Park
LWCF	Land and Water Conservation Fund
NDOT	Nevada Department of Transportation
NPS	National Park Service
NSPCA	Nevada State Parks Cooperative Association
PAC	Protected Activity Center
NDOW	Nevada Department of Wildlife
NDSL	Nevada Division of State Lands
NHP	Nevada Highway Patrol
NTRT	Nevada Tahoe Resource Team
NVUM	National Visitor Use Monitoring
PAOT	persons-at-one-time
PWC	Personal watercraft
QA/QC	Quality Assurance/Quality Control
RTP	Regional Transportation Plan
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SEZ	Stream Environment Zone
SR	State Route
State Parks	Nevada Division of State Parks
TART	Tahoe Area Regional Transit
TMPO	Tahoe Metropolitan Planning Organization
TRPA	Tahoe Regional Planning Agency
TTD	Tahoe Transportation District
TYC	Tahoe yellow cress
U.S. 50	U.S. Highway 50
USFS	United States Forest Service
VERP	Visitor Experience and Resource Protection

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## 1.0 INTRODUCTION

In early 2010, the Nevada Division of State Parks (State Parks) contracted with AECOM to conduct a recreation capacity study at Sand Harbor on Lake Tahoe. The study was conducted between April 2010 and July 2011, with data collected on site throughout the 2010 summer season. The study area covers all lands and recreation facilities within the Sand Harbor Unit of Lake Tahoe-Nevada State Park (LTNSP), which includes the Sand Harbor and Memorial Point areas and Hidden Beach.

### 1.1 PURPOSE AND OBJECTIVES OF THE STUDY

The primary purpose of the recreational capacity study is to determine the level of recreation activity that can be sustained at the Sand Harbor Unit of LTNSP during the peak summer season, when the greatest pressures on park facilities and resources occur. This determination is based on existing data as well as on-site visitor surveys conducted for the study, and an on-site assessment of facility and resource conditions and impacts that may be associated with recreational use. A secondary purpose is to assess visitor use levels to supplement vehicle count data collected at entrance stations and parking areas at the Sand Harbor Unit.

The following objectives were developed to address the purpose of the study:

- Obtain current data on summer visitor use levels and activities at the Sand Harbor Unit, as well as visitors' perceptions and opinions of conditions at Sand Harbor.
- Use the above data (obtained through on-site visitor counts, interviews, other field work, and from State Parks) to analyze capacity conditions and develop capacity assessments.
- Develop an overall capacity assessment for the Sand Harbor Unit, and formulate recommendations for management responses to capacity management challenges.
- Develop recommendations for transportation, pedestrian safety, and transit measures to alleviate congestion and ensure pedestrian safety.

The primary focus of the study is on the Sand Harbor area, where the great majority of recreation activity within the unit occurs. A secondary focus is on Memorial Point, which serves a more limited function as a roadside overlook and rest area. It was agreed during the course of the study that the Hidden Beach area would be addressed only as it relates to other parts of the Sand Harbor Unit, and no on-site data collection would occur there.

## 1.2 BACKGROUND AND NEED FOR STUDY

The following describes the regional context and the information sources used in conducting the study.

### 1.2.1 Background

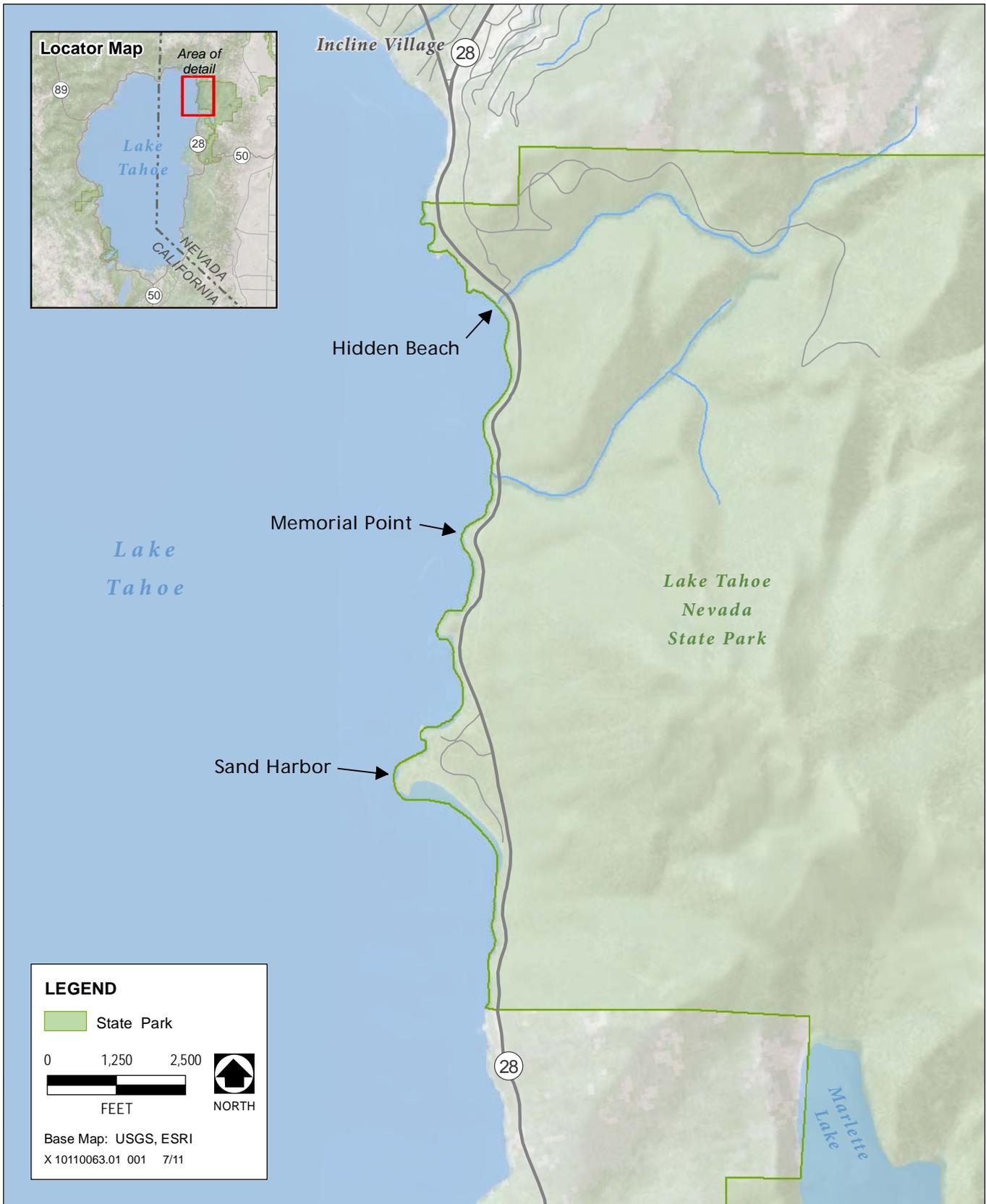
The Sand Harbor Unit is the most heavily used portion of the 14,300-acre LTNSP (State Parks 2010), on the northeast shore of Lake Tahoe (Figure 1-1, *Lake Tahoe Nevada State Park, Sand Harbor Unit*)<sup>1</sup>. The unit is home to one of the largest and most popular beaches on the lake in a setting of unparalleled natural beauty. The Sand Harbor area is a triangular peninsula that covers about 53 acres, with mature cedars and pines and a wide beach stretching over 2,000 feet on the south side of the peninsula, and smaller boulder-strewn sheltered coves on the north side. The Sand Harbor Unit also includes the Memorial Point area, a scenic vista site situated on a small point about 0.5 mile north of the Sand Harbor area. Hidden Beach, also within the unit, is a lightly improved secluded beach about 0.7 mile north of Memorial Point. The unit also includes the stretches of shoreline between these main use areas. The unit is on State Route (SR) 28, designated as part of the Eastshore Drive Scenic Byway due to its outstanding scenic values.

The unit provides an array of land- and water-based recreation opportunities including picnicking, swimming, sunbathing, scuba diving, walking, sightseeing, and boating (both motorized and non-motorized). Each summer, the unit hosts the Lake Tahoe Shakespeare Festival on the Sand Harbor outdoor stage. Most of the remainder of LTNSP, outside the study area, is forested backcountry on the mountain slopes above and to the south of the Sand Harbor Unit, east of SR 28, with opportunities for hiking, mountain biking, and horseback riding.

The main Sand Harbor area is about 2.2 miles south of the community of Incline Village, Nevada (approximate population 10,000). SR 28 links the park to U.S. Highway 50 (U.S. 50), about 7.6 miles to the south, and SR 431 (Mount Rose Highway), about 5.5 miles to the north, which are the primary routes for visitors from the Carson City (approximate population 55,000) and Reno/Sparks (approximate population 315,000) areas, each of which is less than an hour's drive away. The park also draws visitors from the Sacramento area (about a 2-hour drive) and the San Francisco Bay area (about a 3- to 4-hour drive). The park is also popular among Tahoe Basin residents.

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<sup>1</sup> In this report, "Sand Harbor Unit" refers to the entire management unit, which includes both the Sand Harbor and Memorial Point areas and Hidden Beach, as shown in Figure 1-1. "Sand Harbor" generally refers to the smaller Sand Harbor area itself (i.e., the peninsula and immediately surrounding area) but not including Memorial Point or Hidden Beach.



Source: NSP 2011

Fig. 1-1. Lake Tahoe Nevada State Park, Sand Harbor Unit

### **1.2.2 Need for Study**

The study is needed to determine the carrying capacity of the Sand Harbor Unit, taking into account social, spatial, facility, and ecological factors within the existing developed area. (The concept of carrying capacity is defined and explained in Section 1.4.) The capacity of the Sand Harbor Unit needs to be expressed in the context of sustainable desired visitor experiences. Maintaining high quality recreation experiences while absorbing the high level of use during the summer peak season is a long-recognized concern at the unit. Prominent specific capacity related concerns include parking limitations at both the Main Beach and Boat Ramp areas, leading to frequent unsafe parking and pedestrian use along the SR 28 corridor; social impacts leading to lower quality recreation experiences; and potential ecosystem damage.

Beyond these foundational recreational carrying capacity issues, park staffing levels and other aspects of management capability are important considerations in this study, as sufficient capability is vital to maintaining high quality visitor experiences and protecting park resources. State Parks also requested that the study evaluate transportation, pedestrian safety, and transit issues and opportunities. The objective is to more fully inform park management about these important issues, which relate to and may affect capacity concerns, and explore potential management responses to these issues that may serve capacity management goals.

Lastly, State Parks requested that the study include additional data collection at entrance stations to improve existing park visitation estimates derived from vehicle counts. A summary analysis of the data obtained at the entrance stations during the study is provided in Appendix M.

A final need for the study is associated with regional capacity management requirements. The Tahoe Regional Planning Agency (TRPA) currently manages recreation capacity at the regional level through the allocation of “Persons at One Time” (PAOT) capacity to individual parks and recreation sites in the Tahoe Basin, generally tied to parking capacity. TRPA has recognized that the PAOT system does not work well for areas such as Sand Harbor, with substantial parking turnover and walk-in use, suggesting that a different approach is warranted to manage capacity issues. There have also been concerns about the quality of visitor experiences at basin beaches. This study provides alternative means to manage capacity based on measures other than solely PAOT, integrating a range of indicators of high quality recreation experiences.

## **1.3 EXISTING INFORMATION**

More than 30 documents and data sets were compiled and reviewed for this study. State Parks provided plans and data directly associated with LTNSP as well as statewide recreation survey reports. Other documents, including plans addressing the SR 28 corridor in the vicinity of Sand Harbor, TRPA regulations, regional plans developed by TRPA and others, and regional resource management plans, were compiled and

reviewed by AECOM. The general content and relevance of the compiled materials are summarized below. A more detailed discussion of each item is provided in an annotated list in Appendix A.

### **1.3.1 Lake Tahoe-Nevada State Park Plans and Data**

The earliest planning document obtained for LTNSP was the Land Use Plan for the park (Wirth and Associates 1972), developed the year after the park was officially dedicated (and in the initial phase of when park improvements had begun). Even at this early date, planners recognized that demand was high for the unique opportunities available at Sand Harbor, and could not be met on the limited site, stating: "...potential demand easily lies beyond the viable carrying capacities of any facilities that might be developed on the lakeshore portion of the park."

The park master plan/general management plan (GMP) currently in effect is the 1990 LTNSP Master Development Plan (State Parks 1990). The plan evaluated the park facilities at that time, nearly 20 years after the park's development, and proposed some specific improvements. The GMP is being updated in 2011–2012. More recently, plans have been prepared to address specific elements of the park's programs and management, including an Interpretive Plan (State Parks 2003), a Water Conservation Plan (State Parks 2009a), and a Resource Management Plan (RMP) (State Parks 2010). Each of these provides information on and insights into the resources and management of LTNSP, which were incorporated into the capacity analysis.

State Parks provided AECOM several spreadsheet (Excel) files with LTNSP visitation statistics and other park operations data. One file has Sand Harbor annual visitation for the past 10 years, and LTNSP annual visitation for an additional 20 years (1980–2000). A set of files provides daily and monthly visitation totals for the two Sand Harbor entrances (Main Entrance and Boat Ramp) as well as for Memorial Point and Hidden Beach, based on vehicle counts and vehicle occupancy factors (i.e., multipliers). Another set of files contains monthly statistics related to 10 park operations elements. Both of these sets cover the past 3 years (2008–2010). The park visitation data provide a well-documented basis for evaluating trends in park use levels, an important element of capacity assessment. The park operations data also provide useful insight into park management requirements and capabilities.

### **1.3.2 State Route 28 Corridor Studies**

The earliest SR 28 study reviewed was the Recreational Traffic Management Study that coincided with Nevada Department of Transportation (NDOT) efforts to improve the road and reduce erosion and runoff problems (LSC, Inc. 1996). The study is useful in that it documented illegal shoulder parking use and problems, and inventoried both legal and illegal shoulder parking spaces in the corridor. Distinctions between legal and illegal spaces were based on available shoulder width.

Three other SR 28 corridor traffic studies followed the 1996 designation by the Federal Highway Administration of the Eastshore Drive National Scenic Byway, which includes the SR 28 corridor in the vicinity of Sand Harbor. The Eastshore Drive Corridor Management Plan (required by the Byway designation) described roadside parking and associated safety problems, among other corridor management issues, and recommended a management framework and a set of prioritized actions to address the issues (EDAW, Inc. 1997). Key recommended actions included replacement of shoulder parking with new parking areas and increased enforcement to discourage illegal parking. The Draft Environmental Assessment of SR 28 Off-Highway Parking Areas (Harding Lawson Associates 1999) analyzed the impacts of one of the actions recommended in the 1997 Corridor Management Plan, the provision of parking lots to replace shoulder parking. However, just a few years later the Draft East Shore Access Plan (Harding ESE 2001) took into account the previous plans and analyses but recommended a substantially different approach to parking management in the corridor. Expansion of existing U.S. Forest Service (USFS) parking lots and implementation of some form of peak use transit system was recommended. The plan also recommended formalizing some of the existing shoulder parking and taking steps to physically block use of other shoulder areas. (Since that time, there have been transit trial runs, but other recommended actions have not been implemented.)

### **1.3.3 Regional Planning Documents and Reports**

TRPA is charged by the U.S. Congress with regional oversight of resource management, land allocation, and development in the Lake Tahoe Basin. With the basin being one of the nation's most popular recreation areas, land allocation for recreation and recreation management are among the most significant issues. The bi-state TRPA Regional Planning Compact (commonly referred to as "the Compact") recognized that the regional economy is largely based on its recreation resources and identified the preservation of recreational opportunities as one of the primary objectives of the TRPA Regional Plan, which was adopted in 1987. The Regional Plan consists of several documents, several of which may be relevant to this study and are described in the following section.

### **Recreation Resources**

The following information summarizes the primary TRPA documents and regulations affecting land use and recreation in the basin, and in the study area specifically, and is adapted from information provided by TRPA on the *TRPA Regulations* webpage (TRPA 2011).

The Compact, as revised in 1980, gave TRPA authority to adopt environmental quality standards, called thresholds, and to enforce ordinances designed to achieve the thresholds. The TRPA Governing Board adopted the thresholds (more formally known as Environmental Threshold Carrying Capacities) in 1982. The thresholds set environmental goals and standards for the Lake Tahoe Basin and indirectly define the capacity of the region to accommodate additional land development.

The TRPA Recreation Threshold contains two standards, **R-1: Quality Experience and Additional Access, and R-2: Fair Share of Recreation Capacity**. These are expressed as policy statements rather than numerical standards. The purpose of the standards is to encourage the acquisition of lands and development of facilities for additional recreation opportunities.

Threshold R-1 is a two-part policy statement to preserve and enhance high quality recreation and provides additional access to high quality lands for low-density recreation. The first part concerns the perceptual experience on the part of the recreationist. Since 1991, this has been measured through user satisfaction surveys. The second part of the threshold encourages the provision of additional physical access to the shore zone and other undeveloped lands which, if they are not disturbed and have some level of intrinsic natural resource value, could be considered high quality. This part of the threshold can be measured through changes to the supply of lands available to the general public for recreation.

Threshold R-2 is intended to ensure that a fair share of the region's outdoor recreation capacity is available to the general public. This is primarily measured by comparing the capacity of developed recreation facilities against PAOT capacity targets set for the basin by TRPA; development of other "non-PAOT" facilities are also taken into account, such as trails and public land acquisition to support recreation.

The region is periodically evaluated by TRPA to determine if thresholds are attained, most recently in 2006 (TRPA 2007a). Although seasonal traffic and crowding problems were acknowledged, the region was found to be in attainment of Threshold R-1 and to be trending in a positive direction. Difficulties with implementing Threshold R-2 and shortcomings of the PAOT allocation approach were described, but the region was also found to be in attainment with this threshold and trending in a positive direction. Several changes to the recreation thresholds and associated indicators were recommended, to be implemented as part of the ongoing Regional Plan update.

In 1987, the TRPA Governing Board adopted the Regional Plan in effect today, and the plan has been amended numerous times. The Regional Plan is intended to "establish a balance, or equilibrium, between the natural environment and the human-made environment. The Plan emphasizes an improvement in the quality of development in the Region and in the quality of the natural environment."

The Regional Plan Goals and Policies document presents the overall approach to meeting the thresholds (TRPA 2004). A key component of the plan is the Land Use Element, which identifies the fundamental philosophies directing land use and development in the Lake Tahoe Basin. It addresses topics like suitable development locations; maintenance of the environmental, social, physical, and economic wellbeing of the region; and coordination with local, state, and federal requirements. The Regional Plan also contains a Recreation Element, which has three subelements: Urban Recreation, Developed Recreation (most relevant to this study), and Dispersed

Recreation. Together, the goals and policies of these subelements are intended to ensure “that recreational opportunities keep pace with public demand, that recreational facilities remain high on the development priority list, and that the quality of the outdoor recreational experience will be maintained.”

A number of regulations are needed to implement and enforce policies identified in the plan. The TRPA Regulatory Code (Code of Ordinances) compiles all of the laws and ordinances needed to implement the goals and policies. The code contains many chapters that regulate development of recreational facilities associated with the shore zone. These chapters address permissible uses and structures and detail a variety of development standards to be met.

Related to the code are Plan Area Statements, which describe land use for particular areas in the basin. The Lake Tahoe Region is divided into more than 175 separate Plan Areas. The Sand Harbor Unit is within the East Shore Plan Area (#55). For each Plan Area, a “statement” is made as to how that particular area should be regulated to achieve environmental and land use objectives.

As noted above, TRPA is currently updating the Regional Plan, which has extended over several years. One of the steps in this process has been a visioning exercise entitled “Pathway 2007,” which involved a multi-agency working group that conducted several public workshops. A result of the process was vision statements for planning outcomes in the basin over the next 20 years, as well as planning concepts to achieve those outcomes. Public transit and caps on recreation use levels, as warranted, were endorsed by the participants in the process (TRPA 2006a).

TRPA has participated with other agencies in the development of several recent plans addressing recreation issues. TRPA, with the USFS and other federal agencies, developed A Federal Vision for the Environmental Improvement Program (EIP) at Lake Tahoe (TRPA and Lake Tahoe Federal Interagency Partnership 2006). The EIP presented objectives for a Recreation Program, which include monitoring of visitor use and perceptions, and maintaining use at appropriate PAOT capacity levels. More recently, TRPA collaborated with the Tahoe Metropolitan Planning Organization on the Lake Tahoe Region Bicycle and Pedestrian Plan (TRPA and TMPO 2010). The plan evaluates and provides cost estimates for trail segments that would follow the SR 28 corridor and connect Sand Harbor to Incline Village. Lastly, a Non-Motorized Boat Workgroup was formed in 2007, with State Parks as a member, and has produced a framework to support non-motorized boating on the lake, including access and facility improvements, management and operational challenges, and safety and resource stewardship concerns (Lake Tahoe Non-Motorized Boat Working Group 2010).

## **Natural Resources**

Natural resources are of concern in the Sand Harbor area. Biologists have developed a Conservation Strategy for Tahoe Yellow Cress (Pavlik et al. 2002); Tahoe yellow cress (TYC) is a rare plant species endemic to the shores of Lake Tahoe, and known to occur

at Sand Harbor. Although the Conservation Strategy considered the plant extirpated from Sand Harbor (when the strategy was prepared, no plants had been found for over 20 years), the 2009 Annual Report on the Implementation of the Conservation Strategy (Stanton and Pavlik 2010) reported that a low number of plants (less than 30) had been detected in 2003, 2004, 2008, and 2009, while 112 were detected in 2005. Plants have been found at both the eastern and western ends of the main beach. The plant may appear and disappear naturally due to water level, drought conditions, and other factors; no plants were detected in 2006 or 2007. From 2003 to 2006, an enclosure was installed at the northernmost end of the beach north of the boat ramp to protect a population of container-grown plants transplanted there for a pilot study (State Parks 2010).

USFS biologists have developed the Lake Tahoe Basin Northern Goshawk Population Monitoring Plan (USFS 2008), which describes a monitoring program intended to assist with the protection and recovery of the species in the basin. The northern goshawk is a USFS Sensitive Species, a Nevada Division of Wildlife Special Status Species, and a TRPA Special Interest Species; past monitoring has detected birds at Memorial Point and birds and nests in the general vicinity of Sand Harbor, although not in the unit itself. The 2009 Lake Tahoe Basin Management Unit Wildlife Program Annual Report (USFS 2009) provides results of population monitoring and surveys of northern goshawk, as well as bald eagle and osprey. Osprey nests exist in and near Memorial Point and Sand Harbor, and the bald eagle has been observed in the Sand Harbor area during the winter.

### **1.3.4 Statewide Recreation Surveys**

State Parks provided AECOM reports with the results of statewide recreation surveys conducted in 1987–88 and 2005–06, in part to support development of the Nevada Statewide Comprehensive Outdoor Recreation Plan (SCORP) and SCORP updates. Some survey topics addressed in the 1987–88 survey report (Market Systems Research, Inc. 1988) were also included in the visitor interviews conducted for this study, providing an opportunity to compare results across more than two decades. A 2009 Visitor Survey Special Report (State Parks 2009b) provides statewide results for the 2005–06 survey, which duplicated in part the 1987–88 survey. The 2005–06 survey data files provided by State Parks allow for a limited comparison of some of the survey results with the results of similar items from the visitor interviews conducted for this study; missing information on the park unit in which the LTNSP surveys were conducted limits the potential comparisons. An attachment to the above report provides additional economic value data for LTNSP, based on the 2005–06 survey data.

## **1.4 CARRYING CAPACITY CONCEPTS AND APPROACH USED**

A detailed summary of the origin and evolution of recreation carrying capacity research and concepts is not necessary for this report. However, it is important to be clear about the purpose and approach in applying carrying capacity concepts, given the range in how the concepts have been applied, and the existence of some persistent

misconceptions about these concepts. It is also important to note that certain concepts and assumptions about carrying capacity concerning impact thresholds and recreation use limits are implicit in State Parks' goals for this study. The discussion of carrying capacity concepts, such as thresholds and use limits, and approach that follows provides context for the study's conclusions and recommendations.

#### **1.4.1 Introduction to Carrying Capacity**

The concept of carrying capacity speaks to the need to maintain development and activities at a level that is ecologically, socially, and managerially sustainable. It implies that there are limits, or thresholds, beyond which a system will not absorb further changes or increases in use. This concept recognizes that parks have a certain "carrying capacity," that is, a level of recreation development and activity beyond which environmental degradation occurs, facilities become saturated, and/or visitor enjoyment diminishes.

Derived more than 40 years ago from the study of animal populations, the carrying capacity concept for recreation now goes beyond estimating mere numbers; it has increasingly evolved as a tool to enable planners and managers to determine, not, "How much is too much?", but rather, "How much change is acceptable?" (Williams and Gill 1991). As any human use of the natural environment inevitably results in some change to that environment, the focus would be to identify how much change is acceptable for a given setting (Stankey and McCool 1992). The concept stresses the management of desired environmental and social conditions, which can be expressed using planning systems such as Limits of Acceptable Change (LAC) (Stankey et al. 1985), Visitor Experience and Resource Protection (NPS 1997), or similar derivations.

Carrying capacity incorporates the individual components of ecological, physical, social, and facility carrying capacities. (Each of these "capacity types" is described below.) Nonetheless, the estimation of carrying capacity or limits of acceptable change is not an easy task, as many factors affect impacts. Furthermore, there is no set method or formula available, as each situation and application is typically unique.

Many researchers have pointed out limitations of the traditional carrying capacity concept, some even arguing that the concept is misleading and counterproductive (McCool and Lime 2001). Many of these limitations relate to persistent misconceptions or misapplications of the concepts, some of which are described below. However, the concept can be used to identify factors that negatively affect the recreation environment, which is a primary focus of this study. We also identify actions that may be taken to minimize or limit adverse recreation-related impacts on the natural resources and on facilities, and to maximize physical and social capacity.

#### **1.4.2 Carrying Capacity Management**

Most researchers and managers have come to the conclusion that the greater part of carrying capacity management should be focused not on defining the level of use an

area can tolerate, but the desired conditions for an area. Management then focuses on management of conditions instead of user numbers. The primary management task becomes working to identify acceptable resource and social conditions (i.e., level of impacts), formulating these as management goals, and monitoring those conditions (impacts) to ensure that they remain within desired levels. This is in keeping with the “limits of acceptable change” (LAC) implementation of carrying capacity, which has been the most widely used methodology since the 1990s. The following contemporary definition of carrying capacity embodies all of the above concepts:

Recreation carrying capacity is the amount and type of use that an area can sustain over a given time period, given goals to maintain the physical environment and the experience of the visitor (Krumpe 2004).

A persistent misconception about recreation carrying capacity is that there is one “magic number” carrying capacity limit that can be identified for an area. Carrying capacity researchers have long emphasized that carrying capacity should not be an absolute value, but a range of values that must be related to specific management objectives in a given area. Management objectives should state the desired conditions for a management area. These objectives should be related to the needs and values of visitors, but are essentially value judgments made by managers, as are the capacity decisions about how acceptable documented impacts are or how much physical or social impact is too much. Managers must make subjective judgments about appropriate use that reflect their values, or those of visitors.<sup>2</sup> A study cannot change carrying capacity decisions from being value judgments, but can provide descriptive information to inform these decisions, make them more explicit, and thus make them more defensible.

Another important misconception is that setting a capacity limit automatically means use will have to be limited. In reality, the need to limit use can be reduced through other management actions such as zoning, site hardening, facility engineering and expansion, use of education, and protection of sensitive natural and cultural resources. Each of these actions can increase the supply of recreation opportunities, increase the durability of the resource, or reduce impacts, thus reducing the need to regulate or limit use. In addition, research has shown that many types of biophysical and social impacts occur at relatively low levels of use or are not directly related to the amount of use.

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<sup>2</sup> The results of this study can serve as an important component of a more comprehensive capacity planning effort, based on an LAC-type multi-step, stakeholder-involved, planning system or process. A primary purpose of such a process would be to establish management objectives that express desired future conditions. Such a planning effort can potentially be integrated into the GMP update that is underway, or pursued as a separate effort that would inform the GMP update.

### 1.4.3 Components or Types of Carrying Capacity

Carrying capacity of a recreation area can be described in terms of physical or spatial capacity, facility capacity, social capacity, and ecological capacity, as illustrated in Figure 1-2. Assessment of each of these capacity components forms the core of this study. (In addition to these four primary carrying capacity components, this study also included an analysis of management capability to reflect the ability of LTNSP to meet day-to-day and longer term management requirements, given staffing and other management resource constraints, the intensive summer recreation activity at Sand Harbor, and the considerable capacity management challenges the park must meet.)

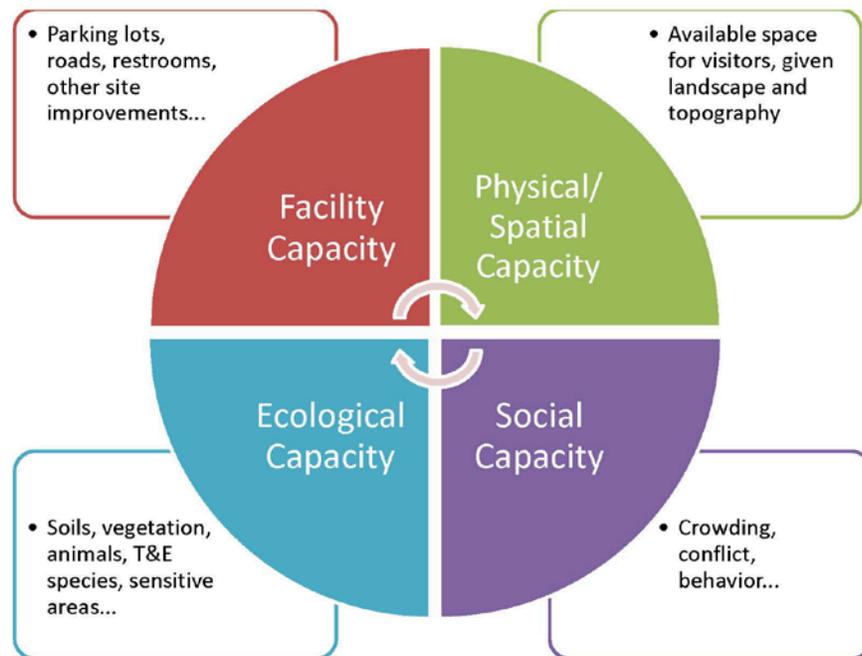


Figure 1-2. Components of Recreation Capacity.

#### Physical/Spatial Capacity

Physical or spatial capacity relates simply to the amount of space that is available in a given recreation setting. Steep terrain, wetlands, and other natural deterrents to use or development of facilities act as constraints on physical capacity. Such constraints are rarely the primary factor limiting overall capacity. That is, other types of capacity are likely to limit use well before physical capacity is reached (use levels reach saturation). Indicators for assessing physical capacity most often are tied to the number of people using a site or occupying a specific length of shoreline. It may also be appropriate to consider the expansion potential of existing sites, or facility expansion within existing use areas, as these can increase physical capacity.

## **Facility Capacity**

Facility capacity relates to the ability of the basic infrastructure and facilities to support and withstand recreation use. Like physical capacity, this often simply relates to space, for example, for parking. Note, however, that facility capacity is not dependent on the area available for whatever recreation activities occur at a site but rather is dependent on the limitations imposed by necessary man-made improvements. In addition to use areas such as picnic areas and campgrounds, facility capacity includes access and road networks, parking, garbage and sewage disposal systems, and potentially electricity and potable water supply. In developed, front-country settings, indicators for assessing facility capacity most often are tied to the number of people or groups or vehicles using a parking area, boat ramp, or campground. For example, useful indicators may include percent occupancy of picnic or campsites, waiting times to use facilities such as boat ramps, or the number of refusals for campsites. (These are similar to the PAOT design capacity standards described in the TRPA Regional Plan.)

## **Social Capacity**

Social capacity relates to a park's ability to host a certain level and type of recreation use without diminishing visitor enjoyment or satisfaction excessively. This type of capacity relates to social impacts and is usually equated to visitors' perceptions of crowding. However, it is important to note that perceptions of crowding have more to do with the nature of interactions, settings, and visitor attributes and expectations than they do with user density (Watson 1988). In a highly developed and/or high use park setting, visitors may expect more crowded conditions. In a park setting intended to provide low-density "peace and quiet" or nature-oriented experiences, most people would expect a less crowded environment. In addition to visitors' perceptions of crowding, perceived and actual conflicts between different visitor groups or types of visitors may also be useful indicators for assessing social capacity.

Visitor satisfaction may not necessarily be a good measure of social carrying capacity, as the number of visitors may reach a point where the desired experience is no longer provided but without a noticeable reduction in satisfaction of the visitors present. Due to the displacement of the most dissatisfied visitors, satisfaction is generally fairly high for current visitors to recreation areas, although their experiences may be drastically different from previous visitors (Watson 1988). Nevertheless, visitor satisfaction can still act as a useful indicator for social carrying capacity.

## **Ecological Capacity**

Ecological capacity relates to the ability of the natural environment to absorb recreation use. The ecological capacity of a park is the level of visitor use and consequent impacts on ecological or biophysical resources that can be sustained without permanent degradation. If highly valued or sensitive resources exist (e.g., fragile or rare ecosystems, threatened/endangered species), an in-depth study of those resources would be required, but is outside the scope of this study. Common indicators for

assessing ecological capacity include loss of ground cover and other vegetative impacts, impacts on wetlands and riparian communities, and observed soil compaction and erosion.

#### **1.4.4 Capacity Thresholds/Standards and Limiting Factors**

The establishment of capacity triggers or thresholds (i.e., standards of quality) to alert managers that “actions may be necessary to sustain the area’s resources, visitor experiences, and management effectiveness,” is inherent in developing the recreational carrying capacity of an area (Haas 2001). Standards of quality for each of the capacity types analyzed in this study, which “define the minimal acceptable condition” of each capacity type, were also used to determine whether a use area was below, approaching, at, or exceeding one or more of the capacity types, as well as the overall park unit capacity (Manning 1999). Commonly used qualitative and quantitative standards of quality from existing management plans and other similar recreational carrying capacity studies were employed in this study.

These standards of quality should be built into the management plan for LTNSP to ensure consistent carrying capacity monitoring and decision-making. However, thresholds or standards should not be confused with visitor limits or site closures; rather, standards of quality tied to the various capacity types are a management tool that can be used to prescribe a range of potential responses.

One or two of the above types of capacity generally act as limiting factors on the use of specific sites or types of sites. As suggested above, these factors may or may not be related to use levels or use density. For each of the recreation use areas and for the Sand Harbor Unit as a whole, qualitative and quantitative data obtained via visitor counts and surveys and other field work were used to identify ecological, spatial, facility, and social capacity impacts that served as indicators in the capacity assessments. One or multiple capacity types were identified as the primary limiting factor(s) at each recreation use area, for Sand Harbor as a whole, and for Memorial Point.

The conclusions of this report (presented in Chapters 4 through 8) summarize the limiting factors for each recreation use area, and for the Sand Harbor Unit as a whole. Similar conclusions are provided separately for the Memorial Point Unit.

## 2.0 DATA COLLECTION FOR THE CAPACITY STUDY

In addition to the compilation and review of existing documents and data described in the previous chapter, this study included a substantial on-site data collection effort. This effort was focused on visitor counts and interviews, but also incorporated other data collection. A survey of current and former State Parks employees was also conducted. Resource specialists visited the study area to inspect facility capacity and condition, and to conduct a survey of resource conditions and recreation impacts on ecological resources. Lastly, a stakeholder consultation effort based on telephone interviews with Tahoe Basin agencies, organizations, and groups was conducted. Table 2-1 summarizes the various data collection components incorporated into this study.

**Table 2-1. Data Collection Conducted for the Capacity Study.**

<b>Data Collection Component</b>	<b>Purpose/Information Obtained</b>
Compilation of Existing Documents	LTNSP plans and related documents provide information on park development and resources and the historic background to capacity issues. Regional plans and related documents provide additional resource information and outline the regional managerial and regulatory environment within which the park operates.
Compilation of Existing Data	Provide quantitative information on current park visitation, vehicle traffic, staffing, revenue, and other important elements of park use and management that reveals trends in these indicators of park use and capacity management challenges.
On-Site Visitor Counts	Document current (2010) recreation use levels and characteristics in specific use areas, and variations by day of week and time of day.
On-Site Visitor Interviews	Document current (2010) visitor use patterns, characteristics, opinions, and concerns related to capacity issues.
Entrance Station Traffic Monitoring	Provide data on the number of vehicles and passengers at locations with mechanical traffic counters, allowing calibration of traffic counters and vehicle load factors used in park visitation estimates.
SR 28 Parked Vehicle Counts	Document the number of vehicles parking along the shoulders of SR 28 in the vicinity of the park due to limited on-site parking capacity.
Employee Survey	Provide information on employees' (past and present) perceptions of capacity issues and concerns at the park.
Facility Inspection	Document the capacity and condition of existing park facilities and infrastructure.
Ecological Resources and Impacts Survey	Document resource conditions at the park, including sensitive resources, and recreation use-related impacts on those resources.
Stakeholder Consultation	Share information about the study and solicit information and input on stakeholder issues and concerns related to the capacity issues.

A study kick-off meeting was held on May 13, 2010 at the Sand Harbor office. In attendance were several members of the park staff, along with the AECOM project manager and technical lead, and staff from the Great Basin Institute (GBI), who contracted with AECOM to perform on-site visitor counts and surveys and to assist with other study elements. AECOM and GBI presented preliminary plans for on-site data collection to support the capacity assessments. The half-day meeting provided the study team with the opportunity to discuss and learn more about the park’s resources and recreational use, park operations, and the issues and management challenges related to recreational capacity. Part of the afternoon was devoted to a walking tour of Sand Harbor to increase the study team’s familiarity with the park facilities. On-site protocols for GBI field data collection staff were discussed.

## 2.1 ON-SITE DATA COLLECTION PLAN AND INSTRUMENTS

The on-site survey schedule included 17 survey days between late May and early September, 2010; 11 of the survey days were weekends and holidays, and 6 were weekdays (Table 2-2). Each survey day, which began at 8 a.m. or 11 a.m. (or 10 a.m., see Table 2-2), included 8 hours of data collection with a 1-hour rest break. Survey times were intended to cover the majority of the daylight period when recreation activity occurred. (There is no overnight use at the Sand Harbor Unit.)

**Table 2-2. On-Site Survey (Visitor Count and Interview) Schedule.**

Day of Week	Date	Strata	Start Time (a.m.) <sup>1</sup>	End Time (p.m.) <sup>1</sup>
Mon	5/31/10	Holiday	11:00	8:00
Sun	6/13/10	Weekend	11:00	8:00
Wed	6/16/10	Weekday	8:00	5:00
Sun	6/20/10	Weekend	8:00	5:00
Fri	6/25/10	Weekday	11:00	8:00
Sat	6/26/10	Weekend	11:00	8:00
Sun	7/4/10	Holiday	8:00	5:00
Mon	7/12/10	Weekday	8:00	5:00
Sat	7/17/10	Weekend	8:00	5:00
Tue	7/20/10	Weekday	11:00	8:00
Sun	7/25/10	Weekend	11:00	7:00
Wed	8/4/10	Weekday	8:00	5:00
Sat	8/7/10	Weekend	8:00	5:00
Sun	8/8/10	Weekend	10:00	7:00
Sat	8/21/10	Weekend	8:00	5:00
Thu	8/26/10	Weekday	10:00	7:00
Mon	9/6/10	Holiday	10:00	7:00

<sup>1</sup> Beginning in August, 11:00 a.m. to 8:00 p.m. survey start/end times were changed to 10:00 a.m. to 7:00 p.m. to better coincide with visitation patterns (few visitors were found to be on site after about 7:00 p.m.).

Source: Compiled by AECOM

Three GBI surveyors were on site each survey day, with an additional senior GBI staff member present on several survey days for quality control. Surveyors followed a randomly selected survey site rotation at Sand Harbor, moving each hour between the four primary use areas: Main Beach, Family Picnic Area, Diver's Cove, and the Boat Ramp beach area. Each use area was thus surveyed twice each survey day. Upon arriving at a use area, the surveyor conducted an "instantaneous count" of visitors using the area and recorded the data on a standard form (the count form is provided in Appendix B). The visitor count was followed by interviews of visitors using the area.

Surveyors at the Main Beach also conducted visitor counts on the Nature Trail boardwalk. Memorial Point was also visited twice each survey day. It was not possible to interview every visitor or a member of each visitor group during the busy mid-day hours; therefore, a visitor/group selection interval (i.e., selection of every  $n^{\text{th}}$  visitor/group to interview) was randomly determined for each survey day to minimize potential survey bias. (The intervals used were every 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, or 5<sup>th</sup> visitor/group.)

Prior to the beginning of on-site data collection on May 31, 2010, State Parks reviewed and commented on the visitor interview form; the comments were reflected in the revised version of the survey forms used in the field. The two-page interview (front and back of one page) addressed several topics of interest, including:

- Description of the visitor and his/her past and present visits to the study area.
- Motivations for visit and importance of various aspects of the park.
- Perceptions regarding facility adequacy.
- Perceptions regarding quality and responses to crowding and related capacity problems.
- Perceptions regarding select other park issues/problems.
- Overall satisfaction with their experience during the current visit.

Spanish language interview forms were prepared for both Sand Harbor and Memorial Point, and GBI assigned Spanish-speaking interviewers several of the survey days. The interview forms are also provided in Appendix B.

The target survey sample size was 400 completed interviews. This number was selected to provide a statistical accuracy for the survey data of +/- 5 percent at a 95 percent confidence level. (This level of accuracy would mean that the survey responses would have a 95 percent likelihood of accurately representing the target population of Sand Harbor Unit visitors within +/- 5 percent of the true population value.)

Additional data collection performed by GBI surveyors included monitoring of vehicle traffic entering Sand Harbor at the Main Entrance and Boat Ramp booths, and entering

the Memorial Point parking area, with simultaneous monitoring of electronic traffic counters at those locations. Lastly, GBI surveyors counted parked vehicles on the shoulder of SR 28 in the vicinity of Memorial Point and Sand Harbor twice each survey day, usually once in the late morning or early afternoon and again in mid to late-afternoon.

After the on-site surveying was concluded, a meeting was scheduled with State Parks to review the survey samples and other data obtained and to discuss next steps. This meeting, held at Sand Harbor on October 27, 2010, also provided an opportunity for a second tour of Sand Harbor focused on a closer examination of potential impacts of recreation activity and facility issues. The AECOM biologist conducting the ecological capacity assessment participated in the meeting and tour. During early November, AECOM staff conducted field visits focused on obtaining data needed for the ecological and facility capacity assessments, using data collection forms developed for this study (see Appendices C and D). State Parks staff met with and assisted AECOM staff in the field.

## **2.2 SURVEY SAMPLES (VISITOR INTERVIEWS AND COUNTS) OBTAINED**

The following summarizes the number of visitor interviews and visitor counts completed during the 17 survey days. The GBI surveyors accomplished a very successful survey effort, with all survey and other data collection objectives met or exceeded and a generally good response to the interviews from visitors. Visitor refusals to interview requests were relatively few.

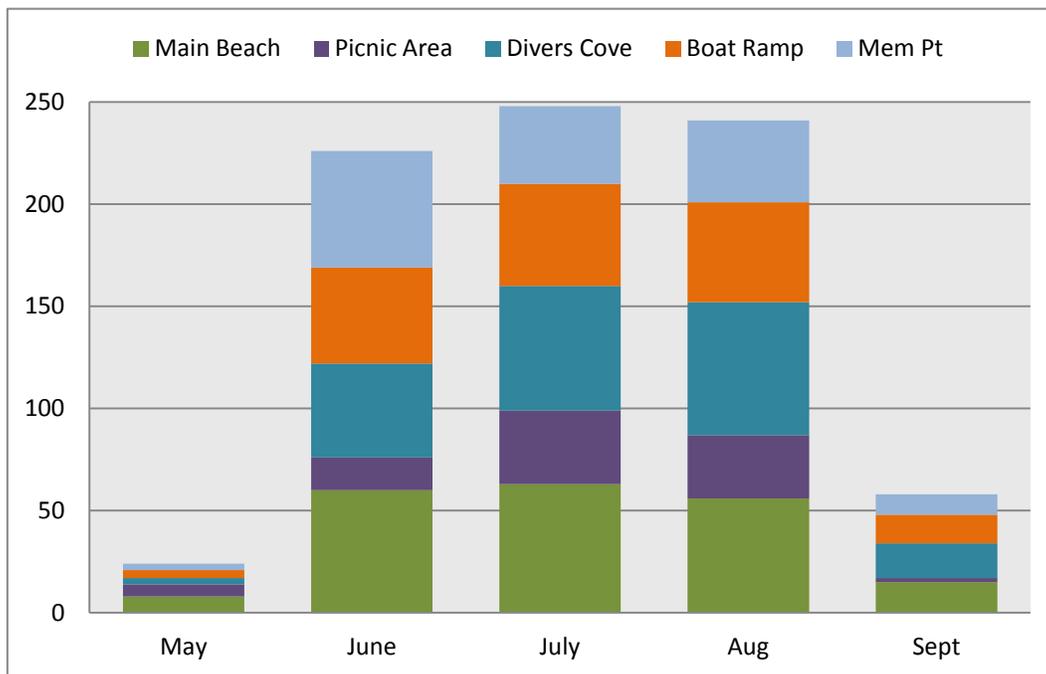
### ***2.2.1 Visitor Interviews Completed***

With the high use levels at Sand Harbor in 2010, GBI interviewers exceeded the target survey sample size of 400 visitor interviews; nearly 800 interviews were completed at Sand Harbor and Memorial Point (Table 2-3). The primary benefit of this doubling of the minimum desired sample is more robust samples for specific use areas at Sand Harbor than would have been obtained with fewer completed interviews, which increases the confidence in the results for those subareas. During each of the months of June, July, and August, about 225 to 250 visitor interviews were completed, about 170 to 210 at Sand Harbor and about 40 to 60 at Memorial Point (Table 2-3, Figure 2-1). About 20 interviews were completed at Sand Harbor in May (on the Memorial Day holiday, with cool weather conditions), and about 60 were completed at the two areas in September (on the Labor Day holiday).

**Table 2-3. Visitor Interviews Completed by Use Area and Month (May – Sept. 2010).**

Use Area	May <sup>1</sup>	June	July	Aug	Sept <sup>2</sup>	Total
<b>Sand Harbor</b>						
Main Beach	8	60	62	55	15	<b>200</b>
Family Picnic Area	6	17	36	32	2	<b>93</b>
Diver's Cove	3	46	60	65	17	<b>191</b>
Boat Ramp	4	47	49	49	14	<b>163</b>
<i>Subtotal</i>	<b>21</b>	<b>170</b>	<b>207</b>	<b>201</b>	<b>48</b>	<b>647</b>
<b>Memorial Point</b>	0	57	38	40	10	<b>145</b>
<b>Total</b>	<b>21</b>	<b>227</b>	<b>245</b>	<b>241</b>	<b>58</b>	<b>792</b>

<sup>1</sup> One survey day was scheduled in May, on the Memorial Day holiday. Park use was low due to cool weather. Interviews were not conducted at Memorial Point that day.  
<sup>2</sup> One survey day was scheduled in September, on the Labor Day holiday.  
 Source: Compiled by AECOM.



**Figure 2-1. Sand Harbor and Memorial Point Visitor Interviews Completed by Month.**

### 2.2.2 Visitor Counts Completed

In total, 21 or 22 weekend and holiday visitor counts were conducted at each Sand Harbor use area and at Memorial Point. From 3 to 6 visitor counts were conducted at each Sand Harbor use area during most of the 2-hour time blocks between 8 a.m. and 8 p.m., as shown in Table 2-4. The fewest counts were conducted during the last 2 hours of the day, by which time most visitors had left. After it was observed that the number of visitors at Sand Harbor declined quickly after about 5 p.m., the schedule was revised so

that survey days which were scheduled for 11 a.m. to 8 p.m. would instead be scheduled from 10 a.m. to 7 p.m., with the last visitor counts conducted at 6 p.m.

**Table 2-4. Weekend and Holiday Visitor Counts Completed by Use Area and Time of Day.**

Use Area	8-10 a.m.	10-12 a.m.	12-2 p.m.	2-4 p.m.	4-6 p.m.	6-8 p.m.	Total
<b>Sand Harbor</b>							
Main Beach	2	5	5	3	5	1	<b>21</b>
Family Picnic Area	5	2	6	3	4	1	<b>21</b>
Diver's Cove	3	5	2	6	4	1	<b>21</b>
Boat Ramp	2	4	5	5	4	2	<b>22</b>
Nature Trail	4	2	6	4	4	1	<b>21</b>
<b>Subtotal</b>	<b>16</b>	<b>18</b>	<b>24</b>	<b>21</b>	<b>21</b>	<b>6</b>	<b>106</b>
<b>Memorial Point</b>	2	4	5	6	5	0	<b>22</b>
<b>Total</b>	<b>18</b>	<b>22</b>	<b>29</b>	<b>27</b>	<b>26</b>	<b>6</b>	<b>128</b>

*Source: Compiled by AECOM.*

Fewer visitor counts were possible during the six weekday survey days. In total, 12 weekday visitor counts were conducted at each use area (two each survey day), with the exception of at the Nature Trail, as shown in Table 2-5. At most use areas, a total three to five counts were conducted during one morning, midday, and/or afternoon time periods, with one or two additional counts conducted during the intervening periods of the day. Although the weekday count sample is small, the data are sufficient to provide a relative comparison with weekend and holiday use levels, which are more critical to the capacity analysis.

Results of the visitor surveys are reported in the capacity assessments throughout the remainder of this report.

**Table 2-5. Weekday Visitor Counts Completed by Use Area and Time of Day.**

Use Area	8-10 a.m.	10-12 a.m.	12-2 p.m.	2-4 p.m.	4-6 p.m.	6-8 p.m.	Total
<b>Sand Harbor</b>							
Main Beach	3	1	4	0	4	0	<b>12</b>
Family Picnic Area	2	1	4	2	1	2	<b>12</b>
Diver's Cove	0	5	0	5	1	1	<b>12</b>
Boat Ramp	1	3	3	2	2	1	<b>12</b>
Nature Trail	1	2	2	3	1	1	<b>10</b>
<b>Subtotal</b>	<b>7</b>	<b>12</b>	<b>13</b>	<b>12</b>	<b>9</b>	<b>5</b>	<b>58</b>
<b>Memorial Point</b>	1	4	2	3	2	0	<b>12</b>
<b>Total</b>	<b>8</b>	<b>16</b>	<b>15</b>	<b>15</b>	<b>11</b>	<b>5</b>	<b>70</b>

*Source: Compiled by AECOM.*

Visitor interview forms were coded and entered into a spreadsheet database for analysis. Visitor count data were also entered into a spreadsheet database for analysis. These data were subject to Quality Assurance/Quality Control (QA/QC) procedures, including review of the data obtained, focusing on consistency between survey and count data forms and the resulting database.

## 2.3 EMPLOYEE SURVEY

The intent of the employee survey was to take advantage of the “close-to-the-ground” perspective and substantial individual and collective experience of the employees, most of whom have several years of experience at Sand Harbor. The survey was sent to the LTNSP Park Supervisor to distribute to current permanent and seasonal staff at Sand Harbor, and was also sent to State Parks administrators in Carson City, and some previous Sand Harbor staff. Responses to the survey were anonymous. The 3-page survey included 15 questions related to a range of park management and capacity issues at Sand Harbor (the survey form is provided in Appendix B). Most of the questions were presented in an open-ended format (rather than providing response choices) to allow respondents the best opportunity to express their opinions on the complex topics addressed and thus maximize the richness and value of the information obtained. A total of 25 surveys were returned, including from eight current permanent staff at Sand Harbor, 13 seasonal staff members, two State Parks administrators, and two former Sand Harbor staff members.

## 2.4 STAKEHOLDER CONSULTATION

AECOM prepared a preliminary list of 17 local, regional, and state organizations and agencies to consider for inclusion in stakeholder consultations, with notes outlining their potential interests in the study and the issue of recreation capacity at Sand Harbor. The list prioritized those entities as high, medium, or low based on their expected level of interest. The list was reviewed by State Parks and discussed at a meeting at Sand Harbor, with the result that 10 organizations and agencies were considered as “high priority” based on their expected high level of interest and potential effect of the study on resources under the agencies’ jurisdiction or responsibility. These included two state, three regional (Tahoe Basin), and five local entities.

Each entity on the stakeholder list was contacted by phone. A representative of each of the agencies and organizations who responded to the initial phone contact was e-mailed a summary document outlining the purpose of the interviews, the objectives of the capacity study, its deliverables, and a study timetable prior to the scheduled phone call to help the representative prepare for the interview. In response to recommendations made during interviews, three additional local and regional entities and an individual associated with two of the originally identified stakeholder entities were consulted. All but two of the entities on the stakeholder list responded to the consultation request. In all, 19 stakeholder representatives were interviewed.

A log was kept of all phone calls, and written summaries were prepared of the resultant stakeholder interviews. Based on the information collected during the calls and any documents received, a determination was made as to the need for follow-up calls or face-to-face meetings. Follow-up contacts were made with all stakeholders interviewed to thank them for their participation, keep them informed of progress, and answer any additional questions. No face-to-face meetings were required. A summary of the stakeholder consultation conducted, and the results of the consultations, is provided in Appendix L. New information provided by stakeholders, as well as their concerns and suggestions regarding capacity management, was integrated into the capacity analysis where appropriate, and used in formulating capacity management recommendations provided in the final chapter of the study report.

## 3.0 EXISTING CONDITIONS

This section describes the facilities available to support recreation use at Sand Harbor and Memorial Point, the characteristics of visitors and their visits to the area, current and historical use levels within the study area, and the general conditions of natural resources within the study area.

### 3.1 RECREATION FACILITIES IN THE STUDY AREA

The following inventory of recreation facilities within the Sand Harbor Unit is drawn from information presented in the 2003 LTNSP Interpretive Plan (State Parks 2003), updated and supplemented with information available from more recent park plans and the park website, and from AECOM on-site observations.

#### 3.1.1 Sand Harbor Area

Visitors may access the facilities at Sand Harbor via two entrances (Figure 3-1, *Sand Harbor Site Map*). The main entrance to Sand Harbor can be accessed by either north or southbound traffic on SR 28 via turn lanes. Visitors are greeted in the summer months at a fee booth just inside the main gate. The boat launch entrance is one-tenth of a mile north of the main entrance and is also accessed by north and southbound turn lanes. Here, the road winds down to a fee booth that is staffed in the summer. Instructions to self-pay are posted during the off-season at each entrance. (A third entrance at the south end of the park is barred by a locked gate and used only in case of emergency or other special circumstance.) There are about 530 unrestricted and handicap general access vehicle parking spaces within the portion of the Sand Harbor area accessible via the main entrance. (The precise number of spaces available depends on whether spaces signed “compact car only” and spaces temporarily reserved for Shakespeare Festival staff are included. Additional spaces were occupied by dumpsters during this study). A gated lot provides parking reserved for the Group Use Area. The Boat Ramp area provides additional parking for vehicles with boat trailers, and several spaces are reserved for vehicles with car-top boats (e.g., kayaks).

#### Main Beach

The main attraction for most Sand Harbor visitors is the 2,500-foot stretch of sandy beach on the south side of the peninsula (Figure 3-1). The beach is narrow, about 100 to 150 feet wide when lake levels are low and with progressively less width as lake levels rise. The beach is primarily open sand, but a few large “sentinel” pine trees remain and are important visual elements of the scenic beach setting. An elevated life guard station is at the center of the beach, and two lifeguard chairs are spaced along the length of the beach.

Two large parking areas serve the Main Beach. The main parking area (the lot closest to the main entrance) has 300 parking spaces (12 handicap), not including two spaces occupied by dumpsters at the time of this study and one “compact car only” space.



Source: NSP 2011

Fig. 3-1. Sand Harbor Site Map



**Figure 3-2. Sand Harbor Main Beach and Walkway.**

The south parking lot has 211 parking spaces (6 handicap), not including three spaces occupied by dumpsters at the time of this study and one “compact car only” space. An additional 21 spaces (one handicap) are provided adjacent to the road between the main and south parking lots. The main lot is also the location of an interpretive kiosk and restrooms with coldwater showers, at the north and south ends of the lot near the beach. The south lot has two restrooms with coldwater showers near the beach.

(The main lot also serves the Visitor Center and restaurant concession building. Both lots provide direct access to the Family Picnic Area as well as the Main Beach, and are used by visitors to Diver’s Cove and the Boat Ramp beaches.) Paved walkways run along the beachside edge of the parking lots and at the landside margin of the beach between the two lots (Figure 3-2). A branch of the walkway extends from the southernmost restroom to the south end of the beach. Three concrete overlook platforms extend onto the beach from the main lot. On several occasions during the 2010 season, an estimated 1,000 to 1,300 people were observed using the beach at one time.

### **Family Picnic Area**

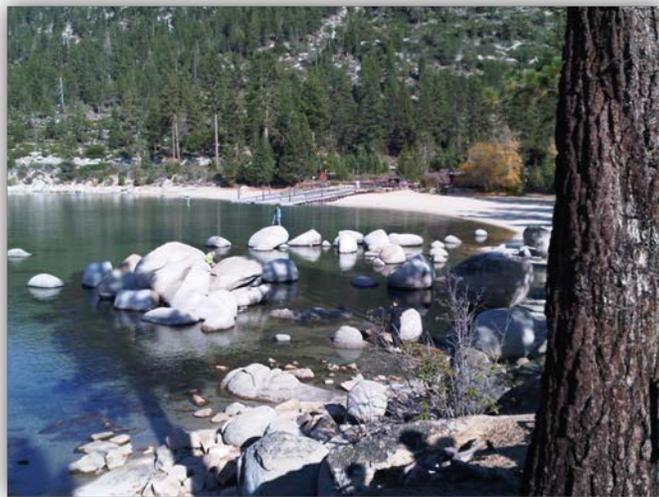
The Family Picnic Area is south of the main entrance (Figure 3-1). It is accessible by foot from all parking areas, and is in an open forest setting with many large pines and cedars. There are 57 picnic tables (some picnic sites provide more than one table), two restrooms, several bear-proof garbage and recycling receptacles, and hot coal safety enclosures in this area. Each picnic site has a grill. A paved pathway winds through the area, connecting the picnic sites. In addition to the parking available in the main lots, a smaller parking area is alongside a segment of road that connects the north and south lots. The picnic area is heavily used in the summer months, particularly on holidays. Over 500 people were counted in the Family Picnic Area during the afternoon of the July 4, 2010 holiday.

### **Group Use Area**

One-tenth of a mile west of the fee booth is the Group Use Area and pavilion (“ramada”) (Figure 3-1). Use is by reservation only; the facility can be reserved for \$200 on weekdays and \$400 on weekends and holidays. Information provided with the reservation form states that the area can comfortably accommodate 120 people, but larger groups can be served with special arrangements. The ramada was upgraded a few years ago with a new counter surface and improved access to comply with the Americans with Disabilities Act (ADA). There is a sink with running water, granite counter, a large barbeque (BBQ) and fire pit, and 12 picnic tables. The area has good views of Lake Tahoe and easy access to Diver’s Cove. There are 26 parking spaces (two handicap) in a gated lot, a restroom, and garbage/recycling receptacles at this location. The Group Use Area is in constant demand for weddings and other events and remains reserved throughout most of the summer. During both June and July 2010, nearly 30 groups reserved the area, and from 1,000 to 2,000 people used the area each month between June and September.

### **Boat Ramp Area**

The Boat Ramp area provides a four-lane boat ramp with three boarding docks, 59 vehicle-trailer parking spaces, and 16 vehicle spaces (intended for use by car-top boaters, such as kayakers) (Figures 3-1 and 3-3). Just past the entrance station is a Nevada State Historic Marker displaying the story of Walter Scott Hobart and the Sierra Nevada Wood and Lumber Company, which formerly occupied the site. The Boat Ramp area also has a restroom, a bulletin board, and trash/recycling receptacles. The narrow strips of beach on each side of the Boat Ramp are popular with boaters and swimmers alike, who clamber on the large boulders in the shallow cove. Kayak and paddle board launching from the beaches is increasingly common.



**Figure 3-3. Boat Ramp Area Viewed from Ramada Point.**

Normal boat launch hours during the summer (May through September) are 6 a.m. to 8 p.m. Ramp hours vary the remainder of the year based on water levels and staffing considerations. The ramp is often closed in the fall and winter months (and sometimes in the late summer as well) when the lake levels are low. (The ramp closed August 5th in 2009 and September 7th in 2010.) Plans are under development to extend the ramp to enable use of the ramp during lower water levels, as are parking area improvements (State Parks 2008). State Parks has also investigated dredging a channel between the ramp and deeper water, but no practical solutions have been identified.

This area is heavily congested during the summer months, and the parking lot fills to capacity daily during July and August. Since November 2008, boaters have been required to have an aquatic invasive species inspection of their boat at the ramp area prior to launching, which contributes to congestion. Inspection records indicate that over 4,400 boat launches occurred in 2010. Boaters are given the option to “Launch and Leave” under capacity conditions, at which time a reduced fee is collected and the vehicle and trailer must be parked outside the park. Several times during the 2010 summer season, approximately 250 to 350 people were counted on the Boat Ramp area beaches and in adjacent areas of the water at one time.

### **Diver’s Cove**

Diver’s Cove is situated on the shore adjacent to the Group Use Area/pavilion and between Sandy Point to the south and Ramada Point to the north (Figures 3-1 and 3-4). The cove features several large boulders partially submerged in the shallow water, and a few acres of beach area (depending on water levels) between the two points, providing a more enclosed beach setting than the Main Beach. Scuba divers, including organized classes and groups, often use this area to enter and exit the water. Paved walkways connect the area to the Boat Ramp and Main Beach areas. A restroom is nearby, at the adjacent Group Use Area. During the 2010 summer season, as many as 200 to 300 people were counted at one time at Diver’s Cove.



**Figure 3-4. Diver's Cove Viewed from Ramada Point.**

### **Sandy Point Nature Trail**

In 1995, a volunteer organization built the Sandy Point Nature Trail and installed boardwalk along the entire 1,500 feet to make it more accessible to visitors. Kiosks were added and existing interpretive signs improved. Today, there are three kiosks and six interpretive signs along the trail. Trail users can stop at several overlooks with views of Diver's Cove, the Main Beach, and other vistas (Figure 3-1). The trail provides access to the west end of the Main Beach and links to the large main parking lot. A restroom is convenient to the trail. From 30 to 60 people were counted on the boardwalk on several occasions during the 2010 summer season.

### **Shakespeare Festival Theatre Stage Area**

The Shakespeare Festival at Sand Harbor has been a summer tradition since the 1970s. In 1996, a long-term contract was signed between the festival, now a non-profit organization, and State Parks. As part of the agreement, the Lake Tahoe Shakespeare Festival constructed a state-of-the-art stage facility entirely from private funds. The Warren Edward Trepp Stage, built at a cost of nearly \$2 million, was dedicated on July 15, 2000. It is 60 feet long by 30 feet wide and stands 3 feet above the lower level of the amphitheatre. It includes dressing rooms below, four light towers, and a sound system. The amphitheatre is a sand bowl where attendees sit on beach chairs or blankets during performances, and can hold up to 1,200 people at one time (Figure 3-1).

The festival is an established cultural institution at Sand Harbor and saw continued growth for several years, before dips in attendance in recent years; from 25,000 to 30,000 people attend the festival each year (MacMillan, K. 2010). Attendees have the option of using a shuttle service from Reno or Incline Village, rather than driving personal vehicles to the park. The 38th annual festival took place from July 9 through August 22, 2010 (LakeTahoeShakespeare.com 2010). Performances began at 7:30 p.m., after most beach goers and other park visitors had left. (Some theatre patrons, however, arrive several hours before the performance, and may encounter parking limitations while many beach goers remain at the park.)

### **Visitor Center and Concession**

The 5,000 square foot Sand Harbor Visitor Center, Gift Shop, and concession building is a handsome pole-framed structure, constructed at a cost of over \$5 million and opened in 2007. The structure is adjacent to the main parking lot, Sandy Point Nature Trail, and Group Use Area (Figures 3-1 and 3-5). The center provides interpretive displays regarding Lake Tahoe's natural and cultural history as well as administrative offices, a gift shop/snack bar, and a restaurant ("Char-Pit Sand Harbor") with an outdoor deck. The building is ADA accessible. Until August 8, 2010, the gift shop was operated by the non-profit Nevada State Parks Cooperative Association (NSPCA) and was open full time during the summer. (With the subsequent dissolution of the NSPCA, the gift shop was closed for the remainder of the season and the Visitor Center was open only part time. It is anticipated that the gift shop and beach store will re-open in the spring of 2012 and be

operated by State Parks.) The restaurant is operated by a concessionaire and is open from 10 a.m. to 6 p.m., seven days a week from Memorial Day weekend through Labor Day weekend. Operating times may vary according to visitation levels.



**Figure 3-5. Visitor Center and Concession Building.**

### **Park Operations Area**

To the north of the fee booth are the park office, maintenance shop, main sewage lift station, and maintenance yard (Figure 3-1). All park operations are based in this area. Several shop and office facility renovations and improvements have been completed in recent years.

#### ***3.1.2 Memorial Point***

Memorial Point, 1 mile north of Sand Harbor, is a roadside pull-out with 28 parking spaces (2 handicap) accessible from both the north and south directions of the highway. It is primarily used by travelers along the scenic highway who stop to rest or take photos. The site offers fine views of Lake Tahoe, a trail to its rocky shoreline, and a restroom. There are interpretive panels near the parking area and along the trail. Although as many as 44 people at one time were counted at Memorial Point during the 2010 summer season, more typical counts were 20 to 30 people. (Given that the parking area was often full during the peak use counts, it is likely that additional visitors were in the restrooms and using the shoreline, where they were difficult to observe. Sand Harbor visitors also frequently park at Memorial Point but would not have been present to count.) Figure 3-6 depicts the lake view enjoyed by visitors to Memorial Point from a vantage point along the trail.



**Figure 3-6. Memorial Point Lake View, Showing Trail and Interpretive Sign (in the background in front of the visitor).**

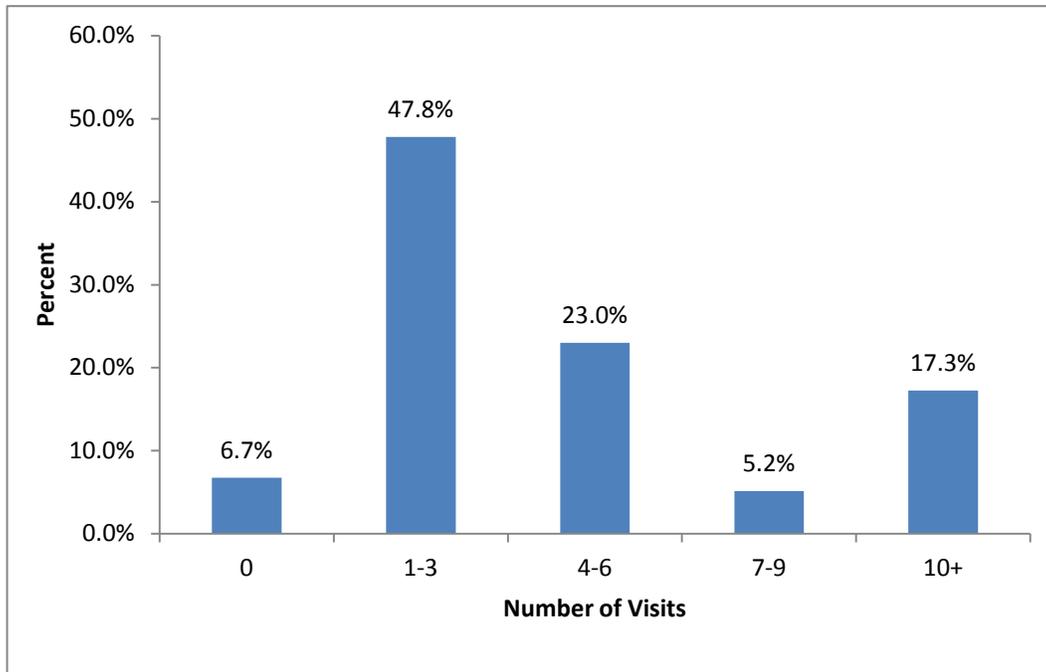
## **3.2 VISITOR AND VISIT CHARACTERISTICS**

The following information is drawn from the 647 visitor responses to the survey conducted for this study at Sand Harbor during summer 2010 (Appendix E provides detailed survey response frequencies and other statistics as well as categorized and verbatim responses to open-ended questions). A summary of the survey data from the 145 visitors surveyed at Memorial Point, which included a subset of the questions asked at Sand Harbor, is provided in Appendix F (Memorial Point survey response frequencies and other details are provided in Appendix E, following the Sand Harbor survey response data).

### ***3.2.1 Return Visitors and Frequency of Visits***

Most visitors to Sand Harbor are return visitors. About 85 percent of those surveyed had visited the park before, while only 15 percent were first-time visitors.

Sand Harbor visitors tend to be fairly regular users of the park. Although the greatest percentage of return visitors had visited one to three times during the previous 12 months (Figure 3-7), on average, return visitors had made about five visits during the previous 12 months. Only about 7 percent had not been to the park in the past 12 months, while nearly one-quarter (22 percent) had visited more than half a dozen times in that period. A minority consisting of very frequent visitors (about 6 percent of the total) had been to the park from 20 to 60 times in the past 12 months.



**Figure 3-7. Return Visitors' Frequency of Visits (past 12 months).**

### **3.2.2 Means of Access to Park/Number of Vehicles Used**

The majority of visitors to Sand Harbor drive themselves or their group to the park and park on site. Nearly 96 percent of surveyed visitors to Sand Harbor used a personal vehicle to enter the site. About 2 percent of those surveyed walked in (presumably, after parking along SR 28), and approximately 1 percent arrived by bus or group van. Less than 1 percent in total were dropped off or bicycled to Sand Harbor. (Data from the main entrance booth indicate that several hundred walk-in passes are sold on many summer days. Accounting also for walk-ins who do not pay, it is estimated that walk-ins may account for as much as 10 percent of attendance at certain peak use times. This suggests that some walk-in visitors misunderstood the survey question, thinking “walk-in” did not apply to them if they parked along SR 28. Perhaps others did not want to reveal that they walked when they did not pay the entrance fee, and checked the “personal vehicle” response.)

Sand Harbor visitors commonly come to the park as part of a multiple-vehicle group. Although slightly more than half of the visitors surveyed came in a group transported in just one vehicle, about 47 percent used more than one vehicle (Figure 3-8). Furthermore, those groups that came in more than one vehicle used an average of three vehicles to come to the park. A small minority of groups (less than 5 percent) used six or more vehicles.

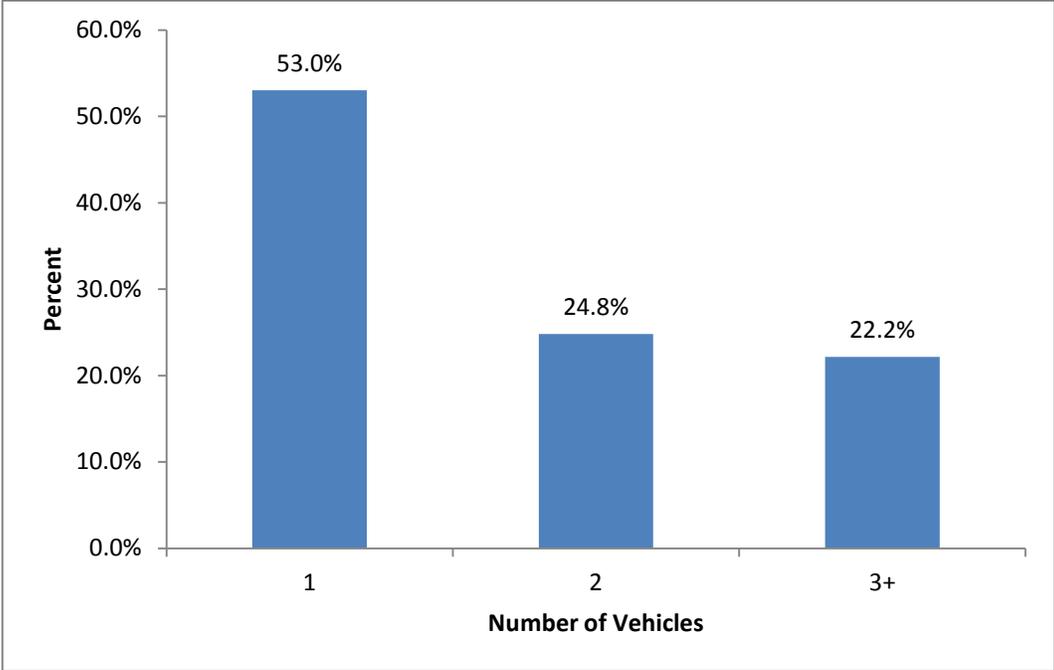


Figure 3-8. Number of Vehicles Used by Groups to Come to Sand Harbor.

**3.2.3 Group Size**

Large groups are the norm at Sand Harbor. Although nearly half of those surveyed were in groups of up to five people, slightly more than half were in groups of more than five (Figure 3-9). The average group size was approximately eight (7.9), while the mean group size was six.

**3.2.4 Length of Visit**

Most visits to Sand Harbor last at least a half day and many last the full day. The most common length of time visitors planned to spend at Sand Harbor the day they were surveyed was in the range of 4.5 to 6.0 hours, and more than two-thirds of visitors were planning to be on site more than 4 hours (Figure 3-10). On average, visitors reported spending about 5.5 hours at the park. Visitor responses ranged from 0.5 to 16 hours, with a median of 5 hours.

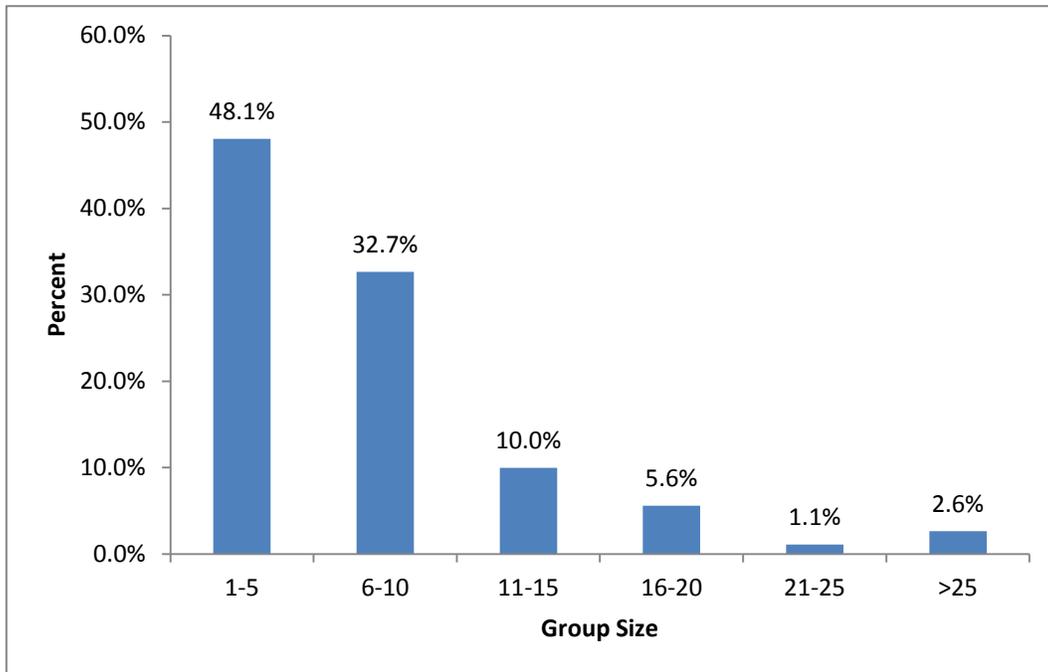


Figure 3-9. Group Size at Sand Harbor.

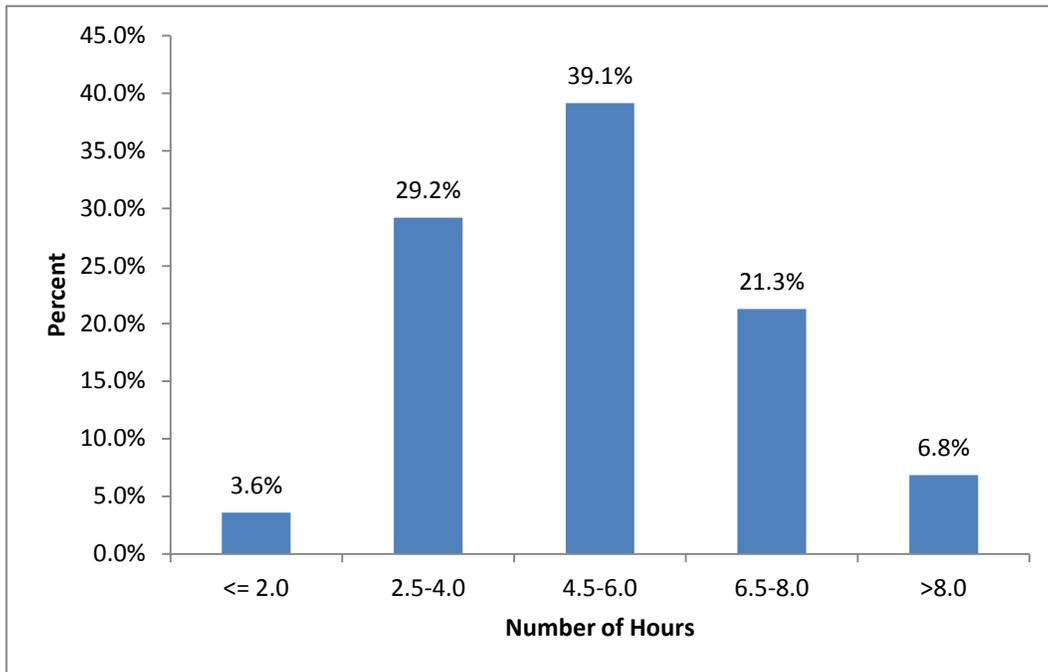


Figure 3-10. Length of Visits to Sand Harbor.

### 3.2.5 Visitor Origin

Nevada residents make up the majority of Sand Harbor visitors, and most of the remaining visitors are California residents. Based on their home postal Zip Code, visitors from Nevada accounted for nearly two-thirds of the visitors surveyed, while California residents accounted for about one-third, excluding foreign visitors (Figure 3-11). Nearly half of the Nevada residents were from the park's home county of Washoe, and nearly all of the remainder resided in Carson City and adjacent counties. The California residents primarily came from the San Francisco Bay area (51 percent) and Sierra foothill and Central Valley counties to the west of Lake Tahoe (33 percent). About 5 percent were from Southern California counties and other areas of the state.

Six percent of the visitors surveyed came from one of 18 states other than Nevada or California, with states in all regions of the country generally represented. Foreign visitors accounted for about 1 percent of the total.

### 3.2.6 Recreation Activities

Given its beach setting, Sand Harbor visitors are focused on four primary activities: resting/relaxing, swimming, sunbathing, and picnicking. Of the 13 activities listed on the survey form (plus "other", which respondents could write in), these were the only four that a majority participated in during their visit. About three-quarters to over 90 percent of visitors participated in these activities (Figure 3-12). No other activity was participated in by more than 13 percent of visitors<sup>3</sup>. Visitors were also asked to indicate their primary, secondary, and third activities; the same four activities accounted for more than 80 percent of the primary activities, and these were also the most commonly listed as secondary or third activities. Sightseeing was also a common activity with 40 percent participating, but only 3 to 7 percent listed it as one of their "top three" activities. No other activity accounted for more than 5 percent of primary activities.

A variety of responses was written in by the 16 percent of visitors who mentioned an "other" activity, most of which were commonly observed activities associated with beach and water activities. Popular examples included jumping off and climbing on rocks, catching crawdads, playing in sand, and snorkeling.

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<sup>3</sup> Visitor surveys conducted at the Boat Ramp area focused on the beach areas rather than the boat ramp itself. Boaters who launched at Sand Harbor but did not use the Boat Ramp beaches would have had less opportunity to be surveyed. Therefore, participation in boating activity other than kayaking is low in the sample population.

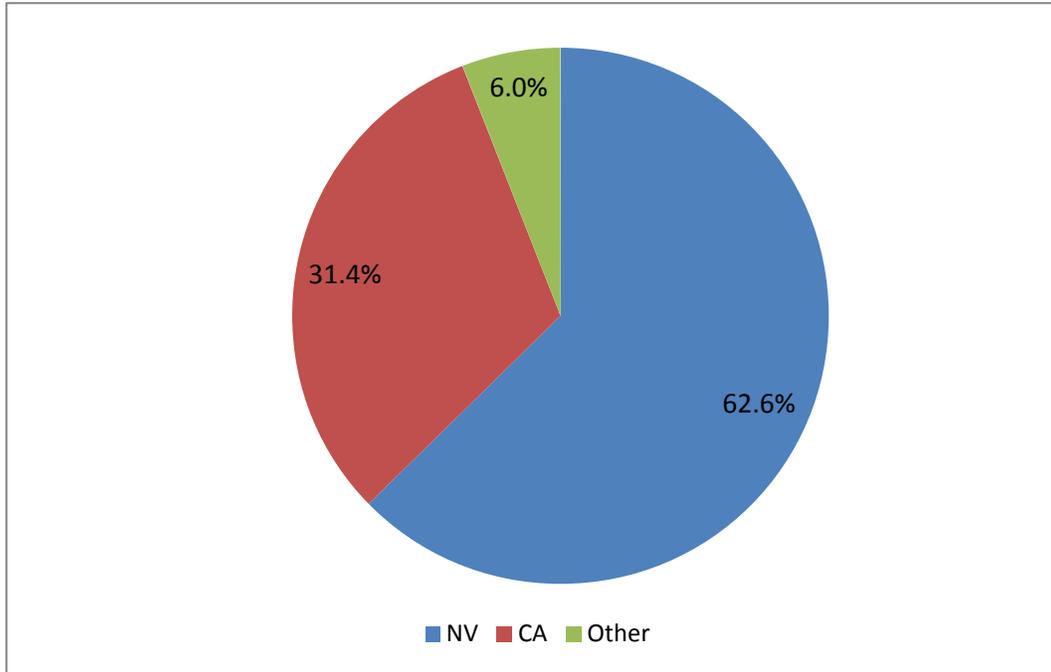


Figure 3-11. Home State of Sand Harbor Visitors.

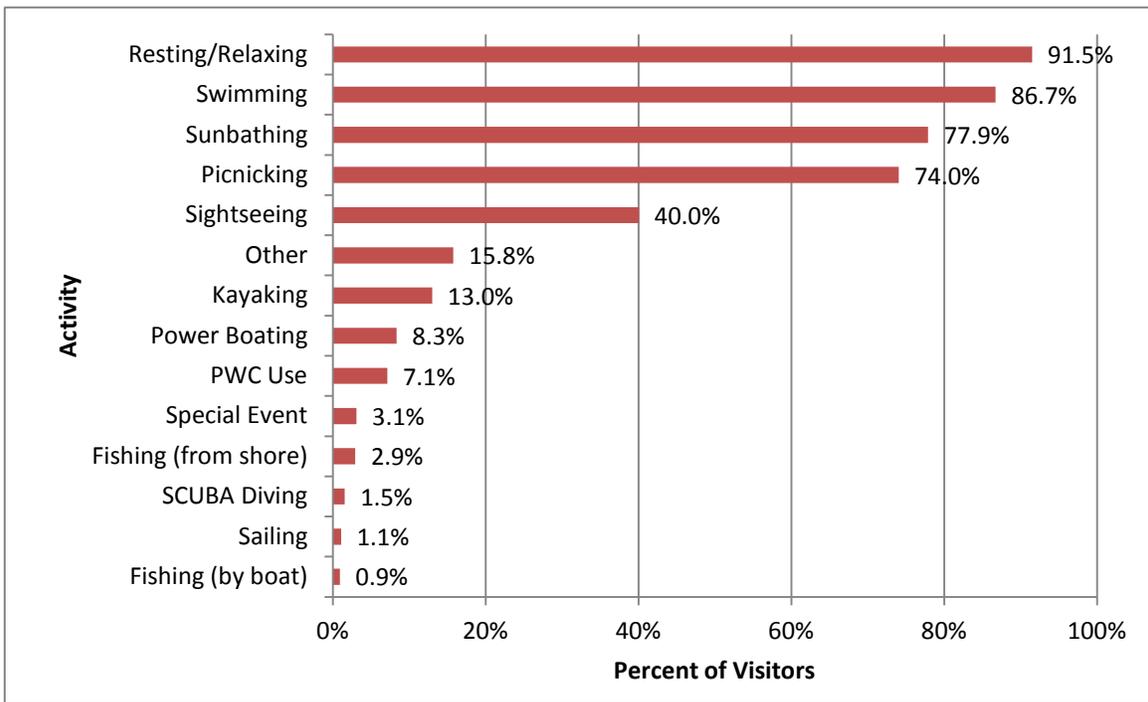


Figure 3-12. Activities Participated in by Sand Harbor Visitors.

### 3.3 OVERALL PARK USE LEVELS

Information on overall Sand Harbor and Memorial Point use levels is available from data collected by State Parks staff and by mechanical traffic counters at the two entrance stations at Sand Harbor and via a traffic counter at Memorial Point.<sup>4</sup> State Parks Monthly Statistical Reports provide monthly attendance data for 2010 (Statistical Reports for 2008 and 2009 were also provided by State Parks). Historical records provide annual attendance figures for the Sand Harbor Unit in total, which includes both the Sand Harbor and Memorial Point areas. Annual attendance data for the past 10 years (2000–2009) were provided by State Parks.

#### 3.3.1 2010 Entrance Station/Vehicle Counter Data

The 2010 data from the two Sand Harbor entrance stations indicate that use levels increased only slowly in June from the modest late spring use levels, but then rose steeply to nearly 180,000 visitors in July and nearly 150,000 visitors in August (Table 3-1, Figure 3-13). Spring and fall “shoulder-season” use levels were in the 10,000 to 20,000 visitors per month range. Use levels at Memorial Point followed a similar pattern, although the summer use levels peaked at a much lower 42,000 to 46,000 visitors in July and August.

**Table 3-1. 2010 Sand Harbor Unit Attendance.**

Month	Sand Harbor	Memorial Point <sup>1</sup>	Total
January	3,744	8,575	12,319
February	6,635	11,785	18,420
March	11,195	17,573	28,768
April	15,971	18,964	34,935
May	21,806	21,880	43,686
June	68,432	33,250	101,682
July	177,729	46,225	223,954
August	148,062	42,313	190,375
September	22,582	20,883	43,465
October	11,133	14,690	25,823
November	4,263	8,284	12,547
December	4,734	10,876	15,610
<b>Total</b>	<b>496,286</b>	<b>255,298</b>	<b>751,584</b>

<sup>1</sup> Memorial Point data also include Hidden Beach, which typically has low use levels relative to Sand Harbor, based on visual State Parks estimates.  
Source: State Parks data (2010 Monthly “ADM 27” Statistical Reports for Sand Harbor Unit).

<sup>4</sup> Surveyors collected people-per-vehicle and other traffic-related data at each of these locations on each of the 17 survey days. The primary purpose was to provide a check on vehicle occupancy factors used by State Parks in estimates of Sand Harbor Unit attendance. A summary and analysis of these data are provided in Appendix M.

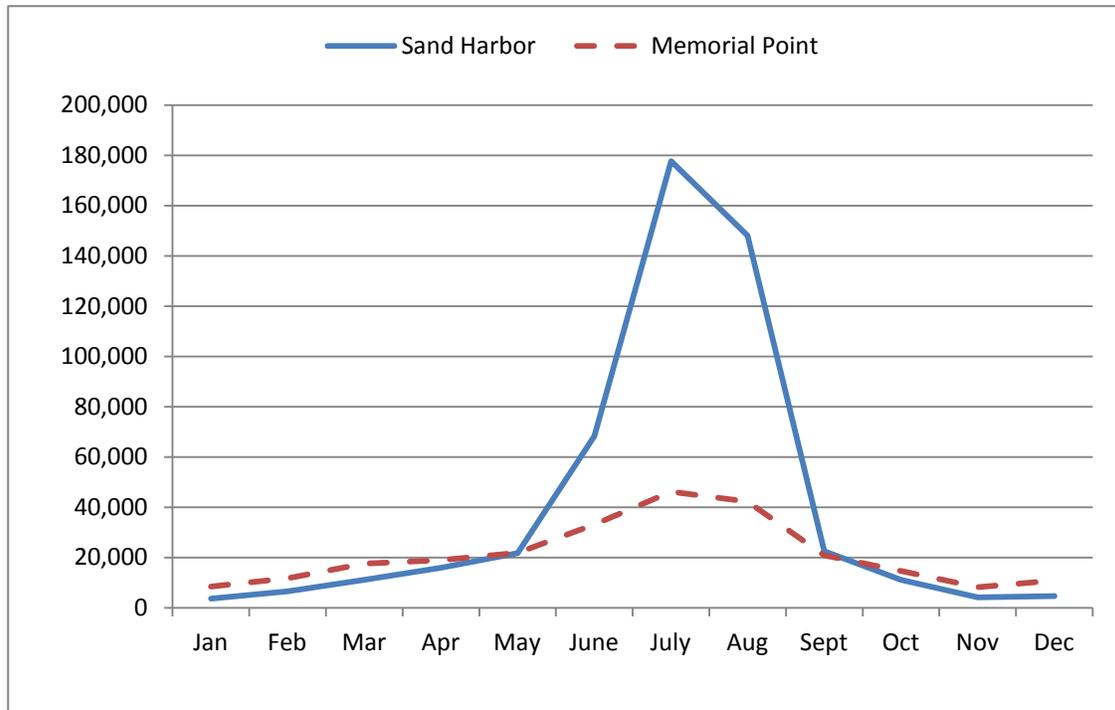
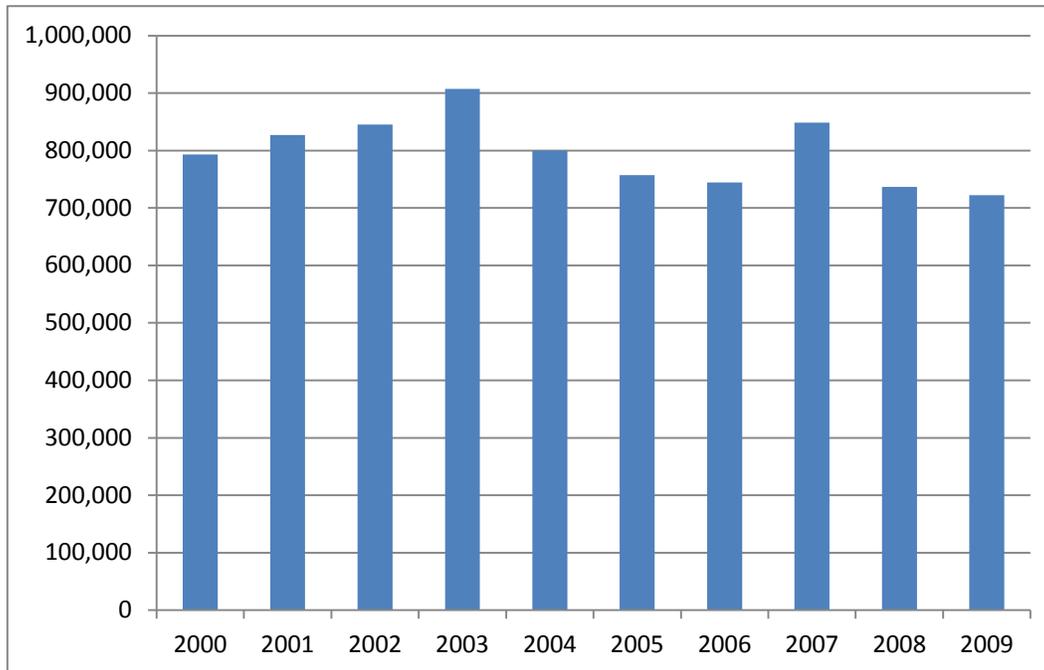


Figure 3-13. 2010 Sand Harbor and Memorial Point Attendance.

### 3.3.2 Historical Attendance Data and Projected Attendance

The historical attendance data indicate that annual attendance at the Sand Harbor Unit has fluctuated between about 700,000 and 900,000 visits over the 10 years prior to the 2010 study season (Figure 3-14). The peak year within that period was 2003, with just over 907,000 visits, and the low year was 2009, with just over 722,000 visits. The 2009 attendance represents about a 20 percent drop from the 2003 high. Many factors can influence annual attendance including economic conditions, weather (e.g., cool or wet late spring/early summer), regulation and fee changes, and lake levels (i.e., low lake levels result in late opening and early closing of the boat ramp, but result in wider beaches and thus more beach space to accommodate visitors). Lane closures associated with several weeks of construction on SR 28 also reduced attendance in 2009.

Specific attendance projections are not available for LTNSP or Sand Harbor, and potential projections are complicated by economic uncertainty. The Nevada State Demographer's Office projects that Washoe County, Carson City, and Douglas County (which together comprise the home county of nearly 60 percent of Sand Harbor visitors surveyed) may lose a few percent of their population over the next few years, although under an optimistic "high job growth" scenario, Washoe County is projected to gain 4 percent in population over the next decade (Nevada State Demographer's Office 2010). This is following a decade in which the population of Washoe and Douglas counties and Carson City increased 24 percent, 14 percent, and 5 percent, respectively (U.S. Census Bureau 2010).



Note: Attendance data include both the Sand Harbor and Memorial Point areas. Hidden Beach use levels are included in the Memorial Point estimates, but comprise a small percentage of the total attendance figure. Source: State Parks data (LTNSP Attendance Summary Tables).

**Figure 3-14. Sand Harbor Unit Annual Attendance, 2000–2009.**

State and regional recreation participation and visitation data are also relevant to potential future attendance at Sand Harbor. Nevada's 2003 SCORP ranked several of the most popular activities at Sand Harbor (such as swimming, picnicking, visiting a beach, family gatherings, and viewing/photographing natural scenery) among the most popular activities among Nevadan's, based on statewide and national outdoor recreation surveys. In addition, participation by Nevadans in each of these activities was projected to increase (State Parks 2004). Based on USFS National Visitor Use Monitoring (NVUM) estimates, annual visits to the Lake Tahoe Basin Management Unit (LTBMU) increased 9 percent between 2001 and the most recent surveys in 2005 (USFS 2002, TRPA 2007b). The current projection from the NVUM analysis is an increase of 1.6 percent per year, or 50,000 additional visits each year for the next 20 years (TRPA 2007b).

The substantial fluctuations in annual attendance at Sand Harbor (including increases and decreases of more than 100,000 visits 3 of the past 10 years), and the absence of an upward trend in attendance over the past decade despite rapid regional population growth (28 percent increase in Reno/Sparks and 24 percent increase in Washoe County as a whole since 2000), do not provide a basis for projecting increased attendance at Sand Harbor in the coming years. However, these county, statewide, and regional data suggest that visitor demand, and thus use pressure (if not actual attendance), at Sand Harbor may continue to increase and is not likely to substantially subside.

### 3.4 VISITOR COUNTS AT SAND HARBOR USE AREAS

Visitor counts were conducted between 8 a.m. and 7 p.m. on 17 sample days, including 11 weekend days and holidays and 6 weekdays (the schedule of survey days and data collection times is provided in Section 2.1). Two counts were conducted at each use area on each sample day, generally one in the morning or mid-day and one 4 to 5 hours later, in mid- or late afternoon.

The Main Beach was divided into four approximately equal zones (A, B, C, and D, moving from east to west) for the purpose of visitor counts and surveys. Most of the visitor counts on the Main Beach covered the entire beach; on a few occasions when beach use was very high (e.g., the July 4 holiday), the counts covered only one-half of the beach (zones A and B, or C and D). Counts at the Boat Ramp area focused on boaters and others using the beach areas on either side of the ramp. The counts also included boaters who were launching or retrieving a boat at the time of the count, but did not include boaters in the parking area who were preparing to launch or preparing to leave. Counts at Diver's Cove included all visitors observed on the beach and on the adjacent Ramada Point, where there are dirt pathways and some access to the boulder-lined shoreline. The counts at the beach areas included visitors who were on the beach and in the water.

Summaries of the visitor counts for the Sand Harbor use areas are presented below. More detailed Sand Harbor visitor count results (including count data for the Nature Trail, not presented here) as well as count results for Memorial Point are available in Appendix H.

#### 3.4.1 *Weekends and Holidays*

Table 3-2 presents the average weekend and holiday visitor counts (PAOT) for the three beach areas and the Family Picnic Area, for each 2-hour period between 8 a.m. and 8 p.m. Figure 3-15 is a graphical depiction of these data.

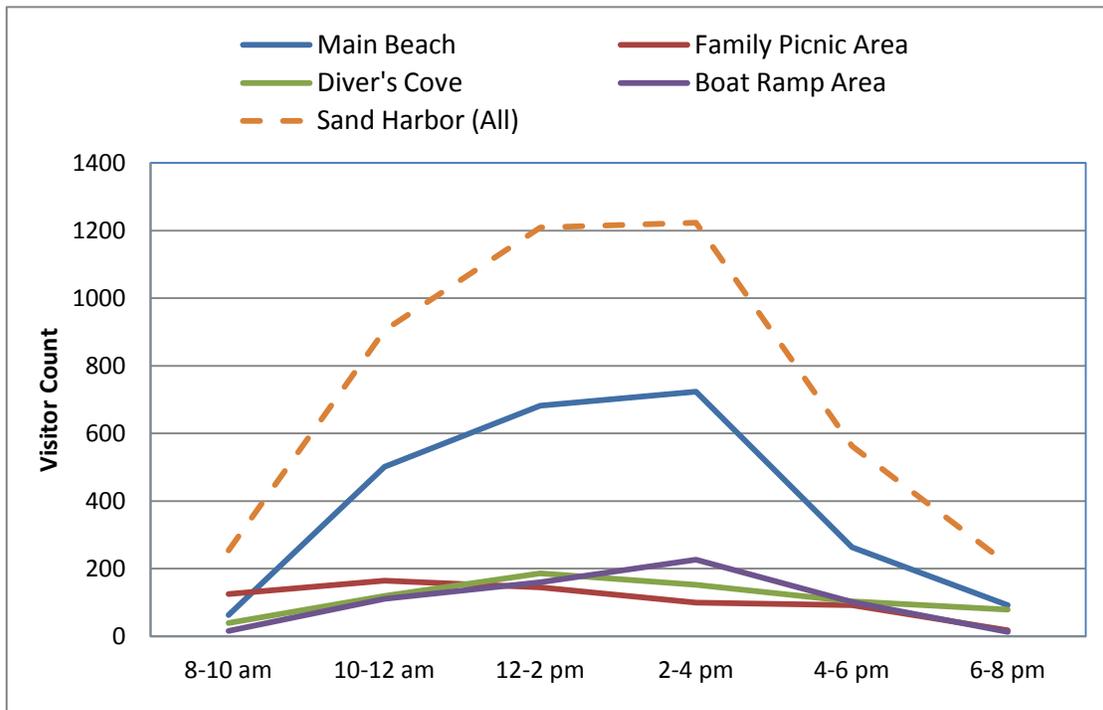
As the largest beach and main attraction for many visitors, the Main Beach accounted for a large proportion of the visitors counted on weekends and holidays. Between mid-morning and mid-afternoon (10 a.m. to 4 p.m.), an average of about 500 to 725 PAOT were observed using the area. Use of the Main Beach was generally light during the first few hours of the survey day and tended to drop off quickly after about 5 p.m. on most survey days. Figure 3-16 depicts typical summer afternoon use of the Main Beach.

**Table 3-2. Weekend and Holiday Average PAOT at Sand Harbor Use Areas by Time of Day.**

Use Area	8-10 a.m.	10-12 a.m.	12-2 p.m.	2-4 p.m.	4-6 p.m.	6-8 p.m.
<b>Sand Harbor</b>						
Main Beach	63	501 <sup>1</sup>	682	723 <sup>1</sup>	263	92
Family Picnic Area	125	165	145	99	92	18
Diver's Cove	39	119	187	152	103	79
Boat Ramp	16	111	160	226	102	14
<b>Total</b>	<b>243</b>	<b>897</b>	<b>1,174</b>	<b>1,201</b>	<b>560</b>	<b>203</b>

<sup>1</sup> Data are adjusted to account for three visitor counts that covered only two of four beach zones (zones A and B, or C and D), due to high use levels. The number of visitors in the uncounted zones was assumed to be approximately the same as in the counted zones, based on general observations of the distribution of beach users throughout the data collection season. Visitor counts were not recorded by beach zone when the count covered the entire beach, but observers reported that use tended to be greatest in the middle zones of the beach (B and C).

Source: Compiled by AECOM.



**Figure 3-15. Weekend and Holiday Average Use Levels (PAOT) at Sand Harbor Use Areas by Time of Day.**



**Figure 3-16. View of the Main Beach on a Busy Summer Afternoon.**

Use of the Family Picnic Area was typically steady throughout most of the day on weekends and holidays, with an average of about 100 to 165 PAOT observed between about 8 a.m. and 5 p.m.<sup>5</sup> The area tended to fill more quickly in the morning than other Sand Harbor use areas, presumably because visitors who wanted to have some certainty of getting a picnic site made sure to arrive at the park early. The area also tended to start emptying out earlier in the afternoon than the other areas.

The daily pattern of use levels at Diver's Cove was similar to that of the Main Beach, with about 120 to 190 PAOT observed using the area between mid-morning and mid-afternoon (10 a.m. to 3 p.m.), and somewhat lower visitor counts the remainder of the day. Use levels at the Boat Ramp area beaches were generally similar to Diver's Cove throughout the day on weekends and holidays, with an average of about 100 to over 200 PAOT counted between 10 a.m. and 5 p.m. The peak use period was later (2–4 p.m.), and average peak use somewhat higher, than Diver's Cove. Figures 3-17 and 3-18 depict typical summer afternoon use of Diver's Cove and the Boat Ramp beach and harbor south of the ramp.

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<sup>5</sup> The visitor counts at the Family Picnic Area may underestimate use levels, due to many picnickers spending a substantial part of the visit at the beach or other parts of Sand Harbor. Over 80 percent of visitors surveyed at the Family Picnic Area spent time swimming during their visit.



Figure 3-17. A View Across Diver's Cove from Ramada Point on a Summer Afternoon.



Figure 3-18. A View of the Boat Ramp Cove and South Beach on a Summer Afternoon.

Table 3-3 presents the maximum weekend and holiday visitor counts (PAOT) for the three beach areas and the Family Picnic Area, for each 2-hour period between 8 a.m. and 8 p.m. The maximum PAOT observed on the Main Beach during those hours ranged from about 1,000 to nearly 1,300 visitors. The maximum PAOT observed at the Family Picnic Area was quite high during the first half of the survey day, with 456 and 524 visitors counted on the July 4 holiday, three times the average PAOT. (The maximum PAOT counts for non-holiday weekends were substantially lower, in the range of 150–200 visitors.) The maximum PAOT observed at Diver’s Cove was nearly 300 visitors, counted during the 2–4 p.m. time period. Maximum PAOT at the Boat Ramp area beaches was consistent, with about 320 to 340 visitors observed between about 12 and 5 p.m.

**Table 3-3. Weekend and Holiday Maximum PAOT at Sand Harbor Use Areas by Time of Day.**

Use Area	8-10 a.m.	10-12 a.m.	12-2 p.m.	2-4 p.m.	4-6 p.m.	6-8 p.m.
<b>Sand Harbor</b>						
Main Beach	119	1,100 <sup>1</sup>	1,272	1,000 <sup>1</sup>	548	92
Family Picnic Area	456	207	524	144	187	18
Diver’s Cove	64	158	189	293	228	79
Boat Ramp	22	185	333	337	319	18
<b>Total</b>	<b>661</b>	<b>1,650</b>	<b>2,318</b>	<b>1,774</b>	<b>1,282</b>	<b>207</b>
<sup>1</sup> Data are adjusted to account for July 4 holiday visitor counts that covered only two of four beach zones (zones A and B, or C and D), due to very high use levels. The number of visitors in the uncounted zones was assumed to be approximately the same as in the counted zones, based on general observations of the distribution of beach users throughout the data collection season. Source: Compiled by AECOM.						

### 3.4.2 Weekdays

In general, the use levels observed at the Sand Harbor use areas on weekdays were about one-half to three-quarters of the use levels observed on weekends and holidays through the peak hours of the day. Table 3-4 and Figure 3-19 present average weekday use levels at Sand Harbor.

At the Main Beach, average PAOT was between about 250 and 400 visitors for counts conducted between 10 a.m. and 5 p.m. At the Diver’s Cove and Boat Ramp areas, average PAOT on weekdays was typically about half of the weekend and holiday use levels, although that did not hold true for all time periods. (Average visitor counts at Diver’s Cove between 2 and 4 p.m. were actually about 25 percent higher on weekdays, and at the Boat Ramp area were only slightly lower than weekend counts between 12 and 2 p.m.) Weekday use of the Family Picnic Area was much lower than weekend and holiday use, with an average of 10 to 20 PAOT most of the day.

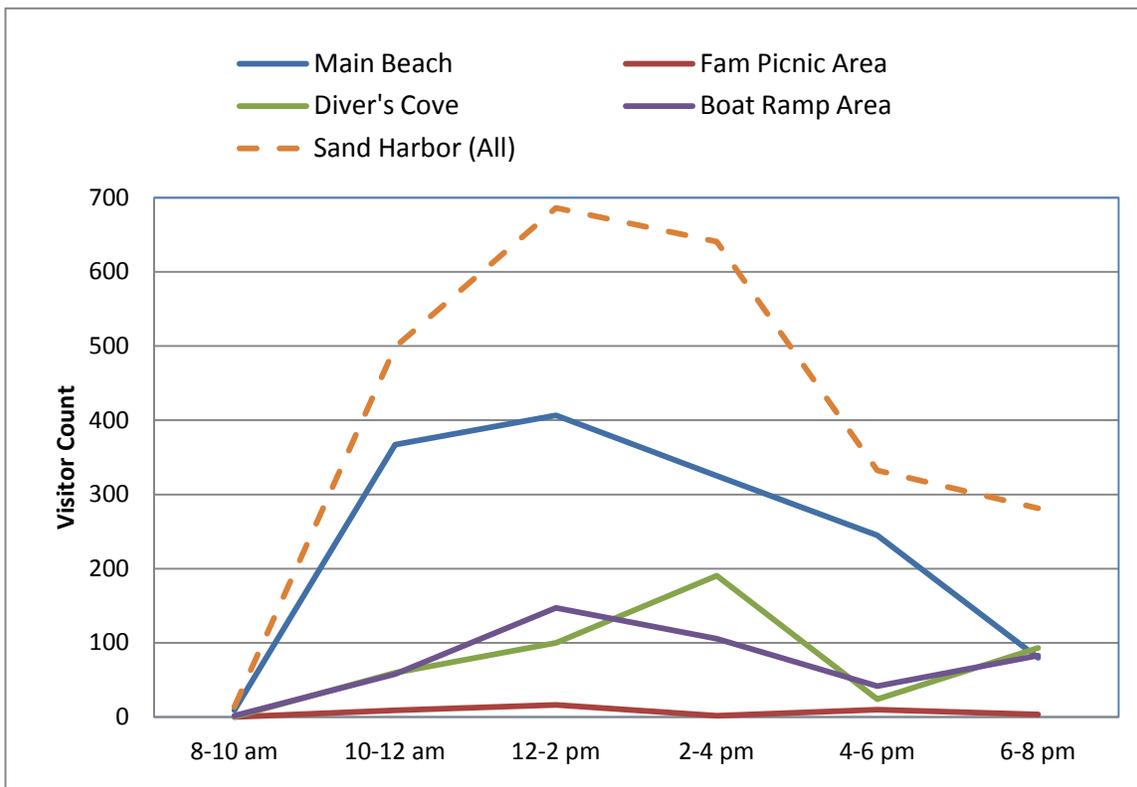
**Table 3-4. Weekday Average PAOT by Use Area and Time of Day.**

Use Area	8-10 a.m.	10-12 a.m.	12-2 p.m.	2-4 p.m.	4-6 p.m.	6-8 p.m.
<b>Sand Harbor</b>						
Main Beach	9	367 <sup>1</sup>	407	325 <sup>2</sup>	245 <sup>1</sup>	80 <sup>2</sup>
Family Picnic Area	0	9	17	2	10	4
Diver's Cove	0	60	100 <sup>2</sup>	190	24	93
Boat Ramp	2	58	147	106	42	83
<b>Total</b>	<b>11</b>	<b>494</b>	<b>670</b>	<b>623</b>	<b>321</b>	<b>260</b>

<sup>1</sup> Data are adjusted to account for two visitor counts that covered only two of four beach zones (zones A and B, or C and D), due to high use levels. The number of visitors in the uncounted zones was assumed to be approximately the same as in the counted zones, based on the general distribution of visitors observed at other times.

<sup>2</sup> No weekday counts were completed at the Main Beach during the 2–4 p.m. or 6–8 p.m. periods or at Diver's Cove during the 12–2 p.m. period. These estimates are based on earlier and/or later counts.

Source: Compiled by AECOM.



**Figure 3-19. Weekday Average Use Levels (PAOT) at Sand Harbor by Time of Day.**

Weekday maximum PAOT for Sand Harbor use areas also tended to be substantially lower than weekend and holiday maximum PAOT, although some high counts on weekdays indicate that weekday use can also occasionally be quite high. For example, the maximum PAOT at the Main Beach for the 12 p.m. to 2 p.m. period of over 900 visitors was well above the weekend and holiday average PAOT and only a few hundred visitors less than the weekend and holiday maximum PAOT for the mid-day hours (Table 3-5).

Also, the weekday maximum PAOT for the Boat Ramp area during the 12 p.m. to 4 p.m. hours was only about 110–130 fewer visitors than the weekends and holiday maximum PAOT for the same time of day. These data indicate that while weekday use of Sand Harbor is typically well below weekend and holiday use in most use areas and at most times of day, at certain times weekday use can approach typical weekend use levels.

**Table 3-5. Weekday Maximum PAOT Visitor Counts by Use Area and Time of Day.**

Use Area	8-10 a.m.	10-12 a.m.	12-2 p.m.	2-4 p.m.	4-6 p.m.	6-8 p.m.
<b>Sand Harbor</b>						
Main Beach	21	374 <sup>1</sup>	909	NA	430	NA
Family Picnic Area	0	9	23	4	10	7
Diver's Cove	NA	118	NA	307	24	93
Boat Ramp	2	101	223	208	48	83
<b>Total</b>	<b>23</b>	<b>602</b>	<b>1,155</b>	<b>519</b>	<b>512</b>	<b>183</b>
<i>NA = not available (no visitor counts conducted during this time period).  <sup>1</sup> Data are adjusted to account for the visitor count covering only two of four beach zones (zones A and B). The number of visitors in the uncounted zones was assumed to be approximately the same as in the counted zones, based on general observations of beach use distribution at other times.                      Source: Compiled by AECOM.</i>						

### 3.5 GENERAL NATURAL RESOURCE CONDITIONS

Before becoming a park, Sand Harbor had a century-long history of logging, rail operations, and commercial and private recreation development and use. The development of the major park facilities that primarily occurred in the early 1970s has since occupied most of park's land base; only about 10–15 percent is relatively undisturbed. A 3-acre low, wet forest and meadow area is located between the two main parking areas and is protected by a surrounding fence, although visitors are permitted to enter the area. A more open forested area of about 4 acres between the office and shop complex, the Group Use Area and Boat Ramp parking area are also relatively undisturbed. These areas contribute to the aesthetic quality of the park and provide a buffer between the park operations area and the recreation areas.

The park retains good overstory tree cover in most unpaved areas, primarily composed of large mature pine, cedar, and fir trees. Mistletoe has infested many of the mature conifers; despite efforts at control, many trees have been lost. Hardest hit has been the Family Picnic Area. Some areas also retain a relatively intact understory of manzanita

and other shrubs and young trees, which also preserve the predominantly natural appearance of much of the park despite its highly developed state.

The paved pathways within and connecting Sand Harbor use areas and the Sand Point Boardwalk Trail have directed most pedestrian traffic and controlled much of the inevitable resource impacts that result from that traffic. Rail fencing has also been installed in high traffic and sensitive locations to protect dunes and vegetation. This has also limited pedestrian traffic impacts and allowed some success with revegetation and natural recovery.

Additional details on natural resource conditions are provided in Chapter 6.

### 3.6 PARK FEATURES OF IMPORTANCE TO VISITORS

People choose to come to Sand Harbor for various reasons, including factors described above such as the park’s access, facilities, and resources. Among the eight reasons listed on the survey, the majority of visitors checked three related to the natural resource setting: quality of beaches, water quality, and scenery/natural environment (Figure 3-20). Echoing the survey data indicating that a high percentage of visitors come from Washoe and nearby counties, nearly half indicated that the park’s proximity was also a motivation for their visit. The park facilities were relatively less important, with 40 percent selecting that response. Other reasons given (written in on the survey form) included a variety of resource, facility, and social motivations, along with simple habit or tradition.

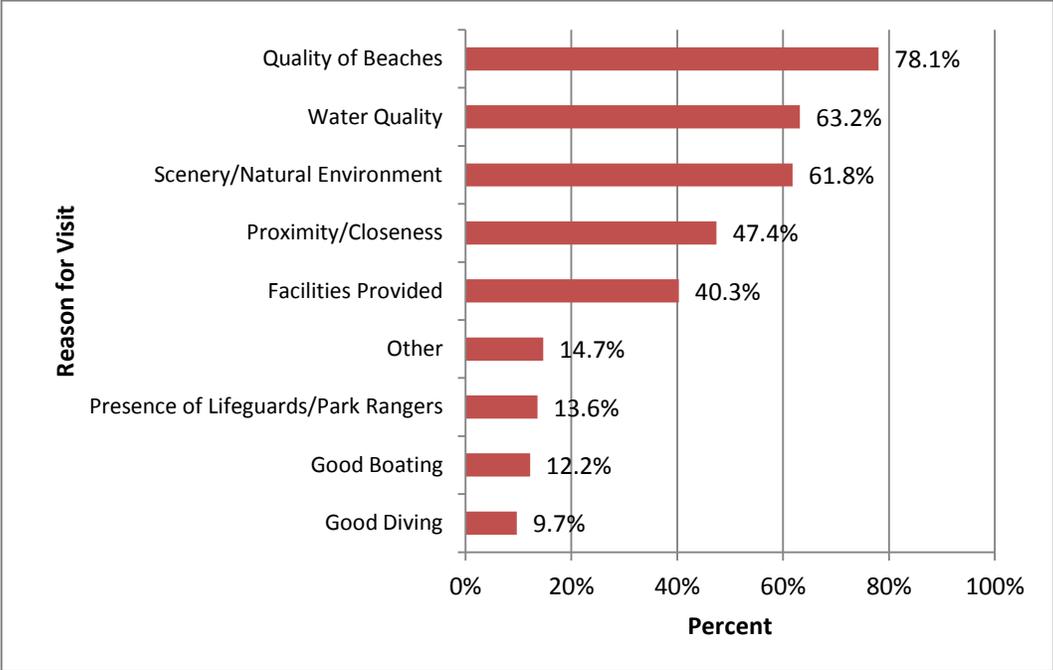


Figure 3-20. Reasons Visitors Chose to Come to Sand Harbor.

## 4.0 PHYSICAL/SPATIAL CAPACITY ASSESSMENT

This section describes physical or spatial capacity, which relates to the amount of space available at a recreation area and the maximum number of people who can be accommodated in that area.

### 4.1 DESCRIPTION AND APPLICATION AT SAND HARBOR

The focus of the physical/spatial capacity assessment is on usable area. At the Sand Harbor Family Picnic Area, this relates to the area available for picnicking and associated activities. This included designated picnic sites but also areas between the designated sites often used informally by visitors when no designated sites are available. At the Main Beach, Diver's Cove, and Boat Ramp beach areas, the area available for each person or group on the beach is the main determinant of physical capacity.

The Group Use Area and Sandy Point are not included in the physical capacity analysis. The Group Use Area has an established design capacity of 120 users (although larger groups can be accommodated with special arrangements), and visitor surveys and counts were not conducted there for this study to avoid disturbing visitors during the special events held there. (Group Use Area use data from reservation records are summarized in Section 3.1.1) Sandy Point is used by visitors walking the Nature Trail boardwalk and by a relatively low number of visitors who clamber over the shoreline boulders and wade or swim in the adjacent parts of the lake, but it was not practical to conduct visitor counts only on the boardwalk.

Although the Boat Ramp area beaches are included in the physical capacity analysis, the ramp itself is not included because it is a point of access to the water, rather than a recreation activity area where spatial use density standards would apply. The boat ramp is addressed in the facility capacity analysis below, however (Chapter 5).

Physical capacity is not assessed at Memorial Point as the area is primarily occupied by steep and boulder-strewn hillside between the parking area and shoreline, and actual recreation use is essentially limited to the trail network and the water's edge. Memorial Point is addressed, however, in the facility, ecological, and social capacity assessments.

Existing standards developed by parks agencies, professional organizations, or recreation researchers may be used to evaluate physical or spatial capacity. These standards provide the minimum area that should be available for each person for safe and enjoyable use. Due to the range in area features and in user preferences, limits based on these should serve an index or baseline function only.<sup>6</sup>

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<sup>6</sup> Physical capacity can be further defined in terms of "maximum capacity" (absolute physical limit) and "optimum capacity" (desirable levels of use). We will apply existing standards to establish "maximum capacity" ranges. If the

Physical capacity analysis may also consider the ability of a site to absorb additional recreation use, either through the construction of new facilities within the existing use area or site expansion. However, at Sand Harbor the available land area is fixed and, for the purposes of this study, it was understood that State Parks would be unlikely to consider expanding existing facilities into new, relatively undisturbed areas of Sand Harbor. However, the potential exists to increase the number of picnic sites (and thus density of use) at the Family Picnic Area (within the existing use area).

Although physical capacity of a site sets the most fundamental limits to use (only so many people can use any recreation site at one time, even if high density use is acceptable), in many instances it is likely to be the least restrictive type of capacity. Depending on the site and its uses, ecological, social, or facility capacity may place greater limits on acceptable use levels.

## **4.2 METHODOLOGY**

As described above, the physical capacity assessment requires three items of information:

- The space available (acres) within each use area (i.e., the usable area).
- The number of people using the area at peak use times.
- User density standards that will be compared with existing user density (based on the comparison of the usable area with the number of people using the area).

### **4.2.1 Usable Area Measurements**

The approximate boundary of the Sand Harbor Family Picnic Area (and other use areas) was observed during site visits, as were features such as the number of picnic sites. The acreage of the use area was estimated using aerial photos and geographic information system (GIS) measurements.

Beach acreage was provided by State Parks based on aerial photographs taken September 28, 2004 and July 2, 2006. The year 2004 was the lowest water year at Lake Tahoe in the past 10 years. Lake elevations were only modestly higher during 2010; thus, the beach area available during the summer 2010 study data collection period represents a somewhat typical condition for low, if not the lowest, water years. Conversely, 2006 was the highest water year at Lake Tahoe in the past 10 years, with

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overall capacity analysis indicates that physical capacities are a limiting factor, the maximum capacity can be adjusted downward based on the assumption that consistent use at that level is not beneficial to the natural resource, the facilities, or user experiences. In other words, optimum capacity is the amount of use most appropriate for both the satisfaction of visitors and the protection of the resource (Urban Research and Development Corporation 1977).

the lake elevation essentially at or within 1 foot of the maximum permissible elevation of 6,229.10 feet the entire summer. The year 2006 thus represents the opposite condition from 2004 regarding the total beach space available for visitor use at Sand Harbor.<sup>7</sup>

Table 4-1 presents a comparison of the beach acreage available on the two aerial photograph dates. The acreage figures are derived from GIS measurements. As indicated by the figures in the far right column of the table, the Main Beach was about half as large in area in 2006, when Lake Tahoe was at a high elevation (6229.03 feet, 0.7 feet below the maximum permissible level) as compared to 2004, when the lake was at a low elevation (6222.85 feet, about 6.2 feet lower than the 2006 elevation). The area measurements indicate that the other Sand Harbor beaches lose an even greater percentage of their area when the lake is high. Figure 4-1 depicts the extent of Sand Harbor beaches on the 2004 and 2006 aerial photo dates.

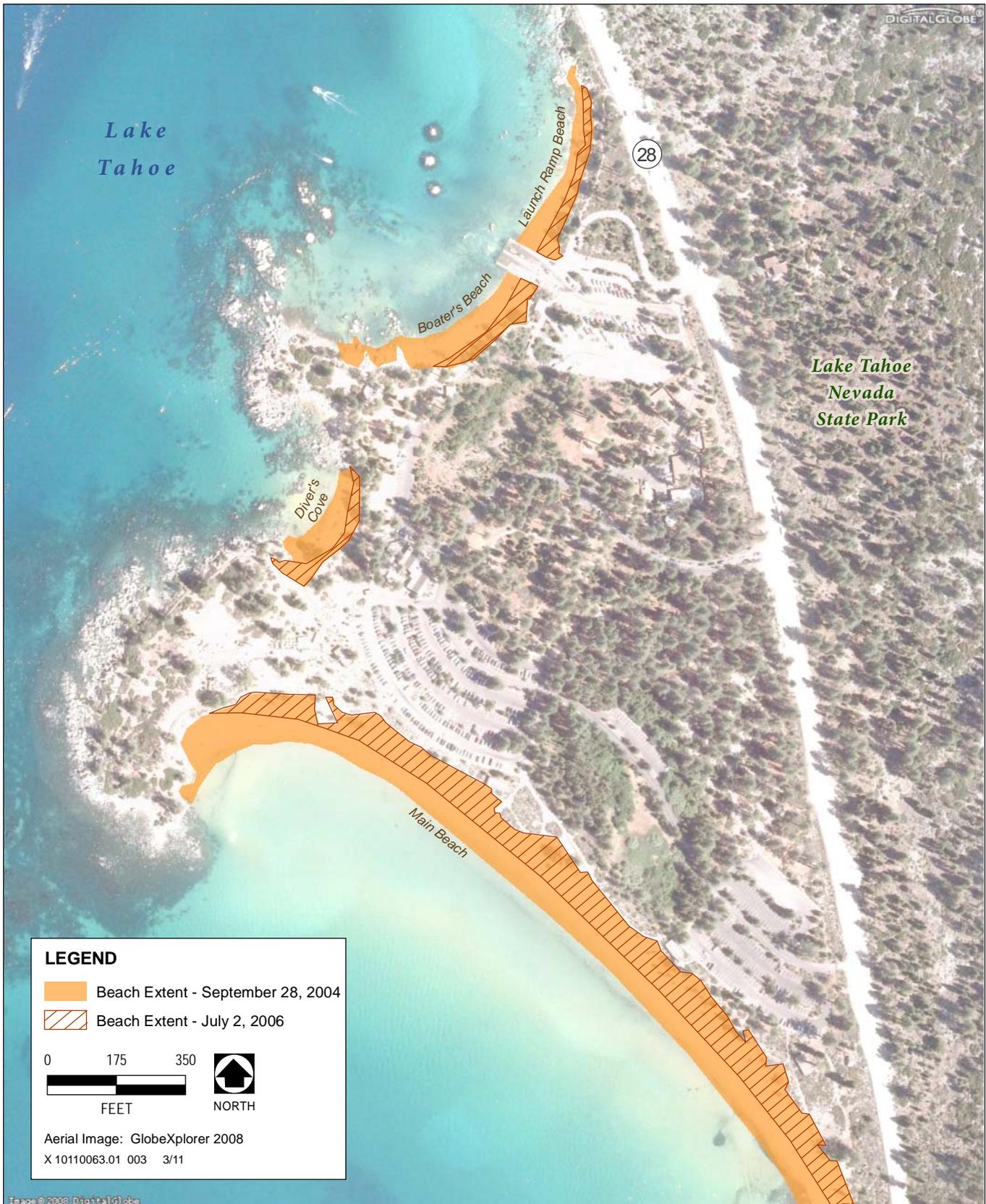
**Table 4-1. Beach Space Available on Representative High and Low-Water Dates.**

Beach Area	2004 Low Water Date <sup>1</sup> (acres)	2006 High Water Date <sup>2</sup> (acres)	Beach Area Loss – 2006 vs. 2004 (acres)	Percent Loss
Main Beach	7.28	3.46	3.82	52%
Diver's Cove	0.62	0.23	0.39	63%
<b>Boat Ramp Area</b>				
Boater's Beach (south of ramp)	0.96	0.27	0.69	72%
Boat Ramp Beach (north of ramp)	0.65	0.26	0.39	60%
<b>Total</b>	<b>9.51</b>	<b>4.22</b>	<b>5.29</b>	<b>56%</b>
<sup>1</sup> Acreage figures are based on measurements taken from aerial photographs dated September 28, 2004; the lake elevation on that date was 6,222.85 feet. <sup>2</sup> Acreage figures are based on measurements taken from aerial photographs dated July 2, 2006; the lake elevation on that date was 6,229.03 feet. Source: State Parks (GIS data).				

#### 4.2.2 Visitor Counts Data for Peak Use Times

The visitor counts conducted at the Sand Harbor use areas provided the necessary data on peak use levels for this analysis. Both average and maximum weekend and holiday PAOT use levels are incorporated into this analysis. Section 3.4 summarizes the visitor count results.

<sup>7</sup> The surface elevation of Lake Tahoe was nearly the same in early summer of 2004 and early summer 2010, and was just 0.4 to 0.6 foot higher during most of the remainder of the summer 2010 field data collection period as compared to the same dates in 2004. However, lake elevations were 0.9 to 1.8 feet higher during the field data collection period than on the date of the 2004 aerial photo. Lake elevations in 2006 were 4.4 to 4.6 feet higher than on the same dates during the field data collection period. Appendix G provides a comparison of lake elevations during the summer 2010 study data collection period and the same months during 2004 and 2006.



Source: NSP 2011

Fig. 4-1. Extent of Sand Harbor Beaches - 2004 and 2006

### 4.2.3 Use Density Standards

Standards for maximum use levels of picnic areas, based on recommended densities of picnic and campsites and numbers of users per site, were applied. Several such standards have been developed and applied by various parks agencies in the United States and Canada (e.g., New York State Parks [2008], Florida State Parks [2004], and BC Parks [1995]). The picnic site standards used by the Florida Division of Recreation and Parks (Florida State Parks) were used for this study. Other sources consulted generally recommend similar picnic site densities, although some include higher density standards, which may be more appropriate for some park settings. Comparison of the density of picnic sites (and resulting capacities) under the standard ranges with actual density at each site helps to identify if site development decisions have resulted in higher-than-standard use density levels, or lower-than-standard densities that may result in unused capacity.

No examples were found of use density standards applied to beaches in the United States; the best available examples come from beach capacity studies conducted in Portugal and Spain (Silva et al. 2007; Jurado et al. 2009). The standards developed in those studies were applied to large non-urban ocean beaches, with a moderate density standard (approximately 270 users per acre) applied to a “concession area” (presumably, the most accessible portion of the beach) and a lower density standard (approximately 135 users per acre) applied to a “non-concession area” (presumably, the more remote portion of the beach). Those studies reference similar studies conducted on coastal beaches in Brazil and Australia. These standards incorporate not only the beach space that a visitor will actually occupy, but also the unused space between visitors or groups that provides a sense of personal or group space and a modicum of privacy.

An SR 28 Traffic Management Study (LSC, Inc. 1996) applied a 75 square feet per user capacity standard to most of the primitive USFS-managed East Shore beaches, and a 150 square feet per user capacity standard to Chimney Beach (a USFS-managed site on Lake Tahoe north of the project area). The 75 square feet per user standard equates to about 580 PAOT/acre, a higher density standard than even an “urban” standard found in the European beach capacity studies mentioned above. The 150 square feet per user standard equates to about 290 PAOT/acre, a slightly higher density standard than the “concession area” standard applied in those studies.<sup>8</sup>

For this study, we adopted the 135 users per acre and 270 users per acre standards described above for low and high-density beach use, respectively, as the best available standards applied to similar beach settings. Although cultural factors may have

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<sup>8</sup> The LTBMU Land and Resource Management Plan (USFS 1988) does not apply these specific PAOT standards, which may be considered outdated and are generally intended to express a design capacity for developed recreation facilities. The LTBMU plan does apply a low density standard of less than 1 PAOT/acre (875 PAOT on 1,159 acres) for the majority of the East Shore Beaches management area to be managed under an “intensive dispersed recreation” prescription.

influenced these standards (which were developed at European beaches), in the absence of U.S. standards that could be applied or adapted, we judged them to be reasonable to apply at Sand Harbor. Converting these standards to square feet per user units, the equivalent standards are 162 square feet per user for the high density standard and 323 square feet per user for the low density standard. The high density standard is similar to the 150 square feet per user standard applied to Chimney Beach in the SR 28 Traffic Management Study.

### 4.3 PHYSICAL CAPACITY OF USE AREAS

Estimates of the physical capacities for Sand Harbor use areas are presented below, first for the Family Picnic Area and then for the three beach areas.

#### 4.3.1 Family Picnic Area

Based on an adapted standard of 3 to 5 tables per acre and 8 users per table, the Family Picnic Area has a physical capacity between about 480 and 900 users (Table 4-2). A middle value within that range equates to a potential physical capacity of about 690 users.

**Table 4-2. Physical Capacity of Family Picnic Area based on Usable Area and Picnic Sites Provided.**

Size of Area (Approx. Acres)	Standards for Number of Picnic Sites and User Capacity		Actual Number of Sites and User Capacity	
	# Picnic Sites	Capacity <sup>1</sup>	# Picnic Sites <sup>2</sup>	Capacity <sup>3</sup>
7.5 acres	60–113 tables	480–904 users	57 tables	456 users

<sup>1</sup> The standard is based on a range of 8-15 tables per acre and 8 users per table (32-60 users/acre), adapted from Florida State Parks (2004). Other sources consulted recommend similar standards, although one source includes a "High Density" standard of 22-24 sites per acre (BC Parks 1995). The number of users per table is a maximum, based on a comfortable use level.

<sup>2</sup> Sites are based on existing tables, but additional groups could be accommodated on portions of each picnic site without tables.

<sup>3</sup> Actual capacity is based on a simple multiplication of 8 users per table. It is assumed that most groups would prefer to have a table to use.

Source: Compiled by AECOM.

Based on the adapted standard, the actual capacity at the Family Picnic Area relative to the number of existing picnic tables indicates that the facilities provide a slightly lower physical capacity than the lower limit of the standard. The 57 tables can support 456 users, based on 8 users per table and the assumption that each visitor group requires a picnic table. It is presumably the preference of visitors to have a table (and perhaps grill) to use, but the picnic area contains additional open areas beneath the forest canopy that picnickers can and do use, particularly large groups. Nevertheless, it appears that the physical capacity of the Family Picnic Area could be increased by the installation of additional picnic sites (tables, hardened pad, grill) since the area has relatively few tables given the area available. However, it is recognized that the relatively low density of picnic sites provides a more desirable setting, with more space between picnicking

groups and less disturbance of the native forest overstory and shrub understory. Also, picnicking groups often bring lawn chairs and blankets, thereby effectively increasing the capacity of the picnic sites beyond the capacity indicated solely by a calculation of 8 users (seats) per table.<sup>9</sup>

### 4.3.2 Beach Areas

The area available for beach activities and the potential capacity of the three beach areas (Main Beach, Diver’s Cove, and Boat Ramp beaches) based on an adapted standard of 135 to 270 users per acre indicates those sites have a physical capacity between about 1,280 and 2,570 users during low water years and between 570 and 1,140 users during high water years (Table 4-3). Middle values within those ranges equate to a physical capacity of about 1,900 users during low water years and 855 users during high water years. The Main Beach could potentially host about 1,475 users during low water years and 700 users during high water years. Figures 4-2 and 4-3 illustrate typical summer afternoon use levels at the Main Beach and Diver’s Cove, with the high water levels and thus limited available beach area that occurred during the 2011 season.

**Table 4-3. Physical Capacity of Beach Areas based on Available Beach Area.**

Beach Area	Available Beach Area (Approx. Acres)		Low Water Year <sup>3</sup> Capacity (Beach Users)		High Water Year <sup>3</sup> Capacity (Beach Users)	
	Low Water Year <sup>1</sup>	High Water Year <sup>2</sup>	Low Density	High Density	Low Density	High Density
Main Beach	7.28	3.46	983	1,966	467	934
Diver’s Cove	0.62	0.23	84	167	31	62
Boat Ramp Beaches	1.61	0.53	217	435	72	143
<b>Total</b>	<b>9.5 acres</b>	<b>4.2 acres</b>	<b>1,284 users</b>	<b>2,568 users</b>	<b>570 users</b>	<b>1,139 users</b>

<sup>1</sup> Acreage figures are based on measurements taken from an aerial photograph dated September 28, 2004; the lake elevation on that date was 6,222.85 feet. The lake was 0.9 to 1.8 feet higher during the study data collection period than on the 2004 photo date; as a result, the beach area available was somewhat less during the study period than the acreage figures given here, and the physical capacity of the beaches would have been less.

<sup>2</sup> Acreage figures are based on measurements taken from an aerial photograph dated July 2, 2006; the lake elevation on that date was 6,229.03 feet.

<sup>3</sup> The standards are based on a range of 135 to 270 users per acre (323 to 162 square feet per user), adapted from standards for intensively used non-urban developed beaches on the coasts of Spain and Portugal. Some other standards found in the literature recommend a higher use density (e.g., 480 users per acre), but these are applied in more urban beach settings and were not considered appropriate for Sand Harbor. These standards should be considered maximums (they are based on a maximum acceptable use level expressed by beach users in the source studies). These standards may express, in part, cultural preferences; however, no similar standards applied to U.S. beaches were found.

Sources: State Parks GIS data (beach area); Silva et al. (2007) and Jurado et al. (2009) (beach capacity standards).

<sup>9</sup> During the on-site surveys, it was observed that picnickers often used undesignated areas to set up informal picnic sites, causing trampling and other vegetation impacts in the process. The employee survey confirmed these observations, and the resource impacts were noted during the ecological impact assessment (see Chapter 6).



**Figure 4-2. A View of the Main Beach with Typical Summer Afternoon Use Levels and High Water Level.**



**Figure 4-3. A View of Diver's Cove with Typical Summer Afternoon Use Levels and High Water Level.**

*(Note: These photographs were taken in early August 2011, when the Lake Tahoe elevation was about 1 foot lower, and the available beach area was thus slightly greater, than on the 2006 aerial photo date, on which the high water year beach capacities are based. However, the lake elevation was about 5.5 feet higher than the 2004 aerial photo date, on which the low water year beach capacities are based, and about 4 feet higher than on the same date during the 2010 field data collection season. Thus, the available beach area was much less on the date of these photos than on either of those dates.)*

## 4.4 PHYSICAL CAPACITY ASSESSMENT

To assess the current use levels of Sand Harbor in relation to physical capacity, the physical capacity of the Family Picnic Area and the beach areas were compared with the average and maximum observed use levels.

### 4.4.1 Beach Areas

Table 4-4 compares the low and high beach use density capacities for low water and high water years for the three beach areas with the 2010 average and maximum PAOT for the beaches. Figures 4-4, 4-5, and 4-6 display these data.

**Table 4-4. Physical Capacity Assessment for Beach Areas (High and Low Water Years Capacity Ranges vs. 2010 Peak Use Levels)**

Beach Area	Low Water Year Capacity <sup>1</sup> (Beach Users)		High Water Year Capacity (Beach Users)		2010 Peak Weekend And Holiday Use Levels <sup>2</sup>	
	Low	High	Low	High	Avg. PAOT	Max. PAOT
Main Beach	983	1,966	467	934	723	1,272
Diver's Cove	84	167	31	62	187	293
Boat Ramp Beaches	217	435	72	143	226	337
<b>Total</b>	<b>1,284</b>	<b>2,568</b>	<b>570</b>	<b>1,139</b>	<b>1,136</b>	<b>1,902</b>

<sup>1</sup> The acreage calculations for 2004, on which the low water year physical capacities of the beach areas are based, somewhat overestimate the physical capacity of the beach areas during the study period, since lake levels during the study period were from 0.9 to 1.8 feet higher than on the 2004 reference (aerial photo) date. However, the actual physical capacity of the beaches would be close to the ranges shown and much higher than those shown for high water years, which are based on a much higher lake level than what occurred during the study period.

<sup>2</sup> Although the highest average and maximum observed weekend and holiday use levels of the beach areas did not all occur at the same hour, all occurred between 12 p.m. and 4 p.m. Therefore, the totals provided in these columns do not represent actual observed use levels, but do provide a reasonable approximation of average peak use and maximum use for the beach areas as a whole.

Source: Compiled by AECOM.

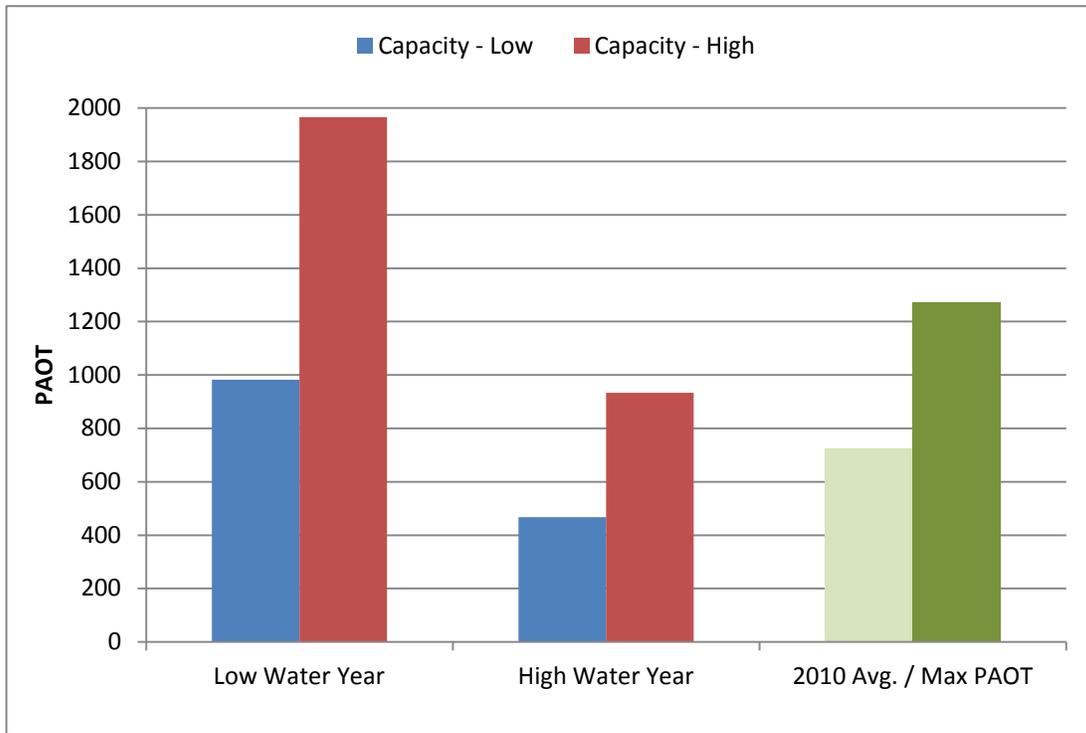


Figure 4-4. Main Beach High and Low Water Year Capacity vs. 2010 Use Levels.

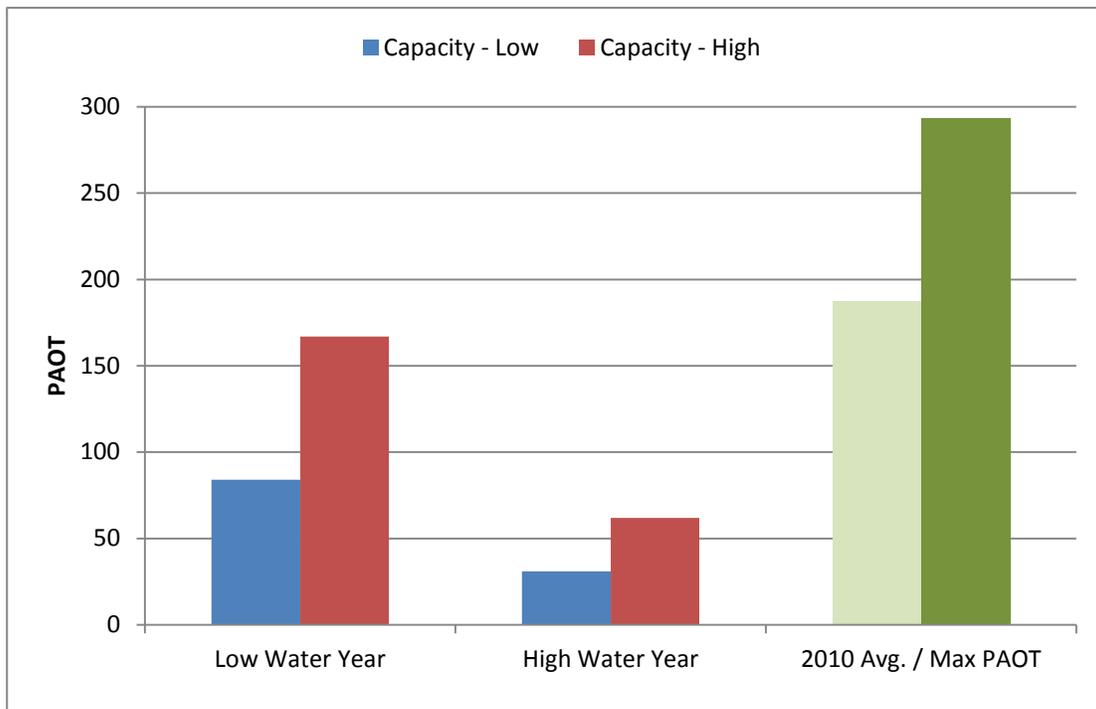
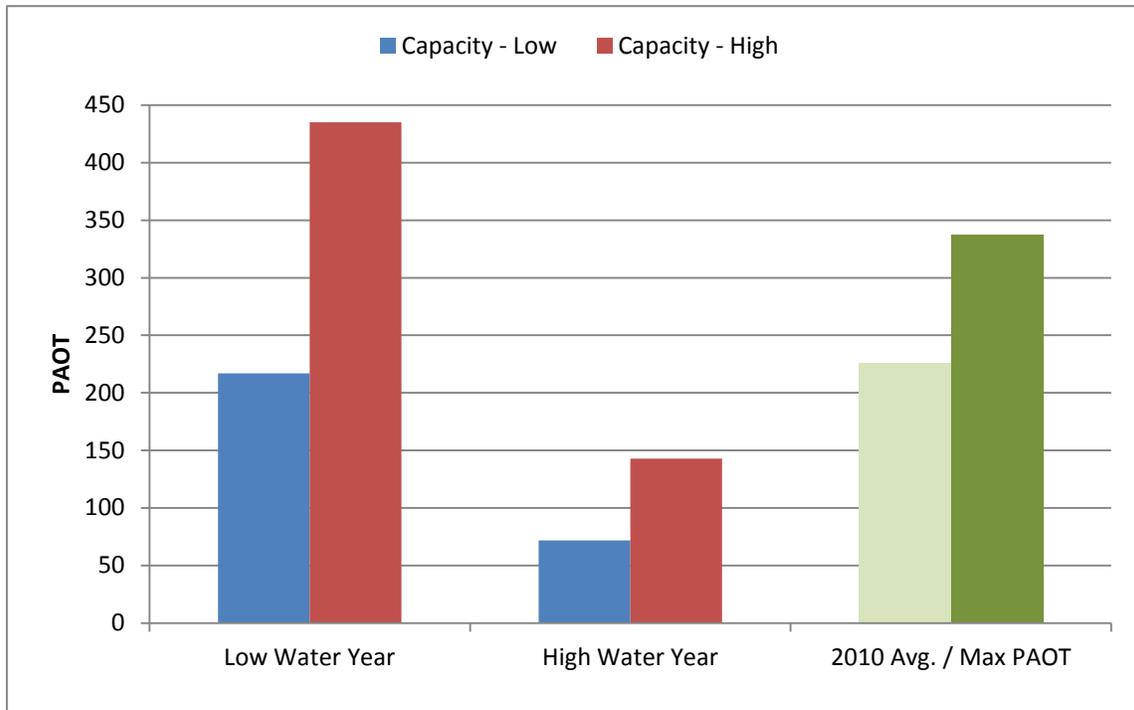


Figure 4-5. Diver's Cove Beach High and Low Water Year Capacity vs. 2010 Use Levels.



**Figure 4-6. Boat Ramp Beach Area High and Low Water Year Capacity vs. 2010 Use Levels.**

Based on average peak weekend and holiday observed use levels, the Main Beach use area was below capacity during most of the 2010 season (a low water year). Although use levels were quite high at times (and Sand Harbor as a whole was full to capacity much of the summer based on parking limits), the large area of beach available due to the low Lake Tahoe water levels kept the use density standards adopted here from being exceeded. However, at the maximum observed weekend and holiday use levels, use of the Main Beach during 2010 exceeded by several hundred users the lower beach use density standard. During a high water year, the observed average peak weekend and holiday use levels of the Main Beach would have well exceeded the lower use density standard, and the maximum observed use level would have exceeded even the higher use density standard by several hundred visitors.

Based on average peak weekend and holiday observed use levels, the much smaller Diver's Cove area was above capacity during most of the 2010 season, exceeding by 20 users even the higher use density standard for low water years. The maximum observed use was nearly twice the capacity of the area based on the higher use density standard. The level of use observed during 2010 could not be sustained by the Diver's Cove use area during a high water year, as the average peak use exceeded by a factor of three even the higher use density standard for high water years. It is likely that during high water years some of those visitors would be displaced to the Main Beach, although it too would be much reduced in size.

Based on average peak weekend and holiday observed use levels, the Boat Ramp beaches were likely approaching or at capacity during most of the 2010 season,

exceeding by about 10 users the lower use density standard for low water years, but coming well short of the higher use density standard (Table 4-4). The maximum observed use was about midway between the lower and higher use density standards. Like at Diver’s Cove, the level of use observed during 2010 could not be sustained by the Boat Ramp beaches during a high water year, as the average peak use exceeded by a factor of three the lower use density standard for high water years and exceeded the higher use density standard by about 60 percent. It is likely that during high water years some of those visitors would be displaced to the Main Beach, although it too would be reduced in size.

**4.4.2 Family Picnic Area**

Based on average peak weekend and holiday observed use levels, the Family Picnic Area was well below its physical capacity during most of the 2010 season, with average PAOT only about one-third of the capacity of 456 users, based on the number of available tables (Table 4-5, Figure 4-7). However, the maximum observed use (which occurred on the July 4 holiday) was well above the site capacity. Based on the visitor counts, this maximum use level was not approached on any other survey weekend; the maximum observed use on other weekends was about 200 visitors. However, as noted previously, the visitor counts may underestimate the actual use of the Family Picnic Area because many visitors spend part of their day at one of the beaches. It is also notable that more than 60 percent of the visitors surveyed at this area were in groups of more than 8 people (and up to 50 people), and the average group size was 14; therefore, many groups likely occupied more than one table and possibly more than one site.

These data correspond with study observations and employee survey data noting the common occurrence of visitors setting up informal picnic sites in undesignated portions of the Family Picnic Area when all of the designated sites are occupied. Figure 4-8 depicts one of the designated sites within the Family Picnic Area in use.

**Table 4-5. Physical Capacity Assessment for the Family Picnic Area (Capacity vs. 2010 Peak Use Levels).**

Use Area	Existing Number Of Picnic Sites And Use Capacity		2010 Peak Weekend And Holiday Use Levels <sup>1</sup>	
	# Picnic Sites	Capacity	Avg. PAOT	Max. PAOT
Family Picnic Area	57 tables	456 users	165	524

<sup>1</sup> The highest average PAOT for this use area was observed during the 10 a.m. to 12 p.m. time period, while the maximum use level was observed during the 12 p.m. to 2 p.m. time period. It is possible that the lower average PAOT recorded after 12 p.m. was due to some members of picnicking groups going to the beaches and other areas of Sand Harbor, rather than an actual decline in use during the early afternoon.

Source: Compiled by AECOM.

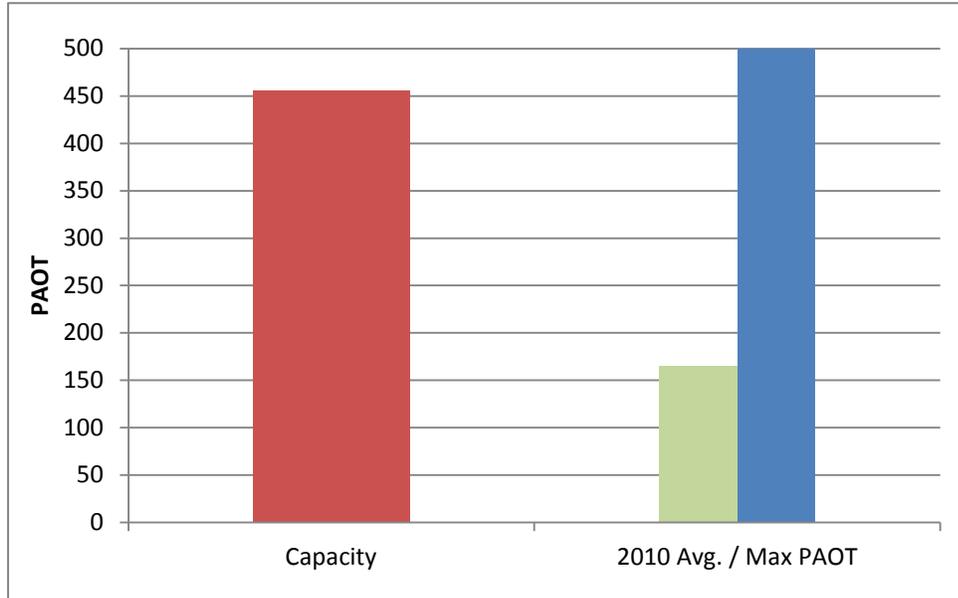


Figure 4-7. Family Picnic Area Capacity vs. 2010 Weekend and Holiday Use Levels.



Figure 4-8. Picnic Site in Use within the Family Picnic Area.

## 4.5 PHYSICAL CAPACITY CONCLUSIONS

Table 4-6 summarizes the conclusions drawn from the above analysis of physical capacity at Sand Harbor use areas. The assessment of physical capacity of the beach areas indicates that, for low water years like 2010 when the area of available beach is maximized, the physical capacity of the Main Beach is not reached at most times. However, the physical capacity of the Main Beach is likely reached or even exceeded on the highest use weekends. At progressively higher lake levels, the available area of beach gradually diminishes, with more than half of the beach area lost at the highest lake levels. Given the levels of beach use observed in 2010, the user density on the beach would also increase with higher lake levels, and use levels exceeding physical capacity would probably be a more frequent occurrence during high water years. Available beach space is an occasional constraint (or limiting factor) on the main beach during low water years, and is likely a frequent constraint during high water years.

**Table 4-6. Physical Capacity Conclusions for Sand Harbor Use Areas.**

Use Area	Capacity Conclusion
Main Beach	<u>Low Water Years:</u> Physical capacity exceeded (based on 2010 use levels) only on highest use weekends.
	<u>High Water Years:</u> Physical capacity likely to be frequently exceeded (if use levels are similar to 2010).
Diver's Cove	<u>Low Water Years:</u> Physical capacity frequently exceeded (based on 2010 use levels).
	<u>High Water Years:</u> Physical capacity likely to be exceeded at nearly all times (if use levels are similar to 2010).
Boat Ramp Area Beaches	<u>Low Water Years:</u> Physical capacity frequently exceeded (based on 2010 use levels).
	<u>High Water Years:</u> Physical capacity likely to be exceeded at nearly all times (if use levels are similar to 2010).
Family Picnic Area	Based on visitor counts, use appears to be below physical capacity at most times; however, the likelihood that visitor counts underestimate actual use and the observation of visitors frequently setting up informal picnic sites in undesignated areas suggest that the capacity provided by the existing number of tables/sites is frequently exceeded. The potential exists to increase physical capacity by expanding sites within the existing use area, which may be justified by the high demand at peak use times.
<i>Source: Developed by AECOM.</i>	

The beaches at Diver's Cove and the Boat Ramp are much smaller than the Main Beach, yet as many as 300 or more visitors were observed on those beaches on weekends and holidays during the 2010 season. At such use levels, the Diver's Cove beach area was above physical capacity on most weekends and holidays; the beaches

at the Boat Ramp were also being used at capacity much of the time. Both beaches would well exceed capacity at most times when the lake levels are higher, with the already limited beach areas further diminished. Thus, available beach space is a frequent constraint at Diver's Cove, and less frequent but still common at the Boat Ramp beaches, during low water years. Available beach space is likely to be a frequent or possibly a nearly constant constraint at both areas during high water years.

During high water years, some beach goers who might otherwise use the Diver's Cove and Boat Ramp beaches would likely become displaced to the Main Beach due to the lack of space on the smaller beaches, further increasing use density (and probably visitors' sense of crowding) on the Main Beach. Other factors affecting physical capacity of the Boat Ramp beaches may also come into play during high water periods. High water allows more large boats to use the boat ramp, and some of these boats are likely to stay in the area when the occupants want to anchor the boat and engage in beach activities, reducing the area available for non-boating beach users. The presence of more boats and more large boats is also likely to reduce the area available for kayak launching on the Boat Ramp beaches, which has become such a prominent use at this area.

The assessment of physical capacity of the Family Picnic Area indicates that about 450 picnickers can be accommodated at that use area at the existing relatively low level of picnic site density. Developed picnic sites are relatively few in number given the area available, providing a use density that is about equal to the lower end of the range used in the standard adopted for this study. The number of visitors that can be hosted by the existing sites is only about half of the theoretical limit associated with a higher site density standard. Therefore, the possibility exists to increase the physical capacity of this area with the installation of more picnic sites in unused areas. Although visitor counts seem to indicate that the area is used above physical capacity only occasionally (e.g., on the July 4 holiday), other observations indicate that the space available at the existing picnic sites is often a constraint. Therefore, there may be justification for an increase in picnic sites. Because parking is limited, the implications of additional sites on demand for parking would need to be considered.

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## 5.0 FACILITY CAPACITY ASSESSMENT

This chapter describes the constraints on recreation capacity at Sand Harbor imposed by the built environment.

### 5.1 DESCRIPTION AND APPLICATION AT SAND HARBOR

In general and for the purposes of this study, facility capacity relates to the existing capacity of the built environment (i.e., constructed facilities) at Sand Harbor. The intent of the built environment in outdoor recreation settings is two-fold: (1) to provide appropriately designed facilities that enhance and/or provide the opportunity for high quality recreation experiences/outcomes, and (2) to protect the area's sensitive resources (e.g., natural, cultural/historic, etc.) from potential recreation-related impacts. At Sand Harbor, the built environment includes access roads, parking areas, pathways and trails, picnic sites, utilities (e.g., water, sewer, electricity, etc.), restrooms, the boat ramp, and other types of infrastructure that facilitate recreational use at the site.

Similar to physical capacity, facility capacity provides a basic limit to the amount of use a site may receive at one time regardless of social and/or biophysical constraints. At heavily developed outdoor recreation sites (such as Sand Harbor), this limit is often associated with a specific type of infrastructure. At sites accessed primarily by vehicle, the number and availability of parking spaces may be the primary facility capacity-related constraint. For a boat launch, the number of ramp lanes may limit the number of boats that can be safely launched during a specified time period. While it is sometimes useful to condense the assessment of facility capacity to a specific type of infrastructure, it is generally helpful to broaden the evaluation to include other aspects of a facility. For this study, facility capacity at Sand Harbor not only considers use level limitations of existing built structures, but also the condition of these facilities, visitor opinions, and preferences for existing and potential improvements.

In recent capacity-related research and guidance, facility capacity is commonly included as a component of the managerial setting of an outdoor recreation area (Whittaker et al. 2010). That is, the capacity of the built environment is a direct function of management priorities and decisions (within the larger context of resource and budgetary constraints). For facility capacity, typical issues and concerns can often be addressed through capital improvements, renovations, visitor management actions, and/or increased staffing. For example, given the availability of expansion space (spatial capacity), lack of significant biophysical (ecological capacity) and social (social capacity) constraints, and adequate funding (another component of managerial capacity), facility capacity becomes less relevant to the overall capacity of an area/site since additional facilities may be constructed (thereby increasing the facility capacity of the area/site). On the other hand, if a site is built out (i.e., all usable space has been developed), then the facility capacity of the site is essentially unchangeable and facility expansion to increase capacity is not practical. So, while facility capacity is intricately tied to management direction (as well as

other capacity types), it also provides an important analytical tool in establishing the overall capacity of an area/site.

## **5.2 METHODOLOGY**

Three aspects of facility capacity (existing facility capacity, condition of facilities, and visitor opinions and preferences) were considered in aggregate to derive the overall facility capacity conclusion for Sand Harbor. The methodology for each component is described below.

### **5.2.1 Existing Facility Capacity**

At its most basic, facility capacity is an inventory-based indicator. For example, if a park has 50 parking spaces, the maximum at-one-time facility capacity is 50 vehicles. The utility of an inventory-based indicator is limited and so is typically augmented by comparing use levels to actual built capacity. To continue the example above, if on average 25 vehicles are parked at-one-time in the 50 parking spaces at peak use times, facility use is considered to be at 50 percent of the built capacity. This level of use is well below the built capacity of the parking area and it can be surmised that parking is not likely a limiting factor to overall use in the park at this time.

At Sand Harbor, the inventory of specific facilities and their respective use levels were evaluated to derive the estimate of existing facility capacity. This evaluation focused primarily on parking since it tends to be the primary facility limitation at Sand Harbor; however, other facility types were also considered, including picnic sites, the boat ramp, and utilities (e.g., water, sewer, electric, etc.). The Facility Inventory and Condition Assessment Form used for the study is included as Appendix D.

While facility capacity standards are common in capacity processes, they tend to be most useful in capacity-based monitoring and management planning efforts. As a monitoring and management tool, facility capacity indicators and standards specific to the site in question are developed (i.e., a universal standard does not exist). In addition, a properly designed and well-maintained developed recreation facility should be able to accommodate 100 percent use levels over sustained periods of time with only normal wear-and-tear expected (notwithstanding any social capacity-related concerns). As such, the value of applying other facility capacity standards to Sand Harbor is limited for study purposes. Instead of relying on a specific facility capacity standard, use levels and the inventory of built structures were evaluated to assess appropriate facility capacity at Sand Harbor, in addition to parking capacity.

### **5.2.2 Condition of Facilities**

Two primary methods were used to assess the current condition of existing facilities at Sand Harbor: a visual assessment and staff interviews. During the visual assessment, built structures at the site were photographed and evaluated using the following condition assessment categories:

- **Good** – Facilities are in good condition and appear to function as designed.
- **Needs Maintenance** – Facilities are in serviceable condition, but are in need of routine maintenance.
- **Needs Repair** – Facilities need repair to function properly.
- **Needs Replacement** – Facilities are in need of replacement (cannot be repaired).

To supplement the visual assessment, Sand Harbor operations and maintenance staff were also interviewed about facility and general infrastructure conditions at the site.

### ***5.2.3 Visitor Opinions and Preferences***

As a component of the visitor survey (described in Section 2.2), visitors to Sand Harbor were asked several questions about their opinion and preferences on facilities and facility maintenance, as well as facility needs at the park:

- Are the current recreation facilities provided at Sand Harbor adequate to meet your needs?
- On this visit, why did you choose to come to Sand Harbor?
- Have you ever not gotten into the park due to lack of available parking?
- For each potential issue at Sand Harbor (including getting into the park or a parking space, ability to launch a boat, and finding a picnic site, among others), please indicate the degree of concern you may feel about these issues.
- If you could change one thing at Sand Harbor, what would it be?

When considered in aggregate, the responses to these questions provide important insight about visitor perceptions of facility-related issues at Sand Harbor.

## **5.3 FACILITY CAPACITY RESULTS AND ASSESSMENT**

Results specific to addressing facility capacity at Sand Harbor are presented below. The related capacity conclusions are provided in Section 5.4.

### ***5.3.1 Existing Facility Capacity***

As noted in the methodology, the existing facility capacity estimate focused on parking area capacity and use. Parking area limitations have been recognized at least since the 1990 LTNSP General Management Plan, which noted that the parking areas fill to capacity on many summer days (State Parks 1990). In addition and as noted in the recent RMP, parking tends to be the primary facility limiting factor at Sand Harbor (State Parks 2010). Parking capacity is thus the primary facility-related constraint on use levels at the park.

## **Facility Capacity at Parking Areas**

As described in Section 3.1.1, the primary beach and picnic areas and the boat ramp at Sand Harbor have separate entrances and associated parking areas. There is no public vehicular access between the Boat Ramp area and the rest of Sand Harbor. Memorial Point has a parking area alongside SR 28. The approximate existing parking capacity at each site is listed below.

**Sand Harbor Main Area** – 532 vehicle spaces (combination of main parking lot, south parking lot, and spaces along the road between the two lots; does not include the 26 reserved parking spaces at the Group Use Area, five marked spaces occupied by dumpsters during the study, or the two spaces signed “compact car only”).

**Boat Ramp Area** – 59 vehicle-trailer spaces, and 16 vehicle spaces that are reserved/signed as car-top boat (kayak) spaces. (Vehicles with short trailers can sometimes fit an additional group member’s vehicle in the space. The vehicle-trailer spaces may also be used by two vehicles without trailers when the ramp is closed due to low water.)

**Memorial Point** – 28 vehicle spaces, of which about 18 (those closest to the restrooms) are signed as 20-minute spaces.

Park staff close Sand Harbor to additional vehicles when the parking areas are full. In 2010, the Sand Harbor parking areas were temporarily closed to new vehicles on 47 days during the summer season (nearly 50 percent of the summer season days) because of parking capacity issues. The parking areas reopen at 3 p.m., the time at which it has been determined (through trial and error) that enough vehicles have usually left the park so that parking will not refill. In 2008 and 2009, there were 26 and 27 closures, respectively, because of the parking areas being at capacity (i.e., full).

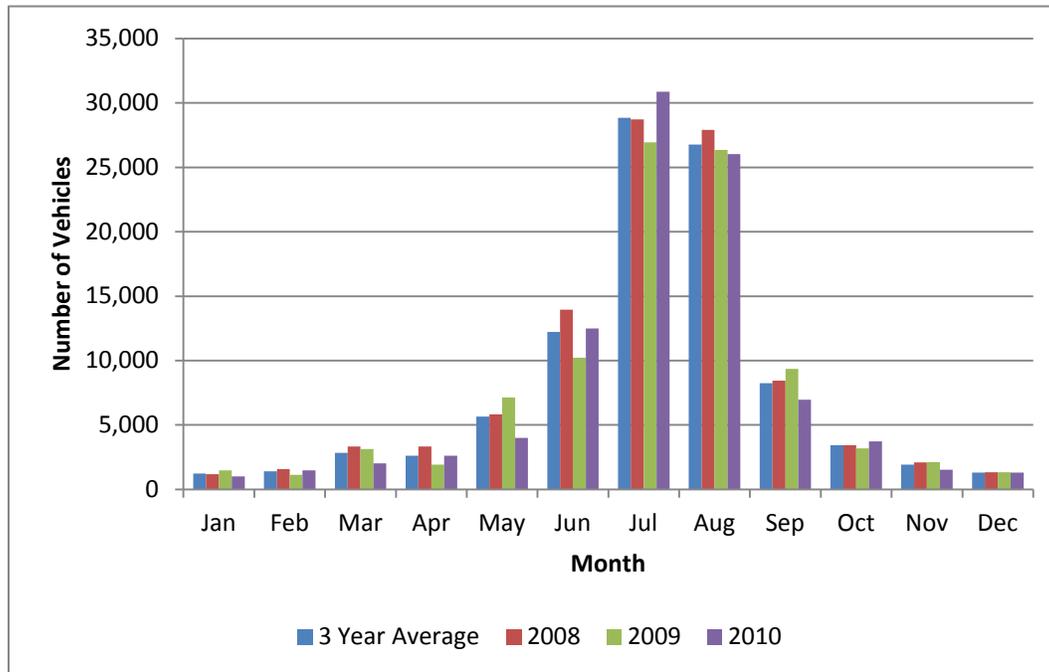
At both Sand Harbor and Memorial Point, parking along SR 28 functions as overflow when the primary parking areas are full (Appendix I presents the results of counts of vehicles parked along SR 28 conducted for this study). This overflow capacity is limited by parking prohibitions and the distance visitors are willing to walk to reach the park. At Sand Harbor, it is estimated that parking along SR 28 adds an additional 150 spaces to the total parking capacity of the park. This figure may be as high as 200–250 spaces if areas farther to the south are included and if “no parking” areas are not actively enforced. State Parks uses mechanical traffic counters to monitor the number of vehicles that enter Sand Harbor at the Main Beach and Boat Ramp area entrances, and Memorial Point.

### ***Parking Areas Reached via the Main Entrance***

On average over the past 3 years (2008–2010), approximately 96,500 vehicles entered Sand Harbor at the main entrance on an annual basis. Figure 5-1 displays the monthly level of traffic entering Sand Harbor at the main entrance (data provided by State Parks).

During the peak use summer months of June, July, and August, the 3-year average number of vehicles entering Sand Harbor was about 12,221, 28,853, and 26,767, respectively. Table 5-1 estimates capacity use levels during these peak summer months by comparing the number of vehicles to the existing capacity of parking spaces at Sand Harbor.

The capacity utilization estimates provided in Table 5-1 (and Tables 5-2 and 5-3) rely on the use of a turnover rate. Based on the Sand Harbor Visitor Survey results (see Section 2.2), visitors reported spending an average of about 5.5 hours at the park.



**Figure 5-1. Monthly Total Vehicles that Entered Sand Harbor at Main Entrance (2008 – 2010).**

Given this average time-on-site, a turnover rate of one (i.e., each parking space is used twice per day) may be appropriate for capacity estimation purposes. However, as noted previously, Sand Harbor was closed to additional vehicles about 47 days in 2010 due to a lack of parking, and many parking spaces are occupied by the same visitors’ vehicles from mid-morning through mid-afternoon, when park usage (and parking demand) is greatest. Therefore, the entire parking area, and perhaps most spaces, do not likely turn over each day. As such, the “true” capacity utilization level is likely somewhere between the two estimates (based on turnover rates) listed in Table 5-1.

Nevertheless, the documentation of parking use levels consistently at 80 to 95 percent of capacity through June and July (with the assumption of one turnover of each space per day) quantifies the high parking occupancy that is the summer season norm at Sand Harbor and verifies that parking usage very regularly exceeds capacity.

**Table 5-1. Summer Season Parking Area Capacity Utilization Estimate at Sand Harbor (Main Area).**

Year/Month	Number of Vehicles <sup>1</sup>	Monthly Maximum Capacity <sup>2</sup>		Monthly Capacity Use Estimate <sup>3</sup>	
		No Turnover	1 Turnover/Day	No Turnover	1 Turnover/Day
<b>2008</b>					
June	13,960	15,960	31,920	87.5%	43.7%
July	28,717	16,492	32,984	174.1%	87.1%
August	27,906	16,492	32,984	169.2%	84.6%
<b>2009</b>					
June <sup>4</sup>	10,209	15,960	31,920	64.0%	32.0%
July	26,958	16,492	32,984	163.5%	81.7%
August	26,351	16,492	32,984	159.8%	79.9%
<b>2010</b>					
June	12,494	15,960	31,920	78.3%	39.1%
July	30,885	16,492	32,984	187.3%	93.6%
August	26,043	16,492	32,984	157.9%	79.0%
<b>3-Year Average</b>					
June	12,221	15,960	31,920	76.6%	38.3%
July	28,853	16,492	32,984	175.0%	87.5%
August	26,767	16,492	32,984	162.3%	81.2%
<p><sup>1</sup> Vehicle counts are 80 percent of the traffic counter values, based on State Parks estimate of 20 percent non-visitor traffic (turn-around and official traffic). Entrance station data collected for this study suggest that the non-visitor traffic is closer to eight percent of the total; if this lower percentage were used in this analysis, parking utilization would be substantially higher than shown.</p> <p><sup>2</sup> Monthly maximum capacity is the total number of parking spaces available per month. Maximum capacity is calculated with no turnover (i.e., each parking space is only occupied once per day) and 1 turnover per day (i.e., each parking space is occupied twice per day). For example, in June there is a maximum parking capacity of 15,960 vehicles with no turnover (532 parking spaces x 30 days = 15,960 total parking spaces) and 32,984 vehicles with one turnover (532 parking spaces x 2 uses per day x 30 days = 32,984 total parking spaces). The maximum capacity estimate does not include the 26 parking spaces that are reserved for the group picnic site.</p> <p><sup>3</sup> The monthly capacity use estimate compares total vehicles per month with maximum capacity.</p> <p><sup>4</sup> SR 28 construction through June resulted in Monday through Thursday lane closures between Sand Harbor and Incline Village, which caused traffic delays and reduced Sand Harbor attendance and thus parking usage.</p> <p>Source: data provided by State Parks.</p>					

### **Boat Ramp Area**

On average, over the past 3 years (2008–2010) approximately 29,400 vehicles entered the Boat Ramp area of Sand Harbor on an annual basis. Figure 5-2 displays the monthly level of traffic entering the Boat Ramp area at Sand Harbor (data provided by State Parks). While vehicle use is displayed year round at the Boat Ramp area, the ramp is not necessarily usable (i.e., boats can be safely launched) during all months. In 2008 and 2010, the ramp remained open through Labor Day, while in 2009 the ramp closed in early August. When the ramp is closed, the parking area is open and used for overflow parking and launching of car-top boats. Boat ramp usability is described in greater detail below.

Table 5-2. Summer Season Parking Area Capacity Utilization Estimate at the Sand Harbor Boat Ramp.

Year/Month	Number of Vehicles <sup>1</sup>	Monthly Maximum Capacity <sup>2</sup>				Monthly Capacity Use Estimate <sup>3</sup>			
		No Turn over	Turnover 1X / Day	Turnover 2X / Day	Turnover 3X / Day	No Turnover	Turnover 1X / Day	Turnover 2X / Day	Turnover 3X / Day
<u>2008</u>									
June	4,590	2,250	4,500	6,750	9,000	204.0%	102.0%	68.0%	51.0%
July	11,968	2,325	4,650	6,975	9,300	514.8%	257.4%	171.6%	128.7%
August	11,968	2,325	4,650	6,975	9,300	514.8%	257.4%	171.6%	128.7%
<u>2009</u>									
June <sup>4</sup>	2,028	2,250	4,500	6,750	9,000	90.1%	45.1%	30.0%	22.5%
July	7,112	2,325	4,650	6,975	9,300	305.9%	153.0%	102.0%	76.5%
August <sup>5</sup>	5,663	2,325	4,650	6,975	9,300	243.6%	121.8%	81.2%	60.9%
<u>2010</u>									
June	3,625	2,250	4,500	6,750	9,000	161.1%	80.6%	53.7%	40.3%
July	7,436	2,325	4,650	6,975	9,300	319.8%	159.9%	106.6%	80.0%
August <sup>5</sup>	5,920	2,325	4,650	6,975	9,300	254.6%	127.3%	84.9%	63.7%
<u>3-Year Average</u>									
June	3,414	2,250	4,500	6,750	9,000	151.7%	75.9%	50.6%	37.9%
July	8,839	2,325	4,650	6,975	9,300	380.2%	190.1%	126.7%	95.0%
August	7,851	2,325	4,650	6,975	9,300	337.7%	168.8%	112.6%	84.4%

<sup>1</sup> Vehicle counts are 40 percent of the traffic counter values, based on State Parks estimate of 60 percent non-visitor traffic (turn-around and official traffic). It is a common occurrence for vehicles to enter the boat ramp area by mistake, then leave and go to the main entrance.

<sup>2</sup> Monthly maximum capacity is the total number of parking spaces available per month, assuming vehicle-trailer spaces would not be used by vehicles without trailers (75 total parking spaces are available at the boat ramp). Such use is allowed when the boat ramp is closed due to low lake levels.

<sup>3</sup> The monthly capacity use estimate compares total vehicles per month with maximum capacity.

<sup>4</sup> SR 28 construction through June resulted in Monday through Thursday lane closures between Sand Harbor and Incline Village, which caused traffic delays and reduced Sand Harbor attendance, and thus parking usage.

<sup>5</sup> 2009 and 2010 were low water years at Lake Tahoe causing the boat ramp to be closed August 5 and September 7, respectively, those years. This would have reduced usage of (and presumably boater traffic into) the area during August of those years, and would have also reduced parking utilization.

Source: data provided by State Parks.

Table 5-3. Summer Season Parking Area Capacity Utilization Estimate at Memorial Point.

Year/Month	Number of Vehicles <sup>1</sup>	Monthly Maximum Capacity <sup>1</sup>				Monthly Capacity Use Estimate <sup>2</sup>			
		No Turn over	Turnover 5X / Day	Turnover 10X / Day	Turnover 15X / Day	No Turn over	Turnover 5X / Day	Turnover 10X / Day	Turnover 15X / Day
<u>2008</u>									
June	9,038	840	5,040	9,240	13,440	1076.0%	179.3%	97.8%	67.3%
July	9,452	868	5,208	9,548	13,888	1089.0%	181.5%	99.0%	68.1%
August	9,474	868	5,208	9,548	13,888	1091.5%	181.9%	99.2%	68.2%
<u>2009</u>									
June <sup>4</sup>	7,176	840	5,040	9,240	13,440	854.3%	142.4%	77.7%	53.4%
July	12,468	868	5,208	9,548	13,888	1436.5%	239.4%	130.6%	89.8%
August	9,668	868	5,208	9,548	13,888	1113.8%	185.6%	101.3%	69.6%
<u>2010</u>									
June	8,750	840	5,040	9,240	13,440	1041.7%	173.6%	94.7%	65.1%
July	12,165	868	5,208	9,548	13,888	1401.5%	233.6%	127.4%	87.6%
August	11,135	868	5,208	9,548	13,888	1282.8%	213.8%	116.6%	80.2%
<u>3-Year Average</u>									
June	8,322	840	5,040	9,240	13,440	990.7%	165.1%	90.1%	61.9%
July	11,362	868	5,208	9,548	13,888	1309.0%	218.2%	119.0%	81.8%
August	10,092	868	5,208	9,548	13,888	1162.7%	193.8%	105.7%	72.7%

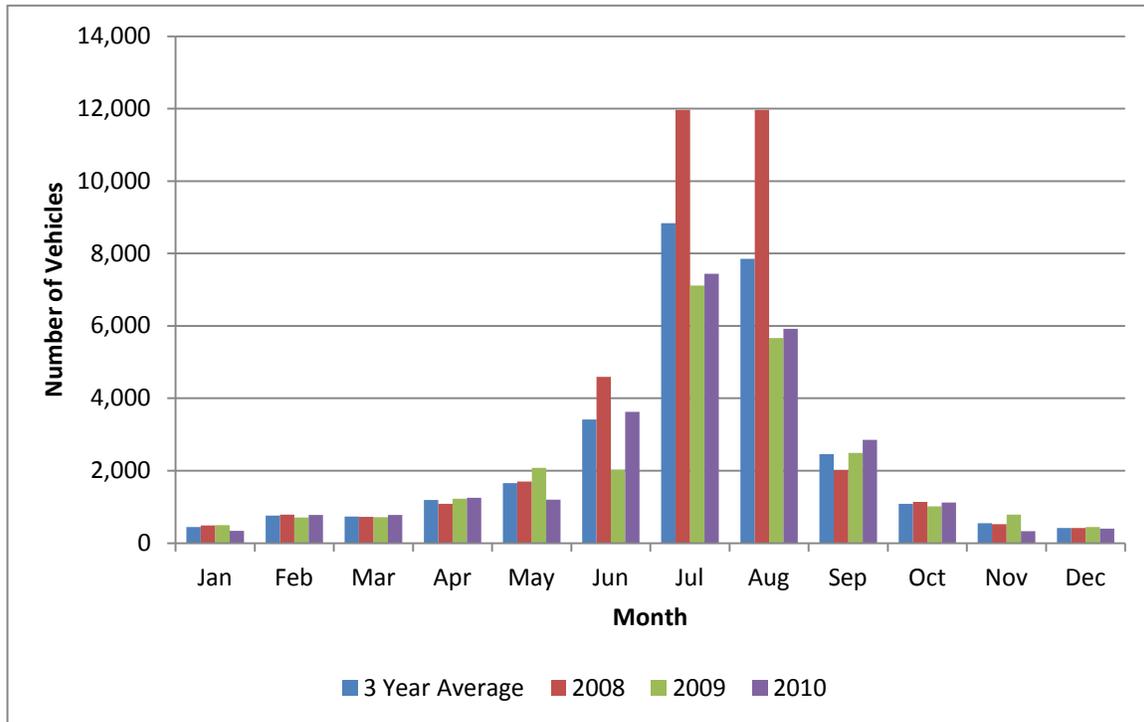
<sup>1</sup> Vehicle counts are 70 percent of the traffic counter values, based on State Parks estimate of 30 percent non-visitor traffic (turn-around and official traffic).

<sup>2</sup> Monthly maximum capacity is the total number of parking spaces available per month (28 spaces are available at Memorial Point). Maximum capacity is calculated with no turnover (0), 5 turnovers per day (5), 10 turnovers per day (10), and 15 turnovers per day (15). Fifteen turnovers per day most closely corresponds with the 34-minute average duration of visits (reported by surveyed visitors) over an 8-hour daily peak use period (approximately 10 a.m. to 6 p.m.).

<sup>3</sup> The monthly capacity use estimate compares total vehicles per month with maximum capacity.

<sup>4</sup> SR 28 construction through June resulted in Monday through Thursday lane closures between Sand Harbor and Incline Village, which caused traffic delays and presumably reduced Memorial Point attendance and thus parking usage.

Source: data provided by State Parks.



**Figure 5-2. Monthly Total Vehicles that Entered the Sand Harbor Boat Ramp (2008 – 2010).**

Peak use at the Boat Ramp area occurs in the summer months (similar to the Main Beach area of the park), in particular during the months of July and August. During the peak use summer season, the 3-year average number of vehicles entering the Boat Ramp area at Sand Harbor was approximately 3,414, 8,839, and 7,851 for the months of June, July, and August, respectively. Table 5-2 estimates capacity use levels during these peak summer months by comparing the number of vehicles to the existing capacity of parking spaces at the Boat Ramp parking area of Sand Harbor.

Similar to the capacity use estimate at the main parking area at Sand Harbor (Table 5-1), the estimates in Table 5-2 rely on turnover rates. Based on the Sand Harbor Visitor Survey results, boaters surveyed in the Boat Ramp area (kayakers, power boaters, personal watercraft [PWC] users) reported spending an average of about 5.5 to 6.5 hours at the park.<sup>10</sup>

Given this average time on site, a turnover rate of one (i.e., each parking space is used twice per day) may be appropriate for capacity estimation purposes. However, as

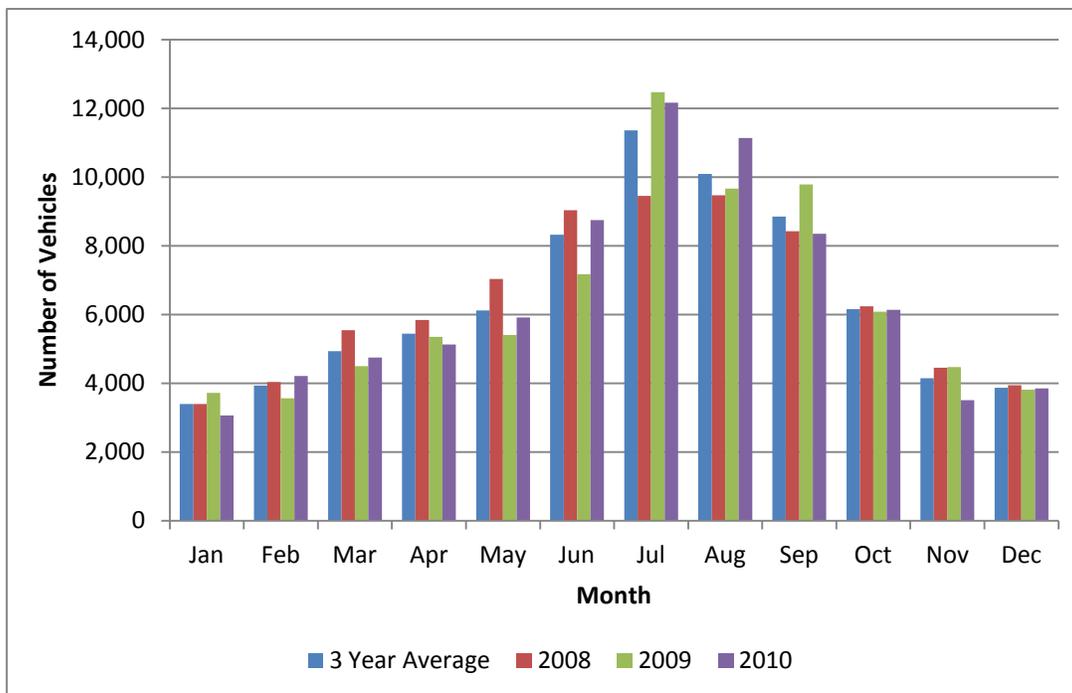
<sup>10</sup> Many non-boaters (e.g., beach users, swimmers) were also surveyed in the Boat Ramp area, but it is not known if they parked in the boat ramp parking area. Given that most of the boat ramp parking spaces are reserved for vehicles with trailers (when the ramp is open), it is likely that many parked in the parking lots reached via the main entrance.

displayed in Table 5-2, the vehicle counts indicate that the turnover rate may be closer to three (i.e., each parking space is used four times per day) or higher. There is also the potential for higher turnover at the Boat Ramp parking area than the main area of Sand Harbor due to the early arrival of most ramp users; during 2010, 43 percent of boats were launched before 10 a.m. and more than 70 percent were launched by noon. This increases the likelihood that some of the parking spaces would become available (turn over) relatively early in the day.

Although the data are not as consistent as at the main entrance parking areas (likely due to low water conditions and boat ramp closures in 2009 and 2010), parking use levels were at 85 to 95 percent of capacity through June and July, on average, over the 3-year period analyzed (with the assumption of three turnovers of each space per day). Thus, high parking occupancy is also verified to be the summer season norm at the Boat Ramp, and it is verified that parking usage very regularly exceeds capacity.

**Memorial Point**

At Memorial Point, an average of 76,600 vehicles per year entered the site over the past 3 years (2008–2010). Figure 5-3 displays the monthly traffic levels at Memorial Point. Use at Memorial Point tends to be more evenly distributed throughout a year although, similar to Sand Harbor, use does peak during the summer months. At all three parking area locations, use tends to remain high into September (use levels in September are similar to those recorded in June), after peaking in July and August.



**Figure 5-3. Monthly Total Vehicles that Entered Memorial Point (2008 – 2010).**

During the peak use summer months (June, July, and August), the 3-year average number of vehicles entering Memorial Point was about 8,322, 11,362, and 10,092, respectively. Table 5-3 estimates capacity use levels during these peak summer months by comparing the number of vehicles to the existing capacity of parking spaces at Memorial Point. Although not listed, use levels in September tend to be similar to those in June and thus capacity utilization levels would be similar.

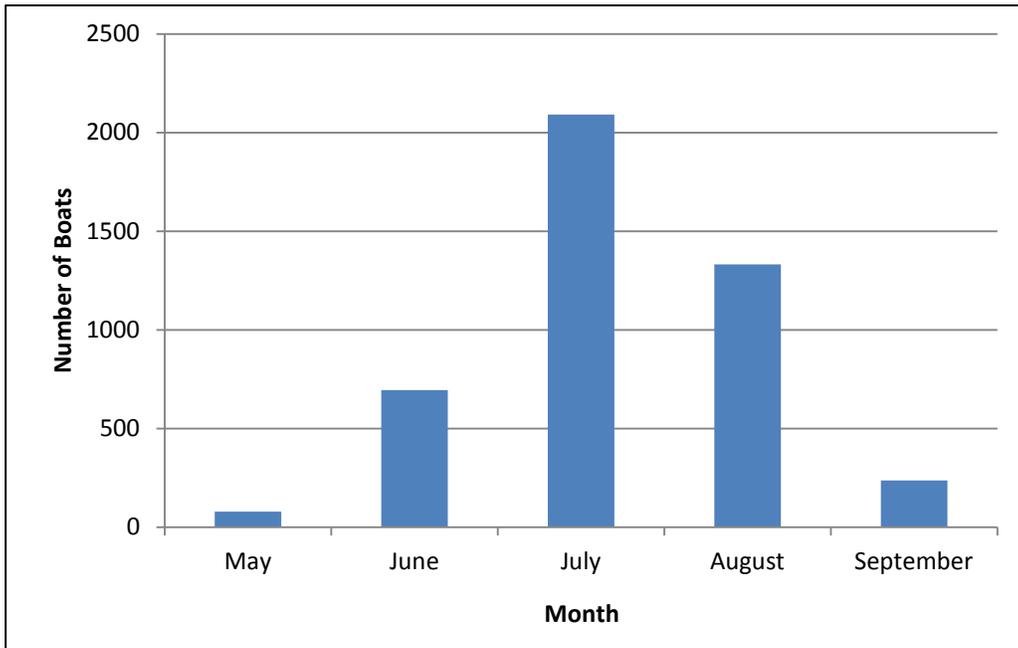
Similar to the other capacity use estimates (Tables 5-1 and 5-2), the estimates in Table 5-3 rely on the use of turnover rates. Based on the Memorial Point Visitor Survey results (Appendix F), visitors reported spending an average of about 34 minutes at the site (parking at a portion of the parking spaces at Memorial Point is limited to 20 minutes). Given this average time on site, a higher turnover rate is appropriate for capacity estimation purposes. As such, turnover rates of 5, 10, and 15 are used in the capacity utilization estimates in Table 5-3.

Parking use levels at Memorial Point were above 80 percent of capacity, on average, only during July over the 3-year period analyzed (with the assumption of 15 turnovers of each space per day, which most closely matches the short duration of most visits). Thus, high parking occupancy may be less of a summer season norm at Memorial Point than at Sand Harbor with parking usage less regularly exceeding capacity. However, it should also be noted that Sand Harbor visitors commonly park at Memorial Point and walk to Sand Harbor, leaving the vehicle for several hours and using a portion of the parking capacity intended for Memorial Point visitors.

### **Facility Capacity at the Boat Ramp**

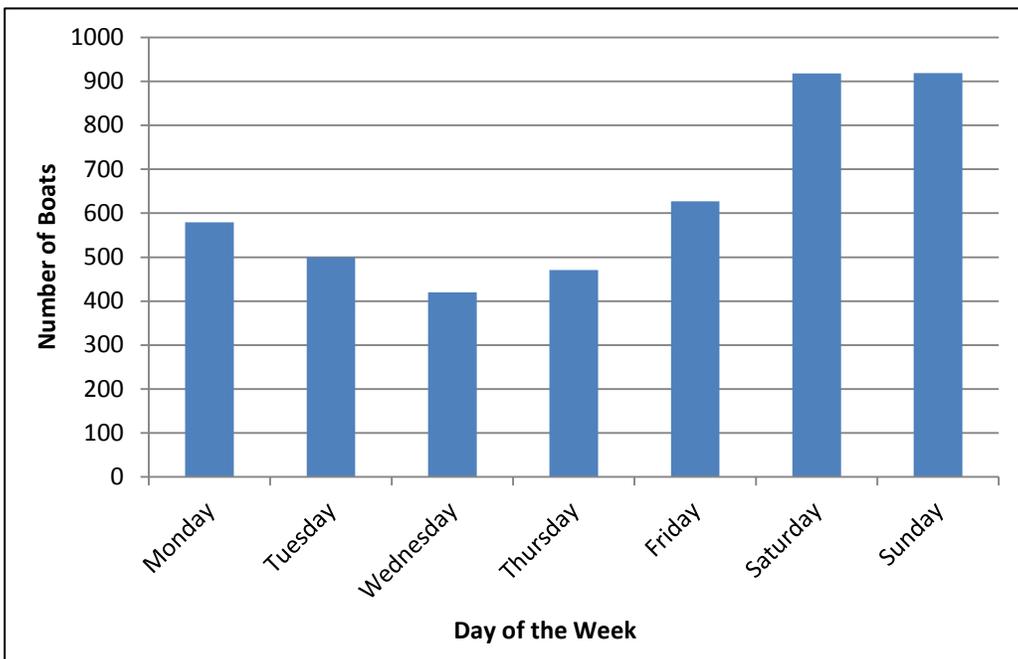
Excluding the likely parking capacity constraints at the Boat Ramp area, the launch itself has a theoretical maximum use capacity in terms of boats that can realistically and safely be launched in a day. In 2010, visitors launched about 4,430 boats at the Sand Harbor boat ramp. As with other use areas at the park, boat ramp use tended to be highest during the summer months of June, July, and August (Figure 5-4). Nearly 2,100 boats were launched in July 2010. Low lake levels probably reduced boat ramp use after mid-August, although the ramp did not close until September 7. Saturday and Sunday accounted for the highest daily use levels at the boat ramp, with just over 900 boats launched on those days in 2010 (Figure 5-5). On a daily basis, the heaviest levels of use generally occurred between 8 a.m. and 1 p.m., when over 70 percent of launches occurred.

Given the number of boat ramp lanes (four) and an average launch time of 15–20 minutes (accounting for the congestion observed at the ramp area), an estimated 12 to 16 boats can be launched and/or retrieved per hour. Table 5-4 displays the estimated average hourly boat launch rates between 8 a.m. and 1 p.m. (the peak use hours) at the boat ramp during summer 2010. Compared to the minimum hourly facility capacity (12 boats), capacity utilization at the boat ramp ranges from about 14 to 57 percent during weekdays and 29 to 98 percent on weekend days, depending on the time of day.



**Figure 5-4. Total Monthly Boat Ramp Use Levels (2010).**

*Source: Data provided by State Parks*



**Figure 5-5. Total Daily Boat Ramp Use Levels (2010).**

*Source: Data provided by State Parks*

**Table 5-4. Hourly Average Number of Boats Launched May 1 – Sept. 7, 2010  
(8 a.m. – 1 p.m.).**

Time of Day <sup>2</sup>	Average Number of Boats Launched per Hour <sup>1</sup>						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8:00-8:59 a.m.	3.4	4.4	1.7	1.7	4.8	8.5	9.8
9:00-9:59 a.m.	5.2	5.1	3.3	1.6	6.8	11.8	10.5
10:00-10:59 a.m.	5.6	5.5	3.1	5.2	5.6	6.7	8.3
11:00-11:59 a.m.	5.6	2.9	2.8	3.2	3.9	5.6	4.2
12:00-12:59 p.m.	3.2	4.4	3.8	4.3	4.3	4.2	3.5

<sup>1</sup> Includes only boats launched per hour, not retrievals.  
<sup>2</sup> Peak boat launch hours.  
Source: Data provided by State Parks.

In addition to the facility capacity of the boat ramp, the lake level largely dictates when the ramp lanes are usable. The boat ramp often closes when lake levels prohibit the safe launching of boats (as previously noted, in 2009 the ramp closed in early August). While the boat ramp could potentially be extended to provide greater usability at lower lake levels, the feasibility of extending the ramp and associated dredging has been recently evaluated. Results of planning indicate that successful extension of the ramp would likely be unattainable due to a lack of water depth throughout the near shore portions of the harbor, which provides insufficient draft for many boats, particularly at low lake levels.

### **Capacity at Other Facilities**

As stated previously, parking is the primary facility-capacity related use constraint at Sand Harbor; the Main Beach, Diver's Cove, and the Boat Ramp beaches do not have their own improvements (e.g., parking and restrooms are shared with other use areas), and therefore do not have facility constraints specific to those use areas. However, parking may be a limiting factor for use of the Visitor Center and restaurant since no dedicated parking is available for those facilities, and some visitors appear to come to the park solely to use those facilities (Trip Advisor 2010). Visitors coming to Shakespeare Festival performances, particularly those who arrive early, may have difficulty finding parking until more beach users have left the park.

It was observed during the 2010 summer season that restrooms near the beaches and at the Visitor Center were sometimes crowded, with long lines. This was particularly evident during the July 4 holiday. The Shakespeare Festival also expressed concern in a stakeholder interview about insufficient capacity for women at the restroom most convenient to the theatre. However, it is notable that few of the surveyed visitors who felt that the park's facilities were not adequate mentioned a need for more restrooms in their explanation of this perception (rather, most who mentioned restrooms stated that the restrooms needed to be cleaned or stocked more often).

Not including the Visitor Center restroom, there are eight public restrooms at Sand Harbor: two at the Boat Ramp/Group Use Area, two at the Family Picnic Area, and four

at the Main Beach. Each Main Beach restroom provides four toilets/urinals for men and four toilets for women, while the other restrooms each provides two toilets/urinals for men and two toilets for women; thus, there are a total of 48 fixtures, 24 for men and 24 for women, in the eight stand-alone restrooms. This number exceeds national guidelines established by the American Restroom Association and the National Standard Plumbing Code relative to peak visitation levels at Sand Harbor.<sup>11</sup> Nevertheless, State Parks is considering replacing some or all of the showers in the Main Beach restrooms, which appear to receive little use, with additional toilet fixtures.

The 2010 summer season observations also provide insight on use of the Family Picnic Area and beach areas. Use of these areas is addressed in Chapter 4, in relation to spatial or physical capacity. (Weekend and holiday use levels are generally considered to be at or exceeding the spatial capacity of the Diver's Cove and Boat Ramp Area beach areas at most times.) The Family Picnic Area is potentially constrained by the number of picnic sites; however, the number of sites is limited by the area available; thus, capacity of the area was addressed in relation to physical (spatial) capacity rather than facility capacity. (Use levels exceeded physical or spatial capacity in the Family Picnic Area only during peak holiday periods and occasional non-holiday weekends. Additional sites/facilities could increase the physical capacity of the area, but may adversely affect visitor experiences and resource conditions.)

### **5.3.2 Facility Conditions**

Facility conditions were visually assessed by AECOM and Sand Harbor staff on November 17, 2010. Facility conditions were visually inspected to best identify those potential issues or concerns that are readily visible by visitors. In general, the park and its facilities/amenities are well maintained and do not appear to need substantial repairs or replacement at this time, except as noted below.

#### **Condition of Utilities**

The primary utilities (sewer, water, and electricity) at Sand Harbor and Memorial Point appear to be well maintained and sufficient to meet peak use demands at this time (pers. comm., J. Fontaine, 2010). The sewer system at the park is connected to Incline Village's sewer system via a 4-inch pipe and multiple lift stations. The system can accommodate about 100 gallons of effluent per minute with a maximum capacity of

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<sup>11</sup> The National Park Service (NPS) and the National Recreation and Park Association provide only general guidelines for the distribution and number of restrooms. NPS policies state that the level of use determines the size of facilities needed (*Management Policies 2006, sec. 9.3.3*) (NPS 2006). However, the American Restroom Association guidelines recommend four toilets and eight urinals for men and 12 toilets for women at sites with hourly visitation of 1,000 to 2,000 people, a range which is comparable to Sand Harbor use levels at peak hours. The National Standard Plumbing Code guidelines for "outdoor assembly areas" recommend eight facilities for men and 14 facilities for women at sites with peak hour visitation of 2,600 people (NPS 2010), which exceeds peak use of Sand Harbor at most times.

approximately 43,000 gallons per day. The highest load to date on the sewer system was 38,000 gallons in one day, but typical loads are much lower.

Sand Harbor and Memorial Point each has its own water system. Both sites draw water from nearby wells that are on an aquifer that is not fed by Lake Tahoe. A separate water tank provides storage for potential fire emergencies. The 50,000-gallon fire storage tank is filled manually and operated separately from the potable water system (so as to not overly tax or drain the potable water system and to avoid potential contamination of the potable water system). Pertinent information about the water systems at both Sand Harbor and Memorial Point is provided in Table 5-5.

At Sand Harbor, typical water demands include (listed by type of day):

- Weekday – 8,000 gallons/day
- Weekend day – 15,000 gallons/day
- Peak use day – 35,000 gallons/day

**Table 5-5. Key Information about the Sand Harbor and Memorial Point Water Systems.**

Site	Primary Facilities with Water	Average Annual Use (gallons/year) <sup>1</sup>
Sand Harbor	<ul style="list-style-type: none"> <li>• Restrooms (eight total, four with showers)</li> <li>• Drinking fountains</li> <li>• Irrigation</li> <li>• Park office and shop</li> <li>• Visitor Center and restaurant/concessions building</li> <li>• Park staff residences (two)</li> </ul>	2,153,000 <sup>2</sup>
Memorial Point	<ul style="list-style-type: none"> <li>• Restroom (four unit)</li> <li>• Drinking fountain</li> <li>• Irrigation</li> </ul>	316,000

<sup>1</sup> Annual use is averaged over a 5-year period.

<sup>2</sup> Highest water use during the 5-year period 3.7 million gallons/year and lowest was 1.5 million gallons/year.

Source: State Parks (2009a) and personal communication with J. Fontaine (2010).

The water systems at both Sand Harbor and Memorial Point appear to accommodate current use levels. The only exception would be under extreme drought conditions. State Parks has a Water Conservation Plan in place that would guide water use at both sites during the event of severe drought (State Parks 2009a). The Water Conservation Plan provides for continued visitor use of the park, although with several water use-related constraints and management strategies (e.g., use of portable toilets).

The electrical systems at both Sand Harbor and Memorial Point are in good condition and are able to meet the demands of current use levels (pers. comm., J. Fontaine, 2010). The electrical system at Sand Harbor was replaced when the new Visitor Center was recently constructed. In the event of a power outage, a back-up generator provides electricity to key facilities, including the sewer and water systems. Power outages do

occur, although they are infrequent and are not generally associated with use levels at the park.

### **Condition of Parking Areas**

The existing parking areas at Sand Harbor (including the Boat Ramp Area) and Memorial Point are generally in good condition and function as designed. The main parking area and roadways were resurfaced and water quality vaults were installed in recent years as a “Question 1” Conservation Bond/EIP project (State Parks 2008). Parking spaces, circulation patterns, and ADA-compliant parking spaces are clearly delineated and signed. As shown in Figure 5-6, some of the curbing in the Sand Harbor parking areas is damaged/cracked (in need of replacement/maintenance), although curb damage does not limit the overall function of the parking area.

At the Boat Ramp, there appears to be a drainage issue associated with the southwestern pull-through lane (near the adjacent wetland) (Figure 5-7). The drainage issue does not appear to limit use, but the turning radius of this lane is inadequate for vehicles with large trailers and has resulted in damage to curbing.



**Figure 5-6. Example of Damaged Curb at Sand Harbor Parking Area.**



**Figure 5-7. Poor Drainage/Puddling at Sand Harbor Boat Ramp Parking Area.**

### **Condition of Picnic Areas**

The two picnic areas at Sand Harbor are well maintained, and most facilities appear to be in good condition. At the Family Picnic Area, typical picnic site facilities include a table and grill (Figure 5-8). The Family Picnic Area also has drinking fountains, trash and recycling receptacles (Figure 5-9), signs, and restrooms at appropriate locations. While not related to the condition of facilities at the picnic sites, visitors are using logs (from trees that were felled earlier in the year for forest health reasons) as de facto picnic site furniture. This may indicate a need for additional tables or other amenities at the existing picnic sites.



**Figure 5-8. Typical Facilities at a Family Picnic Area Site.**



**Figure 5-9. Garbage and Recycling Receptacles at Sand Harbor.**

The internal pathways in the Family Picnic Area are constructed from concrete and asphalt. The newer concrete pathways are in very good condition. However, the older asphalt pathways are cracked and broken in several locations (Figures 5-10 and 5-11) and in need of repair or replacement. State Parks has previously identified the need to replace the asphalt pathways, pending funding (pers. comm., J. Fontaine, 2010) and a replacement project is currently planned.



**Figure 5-10. Cracked and Broken Asphalt Pathway in the Family Picnic Area of Sand Harbor.**



**Figure 5-11. Cracked Internal Asphalt Pathway at the Family Picnic Area.**

Similar to the Family Picnic Area, the Group Use Area is well maintained and in good condition. The group site can accommodate large groups and consists of a covered picnic pavilion (“ramada”), tables, food preparation facilities (sink and counter), trash and recycling receptacles, and nearby restrooms (Figures 5-12 and 5-13). As acknowledged by State Parks staff, there is a drainage issue at the Group Use Area (pers. comm., J. Fontaine, 2010). The floor drain is about 1 inch higher than the lowest areas under the covered picnic facility; this causes puddles to form and the drain is in need of replacement.



**Figure 5-12. Interior of the Group Use Area at Sand Harbor.**



**Figure 5-13. Garbage and Recycling Receptacles at the Group Use Area.**

### **Condition of Boat Ramp**

The boat ramp at Sand Harbor, as with most facilities at the park, is well maintained, in good condition, and generally functions as designed. As noted previously, the ramp becomes unusable at lower lake elevations. While extending the ramp would make it usable at lower lake levels, physical constraints imposed by the shallow slope of the lake bottom in the harbor are a significant obstacle, and the permitting and costs associated with the extension would likely be prohibitive. Channel dredging is not feasible due to currents and sand movement. Also, several surveyed boaters expressed concern about a drop off at the end of the boat ramp that is a hazard for boats launching during low water periods. Trailers may get stuck or may be damaged. Plans are underway to modify the ends of the launch lanes to soften the drop off and for improvements to the Boat Ramp parking area, as a “Question 1/EIP” Conservation Bond project (State Parks 2008).

### **Condition of the Beach Areas**

Built structures at the beach areas are primarily limited to access pathways and three circular overlook platforms near the main parking area (restrooms, trash receptacles, and other facilities are described below). The pathways are relatively new and constructed from either stamped or poured concrete. They are generally in good condition, although settling and erosion are causing some cracks and undercutting (Figures 5-14 and 5-15). The overlook platforms are brick circles with brick paver surfaces. Some settling and cracking of the concrete and pavers is apparent. The damage to the pathways and overlook platforms does not affect their use at this time, but may limit their functionality in the future if not addressed. Drinking fountains at the overlook platforms were also found to be sand-clogged and not operating during the 2010 season. Replacement with standard gate valve faucets is being considered.



**Figure 5-14. Cracking Beach Overlook Platform at Sand Harbor.**



**Figure 5-15. Beach Access/Overlook Pathway Undercut by Erosion.**

### **Condition of Restrooms and Other Amenities**

In addition to the built structures identified above, there are multiple restrooms (Figures 5-16 and 5-17), garbage and recycling receptacles, benches, signage, and other amenities at Sand Harbor and Memorial Point that facilitate responsible visitor use of the site. Given existing use levels at the park, these other amenities are generally in good condition and only show wear-and-tear associated with normal use of the park.

Some of the restroom buildings are aesthetically dated (in particular when compared to the new Visitor Center and concession building), but both the interior and exterior appear well maintained and functional (visitor opinions on restrooms are described in Section 5.2.3). At the time of the field observation, there was some graffiti on the restroom building at Memorial Point (despite its graffiti-proof exterior). According to State Park staff, graffiti is a periodic issue at Memorial Point since the lakeside of the restroom building is not visible from the parking area. The restroom interiors, rocks (along the shoreline), and other site amenities are occasionally vandalized, but park staff are committed to addressing graffiti as soon as practicable (pers. comm., J. Fontaine, 2010).



**Figure 5-16. Sand Harbor Restroom Building (near Family Picnic Area).**



**Figure 5-17. Sand Harbor Restroom Building (near Beach and Shakespeare Festival Theatre).**

### 5.3.3 Visitor Opinions and Preferences

As noted in the facility capacity methodology (Section 5.2), the Sand Harbor and Memorial Point Visitor Surveys conducted during summer 2010 included several questions related to facility capacity. Investigating visitor preferences for and opinions on facility capacity-related issues is useful in capacity studies as managers' and visitors' perceptions often differ. Visitor opinions and preferences (in addition to use patterns) can often provide helpful insight and another perspective on the management priorities that ultimately emerge from capacity studies.

Facility capacity-related results from the visitor surveys are provided below by area (Sand Harbor, Memorial Point). The results are presented separately for three reasons:

- The facility-related questions were slightly different on each survey form.
- While there is some overlap in visitors between Sand Harbor and Memorial Point (approximately 30 percent of Memorial Point visitors indicated they also visited or will visit Sand Harbor on their current trip), each site appears to attract different visitor groups, who may have differing opinions and preferences.
- Site-specific results tend to be most useful, in particular when considering actions based on the results of a capacity study.

Also, the visitor survey questions and applicable responses provided by site below are facility capacity-related excerpts from the surveys. The full range of responses to each of the survey questions, including those described in this section, are provided in Appendix E.

#### **Sand Harbor**

Visitors have several key motivations or reasons for taking trips to Sand Harbor, most of which are rooted in the environmental setting of the park (e.g., quality of the beaches, water quality, scenery, etc.). However, about 40 percent of visitors indicated that the facilities provided were one of the reasons they chose Sand Harbor (Sand Harbor Visitor Survey Question 9; Appendix E).

Of all visitors, approximately 81 percent reported that the current recreation facilities at Sand Harbor were adequate to meet their needs. However, nearly 20 percent did not feel the current recreation facilities were adequate (Sand Harbor Visitor Survey Question 8; Appendix E). For these visitors, the most common explanation given for this perceived inadequacy included (percentage of responses given is provided after each response category):

- Restrooms (need more, need maintenance/stocking, need improvement, etc.) – 39.0 percent.
- Parking (need more, need ADA parking spaces, need more boat trailer parking, etc.) – 14.6 percent.
- Concessions (need better food, too expensive, slow service, etc.) – 13.0 percent.

- Other site amenities (more picnic tables, more grills, more trash receptacles, more/functioning drinking fountains, etc.) – 7.3 percent.
- Boat ramp (needs improvement, needs to function at lower water levels, needs to stay open later in the day, etc.) – 1.2 percent.

While nearly 20 percent of visitors thought the existing facilities at Sand Harbor were not adequate to meet their needs, no one type of facility was universally identified as inadequate by visitors, as evidenced by the list above. In fact, with the exception of restrooms, no type of facility was identified as inadequate by more than 3 percent of visitors.<sup>12</sup>

Regarding parking, about half of the visitors (51.1 percent) to Sand Harbor reported not getting into the park (at some time in the past) due to lack of parking (Sand Harbor Visitor Survey Question 14; Appendix E). This contrasts with the slightly less than 3 percent of visitors who indicated parking was inadequate. The seeming disparity in responses may be due to differences in how each question was asked (e.g., open versus closed, general versus specific, etc.). Also, as has been noted above, visitors commonly park along SR 28 when the parking is full (Appendix I); this “coping action” may increase visitors’ acceptance of parking limitations, particularly if they recognize that large areas are already devoted to parking and would not wish to see those areas expanded at the expense of the natural setting.

The average number of times during a season visitors reported not being able to get into Sand Harbor because of lack of parking was two (responses ranged from 1 to 15 times). When the parking area is full, the average number of times visitors reported parking along SR 28 was one (responses ranged from 0 to 10 times). Interestingly, responses of zero accounted for nearly 45 percent of the responses to this question, which may indicate that many visitors (who do not get into the park because of lack of parking) prefer forgoing a visit to Sand Harbor rather than parking along the highway.

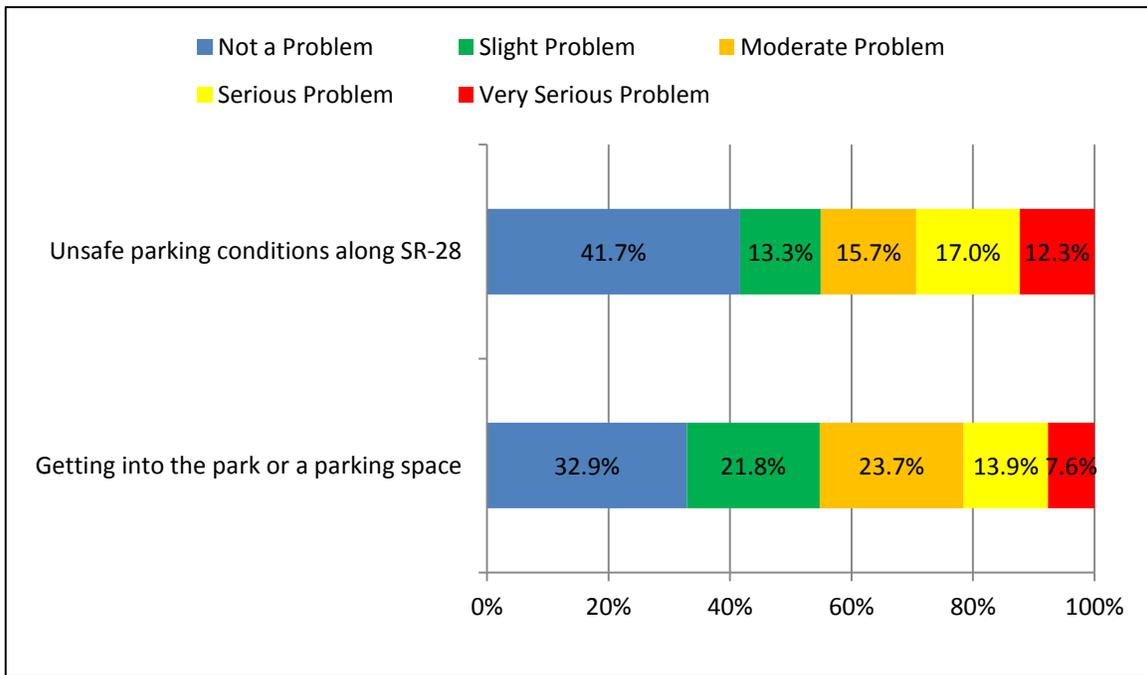
Visitor concerns with both parking and parking along SR 28 were also identified as key problems (Sand Harbor Visitor Survey Question 15; Appendix E). Among the eight issues listed on the survey form, getting into the park or finding a parking space was the issue most often identified as a problem (combination of slight, moderate, serious, and very serious problem response categories) by visitors to Sand Harbor (67.1 percent of visitors indicated parking/finding a parking space was a problem). The second most identified problem was unsafe parking conditions along SR 28 (58.3 percent of visitors indicated it was a problem). In addition and as indicated in Figure 5-18, unsafe parking

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<sup>12</sup> Responses to the employee survey indicate that Sand Harbor employees have a higher level of concern about the adequacy of the facilities, with 15 of 25 respondents stating that the existing facilities were not adequate. The reasons given for this opinion generally parallel those of the visitors listed above. The average rating employees gave the quality of the facilities at Sand Harbor was 4.8 (with 1 = poor and 7 = excellent).

along SR 28 was also identified as a “very serious problem” by more than 12 percent of visitors to Sand Harbor (the highest percent of all listed issues/concerns).

Finally, visitors were asked to describe the one thing they would change at Sand Harbor (Sand Harbor Visitor Survey Question 20; Appendix E). Approximately 60 percent of visitors provided a valid response to this question (the remaining 40 percent of visitors provided a positive comment or left this question blank).



**Figure 5-18. Level of Visitor Concern For Unsafe Parking Conditions Along SR 28 and Getting into the Park/Finding a Parking Space.**

Responses to this question were highly varied, although there were several notable facility-related responses. These included (percentage of visitors is provided in parentheses):

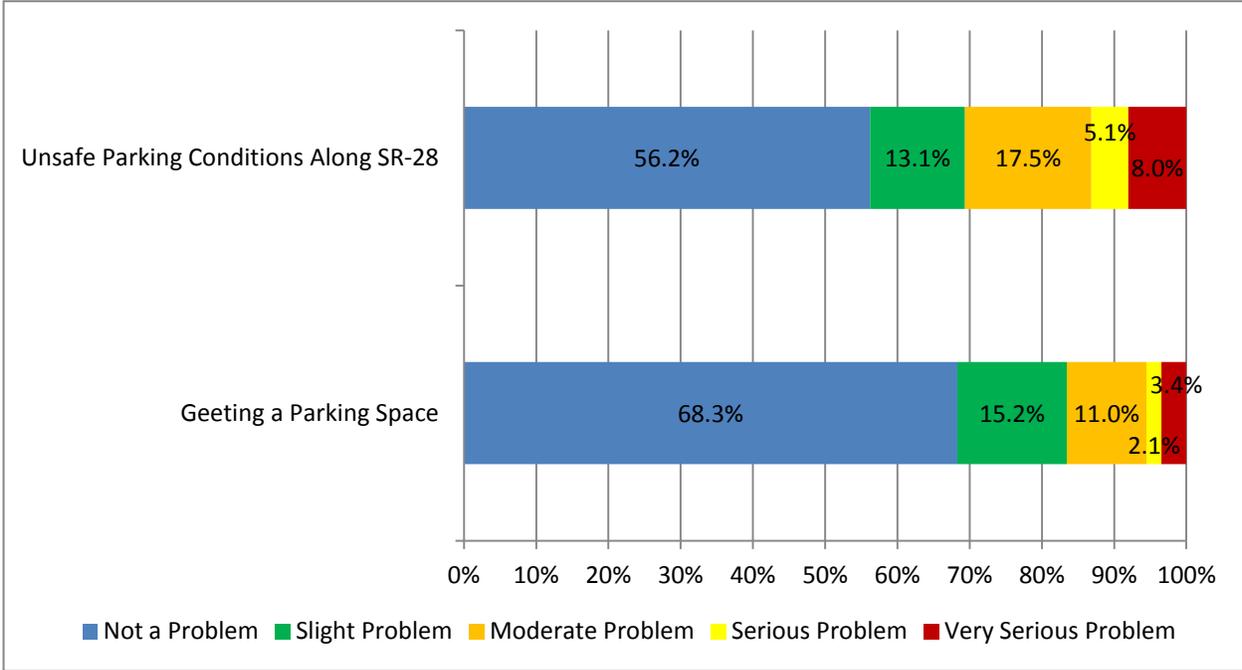
- Provide more parking/general parking improvements (14.5 percent).
- Provide better maintenance of the site/facilities (4.8 percent).
- Provide/allow picnic sites/grills on or near the beach (2.2 percent).
- Extend or improve the boat ramp (2.0 percent).
- Add site amenities (picnic tables, trash/recycling, etc.) (2.0 percent).
- Improve/provide more restrooms (1.5 percent).

Visitors also identified several other facility-related changes, although no single change was identified by more than 1 percent of visitors. These changes included improving access and circulation, increasing the size of the park, and prohibiting parking on SR 28.

**Memorial Point**

At Memorial Point, more visitors indicated that the facilities provided were adequate to meet their needs compared to those at Sand Harbor (Memorial Point Visitor Survey Question 6; Appendix E). In fact, only about 8 percent of visitors to Memorial Point indicated that the facilities provided were inadequate. When asked to provide a reason why the facilities were inadequate, nearly all of these visitors indicated that the restrooms were closed. (Note: Restrooms were occasionally closed due to seasonal staff limitations and resulting maintenance issues.)

As shown in Figure 5-19, a majority of visitors to Memorial Point do not think that either getting a parking space or unsafe parking conditions along SR 28 are a problem. Slightly more than 30 percent of visitors indicated a concern or problem (combination of slight, moderate, serious, and very serious problem response categories) with getting a parking space at Memorial Point. However, only about 5 percent of visitors indicated that getting a parking space was a serious or very serious problem.



**Figure 5-19. Level of Visitor Concern for Unsafe Parking Conditions Along SR 28 and Getting a Parking Space.**

While a slight majority of visitors do not perceive unsafe parking conditions along SR 28 as a problem, nearly 45 percent of visitors indicated it was a problem (combination of slight, moderate, serious, and very serious problem response categories). This includes about 13 percent of visitors who indicated that unsafe parking conditions were a serious or very serious problem.

## 5.4 FACILITY CAPACITY CONCLUSIONS

Considered in aggregate, the facility capacity-related factors that were investigated and reviewed for this study indicate that existing use levels are likely at and at times exceed the facility capacity of Sand Harbor, at least during the peak summer season. In particular, the parking areas at Sand Harbor (including the Boat Ramp) and Memorial Point fill to capacity during summer season days, causing the park to close to additional vehicles and visitors to use places along SR 28 as de facto overflow parking areas. Visitor opinions and preferences also identify parking and safety along SR 28 as primary concerns. Parking constraints have been a concern for at least the past 20 years; the 1990 General Management Plan also recognized that the facilities at Sand Harbor were utilized at or near capacity during the summer months (State Parks 1990).

While parking is the primary facility-related constraint at Sand Harbor, the potential effects of adding more parking capacity are unclear. Although the 1990 General Management Plan recommended expansion of the Boat Ramp parking area, it is also acknowledged that additional facility development should be explored with caution, as the quality of the recreational experience would likely be degraded with additional development. This is particularly true in relation to beach use, which appears to be at or exceeding spatial capacity during years with higher lake levels. However, other areas of the park, in particular the Family Picnic Area, seem able to accommodate higher use levels than are currently observed on most days (excluding periodic peak summer season weekend days and holidays). So, while visitor demand is high, the consequences of addressing this demand through additional parking capacity are problematic.

That said, the Boat Ramp may be able to accommodate higher use levels if additional parking capacity could be provided. Parking (as opposed to the capacity of the launch itself) appears to limit the number of boats launched per day based on the boat launch counts and capacity utilization estimates provided in Section 5.3.1. As described previously, function and capacity of the boat ramp are also affected by congestion (particularly in the area directly above the ramp), inadequate turning space for larger boat trailers, and problems with the ramp itself at low water. Increased use of the boat ramp could also increase congestion in the harbor and on the boat ramp beaches, where many boaters stay for a large part of their time on the lake.

The “launch and leave” policy at the boat ramp also affects parking capacity at Memorial Point and exacerbates the overflow parking situation along SR 28. It was observed that boaters taking advantage of this policy commonly park at Memorial Point (some of whom violate the 20-minute parking limitation for spaces facing the lake, which cannot be used for vehicles with trailers but can be used for vehicles used to haul car-top boats) or along SR 28 in front of Memorial Point.

On-site expansion of the Boat Ramp parking area may not be considered feasible (for that matter, site expansion may not be a viable option anywhere at Sand Harbor due its

geographic constraints and the effects of such expansion on the natural setting), but off-site parking and shuttles to the Boat Ramp may be appropriate options to consider to meet visitor demand. The increasing presence of kayakers and paddle boarders and the planned introduction of a kayak and PWC concession at the boat ramp are also factors to consider in any potential plans for changes to this facility.

Even with high summer use levels that are at and/or exceeding capacity, the facilities at Sand Harbor are generally well maintained and function as designed. This is a testament to both the responsible use of these facilities by most park visitors, as well as the dedication of Sand Harbor park staff to maintain these facilities.

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## 6.0 ECOLOGICAL CAPACITY ASSESSMENT

Ecological capacity relates to the impacts of recreation on the environment and the amount of recreation use that can occur without unacceptable impacts on the environment. Ecological impacts from recreation include things such as soil compaction, soil erosion, loss of vegetation/ground cover and associated habitat, and disturbance to wildlife and sensitive plants. This chapter describes the nature of ecological (i.e., biophysical) impacts associated with recreational use at Sand Harbor and Memorial Point, and characterizes the current magnitude (i.e., extent and intensity) and status (i.e., stable, increasing, or decreasing in effect) of those impacts to the extent feasible. Field observations provided the basis for estimates of the extent and intensity of ecological impacts and subsequent qualitative rating (none, low, moderate, high) of those parameters. The qualitative evaluation of the status of observed impacts was based on both field observation and discussions with park staff. The emphasis of the assessment is on readily observable vegetation and soil characteristics. Overall ecological capacity assessments for each of the five Sand Harbor use areas and for Memorial Point are provided,

### 6.1 DESCRIPTION AND APPLICATION AT SAND HARBOR

To assess ecological capacity within the study area, ecological issues of concern were first identified by LTNSP managers and AECOM resource specialists to guide development of an appropriate assessment methodology. Ecological issues of primary concern within the study area include soil erosion and associated beach stability, loss of ground cover and soil compaction in areas of concentrated use, and damage to unique ecological features within the study area (e.g., large pine trees bordering primary beaches and mature oak scrub habitat). Also of concern is dwarf mistletoe (*Arceuthobium* spp.) infestation of overstory conifers, forest recruitment, proliferation of user-created trails throughout the park, potential disturbances to special-status species, and impacts on wildlife habitat. Special-status species of interest in the study area include osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), and the state-endangered Tahoe yellow cress (*Rorippa subumbellata*). The northern goshawk (*Accipiter gentilis*) is of management concern in the area (and within the larger LTNSP). Potential goshawk foraging habitat is present in the Sand Harbor vicinity with the sufficient size class and relatively open forest stand structure present there. However, the nearest designated goshawk Protected Activity Center (PAC) is more than 1 mile from Sand Harbor and 2 miles from Memorial Point. The closest active nest is nearly 8 miles from both Memorial Point and Sand Harbor. Because of the high disturbance and use at the sites, regular use by goshawks is not expected at Sand Harbor or Memorial Point, and goshawks were not specifically considered in the analysis.

Sand Harbor and Memorial Point are well-developed recreation sites; thus, the use areas evaluated in this document generally have numerous facilities and hardened features present, lessening the potential for certain types of ecological impacts.

However, some ecological impacts are to be expected at developed recreation sites due to the existence of facilities that support relatively heavy use. Additionally, evidence of uses beyond the extent of hardened surfaces is prevalent at Sand Harbor and Memorial Point, indicating that the potential for additional ecological impacts is high.

An ecological capacity rating of below, approaching, at, or exceeding capacity was determined for each of the five identified use areas at Sand Harbor (Main Beach, Sandy Point, Diver's Cove/Group Use Area, Family Picnic Area, and Boat Ramp Area/Boater's Beach) and also for Memorial Point based on the magnitude and status of observed impacts within each use area. This assessment is not intended to determine precise cause-and-effect relationships between the level and types of recreational use and observed impacts.

## 6.2 METHODOLOGY

Ecological resources were assessed for capacity-related impacts on October 27, and on November 17 and 18, 2010 at the five main use areas at Sand Harbor (Main Beach, Sandy Point, Diver's Cove and Group Use, Family Picnic, and Boat Ramp/Boater's Beach use areas) (Figure 6-1) and also at Memorial Point. Impact assessment forms (Appendix C) were filled out at each use area during field observations. Photographs of impacts were taken to document the extent, severity, and location of impacts. To assess ecological capacity within the study area, several ecological impact variables were evaluated under the following five impact topics:

- Soil impacts (erosion and compaction, including that caused by user-created trails).
- Vegetation impacts (loss of ground cover, dwarf mistletoe infestation of conifers, root exposure, and forest recruitment).
- Damage to unique ecological features (sentinel pines, mature oak scrub habitat).
- Wildlife habitat impacts (large trees and snags providing raptor perch sites).
- Impacts on special-status plants (i.e., Tahoe yellow cress).

Impact variables were based on identified issues of concern, as described above. The significance and methods to assess most of these impact variables have been widely discussed in the ecological impact management and recreation ecology literature (Hammit and Cole 1998, Leung and Marion 2000, Marion 1991, Newsome et al. 2002), although they have generally been addressed in backcountry or wilderness settings and in relation to trail and campsite impacts. Appendix J provides a detailed description of each variable assessed and its relevance to the study area.

Ecological impact variables were evaluated at each of the five Sand Harbor use areas and at Memorial Point based on a rating of the magnitude and status of the associated impact. Magnitude of impact is defined by two components: (1) the spatial extent or relative prevalence of the impact (i.e., extent); and (2) the overall severity of the impact (i.e., intensity) (Cole 2004). Status is defined as the direction and speed at which the magnitude of the impact is changing, if identifiable, or whether the impact is not changing and is stable.

Impact magnitude (both the extent and intensity) is rated on a four-point scale: none, low, moderate, or high. The extent of impact was generally assessed in terms of the estimated proportion of the use area over which observed impacts were distributed. Extent ratings corresponded to the following: none (no impact observed), low (less than about one third of use area with observed impacts), moderate (between about one third and two thirds of use area with observed impacts), or high (more than about two thirds of use area with observed impacts). Impact extent rating criteria are summarized in Table 6-1. Additional details about factors contributing to impact extent ratings for each impact variable are provided in Appendix J.

The intensity of impact (e.g., severity) was assessed according to the nature of the impact and was also rated on a four-point none/low/moderate/high scale. The intensity rating criteria were specifically identified for each impact variable and are also provided in Table 6-1. Although the specific extent and intensity rating criteria were formulated specifically for this study, with the primary goal of accurately representing the range of impacts observed, similar broad-scale ratings have been proposed for the assessment of natural resource impacts in parks by conservation organizations (NPCA 2008).

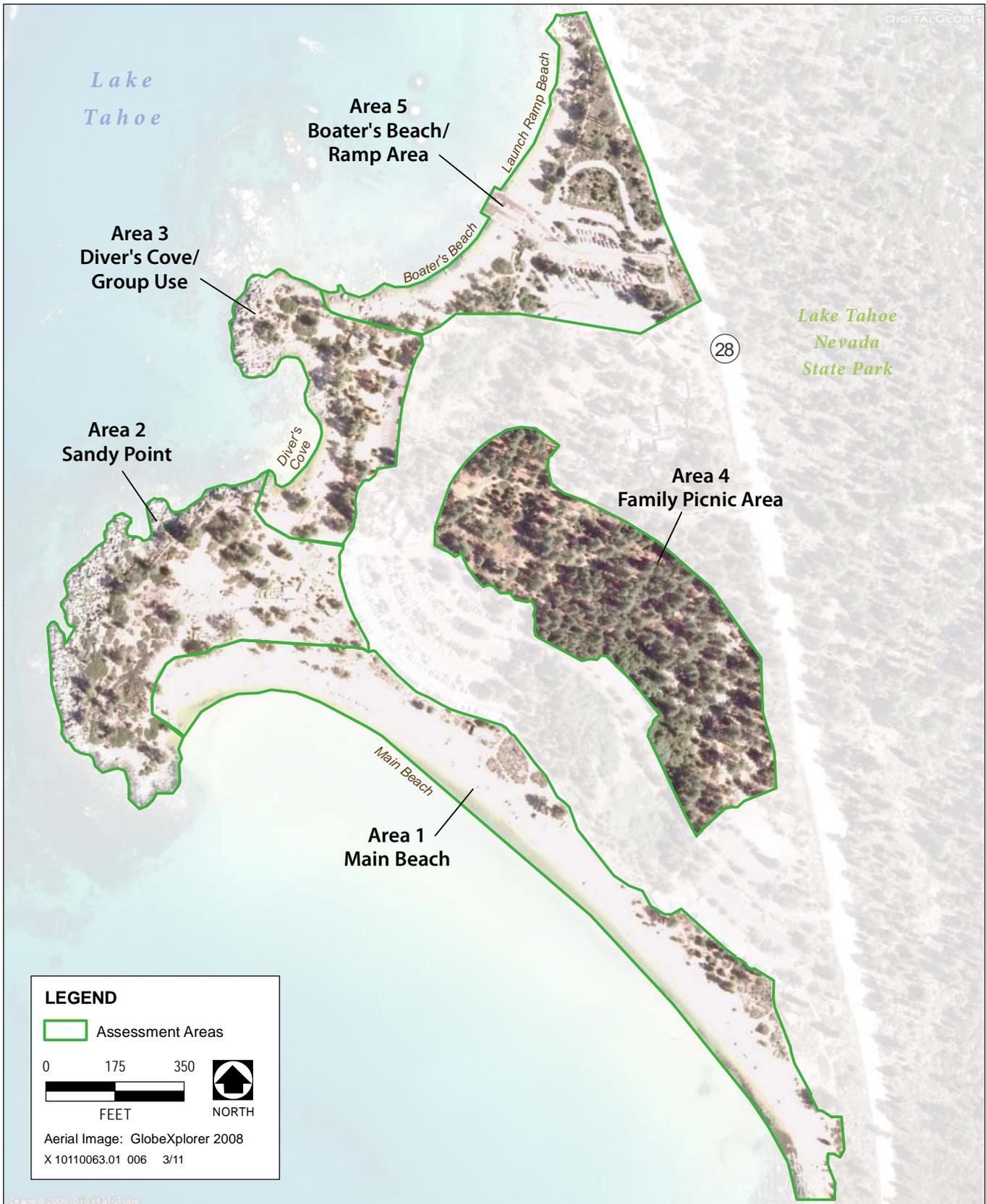
Impact status was assessed based on a qualitative evaluation of observed changes to the impact magnitude over time (primarily based on discussions with park staff), in combination with the potential for the impact to increase in magnitude in the near future (based on recent observations). Impact status was rated as one of the following three categories:

**Low** — Impact appears to be stable or decreasing in magnitude and/or shows some signs of recovery.

**Moderate** — Impact appears to be slowly increasing in magnitude.

**High** — Impact appears to be moderately to rapidly increasing in magnitude.

In some cases, the extent, intensity, or status of an ecological impact was found to vary somewhat within the affected portions of a use area. For example, some portions of a use area were observed to have a moderate intensity of impact and other portions a high intensity of impact for particular ecological variables. Similarly, some portions of a use area had a low intensity of impact and other portions a moderate intensity of impact. In such cases, impact assessments of moderate to high and low to moderate, respectively, were used for the ecological variable in question.



Source: NSP 2011, AECOM 2011

Fig. 6-1. Ecological Impact Assessment Areas at Sand Harbor

**Table 6-1. Rating Criteria Used to Evaluate the Extent and Intensity of Ecological Impacts at Sand Harbor and Memorial Point.**

Ecological Variable	Extent Of Impact		Intensity Of Impact	
	Indicators	Rating	Indicators	Rating
<b>Soil Impacts</b>				
Soil Erosion	Number, total length, and distribution of identified erosion sites throughout the use area	<p>None = no evidence of soil erosion observed</p> <p>Low = up to 1/3 of use area with signs of soil erosion</p> <p>Moderate = between 1/3 and 2/3 of use area with signs of soil erosion</p> <p>High = more than 2/3 of use area with signs of soil erosion</p>	Average depth (in inches) of soil loss observed at identified erosion sites	<p>None = no evidence of soil erosion observed</p> <p>Low = up to 6 inches</p> <p>Moderate = more than 6 to 18 inches</p> <p>High = more than 18 inches</p>
Soil Compaction (including user created trails)	Distribution of concentrated use areas (including user-created trails) and total length of user-created trails in the use area	<p>None = no evidence of soil compaction or user-created trails observed</p> <p>Low = up to 1/3 of use area with areas of soil compaction/user created trails</p> <p>Moderate = between 1/3 and 2/3 of use area with areas of soil compaction/ user created trails</p> <p>High = more than 2/3 of use area with areas of soil compaction/user created trails</p>	Qualitative observation of soil surface hardening and prevalence of compaction-related effects (e.g., loss of vegetative cover, erosion, and root exposure)	<p>None = no evidence of soil compaction or user created trails</p> <p>Low = soil surface hardness and compaction related effects are minimal</p> <p>Moderate = soil surface hardness and compaction related effects are moderate</p> <p>High = soil surface hardness and compaction related effects are severe</p>

**Table 6-1. Rating Criteria Used to Evaluate the Extent and Intensity of Ecological Impacts at Sand Harbor and Memorial Point.**

Ecological Variable	Extent Of Impact		Intensity Of Impact	
	Indicators	Rating	Indicators	Rating
<b>Vegetation Impacts</b>				
Loss of Ground Cover	Proportion of shoreline (for beaches) or proportion of use area where impacts on ground cover as a result of recreation are apparent	<p>None = no evidence of impacts on ground cover observed</p> <p>Low = up to 1/3 of use area with signs of ground cover loss</p> <p>Moderate = between 1/3 and 2/3 of use area with signs of ground cover loss</p> <p>High = more than 2/3 of use area with signs of ground cover loss</p>	Estimated % of ground cover loss in “impacted” areas relative to identified “unimpacted” areas in use area <sup>2</sup>	<p>None = no evidence of impacts on ground cover observed</p> <p>Low = loss in vegetative ground cover less than 20% relative to “unimpacted” areas</p> <p>Moderate = loss in vegetative ground cover between 20 and 40% relative to “unimpacted” areas</p> <p>High = loss in vegetative ground cover more than 40% relative to “unimpacted” areas</p>
Dwarf mistletoe infestation of conifers	Number and estimated proportion of trees in the use area with visual signs of dwarf mistletoe infestation (i.e., number of infested trees counted divided by an estimate of the total number of trees in the use area)	<p>None = no visual signs of dwarf mistletoe infestation observed in the use area</p> <p>Low = up to 1/3 of conifers in the use area with visual signs of dwarf mistletoe infestation</p> <p>Moderate = between 1/3 and 2/3 of conifers in the use area with visual signs of dwarf mistletoe infestation</p> <p>High = more than 2/3 of conifers in the use area with visual signs of dwarf mistletoe infestation</p>	Average Dwarf Mistletoe Rating (DMR) of infected trees, based on the Hawksworth six-point rating system of the level of infection in the lower, middle, and upper crown of the tree (State Parks 2010)	<p>None = no visual signs of dwarf mistletoe infestation observed</p> <p>Low = average DMR less than 2</p> <p>Moderate = average DMR between 2 and 4</p> <p>High = average DMR more than 4</p>
Root exposure	Number and estimated proportion of trees in the use area with exposed roots (i.e., number of affected trees counted divided by an estimate of the total number of trees in the use area)	<p>None = no trees in use area with exposed roots</p> <p>Low = up to 1/3 of trees in the use area with exposed roots</p> <p>Moderate = between 1/3 and 2/3 of trees in the use area with exposed roots</p> <p>High = more than 2/3 of trees in the use area with exposed roots</p>	Average depth (in inches) of root exposure observed	<p>None = no trees in use area with exposed roots</p> <p>Low = up to 6 inches</p> <p>Moderate = more than 6 to 18 inches</p> <p>High = more than 18 inches</p>

**Table 6-1. Rating Criteria Used to Evaluate the Extent and Intensity of Ecological Impacts at Sand Harbor and Memorial Point.**

Ecological Variable	Extent Of Impact		Intensity Of Impact	
	Indicators	Rating	Indicators	Rating
Pine recruitment	Presence of pine saplings or younger age class pines in the use area	See Appendix J, p. J-4 for description of evaluation methods for this variable	Presence of pine saplings or younger age class pines in the use area	See Appendix J, p. J-4 for description of evaluation methods for this variable
<b>Impacts on Unique Ecological Features<sup>1</sup></b>				
Sentinel Trees	Number and estimated proportion of large sentinel pines with signs of damage (e.g., dwarf mistletoe infestation, exposed roots, or cankers)	<p>None = no signs of damage to identified sentinel pines</p> <p>Low = up to 1/3 of pines with signs of damage</p> <p>Moderate = between 1/3 and 2/3 of pines with signs of damage</p> <p>High = more than 2/3 of pines with signs of damage</p>	Prevalence of damage to pines combined with the average severity of each damage type	<p>None = no signs of damage to sentinel pines observed</p> <p>Low = only one sign of damage observed on trees with relatively low severity (e.g., DMR less than 2 or root exposure less than 6 inches)</p> <p>Moderate = only one sign of damage observed on most pines with moderate to high severity, or at least 2 signs of damage with low severity</p> <p>High = 2 or more signs of damage observed on most pines with moderate to high severity</p>
Mature Oak Scrub Habitat	Estimated proportion of mature oak shrubs with signs of damage (e.g., exposed roots, dead branches, compacted soil in proximity)	<p>None = no signs of damage to mature oak scrub</p> <p>Low = up to 1/3 of mature oaks with signs of damage</p> <p>Moderate = between 1/3 and 2/3 of mature oaks with signs of damage</p> <p>High = more than 2/3 of mature oaks with signs of damage</p>	Prevalence of damage to mature oak scrub	<p>None = no signs of damage to mature oak scrub observed</p> <p>Low = only one type of damage to mature oak shrubs observed</p> <p>Moderate = two types of damage to mature oak shrubs observed</p> <p>High = more than two types of damage observed on mature oak shrubs</p>

**Table 6-1. Rating Criteria Used to Evaluate the Extent and Intensity of Ecological Impacts at Sand Harbor and Memorial Point.**

Ecological Variable	Extent Of Impact		Intensity Of Impact	
	Indicators	Rating	Indicators	Rating
<b>Wildlife Impacts</b>				
Osprey and Bald Eagle Perch Sites	Number and estimated proportion of large cut stumps relative to existing large trees/snags; large trees/snags defined to be those larger than approximately 24 to 30 inches diameter at breast height (dbh)	<p>None = no large cut stumps observed</p> <p>Low = relatively few large cut stumps observed; up to an estimated 1/3 of all trees</p> <p>Moderate = several large cut stumps observed; between an estimated 1/3 and 2/3 of all trees</p> <p>High = numerous large cut stumps observed; more than an estimated 2/3 of all trees</p>	Average severity of damage observed on existing large trees/snags present in the use area. (e.g., root exposure, dwarf mistletoe infestation)	<p>None = no signs of damage to existing large trees/snags observed</p> <p>Low = either average DMR or root exposure rated as low (refer to respective rating criteria under "Vegetation Impacts", elsewhere in this table)</p> <p>Moderate = either average DMR or root exposure rated as moderate (refer to respective rating criteria under "Vegetation Impacts", elsewhere in this table)</p> <p>High = either average DMR or root exposure rated as high (refer to respective rating criteria under "Vegetation Impacts", elsewhere in this table)</p>

**Table 6-1. Rating Criteria Used to Evaluate the Extent and Intensity of Ecological Impacts at Sand Harbor and Memorial Point.**

Ecological Variable	Extent Of Impact		Intensity Of Impact	
	Indicators	Rating	Indicators	Rating
<b>Special-status Plant Impacts</b>				
Impacts on Tahoe Yellow Cress (TYC)	Current distribution of TYC in use area relative to historic records and suitable habitat	<p>None = occurrences of TYC are consistent with historic records and are distributed throughout potentially suitable habitat in the use area</p> <p>Low = occurrences of TYC are consistent with historic records but are not distributed throughout potentially suitable habitat in the use area</p> <p>Moderate – High = TYC absent from portions of historic distribution and TYC are not distributed throughout potentially suitable habitat in the use area</p>	Relative habitat quality of locations where TYC observed	<p>None = TYC occurs in areas of high quality habitat [with 75% or more sand cover]</p> <p>Low = TYC occurs in areas of moderate quality habitat [with between 30% and 75% sand cover]</p> <p>Moderate = TYC occurs in areas with low quality habitat [with slightly less than but up to 30% sand cover]</p> <p>High = TYC occurs in areas typically considered unsuitable [with less than 10% sand cover]</p>
<p><sup>1</sup> Only applies to use areas where these features were identified as a unique element of the use area.</p> <p><sup>2</sup> Along beaches where the “proportion of shoreline” approach was used, it was assumed that 100% vegetation cover along the shoreline (i.e., back of the beach) represented unimpacted conditions for the relative comparison to current conditions.</p>				

An aggregate impact rating (considering impact extent, intensity, and status) for each ecological variable assessed at each use area was determined, generally based on the highest level of impact found for each variable. For example, an area where the loss of ground cover was determined to be high in extent, but moderate in intensity and low in status would nonetheless have a high aggregate impact rating for that variable. Finally, an overall Ecological Capacity Assessment was determined for each use area based on the ratings for all impact variables assessed. Generally, an area where three or more ecological variables were determined to be at a high or moderate to high level of impact is considered to be at or exceeding ecological capacity in this assessment, whereas an area where only one or two variables were at a high or moderate to high level of impact is considered to be approaching ecological capacity. An area where all ecological variables were determined to be at low to moderate levels of impact is considered to be below ecological capacity. Additional details on this final assessment step are provided in the Ecological Capacity Assessment section (Section 6.4).

### 6.3 RESULTS OF ECOLOGICAL CAPACITY FIELD OBSERVATIONS

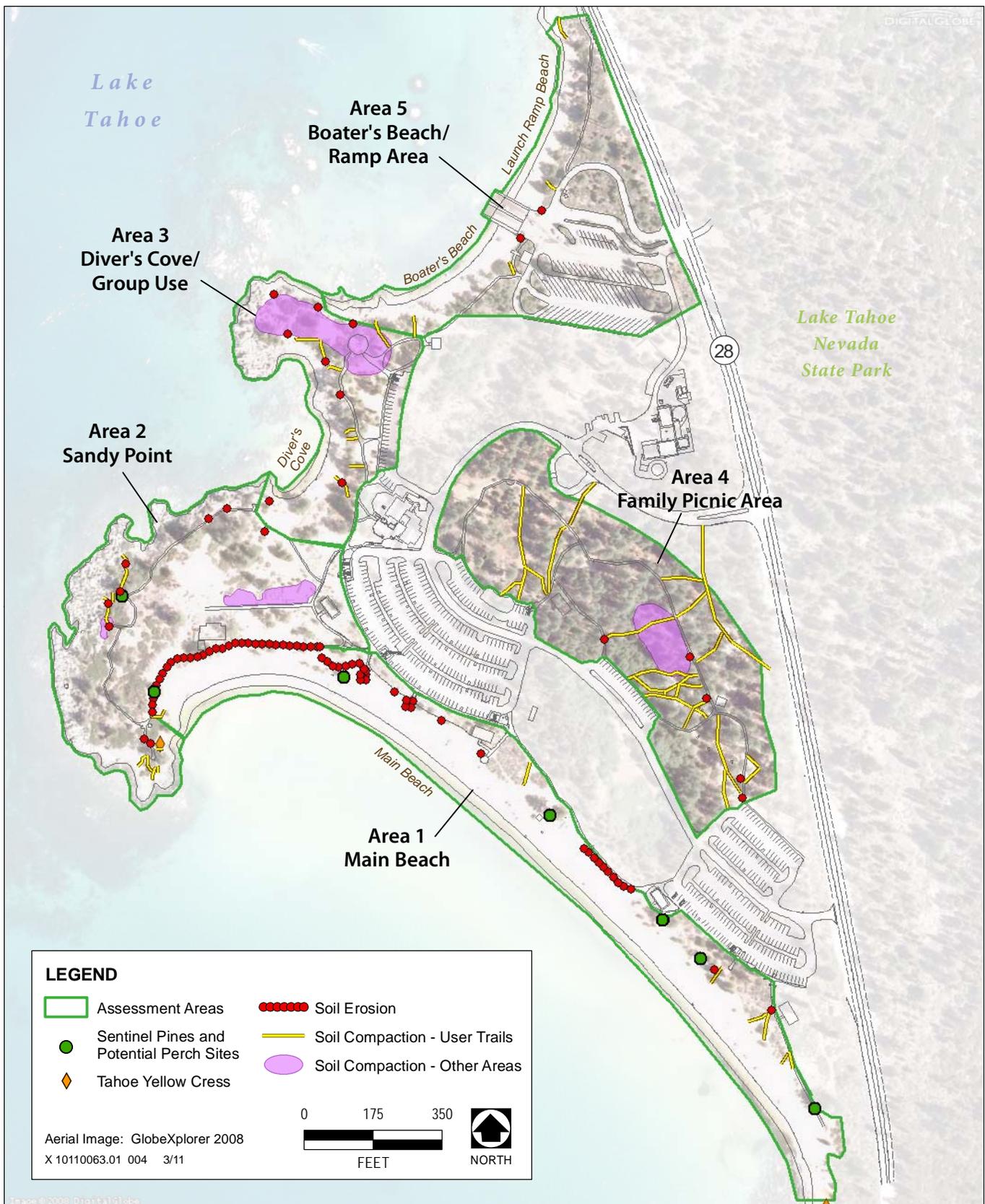
The results of the field observations regarding general conditions and ecological impacts for each use area are described in the sections below. Table 6-2 summarizes the impact assessment for each ecological variable at the five Sand Harbor use areas. Figure 6-2 displays the locations of primary ecological impacts and key resource features at the Sand Harbor use areas. A detailed description of the impacts found by type of impact is provided in Appendix J. Additional photos by use area are located in Appendix K.

#### 6.3.1 Main Beach (Use Area 1)

The Main Beach use area covers an area of approximately 8.5 acres (at low lake levels) and is predominantly a broad sandy beach with some vegetated dunes at the west end. The shoreline extends for nearly 2,500 feet in this use area. Several large pine trees border the back of the beach providing a sentinel-like character. Occasional pockets of chaparral occur in back beach areas, primarily behind fences. Conifers along the back of the beach include Ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*P. jeffreyi*), lodgepole pine (*P. contorta*), and the occasional white fir (*Abies concolor*) and incense cedar (*Calocedrus decurrens*). Cottonwood (*Populus fremontii*) and willow (*Salix* spp.) also occur in a few locations. Chaparral, where present, consists predominantly of bitterbrush (*Purshia tridentata*), rabbitbrush (*Chrysothamnus nauseosus*), manzanita (*Arctostaphylos patula*), sagebrush (*Artemisia tridentata*), and a few tobacco bush (*Ceanothus velutinus*) and huckleberry oak (*Quercus vaccinifolia*). Little to no herbaceous ground cover is present in this use area. Hardened walkways run the entire length of the Main Beach area with three restroom facilities and a life guard stand spaced out along the use area. The primary ecological impacts in the Main Beach use area include: soil/beach erosion, loss of ground covering vegetation, damage to the large sentinel pine trees along the beach (e.g., root exposure and mistletoe infestation, Figure 6-3), and the potential for additional disturbance to TYC.

**Table 6-2. Ecological Impacts at Sand Harbor (Extent, Intensity, and Status Ratings).**

Ecological Variable	Use Areas														
	Main Beach (Use Area 1)			Sandy Point (Use Area 2)			Diver's Cove And Group Use (Use Area 3)			Family Picnic Area (Use Area 4)			Boat Ramp/ Boater's Beach (Use Area 5)		
	E	I	S	E	I	S	E	I	S	E	I	S	E	I	S
<b>Soil Impacts</b>															
Soil Erosion	M	M/H	M/H	L/M	M	L	M	M	M/H	L	L	L	L	M	L/M
Soil Compaction	L	L	L	L/M	L	L	M/H	H	L	M/H	L/M	L	L	L	L
<b>Vegetation Impacts</b>															
Loss of Ground Cover	H	M/H	L	L/M	M	L	M/H	M/H	M/H	M/H	H	L	L/M	L/M	L
Dwarf Mistletoe Infest. of Conifers	M/H	M	L	None	None	L	L	L	L	M	L/M	L	L	L	L
Root Exposure	M/H	H	M/H	L	L	L	M	M	L	L	L	L	M	L/M	L
Pine Recruitment <sup>1</sup>	L (east), M/H (west)			L			L/M			L			None		
<b>Impacts on Unique Ecological Features</b>															
Sentinel Trees	H	M/H	M/H	L	L	L	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mature Oak Scrub Habitat	n/a	n/a	n/a	n/a	n/a	n/a	H	H	M	n/a	n/a	n/a	<b>n/a</b>	n/a	n/a
<b>Wildlife Impacts</b>															
Osprey and Bald Eagle Perch Sites	M	M/H	M/H	L	L	L	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Special-status Plant Impacts</b>															
Impacts on Tahoe Yellow Cress	L	M/H	L/M	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<p><i>Notes:</i>  <i>E = Extent of Impact, I = Intensity of Impact, S = Status of Impact.</i>  <i>H = High, M/H = Moderate to High, M = Moderate, L/M = Low to Moderate, L = Low.</i>  <sup>1</sup> <i>A more general assessment of pine recruitment was used rather than a detailed assessment of extent, intensity, and status of impacts. Additional details on how this ecological variable was assessed are provided in Appendix J.</i></p>															



Source: NSP 2011, AECOM 2011

Fig. 6-2. Key Resource Features and Ecological Impacts, Sand Harbor Assessment Areas



**Figure 6-3. Extensive Erosion Resulting in Root Exposure of Pine Tree on Main Beach.**

### **6.3.2 Sandy Point (Use Area 2)**

The Sandy Point use area covers approximately 7 acres and is predominantly characterized by rocky shoreline intermixed with chaparral scrub uplands. Some dune development occurs at the high points in the eastern portion of this use area. Scattered Jeffery pine and white fir occur throughout this use area, including one prominent large pine along the central portion of the shoreline. Chaparral in this use area consists of huckleberry oak, bitterbrush, manzanita, tobacco brush, and sierra bush chinquapin (*Chrysolepis sempervirens*); rabbit brush (*Chrysothamnus nauseosus*) occurs in the northeast corner of this use area. Occasional herbaceous cover is found throughout this use area. A hardened walkway, including numerous sections of elevated boardwalk, forms a 0.3-mile loop around this use area. Also, the Shakespeare Festival theatre dominates the eastern portion of this use area where vegetation is essentially absent.

The primary ecological impacts in the Sandy Point use area include: soil erosion, soil compaction, and loss of ground cover to some extent.

### **6.3.3 Diver's Cove and Group Use Area (Use Area 3)**

The Diver's Cove and Group Use Area covers approximately 4 acres and is characterized by both sandy and rocky beach and bounded by two rocky points, the most prominent being to the north. Several moderately sized pine trees line the back of

the beach, and mature oak chaparral occurs along the rocky point at the north and adjacent to the Group Use Area pavilion, also at the northern part of this use area. Jeffrey pine is the dominant overstory tree species in this use area, but a few cottonwood, willow, and one alder (*Alnus* spp.) also were observed amongst the rocks along the beach. A single mountain mahogany (*Cercocarpus ledifolius*) occurs at the east side of this use area. Shrubs in the mature oak chaparral habitat include huckleberry oak, manzanita, and Mahala mat (*Ceanothus prostratus*). Areas of bare ground occur throughout, primarily in association with the Group Use Area to the north and east. Hardened walkways border this entire use area, and numerous user-created trails lead from the paved path toward the waterfront as well as form a maze of paths on the rocky point to the north.

The primary ecological impacts in this use area include: soil erosion (Figure 6-4), soil compaction, loss of ground covering vegetation, and damage (e.g., root exposure) to the mature oak chaparral vegetation.



**Figure 6-4. Soil Channeling and Downslope movement at Diver's Cove.**

### 6.3.4 Family Picnic Area (Use Area 4)

The Family Picnic Area covers approximately 8 acres. Two parking lots border this use area to the south, and numerous (57) picnic tables and raised charcoal grills are spread throughout. The area is characterized by eastside pine forest; Jeffrey pine is the dominant overstory tree species, with white fir, incense cedar, and lodgepole pine (near the parking lot) present primarily in the understory. The understory shrub layer is largely absent in the central portion of this use area, is patchy at the west and southeast ends where numerous paths crisscross through fairly large manzanita and bitterbrush, and is dominant along the east-northeast side of this use area between the paved path and SR 28. Areas of bare ground occur throughout, primarily in association with use at picnic tables throughout this use area. Hardened walkways form two primary loops around this use area and numerous user-created trails form a network in the west and southeast portions of this use area.

The primary ecological impacts in this use area include: soil compaction, loss of ground covering vegetation (Figure 6-5), and overstory vegetation stresses (e.g., dwarf mistletoe infestation).



Figure 6-5. Loss of Ground Cover and Open Understory within the Family Picnic Area.

### 6.3.5 Boat Ramp/Boater's Beach (Use Area 5)

The Boat Ramp/Boater's Beach use area covers nearly 7 acres and is characterized by a long sandy beach bisected by the concrete boat ramp. Behind the boat ramp is a large parking lot set amongst open conifer forest. Scattered pine trees occur throughout this use area, including a few large Jeffrey pines near the parking lot. Chaparral occurs as the understory vegetation including many of the same species present in other use areas (e.g., bitterbrush, tobacco brush, etc.). A single sugar pine (*Pinus lambertiana*)

tree occurs in this use area near the restroom at the boat launch. An occasional cottonwood and willow occur along the south end of the beach. Herbaceous ground cover is largely absent in beach areas but is present elsewhere, primarily to the south of the parking lot adjacent to an area of wetter ground where facility runoff is directed. The parking lot covers approximately  $\frac{1}{4}$  of this use area, with hardened walkways running along the back of the beach both north and south from the parking lot for the entire length of the beach.

The primary ecological impacts in this use area include soil/beach erosion and associated vegetation damage (e.g., root exposure and mistletoe infestation); however, impacts in this use area are relatively minor compared to impacts in other use areas.

### **6.3.6 Memorial Point**

Memorial Point covers an area of at least 5 acres or more, extending both north and south to Sand Harbor from the primary facility (restroom and parking lot) approximately 0.5 mile north of Sand Harbor's Boater's Beach. This use area occurs entirely west of SR 28. The area is dominated by a fairly steep rocky shoreline of large boulders with well-developed chaparral vegetation in the upland. Scattered Jeffrey pines occur in the overstory with white fir mixed in with the understory chaparral. Chaparral vegetation is dominated by huckleberry oak, manzanita, Mahala mat, and also rabbitbrush in disturbed areas along the highway. A few large dominant Jeffrey pines occur along the shoreline near the main facility. No hardened walkways occur in this use area, with the exception of the platform around the elevated restroom facility. One developed dirt trail (with rope railing) has been established from Memorial Point south to Boater's Beach, and a well-established user-created trail extends north from the facility for a short distance (approximately  $\frac{1}{8}$  mile) to connect with SR 28. Numerous user-created trails extend to the shoreline from these main trails.

Table 6-3 and Figure 6-7 summarize the impact assessment for each ecological variable at Memorial Point. Ecological impacts are relatively minor in this use area; however, evidence of soil erosion (Figure 6-6) and associated vegetation damage (e.g., root exposure, tree removal) is present.

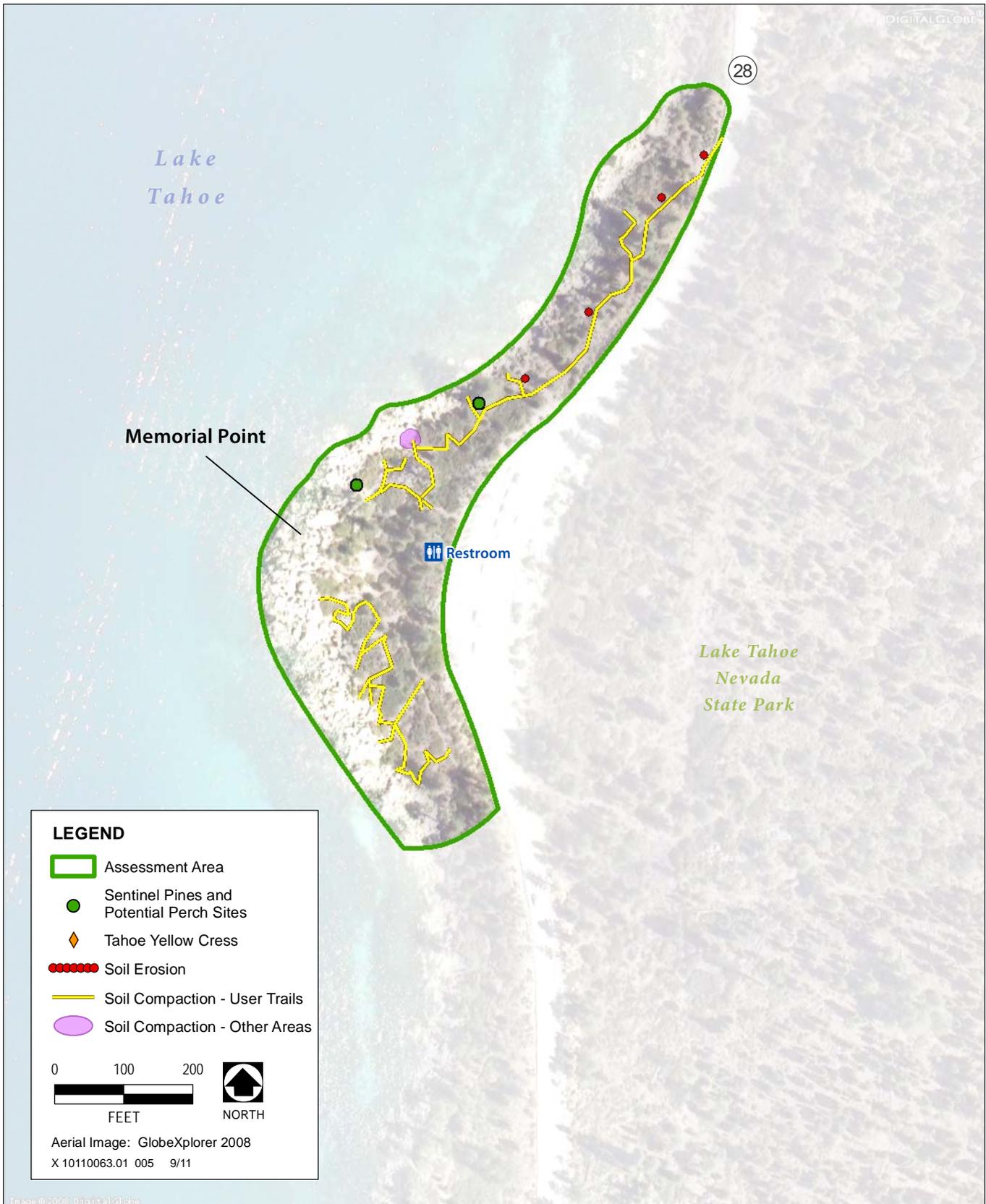
Appendix J describes the impacts found at Memorial Point by topic area. Additional photos are located in Appendix K.



Figure 6-6. Downslope Soil Entrainment at Memorial Point Erosion Site.

Table 6-3. Ecological Impacts at Memorial Point (Extent, Intensity, and Status Ratings).

Ecological Variables	Memorial Point		
	Extent	Intensity	Status
<b>Soil Impacts</b>			
Soil Erosion	L	L/M	L/M
Soil Compaction (including user created trails)	M/H	L	L
<b>Vegetation Impacts</b>			
Loss of Ground Cover	None	None	L
Dwarf Mistletoe Infestation of Conifers	None	None	L
Root Exposure	L	L/M	L
Pine Recruitment <sup>1</sup>	None		
<b>Impacts on Unique Ecological Features</b>			
Sentinel Trees	M	L	L
Mature Oak Scrub Habitat	n/a	n/a	n/a
<b>Wildlife Impacts</b>			
Osprey and Bald Eagle Perch Sites	M	L	L
<b>Special-status Plant Impacts</b>			
Impacts on Tahoe Yellow Cress	n/a	n/a	n/a
<p>Notes:  <i>M = moderate, L/M = low to moderate, L = low.</i>  <sup>1</sup> <i>A more general assessment of pine recruitment was used rather than a detailed assessment of extent, intensity, and status of impacts. Additional details on how this ecological variable was assessed are provided in Appendix J.</i></p>			



Source: NSP 2011, AECOM 2011

Fig. 6-7. Key Resource Features and Ecological Impacts, Memorial Point

## 6.4 ECOLOGICAL CAPACITY ASSESSMENT

This assessment applies thresholds of below, approaching, at, and exceeding capacity calculated for each use area based on the aggregate impact ratings (taking into account extent, intensity, and status ratings) for each impact variable assessed in the use area. As addressed above in the methodology discussion (Section 6.2), the aggregate impact ratings are generally based on the highest level of impact (i.e., extent, intensity, or status) determined for each ecological variable. The ratings for the six to nine ecological variables assessed at each use area, considered as a whole, were then used to determine the overall ecological capacity assessment for each use area. The following are the general guidelines used in making the overall capacity assessments:

Capacity Level	Aggregate Impact Ratings for Relevant Variables
Below capacity	No variables rated high or moderate to high (all rated moderate, low to moderate, or low)
Approaching capacity	One or two variables rated high or moderate to high (all others rated moderate, low to moderate, or low)
At capacity	Several (three or four) variables rated high or moderate to high (all others rated moderate, low to moderate, or low)
Exceeding capacity	Most or all (five to nine) variables rated high or moderate to high

### 6.4.1 Sand Harbor Area

Aggregate impact ratings for relevant ecological variables and overall capacity assessments for Sand Harbor use areas are shown in Table 6-4.

At the Main Beach use area, three of the nine ecological variables assessed were rated high, and five were rated moderate to high, contributing to an overall capacity assessment of “exceeding capacity.” One ecological variable was rated low.

At the Diver’s Cove and Group Use Area, two of the seven ecological variables assessed were rated high, and two were rated moderate to high, contributing to an overall capacity assessment of “at capacity.” One ecological variable was rated low, one low to moderate, and one moderate.

At the Family Picnic Area, one ecological variable was rated high and one was rated moderate to high, contributing to an overall capacity assessment of “approaching capacity.” Three of the remaining four ecological variables were rated low and one was rated moderate.

All ecological variables at the remaining two Sand Harbor use areas (Sandy Point and Boater’s Beach/Boat Launch) were rated moderate, low/moderate, or low. As a result, the overall capacity rating for those two use areas is “below capacity.”<sup>13</sup>

**Table 6-4. Aggregate Impact Ratings and Overall Capacity Assessments for Sand Harbor Use Areas.**

Ecological Variable	Use Area				
	Main Beach (Use Area 1)	Sandy Point (Use Area 2)	Diver’s Cove & Group Use (Use Area 3)	Family Picnic Area (Use Area 4)	Boater’s Beach/Boat Launch (Use Area 5)
<b>Soil Impacts</b>					
Soil Erosion	M/H	M	M/H	L	M
Soil Compaction	L	L/M	H	M/H	L
<b>Vegetation Impacts</b>					
Loss of Ground Cover	H	M	M/H	H	L/M
Dwarf Mistletoe Infestation of Conifers	M/H	L	L	M	L
Root Exposure	H	L	M	L	M
Pine Recruitment	M/H	L	L/M	L	None
<b>Impacts on Unique Ecological Features</b>					
Sentinel Trees	H	L	n/a	n/a	n/a
Mature Oak Scrub Habitat	n/a	n/a	H	n/a	n/a
<b>Wildlife Impacts</b>					
Perch Sites	M/H	L	n/a	n/a	n/a
<b>Special-status Plant Impacts</b>					
Impacts on Tahoe Yellow Cress	M/H	n/a	n/a	n/a	n/a
<b>Overall Capacity Assessment</b>	<b>Exceeding Capacity</b>	<b>Below Capacity</b>	<b>At Capacity</b>	<b>Approaching Capacity</b>	<b>Below Capacity</b>
<i>H = High, M/H = Moderate to High, M = Moderate, L/M = Low to Moderate, L = Low.</i>					

<sup>13</sup> The results of the employee survey indicate that the employees were most often concerned about environmental impacts and ecological capacity being exceeded at the Family Picnic Area, but some were also concerned about impacts they had observed at the beaches and at Memorial Point. Their main concerns correspond with many of the site observations reported here, including vegetation trampling at the Family Picnic Area and in revegetation areas, off-trail use on the shoreline, and littering (which may be regarded as a visitor education or a staffing and maintenance issue, as much as an ecological issue).

### 6.4.2 Memorial Point

Aggregate impact ratings and the overall capacity assessment for Memorial Point are shown in Table 6-5. At Memorial Point, one ecological variable was rated moderate/high while all seven remaining ecological variables assessed were rated moderate, low/moderate, or low. As a result, the overall capacity rating for the area is “below capacity.”

**Table 6-5. Aggregate Impact Ratings and Overall Capacity Assessment for Memorial Point.**

<b>Ecological Variable</b>	<b>Aggregate Impact Rating</b>
<b>Soil Impacts</b>	
Soil Erosion	L/M
Soil Compaction (including user created trails)	M/H
<b>Vegetation Impacts</b>	
Loss of Ground Cover	L
Dwarf Mistletoe Infestation of Conifers	L
Root Exposure	L/M
Pine Recruitment	None
<b>Impacts on Unique Ecological Features</b>	
Sentinel Trees	M
Mature Oak Scrub Habitat	n/a
<b>Wildlife Impacts</b>	
Perch Sites	M
<b>Special-status Plant Impacts</b>	
Impacts on Tahoe Yellow Cress	n/a
<b>Overall Capacity Assessment</b>	
<b>Below Capacity</b>	
<i>M/H = Moderate to High, M = Moderate, L/M = Low to Moderate, L = Low.</i>	

## 6.5 ECOLOGICAL CAPACITY CONCLUSIONS

Two of five use areas at Sand Harbor were found to be exceeding or at capacity, one Sand Harbor use area was found to be approaching capacity, and the remaining two Sand Harbor use areas and Memorial Point were found to be below capacity. An overall ecological capacity assessment of at or exceeding ecological capacity for a use area may indicate a need for action to protect the affected resources. The need for action may depend in part on whether the impact is stable, and whether any practical means exist to reverse or repair the impact.

From these assessments, the overall conclusion is that ecological resources at Sand Harbor and Memorial Point are in relatively good condition, given the intensive recreation use that occurs every summer. Substantial impacts on ecological resources were not unexpected. The extent to which biophysical impacts have been contained is in part due to the extensive efforts made by State Parks over the years to harden the site and protect sensitive areas. However, as noted in the assessment, several types of impacts are widespread, and some impacts appear to be increasing at the Main Beach and Diver's Cove. If these impacts do not stabilize but instead grow worse (i.e., greater in intensity or extent), ecological capacity may be reached or exceeded at additional areas.

It is appropriate to provide a note of caution about the overall impact assessments in this analysis. The purpose of the assessments is to supply conclusions for each use area that account for all relevant impacts, but these should not obscure the relevance of individual impacts. The individual impacts reported in this assessment are significant and noteworthy, particularly those with an aggregate impact rating of moderate to high or high (as shown in Table 6-4), even if the overall impact assessment is not "at capacity" or "exceeding capacity" for a particular use area. Therefore, the one or two ecological variables that received aggregate impact ratings of moderate to high or high in use areas with an overall ecological capacity assessment of approaching ecological capacity may also require intervention to protect the affected resources.

Ecological impacts of soil/beach erosion, soil compaction (primarily in the form of user-created trails), and loss of ground cover appear to be most widespread at Sand Harbor and Memorial Point. These impacts (particularly shoreline erosion) appear to have related effects on other natural resource concerns such as loss of stabilizing vegetative cover, root exposure, and potentially other stressors (e.g., dwarf mistletoe infestation) on back beach pines that are both unique sentinel features and in some cases likely to provide important shoreline habitat (i.e., perch sites) for sensitive wildlife (osprey and bald eagle).

Although some ecological impacts are expected to occur over time due to the intensive recreation activity at Sand Harbor, thresholds and acceptable levels of impacts need to be determined by management to maintain the ecological resources of the study area. Ultimately, these thresholds also determine the point at which ecological capacity for specific areas where impacts are noted is exceeded. The thresholds used in this assessment can provide a strong basis for future assessments that incorporate management judgments regarding what level of impact is and is not acceptable.

The following describes the major ecological impacts on the study area.

## 6.5.1 Soil Impacts

### Soil Erosion

Soil erosion is most extensive along the shoreline at the Main Beach, Diver's Cove, and Group Use Area and is present to a lesser degree at Memorial Point, Boat Ramp/Boater's Beach, and Sandy Point. Portions of these sites are becoming less usable and perhaps less safe (i.e., unstable), and continued erosion threatens to erode useable land area. Erosion at the Main Beach use area and to a lesser extent elsewhere is undermining existing infrastructure (paved walkways, recreation exclusion fencing, and portions of the boardwalk) and degrading the quality of this premier recreational site. Unnecessary infrastructure degradation as a result of erosion is leading to an increased need for maintenance. Additionally, soil erosion (in combination with soil compaction [see the description below, in *Soil Compaction*]) is adversely affecting vegetation where erosion sites occur (e.g., loss of ground cover and root exposure on large back beach pines).

### Soil Compaction

The group use portion of the Diver's Cove and Group Use Area has the most extensive soil compaction in the study area where the combination of heavy use by large groups and the soils being more susceptible to compaction (higher silt content than along beaches) has created an area of large impact.

The Family Picnic Area also suffers from soil compaction where gaps in shrub cover facilitate use by large groups and where soils also are probably more susceptible to compaction. In particular, the area adjacent to the Stream Environment Zone (SEZ) in the southeast portion of the Family Picnic Area where shrub cover is absent is an area of particular concern.

While soil compaction is overall less of a concern in the remaining use areas, an extensive user-created trail network at Sandy Point and Memorial Point is responsible for contributing to other impacts such as erosion and impacts on vegetation resources, including habitat for sensitive species. The trail network is largely the result of unrestricted access between multiple points of interest in these areas. While much of the unrestricted access, primarily along the rocky shorelines, provided to visitors is a desired feature of the recreational experience here, there are a few locations in particular where user-created trails are causing potentially unacceptable impacts on resources. These areas of particular sensitivity to foot traffic include: (1) the west end of the Main Beach where TYC have historically occurred; user-created access is facilitated to this location from the loop trail above; (2) an identified perch tree at the end of the northern spur trail along the west side of the Sandy Point trail (refer to Figure 6-3 for the location of this perch tree); and (3) identified perch trees at Memorial Point.

## **6.5.2 Vegetation Impacts**

### **Loss of Ground Cover**

Ground cover loss throughout the study area is primarily the result of other previously described impacts (e.g., soil erosion and compaction) occurring from recreational uses. Use areas with the greatest impacts of ground cover loss (Main Beach, Diver's Cove and Group Use Area, and Family Picnic Area) reflect the combined level of impact from soil erosion and compaction. As described above, the nearly unrestricted access to beaches and between points of interest and the unmanaged impacts of group uses are probably the primary cause of ground cover losses at Sand Harbor.

### **Damage to Unique Ecological Features and Perch Sites**

Similar to that described above for *Loss of Ground Cover*, the overall impacts on unique ecological features (primarily vegetation resources) in the study area are generally the result of soil erosion and soil compaction, and their adverse impacts on vegetation health. These types of effects are described in the preceding sections. Use areas where unique ecological features have been affected most include Main Beach (sentinel trees), Diver's Cove and Group Use Area (mature oak scrub), and to a lesser degree Memorial Point and Sandy Point (osprey and bald eagle perch sites). Primary effects on these features are likely associated with unrestricted and high levels of use in proximity to these unique features.

## 7.0 SOCIAL CAPACITY ASSESSMENT

This chapter describes the constraints on social capacity at Sand Harbor imposed by visitors' expectations and preferences for social conditions, such as the number of other visitors and their recreation activities, and their interaction with other visitors.

### 7.1 DESCRIPTION AND APPLICATION AT SAND HARBOR

Specific recreation choices (e.g., activities, settings, etc.) are influenced by an individual's needs, interests, and preferences (Jensen 1995). More simply, people come to parks and other natural areas for a variety of reasons that are not always well defined. The challenge in managing parks and natural areas is to provide appropriate recreation opportunities that meet the diversity of visitors' reasons or motivations for coming to the area. Fortunately, while visitors' motivations may differ, it is often possible to provide a variety of opportunities within a specific setting and managerial framework to ensure that, once on site, these visitors have satisfying recreational experiences. Social capacity refers to the effects on the human dimensions of a recreation experience. The assessment of social capacity helps provide the justification for appropriate social contexts (e.g., activities, crowding levels, enforcement strategies, etc.) that influence recreation experiences and associated benefits and outcomes.

Since much of recreation management and planning focuses on appropriately balancing visitor and biophysical needs, the attitudes, opinions, and preferences of recreation visitors are desirable factors to consider in outdoor recreation planning processes. Most of the capacity-related literature, research studies, and applications have focused on social issues and concerns at developed recreation sites (specifically campgrounds) and backcountry or wilderness areas (Manning 1999). This is not to imply that social capacity concerns have not been investigated at developed day use areas; rather, the breadth of research and corresponding literature is not as profound and tends to focus on negative visitor behaviors (e.g., violation of rules/regulations, vandalism, etc.) rather than visitor opinions and preferences. For purposes of this study, both visitor behaviors and opinions/preferences were assessed.

Of the capacity components, social capacity tends to be the most problematic in terms of quantifying and establishing evaluative standards (Shelby and Heberlein 1986). This is primarily because the evaluation of human dimensions typically relies on the subjective impressions and opinions of visitors. The goal of social capacity assessments is to objectively collect and analyze this subjective input in conjunction with other descriptive data (e.g., management observations, occurrences of vandalism, violations, etc.).

### 7.2 METHODOLOGY

In this study, the investigation of social capacity focused on multiple questions and associated results from the Sand Harbor and Memorial Point Visitor Surveys, as well as

management data and observations. Two primary components of social capacity were investigated via the visitor surveys and other information, including:

- Crowding and conflict
- Satisfaction

The specific questions and other sources of available data associated with each of these components is identified and described below. A potential drawback of survey research and reporting majority attitudes or preferences is that it tends to obscure the diversity of opinions that typically exists amongst the recreating public (Cordell and Sykes 1969; Shafer 1969). As such and to the degree practicable, the majority and other summarized responses are provided to better recognize the full breadth of visitors' views at Sand Harbor and Memorial Point.

As with the other capacity parameters (i.e., physical, facility, spatial, ecological), each of the social capacity components described below was considered individually and in aggregate to derive a social capacity conclusion (e.g., below, approaching, at, or exceeding capacity).

### **7.2.1 Crowding and Conflict**

Crowding is one of the most frequently investigated issues in outdoor recreation. This is because of the link or relationship between perceived crowding levels and the quality of recreation experiences. There is general agreement that there is a level of use beyond which the quality of the recreation experience is diminished; however, this use level differs for individual visitors, specific user groups, and in distinct settings. Similar to other human dimensions, visitors to outdoor recreation areas experience varying degrees of crowding. In general, prior research has found that perceived crowding tends to be greater at highly accessible sites (e.g., front-country developed recreation sites) and during peak use periods (e.g., summer weekends, holidays, etc.) and lower in those areas where management decisions and actions had been taken to limit crowding (Manning 1999).

Crowding at Sand Harbor was investigated through four questions that were included in the visitor survey (crowding was not assessed at Memorial Point given the typical length of stay and more transient nature of use at the site). These questions included:

- How crowded do you feel at the area you are currently using?
- How would you compare the level of crowding today with what you expected?
- In general, the number of people at Sand Harbor detracts a lot, detracts a little, adds a little, adds a lot, or doesn't really affect my enjoyment? [choose one]
- Have you ever changed your visits to Sand Harbor to avoid crowding?

The first crowding question (“*How crowded to you feel at the area you are currently using?*”) used a standard 9-point crowding scale commonly employed in capacity studies (Shelby and Heberlein 1986). The scale ranges from 1 indicating “not at all crowded,” to 9 indicating “extremely crowded.” This 9-point scale has been vigorously tested and widely used in human dimension research since about 1975. Often, the scale is collapsed into two general categories for management purposes: (1) not at all crowded (scores 1-2), and (2) some degree of crowding (scores 3-9). These categories are sometimes modified for use at front-county or developed sites since visitors tend to accept and tolerate higher crowding levels in these types of settings. The modified categories collapse scale scores 1–4 into a “not crowded to slightly crowded” category and scale scores 5–9 into a “moderately crowded to extremely crowded” category (Vaske and Shelby 2008).

Since crowding judgments tend to vary by visitor type, activity, and setting, a universally accepted crowding standard does not exist. However, a recent meta-analysis of over 180 crowding-related studies identified five distinct categories of crowding with corresponding capacity ranges. These categories and capacity ranges are specific to the collapsed version of the 9-point scale (i.e., uncrowded versus crowded) and include the following (Vaske and Shelby 2008):

- Less than 35 percent of visitors in the crowded category = uncrowded or below capacity.
- 35 to 50 percent of visitors in the crowded category = low normal crowding or approaching capacity.
- 50 to 65 percent of visitors in the crowded category = high normal crowding or at capacity.
- 65 to 80 percent of visitors in the crowded category = high crowding or over capacity.
- Over 80 percent of visitors in the crowded category = extreme crowding or greatly over capacity.

This generalization of perceived crowding and corresponding capacity levels was applied to the crowding scores of visitors to Sand Harbor. The remaining crowding-related questions (as listed above) provide context for the crowding levels identified in the first question, as well as coping behaviors that visitors engage in to avoid crowding.

In addition to crowding, conflict is another element of the human dimensions of outdoor recreation that is commonly researched and assessed. Conflict is typically defined as “goal interference attributed to others,” or actions that affect a recreationist’s goals for visiting a site and/or participating in an activity (Jacob and Schreyer 1980). Conflict may be between individual visitors, visitor groups, visitors and managers, and/or

recreationists and other types of resource uses (Manning 1999). As with crowding, conflict is related to the overall quality of the recreation experience, but is equally complex and dependent on a number of variables including visitor motivations, social values, level of experience, expectations, and tolerance, among others.

Conflict was also investigated via the visitor survey at Sand Harbor (“*Please describe any problems [if any] you may have had with other visitors during this or past visits to Sand Harbor.*”), as well as through a review of State Parks’ citation records at the park.

### **7.2.2 Satisfaction**

The final element of this study’s social capacity assessment was visitor satisfaction. In social capacity assessments, satisfaction is commonly used as the measure of quality of the recreation experience. However, there is little evidence that satisfaction is directly associated with crowding and/or conflict levels and instead is a complex, multidimensional quality measure that is dependent on a variety of factors (Manning 1999). As such, while satisfaction is a good overall measure of quality, it is less useful in guiding specific management actions related to use levels.

Both the Sand Harbor and Memorial Point visitor surveys included questions about visitors’ overall satisfaction with their recreation experience.

## **7.3 SOCIAL CAPACITY RESULTS AND ASSESSMENT**

As noted elsewhere in the Sand Harbor Recreational Capacity Study, a recreation experience is created or influenced by a combination of factors, including the resource setting, social context, and managerial presence, among other components (Whittaker et al. 2010). The social context in recreation is typically considered to include the types of activities that visitors participate in, socio-demographic characteristics, and visitor opinions, preferences, and needs. Some of these social factors were investigated during the Sand Harbor Recreational Capacity Study and are described in more detail in this section (basic visitor characteristics are described in Chapter 3, *Existing Conditions*). Ultimately, investigating and establishing social capacity levels provide another important factor in the decision-making process to create high quality and safe public recreation opportunities at Sand Harbor.

Results specific to each of the primary social capacity elements assessed during the Sand Harbor Recreational Capacity Study are presented in this section. The related capacity conclusions are provided in Section 7.4.

### **7.3.1 Crowding and Conflict**

Results associated with the multiple elements of visitor crowding and conflict are presented in this section.

## Perceived Crowding

Overall, the average perceived crowding score for all visitors to Sand Harbor was 4.3 on the 9-point crowding scale (Sand Harbor Visitor Survey Question 10; Appendix E). This average score (indicated by the red line on Figure 7-1) is generally within the “slightly crowded” range of the scale.

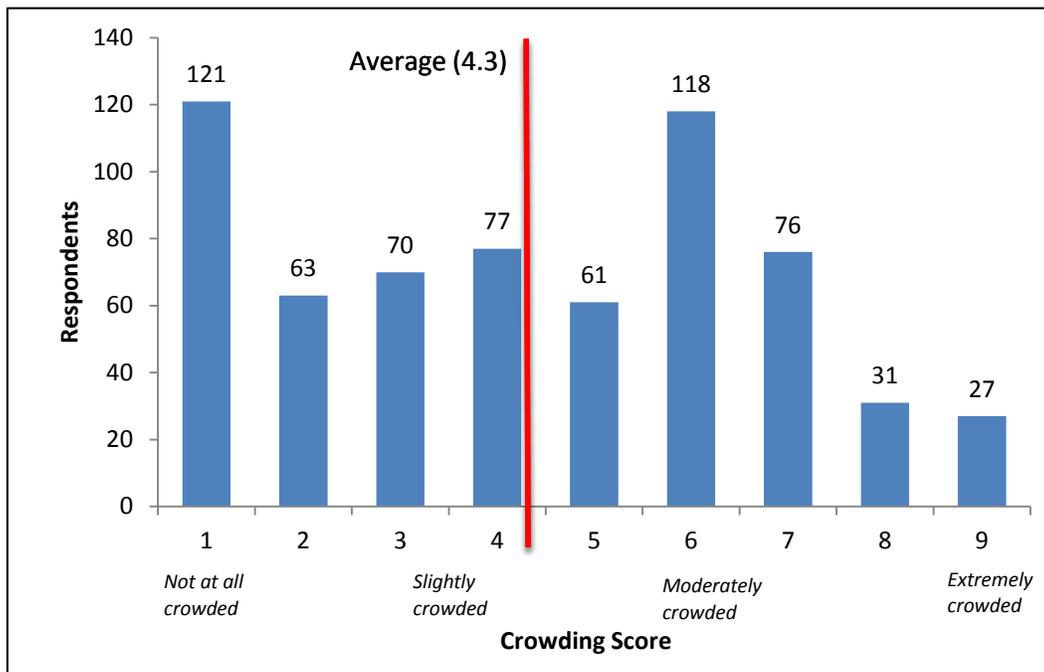


Figure 7-1. Crowding Score Frequencies and Average Crowding Score at Sand Harbor.

Table 7-1 provides the average crowding scores for specific subareas of Sand Harbor, including the Boat Ramp, Family Picnic Area, Main Beach, and Diver’s Cove. Table 7-1 also lists the percent of responses in each of the collapsed crowding categories (as described in Section 7.1.2). As noted in the table, Diver’s Cove has both the highest average crowding scores and the highest percentage of responses in the “moderately crowded to extremely crowded” category. Given the spatial constraints and existing use levels at Diver’s Cove (see Chapter 4, *Physical/Spatial Capacity Assessment*), it is not surprising that this area also has the highest crowding scores.

As shown in Table 7-1, the average crowding scores for weekends and holidays were only slightly to moderately higher than for weekdays. Average crowding scores at the Family Picnic Area and Diver’s Cove were about 1 point higher, and at the Boat Ramp and Main Beach were 0.1 point and 0.4 point higher, for weekends and holidays than for weekdays. The weekend and holiday average score for all Sand Harbor use areas was 0.5 point higher than the average weekday score, indicating that the overall perception of crowding on weekends was slightly closer to the “moderately crowded” point on the scale.

**Table 7-1. Average Crowding Scores and Collapsed Category Percentages at Sand Harbor.**

Use Area <sup>1</sup>	Average Crowding Score			Not Crowded to Slightly Crowded <sup>2</sup> (all days)	Moderately to Extremely Crowded <sup>3</sup> (all days)
	Weekdays	Weekends /Holidays	All Survey Days		
Boat Ramp	4.0	4.1	4.1	54.3%	45.7%
Family Picnic Area	3.7	4.8	4.6	52.2%	47.8%
Main Beach	3.8	4.2	4.0	57.0%	43.0%
Diver's Cove	4.2	5.1	4.7	42.3%	57.7%
<b>Sand Harbor (all)</b>	<b>4.0</b>	<b>4.5</b>	<b>4.3</b>	<b>51.3%</b>	<b>48.7%</b>

<sup>1</sup> Areas correspond to the primary areas where the Sand Harbor Visitor Survey was administered.  
<sup>2</sup> "Not Crowded to Slightly Crowded" category includes crowding scores 1 through 4. Values in column correspond to percentage of visitors reporting crowding score within this range.  
<sup>3</sup> "Moderately to Extremely Crowded" category includes crowding scores 5 through 9. Values in column correspond to percentage of visitors reporting crowding score within this range.

Based solely on perceived crowding scores, Sand Harbor and most of its subareas are within the "low normal crowding" range (see Section 7.2.1) for the summer season. Crowding within this range is generally considered to be approaching the social capacity of the site. The exception is Diver's Cove, which is within the "high normal crowding" range and therefore considered to be at its social capacity. However, it should also be noted that the percentage of responses in the "moderately crowded to extremely crowded" category for Sand Harbor overall was less than 2 percent below the "high normal crowding" threshold of 50 percent, which if reached would have resulted in an assessment of "at capacity."

The overall summer season crowding score is also influenced by the variation in the scores by month. In particular, cool weather and resulting modest use levels during May and the first half of June were reflected in substantially lower average crowding ratings by visitors during those months than during July, August, and September. The average crowding score jumped from about 3.0 for June to about 5.3 for July, and the average score was close to 5.0 for the rest of the summer (Figure 7-2).

As shown in Table 7-2, less than one-quarter of the Sand Harbor visitors surveyed during June gave crowding ratings in the moderately to extremely crowded range, while more than two thirds gave those ratings during July, and more than half did so during August and September. Based on these monthly perceived crowding scores, Sand Harbor is within the "high normal crowding" range and therefore considered to be at its social capacity during the months of July, August, and September (through the Labor Day weekend).

In general, there is a very weak relationship between perceived crowding and overall satisfaction with a recreation experience (Manning 1999). High crowding scores do not necessarily mean that visitors are dissatisfied with their recreation experience (see Section 7.2.2).

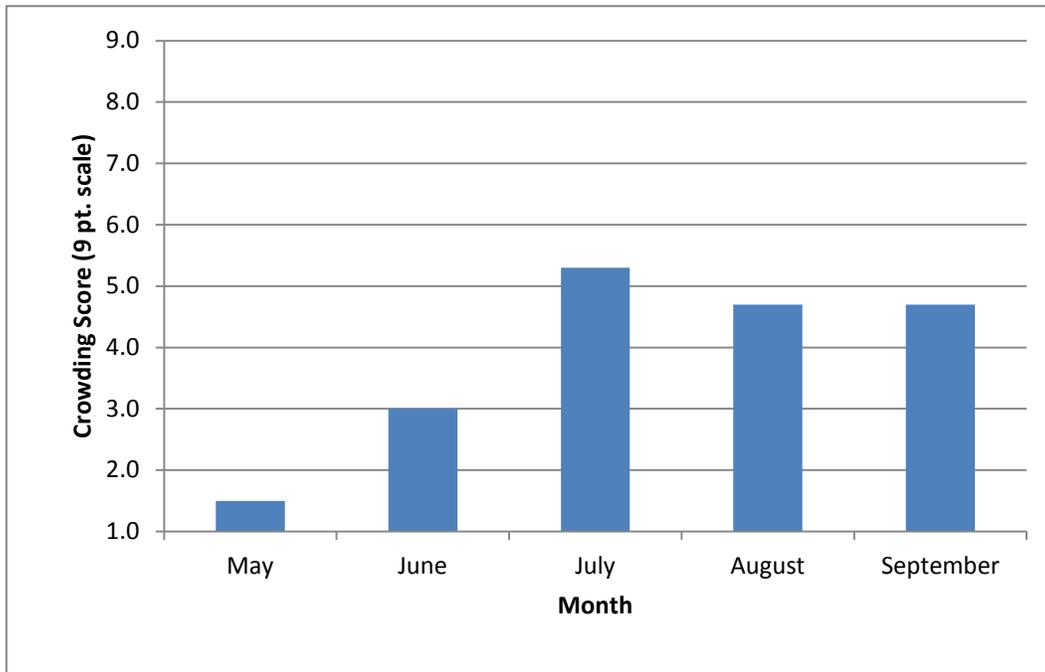


Figure 7-2. Average Crowding Score for Sand Harbor by Month.

Table 7-2. Collapsed Crowding Category Percentages at Sand Harbor by Month.

Month	Not Crowded to Slightly Crowded <sup>1</sup> (all days)	Moderately to Extremely Crowded <sup>2</sup> (all days)
May	95.2%	4.8%
June	77.1%	22.9%
July	32.5%	67.5%
August	45.5%	54.5%
September	45.8%	54.2%

<sup>1</sup> "Not Crowded to Slightly Crowded" category includes crowding scores 1 through 4. Values in column correspond to percentage of visitors reporting crowding score within this range.  
<sup>2</sup> "Moderately to Extremely Crowded" category includes crowding scores 5 through 9. Values in column correspond to percentage of visitors reporting crowding score within this range.

### **Crowding Expectations and Effect on Enjoyment**

Perceived crowding is influenced at least in part by visitor expectations and preferences for the number of people present at a site. At Sand Harbor, over half of the visitors (53.5 percent) indicated that the level of crowding was about what they expected (Sand Harbor Visitor Survey Question 11; Appendix E). As illustrated in Figure 7-3, only about 13 percent of visitors thought Sand Harbor was more crowded than they expected.

As displayed in Figure 7-4, for slightly more than half the visitors to Sand Harbor (51.5 percent), the number of people present at the site does not affect their enjoyment (Sand Harbor Visitor Survey Question 12; Appendix E). Of the remaining visitors (Figure 7-4), a

sizable minority of visitors (21.6 percent) indicated that the number of people added (“a lot” or “a little”) to their enjoyment. Conversely, slightly more than a quarter of visitors (26.9 percent) indicated that the number of people detracted (“a lot” or “a little”) from their enjoyment.

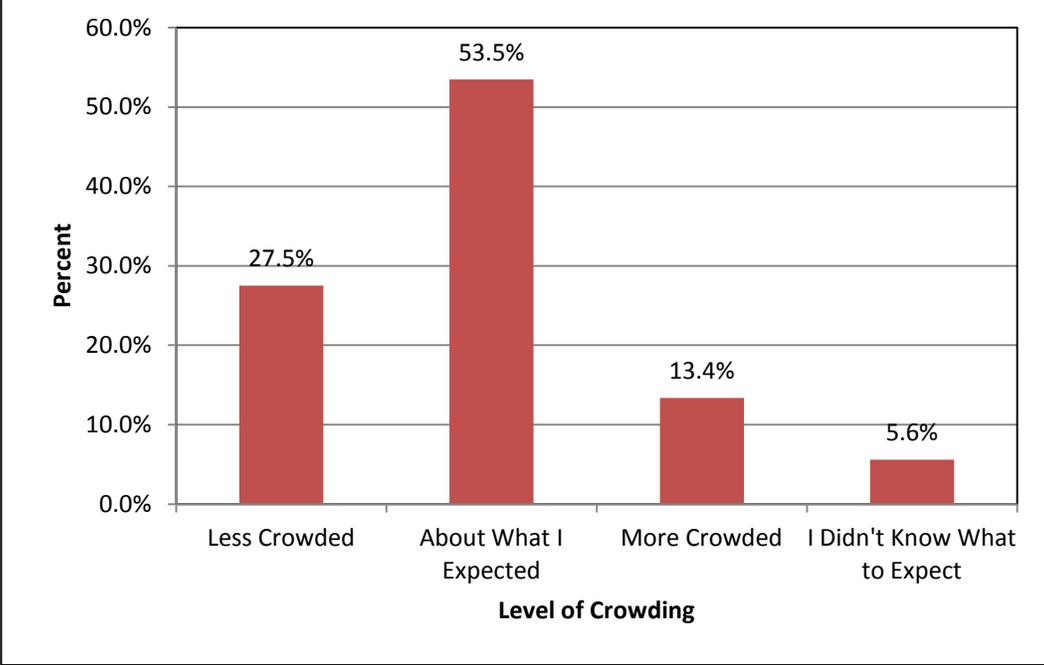


Figure 7-3. Visitor Expectations of Crowding at Sand Harbor.

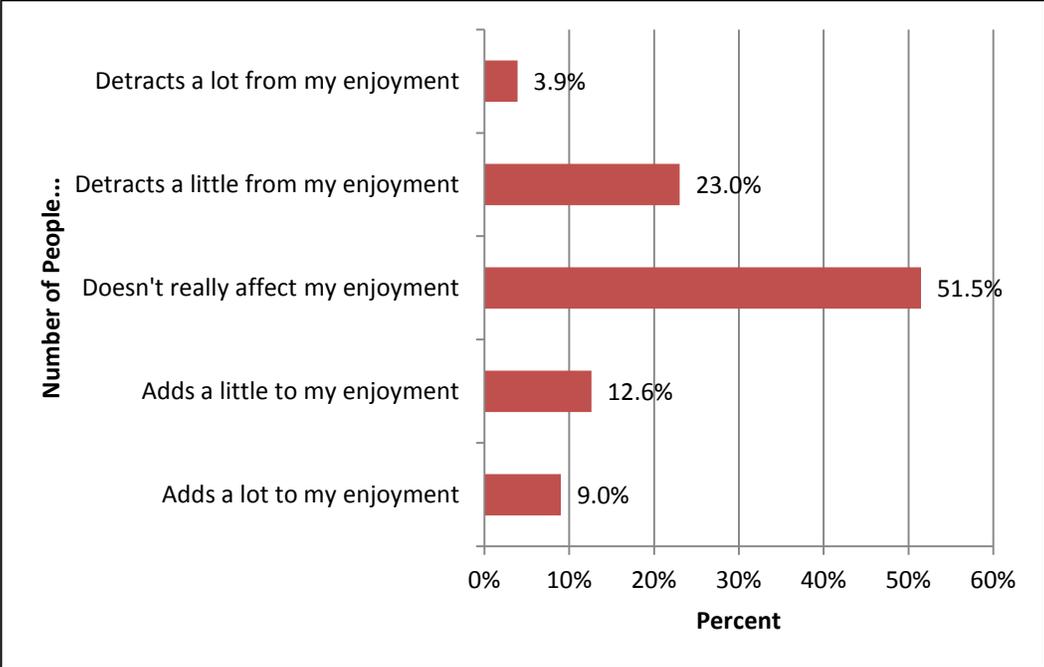


Figure 7-4. Crowding Effects on Visitors' Enjoyment at Sand Harbor.

These perceptions generally held true for the individual use areas as well, with the exception of the Family Picnic Area, where about 24 percent of visitors indicated that the level of crowding was more than they expected. Notably, only about 18 percent of visitors surveyed in that area felt the number of people detracted (“a lot” or “a little”) from their enjoyment, while about 33 percent indicated that the number of people added (“a lot” or “a little”) to their enjoyment. These results indicate a greater tolerance, and in some cases appreciation, of high use levels at the Family Picnic Area where large social gatherings are the norm, particularly among Hispanic groups. (Surveyors noted that a large portion of big groups were Hispanic. Recreation research has indicated that in the Hispanic culture, leisure activity occurs mainly in the context of groups of family and friends, and often includes multi-generational extended family.)

Interestingly, the percentage of visitors who indicated that crowding was about what they expected (Figure 7-3) and of visitors for whom the number of people present does not really affect their enjoyment (Figure 7-4) is similar. This may indicate that many visitors to Sand Harbor are able to rationalize or expect higher use levels, and thus these high use levels do not detract from their overall enjoyment of the site. However, a closer inspection of the relationship between expectations and enjoyment (as displayed in Table 7-3) seems to indicate that the overall relationship is more complex.

For example, over 7 percent of visitors indicated that the number of other visitors detracted (“a lot” or “a little”) from their enjoyment even though the site was less crowded than they expected. Conversely, nearly 3 percent of visitors indicated that the number of other visitors added (“a lot” or “a little”) to their enjoyment even though the site was more crowded than they expected. While there does not seem to be a direct relationship between crowding expectations and preferences at Sand Harbor, it does appear that for a majority of visitors crowding levels are about or less than they expected (approximately 81 percent combined) and crowding either does not affect or has a positive effect on their enjoyment at the site (about 73 percent combined).

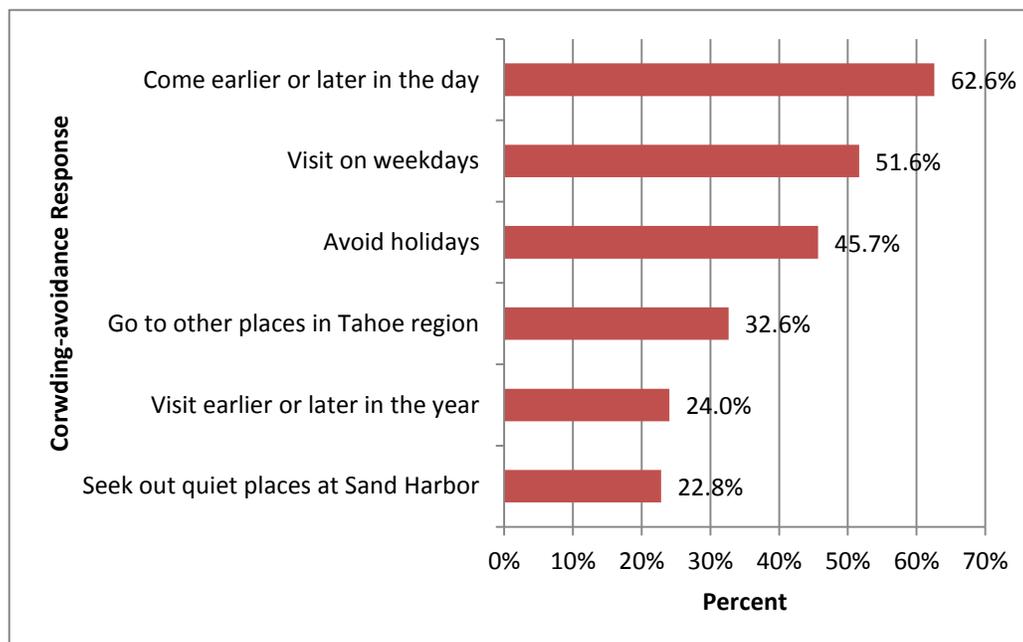
**Table 7-3. Crowding Expectations versus Effects on Enjoyment (percent of visitors in each category).**

Crowding Expectation	Effects of Use Levels on Enjoyment				
	Adds a lot to my enjoyment	Adds a little to my enjoyment	Doesn't really affect my enjoyment	Detracts a little from my enjoyment	Detracts a lot from my enjoyment
Less Crowded	2.0%	3.0%	14.8%	6.3%	1.4%
About What I Expected	4.8%	6.9%	28.0%	12.7%	1.3%
More Crowded	1.1%	1.7%	5.9%	3.3%	1.3%
I Didn't Know What to Expect	1.1%	0.8%	3.0%	0.8%	0.0%

## Visitor Displacement

Visitor displacement is one type of coping mechanism that visitors use to deal or cope with perceived crowding at outdoor recreation areas (Manning 1999). Visitor displacement typically involves shifts in use to another recreation site or changes in visitation patterns to the same site.

At Sand Harbor, slightly more than half of the visitor population (52.9 percent) indicated that they had changed their visits to avoid crowding (Sand Harbor Visitor Survey Question 13; Appendix E). Of those visitors who had changed their visits to Sand Harbor, coming earlier or later in the day was the most popular (as indicated by 62.6 percent of visitors) coping mechanism (Figure 7-5).



**Figure 7-5. Coping Mechanisms at Sand Harbor to Deal with Crowding.**

*Note: percentages do not total to 100 percent as visitors could indicate more than one response.*

While a slight majority of visitors reported using one or more coping mechanisms to deal with crowding, most current visitors change the timing of their visits rather than go to other places in the Tahoe Region. So while crowding may be a concern, it does not seem to deter users from visiting the site entirely. That said, only current visitors were surveyed, so those visitors who have been completely displaced and no longer visit Sand Harbor are not represented in the survey results, which tends to underestimate these crowding effects (Manning 1999).

## Visitor Conflict

Most visitors (about 80 percent) to Sand Harbor did not report experiencing problems or conflict with other visitors during their current visit or during past visits (Sand Harbor

Visitor Survey Question 16; Appendix E). While approximately 20 percent of visitors provided a response to this question, many of the responses were not about conflicts with other visitors. These non-visitor conflict responses included problems or concerns with parking and traffic, trash/litter, and facility maintenance. The visitor conflict-related responses (71 percent of the total) can generally be categorized within two primary types of conflict: (1) disruptive behavior (57 percent of total), and (2) boating-related issues (11 percent of total). Other varieties of conflicts comprised an additional 3 percent of the total.

Slightly less than 12 percent of all visitors surveyed identified problems stemming from disruptive behavior of other visitors. Examples, as provided by visitors, of disruptive behaviors included:

- Swearing and foul language.
- Alcohol and general inebriation.
- Smoking.
- Loud music and excessive noise.
- General conflict between individual visitors.
- Nudity and inappropriate attire.
- Unsupervised children.

Slightly more than 2 percent of visitors identified problems that were categorized as boating-related. These included the following:

- General conflict between boaters and other visitors.
- Issues at the boat ramp (some of which are facility-related).
- Excessive boat speed.
- Boating near swimming areas.

Therefore, while visitor conflict is an issue for some visitors to Sand Harbor, no one type of visitor conflict seems to dominate. Several visitors mentioned littering in their response, but this may be better categorized as depreciative behavior on the part of litterers rather than a visitor conflict. (The shorter survey form used at Memorial Point did not ask visitors about crowding and conflict concerns.)

Sand Harbor employees who responded to the employee survey expressed the greatest concern about visitor conflicts at the Boat Ramp beaches. Specifically, they highlighted the combination of crowding, congestion, and competition for space and among various uses (beach use, swimming/wading, diving, motorized and non-motorized boating, etc.) that occurs there. Similar concerns were expressed about Diver's Cove, although less frequently.

In addition to visitor input, law enforcement actions often provide additional information regarding visitor conflict at a recreation site. Table 7-4 summarizes reported law enforcement actions at Sand Harbor for the past 4 years (2007 – 2010). While the total number of law enforcement actions has increased during this time period, the numerical change of individual actions related to visitor conflict does not provide such a clear trend. For example, the number of citations in 2010 is significantly lower than in 2007, the number of incident reports is about the same during this time period, and the number of non-contact offenses is significantly higher in 2010 than in 2007. Changes in law enforcement personnel and approach (for example, a greater emphasis on educating and informing visitors and others contacted versus on writing citations) may also be a factor in these trends in law enforcement actions.

**Table 7-4. Overview of Law Enforcement Actions at Sand Harbor (2007 – 2010).**

Actions	Year			
	2007	2008	2009	2010
Arrests	0	5	1	2
Citations	716	164 <sup>1</sup>	450	514
Incident Reports	25	29	14	24
Warnings	0	367 <sup>1</sup>	532	613
Visitor Assists	0	64	141	136
Crime Reports	4	7	4	13
Motorist Assists	0	25	42	64
Non-Contact Offense	131	177	254	226
<b>Total</b>	<b>876</b>	<b>838</b>	<b>1,438</b>	<b>1,592</b>

<sup>1</sup> In 2008, rangers changed their approach to enforcement by minimizing issuing of citations on the highway, in favor of issuing warnings, as reflected in these figures. In subsequent years, there has been a return to issuing citations on the highway, while also continuing to issue a significant number of warnings.

Source: Data provided by State Parks.

### 7.3.2 Satisfaction

At Sand Harbor, approximately 93 percent of visitors reported being satisfied (a combination of the satisfied and very satisfied response categories) with their recreation experience (Sand Harbor Visitor Survey Question 19; Appendix E). As displayed on Figure 7-6, only about 5 percent of visitors were dissatisfied (a combination of the dissatisfied and very dissatisfied response categories) with their experience. This is a very high level of visitor satisfaction, especially considering reported crowding and conflict concerns at Sand Harbor. However, as noted in Section 7.2.2 and recognized in these results, there is little connection between crowding and satisfaction.

While the high levels of visitor satisfaction at Sand Harbor may be related to visitor expectations, norms, and/or preferences, it may also be indicative of visitor rationalization (another type of coping behavior). That is, visitors typically invest time, money, and/or energy to visit a site and/or participate in an outdoor recreation activity.

Given this investment, these visitors may rationalize their experience regardless of crowding and/or conflict conditions (i.e., they are able to enjoy their experience despite high levels of crowding and/or conflict) (Manning 1999).

At Memorial Point, visitor satisfaction levels were on par with those reported at Sand Harbor. As displayed in Figure 7-7, nearly 94 percent of visitors to Memorial Point reported being satisfied (a combination of the satisfied and very satisfied response categories) with their recreation experience.

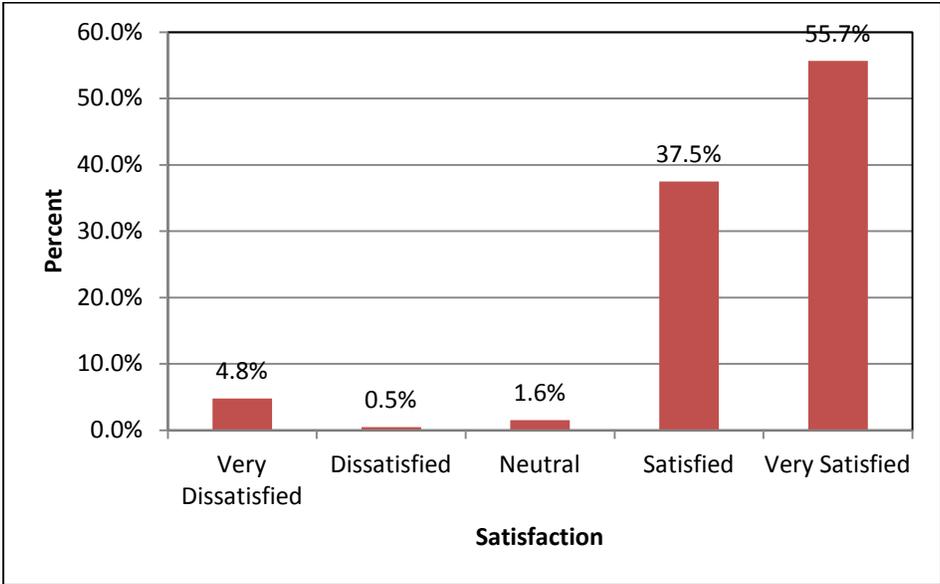


Figure 7-6. Visitor Satisfaction with the Recreation Experience at Sand Harbor.

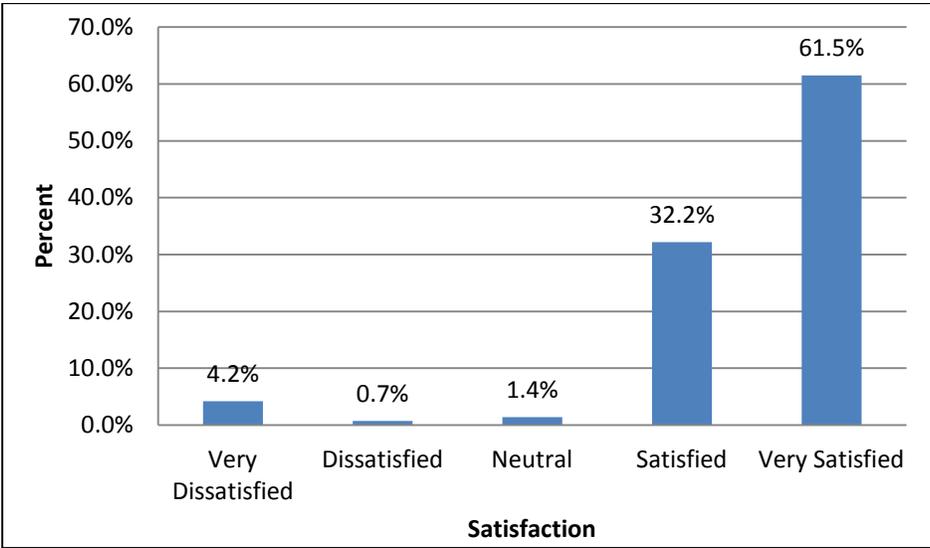


Figure 7-7. Visitor Satisfaction with the Recreation Experience at Memorial Point.

## 7.4 SOCIAL CAPACITY CONCLUSIONS

Considering the full suite of social variables/indicators in aggregate, use levels are likely approaching the social capacity of Sand Harbor. On average, visitors reported being slightly crowded at the site. Except at Diver's Cove (which is likely at capacity), the percentage of visitors within the "moderately to extremely crowded" category is generally considered to be approaching the site's social capacity threshold. More than half of the visitor population has engaged in coping behaviors to avoid crowding. In addition, there is some visitor-reported conflict, and law enforcement actions appear to be trending higher. Sand Harbor employees expressed mixed opinions about social capacity at the park, but permanent and seasonal employees were in general agreement in their perception that most areas of Sand Harbor exceed social capacity at peak use times.

Despite crowding, associated coping behaviors, and reported conflict, most visitors also indicated that the number of other visitors at Sand Harbor was about what they expected and did not really affect their enjoyment. Furthermore, satisfaction levels (a broad measure of the recreation experience) at Sand Harbor are very high. For these reasons, use is currently considered to be approaching social capacity at Sand Harbor and should likely be considered a limiting factor (i.e., if use increases, social capacity-related issues and concerns will potentially become substantial).

Unlike Sand Harbor, Memorial Point is not likely a destination in and of itself and essentially acts as a short-term use/rest area (visitors surveyed at Memorial Point spent on average about half an hour there). Given this more limited use and purpose, social capacity is likely less of a concern at Memorial Point compared to Sand Harbor, and thus the shorter visitor interview form used there did not include crowding-related questions. Since only satisfaction was investigated at Memorial Point, it is not possible to assess social capacity in the same way as way as at Sand Harbor. However, the high satisfaction levels seem to indicate that the site is below social capacity. Also supporting this conclusion is the fact that over 90 percent of the visitors felt the current facilities (including trails, which nearly three quarter of the visitors used) were adequate; no complaints were made about the trails or issues of crowding or conflicts on the trails or elsewhere at Memorial Point.

## 8.0 MANAGEMENT CAPABILITY ASSESSMENT

This section describes the park staffing and financial resources that are available for the operation of the Sand Harbor Unit. It assesses the management capability provided by those human and financial resources as it relates to the ability of the park to effectively operate with the consistent high levels of use it receives each summer. Although this assessment is not a standard element of recreation capacity studies, it was included here to examine if the potential exists for the park to absorb additional use and capacity stresses given these limited (and shrinking) management resources.

### 8.1 PARK STAFFING

The Sand Harbor Unit is operated by a core staff of permanent-status State Parks employees who work year round, and by a group of seasonal staff who are hired for each summer season. The park also benefits from the labor provided by several unpaid sources. Each of these is documented in the State Parks Monthly Statistical Reports; reports for the past 3 years (2008, 2009, and 2010) were reviewed for this study.

#### 8.1.1 *Permanent Staff*

In 2010, permanent staff at LTNSP included seven employees: the Park Supervisor, two commissioned Park Rangers, two park maintenance employees (including the Facility Supervisor), a Conservation Specialist/EIP Ranger<sup>14</sup>, and an Administrative Assistant. Only the Park Rangers are assigned specifically to Sand Harbor; other employees have duties related to other units of the park. An additional Park Supervisor is assigned specifically to the Spooner Lake and Cave Rock units.

The Park Supervisor has overall responsibility for park planning, organization, and management as well as oversight over day-to-day operations. The supervisor's many duties include park budgeting and accounting; personnel management; park operations and maintenance planning (including concessions); administration of park services, special events, and the law enforcement program; and resource management (NDOP 2011).

The commissioned Park Rangers have responsibilities in a variety of operations, law enforcement, resource management, interpretation, and maintenance activities. As commissioned peace officers, they may enforce state laws, county ordinances, and park rules and policies, including writing citations and making arrests (NDOP 2011). (Non-commissioned Rangers have similar duties but do not participate in law enforcement, although they may advise visitors of park rules.) State Parks statistical reports indicate

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<sup>14</sup> This position is focused on Environmental Improvement Program (EIP) responsibilities. The EIP is a cooperative program involving federal, state, and local agencies and private organizations in the Tahoe Basin focused on projects designed to achieve and maintain environmental thresholds in the basin.

that several hundred citations were issued in the vicinity of Sand Harbor within the SR 28 corridor during the 2010 summer season (most often for parking offenses) and occasional arrests were made.

The Facility Supervisor plans, organizes, and directs building and grounds maintenance, custodial work, and fleet maintenance, and assists with the implementation of capital improvements. At Sand Harbor, this employee is responsible for the inspection and maintenance of the complex utility infrastructure throughout the park, including the water, sewage, and electrical systems.

As recently as 2008, the permanent staff at LTNSP was composed of eight employees. State Parks budget shortfalls in recent years have led to a reduction of permanent staff at many parks, often by not replacing staff who have transferred to other parks or retired. A maintenance staff member who retired from LTNSP in 2008 has not been replaced. Also, since July 2009, State Parks employees have been required to take 96 hours of unpaid furlough leave each year, the equivalent of 1 day per month. Thus, the park has operated with reduced permanent staffing for the past few years.

### **8.1.2 Seasonal Staff**

Seasonal staff perform a variety of essential duties at Sand Harbor including collecting park fees and monitoring park use levels at the entrance stations, directing traffic at the entrance areas, routine park maintenance and visitor assistance, assisting with special events, and lifeguarding duties on the beaches. Seasonal employees are hired in three classifications: Park Aid, Park Ranger Technician, and Lifeguard. Each of these classifications has an entry level and a more advanced level for more experienced employees (NDOP 2011).

During the 2010 summer season, Sand Harbor operated with a seasonal staff of 20: three Park Ranger Technicians, 10 Park Aids and seven Lifeguards. The Technicians were on site by mid-May, and most Park Aids and Lifeguards were at the park by Memorial Day weekend. The full seasonal staff was available throughout most of the remainder of the summer season. Several seasonal employees were laid off at the end of August or after the Labor Day holiday. Most of the remaining seasonal employees were laid off during September and the last two were released at the end of October. In total, seasonal staff worked over 12,600 hours in the park during 2010, about 85 percent of which occurred during the 3.5 month summer 2010 season (Table 8-1).

Sand Harbor benefits from the fact that many of the seasonal employees return to the park each summer, and several have multiple seasons of experience in the park. For example, 14 of the 20 seasonal staff who worked in the park in 2010 were also on the seasonal staff for the 2009 season, and most were on the seasonal staff for the 2008 season. In both 2008 and 2009, a total of 22 seasonal employees were hired each year for the summer season. Also, more of the seasonal employees were brought on during early May those years. One current Sand Harbor employee stated in the employee survey that as many as 15 beach patrol staff were available in past years. The reduction

in seasonal staff in recent years places a greater burden on the remaining seasonal employees. It may also place a greater burden on permanent staff who might have to absorb some of the duties formerly done by seasonal staff.

**Table 8-1. 2010 Sand Harbor Unit Seasonal Staff.**

Month	Number of Staff	Total Hours Worked <sup>1</sup>
May	5 to 19	1,134
June	20	3,004
July	20	2,763
August	18 to 20	2,865
September	8 to 18	1,977
October	2 to 8	866
<b>Total</b>		<b>12,609</b>

<sup>1</sup> Based on 14-day pay periods; thus monthly totals include several days at the end of the prior month. Most seasonal staff worked full time or close to full time throughout the Memorial Day to Labor Day period. Seasonal employees were let go beginning in late August, and most concluded their season before October.  
Source: State Parks (2010 Monthly "ADM 27" Statistical Reports for Sand Harbor Unit).

### 8.1.3 Unpaid Labor

In total, the operation and maintenance of the Sand Harbor Unit during the May through October period of 2010 was supported by about 1,100 hours of unpaid labor, from several sources (Table 8-2). Over 75 percent of those hours were provided by NSPCA employees/volunteers, who operated the Visitor Center gift shop throughout the summer. (With the dissolution of the NSPCA in August 2010, a replacement for this important function will need to be identified. State Parks currently envisions an enterprise fund that will allow the individual parks to operate their own gift shops and visitor centers. As of 2011, volunteers have been recruited to staff the visitor center only).

**Table 8-2. 2010 Sand Harbor Unit Unpaid Labor.**

Month	Volunteers <sup>1</sup>	Inmates <sup>2</sup>	NSPCA <sup>3</sup>	Total
May	12	80	248	340
June	8	0	240	248
July	70	0	248	318
August	0	0	112	112
September	0	32	0	32
October	0	38	0	38
<b>Total</b>	<b>90</b>	<b>150</b>	<b>848</b>	<b>1,088</b>

<sup>1</sup> Volunteer hours were contributed by one person in May and June and four people in July.  
<sup>2</sup> Inmates contributed 16 additional hours in March. Inmates include both adult and juvenile offenders and Nevada Division of Forestry Conservation Honor Camp crews.  
<sup>3</sup> NSPCA operated the gift shop at the Visitor Center until August 8, 2010. The organization has since been dissolved.  
Source: State Parks (2010 Monthly "ADM 27" Statistical Reports for Sand Harbor Unit).

Inmates under the direction of the Nevada Department of Corrections occasionally provide labor for projects in state parks, particularly during the spring and fall. During May 2010, an inmate crew from the Nevada Division of Forestry Honor Camp provided 80 hours of labor working on a mistletoe removal project. Juvenile and adult offenders provided additional labor during March, and again during September and October. Volunteers donated a total of 90 hours of labor during May, June, and July.

#### **8.1.4 Adequacy of Existing Staffing**

Reductions in park staffing levels may have a variety of immediate consequences for day-to-day park operations. It may become more difficult for staff to keep up with maintenance tasks, and routine tasks such as restroom cleaning and garbage collection occur less often. Fewer staff on site may mean park staff is less visible to visitors and visitors may have less chance of interacting with park staff. A reduced staff puts a greater strain on the remaining staff who are in the position of having to “do more with less.” The Park Supervisor may respond by putting a special emphasis on certain priority tasks that are vital to park protection and visitor safety and enjoyment. However, eventually both park resources and visitors’ experiences may suffer from a gradual diminishment.

The survey of permanent and seasonal park staff conducted for this study confirms that many of these concerns have become a reality at Sand Harbor. Although several of the 23 current and two former State Parks employees who completed the survey rated the level of service provided to visitors at Sand Harbor as a 6 or 7 (on a 7-point scale with 7 being “excellent” and 1 being “poor”), most rated it as a 4 or 5 (the average score was 5.2). Although most felt visitor expectations were being met (with some caveats), there was a nearly unanimous opinion expressed that the number of personnel was not sufficient to provide quality service and safety for visitors. In general, the greatest concern was expressed about an inadequate number of seasonal employees during the summer, with the belief that this has resulted in insufficient park upkeep (particularly regarding the restrooms), insufficient public safety provided on the beaches with beach patrol, and insufficient staff visibility. Concerns were also expressed about the park’s inability to provide interpretive services, and the inability to staff the Visitor Center, Memorial Point, and Hidden Beach properly.

Given the consistently high levels of visitation that Sand Harbor experiences throughout most of the summer months, the fact that the number of both permanent and seasonal staff have been reduced, and the experience of the park staff with the consequences of the staff reductions, it is reasonable to conclude that there is no “excess” staff capacity available, based on 2010 staffing levels. Thus, any significant increases in attendance, or other changes that may make park operations more challenging, can be expected to result in further undesirable changes in the level of park services and visitor’s experiences.

## 8.2 PARK FINANCES

This study does not present a comprehensive budget analysis for Sand Harbor. However, existing and historical park revenues and current operating costs are examined to illustrate what financial resources are available and required to operate the park effectively and, in particular, to manage high use levels and other capacity pressures. The Monthly Statistical Reports for Sand Harbor provided by State Parks (2008, 2009, and 2010) provide recent historical revenue data, which are summarized below. The park's budget is not directly tied to the revenue collected at the park, as the majority of that revenue goes into the state general fund. Nevertheless, it is appropriate to consider revenue trends as State Parks works to generate revenue to replace the rapidly decreased support from the state's general fund. State Parks also provided a park budget for the current fiscal year, covering such park operating costs as permanent and seasonal staff salaries, utilities, and other operating expenses.

Capital improvement funding is also an important component of park finances, with several major recent improvements at Sand Harbor funded through federal grant programs as well as statewide financing programs utilized by a variety of State of Nevada agencies.

### 8.2.1 Park Revenue

The large revenue earned at Sand Harbor compared to most Nevada state parks makes LTNSP one of the few parks in the system that is a net earner (i.e., revenue exceeds the park's operational costs) (Tavares, S. 2010). Total annual revenue for 2010 at LTNSP was just over \$1 million, nearly 90 percent of which was collected at the Sand Harbor Unit. Total annual revenue for 2010 at Sand Harbor was over \$877,000 (Table 8-3 and Figure 8-1). About 87 percent of the revenue collected was from user fees, which include the park entry fees, boat ramp use fees, and fees for use of the Group Use Area and ramada.<sup>15</sup> More than three-fourths of the revenue was collected during June, July, and August.

Concessionaires enter into a contract with State Parks to lease the portion of the park and the park facilities they use while providing services to the public. Lease fees are based on a negotiated percentage of all gross sales, with a minimum of 8 percent. Fees

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<sup>15</sup> As of April 2010, the April 15 – October 15 park entrance fee is \$12 per vehicle and the boat ramp fee is \$8. The launch-and-leave fee is \$5. Off-season entrance and boat ramp fees are \$7 (Nevada Revised Statutes, Chapter 407). These fees are \$1–3 higher than prior to that date, but were accompanied by a \$2 discount on the entrance fee for Nevada residents. Annual entrance and boat ramp permits (\$100 and \$200, respectively) are also available. The group use area can be reserved for \$400 on weekends and holidays, and \$200 on weekdays. A \$30 Senior Pass may be purchased by Nevada residents 65 or older, which provides entry into any state park for 12 months.

from the two concessions at Sand Harbor – the Char-Pit snack bar and grill in the Visitor Center and the Shakespeare Festival – together accounted for 8 percent of the park’s 2010 revenue. State Parks has recently solicited proposals for a water sports (paddle sports and PWC rental) concession at Sand Harbor, which will generate additional concessions revenue (State Parks 2011b). “Sand Harbor Rentals” began operations at the boat ramp on Memorial Day weekend, 2011.

Surcharge fees are a portion of the above fees that Nevada state law allows parks to collect and deposit into a special account to be used for maintaining the utility infrastructure in the park where the fee was collected (Nevada Revised Statutes, Chapter 407). Therefore, although the surcharge fees collected at Sand Harbor amount to only about 4 percent of total revenue, they are a significant component of the park’s financial base. Donations at Sand Harbor account for less than 1 percent of revenue.

**Table 8-3. 2010 Sand Harbor Unit Revenue**

Month	User Fees <sup>1</sup>	Senior Pass <sup>2</sup>	Surcharge Fees <sup>3</sup>	Concessions <sup>4</sup>	Donations <sup>5</sup>	Total
Jan	\$12,304	\$30	\$390	\$0	\$27	<b>\$12,751</b>
February	\$3,358	\$60	\$460	\$0	\$27	<b>\$3,905</b>
March	\$4,389	\$105	\$617	\$0	\$0	<b>\$5,111</b>
April	\$8,588	\$360	\$866	\$0	\$0	<b>\$9,814</b>
May	\$20,077	\$780	\$1,780	\$0	\$331	<b>\$22,968</b>
June	\$118,174	\$1,710	\$11,153	\$2,680	\$158	<b>\$133,875</b>
July	\$277,685	\$1,710	\$8,239	\$9,971	\$194	<b>\$297,799</b>
August	\$230,114	\$710	\$5,047	\$8,724	\$265	<b>\$244,861</b>
September	\$73,855	\$540	\$1,353	\$1,655	\$2,380	<b>\$79,783</b>
October	\$13,881	\$210	\$255	\$47,250	\$0	<b>\$61,596</b>
November	\$2,961	\$30	\$111	\$0	\$0	<b>\$3,102</b>
December	\$1,624	\$0	\$63	\$0	\$200	<b>\$1,887</b>
<b>Total</b>	<b>\$767,010</b>	<b>\$6,245</b>	<b>\$30,334</b>	<b>\$70,280</b>	<b>\$3,582</b>	<b>\$877,451</b>

<sup>1</sup> User fees are entrance and boat ramp fees collected at the gate (increased \$1–3 in April 2010).

<sup>2</sup> Senior Pass is a \$30 annual fee permit good for entry to any park in the system, and is available to Nevada residents 65 or older.

<sup>3</sup> Surcharge fees are a portion of the entrance fees which, under state law, go into a separate account for each park and are to be used to maintain the park’s utility infrastructure.

<sup>4</sup> Concession revenue for June through September is from the Char-Pit grill at the Visitor Center. Concession revenue for October is from the Shakespeare Festival. Concessions pay a percentage of gross receipts to State Parks as a lease payment for use of park facilities.

<sup>5</sup> Visitors have the opportunity to make donations to the park at the Visitor Center.

Source: State Parks (2010 Monthly “ADM 27” Statistical Reports for Sand Harbor Unit).

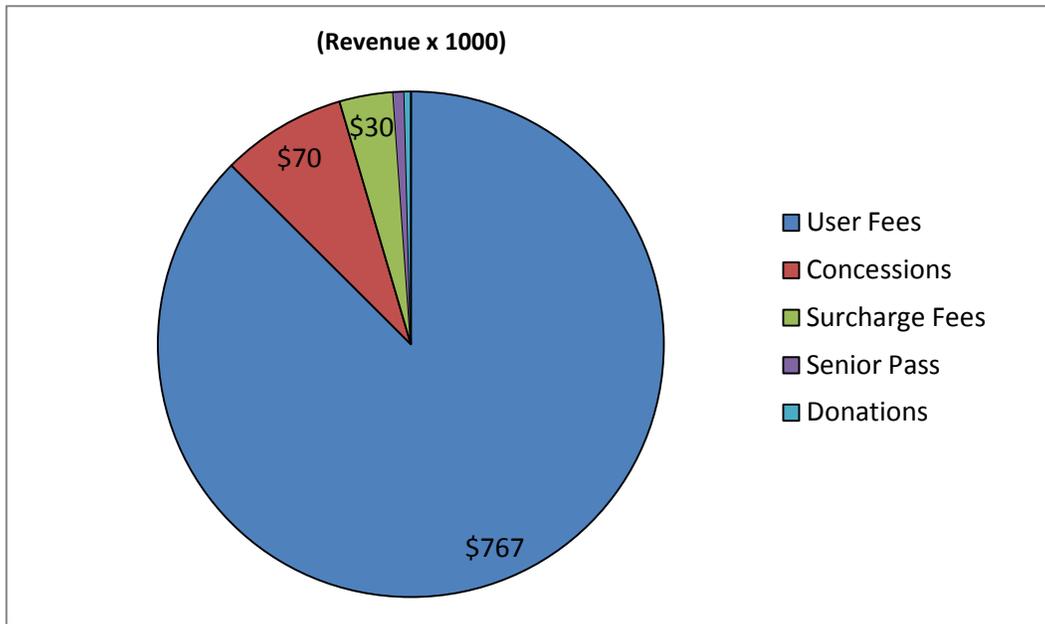


Figure 8-1. 2010 Sand Harbor Unit Revenue.

Revenue at LTNSP has trended upward for the past several years, increasing 30 percent between 2005 and 2010 (Figure 8-2). Sand Harbor revenue for 2010 was about 26 percent higher than in 2009, primarily due to a 40 percent increase in user fees collected, which reflects the April 2010 user fee increases. This offset a 58 percent reduction in surcharge fees that occurred in 2010. Revenue from concession fees changed only slightly between 2009 and 2010.

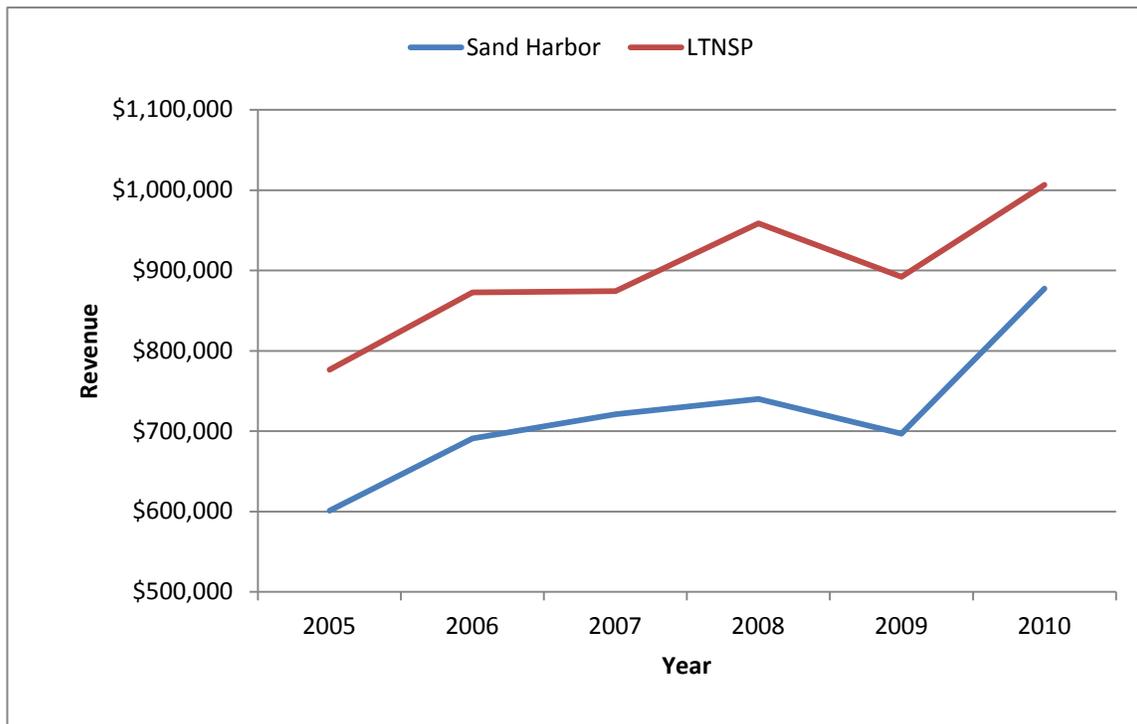


Figure 8-2. 2005–2010 Revenue at LTNSP and Sand Harbor Unit.

### 8.2.2 Park Operating Costs

Information provided by State Parks indicates that over 80 percent of the approximately \$916,000 fiscal year (FY) 2011 (July 1, 2010 through June 30, 2011) budgeted operating costs for LTNSP are for permanent and seasonal staff salaries (Figure 8-3). Most of the remaining costs are for utilities and other expenditures associated with day-to-day operation and maintenance of the park facilities.

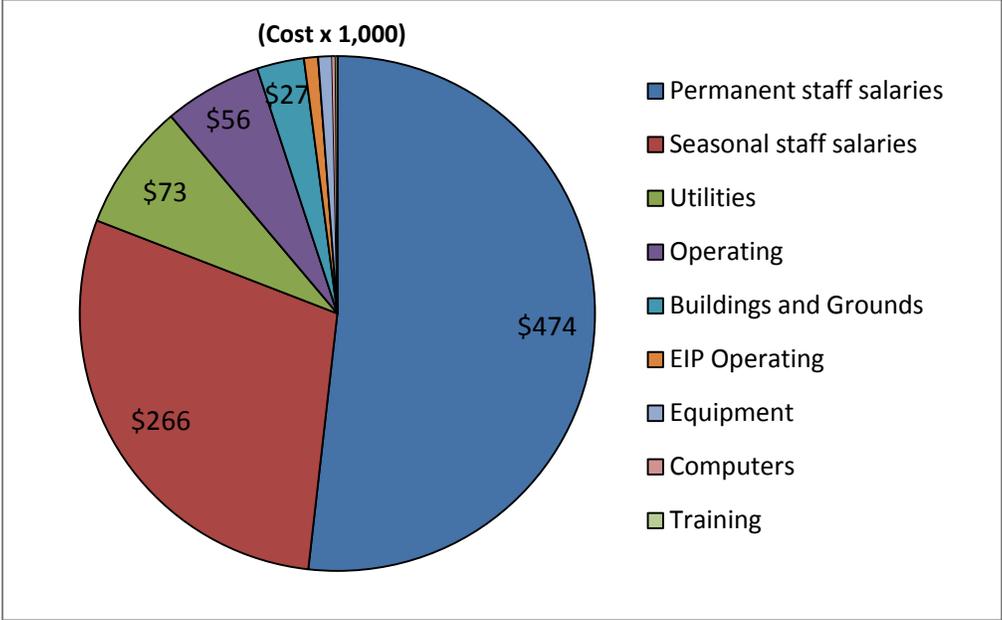


Figure 8-3. Sand Harbor Unit Budgeted Operating Costs (FY 2011).

### 8.2.3 Capital Improvement Funding

Park improvements and major maintenance projects at Sand Harbor may be funded through the federal Land and Water Conservation Fund (LWCF), through Tahoe EIP bonds, and through Nevada’s biennial Capital Improvement Program (CIP) and a special conservation bond program begun in 2002, among other federal and state sources<sup>16</sup>. Large projects are often funded with a combination of federal, state, and other sources.

LWCF grants funded much of the development of the Sand Harbor Unit during the 1970s and 1980s; more recently, they have provided a major portion of the funding for the construction of the Visitor Center and associated infrastructure improvements, and improvements to the maintenance complex. States typically receive a 50 percent federal payment which they match with state funds. However, the U.S. Congress had rarely

<sup>16</sup> Other funding sources used at Sand Harbor include: the Boating Access Grant program administered by the Nevada Department of Wildlife, which provides federal and state funds to build and maintain boating infrastructure (NDOW 2008); and the Lake Tahoe License Plate Program, which provides a dedicated fund for the preservation and restoration of the natural environment in the Tahoe Basin (NDSL 2011a).

provided full funding of LWCF (from oil and gas drilling lease proceeds), resulting in a backlog of state and federal projects across the country. LWCF appropriations have dwindled substantially over the past several years and, in addition, state grants have declined as a percentage of total LWCF appropriations (NPS 2011). Nevada’s 2009 LWCF allocation was about \$334,000, amounting to only 1 percent of the state’s unmet recreation development need (NPS 2009).

The CIP provides financing for construction projects across the state. The Department of Conservation and Natural Resources (DCNR) may submit requests for CIP project funding to the State Public Works Board, which reviews the projects and forwards those that are approved to the Legislature for General Fund appropriations or funding through general obligation bonds. In 2008, the CIP financed accessibility improvements at Sand Harbor picnic sites, walkways, and drinking fountains. However, the 2009 CIP did not fund any State Parks projects (SPWB 2009), and while the 2011 CIP request includes two State Parks projects, neither is at LTNSP (SPWB 2010).

In 2002, Nevada voters approved the Clean Water, Parks, and Wildlife Bond (also referred to as the Question 1 or “Q1” Conservation Bond), authorizing a \$200 million bond fund. Bond allocations included \$27 million to State Parks for acquisition and facility improvements. These funds are typically used as matching funds to be combined with LWCF dollars and other funding sources (State Parks 2011c). Through 2008, several major projects using Question 1 bond funds have been completed at Sand Harbor including: resurfacing of parking lots and roads and installation of runoff sediment control measures; water system, sewer, and electrical utilities upgrades and rehabilitation; renovation of the maintenance shop and office; and construction of the Visitor Center and Concession building. The total Question 1 bond allocation for these projects was more than \$1.5 million (Table 8-4). Planning is also underway for parking area improvements at the Boat Ramp (State Parks 2008). Additional Question 1 bond funding may be sought through a grant program administered by the Nevada Division of State Lands.

**Table 8-4. Recent Sand Harbor Capital Improvement Projects.**

<b>Project</b>	<b>Q1 Bond Funding<sup>1</sup></b>
Parking lot renovation and improvements	\$55,510
Water system, sanitary sewer system, electrical system and fire suppression system upgrades, rehabilitation and replacement	\$527,678
Maintenance shop and office renovation <sup>2</sup>	\$154,055
Visitor Center, Interpretive Center, and Concession Building <sup>3</sup>	\$819,293
<b>Total</b>	<b>\$1,556,536</b>
<sup>1</sup> Based on Question 1 Bond State Park System Capital Improvements Projects Summary, revised 12/30/08. Planning is also underway for boat ramp parking area improvements, with \$250,000 in Q1 bond funding. <sup>2</sup> An LWCF grant of about \$300,000 was also used to fund this project. <sup>3</sup> An LWCF grant of about \$1.35 million was also used to fund the first phase of this project. Source: State Parks (2008).	

The Division of State Lands also coordinates Nevada's participation in the EIP, through the interagency Nevada Tahoe Resource Team (NTRT). The NTRT implements a wide range of projects that utilize EIP funds to restore forests and streams, improve water quality, control erosion, and provide recreational opportunities (NDSL 2011b). EIP funds have supported several projects at Sand Harbor as well as at Memorial Point.

Unfortunately, these vital sources of funding for capital improvements are also threatened by the state's budget problems. The DCNR Director has warned that the current budget crisis will cause the suspension or significant restriction of state general obligation bond sales, which will negatively impact the Tahoe EIP program and the Question 1 Bond Program (DCNR 2011).

Due to the reduction in available funds outlined above, progress on major repairs, renovations, or improvements at Sand Harbor may be slowed or stopped for the next several years, unless other funding sources are identified.

### **8.3 CONCLUSIONS REGARDING MANAGEMENT CAPABILITY**

Over the past few years, sharply reduced state revenues have greatly affected the budgets of all state agencies, including State Parks. General fund support to the State Parks budget has been reduced from 55 percent in FY 2008/2009 to 29 percent in the FY 2012/2013 budget proposal (DCNR 2011). A number of state parks agencies around the west and across the country have been facing similarly severe budget challenges (Dolesh 2008) and, with Nevada, have considered (and in some cases implemented) park closures in response. Nevada and most other states have been able to avoid this drastic action so far, but many have reduced services or instituted seasonal closures at some parks (Lucas, G. 2010; Tavares 2010).

Sand Harbor's high visitation and strong revenue perhaps place the park in an enviable position compared to other parks in the system. Nonetheless, as described above, Sand Harbor has been affected by reductions in both permanent and seasonal staff. Additional seasonal staff reductions are included in the FY 2012/2013 State Parks biennial budget request (DCNR 2011). DCNR has told the state legislature that the past budget reductions have seriously impacted State Parks operations and maintenance, and have caused a shift from proactive maintenance to only critical repairs for equipment and facilities (DCNR 2011). Although the dedicated and experienced staff at Sand Harbor has been able to maintain high quality visitor service and high visitor satisfaction while protecting park resources, it seems apparent that there is little room for additional staff reductions without compromising those high standards.

Some stakeholders recommended steps such as automated entrance stations to free up park staff for other tasks. Such actions may help address staffing-related challenges,

such as keeping up with day-to-day restroom maintenance or increasing lifeguard presence on the beaches.

In response to reduced general fund support, several states have considered or implemented some form of alternative funding for state parks (Caleb 2010), some of which may have relevance to Nevada. A variety of alternative funding mechanisms have been investigated and advocated in different states; examples include new taxes or fees (both related and unrelated to natural resources and outdoor recreation), expanded commercial and concession opportunities in parks, a surcharge added to fines for littering or illegal dumping, sales of advertisements on state parks websites, and sales of commercial sponsorships in parks (CSPF and Save the Redwoods League 2011, Responsive Management 2003). In 2010, Californians voted on (and rejected) a ballot initiative that would have added \$18 to the state's annual vehicle registration fee to provide funding for state parks in exchange for free day-use admission to parks (California Secretary of State 2010). The states of Montana and Michigan have enacted similar programs on a voluntary basis (MDNR 2010, Caleb 2010).

The fee increases instituted in April 2010, which make Sand Harbor's entry fees the highest in the system, were intended to replace losses in general fund support. The increased fees did not appear to significantly reduce visitation in 2010, as visitation actually increased slightly from 2009. However, the study survey results do communicate (not surprisingly) some visitor unhappiness with the fee increases (see Sand Harbor Visitor Survey Question 20, Appendix E). Increased fees may also raise concerns about equity and disproportionate impacts on lower income visitors. Although Nevada residents have generally expressed support for park user fee increases (Rogers 2010), it may not be feasible or desirable to raise fees further.

State Parks statistical reports and attendant notes indicate that the gift shop in the Visitor Center has done increasingly well in the past few seasons, in particular after an upgrade in the variety and quality of goods sold. In addition to the benefit the gift shop provides to visitors as a convenience, given the present State Parks emphasis on increasing revenue (including gift shop sales) to help offset large decreases in general fund support (DCNR 2011), successful operation of the gift shop becomes increasingly important. Therefore, a new arrangement for operation of the gift shop to replace the operation by NSPCA that does not transfer or place an undue burden on State Parks staff will be essential. The current enterprise fund proposal envisions the hiring of additional dedicated staff.

Taken as a whole, it is reasonable to conclude that the present and likely future staffing and financial situation at Sand Harbor does not support any increased capacity demands at the park, although alternative staffing arrangements and funding mechanisms may provide some possibility of alleviating staffing and funding limitations.

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## 9.0 TRANSPORTATION AND PEDESTRIAN SAFETY ASSESSMENT

At Sand Harbor, transportation and pedestrian safety issues are closely associated with high park use levels/demand and other capacity issues. Examples of key issues directly connected to existing vehicle and pedestrian access and parking conditions include the facility capacity of Sand Harbor as represented by available on-site parking, and impacts on visitor experiences associated with high use levels and limited parking capacity relative to those use levels. Also, potential management actions to address transportation issues can adversely affect social, facility, and ecological capacity by increasing crowding or adding to pressures on park facilities and biological resources.

This chapter summarizes an evaluation of transportation-related issues at Sand Harbor conducted by Fehr & Peers Transportation Consultants. This assessment, based on both a literature and site review, serves as the basis for initial recommendations to improve traffic congestion, circulation, and pedestrian safety, as presented in Chapter 10 of this report.

### 9.1 EXISTING CONDITIONS

In recent years, Sand Harbor has hosted from 700,000 to over 900,000 visitors annually, with the majority of use concentrated in the summer months (as described in Section 3.3 of this report). SR 28 provides the only vehicle access for Sand Harbor and comprises a portion of the East Shore Drive National Scenic Byway. As documented in the *Facility Capacity Assessment* (Chapter 5), during peak summer visitation, parking demand routinely exceeds supply, forcing visitors to park along SR 28, return to the park when on-site parking is available, or forego the trip altogether. It is also common for park-related traffic to cause delays along SR 28 as visitors create a queue to enter the park, which is controlled by a single fee booth at each of the public entrances. This queue, most commonly leading north toward Incline, can be several miles long during the busiest weekends and holidays and generally lasts until the park fills and the entrance closes. This section provides additional details on these and related transportation and pedestrian safety conditions.

#### 9.1.1 Vehicle Access to Sand Harbor

SR 28 intersects U.S. 50 at Spooner Summit 7.6 miles to the south and SR 431 at Incline Village 5.5 miles to the north of the Sand Harbor main entrance. Adjacent to Sand Harbor, SR 28 is a two-lane highway with a continuous median / two-way left-turn lane (Figure 9-1). North and south of Sand Harbor, SR 28 returns to a two-lane cross section with narrow shoulders.

The Nevada Department of Transportation (NDOT) maintains a traffic count database (TRINA), which reports daily traffic volume and classification data at traffic count stations throughout the state. The two count stations closest to Sand Harbor are on SR 28 just north of U.S. Highway 50 in Douglas County and approximately 200 feet south of Lakeshore Boulevard at the east end of Incline Village. Average annual daily traffic

(AADT) counts on this portion of SR 28 range from 5,500 to 7,500 vehicles based on one week of hourly data collected in June 2010. The directional split is roughly equal north and south. Weekend traffic volume (approximately 9,500 vehicles per day) registered approximately 28 percent more than during the week at the Incline Village count station.



**Figure 9-1. SR 28 at Sand Harbor.**

The park normally maintains two public access points along SR 28. Both public entrances have a fee booth, permitting only one vehicle to enter at a time (Figure 9-2 and 9-3). The boat ramp entrance (the northernmost access) is intended for boat traffic only during the peak summer months. Boating access is provided year round as weather and lake level permit. During the off-season, the boat ramp lot is generally not enforced for “boater parking only,” as it is in the summer. The main entrance, 700 feet south of the boat ramp entrance, provides access to the Main Beach, Sandy Point, Shakespeare Festival Amphitheatre and Stage, Visitor Center, Diver’s Cove, the Group Use Area, and the majority of the on-site parking. The two areas operate independently, with no public access connecting internal roadways. A third access point, about 1,000 feet south of the main entrance and adjacent to the south parking area, is gated to allow emergency access only, although it is occasionally used at the discretion of park staff to relieve traffic congestion within the park. (See Figure 3-1 for a diagram of the Sand Harbor entrances, parking areas, and internal roadways.)

Beginning the July 4 holiday weekend of 2011, Sand Harbor staff implemented a test of modified fee booth operations at the main entrance. Using temporary barriers, cones, and park staff to direct traffic, the main entrance exit lane was converted to a second entry lane during peak traffic periods. Modified operations were initiated when SR 28 traffic began to back up a substantial distance to the north due to vehicles waiting to enter the park. The normally gated south entrance was used to allow visitors to exit the park during modified operations. Sand Harbor staff reported that this innovation was very

successful in getting visitors into the park faster, with vehicle processing time significantly decreased and the period of time that traffic was backed up on SR 28 also greatly reduced.

During stakeholder consultations, the North Lake Tahoe Fire Protection District (commonly known as Incline Fire) expressed concerns about the difficulty in getting fire equipment into the park during peak periods due to congestion on the highway and at the park entrance. The District also pointed out that it is difficult to navigate with large fire equipment once in the park, and that egress from the park is limited in case of a need for an evacuation.



Figure 9-2. Boat Ramp Entrance Booth.



Figure 9-3. Main Entrance Booth.

### 9.1.2 Parking at Sand Harbor

#### On-Site Parking and Parking Management

Paid parking is available on-site within five parking lots. From the main entrance, approximately 558 spaces are available in the main parking lot, south parking lot, and ancillary areas. The boat ramp area provides 75 spaces for vehicles with boats only (59 for vehicles with trailers and 16 reserved for vehicles with car-top boats).

Sand Harbor staff continuously monitors parking occupancy and closes the park when all spaces are filled. During peak summer visitation, the park commonly closes by mid-morning and reopens again in mid-afternoon. According to State Parks records, Sand Harbor entry was closed for 47 days during the 2010 summer season, including 44 days in a row from July 3 to August 15. Similar data were collected in 2008 and 2009. Sand Harbor was closed approximately 20 more times in 2010 than in previous years based on the lack of on-site parking to accommodate vehicle traffic. It has been the experience of staff that the park will fill almost all summer weekends and holidays and on a number of weekdays as well. When the park reaches this capacity, it has been park policy to keep the entrance closed until 3 p.m. This time was chosen for several reasons. First, 3 p.m. seems to represent that time of day when the park entrance can consistently reopen without having to close again, sometimes repeatedly. Second, the park does not

have the staff to monitor the parking lots for extended periods of time, or the queue length for one out/one in operations. Third, full closures relieve highway congestion and give the public a consistent time for coming back without having to guess when the entrance is going to reopen. Last, full closures allow staff time to focus on other routine park duties such as restroom cleaning and trash removal.

Another management strategy has been to keep the main entrance closed until approximately 80–100 spaces are available. Anecdotal evidence and observations from this study indicate that park patrons are frustrated when some parking spaces are available as seen from SR 28 but the park entrance remains closed.

Advisory message signs with flashing beacons reading “WHEN FLASHING – SAND HARBOR LOT FULL” and located on northbound and southbound SR 28 inform patrons and motorists of parking conditions during the peak season. NDOT staff from Reno can remotely activate the flashing beacons after Sand Harbor staff calls to request activation.

### **Off-Site Parking**

As indicated above, during summer peak visitation, parking demand routinely exceeds supply, and parking along SR 28 is common even though parking is prohibited in the immediate vicinity of Sand Harbor. Based on surveys conducted by GBI for this study between Memorial Point and the Spooner pumping station, it appears that up to 150 vehicles may park along the shoulder of SR 28 to access Sand Harbor during peak visitation (see Appendix I for additional details). Observations made by the study team and as witnessed by Sand Harbor staff suggest that SR 28 parking predominately occurs when on-site Sand Harbor parking reaches capacity. Sand Harbor visitors who park along SR 28, which include children, routinely walk along the shoulder of SR 28 to one of the park entrances, often carrying gear. This issue is described further below in the *Pedestrian Facilities* section.

Select surveys conducted mid-week also signify that some SR 28 shoulder parking adjacent to the park is utilized whether or not on-site parking is over capacity. It is reasonable to assume that the vehicle entrance fee or congestion near the entrances deters some patrons from entering the park in lieu of free parking along SR 28.

Several previous studies (described in Section 9.2 below) have recommended the elimination of all or some portion of the SR 28 shoulder parking spaces, with physical barriers. Some of these studies have recommended the replacement of some portion of SR 28 shoulder spaces with expanded or new parking areas along the corridor. Increased law enforcement to discourage the use of illegal parking spaces on the SR 28 shoulder has also been recommended, but Nevada Highway Patrol (NHP) has expressed numerous reservations concerning the feasibility of that action (Harding ESA 2001). Despite these past concerns, it should be noted that the assignment of dedicated NHP troopers in 2010 has improved enforcement along SR 28. A continued permanent NHP presence in the basin should be encouraged.

### 9.1.3 Pedestrian Facilities and Safety

Within the park, pedestrians use developed trails linking park facilities, vista points and parking areas, sidewalks around the Visitor Center, and designated walkways through parking lots (Figure 9-4).



**Figure 9-4. Designated Pedestrian Access through the Main Parking Lot.**

SR 28 is a two-lane rural roadway section with no designated pedestrian facilities. As noted above, pedestrians routinely walk on the shoulder of SR 28 to access Sand Harbor. The posted speed limit of 45 mph impacts the comfort and safety of pedestrians walking along and crossing SR 28. The terrain results in both horizontal and vertical curves that periodically limit sight distance for both motorists and pedestrians. Even though parking is restricted along SR 28, patrons will either park illegally in a restricted area or walk in from points beyond the restriction to visit Sand Harbor.

Given the prevalence of illegal SR 28 shoulder parking, and the limited potential for effective enforcement, it may not be appropriate to continue shoulder parking prohibitions in the vicinity of Sand Harbor, unless other viable alternatives can be provided, such as a transit system. Without viable alternatives, visitors that comply with the current parking restrictions must walk farther along SR 28 to reach Sand Harbor. Yet, recent experience of park staff during periods when parking enforcement ceased or was reduced indicate that lack of parking enforcement worsens other problems, such as littering, resource damage, traffic back-ups, and illegal entry into the park by visitors going over, under, or around fences.

In addition to the vehicle entrances, a trail provides pedestrian access from SR 28 between Memorial Point and the boat ramp area. A perimeter fence spans the entire stretch of SR 28 through Sand Harbor. Some pedestrians climb over or slip under the fence for convenience or to avoid paying a walk-in entrance fee.

### **9.1.4 Bicycle Facilities**

Bicycle traffic along this portion of SR 28 is infrequent compared to other areas in the Tahoe Basin. SR 28 lacks a continuous bikeway. The lack of an east side bikeway has been cited as a major gap in the bikeway network. Both the Flume Trail and Tahoe Rim Trail run roughly parallel to SR 28, providing recreational opportunities for mountain biking and hiking with some restrictions. In the vicinity of Sand Harbor, the Lake Tahoe Bicycle and Pedestrian Plan Update (TRPA and TMPO 2010) proposes the continuation of a Lake Tahoe Scenic Bike Loop (i.e., on-street bicycle lanes) in addition to a shared-use path (to be used by pedestrians and other non-motorized users as well as by bicyclists).

The proposed Northern Demonstration Project segment of the Nevada Stateline-to-Stateline Bikeway Project, a shared pathway extending from Incline Village to Sand Harbor, is projected to be used by more than 33,000 recreational bicyclists and more than 63,000 pedestrians each year (TRPA 2009). (Additional details on the Bikeway Project are provided in Section 9.2 below.)

Completion of proposed bikeways may provide direct access to Sand Harbor and a scenic recreational corridor for walking and biking; however, the resulting impact of the project on the cross-section of SR 28 and Sand Harbor access, including interaction with parking and pedestrian traffic, has not been fully vetted. A related SR 28 Corridor Management Plan, currently under development by the Tahoe Transportation District (TTD), may provide additional information.

A dedicated bikeway serving Sand Harbor will likely not reduce vehicle parking and congestion at the park during peak times since parking demand routinely exceeds capacity and the great majority of visitors would continue to arrive by personal vehicle. However, the bikeway would provide an alternative to walking or biking along the shoulder of SR 28.

Visitation to Sand Harbor may also increase due to walk-in and bike traffic. However, most walk-ins would probably continue to be associated with parking on the SR 28 shoulder, and the bikeway would not necessarily encourage more SR 28 parking or walk-ins. Nevertheless, additional bicycle and pedestrian traffic at Sand Harbor will exacerbate to some degree the existing park capacity issues.

### **9.1.5 Transit**

Transit service on the north shore is operated by Placer County (California), with funding from the Washoe County Regional Transportation Commission, to serve the Nevada portion of the North Shore. This service is known as the Tahoe Area Regional Transit (TART) system. On the South Shore, a consortium of public and private transit providers (including El Dorado County, the City of South Lake Tahoe, Douglas County, Heavenly Resort, and several casinos) operate BlueGO, a coordinated transit system. All of the buses are equipped with racks for two bicycles, and drivers may allow additional bicycles inside the bus at their discretion. Flume Trail Mountain Bikes operates a private shuttle

between Spooner Lake, the Tunnel Creek Station at SR 28 near Ponderosa Ranch, and Tahoe Meadows Rim Trailhead off of the Mt. Rose Highway (SR 431). None of the transit providers serve Sand Harbor directly. A number of planning documents, including those emanating from the Pathway 2007 visioning process, have recommended establishing both a water- and land-based transit center at Sand Harbor (TRPA 2007c).

During the summer of 1997, a free shuttle bus was operated on the East Shore on weekends as a demonstration project. The shuttle did not stop at Sand Harbor or Memorial Point due to the lack of turnouts. Evaluation of the shuttle demonstration identified the lack of these stops as a key factor in reducing its effectiveness. It also identified the ease and availability of SR 28 shoulder parking as having a direct effect on ridership levels, suggesting that a primary means of increasing ridership was to restrict SR 28 shoulder parking (Harding ESE 2001).

The Lake Tahoe Regional Transportation Plan – Mobility 2030 (TRPA and TMPO 2008) recommends a reexamination of the “Summer Lake Lapper” service, which in the 1990s provided seasonal bus service that circumnavigated the lake. More immediately, TTD is developing a plan for a pilot East Shore seasonal shuttle service, with an anticipated start of operation during the summer of 2012. Operational details, logistics, and funding for the pilot service will depend on the direction provided by the plan (TTD 2011). (Additional details on this effort are provided in Section 9.2 below).

### **9.1.6 Collision History**

Fehr & Peers analyzed the 3-year (January 2007 – December 2009) collision data available through NDOT’s crash database. Reported collisions along SR 28 within approximately a half mile of the Sand Harbor main entrance were reviewed. Of the nine collisions that occurred, four resulted in six injuries and no fatalities. All but one collision, which was a single vehicle collision with a fixed object, occurred during daylight. Rear-end collisions with a slowed or stopped vehicle were the most prevalent type of crash cited (four total). Rear-end collisions often indicate congested conditions where traffic is subject to unexpected stop-and-go conditions. None of the reported collisions involved pedestrians or bicyclists. Four collisions occurred during weekends or holidays between mid-April and the end of July. Table 9-1 provides additional detail regarding the collisions.

These recent data appear to validate data from the early 1990s indicating that the accident rate for SR 28, based on the number of accidents per vehicle-miles of travel, was substantially lower than the Nevada statewide rate (Harding ESE 2001). Considered in isolation, the historical collision data do not indicate that there is a noticeable incident trend. It is possible that more collisions or “near-collisions” have occurred and have not been reported. In general, the collision history is contrary to the common perception of unsafe conditions along SR 28.

**Table 9-1. SR 28 Three-year collision History (2007 – 2009).**

Collision Date	Severity <sup>1</sup>	Type	Primary Factor	Environmental Factor
02-Oct-2007	Injury (B)	Non-collision	Drove Left of Center	None
07-Apr-2009	Injury (C)	Rear-end	Other Improper Driving	Active Work Zone
18-Apr-2009	Injury (B)	Rear-end	Driving too fast for conditions	Active Work Zone
26-Jul-2009	Property Damage Only	Angle	Failed to Yield Right of Way	None
16-Feb-2009	Property Damage Only	Rear-end	Driving too fast for conditions	Wet, Icy, Snow, Slush
04-Jul-2007	Property Damage Only	Rear-end	Followed too closely	None
23-Jun-2007	Injury (C)	Sideswipe, overtaking	Failed to Yield Right of Way	None
06-Aug-2007	Property Damage Only	Angle	Failed to Yield Right of Way	None
15-Sep-2009	Property Damage Only	Unknown	No Improper Driving: Unknown	Unknown

*Notes: Injury (B) = Non-incapacitating, evident injury, Injury (C) = Possible injury.  
Source: NDOT 2010.*

### **9.1.7 Transportation-Related Information Obtained from Recreation Survey**

The recreation survey administered for this study contained several questions pertaining to parking and transportation. The following summary reflects responses received from the 647 survey respondents contacted at Sand Harbor:

- Nearly 96 percent of visitors arrived by personal vehicle; two percent walked in; one percent arrived by bus or van; less than one percent were dropped off or rode a bike.
- About 47 percent of visitors were in a group that used more than one vehicle to come to Sand Harbor. The average group size for one vehicle groups was four people. The average group size for groups with more than one vehicle was about 12 people.
- On average, visitors planned to spend about 5.5 hours at Sand Harbor, which results in low parking turn-over.
- About half the respondents reported not getting into Sand Harbor on a previous visit due to lack of parking. Approximately half of these respondents reported parking along SR 28 at some point, which suggests that some visitors forego the trip if parking is not available.
- Getting into the park or finding a parking space was the issue most often identified as a problem by respondents, among a set of eight potential issues at Sand Harbor.
- Among a set of eight potential problem issues, the issue most often identified as a “very serious problem” or “serious problem” by respondents was unsafe parking conditions along SR 28 (29.3 percent of all responses).

- When asked “If you could change one thing at Sand Harbor, what would it be?”, the most common responses were related to providing more parking or parking improvements.

These survey data underscore and document the high burden placed on parking facilities at Sand Harbor during peak use times, the prevalence of parking-related effects on visitors’ enjoyment due to this high burden paired with limited parking capacity in the park, and Sand Harbor visitors’ substantial level of concern about parking and pedestrian safety issues.

## 9.2 PREVIOUS AND CURRENT RELATED EFFORTS

Several other studies have addressed transportation issues at Sand Harbor and along the SR 28 corridor through LTNSP. At least two projects, the Nevada Stateline-to-Stateline Bikeway Project and the SR 28 East Shore Corridor Seasonal Shuttle Pilot Plan, are ongoing. The following is a brief description of each of these efforts, in chronological order, and its relevance to Sand Harbor.

- Lake Tahoe Nevada State Park Master Development Plan with Resource Analysis (State Parks 1990) – The purpose of the plan was to update the basic principles for use, preservation, and operation of the park. Recommendations included enlarging the boat ramp parking area, installing a series of parking nodes along SR 28, and constructing a bike trail between Incline Village and Spooner Lake.
- Nevada SR 28 Recreational Traffic Management Study (LSC, Inc. 1996) – This study was conducted to address parking and develop a coordinated plan for SR 28. After evaluation of several alternatives, the proposed plan suggested eliminating all shoulder parking through physical measures (i.e., primarily low posts) and implementing a shuttle between Sand Harbor, USFS parking lots, and new shuttle parking lots. Specific recommendations regarding shuttle service operations and routing were included. The plan acknowledged that modifications would be needed to create a shuttle stop at the Sand Harbor main entrance.
- East Shore Drive Corridor Management Plan (EDAW, Inc. 1997) – This plan was required when East Shore Drive was designated a National Scenic Byway. Recommendations included removal of all SR 28 shoulder parking and the development of off-highway or off-site parking lots. During development of the plan, strong public opposition to the elimination of all SR 28 shoulder parking emerged, particularly without the provision of replacement off-highway parking in advance. The issues of how much new off-highway parking should be provided, and at what locations, were not determined pending completion of additional beach site capacity evaluation and environmental studies for proposed new parking lot sites. Increased enforcement of parking restrictions within the SR 28 corridor was also recommended.

- Draft Environmental Assessment, Nevada SR 28 Off-Highway Parking Areas, Eastern Shore of Lake Tahoe (Harding Lawson Associates 1999) – This document evaluated impacts associated with the development of four off-highway parking locations to accommodate the carrying capacity of area beaches and attractions. Less than a dozen additional parking spaces were proposed at each of the two locations close to Sand Harbor.
- Draft East Shore Access Plan (Harding ESE 2001) – The goal of this plan was to develop an acceptable use level for the area and consider parking and shuttle options. The plan recommends expanding USFS parking areas, improving a limited quantity of shoulder parking, and operating a shuttle service on peak weekends and holidays from intercept lots to five locations along the East Shore corridor. However, only four shoulder parking spaces were recommended in the vicinity of Sand Harbor, at a location between Memorial Point and the boat ramp entrance. Also, 14 shoulder spaces between Memorial Point and Sand Harbor and an additional 14 spaces at two sites south of Sand Harbor, just beyond the Spooner pumping station, were recommended to be blocked with post barriers. This plan considered any new off-road parking areas (recommended in several earlier studies) to be infeasible due to environmental constraints, and did not support a policy to eliminate all roadside parking as advocated by some earlier studies. The plan highlights law enforcement agency concerns about the difficulties of increasing parking enforcement in the corridor, and whether it is justified to do so from a safety standpoint.
- Tahoe Interregional/Intraregional Transit Study (TRPA 2006b) – This short-range transit study identified feasible transit strategies for the near-term (i.e., 5 years) to improve regional mobility between the north and south shores and beyond. A summer “Round-the-Lake” transit service is proposed along SR 28. A waterborne ferry service is identified as having the greatest potential to increase near-term ridership in the Tahoe Basin.
- Waterborne Transit Site Selection Study (TRPA 2007d) – The study focuses on four potential sites for cross-lake passenger ferry service. Sand Harbor is not identified as one of the candidate sites. The candidate sites are: Lakeside Marina near the South Shore Stateline area, Ski Run Marina in South Lake Tahoe, the Tahoe City Marina, and the Kings Beach State Recreation Area.
- Lake Tahoe Bicycle and Pedestrian Plan (BPP) (TRPA and TMPO 2010) – This plan recommends bikeway improvements to enhance regional bicycling to protect Lake Tahoe, provide multiple mobility options, and maintain healthy communities. Through Sand Harbor, the BPP proposes continuation of a Lake Tahoe Scenic Bike Loop in addition to a shared-use path. The Scenic Bike Loop is envisioned to consist of continuous on-street bike lanes.
- Nevada Stateline-to-Stateline Bikeway Project (TRPA and TTD, ongoing) – This multi-agency collaboration has been established to complete the Nevada portion of a

separated bikeway around Lake Tahoe. Two project study area segments incorporate Sand Harbor: North Demonstration Project (Incline Village to Sand Harbor), and Central Corridor Segment A (Sand Harbor to USFS parking lot at Secret Harbor Trailhead). An operations and constraints evaluation (TRPA 2009) and a feasibility study (TRPA and TTD 2010) addressing both segments have been completed. Conceptual planning is complete for the North Demonstration Project, and technical studies and environmental review are underway. Conceptual design and environmental review for Segment A are planned for the near future; both would be shared-use paths. The feasibility study highlights the potential of the bikeway to reduce vehicular congestion at East Shore beaches and parks (including Sand Harbor) by improving non-motorized access, but also acknowledges the potential of the bikeway to increase demand on State Parks recreation facilities that are already at capacity on peak days.

- SR 28 East Shore Corridor Seasonal Shuttle Pilot Plan (TTD ongoing) – This plan, an element of the TTD SR 28 Corridor Management Plan, will establish the service parameters, logistics, equipment needs, required capital improvements, and funding plan for a seasonal shuttle service along the East Shore. It is anticipated that the pilot service program will start operation during the summer of 2012 based on the findings and direction of the plan (TTD 2011).

### 9.3 TRANSPORTATION AND PEDESTRIAN SAFETY ASSESSMENT CONCLUSIONS

Transportation and pedestrian safety issues of concern for this study primarily relate to the SR 28 corridor (on-site parking capacity constraints and pedestrian facilities are addressed in Chapter 5). This and previous studies have examined and documented long-standing issues with shoulder parking on SR 28 and related traffic and pedestrian safety, and traffic congestion resulting from a limited capacity for arriving vehicles to pass through the two entrance stations.

The various entities that have studied SR 28 traffic and parking issues over the past decade and a half have proposed a variety of actions to address the main concerns. However, there is generally no consensus among affected agencies (including State Parks) and decision makers on the best actions to take. In addition, there have been notable changes in direction in these proposals through the years. For example, focus has shifted from creating new parking lots in the SR 28 corridor coupled with elimination of shoulder parking spaces and stepped-up parking enforcement, and toward more modest expansion of existing parking lots, formalization of some shoulder parking (some of which has been lost due to NDOT erosion control and drainage improvement work in the corridor), and less insistence on increased parking enforcement.

Expansion of regional transit to serve the East Shore has been proposed by several studies and plans and was tested with the 1997 demonstration, with limited success. However, a regional commitment to expand transit remains (as expressed in recent transportation plans), lessons have been learned about factors for success, and a new

effort to bring transit to the East Shore and possibly Sand Harbor is in development. If successful, this holds promise for alleviating some traffic congestion and SR 28 parking pressure. Despite concerns about its practicality, recent years have seen increased SR 28 parking enforcement, and an insistence on maintaining increased enforcement given viable alternatives such as public transit.

Traffic and pedestrian safety remain concerns and will be so as long as parking along SR 28 is common, although accidents have not been frequent. Development of an East Shore shared pathway (as proposed in the Lake Tahoe BPP and the Stateline-to-Stateline Bikeway Project) may alleviate some pedestrian safety concerns if fewer Sand Harbor visitors walk on the highway shoulder to the park.

The planned bikeway segments to link Sand Harbor to Incline Village and points south of Sand Harbor may be a “double-edged sword” in relation to Sand Harbor recreational capacity issues. Generally, enabling visitors to switch from vehicular to non-motorized transportation to reach a park could be regarded as a positive step and consistent with State Parks’ mission. But at Sand Harbor, any reduction in vehicle traffic may be accompanied by an increase in bicycle traffic in the congested park, and an increase in the number of visitors gaining access to the park at peak use times, when available space for additional visitors is severely constrained.

## 10.0 CAPACITY CONCLUSIONS AND RECOMMENDATIONS

This chapter provides study conclusions for Sand Harbor and Memorial Point, bringing together the quantitative and qualitative results of the four capacity assessments (physical/spatial, facility, ecological, and social) described in Chapters 4 through 7. Conclusions are provided for each Sand Harbor use area as well as for Sand Harbor as a whole. Results of the Management Capability Assessment and Transportation and Pedestrian Safety Assessment (described in Chapters 8 and 9) are also integrated into the conclusions. The conclusions are followed by a discussion of policy and operational recommendations to address key capacity management issues identified by the study. As a prelude to the conclusions and recommendations, the chapter outlines an overall recreation management strategy that proposes how the study conclusions and recommendations can be best interpreted and applied to address recreation capacity issues at Sand Harbor.

### 10.1 OVERALL RECREATIONAL CAPACITY MANAGEMENT STRATEGY

Sand Harbor needs a comprehensive recreational capacity strategy. Capacities are an integral part of State Parks' mission: to exercise care and oversight of Nevada's natural, cultural, and historic resources while simultaneously providing quality recreation to the citizens of Nevada, and all of the visiting public. Moreover, it is clear from visitor opinions and from the assessments of impacts described in this report that current management policies and activities may not be enough to ensure preservation of the park and high quality recreation opportunities.

Before summarizing the capacity conclusions drawn from the capacity assessments in this report, two concepts are important to consider when interpreting the capacity conclusions and applying them to management decisions. The first concept is an explanation of the descriptive and evaluative components of recreational capacity; that is, the "facts" versus "values" inherent in the application of the concept. The second concept is the formulation of an immediate capacity management goal that points a way forward for capacity management at Sand Harbor, even if the evaluative component of capacity has not yet been fully addressed. In this way, this study can result in substantial progress in addressing the myriad of complex capacity concerns that have motivated the study effort, although a firm determination of "how much is too much" may not have been made. (Indeed, some professionals and academics in the recreation capacity field argue that there is little value in making or need to make an ultimate "how much is too much" determination. For more on this perspective, see Borrie et al. 1998, and McCool and Lime 2001.)

#### 10.1.1 *Descriptive and Evaluative Components of Recreational Capacity*

When applying capacity concepts to recreation settings, it is important to distinguish between the descriptive and evaluative components. The essential distinction is between

description and evaluation or, just as essentially, between facts and values (Shelby and Heberlein 1986).

The descriptive component seeks to answer: *What is happening now in terms of the numbers and types of recreation visitors and the character of physical and social recreation impacts?* Determining these essential facts is a primary contribution of this study.

The next step is the evaluative component, which can be expressed in the question: *How should the park be managed in regards to allowable use levels and capacity limits?* Essentially, the evaluative component of capacity seeks to answer the question, *How much impact (social or physical/ecological) is too much?* The answer is a judgment based on study data and professional evaluation, but also on agency values and choices.

To complete the evaluative component of recreational capacity, evaluative standards need to be set. Capacity planning frameworks, such as Limits of Acceptable Change (LAC) and Visitor Experience and Resource Protection (VERP), developed by the USFS and National Park Service, respectively, set evaluative standards and institute a monitoring protocol focused on those standards. (Additional details on these frameworks are available in numerous widely available publications.)

In the interim, this study provides policy and operational recommendations that can enhance capacity management in the near term, to meet immediate needs and to respond to capacity issues.

### **10.1.2 Immediate Capacity Management Goal**

Any capacity management recommendations must be consistent with guidelines established by State Parks for park management, as outlined in the State Parks Policy Manual and cited in the LTNSP General Management Plan (State Parks 1990). Among several guidelines of relevance to capacity management, the guidelines underscore the purpose of establishing parks “to preserve and protect exceptional or unique natural features of ecological, geological, scientific or similar nature, or exceptional scenic qualities.” The guidelines also provide the directive that “development shall be limited to that which is necessary to protect and preserve the scenic and natural values, provide public access, protect public health, provide adequate interpretive programs, and other recreational public use facilities.”

Consistent with these agency goals, what is a reasonable capacity management goal for Sand Harbor, given documented resource, social, facility, and managerial constraints?

We propose the following capacity management goal:

***Identify actions that maximize visitor satisfaction while maintaining visitor safety and maintaining biological/ecological resource conditions.***

Any recommended policy or operational recommendations must be made in the context of the following key constraints to management at Sand Harbor:

- High demand and use levels throughout most of the peak season, which will likely continue into the future.
- A limited ability to impose limitations on use levels above parking capacity, given the history of SR 28 shoulder parking and the difficulty and limited success of past attempts to control and manage it.
- The undesirability of imposing limitations on use levels above on-site parking capacity, given State Parks' mandate to facilitate the public's enjoyment of the special recreation opportunities available at Sand Harbor (within ecological, social, facility, and managerial constraints) and concerns about equity and fairness in providing access to these opportunities. Imposing such a limitation is further constrained by an inability to quantify the additional park use that results from SR 28 parking as a primary cause of unacceptable impacts, given that the impacts may occur regardless of this additional use, and may not be substantially worsened.
- Reduced staffing levels that are unlikely to return to former levels given state and agency budget limitation (at least for the foreseeable future).
- The need to preserve as much of the remaining natural and scenic values as possible, recognizing their importance to the ecological integrity and quality of recreation at Sand Harbor.

## 10.2 OVERALL RECREATIONAL CAPACITY ASSESSMENTS AND CONCLUSIONS

Based on the capacity assessments described in Chapters 4 through 7, what can be said about the acceptability of the current level of recreation activity at Sand Harbor? The following discussion “brings the threads together” for all four capacity types, for each of the five use areas at Sand Harbor, identifying which type or types of capacity appear to be exceeded in each use area at the present time, and/or which types of capacity appear to be constraints on recreational capacity of the park. Broadening the focus to the Sand Harbor area in its entirety, and viewing each capacity type as an overall capacity “indicator,” this section then identifies the types of capacity exceeded for Sand Harbor as a whole and provides an overall capacity conclusion (“below,” “approaching,” “at,” or “exceeding”) for Sand Harbor. Conclusions for each capacity type and an overall capacity conclusion for Memorial Point are provided as well.

Capacity levels expressed in maximum numbers of users or vehicles, for example, are not the focus of this assessment because of the complexity inherent in the range of capacity types or factors in each use area. Absolute numbers proposed as “capacity limits” have proven to be incorrect over time in many recreation settings, and numerous authors have expressed strong reservations with such a numerical approach to recreation capacity (e.g., Borrie et al. 1998, McCool and Lime 2001).

At Sand Harbor, using maximum use levels to determine capacity may not be practical, for reasons expressed in the recreational capacity literature. First, use levels appear to be exceeding capacity based on one or more indicators (capacity types) in several use areas, but it is not known if a lower level of use, or what lower level of use, would reduce impacts to an acceptable level, with the exception of facility capacity (i.e., parking utilization). Second, use levels are not likely to decline in any significant amount absent new restrictions, and restricting access to the park, beyond current closure of entrance stations when parking is full, is likely not a viable option, or one acceptable to the visiting public. It should also be noted that management actions have the potential to reduce impacts below capacity thresholds without a reduction in use levels; for example, by halting or remediating ecological impacts.

Capacities reported in this assessment are presented in the qualitative terms listed above, as first introduced in relation to the individual capacity types. Because capacities are expressed in qualitative terms and as estimates, capacity levels should be monitored over time to adapt to changing conditions. Monitoring of specific capacity indicator variables is an essential component of capacity processes, such as those described above (LAC and VERP) and similar examples.

In the broader regional context, it should be noted that the limitations of numerical capacity limits have also been recognized by TRPA in relation to Recreation Capacity Threshold R-2: Outdoor Recreation Capacity Available to the General Public. (TRPA recreation thresholds are described in Section III of Appendix A.) Attainment of this threshold is measured in part with PAOT, which provides a numeric indicator of the supply of developed recreation opportunities in the basin. PAOT is essentially a theoretical design capacity of a site at any one time. However, recent TRPA threshold evaluations have highlighted several limitations of PAOT as a measure of recreation opportunities (e.g., it does not indicate the overall visitation, or potential visitation, at a site, or impacts of visitation, and can be affected by changing circumstances such as transit becoming available or the amount of beach changing with fluctuations in lake level) (TRPA 2007a, b). Although no acceptable alternative to PAOTs has been identified, stakeholders involved in the TRPA Regional Plan Update have expressed a desire to place more emphasis on recreation quality, and move toward desired conditions, indicators, and standards in the thresholds (TRPA 2010). In a stakeholder interview conducted for this study, the USFS also stressed a desire to move away from PAOT in capacity management, in favor of management focused on providing sustainable recreation opportunities and experiences.

### **10.2.1 Sand Harbor Use Area and Overall Capacity Conclusions**

Capacity study conclusions for the Sand Harbor use areas and Sand Harbor as a whole are summarized below based on the four capacity types (physical/spatial, facility, social, and ecological) based on the assessments presented in Chapters 4 through 7. Capacity conclusions for Memorial Point are presented following the Sand Harbor area discussion. Table 10-1 presents the capacity conclusions for both areas.

**Table 10-1. Summary of Recreational Capacity Conclusions.**

Use Area	Capacity Types/ Indicators	Capacity Conclusion	Overall Capacity Summary <sup>5</sup>
<b>Sand Harbor</b>			
Main Beach	Physical/Spatial Facility Ecological Social	Exceeding <sup>1</sup> Exceeding Exceeding Approaching	Exceeding
Family Picnic Area	Physical/Spatial Facility Ecological Social	Approaching <sup>2</sup> Exceeding Approaching Approaching	Approaching
Diver's Cove	Physical/Spatial Facility Ecological Social	Exceeding <sup>1</sup> Exceeding At At	Exceeding
Boat Ramp Area	Physical/Spatial Facility Ecological Social	Exceeding <sup>1</sup> Exceeding Below Approaching	Exceeding
<b>Overall Sand Harbor Area</b>			
	Physical/Spatial Facility Ecological Social	Exceeding Exceeding At/Exceeding <sup>3</sup> Approaching/At <sup>4</sup>	Exceeding
<b>Memorial Point</b>			
	Physical/Spatial Facility Ecological Social	Not assessed At Below Not assessed	At
<p><sup>1</sup> Physical capacity conclusions for these use areas are based on the beach area available in mid-summer of high- water years, as occurred in 2006, 2007, and 2011. In this study, a high-water year is defined as a year in which the annual high elevation of Lake Tahoe was within approximately 1 foot of the maximum permissible elevation of 6,229.10 ft.</p> <p><sup>2</sup> Although the visitor counts suggested that the picnic area was "below capacity," this conclusion is based on the likelihood of higher peak use levels than the counts indicated (due to most picnic area users spending part of their visit on the beach), and observations of use of undesignated areas for picnicking at peak use times (when the actual number of picnic sites available, if not the land area, represented a constraint that was exceeded at those times).</p> <p><sup>3</sup> Although ecological capacity conclusions across use areas range from "below" to "exceeding capacity," this conclusion acknowledges that two of the most heavily used portions of Sand Harbor, Main Beach and Diver's Cove, were found to be "at" and "exceeding capacity," respectively.</p> <p><sup>4</sup> This overall social capacity conclusion is based on overall Sand Harbor crowding scores in the "approaching capacity" range, while acknowledging that the Diver's Cove area was found to be "at" social capacity, and that monthly crowding scores were just above the "at capacity" range for July (primarily due to the July 4 holiday) and in the "at capacity" range for August and September.</p> <p><sup>5</sup> Indicates whether overall peak season recreational use is considered to be "below," "approaching," "at," or "exceeding capacity" at this time based on a synthesis of the results for each capacity type or indicator.</p>			
Provided by AECOM.			

In determining the overall capacity conclusion for a recreation use area, all four capacity types were considered in aggregate. No attempt was made to prioritize one capacity type over another; rather, all capacity types were considered equally with no prioritization or ranking of importance among the factors. As explained below, the facility capacity limitation imposed by parking constraints is considered separately from other

capacity constraints in this analysis. Parking constraints alone were not judged to be sufficient justification to consider a use area to be “at” or “exceeding capacity.” With the exception of the Family Picnic Area, at least one additional capacity type was found to be “exceeding capacity” at all use areas, and therefore all three were considered to be “exceeding” their overall capacity.

### **Main Beach**

The Main Beach is perhaps the most distinctive feature and biggest draw for visitors to Sand Harbor, accounting for about 55–60 percent of visitors through the peak hours of the day (from about 10 a.m. to about 5 p.m.) on summer weekends and holidays. Recreational capacity pressures are expected to be particularly high at this use area.

Overall, peak season recreational use at the Main Beach is **exceeding** its capacity (Table 10-1). Currently, the primary capacity constraints are physical capacity (particularly during moderate or high water years), facility capacity, and ecological capacity. Physical capacity is considered a constraint due to the limited beach area available coupled with high use levels. Facility capacity is considered a constraint due to parking limits. Ecological capacity is considered a constraint due to the extent and severity of soil and vegetation impacts in portions of the back beach. Social capacity is not considered a constraint at this time (based on field data collected during the 2010 season), but may be a factor in moderate or high water years.

### **Family Picnic Area**

The Family Picnic Area tends to fill early in the morning on peak use days, as visitors eager to claim a picnic site arrive. Mid-day use levels are more moderate as many picnickers head to one of the area beaches for part of the day. Designated picnic sites are commonly filled on weekends and holidays, and later-arriving visitors begin to set up picnic sites in undesignated areas. Therefore, recreational capacity pressures are expected to be high at this use area.

Overall, peak season recreational use at the Family Picnic Area is **approaching** the area’s capacity (Table 10-1). The only capacity constraint is that imposed by the limited parking available in the shared parking areas. When considered in the context of Sand Harbor as a whole, the limited parking represents a helpful limit on peak use levels that needs to be maintained (i.e., not expanded) to manage overall park capacity. (This topic is described further in Section 10.2.2 below, in relation to overall Sand Harbor capacity.)

Currently, the physical and ecological capacities of the Family Picnic Area do not appear to be constraints, although certain spatial limits and ecological impacts are noteworthy. Designated picnic sites may quickly fill up on weekends and holidays, but physical capacity is not considered limiting due to the potential to expand existing picnic sites or increase the number of picnic sites, possibly within the currently impacted area. Although some biophysical impacts are present, particularly in and around the picnic sites, ecological capacity is not considered a constraint at this time due to the generally

moderate extent and severity and apparent stability of soil and vegetation impacts. If designated picnic sites are not increased, however, additional soil and vegetation impacts may occur due to the continued use of undesignated areas.

Social capacity is not considered a constraint at this time (based on field data collected during the 2010 season), particularly given that many picnic area users expressed a relatively high tolerance (and even enjoyment of) high use levels.

### **Diver's Cove**

The sheltered water and boulders at Diver's Cove's make it a popular area for beach users, as well as for special users such as scuba divers. Due to the small beach area available (particularly during high water years), the area fills up before the Main Beach, accounting for about 13–18 percent of all visitors through the peak hours of the day (from about 10 a.m. to about 5 p.m.) on summer weekends and holidays.

Overall, peak season recreational use at Diver's Cove is **exceeding** its capacity (Table 10-1). All four capacity types are constraints, with physical capacity and social capacity particularly of concern during moderate or high water years. Physical capacity is considered a constraint due to the limited beach area available coupled with high use levels. Facility capacity is considered a constraint due to parking limitations common to all of the Sand Harbor use areas. Ecological capacity is a concern due to the extent and severity of soil and vegetation impacts. Social capacity is concern due to visitors' crowding perceptions, which are higher in this use area than any other (based on field data collected during the 2010 season).

### **Boat Ramp Area**

The Boat Ramp area provides motorized boat access to Lake Tahoe, although with parking limitations and, during low water, boat launching limitations. The several hundred feet of beach on either side of the ramp also provide beach space for boaters as well as non-boaters (who also use the Main Beach and Diver's Cove), and this part of the shoreline is increasingly used for launching kayaks and other non-motorized craft. (A kayak concession began operating at the ramp during the 2011 season.) The unique capacity pressures at this use area relate to the attractiveness of the beach areas for motorized and non-motorized boating as well as non-boating uses (swimming, beach use), and the presence of the heavily used boat ramp in the midst of the beach areas.

Overall, peak season recreational use at the Boat Ramp area is **exceeding** its capacity (Table 10-1). Currently, the primary constraints are physical capacity (particularly during moderate or high water years) and facility capacity. Physical capacity is considered a constraint due to the limited beach area available, coupled with high use levels. Facility capacity is considered a constraint due to parking limits. Social capacity is not considered a concern at this time (based on field data collected during the 2010 season), but may be a factor in moderate or high water years. Ecological capacity is not considered a concern at this time.

## **Sandy Point**

Although the Sandy Point area was included in the ecological capacity assessment, a comprehensive recreational capacity assessment was not conducted at this area, which includes the Shakespeare Festival stage and amphitheatre. This was due to how the area is used and the limited potential to accurately document use levels in this area. Although some Sand Harbor visitors may use only the Sandy Point area (particularly the boardwalk trail), it is likely that most users of this area come over from other areas, such as the adjacent Main Beach or Diver's Cove, and only spend a portion of their visit at Sandy Point. Thus, visitors were not interviewed at Sandy Point for this study, but most would have had the opportunity to be interviewed at the other use areas, and their survey responses were taken as relevant to those use areas. Also, much of the activity at Sandy Point is dispersed along the rocky shoreline, where it would be difficult to obtain a visitor count (counts were conducted on the boardwalk). Finally, most of the amphitheatre use occurs in the evening during the Shakespeare Festival season, mainly after other park users have left although there is some overlap.

The ecological capacity assessment did not document any biophysical impacts at Sandy Point that were moderate or worse in extent and severity. Soil erosion and loss of ground cover were observed to be moderate in severity but low to moderate in extent. All observed impacts appeared to be stable.

### **10.2.2 Overall Capacity Assessment for Sand Harbor**

***Overall, peak season recreation use in the Sand Harbor area is exceeding the recreational capacity of the area.***

During the summer recreation season, physical/spatial and facility capacity are the primary constraints on recreational capacity. Ecological capacity is also a concern for the Main Beach and Diver's Cove use areas. Given the popularity of those two use areas and the large percentage of visitor use they receive, ecological capacity can also be considered a constraint in the Sand Harbor area at this time. Social capacity is of most concern at Diver's Cove at this time and may become a factor for the Sand Harbor area as a whole in the future; however, social capacity is not found to be a constraint overall.

If management capability is also considered, the conclusion that the Sand Harbor area is exceeding its recreational capacity is reinforced. This is based on the difficulties for current staffing levels to meet day-to-day management needs. These needs include providing a sufficient number of lifeguards and sufficient patrol presence on the beaches, managing traffic flow and parking utilization within the park, and keeping up with constant site maintenance needs, particularly for restrooms.

On a use area basis, recreation use at the Main Beach, Diver's Cove, and Boat Ramp areas are exceeding the recreational capacity of those use areas. This conclusion reflects the high use levels during most of the peak season, including many weekdays (as evidenced by the visitor counts and the closure of the Sand Harbor entrances when

parking is full on numerous weekdays during the study field data collection period). However, weekday use is likely below capacity at times, particularly early in the summer season before the warmest weather arrives. The Family Picnic Area is likely approaching its recreational capacity at this time, but the addition of picnic sites within this and other use areas can increase the use of the site and reduce pressure on existing sites.

Following are the overall conclusions for the Sand Harbor area by the four capacity types (physical/spatial, facility, ecological, and social).

### ***Physical/Spatial Capacity***

Overall, Sand Harbor is **exceeding** its physical/spatial capacity. The limited beach space available at Sand Harbor, particularly in high-water years, given the very high demand for this scarce Lake Tahoe resource, is the primary physical/spatial capacity constraint. With less than 10 acres of beach available even during low water years, no possibility of expanding beach areas, and most visitors drawn to the available beach area, this constraint will be a permanent reality at Sand Harbor.

### ***Facility Capacity***

Overall, Sand Harbor is **exceeding** its facility capacity. Parking capacity is the primary facility capacity constraint at Sand Harbor, with parking demand frequently exceeding the limited available parking at both the main entrance and boat ramp sides of the park throughout the summer. Like the limited beach area that comprises the primary physical/spatial capacity constraint, limited on-site parking is also a factor that is unlikely to change, and thus can be considered a permanent reality at Sand Harbor.

However, it is appropriate to consider this capacity constraint apart from other constraints, in that it can be regarded as beneficial and even necessary, and therefore not one that should be reduced by expanding on-site parking. Although the prevalent use of SR 28 shoulder parking when the on-site parking is full means that the available on-site parking only partially limits park use levels, increasing on-site parking would tend to exacerbate other capacity issues by allowing more people to use the park at peak use times. In addition, any expansion of parking would require the development of more of the remaining undeveloped natural resource base available on the 53-acre Sand Harbor peninsula, and would further reduce the naturalness of the setting.

Restroom crowding observed during the summer, particularly on holidays, and near the Shakespeare Festival theatre during performances may also indicate a facility capacity issue of concern. However, the number of restrooms at Sand Harbor meets standards, and visitors seemed more concerned with restroom maintenance issues rather than too few restrooms or long waits to use a restroom. Therefore, this may be regarded as a relatively minor issue, limited to certain locations and certain times. (Maintenance issues are due to staffing limitations, and so represent a management capacity constraint rather than a facility constraint.)

### ***Social Capacity***

Overall, Sand Harbor is **approaching or at** its social capacity, depending on location and month. Although only one use area – Diver’s Cove – appears to have reached social capacity thresholds, this should be considered a limiting factor for Sand Harbor as a whole in that the other three use areas were close to the “high normal crowding” threshold (i.e., “at capacity”) taking all days into account (weekdays as well as weekends and holidays). Overall crowding scores for July were in the “exceeding capacity” range (mainly due to the July 4 holiday weekend), but were in the “at capacity” range for August and September (and in the “below capacity” range for May and June).

Although high use levels and crowded conditions are the norm at Sand Harbor during the peak season, social capacity emerges as a more moderate issue than other capacity indicators, tempered by the long history of high use levels to which most visitors have grown accustomed or adapted to. Visitors recognize that Sand Harbor is a unique and highly in-demand recreation setting and opportunity, and most visitors factor this recognition into their reaction to the high use levels they encounter there. Were this setting and opportunity less unique and more widely available, visitor reactions to high use levels might be more negative, as is more typically seen at parks that receive such consistently high use. It is also important to note that some visitors who are more sensitive to high use levels and crowding have been displaced, and no longer visit Sand Harbor during the summer. The perceptions of these visitors were not captured by the on-site visitor survey.

### ***Ecological Capacity***

Overall, Sand Harbor is **at or exceeding** its ecological capacity. This is based on the findings of the Main Beach exceeding its ecological capacity and Diver’s Cove at its ecological capacity, and the fact that these two areas together account for about two-thirds to three-quarters of visitors at peak use times. Both of these areas are substantially impacted by visitor use, and some of these impacts appear to be increasing.

Recreational use of the Sand Harbor area (primarily during the summer months) has had a widespread impact on the ecological integrity of the recreation use areas, although many of the impacts appear to have stabilized, and extensive site hardening and other measures such as fencing have prevented and contained some impacts. The most widespread ecological concerns are the loss of ground cover and soil compaction. Other ecological concerns are more localized, such as soil erosion, root exposure, and loss of sentinel pines, particularly at the back beach portion of the Main Beach. In addition to site hardening, ecological concerns have been minimized to some extent by the high level of site maintenance and the presence of on-site management. If State Parks were to reduce the existing level of site maintenance due to staff or budget reductions, the use areas may show additional or worsened signs of resource impacts from recreation use.

With expected continued high use levels, there may be only limited potential to reverse or repair some impacts, which are inevitable in areas that receive concentrated use.

However, there are likely to be opportunities to respond to other ecological impacts that do not appear to be at a high level at this time but that are increasing in extent and/or severity, to prevent them from reaching a greater extent or severity. (Potential management responses to these impacts are described in Section 10.3.4.)

### **10.2.3 Overall Capacity Assessment for Memorial Point**

***Overall, peak season recreational use at Memorial Point is considered to be at capacity.***

This overall capacity conclusion for the Memorial Point area is based on two capacity types—facility and ecological—brought forward from assessments presented in Chapters 5 and 6.

Currently, the primary constraint is facility capacity. Although interpretation of the data is less clear than at Sand Harbor, facility capacity is considered a constraint due to parking limitations. It is not clear to what extent parking constraints limit access to Memorial Point, and to what extent the use of parking space by Sand Harbor visitors contributes to limiting access. Also, like at Sand Harbor, the parking constraints may be seen as a positive factor in allowing management to prevent overuse of the area. Thus, a conclusion of “exceeding capacity” was not reached.

Although relatively few visitors (7 percent) expressed concern about the restrooms at Memorial Point, the employee survey indicated that many of the park staff feel the restrooms are overused and are concerned about their inability to keep up with day-to-day maintenance. As at Sand Harbor, these maintenance issues are due to staffing limitations, and so represent a management capacity constraint rather than a facility constraint.

Ecological capacity is not considered a concern due to the moderate extent and severity of soil and vegetation impacts.

Physical/spatial capacity was not assessed at Memorial Point, because the available space for the intended uses of the area as a rest stop and overlook was not a concern. In addition, the standard assessment methodology based on comparing use levels with available use area is not suitable to this area. Recreational use that may occur beyond the restroom and parking area is concentrated on the trails crossing the steep boulder-covered slope, and so much of the available acreage is not directly used by visitors. Social capacity was also not addressed at this site, given that the typically short visits and generally homogenous use of the site minimize the opportunity for crowding or conflict issues to arise. The general survey data did not suggest any crowding or conflict issues. Although not specifically addressed by the study, social capacity does not appear to be a concern at this time.

## 10.3 POLICY AND OPERATIONAL RECOMMENDATIONS FOR CAPACITY MANAGEMENT

Beach and other public shoreline recreation opportunities are in low supply at Lake Tahoe. The overall objective of capacity management at Sand Harbor is to balance the provision of these scarce and highly valued recreation opportunities with the preservation of the natural resource base within the park and high quality visitor experiences. This balancing is the essence of capacity management and is the fundamental management challenge at Sand Harbor addressed in this study.

Capacity management seeks to influence physical/spatial, facility, ecological, and social capacity by acting on limiting factors and specific variables within those factors. In effect, these actions may function to increase capacity, not necessarily so that more visitors may use the area but so that an undesirable or unacceptable level of impact and degradation of resources and visitor experiences is avoided. These actions can help ensure that capacity status is maintained at a “below capacity” or “approaching capacity” level, rather than “at capacity” or “exceeding capacity.”

Increasing capacity does not imply increasing visitor numbers to Sand Harbor. Considering the high visitor use the park is already receiving, increasing visitor numbers may lead to further park degradation, visitor dissatisfaction, and a saturation of facilities. Instead, increasing capacity implies that appropriate management actions are taken to manage the existing levels of visitation and limit visitor use such that the park environment is not degraded, adequate facilities and services are provided, and visitor needs are met and satisfaction is high.

### 10.3.1 *Capacity Management Strategies*

Research and management experience have identified a variety of strategies and tactics to address resource or experiential impacts resulting from recreational use. A capacity management handbook developed by the National Park Service (Anderson et al. 1998), with the input of other federal and state resource management agencies, provides a useful framework for considering a range of management strategies and specific tactics. The handbook identifies five general management strategies that managers can use to address recreational use impacts:

- Increase the supply of recreation opportunities, areas, and facilities to accommodate increased demand.
- Reduce use in specific sites/problem areas or the entire park.
- Modify the character of use:
  - Where use occurs
  - When use occurs
  - What type of use occurs
  - How visitors behave
- Modify visitor attitudes and expectations.
- Modify the resource base:

- Increase the durability of the resource
- Maintain/rehabilitate the resource

At Sand Harbor, few options are available to pursue the first two of these strategies. The supply of recreation opportunities is for the most part fixed as there is no opportunity to expand the park’s land base or available beach area or to substantially increase facilities within the present area, with the possible exception of within the Family Picnic Area. Demand for the unique recreation opportunities offered at Sand Harbor will remain high. Thus, significantly reducing overall park use seems unlikely, although it may be possible to reduce use in limited problem areas.

Tactics are the means by which the general management strategies may be implemented and may include operational or policy changes. Within a particular management tactic, a number of specific management actions (policy or operational) may be taken as appropriate to the situation. Table 10-2 summarizes several potential management tactics.

**Table 10-2. Potential Recreational Capacity Management Tactics.<sup>1</sup>**

<b>Tactic Category</b>	<b>Management Tactics</b>	<b>General Purpose of Tactics</b>
Site Management	<ul style="list-style-type: none"> <li>● Facility design or improvements</li> <li>● Vegetation management</li> <li>● Site hardening</li> <li>● Physical barriers</li> <li>● Area or facility closure</li> </ul>	Maintain desired resource conditions by directly or indirectly controlling how visitors use an area, and how that use physically impacts the park’s resources.
Use Rationing and Allocation	<ul style="list-style-type: none"> <li>● Limit park access</li> <li>● Change park fees</li> <li>● Reservation systems</li> </ul>	Regulate use intensity by directly controlling or indirectly influencing how many visitors use an area, and when.
Use Regulation	<ul style="list-style-type: none"> <li>● Restrict uses/behaviors</li> <li>● Restrict equipment</li> <li>● Zoning uses</li> <li>● Restrict or prohibit use of sensitive areas</li> </ul>	Modify visitor use of an area by directly controlling what recreational uses/ behaviors occur and where they occur.
Deterrence and Enforcement	<ul style="list-style-type: none"> <li>● Signage</li> <li>● Sanctions for non-compliance</li> <li>● Increase or target ranger or law enforcement presence</li> </ul>	Control and eliminate undesired visitor behavior by indirectly influencing visitor behavior.
Visitor Education	<ul style="list-style-type: none"> <li>● Inform visitors about appropriate/desired behaviors</li> <li>● Inform visitors about desired use patterns</li> <li>● Incentive programs</li> </ul>	Increase low-impact behaviors and reduce visitor-caused resource and social impacts by indirectly influencing visitor behavior.
<p><sup>1</sup> Management tactics refer to the means by which a management strategy is implemented.</p> <p>Source: Adapted from Anderson et al. 1998.</p>		

A combination of strategies and tactics is often the best approach to reduce many undesirable or unacceptable impacts on the resource and visitor experience. An indirect

or persuasive strategy may be most appropriate when an impact or concern is not yet at a high level (i.e., not clearly at an unacceptable or unsustainable level). When an impact or concern is at a high level (i.e., clearly at an unacceptable or unsustainable level), a direct or restrictive strategy may be most appropriate. Indirect tactics generally target the decision factors that influence visitor behavior. These tactics persuade visitors to behave appropriately or differently (e.g., by redirecting recreation use to shoulder seasons or less-impacted or more resilient locations). Direct management tactics operate directly on visitor behavior and restrict behavior in some way (e.g., by preventing or prohibiting recreation use in total or some aspect of that use). Indirect and unobtrusive actions are generally much more supported by visitors than are direct, more obtrusive measures.

Focusing more directly on capacity issues of concern, Table 10-3 identifies a number of potential management responses to facility, social, and ecological capacity issues.

**Table 10-3. Potential Management Response to Capacity Issues.**

General Capacity Issues	Potential Management Responses <sup>1</sup>
<p><b>Facility Capacity:</b></p> <p>Unacceptable Facility Impacts / Inadequate Facilities for Level of Demand</p>	<ul style="list-style-type: none"> <li>• Expand existing facilities</li> <li>• Add amenities to existing facilities</li> <li>• Provide additional visitor management and/or enforcement</li> <li>• Change visitor services or increase operations and maintenance</li> <li>• Increase visitor education to maximize the efficient use of facilities</li> <li>• Offer incentives to redistribute use (to other sites or shoulder seasons)</li> </ul>
<p><b>Social Capacity:</b></p> <p>Unacceptable Crowding and/or Conflicts</p>	<ul style="list-style-type: none"> <li>• Expand existing facilities</li> <li>• Provide additional enforcement</li> <li>• Provide adequate buffers between uses (e.g., swimmers, power boaters, non-powered boaters at ramp area)</li> <li>• Site closures</li> <li>• Change visitor services</li> <li>• Increase visitor education to reduce conflicts between user groups</li> </ul>
<p><b>Ecological Capacity:</b></p> <p>Unacceptable Resource Impacts</p>	<ul style="list-style-type: none"> <li>• Increase resource protection measures (e.g., barriers to define site boundaries and protect sensitive areas, vegetation, or soils; fix drainage problems affecting soils on slopes)</li> <li>• Increase site hardening</li> <li>• Close sites or areas to allow recovery of ground cover</li> <li>• Restore impacted areas</li> <li>• Increase visitor education to reduce behaviors that worsen ecological impacts (e.g., using social trails)</li> </ul>
<p><i>Note: Physical capacity issues are not addressed in this table due to the fact that potential management actions involve expanding the land base of the park, which is not feasible at Sand Harbor, or expanding the developed or usable area within the current boundary of a park, which is assumed to not be desirable at Sand Harbor.</i></p>	
<p><sup>1</sup> <i>The listed potential responses are general in nature, and each could be implemented in a variety of ways with a wide range of specific management actions most appropriate to a specific place and circumstance. The lists are not intended to be exhaustive.</i></p>	
<p><i>Provided by AECOM.</i></p>	

Finally, it is important to recognize that selecting appropriate management strategies, tactics, and actions requires value judgments. Paraphrasing capacity management advice supplied by the National Park Service in their VERP Handbook (NPS 1997):

Ultimately, managers are left with the difficult decisions regarding how much visitation is appropriate and how visitor use is to be managed. For some decisions, the appropriate course of action is clear because there are few alternatives. More frequently, information to support a decision is less than complete (for example, it is difficult to determine the relationship between particular amounts and character of recreation use and social and resource impacts). Information may also be conflicting. Political, administrative, legal, budgetary, and resource constraints influence decisions, and the viability of potential management actions, as well. While study data and managerial experience can help, such information only reduces the range of uncertainty associated with the decision. It does not eliminate it.

### **10.3.2 Physical and Facility Capacity Recommendations**

Generally, physical capacity of a park can be increased by expanding the developed area of the park, or by expanding the number of recreation facilities or sites within the existing developed area. At Sand Harbor, there is little potential for increasing physical capacity given the limited space on the peninsula. Expanding the number of recreation facilities or sites is also generally not a desirable option as the area is already crowded during much of the peak season, and the biophysical resources are under pressure from visitor activities. Therefore, the best option may be to upgrade and improve existing facility efficiency rather than building any new, expanded facilities. Some physical and facility changes can increase the recreational capacity of the park by encouraging visitor dispersion and alleviating facility overuse (and, potentially, reducing crowding and ecological impacts to some degree). The following two facility changes, in particular, are supported by the study results and are offered for consideration:

- Provide additional picnic sites.

Picnic sites could be added within the Family Picnic Area, based on the relatively low density of sites at present (see Section 4.3.1). Also, the potential for adding picnic sites at the margin of the Main Beach was noted by staff during a site visit (possibly in conjunction with removal of the concrete overlooks, described in the section below). Increasing the number of picnic sites could take pressure off the existing Family Picnic Area and reduce the use of undesignated areas when all designated sites are taken.

However, the effectiveness of this action in dispersing visitor pressure on the existing facilities should be weighed against any potential negative impacts on the natural resources of the park or on social capacity. Additional picnic sites could increase the extent or severity of soil compaction or vegetation impacts within the Family Picnic Area (although use of undesignated areas by picnickers would be expected to decrease) or at the margin of the Main Beach. Poor placement or too high a density of picnic sites could

increase visitors' perception of crowding or increase visitor conflicts. These concerns must be considered when designing facility changes to avoid or minimize these potential negative impacts.

- Expand/improve Sand Harbor restrooms.

Although less than 8 percent of the visitors surveyed considered the toilet facilities at Sand Harbor to be inadequate, long waiting lines occur at times. The idea was expressed by park staff during site visits and in the employee survey to replace the restroom showers with toilet stalls. Staff perception is that the showers are underused, and their removal may be justified in favor of increasing the number of toilet facilities and to reduce waiting lines.

Other alterations of the park's design or alteration of its facilities, in addition to adding picnic sites and remodeling restrooms to increase these facilities' capacities, may also be worth consideration. Ideas that were mentioned in the employee survey include:

- Reconfigure the Family Picnic Area to accommodate more large groups.

This change would provide better service to the large groups that commonly use the Family Picnic Area; would reduce the need for those groups to bring additional seating, portable tables and other equipment to supplement the site amenities provided; and would reduce the use of undesignated areas by large groups who spill over from designated sites.

- Provide additional or reconfigure parking at the boat ramp.

Reconfigured parking at the boat ramp could provide a more organized and less congested flow at the ramp, increasing launching efficiency and reducing conflicts among and between boaters and others. It may also be possible to provide additional parking spaces as part of the reconfiguration.

- Provide an additional Group Use Area.

An additional Group Use Area would provide additional capacity for the types of special events that occupy the existing facility a high percentage of the season. Given the high demand for this type of facility, an additional facility would also be likely to have a high occupancy rate and thus increase park revenue.

- Remove the overlooks from the Main Beach.

Removal of the large concrete overlooks from the Main Beach, which were found to have some condition problems due to settling, would increase the available space on the beach, which would reduce beach crowding to some degree.

In addition to changes to facilities, changes in visitor management and/or enforcement may also help increase facility capacity by improving the functioning of the existing facilities and increasing site efficiency. For example, increased staffing focused on

directing traffic and boaters at the boat ramp could reduce delays and congestion at the ramp. An increased focus on day-to-day maintenance may also help existing facilities function better under high demand; for example, increased maintenance of the most heavily used restrooms.

Increased visitor education to reduce behaviors that worsen facility capacity issues should also be considered; examples of such behaviors include boaters blocking boat ramp lanes or paddlers impeding boat traffic coming to and from the ramp.

### **10.3.3 Social Capacity Recommendations**

The visitor survey results indicate that Sand Harbor visitors expect to encounter a high number of visitors at the park at most times (and the employee survey results indicate a similar understanding). The results further indicate that many visitors successfully employ coping behaviors in response to high use levels while continuing to visit, and more socially inclined visitors actually consider high use levels a desirable feature of the park. Survey results related to motivations for visiting Sand Harbor highlight that family bonding (often involving large family groups) is a factor for most visitors, and social interaction is important for many.

Nevertheless, the high use levels and diversity of uses do have certain undesirable effects on the quality of recreation that can be addressed as part of a capacity management strategy. Expansion of facilities can reduce crowding and conflicts by distributing recreation use over a larger area but, as noted previously, there is little or no practical opportunity for expansion at Sand Harbor.

Social capacity can be increased by taking actions to help ensure visitor satisfaction is met and by properly addressing any complaints raised. The implementation of an education and awareness program is one option for achieving this, focused on reducing behaviors that cause social conflicts or otherwise adversely affect other visitors (or the park's resources, addressed under *Ecological Capacity Recommendations*). Examples of topics for an awareness campaign include:

- Discouraging littering/encouraging litter removal ("pack it in – pack it out").
- Acknowledging cultural differences among user groups.
- Respecting other visitors (regarding use of profanity, smoking, noise, and excessive drinking).

Another option is to ensure that adequate buffers are provided between competing and conflicting uses. Examples include buffers between motorized boaters, non-motorized boaters, and swimmers at the boat ramp beaches, and between divers and other beach users at Diver's Cove:

- Set aside areas for non-motorized boat launching and retrieval and/or swimmers at the boat ramp beaches where motorized boats cannot park or anchor. (The

intent would be to address complaints voiced by some kayakers and swimmers about conflicts with motorized boaters anchored near shore or parked on the beaches at the Boat Ramp area.)

- Set aside an area at Diver's Cove where divers could stage their equipment and enter and exit the water, to avoid conflicts with swimmers and beach users. (Some beach users complained about divers setting up their equipment under shade tents on the shoreline and thereby monopolizing part of the shore and blocking their view of the water.)

Additional enforcement is a more direct way of reducing some behaviors that cause social conflicts, but should be limited to behaviors that may not be amenable to the education approach and that are clearly associated with a violation of park regulations, such as littering and use of glass containers on the beaches.

#### **10.3.4 Ecological Capacity Recommendations**

The Ecological Capacity Assessment identified a variety of recreation impacts on natural resources within the park. Of particular interest in guiding these recommendations are those that are associated with limited or sensitive resources and those that were found to be increasing in intensity and/or extent. Accordingly, the following actions (developed concurrently with the field assessments) are recommended to minimize the resource impacts of the high intensity recreation use that Sand Harbor and Memorial Point receive.

- Implement bank stabilization techniques and/or reduce visitor access to sites vulnerable to erosion.

In use areas where erosion is affecting infrastructure, vegetation, and slope stability, aggressive revegetation and natural bank stabilization techniques may be necessary to help erosion sites recover. In some areas where rocky substrate already persists (e.g., Sandy Point and Memorial Point), the use of rock slope protection may be appropriate if designed to blend into the natural setting. Because of high recreational use at Sand Harbor, it is likely that recovery of most erosion sites will require a combination of active management (i.e., revegetation and/or replacement of lost sand or soil along pathways or exposed vegetation) and restricted access (via protective fencing or other natural barriers such as rocks, large downed logs, or through revegetation) to minimize the extent of recreational impacts.

In many cases, erosion problems could be reduced substantially by merely reducing points of access along the shoreline compared to the nearly open access that currently exists. This would be most useful at the Main Beach and Diver's Cove and Group Use areas. For example, large logs placed strategically along the walkway at the back of the Main Beach use area could reduce the number of locations where visitors step off the path to access the beach and may reduce impacts. Large logs may also create small pockets of sand deposition during high wind events. One large log already is placed

along the walkway on the eastern portion of the Main Beach, one of the few sections of walkway where erosion was not observed. Other means of restricted access may be necessary along the back of Diver's Cove beach. Restricted access would probably need to be maintained over the long term to reduce impacts to sustainable levels.

As for the Boater's Beach/Boat Launch use area where wave action may have contributed to erosion along the south end of the beach, additional restrictions on boat speed or strategically placed boulders may reduce the destructive forces of water to this area.

- Provide additional pedestrian boardwalks or paths.

The group use portion of the Diver's Cove and Group Use Area has the most extensive soil compaction within Sand Harbor. A boardwalk, similar to the one constructed around Sandy Point, could be constructed between the group use pavilion and the rocky point to the west. Additional features could be added (e.g., benches, overlooks, or gazebo) and creative design (interweaving the boardwalk with the mature oak scrub) could add to the appeal for group use while reducing the impact on the soils and vegetation. A single hardened access path down to Diver's Cove beach could also eliminate some of the erosion concerns between these two components of the Diver's Cove and Group Use Area.

The Family Picnic Area also suffers from soil compaction, where gaps in shrub cover facilitate use by large groups. Constructing a defined hardened facility for group use here (e.g., another pavilion), or grouping select picnic tables to allow for larger families, while perhaps revegetating the surrounding area, may be beneficial.

- Control visitor access to areas sensitive to compaction due to foot traffic and other sensitive areas, and rehabilitate/revegetate as necessary.

Controlled access in locations that are particularly sensitive to foot traffic but where an extensive network of user-created trail network has formed would protect these resources. Directed access to a fewer number of access locations or pathways is recommended to reduce loss of ground cover (often found to be associated with soil erosion and compaction impacts). This action would not eliminate visitor access to desired locations along the shoreline and, therefore, the overall visitor experience would be maintained.

Removing and rehabilitating the user-created trails that access the areas of sensitivity (refer to Chapter 6 for details) would be required, as well as placement of features (e.g., railings or fences) to restrict future access off of established walkways to these locations. Use of signage, especially at the west end of the Main Beach, to discourage visitor use of the area near the TYC occurrence could also protect resources from impacts of visitor use along created trails.

Reduced access points are needed from the paved pathways running along the back of the beach at Diver's Cove and Main Beach, throughout the Group Use Area, and in the

northwestern portion of the Family Picnic Area. If user access is restricted in these areas, vegetation may be able to partially recover on its own in some locations; however, revegetation is probably necessary in most use areas with observed impacts.

- Reduce and/or eliminate access to unique ecological features.

It is recommended that actions be taken to reduce and/or eliminate access to unique ecological features and perch sites, such as sentinel pines on the Main Beach, to minimize or halt additional impacts. It is possible to protect these features while maintaining access to the vicinity, such as with the use of raised boardwalks and railings.

- Increase visitor education regarding ecological impacts and behaviors.

Visitor education is recommended to address behaviors that worsen ecological impacts, such as using undesignated areas for picnicking and user-created trails. Many visitors may not be aware of the ecological impacts these behaviors may cause, nor of the persistence of some of the impacts and the costs of repairing them.

### ***10.3.5 Transportation and Pedestrian Safety/SR 28 Recommendations***

As detailed in both the Facility Capacity Assessment (Chapter 5) and the Transportation and Pedestrian Safety Assessment (Chapter 9), parking at Sand Harbor is full by mid-morning many days during the summer. The morning rush of arriving visitors at the main entrance has commonly resulted in traffic backing up a considerable distance on SR 28. Largely as a result of the limited parking capacity at Sand Harbor, there is consistently high use of the SR 28 shoulder for parking in the vicinity of Sand Harbor, with many visitors walking on the road shoulder from their vehicles to the park. Also, Sand Harbor visitors often park at Memorial Point, reducing parking for Memorial Point visitors. State Parks and law enforcement agencies have acknowledged a limited ability to control illegal shoulder parking in the SR 28 corridor.

For this reason, the 2001 East Shore Access Plan (Harding ESE 2001) (the last of the SR 28 management plans completed) moved the focus away from increased law enforcement and/or legal prohibition of parking along the highway, which previous plans had emphasized, in favor of other approaches. Even so, this plan did advocate placing barriers to block the use of more than two dozen SR 28 parking spaces in the vicinity of Sand Harbor, while formalizing fewer than 10 shoulder parking spaces in the same area. NDOT, in a stakeholder interview conducted for this study, stated that approximately 30 wooden bollards installed along SR 28 north of Sand Harbor to prevent shoulder parking have been removed by people who want to continue to use those areas to park. Bollards NDOT installed south of the Sand Harbor main entrance have not been seriously impacted by the public.

The plan also advocated for the implementation of a weekend and holiday transit system for the east shore, a idea that more recent regional planning documents have brought to the fore and that will be tested in a TTD pilot test program in 2012 (TTD 2011).

In the context of these existing transportation circumstances, traffic engineers from Fehr and Peers have recommend the following modifications to improve transportation-related concerns at Sand Harbor. ***All of these recommendations are preliminary in that they must be evaluated by State Parks in the broader context of capacity management.*** A recommended action may be appropriate when considered solely from the traffic congestion or pedestrian safety perspective that framed the development of the recommendations. However, it is recognized that some recommended actions may also exacerbate certain capacity concerns; for example, a shuttle service from remote lots or expanded transit could substantially increase the number of visitors who may access the park, above the number who can now access the park, as limited by Sand Harbor parking and use of the SR 28 shoulder for parking. It may be possible to offset this increased demand through strict parking enforcement along SR 28 to reduce the number of visitors parking illegally along the shoulder.

### **Vehicle Circulation**

- Extend vehicle storage capacity on SR 28 through temporary measures (signing and lane delineation) during peak summer visitation.

This may be achieved by shifting through traffic into the center two-way left-turn lane to use the travel lane for additional vehicle storage adjacent to Sand Harbor. This treatment extends the length of the right-turn lane into Sand Harbor by temporarily utilizing the southbound travel lane for vehicle storage. This treatment can be done at either or both of the entrances in the southbound direction (see Figure 10-1). This type of traffic control occurs routinely during peak ski weekends at some of the Tahoe area resorts to facilitate efficient ingress and egress. If pursued, this concept should be further developed in coordination with NDOT and the Nevada Highway Patrol. Required lane transitions and taper lengths will need to be determined in cooperation with NDOT.

- Change park ingress at the main entrance to two lanes inbound (reverse flow) from the time of daily opening to park closure during peak summer visitation.

Approximately 12 vehicles can be accommodated in a single-lane queue on-site. At least eight more vehicles can be stored with the proposed reverse flow operation. This can be achieved through signage and manual traffic control. Two fee stations should be provided at peak times to double the speed of park entry. The second fee station is envisioned as a temporary station near the permanent fee station. According to observations made by GBI on September 6, 2010, approximately 60 vehicles are processed per hour at the main entrance. Providing two fee stations would double the entrance capacity, potentially cutting vehicle wait time in half. Staff may need to be stationed at the southern entrance to allow vehicle egress out of the park while reverse flow is in effect. Alternatively, traffic spikes (i.e., tire shredders) installed at the exit might be just as effective. Signage may decrease the need for additional staffing. Staff may also be able to collect walk-in fees at the south entrance. To maintain full access to the park's administrative offices and the maintenance building, two-way traffic operation could be maintained west of the fee booth. Figure 10-1 illustrates this concept.

With the reverse flow, entering vehicle would merge left into the outbound lane only after passing the median dividing the inbound and outbound entrance lanes (about 150 feet into the park), maintaining an outbound lane at the entrance itself. (As described in Section 9.1.1, State Parks devised and successfully implemented on a test basis a modified version of the reverse flow operation recommended here during the July 4, 2011 holiday weekend.)

- As an alternative or in addition to the reverse flow operation described above, consider temporarily moving the existing main entrance fee station farther west, closer to the Main Beach, to double the number of vehicles that can be in the queue within the park.

Under this scenario, two fee stations should be provided at peak times to double the speed of park entry. These fee stations are envisioned as temporary in nature. Minor road widening may be necessary near the group use parking area entrance / visitor center to accommodate two inbound lanes. Alternatively, the outbound lane could be temporarily reassigned as an inbound lane similar to the preceding recommendation. Lengthening the area for waiting vehicles prior to the fee stations in combination with reverse flow would yield approximately three times the historical capacity.

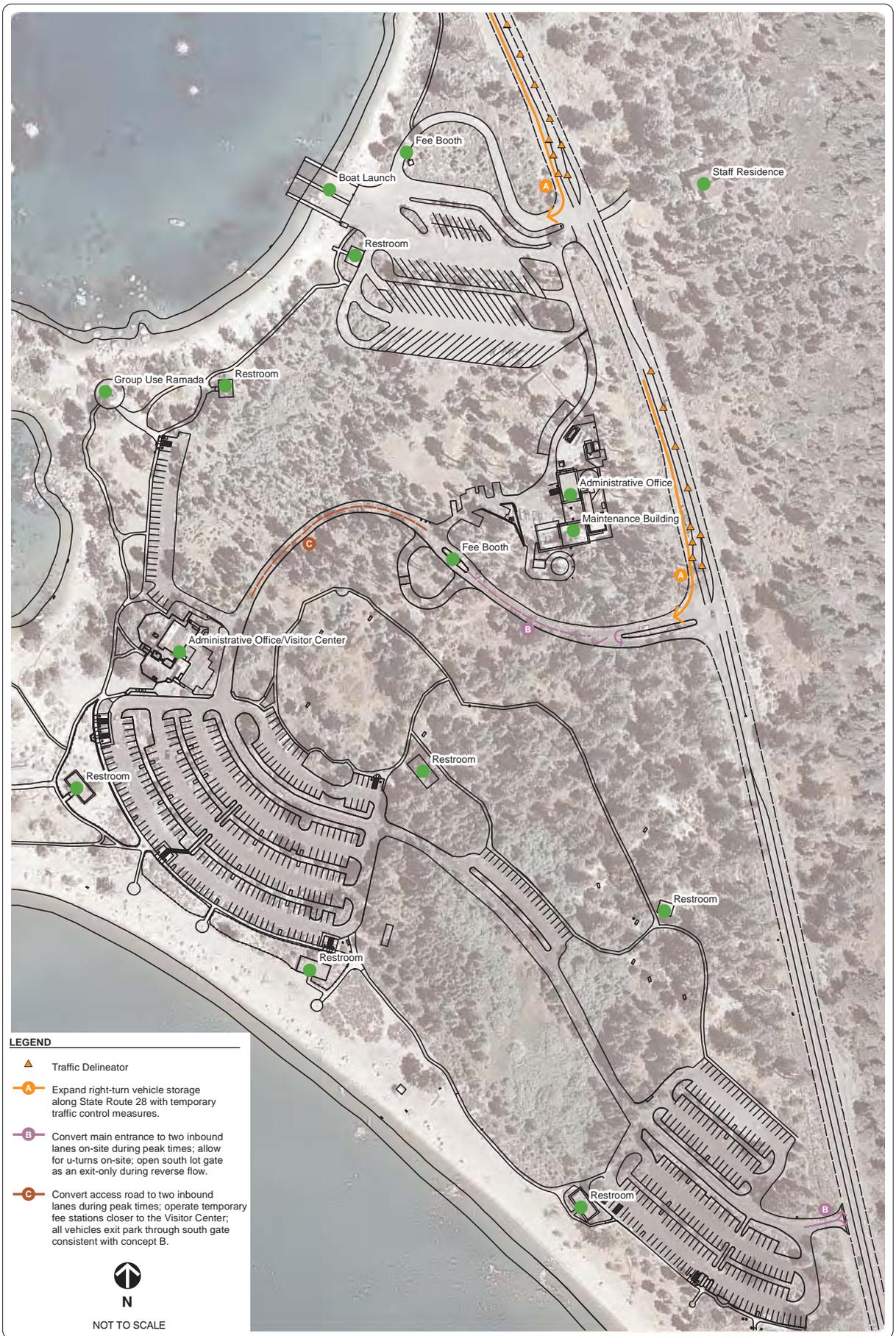
- Improve access and circulation in the boat launch area through a redesign of drive aisles to better accommodate trailer turning movements.

State Parks has recognized that the current design of the boat launch parking area can be improved, and has had preliminary discussions with agency planners and designers about potential improvements.

- Consider collecting parking payment upon exit instead of upon entry. (Refer to the second to the last item under *Parking Operations*, below.)
- Consider implementing Park and Display parking. (Refer to the last item under *Parking Operations*, below.)

### **Public Information**

- Erect “cash / check only” and “No buses or RVs” signs near the entrances along SR 28 to prevent unnecessary U-turns within the park.
- Explore using NDOT changeable message signs at SR 431 and US 50 and Highway Advisory Radio to provide advanced warning regarding park entrance closure, conditions on SR 28, or prohibition of tour buses and RVs at Sand Harbor.



## **Parking Operations**

- Evaluate the current policy of maintaining park entrance closure until 3 p.m.

Staff should continue to monitor parking usage and evaluate if the park entrance can be reopened at an earlier time, to increase customer service and provide flexibility in operations to coincide with day-to-day variations in conditions. In a similar way, it may also be useful to evaluate admitting vehicles as parking becomes available (e.g., approximately 10 empty spaces in the main parking lot) instead of waiting until 80 or more spaces are available, as is sometimes done in lieu of the 3 p.m. re-opening policy. The potential advantages to altering the policy would need to be weighed against the benefits of the 3 p.m. policy, including: (1) making staff who would be occupied with traffic control and parking monitoring available for other important tasks, particularly trash removal and restroom maintenance; (2) reducing SR 28 congestion and removing an incentive for vehicles to circle the area hoping to catch the moment when the park reopens; and (3) providing a set time that the public can return and know that the park will have reopened.

- Identify and evaluate the feasibility of a shuttle service from remote parking lots.

The Lake Tahoe Shakespeare Festival advertised a shuttle system from Reno and Incline Village (D.W. Reynolds Community Center) for the 2011 season at Sand Harbor. A shuttle service may increase park visitation (person trips).

- Consider collecting parking payment upon exit instead of upon entry.

Currently, peak travel demand at Sand Harbor is during the morning on peak summer weekends. Visitors routinely line up early and queue along SR 28 to secure a coveted parking space. If payment were collected upon exit, queue lengths entering the park would be reduced significantly. Since visitors will leave throughout the day, the outbound demand and resulting queues will not be as significant as the current inbound morning peak. Parking turnover can be encouraged by introducing a variable time-based fee structure instead of a flat rate entrance fee. This operation would require administering a time-stamped ticket to each vehicle upon entry. Fees may be paid at a kiosk or staffed fee stations. This operational change may increase park visitation (vehicle and person trips).

- Consider implementing Pay and Display parking.

Fully automated “Pay and Display” parking kiosks would likely eliminate vehicle queuing at the park entrance. Patrons park, walk to a kiosk (i.e., pay station), and pay for parking. Variable parking rates and hourly or daily fee structures can be used. Patrons place the parking receipt, which contains the expiration time, on the dashboard of the vehicle. Staff resources would need to be redirected from parking fee collection to parking enforcement. California Department of Parks and Recreation (CDPR) is in the process of incorporating a Pay and Display system to control parking at several state beaches along the San Diego County coast. Potential advantages of this system cited by CDPR

include reduced-fee options for hourly parking, and encouragement of more people to make shorter visits, which may create more turnover and more revenue (CDPR 2011).

### **Pedestrian and Bicycle Safety**

- Actively participate in the planning and development of the bikeway proposed built on State Park lands. Ensure that the planning and development of the trail are in sync with the capacity issues within the park.

The Nevada Stateline-to-Stateline Bikeway project is proposed to be, in part, on State Park lands, and would provide direct access to Sand Harbor for pedestrians and bicyclists (see Section 9.2 for additional details). Conceptual planning is complete for the North Demonstration Project portion of the bikeway, from Incline to Sand Harbor, and technical studies and environmental review are underway. Similar steps will occur for other bikeway segments in the near future. Chief among Sand Harbor concerns is the potential of the bikeway to increase demand on State Parks recreation facilities that are already at capacity on peak days. Other issues of concern for Sand Harbor are impacts on SR 28 parking, on pedestrian activity and access to Sand Harbor associated with SR 28 shoulder parking, and on existing access to Sand Harbor. State Parks involvement in bikeway design, routing, and other key steps will provide the best opportunity to provide input to the development process so that potential adverse effects on Sand Harbor operations and visitors are minimized or mitigated as much as is feasible.

- Continue parking enforcement along SR 28 to provide available shoulder width to cyclists and pedestrians.

Continued attention to parking enforcement along SR 28 is needed to preserve space for pedestrians and cyclists to safely use the corridor. Where parked vehicles occupy most of the available shoulder, pedestrians and cyclists are forced to travel closer to vehicle traffic or may use the roadway itself, which compromises their safety.

- Install bike racks near the Visitor Center and increase capacity commensurate with demand.

Develop in-park riding regulations and a circulation plan to provide access and reduce pedestrian and vehicle conflicts. Ensure that bicycle parking is provided in accordance with recommendations presented in the Association of Pedestrian and Bicycle Professionals Bicycle Parking Guidelines, Second Edition (2010).

- Collaborate with NDOT on the potential addition of pedestrian warning signs along SR 28 to alert motorists of pedestrian traffic adjacent to travel lanes and crossing the highway.

Visitors who park along SR 28 walk along the shoulder and may cross the highway coming to and from the park. These pedestrians may be at risk from motorists who are not aware of the common presence of pedestrians along the highway or who may not see them when they are present. Warning signs would help ensure that motorists are

aware of the presence of pedestrians and signal them to drive with increased care while passing through the corridor in the vicinity of the park.

## **Transit**

- Continue to evaluate the feasibility of regional transit providers implementing a transit stop at Sand Harbor.

There are two significant hurdles to providing reliable and convenient transit service: traffic congestion and site constraints along SR 28 at Sand Harbor. Locating a southbound transit stop along the west side of SR 28 adjacent to a park entrance would prevent delays associated with gaining access to the park and turning around on site. However, past studies have indicated that modifications would be needed to create a shuttle stop on SR 28 at the Sand Harbor main entrance (LSC, Inc. 1996), and NHP has indicated during this study that there is insufficient room for safe operation of a shuttle stop at that location. Northbound transit vehicles would likely need to pull into the park to prevent blocking traffic and loading/unloading on the east side of SR 28, requiring pedestrians to cross and wait adjacent to traffic.

Another option is to install a transit stop within the park, possibly in front of the Visitor Center, although park staff would need to facilitate the shuttle's entry into the park to prevent delays and during park entrance closures. A solution may be found in having a shuttle enter the park at the boat launch entrance, or a service entrance passing through the office and shop area. Providing enhanced transit access may increase park visitation (person trips).

- Identify and evaluate the feasibility of a shuttle service from remote parking lots. (See the *Parking Operations* recommendation referring to remote parking above).

The Tahoe Interregional/Intraregional Transit Study (TRPA 2006b) describes many of the privately operated transit shuttles offered in the region. They are highly successful during peak ski season. In 1997, East Shore Transit Shuttle operated a demonstration project between designated parking lots at Spooner Summit and Incline Village to Sand Harbor. The highest ridership was recorded on the Saturday of Labor Day weekend (215 passenger-trips). Based on customer surveys taken during this experience, marketing, schedule adherence, and reasonable headways were important. A shuttle service may increase park visitation (person trips).

Enhancing both the bikeway/pedestrian network and transit options would provide opportunities to take transit for one leg of the trip to Sand Harbor and walk or bike the reverse. The success of this type of operation is demonstrated by the Flume Trail shuttle system, described in Section 9.1.5. The Flume Trail shuttle advertises one-way service for mountain bikers and hikers to use the trail in one direction and return to vehicle parking via the shuttle. Enhancing transportation options may increase park visitation (person trips).

## **SR 28 Corridor Planning**

- Work collaboratively with other agencies on SR 28 initiatives to ensure that capacity and transportation issues are properly addressed.

Several regional agencies are in the processes of developing plans and programs that relate to the SR 28 corridor. TTD has begun a collaborative effort among federal, state, and local agencies to develop a Corridor Management Plan (CMP). The CMP takes a holistic view of the highway and will identify strategies and projects to organize parking, improve access to recreational areas, enhance safety, create new options for alternative modes of transportation, and improve the scenic and environmental aspects of the corridor. The CMP will address transit (including the transit pilot program, described previously), signage, and parking enforcement, among other issues of relevance to LTNSP and Sand Harbor. In addition, TTD is continuing design and environmental review work for the North Demonstration Project portion of the Nevada Stateline-to-Stateline Bikeway and analysis of Lake Tahoe North Shore to South Shore Transit Connection Alternatives (TTD 2011).

TMPO is currently conducting public review and outreach for the Draft Lake Tahoe Regional Transportation Plan (RTP) update. RTP programmatic strategies include transit enhancements, pedestrian facilities, and bicycle facilities. The RTP is scheduled to be finalized in September 2012 (TMPO 2011).

It is recommended that State Parks work collaboratively with other agencies on the SR 28 and associated initiatives to ensure that capacity and transportation issues are properly addressed. In particular, it is important that the potential beneficial and adverse impacts of these programs on Sand Harbor operations, access, and recreational quality are understood and that potential adverse effects are minimized or mitigated.

### ***10.3.6 Future Evaluation and Refinement of Recommendations***

The preliminary recommendations provided here can be further evaluated and refined into specific management prescriptions, based on the ongoing LTNSP General Management Plan Update. The updated GMP will contain guidance about the desired resource conditions, visitor experiences, and appropriate kinds and level of management, development, and park access (modes of transportation) for Sand Harbor, Memorial Point, and LTNSP as a whole, and the kinds of operational and policy changes needed to move from the existing to the desired conditions. (A comprehensive capacity planning process such as LAC or VERP also typically includes the development of statements of desired conditions and visitor experiences.)

The following questions are suggested for use in the evaluation of potential management actions:

- What is the likelihood of short- and long-term success, or of having the desired effect on resources or visitors?

- Are the resources needed to implement the tactic or action (time, money, personnel) practicable in the short- and long-term?
- Are there unanticipated effects on resources? (e.g., could it further concentrate use in already impacted areas? Could it expand use into un-impacted or less impacted areas?)
- What are the likely resulting effects on visitor experiences? (i.e., is the action direct or indirect, subtle or intrusive in its possible effects?) What is the potential for undesirable social consequences (e.g., might the action increase crowding in some areas)?

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