Auke Lake Watershed Assessment

Auke Lake Watershed in Juneau, Alaska

Prepared by the Juneau Watershed Partnership
April 2009

The Juneau Watershed Partnership (JWP) is a nonprofit organization whose mission is to promote watershed integrity in the City and Borough of Juneau through education, research, and communication while encouraging sustainable use and development.

Statement of Need and Purpose

Situated approximately 12 miles north of Juneau, Alaska, Auke Lake is an anadromous system supporting coho, sockeye, pink and chum salmon, as well as cutthroat trout, rainbow trout and Dolly Varden char (Bethers, 1996). The Auke Lake watershed is a popular recreational area for Juneau residents, serves as a backdrop for the University of Alaska-Southeast campus, is a growing residential area, and hosts a NOAA/NMFS research facility on its outlet.

The purpose of this watershed assessment is to compile existing data into a single document, in order to identify data gaps and provide recommendations for further studies. This document also provides the City and Borough of Juneau (CBJ) and the public with an overview of the current condition of the Auke Lake watershed, and outlines management recommendations to ensure the sustainability of fish habitat and recreational and aesthetic values.

The results of this assessment should be used to guide watershed management of this valuable lake system. The intention is that this report will be utilized by CBJ staff, the CBJ Planning Commission, Wetlands Review Board, the City Assembly, as well as Juneau residents and local, state and federal agencies involved in conservation and land management decisions within the Auke Lake watershed.

Acknowledgements

Production of this document was made possible through a grant from the US Fish and Wildlife Service's Coastal Conservation program, and could not have been completed without the help of Neil Stichert and Shannon Seifert, U.S. Fish and Wildlife Service; Samia Savell, Natural Resources Conservation Service; Thatcher Brouwer; Jerry Taylor, National Marine Fisheries Service; and the JWP Board of Directors.

Many thanks go to the members of our technical advisory committee and to all of our neighbors who came and participated in our community meetings. Special thanks to the Mayor, Assembly members and staff of the City and Borough of Juneau.

TABLE OF CONTENTS

1. Introduction
    1.1 Watershed Description
    1.2 Geology, Vegetation and Fauna
    1.3 History of the Auke Lake Watershed
2. Hydrology, Water Rights and Wetlands
    2.1 Auke Lake and Auke Lake Tributaries
    2.2 Surface and Ground Water Rights
    2.3 Wetlands
3. Fish and Fisheries Habitat
    3.1 Fish Populations
    3.2 History of Fish Propagation
    3.3 Habitat Condition Summary
4. Water Quality
5. Land Use and Lake Management
    5.1 Land Ownership
    5.2 Land Use Designations
    5.3 Zoning
    5.4 Lake Management
    5.5 Proposed Development in the Watershed
6. Community Uses of the Auke Lake Watershed
    6.1 Auke Lake User Survey
    6.2 Motorized Watercraft on Auke Lake
    6.3 University of Alaska Southeast (UAS)
7. Watershed Condition Summary
8. Watershed Protection and Enhancement Opportunities
9. References
8. Appendices

List of Figures

Figure 1: Auke Lake Watershed Location and Boundary……pg. 6
Figure 2: Mean Monthly Depth at the Auke Lake UAS Dock and Mean Monthly Discharge for Auke and Lake Creek……pg. 8
Figure 3: Mean Monthly Discharge for Auke and Lake Creeks, Mean Monthly Snowfall and Precipitation……pg. 9
Figure 4: National Wetlands Inventory Wetland Types in the Auke Lake Watershed……...pg. 11
Figure 5: Auke Lake Anadromous Streams……pg. 13
Figure 6: Auke Lake Watershed Channel Types and Fish Utilization Map……pg. 17
Figure 7: Auke Lake Watershed Ownership……...pg. 20

Appendices

Appendix A: Surface Water Rights Reserved in the Auke Lake Watershed
Appendix B: Auke Lake Watershed Channel Process Types and Management Considerations
Appendix C: Available Water Quality Data for Auke Lake and its Tributaries
Appendix D: Auke Lake State Land Use Designations
Appendix E: Definitions of Land Use Designations in the Auke Lake Watershed
Appendix F: Auke Lake Public Meeting Notes
Appendix G: Auke Lake Watershed Assessment Community Survey Results

1. INTRODUCTION

1.1 Watershed Description

Auke Lake is a freshwater lake located approximately 12 miles north of downtown Juneau, Alaska (Figure 1). Oriented roughly northwest to south, the watershed encompasses approximately 2,558 acres, with elevations ranging from sea level to just over 2,000 feet. The Auke Lake watershed drains into an area of approx. 2, 500 acres (Bethers, 1995), and is bounded by the mouth of Auke Creek in Auke Bay, the headwaters of Lake Creek, Goat Hill, and Peterson Hill.

Auke Lake itself covers a surface area of approximately 177 acres and has a maximum depth of 113 feet (Bethers, 1995). The lake surface rises 56 feet above sea level and the forested shoreline consists of a mix of gentle slopes and steep-sided banks (Lum and Taylor, 2006).

1.2 Geology, Vegetation and Fauna

Geology

A combination of tectonic forces and glacial activity formed the Auke Lake watershed (Monteith, 2007). Area geology consists primarily of glacial, glacio-marine, and alluvial deposits overlaying a northwest trending belt of metamorphosed volcanic and sedimentary bedrock (Brew and Ford, 1985).

Between 10,000 to 12,000 years ago, Auke Lake was part of a marine embayment that extended southwest to Pederson Hill and northwest to Goat Hill. Isostatic rebound lifted the landmass in the area around 6,500 years ago, transforming the lake into a salt chuck with salt water entering the lake during high tides. Auke Lake stabilized at its current elevation of approximately 56 feet above sea level some time within the last 6,000 years (Monteith, 2007).

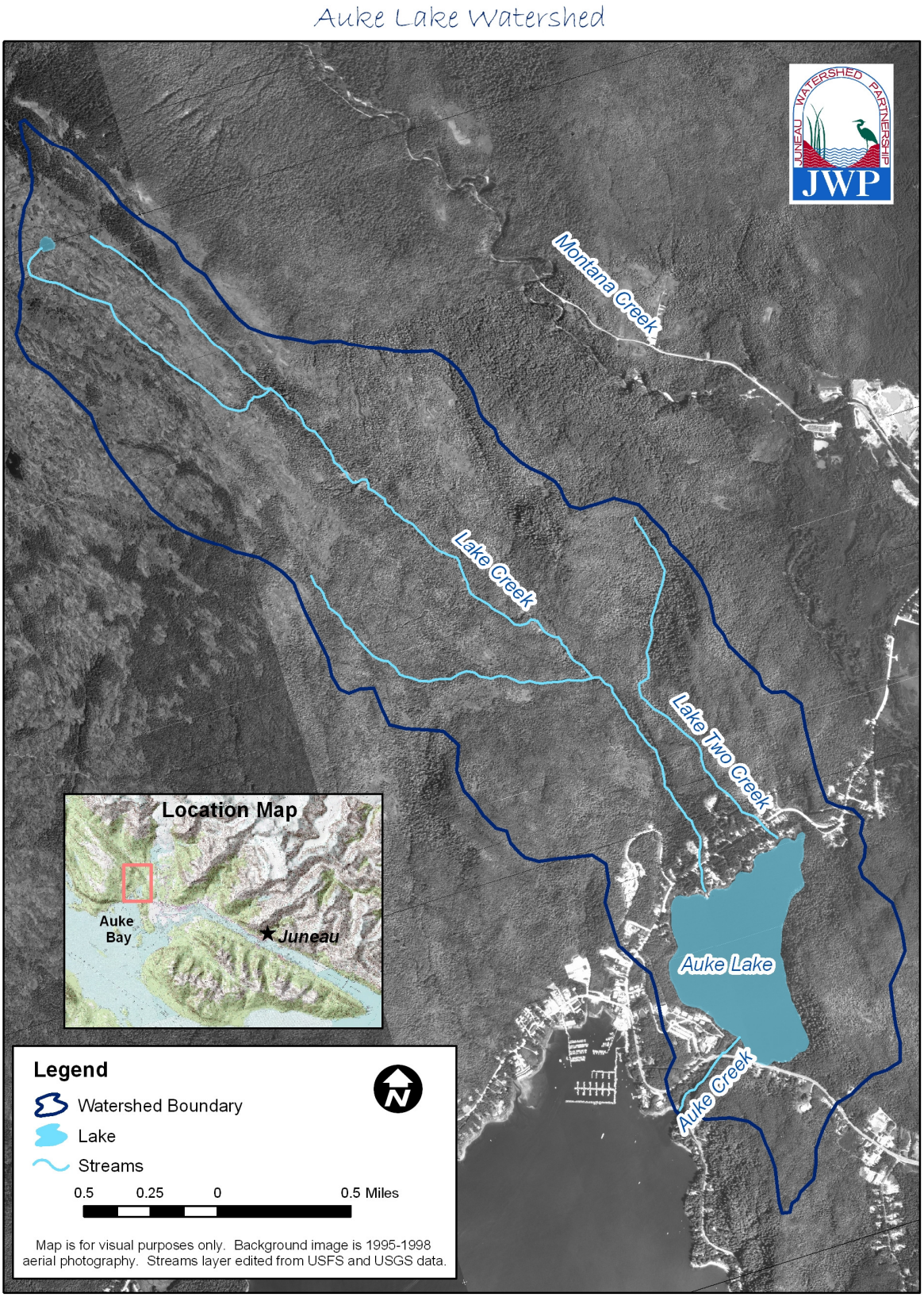
The Mendenhall Glacier advanced four kilometers during the Neoglacial or Little Ice Age (3,000-250 years ago) but the terminal glacial moraine did not extend into the Auke Lake watershed. However, the bathymetric model created by Connor et al. in 2006 demonstrates a U-shaped lake basin in both the north-south and east-west profiles, indicating repeated advances of the Mendenhall Glacier into the Auke Lake watershed at some point in time (Monteith, 2007).

Vegetation

The Auke Lake watershed is forested primarily with Sitka spruce and western and mountain hemlock, with alder species found adjacent to streams and wetlands. Spruce trees began growing on the terminal moraine near the watershed boundary on Back Loop Road by the late 1700s (Montieth, 2007). Trees on the east side of the lake are primarily uneven-aged old growth including some large spruce trees. Wind influences the forest structure around Auke Lake, leaving the exposed, mostly southeast facing slopes dominated by even-aged hemlock trees. (Carstensen, 2007)

Typical understory vegetation includes shrubs such as Devil's club, blueberry, and salmonberry as well as herbaceous plants including ferns and skunk cabbage. Wetland plant species indicative of emergent wetland habitats are primarily located in the upper watershed along the Lake Creek system while estuarine wetland plants grow near the mouth of Auke Creek. Emergent vegetation such as horsetail and pond lily dominate some areas along the lake shoreline. Submerged and floating conifers are anchored to the bottom by large root wads along much of the lakeshore. (Lum and Taylor, 2006).

Figure 1: Auke Lake Watershed Location and Boundary.



Birds and Wildlife
Mallard, merganser, belted kingfisher, great blue heron and red-throated loon regularly use the Auke Lake watershed. Robin, varied thrush, Steller's jay and winter wren frequent the Little Auke Creek area, and hermit thrush and junco live in the muskeg area near Lake Creek (Adamus et al., 1987). Sandhill crane, bald eagle, Canada geese, and trumpeter swans also use the area.

Beavers and river otter have been sighted in and around Auke Lake. Sitka black-tailed deer and black bear also frequent the area. Other mammals common to forested habitats in the Juneau area likely to inhabit the watershed include porcupine, marmot, red squirrel, and voles. Wolves have been observed near Mendenhall Lake and likely travel through the Auke Lake watershed to Peterson Creek.

1.3 History of the Auke Lake Watershed
Auke is a derivative of the Tlingit word for "little lake," or "Aak'w." The Auk'w Kwaan is one of fourteen Tlingit tribes in Southeast Alaska and resided near the lake in historic times (Monteith, 2007). The traditional territory of the Auk'w Kwaan encompassed the north end of Admiralty Island, Douglas Island and the mainland from Juneau north to Berners Bay (Chandonnet, 2002).

The Auk people landed in Auk Bay around 1564 and occupied a village and fish camp along Auke Lake where the campus of the University of Alaska Southeast (UAS) now resides (Monteith, 2007). Researchers and students from UAS conducted an archaeological survey of Auke Lake in 2006 and 2007 and found 9 culturally modified trees around the lake, as well as charcoal and other artifacts from pre-European contact.

Early European settlers called the lake "Aylward Lake", after Ed Aylward who staked mining claims in the area in 1884. The lake is first referred to by the name Auke Lake in records from 1902, when William Winn and N.A. Needham claimed it for a fish hatchery site (Mobley, 1992).

The Auke Bay District gold rush began when Tom Dull and John Stephens announced a new discovery site "just north of Auke Bay" in August, 1908. Prospectors staked claims throughout the Auke Bay area, a few of which were successful small-scale operations. The Stephens and Dull claims are situated on Lake Creek near the confluence of its southernmost tributary. Victor Spaulding was among the prospectors who worked the Treasury Hill group of claims, located near the watershed boundary between the Lake and Wadleigh Creeks. Both panning and tunnel blasting were conducted, and there were several abandoned mine shafts in the watershed (Redman, 1988).

Road and trail development in the Auke Lake watershed intensified in 1908 and 1909 when a wagon and foot trail was built between downtown Juneau and Eagle Creek. Glacier Highway was extended to Auke Bay between 1914 and 1918, and a bridge over the Mendenhall River was constructed in 1916. Road and bridge development over Auke Creek likely wiped out archeological evidence of Auk fish camps where the creek drains from the lake. Back Loop Road was built in 1921 (Monteith, 2007) and was reconstructed in 1968. (Taylor and Wing, 2008).

2. HYDROLOGY, WATER RIGHTS, AND WETLANDS

2.1 Auke Lake and Auke Lake Tributaries
Auke Lake is the largest non-glacial lake on the Juneau road system. The lake water is generally clear with a brownish tint. Mud is the primary lake substrate, with some gravel areas located at the stream inlets (Bethers, 1995). Water depth measurements taken at the University of Alaska Southeast dock in 2006 and 2007 show some fluctuation in lake level somewhat correlated with mean monthly discharge data for Auke and Lake Creeks (Figure 2).

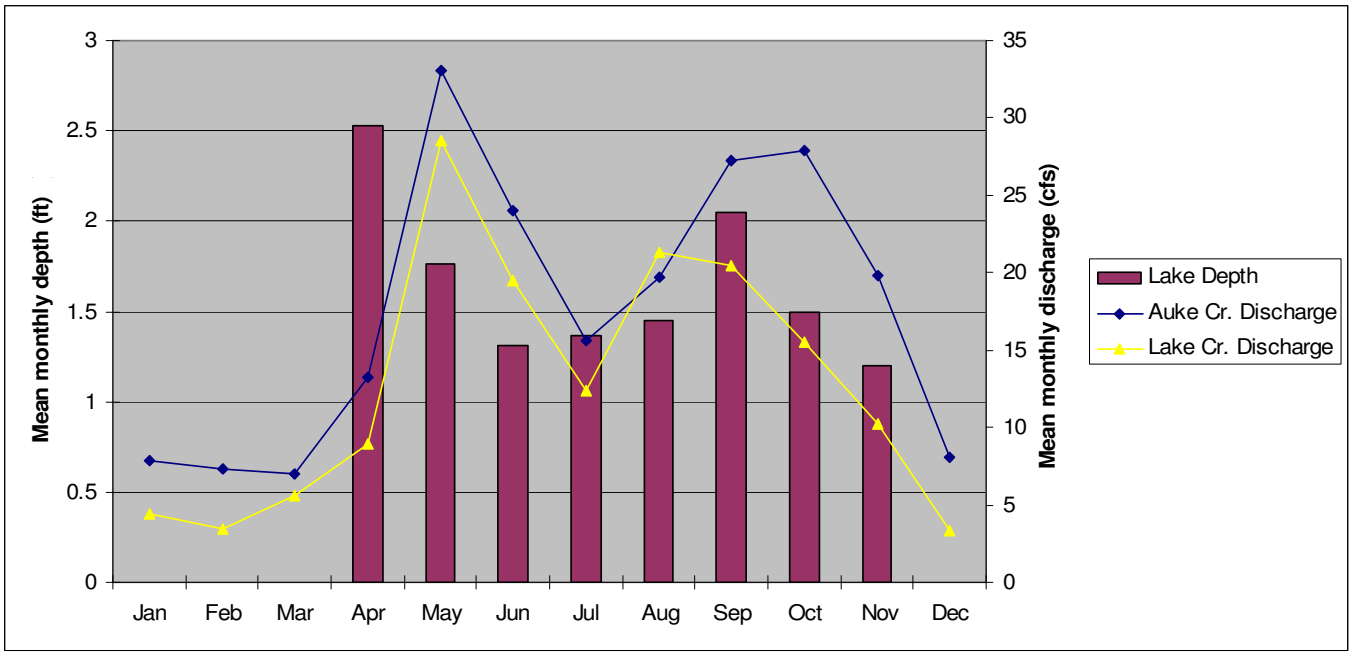


Figure 2: Mean monthly depth at the Auke Lake UAS dock and mean monthly discharge for Auke and Lake Creeks. Lake depth measurements taken when the lake was ice free, May 2006 through November 2007 (Hood and Jacobs, unpublished data). USGS data period of record for Auke Creek: 1947-1975; for Lake Creek: 1963-1973.

The lake freezes over each winter and has both fall and spring turnover events, when the entire water column mixes as a result of changing temperature gradient. Observations of lake freezing and thawing since 1961 show a general trend toward earlier ice-out, though not at a statistically significant rate (Taylor, 2007). Midwinter breakup events followed by refreezing occurred in 2000, 2001, and 2003 (Wing et al., 2006).

Lake Creek is the largest of the six inlet streams that enter the lake on the north and west shores of Auke Lake. Smaller streams include Lake Two Creek (also known as Little Auke Creek), and the unofficially named UAJ, MB and Hanna Creeks (Bethers, 1995). Auke Creek is the only outlet stream for Auke Lake and enters saltwater at Auke Bay.

U.S. Geological Survey (USGS) discharge data is only available for Lake Creek and Auke Creek. Mean monthly discharge for the two creeks is correlated, and the peak discharge for both creeks occurs in May. Precipitation data show discharge for Lake and Auke Creeks is correlated with rainfall in late summer and early fall, while the spring peak discharges are likely a response to snowmelt (Figure 3).

Lake Creek is the primary tributary to Auke Lake and drains approximately 3.5 square miles of undeveloped forestland. The creek's main channel is 3.6 miles in length with a total of 6 miles of stream. Its headwaters rise nearly 1700 feet in elevation in a substantial forested/shrub wetland complex locally known as 'Spaulding Meadows'. The streambed substrate is mostly composed of gravel with some bedrock, with a fish passage barrier falls located approximately 1.25 miles upstream from the mouth (Bethers, 1995).

Lake Two Creek (also known as Little Auke Creek) is a small drainage of approximately 1 square mile located east of Lake Creek. Most of the land draining into both Lake and Lake Two Creeks is largely undeveloped. Back Loop Road crosses both streams approximately 600 feet upstream from their lake outlets.

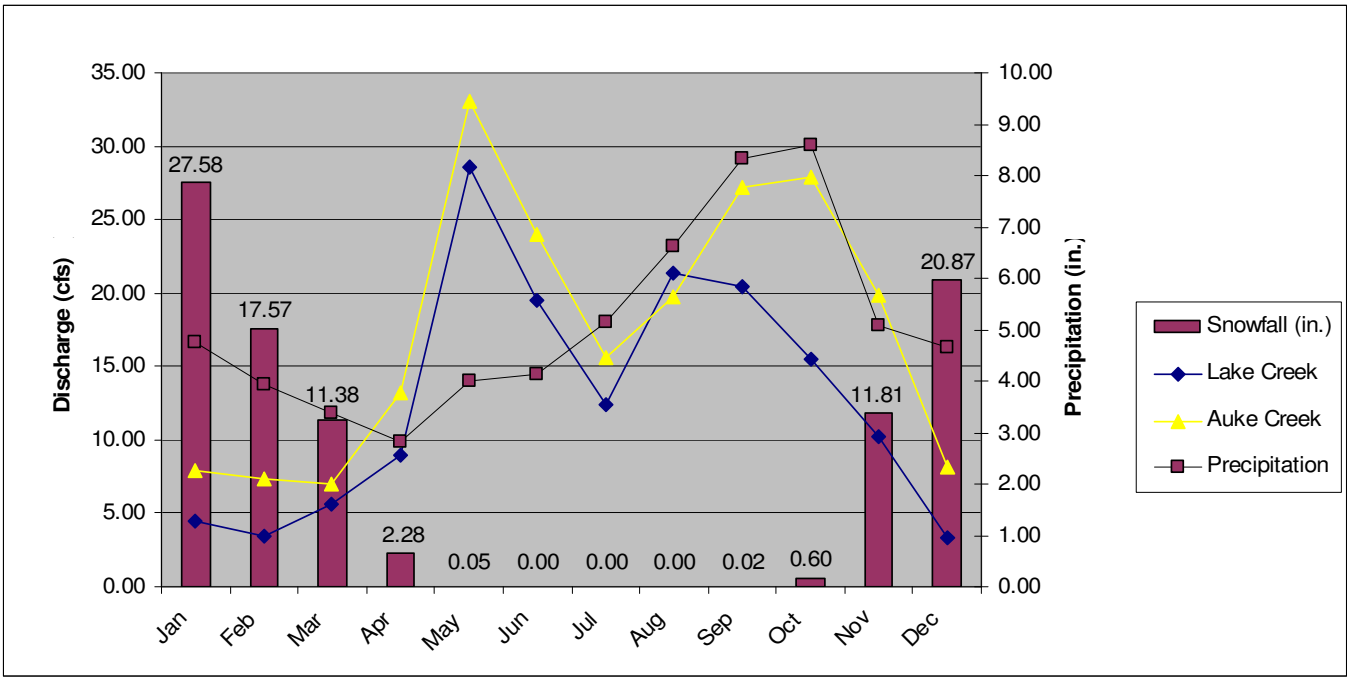


Figure 3: Mean monthly discharge for Auke and Lake Creeks, mean monthly snowfall and precipitation. Snowfall and precipitation data collected at the NMFS Auke Bay Laboratory, 1963-1993 (Wing and Pella, 1998). USGS data period of record for Auke Creek: 1947-1975; for Lake Creek: 1963-1973.

Auke Creek is a lake-fed outlet stream that flows about 0.3 miles from Auke Lake into Auke Bay (Wing et al., 2006). Water flowing into Auke Creek passes through a shallow lagoon, and a narrow channel with a bedrock sill and water depth often less than 8 inches. The Glacier Highway crosses over Auke Creek just below the lake outlet. Experimental spawning beds were installed by National Marine Fisheries Service (NMFS) in the upper section of Auke Creek, but otherwise the substrate is primarily bedrock and small boulders or cobbles. A concrete flume adjacent to the creek supplies water to the NMFS Auke Bay Laboratory (Kramer, Chin & Mayo, Inc., 1978). A weir has been in place approximately 0.25 miles downstream from the lake since 1961 (Bethers et al., 1995; Lum and Taylor, 2006).

2.2 Surface and Ground Water Rights

Surface and groundwater rights are reserved throughout the watershed. Water rights permits are adjudicated by the Alaska Department of Natural Resources (ADNR), and have been issued to federal and state agencies and private citizens who own land on Auke Lake, Auke Creek, Lake Creek, and Little Auke Creek (Appendix A). There are three surface water rights in the Auke Lake watershed for household use and three substantial withdrawal permits held by NMFS and the Alaska Department of Fish and Game (ADF&G) for use in research and hatchery operations. ADF&G also holds instream flow reservations for Auke and Lake Creeks, which vary in flow rates throughout the year in order to maintain minimum flows for fish habitat.

The ADNR water rights database has 20 subsurface rights on record, primarily held by citizen landowners around Auke Lake. At least one subsurface right is listed as being permitted to an individual but is slated for use by the NMFS lab and domestic facilities (ADNR, no date). All of the subsurface rights applications were initiated and all but two were permitted prior to the extension of city water lines to the area in 1986 (Lowery, 2008).

2.3 Wetlands

There are multiple wetland areas within the Auke Lake watershed. Wetlands designated by the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) do not necessarily coincide with those identified and classified by CBJ. This is partly due to the scope of CBJ's wetland assessment, which does not

include federal lands within the Borough boundaries. CBJ also used U.S. Army Corps of Engineers maps, combined with field-truthing on a subset of wetlands included on the maps, in order to establish its wetland management plan (CBJ, 1997). The NWI has a much broader scope and uses aerial photography and USGS 1:24,000 topographical maps as a basis for regional or watershed analyses (USFWS, 2007).

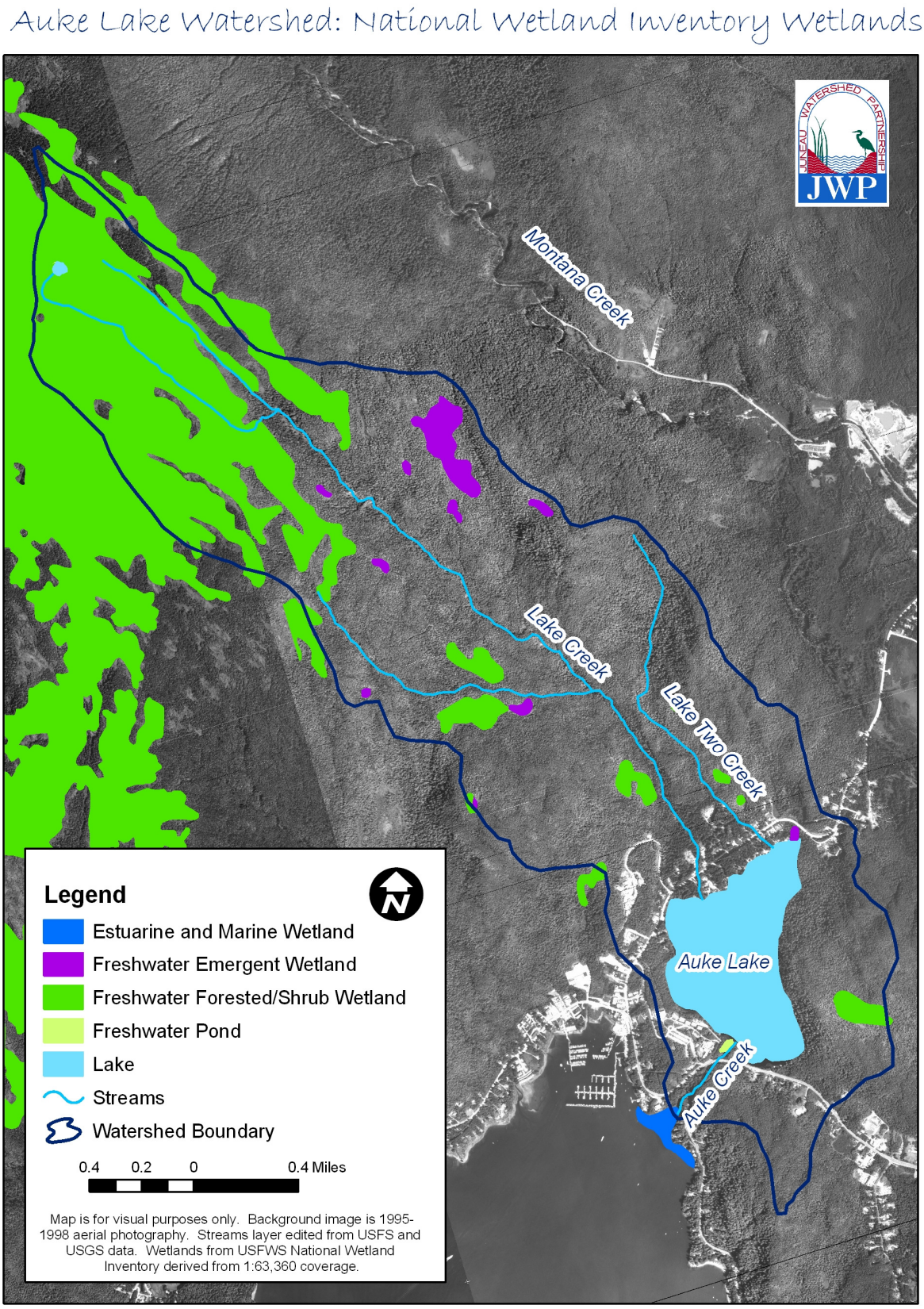
CBJ Wetlands

CBJ wetlands designations are based upon three factors: 1) the evaluated environmental functions of each wetland unit, 2) the availability of practicable upland alternatives to wetlands development, and 3) a survey of public preferences for the management of wetland units. Designations range from Class A, wetlands of the highest value which are least suitable for development, to Class D wetlands that are more suitable for development (CBJ, 1997). In the Auke Lake watershed, there is a substantial Class A wetland situated along and adjacent to Lake Two Creek. Two smaller Class A wetlands associated with UAJ and MB Creeks on the north side of the lake are located within a larger Class B wetland to the west of Lake Creek. Five Class C wetlands are scattered around Auke Lake, and there are no Class D wetlands identified in the watershed (CBJ, 1994).

National Wetland Inventory

Most of the wetlands in the Auke Lake area are forested or shrub type freshwater wetlands, with a few small freshwater emergent wetlands scattered across the northern portion of the watershed (Figure 4). A marine/estuarine wetland is situated at the mouth of Auke Creek (USFWS, 2007). Wetlands in the Auke Lake watershed function primarily as recharge zones, or "have groundwater moving laterally," according to the Juneau Wetlands Functions and Values report (Adamus et al., 1987).

Figure 4: National Wetlands Inventory Wetland Types in the Auke Lake Watershed



3. FISH AND FISHERIES HABITAT

3.1 Fish Populations

The Auke Lake system supports populations of pink, chum, sockeye and coho salmon, and supports populations of Dolly Varden char and cutthroat and rainbow trout (Figure 5). Research conducted at Auke Creek since 1961 by the Auke Bay Lab has resulted in a substantial body of knowledge about the Auke Lake fish populations. Auke Creek is also one of the four index runs in Southeast Alaska that ADFG uses to determine coho salmon abundance (Taylor and Wing, 2008). In addition to Auke Lake watershed's importance for fisheries research, it is also a contributor to area sport and commercial fisheries.

Pink Salmon

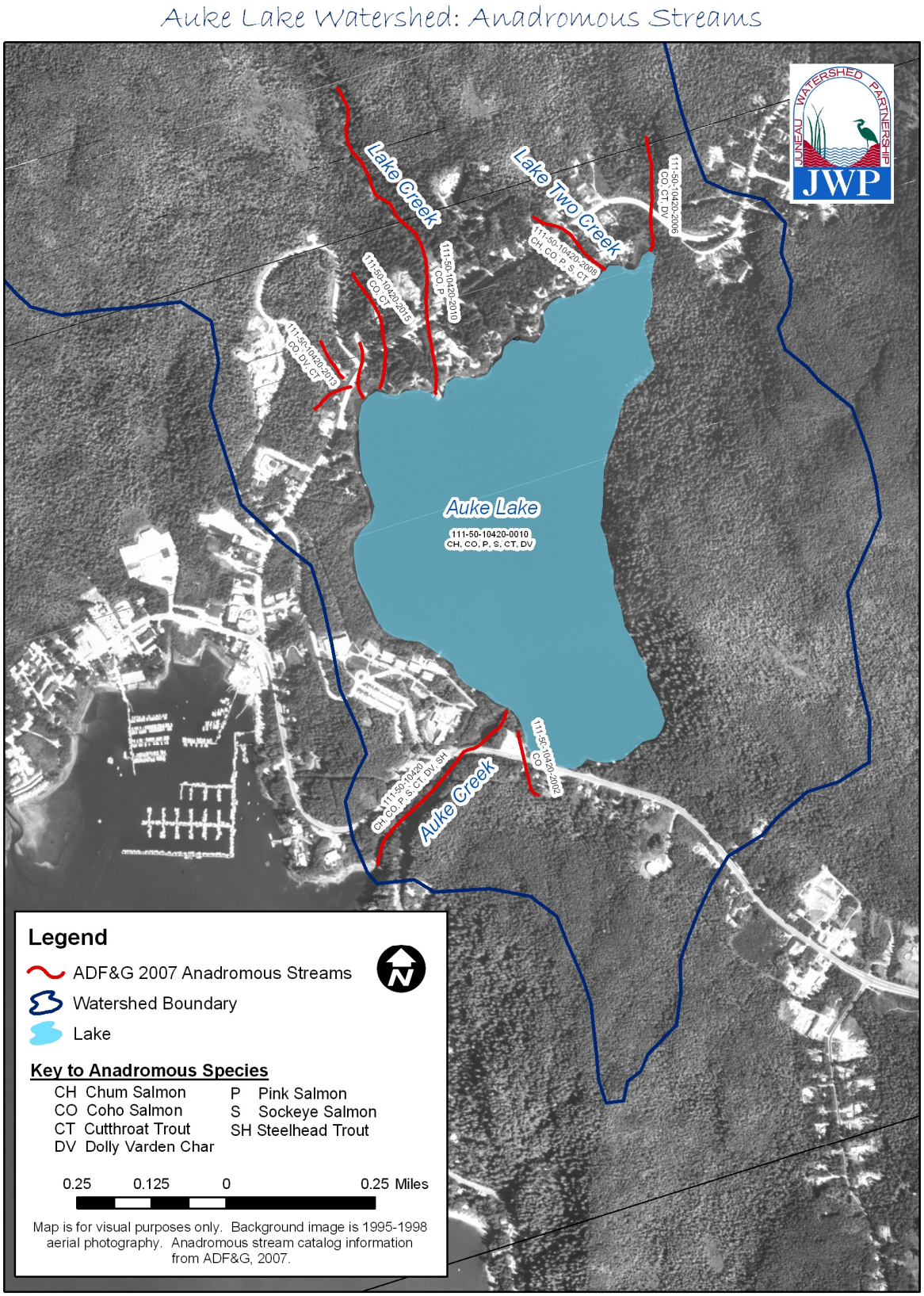
Pink salmon spawn in the intertidal area at the mouth of Auke Creek and in the tributaries to Auke Lake. Between 1967 and 1972, before the first hatchery return in 1973, the average annual adult run was about 2,600 pink salmon. Large numbers of pink salmon were released in Auke Creek in the 1970s and again in 1995. In 2007, University of Alaska Fairbanks released 35,159 fin marked fry in Auke Creek. In 2007, only 3,123 (2,944 wild and 179 hatchery) pink salmon adults were counted at the weir. This compares to an average return of 10,071 adults since 1967. Returns of wild adult pink salmon have ranged from 334 to 28,000 adults since 1967. The number of fry counted in 2007 was 81,899. The average wild pink salmon fry outmigration since 1972 was 113,636 (Taylor, 2008).

Over the last three decades there has been a trend of pink salmon fry outmigrating earlier in the year and adults returning earlier. In both Auke Bay and Auke Creek, a warming trend in sea surface and air temperatures as been documented over the past 34 years. Given the recent trend for salmon fry to outmigrate earlier, a portion of the populations may not benefit from optimum environmental conditions during their early marine life history. If salmon adults continue to migrate into the creek earlier when water temperatures are commonly high, it may result in increased prespawning mortality (Taylor, 2007). There is a current trend in decreasing fry production and while this might be a result of climate change, it may also be due to loss of spawning habitat. Floods have washed the gravel downstream from the constructed spawning channels and the creek is reverting back to its original large cobble and bedrock substrate (Taylor, 2008).

Sockeye Salmon

Auke Lake sockeye salmon spawn in Lake Creek and Lake Two Creek and are also thought to spawn on gravel patches on the lake perimeter and lake floor (Nelson, personal communication 2008). The average number of Auke Lake sockeye smolts between 1980 and 2007 was 17,115. While some of the pre-1980 smolt estimates are incomplete, it was estimated in 1961 that the sockeye smolt production was 90,816. Between 1963 and 1981 the sockeye adults returning to Auke Lake averaged nearly 7,000. This compares to an average return of 2,560 wild adults since 1982. In 2007, 2,942 sockeye returned to Auke Creek (Taylor, 2008). The cause of the decreased number of sockeye returning to Auke Lake is unknown. One possibility is that Lake Creek may be more difficult for sockeye salmon to spawn in, especially during low flows, as a result of gravel aggradation in Lake Creek (Taylor and Wing, 2008).

Figure 5: Auke Lake Anadromous Streams



NMFS conducted research on sockeye salmon in Auke Lake in the 1990s using radio tags and divers to track the movements and locations of adult salmon. NMFS determined that not every fish that entered Auke Lake spawned in the tributaries, so it was inferred that those fish either did not spawn or spawned on the lake floor or perimeter. Subsurface gravel patches are located in front of UAS, near the dock and also at the mouth of Lake Creek, and gravel and rock along Glacier Highway also appears to provide some habitat function for sockeye. NMFS determined that approximately two thirds of the sockeye entering the lake congregate along Glacier Highway shore for one day to three weeks, before they move on to spawn (Nelson, 2008).

Chum Salmon

Chum salmon have been observed in Auke Lake spawning locations, however it is suspected few chum salmon used the Auke Lake system before fishery enhancement programs started in the Juneau area. The average chum run size before the enhancement experiments in 1977 was 20 adults, and these were likely strays from other systems. During the past 30 years, several hundred chum salmon have returned to Auke Creek, but these returns are a result of the Auke Lake hatchery experiments in the 1970s and 1980s, and more recently thought to be strays from Macaulay hatchery. In 2007, 719 adults were counted at Auke Creek and of these 15 were indentified as wild fish. An average of 1,028 adults have been counted at the weir in recent years, with a near record return of 6,571 chum in 2006 (Taylor, 2008).

Coho Salmon

Coho salmon spawn in the upper reaches of Auke Creek and in the tributaries to Auke Lake. Juveniles rear throughout the watershed. In 2007, a total of 4,071 smolts migrated downstream and 352 adults and 106 'jacks' (premature males) immigrated upstream. The average smolt production between 1978 and 2004 has been 5,923 outmigrants, with adult returns averaging 703 fish and an additional 272 jacks returning annually. Adults returning in 2007 represented the lowest on record with a trend of decreasing smolt numbers at Auke Lake. The highest recorded smolt count was in 1980 when 10,022 smolts left the system. Adult returns peaked in the late 1990s and the adult numbers have followed a decreasing trend since then (Taylor, 2008).

In 2007, the harvest of Auke Creek coho salmon was estimated at 176 adults based on the recovery of coded wire tags in commercial and sport fishery port sampling programs. On average, 470 adults originating from Auke Creek are harvested annually. In 1990 1,454 Auke Lake coho salmon were estimated to return and of these 754 were harvested. The commercial troll fishery harvested 83% of these coho while the drift gill net and purse seine fisheries took a combined 9% and the sport fishery took 8%. The survival rate in 1990 (including those harvested) was estimated to be 21% (Elliott and Sterritt, 1991).

Dolly Varden Char

Dolly Varden use the Auke Lake system for spawning, rearing and over wintering. Since 1996 the number of Dolly Varden outmigrants has been decreasing. In 2007, 4,300 Dolly Varden outmigrated from Auke Lake, compared with an historical average outmigration of 6,013 fish (Taylor, 2008). The number of Dolly Varden that spawn in Auke Lake and the juvenile production are both unknown (Lum and Taylor, 2006). In the 1980s Auke Lake was closed to the harvest of Dolly Varden because a concern of low population numbers (Taylor and Wing, 2008).

Cutthroat Trout

Auke Lake supports populations of both resident and anadromous cutthroat trout. Some adults spawn in the lake before outmigration, while others emigrate and spawn elsewhere (Lum and Taylor, 2006). The average number of cutthroat trout outmigrants at Auke Creek since 1980 has been 241. In 2007, a total of 162 emigrants were counted. Weir operations and tagging programs have shown that Auke Lake cutthroat trout are found in nearby lake and stream systems. Since 1997, the numbers of Auke Lake cutthroat trout have been on a downward trend and anecdotal information suggests populations prior to 1960 were larger than current numbers (Taylor, 2008). Between 1999 and 2004 the estimated cutthroat trout population ranged

between 672 and 301 (Lum and Taylor, 2006). While cutthroat harvest is allowed, the trout must be greater than 14 inches for an angler to retain them and consequently very few, if any, are retained annually.

Between 1998 and 2004, ADFG and NMFS estimated cutthroat trout populations and survival rates. The average overwinter survival rate was 62% and the average annual survival rate was 37%. While the annual survival is lower than two similar lake-bound populations in Southeast Alaska, this may simply be because immature cutthroat emigrate from Auke Lake and do not return before sampling takes place. The annual survival estimate is similar to the landlocked lakes if the fish observed at the weir are excluded (Lum and Taylor, 2006).

Rainbow Trout

Little is known about rainbow trout populations in Auke Lake. Since 1999, an average of six rainbow trout have been counted at the weir during the spring outmigration (Taylor, 2008). During the years of weir operation, only one mature rainbow has been seen at the weir in the spring trying to migrate upstream (Taylor and Wing, 2008). In Auke Lake there is a small number of overwintering juvenile rainbow, but no spawning population (Lum and Taylor, 2006).

Chinook

While chinook salmon are not native to the Auke Lake watershed, there has been a history of chinook returning to Auke Creek as part of an experimental release project that began in 1986, coordinated by ADFG and Douglas Island Pink and Chum hatchery. This continued in 2007 with the release of chinook salmon juveniles near Auke Creek.

Prickly Sculpin, Stickleback, and Freshwater Mussels

Prickly sculpin and stickleback are year round residents of Auke Lake and found in the near shore perimeter of Auke Lake. Auke Lake residents report stickleback and fresh water mussels were once commonly found along the Auke Lake shore, but according to dive surveys conducted in 2006 by the USFWS, their distribution in Auke Lake may be patchy and variable.

Fish Population Trends

With the exception of chum salmon, weir counts indicate Auke Lake salmon and trout populations are declining. At this time it is unclear why both fry and adult populations are decreasing. One possible contributor to the decreasing numbers is climate change and the gradual warming at Auke Creek that has affected fry migration timing and survival of immigrating adults. Additionally, changes in the geomorphology of both Lake Creek and Auke Creek may have reduced spawning success in both locations (Taylor and Wing, 2008).

3.2 History of Fish Propagation

Auke Lake has been stocked with pink salmon, cutthroat trout, eastern brook trout, grayling, rainbow trout, sockeye and coho salmon (Bethers, 1995). In 1902, Colonel William Winn and Martin A. Needham built an illegal hatchery and dam on Auke Creek, and later, the John L. Carlson Cannery was built on Auke Creek in 1919, and operated until 1921. In 1954, a small fish hatchery was built on Auke Creek by the Territorial Sportsmen Club (Mobley, 1992).

3.3 Habitat Condition Summary

Channel Type

Stream channel reaches in the Auke Lake watershed are classified according to the Tongass National Forest Channel Type User Guide (Paustian et al., 1992). The classification system is organized according to nine basic fluvial process groups for Southeast Alaska, which are based upon the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion and deposition. Within each process group, stream channels can be further classified into channel types that provide more

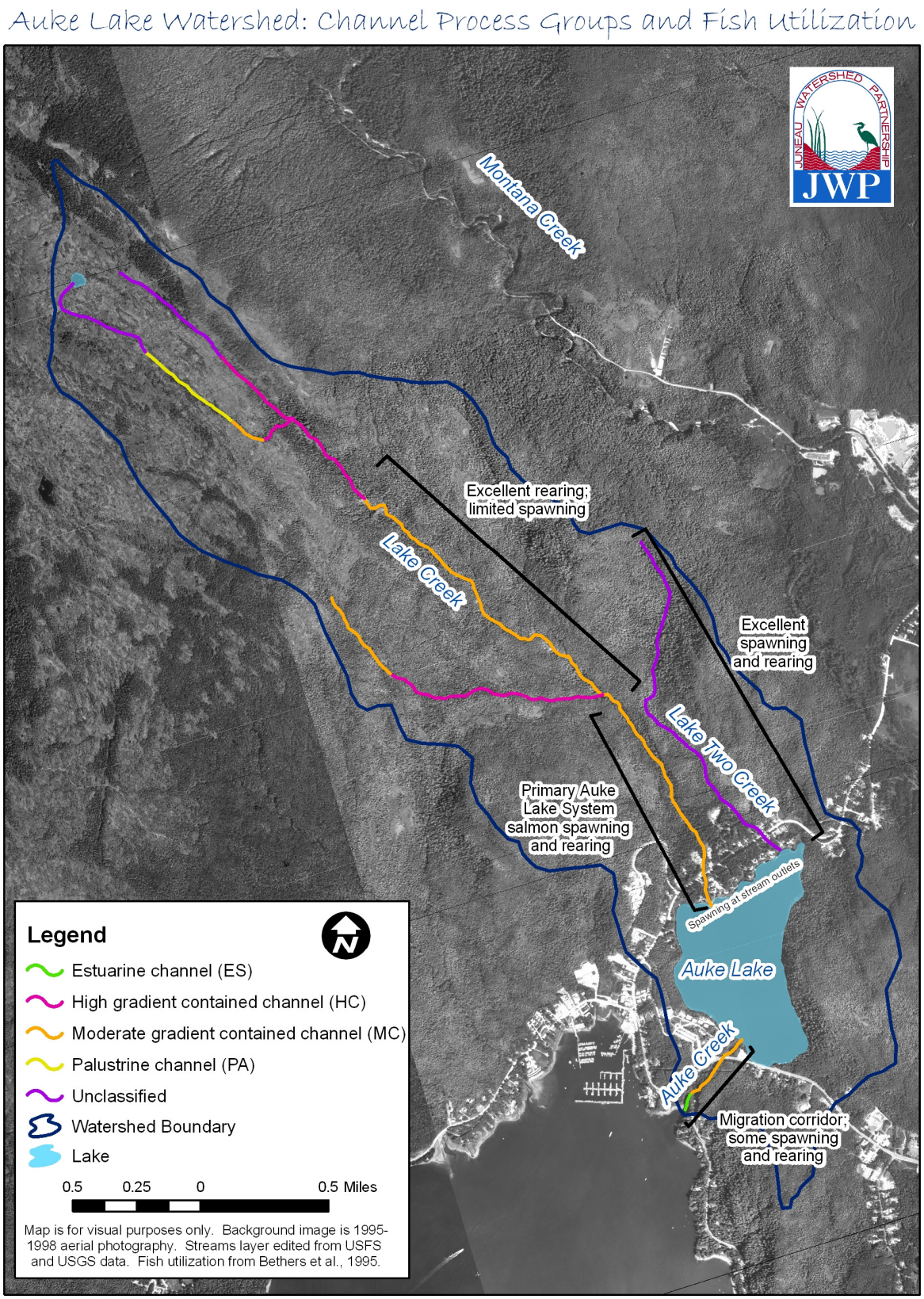
detailed descriptions, including expected soil and vegetative types, channel structure, and aquatic habitat capability.

In the Auke Lake watershed, only Lake Creek and Auke Creek have been classified by the Forest Service. Channel process types are shown in Figure 6, (U.S. Forest Service, 2002) which also includes fish habitat information as stated in the Juneau Fish Habitat Assessment (Bethers et al., 1995). Channel type characteristics and management considerations are outlined in the table included in Appendix B. While Lake Creek has a variety of channel types, Auke Creek is limited to moderate gradient contained channel and estuarine channel types. The primary channel process groups on these two streams are moderate gradient contained channels (MC). MC channels are generally stable, sediment transport channels that tend to be narrow, shallow, and contained by geologic features such as bedrock or large boulders. Spawning gravels occur in patches separated by bedrock or boulder substrate, and sediment storage and/or retention tends to be minor.

Because MC stream channels function as sediment transport systems and tend to have relatively stable streambanks, the frequency of spawning gravels may be a limiting factor for fish habitat. Pools may also limit the number of fish utilizing the systems for overwintering or summer rearing, as these channels tend to be shallow and therefore subject to freezing in winter and oxygen depletion and/or overheating during the summer months.

Deposition of sediments from upstream and upland disturbances is likely in estuarine channels (ES), due to low stream energy. Several species of anadromous fish utilize ES channel types for spawning and rearing, and such channels are also important for a variety of marine fish, waterfowl and predatory birds, and mammals.

Figure 6: Auke Lake Watershed Channel Types and Fish Utilization Map.



Channel and Riparian Modifications
Auke Creek- NOAA/NMFS Fish Weir
In 1963 Auke Creek was modified when NMFS installed a water pipe from Auke Lake to the lab and added a spawning channel in the upper portion of the creek. The channel was created with timbers stacked approximately 3.3 feet high that were buttressed with concrete filled sandbags. The channel was filled with locally purchased cobbles approximately 5-10 cm in size. Since 1963 floods have washed large amounts of the cobble downstream and the upper portion is reverting to bed rock (personal communication, J.Taylor, 2007).

Lake Creek
The lower section of Lake Creek has been channelized to prevent flooding. (Adamus et al., 1987) It has been anecdotally observed that the channel is aggrading in the lower reaches, and low flows go subsurface.

UAJ Creek
In 1983, construction of a road to the UAS housing project completely rerouted lower UAJ creek (Ferlauto, 2001). Stormwater form the UAS access road discharges into UAJ creek, along with fine sediments.

Riparian Shoreline Development
Approximately 50% of the shoreline of Auke Lake is developed, including state, private, and municipal land owners.

Fish Migration Barriers
Auke Creek-NMFS Fish Weir
The current weir allows biologists to count all emigrants and immigrants, and this information has been recorded since 1980. Data on sockeye salmon populations dates back to 1961. Operation of an experimental hatchery and release of juvenile salmon in and near Auke Creek has continued since 1971. The weir continues to operate on a daily basis between March 1st and the end of June to catch emigrants, and then operates through October to catch immigrants. (personal communication, J. Taylor, 2007)

Lake Creek
A barrier falls is located approx 1 ¼ mile upstream from the mouth of Lake Creek (CBJ, 1987). The barrier (58.24.369N 134.38.409W) is characterized by an initial chute that is 5.5 feet high with no plunge pool. A second drop of 6 feet is located directly above and also is lacking a resting spot or plunge pool. Salmon and Dolly Varden are known to navigate falls greater than 6 feet in height, but the lack of plunge pools and the combined difficulty of two adjacent falls would qualify this location as a barrier to anadromous fish. While there is good to high quality spawning and rearing habitat further upstream, the canyon continues with several other sets of falls and would not be conducive for fish passage modifications (Hood, 2008).

4. Water Quality

Water quality data for Auke Lake and its tributaries is limited. The most extensive data available is water temperature in the lake and some of the tributary streams. Other data include standard water quality parameters such as dissolved oxygen, pH, selected cations (such as iron, magnesium, calcium, etc.), some anions (such as fluorine, chlorine, and sulfate), conductivity, hardness, alkalinity, and nutrients. Less common are data for benzene, toluene, ethylbenzene, and xylene (BTEX), and polycyclic aromatic hydrocarbons (PAH), which had been collected as part of a study to determine the effect of motorized water craft on water quality in Auke Lake (Rice et al., 2008. A table listing the known water quality data collected for Auke Lake and its tributaries is included in Appendix C.)

Samples collected from Auke Lake and Auke Creek to assess the water supply for use in research facilities at Auke Bay Laboratories indicated some parameters may exceed EPA drinking water standards. Selenium, arsenic, copper, lead, mercury, and silver exceeded recommended limits for some samples (personal communication, Adam Moles, 2007). However, analysis of 20 different water quality parameters in Auke Lake indicated that the lake was not impaired according to the Alaska Water Quality Standards under 18 ACC 70 (ADEC, 2006).

Limnological studies conducted by ADF&G have not been published (personal communication, Dave Barto, 2007). Data collected is not available publicly, but would be helpful for characterizing Auke Lake water quality and determining potential management considerations.

Concern about the effect of motorized water craft use on Auke Lake prompted water quality studies to assess PAH concentrations in relation to recreational use of the lake. Studies conducted by NMFS in 1995-2003 showed that increases in PAH concentrations in surface waters coincided with the increase of two-stroke engine water craft on the lake. PAHs were detected in surface waters at a depth of 1 meter, but not at 9 meters (Rice et al., 2008).

5. LAND USE AND LAKE MANAGEMENT

5.1 Land Ownership

Much of the watershed is owned by local, state, and federal government entities (Figure 7) Private residences and the University of Alaska Southeast line the south, west and north Auke Lake shoreline. It is estimated that at least 50% of the shoreline has been urbanized by residential development (Lum and Taylor, 2006).

5.2 Land Use Designations

The actual Auke Lake waterbody, submerged lands, and shoreline up to the high water line are all owned by the State of Alaska. State management is described in the 1993 Juneau State Land Plan (Appendix B). Land within the watershed surrounding Auke Lake is managed by the CBJ and land use designations are based on the 2005 CBJ Comprehensive Plan and the 1997 CBJ Parks and Recreation Plan.

State Land Use Designations

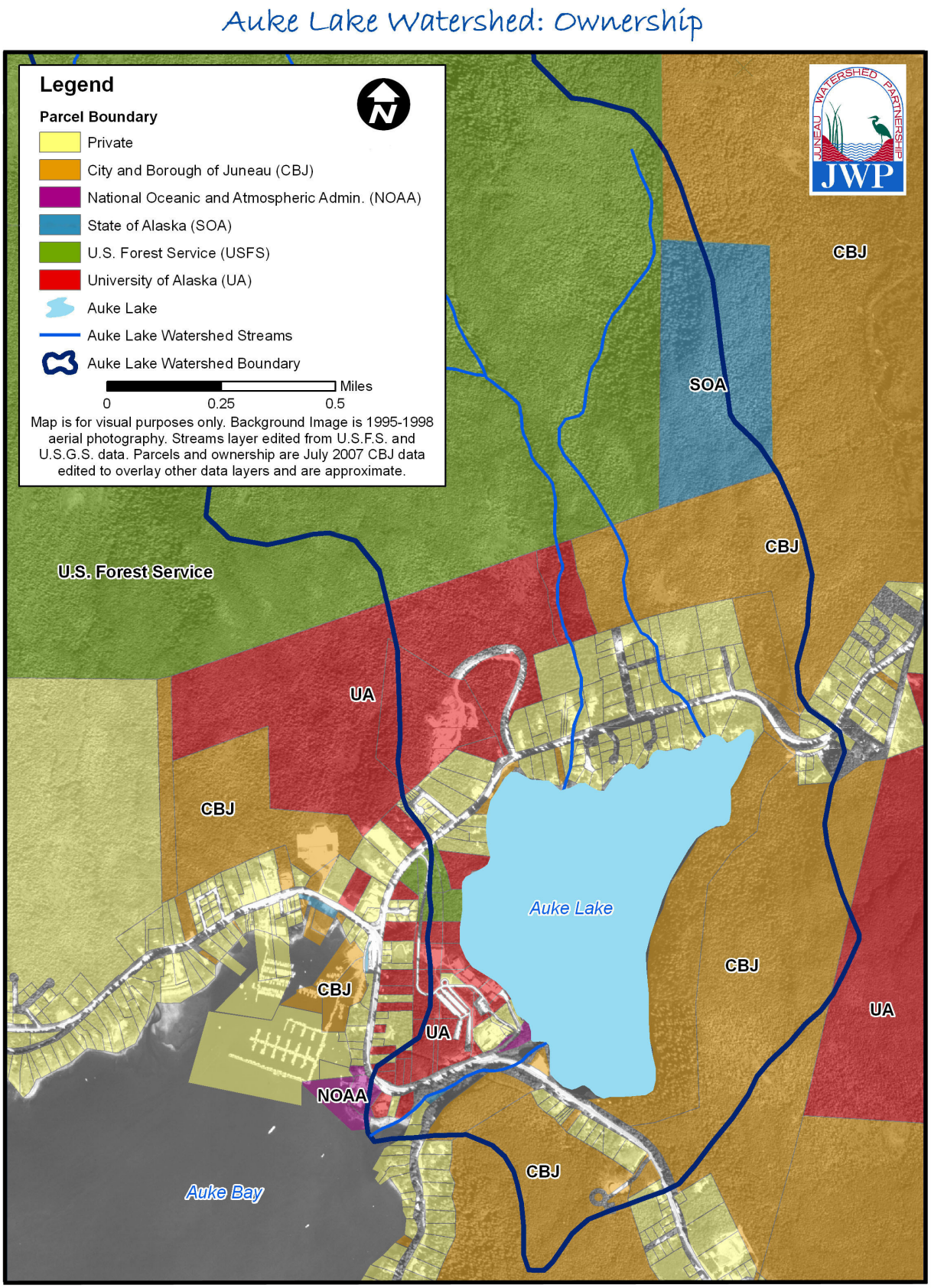
In the Juneau State Land Plan the State of Alaska notes the importance of Auke Lake for both fish and wildlife habitat and recreation. In addition to acknowledging the numerous types of recreation that occur on and around Auke Lake, the state mentions the particular importance of water quality because Auke Lake water is used for research purposes by NMFS and UAS (Juneau State Land Plan, 1993).

The State of Alaska has decided to manage Auke Lake to maintain important habitat and allow recreation to continue on the lake. The Juneau State Land Plan states: "Auke Lake will be managed to support the high public values of the lake including research, water quality, habitat restoration, fisheries management, summer and winter recreation, and landings by aircraft (Juneau State Land Plan, 1993).

City and Borough of Juneau Land Use Designations

Land surrounding Auke Lake is primarily designated by CBJ for residential development, but there are portions designated for other uses such as public institutions and recreation. (Appendix C) Along the east side and northwest shore of Auke Lake there are two CBJ Natural Park areas. Additionally, at the southwest corner of the Lake there is a parking lot and boat launch designated as a CBJ Recreation Service Park. The University of Alaska Southeast (UAS) land is designated for Institutional and Public Use, along the west shore of Auke Lake the area is designated for Urban Low Density Residential, and at the north end of the lake the land is designated as Rural Dispersed Residential transitioning to Urban Low Density Residential (CBJ Comprehensive Plan, 2008).

Figure 7: Auke Lake Watershed Ownership



Land south of Auke Lake, owned by the State of Alaska is designated for Resource Development and U.S. Forest Service land north of Auke Lake is designated for Recreation. There is a small CBJ Conservation Area around the northern portion of Lake Creek. Residential land in the watershed is mostly designated for Urban Low Density Residential and Rural Dispersed Residential transitioning to Urban Low Density Residential. One notable exception is a small area west of the lake that is designated for Medium Density Residential development (CBJ Comprehensive Plan, 2008). Also within the Auke Lake watershed are large parcels of land owned by the State of Alaska and the Forest Service (CBJ Comprehensive Plan, 2008).

5.3 Zoning

The Auke Lake watershed is surrounded by mostly low density private housing, the University of Southeast Alaska, and undeveloped land owned by the CBJ. The undeveloped land east of Auke Lake is zoned as Rural Dispersed Residential/ Urban Low Density Residential. Land along the west shore of Auke Lake is zoned for Medium Density Residential and Institutional and Public Use.

Along the north shore of Auke Lake land is zoned for Urban Low Density Residential and Medium Density Residential, and there is a Stream Corridor designation for a portion of Lake Creek. South of Auke Lake and Glacier Highway land is zoned for Rural Dispersed Residential/ Urban Low Density Residential and Resource Development/ Medium Density Residential. The parking lot and Auke Lake boat launch along Glacier Highway is designated as a Recreational Service Park, and the upper reaches of the watershed are zoned for Recreational Resource and Resource Development. (CBJ Comprehensive Plan, 2008).

5.4 Lake Management

Formally for the last 11 years, the City and Borough of Juneau has worked with DNR and DEC, University of Alaska, NOAA, user groups and property owners to manage Auke Lake and to address water quality concerns raised by NOAA and some Juneau residents. While the Lake is owned by the State of Alaska, the state has allowed the city to manage the use of Auke Lake (CBJ, May 7, 2007).

In 1996 the CBJ Parks and Recreation Advisory Committee formed a task force of interested parties to draft a set of recommendations in response to concerns over the use and management of Auke Lake. The task force recommendations address hours of motorized use, designation of an area for non motorized use, a 16' boat length limit and the relocation of the launch ramp to protect salmon habitat. Shortly after permit applications were submitted for the new launch ramp, they were withdrawn due to agency concerns over the location of the proposed launch ramp and the ability of the lake to support motorized use (CBJ, May 7, 2007).

In April 2006 the Assembly received a request from the "Friends of Auke Lake" community advocacy group to consider restrictions on motorized use on the lake. As a result of this request in June 2006 the city hosted a special meeting of the Assembly Lands Committee to discuss Auke Lake use issues including management of the lake, UAS interests and concerns, NOAA Auke Bay Lab water quality concerns and use, and the concerns and interests of both motorized and non-motorized user groups and property owners. As a result of these meetings, the CBJ agreed to partner with NOAA to continue water quality sampling in Auke Lake for the 2007 study period, and agreed to conduct an Auke Lake user study during the 2007 season.

On June 6, 2007 CBJ Ordinance 2007-31, "An Ordinance Relating to Motorized Uses on Auke Lake, and Providing for a Penalty", went into effect. This ordinance limits the hours of operation for motorized vessels and it also limits the vessel size to 16 feet. Use of some portions of the lake by motorized vessels is restricted and wake height is limited to six inches in certain areas. The ordinance prohibits refueling on and surrounding the lake, and fines relating to individual violations of the ordinance were put in place.

5.5 Proposed Development in the Watershed

Auke Lake Trail

Construction of the Auke Lake trail begun in the spring of 2008, and development plans include a bridge following the historic Glacier Highway route from the university across Auke Creek to the CBJ park property. The trail follows the southern Auke Lake shore line, skirts the undeveloped eastern shore of the lake and eventually connects to other road and trail networks around the Goat Hill area. In addition to following portions of historic Glacier Highway this trail follows the route of a traditional pedestrian corridor between Back Loop Road and Glacier Highway. Historic interpretive and educational kiosks are also being developed for the trail (Monteith, 2007).

This trail is a component of the UAS master plan and according to Chancellor John Pugh, "The Auke Lake Trail will enable students to engage in biological and geological studies of the ecology of the lake, in historical and anthropological studies of the area, and in outdoor recreational studies and activities" (Judd, 2008).

Auke Lake Launch Ramp

The CBJ appropriated $50,000 on September 24, 2007 for the permitting and design phase of a new Auke Lake launch ramp. (CBJ, September 24, 2007). The CBJ launch ramp and are currently in the permitting phase. In order to begin the project, the CBJ will need to obtain an Army Corp permit, State Fish Habitat permit and undergo an Alaska Coastal Management Program consistency review for the development.

UAS Developments

The 2002 "University of Alaska Campus Facilities Master Plan" identifies 3 top priorities for land acquisition and future development of the UAS Juneau Campus. Land acquisition priorities include purchasing or trading land to acquire property adjacent to the Anderson Building, U.S. Forest Service property to the north of Egan Library, property on north side of Back Loop Road, five residential properties located on the east side of Glacier Highway, and vacant land on the north side of this Back Loop Road and to the west of University Drive.

According to the 2002 report, UAS is also in negotiation with the Church by the Lake to conduct a land trade for the church to expand their parking lot and build a new recreational center. (Cunningham Group, 2002)

CBJ Housing

The CBJ identified Peterson Hill (a.k.a. Hill 560) as a potential site for affordable housing during their 2008 Comprehensive Plan process. In a memo to the CBJ Assembly, CBJ staff suggested that road and intersection improvements would be needed in order to fully development this site for affordable housing. (CBJ, 2007)

Proposed Transportation Improvements

There are three proposed large-scale transportation improvements in the watershed. The first project is currently in the pre-construction phase with the Alaska Department of Transportation and Public Facilities. (AKDOT&PF) The "Fritz Cove Road to Auke Bay Ferry Terminal Roadway Reconstruction, Back Loop Road Intersection Improvement and Auke Bay "Main Street" Treatment" will consist of construction of a roundabout or traffic signal at the Back Loop Road/ Mendenhall Loop Road intersection. This project includes landscaping, sidewalk construction, bus pullout/shelter construction, curb extensions and bicycle lanes.

In a 2008 letter to the AKDOT&PF, City Manager Rod Swope asked that "Glacier Highway Improvements-Brotherhood Bridge to Fritz Cove Rd. - Vehicle/Pedestrian/Bicycle Safety and Lighting Improvements" be added to the 2010-2013 Statewide Transportation Improvement Plan. (STIP). The 2004 "Auke Bay Corridor Study" by the DOT&PF mentions their long term transportation goal of creating a bypass of the Auke Bay community starting at Industrial Blvd., following the east side of Hill 560, crossing Back Loop Road at Goat

Hill and continuing behind the community of Auke Bay and to connect Glacier Highway near Auke Nu Creek. These proposed projects would be the largest development in the watershed since construction of Back Loop Road.

6. COMMUNITY USES OF THE AUKE LAKE WATERSHED

In order to understand the volume of recreational use on the lake, in 2007 CBJ contracted UAS student observers to monitor Auke Lake use everyday between May 31st and September 9th, 2007. The number of trailers, power boats, jet skis, kayaks, hikers and swimmers were counted at varying times each day with at least two observations made daily. An additional evening count was made on half of the days during the monitoring period, usually when a combination of good weather and the weekend increased lake usage.

The daily use of Auke Lake during the study period varied between 0 and 25 users. Non-motorized users outnumbered motorized users of the lake every month with kayakers being the top user group in June and September and swimmers being the top user group in July and August. During the survey period 124 swimmers, 60 kayakers and 37 hikers, 54 jet skis and 50 powerboats used Auke Lake. There were 104 total lake users in both June and August while 90 users were on the lake in July (CBJ, November 14, 2007). Power craft use in Auke Lake (powerboats and jet skis combined) during the 2007 season was down in comparison to use documented by NOAA in 2003 and 2006.

During the 102 days of observations in 2007, power boats were on the lake 43% of the days compared with 62 % percent of the days between May 31 and September 9, 2003. Jet ski use was also down. The difference may be due to the different survey designs. NOAA made counts at noon, 5 pm and 7 pm daily (Moles, 2008). Between May 31 and September 9 in 2003, 143 jet skis and 84 powerboats were counted compared with 54 jet skis and 50 powerboats during the same period in 2007. In 2006 NOAA gathered data between 6/21 and 7/11 and during this time they counted 45 jet skis and 24 powerboats compared with 13 jet skis and 13 powerboats counted by the CBJ during the same time period in 2007 (Moles, 2008).

There are varying opinions by community members about the motorized use of Auke Lake. Testimony recorded at JWP's January 2008 Auke Lake Watershed Assessment's Community meeting and the 2006 CBJ assembly meetings on an Ordinance Relating to Motorized Use on Auke Lake reflects competing interests. Some people desire an outright ban on motorized use, others would like to see motorized use restricted, and some would like the city to allow increased motorized use of the lake.

7. WATERSHED CONDITION SUMMARY

The following are a summary of the findings of the current condition of the Auke Lake watershed.

- The Auke Lake watershed is a valuable recreational, aesthetic, research and habitat area for the City and Borough of Juneau. The watershed supports diverse populations of birds, mammals, fisheries, and other aquatic life. The upper reaches of the watershed remain undeveloped, drain into important salmon rearing tributaries, and are high value functioning wetlands.

- Although research shows that salmon populations are declining in Auke Lake, these changes could be attributed to regional factors such as climate change and water temperature fluctuations. Other factors that might contribute to the decline of salmon in Auke Lake is the condition of the flume and weir on Auke Creek , and lack of good salmon spawning conditions in Lake and UAJ creeks.

- Although Auke Lake and its tributaries are not considered to be 'impaired' by the State of Alaska, residents are concerned about recreational and developmental impacts on local water quality.

- Lack of clarity of management and land ownership in the watershed could be attributed to a lack of a formal agreement between the state and the CBJ on roles and responsibilities for Auke lake management decisions.

- Proposed development and stormwater runoff in the watershed poses the biggest threat to fisheries habitat and water quality in Auke Lake. Runoff from roads, streets, and ditch lines will affect water quality, if not planned for appropriately.

7.1 Recommendations for Additional Research

During the course of this assessment, JWP gathered representatives from local resource agencies to participate in the "Auke Lake Technical Advisory Group". Representatives of this group include the USFWS, NOAA/NMFS, ADFG, CBJ, the USDA Forest Service, Natural Resources Conservation Service, and others.

This group reviewed and commented on the assessment and made summary recommendations for additional research and data needed to fully understand the condition of the Auke Lake watershed. The following is a summary list of the recommendations made by this advisory group:

- Conduct invasive weed survey in the Auke Lake watershed.
- Conduct targeted bird counts for Auke Lake
- Using geomorphic and fish habitat feature data collected by stream reach, map habitat and stream channel characteristics, identifying areas critical for protection or with restoration potential
- Create maps of critical fisheries habitat areas to inform development, permitting, planning and enhancement activities
- Support continued funding of NOAA/NMFS fisheries data set
- Monitor and assess non-salmonid fish populations
- Monitor and assess invertebrate populations
- Conduct fresh water mussel survey
- Develop a long term monitoring plan to sample basic water quality parameters in Auke Lake
- Identify and map, where possible, potential contaminants, point and non-point pollution sources, including stormwater discharge sites
- Obtain funding to compile and publish past water quality monitoring data gathered by NOAA/ NMFS
- Obtain funding to compile and publish limnological studies conducted by ADF&G
- Conduct wetland delineation of upper watershed
- Assess and map locations and extents of actively eroding banks throughout the watershed
- Identify areas where stabilization or other controls are warranted to improve water quality or fish habitat

8. WATERSHED PROTECTION AND RESTORATION OPPORTUNITIES

The following is a list of goals and strategies for watershed protection and restoration opportunities for the Auke Lake watershed. This list should be not be considered exhaustive, rather it is a list of suggestions that evolved from the Auke Lake Technical Advisory Committee and from the series of community meetings conducted for this assessment.

Goal 1: Protect Wildlife Habitat and Vegetation Communities

- Conduct outreach and education to area landowners on streamside and lakeside stewardship practices in order to minimize shoreline impacts
- Work with Southeast Alaska Land Trust to identify easement or acquisition opportunities in critical habitat or passive recreation areas

- Conduct an invasive and noxious weed survey and create long term management plan for invasive weeds in the watershed
- Ensure that state and local regulations for the protection of waterfowl and other bird habitat is incorporated into local planning and development protocols

Goal 2: Maintain and Improve Auke Lake Anadromous and Resident Fish Populations and Fish Habitat

- Identify and map anadromous and resident fish habitat areas in the Auke Lake watershed
- Identify anadromous and resident fish habitat enhancement opportunities in the Auke Lake watershed
- Work with appropriate partners to improve anadromous and resident habitat in the Auke Lake watershed
- Maintain existing riparian buffers by continuing to regulate setback variances and incorporate water quality and habitat based criteria into CBJ variance criteria
- Enforce regulations and require mitigation where riparian disturbance has occurred within the 50 foot setback

Goal 3: Maintain and Improve Water Quality in the Auke Lake Watershed

- Develop and implement a long term water quality monitoring plan to sample basic water quality parameters in Auke Lake
- Work with the CBJ to encourage sewer expansion in the watershed, as development progresses
- Assess and map stormwater outfalls in the watershed
- Repair or improve existing stormwater treatment systems
- Work with contractors and developers to create Storm Water Prevention Plans (SWPPS) or storm water "Best Management Plans" (BMP's) for new development in the watershed

Goal 4: Assess and Reduce Erosion and Pollution in the Auke Lake watershed.

- Rehabilitate disturbed streambanks, riparian areas, floodplains, and uplands where feasible to increase erosion resistance
- Reduce gravel, debris, and hydrocarbon inputs from snow plowing and storage sites
- Improve parking lot on Glacier Highway to reduce sediment transport
- Work with land owners, CBJ, and appropriate agencies to reduce and prevent other forms of pollutants to the watershed and adjacent wetlands

Goal 5: Manage Auke Lake for Multiple and Sustainable Use.

- Identify and organize a diverse group of stakeholders to inform current and future management decisions within the Auke Lake watershed
- Continue to enforce CBJ motorized vehicle ordinance on Auke Lake
- Educate boaters about clean boating practices, including safe and proper fuel storage and maintenance
- Educate the public about proper garbage and litter disposal at Auke Lake
- Educate the public about the impacts of dog waste on the watershed
- Provide dog waste disposal baggies at Auke Lake

9. REFERENCES

Adamus, P., D. Beers, K. Bosworth, R. Carstensen, and K. Munk (1987) *Juneau Wetlands Functions and Values* City and Borough of Juneau, Alaska.

Alaska Department of Environmental Quality (2006) *Status of Water Quality in Auke Lake, Juneau, Alaska.*

Alaska Department of Natural Resources- Division of Land (1993) *Juneau State Land Plan*

Alaska Department of Transportation and Public Facilities (2009) *Southeast Region Pre-Construction Reports*

Bethers, M. et al (1995) *Juneau Fish Habitat Assessment.* Alaska Department of Fish and Game.

Brew, D.A. and A.B. Ford (1985) *Preliminary Reconnaissance Geologic Map of the Juneau, Taku River, Atlin, and Part of the Skagway 1:250,000 Quadrangles, Southeastern Alaska.* US Geological Survey Open File Report 85-395.

Bucaria, G.P. (1968) *Growth of Juvenile Sockeye Salmon in Auke Lake, Alaska.* MS Thesis, Fisheries, Oregon State University Corvallis, Oregon.

Carstensen, Richard. (2007) Email Correspondence.

Chandonnet, A. (2002) *Native Place Names* Juneau Empire, Sunday March 3, 2002

City and Borough of Juneau (November 14, 2007) *Agenda Assembly Lands Committee.*

City and Borough of Juneau (2001) *Area Wide Transportation Plan, Volume 1*

City and Borough of Juneau (2008) *Comprehensive Plan*

City and Borough of Juneau (1997) *Juneau Wetlands Management Plan*

City and Borough of Juneau (1994) *Juneau Wetlands Management Plan Atlas.*

City and Borough of Juneau (April 4, 2007) *Memorandum: Auke Lake Management*

City and Borough of Juneau (January 9, 2007) *Memorandum: Comprehensive Plan Update Buildable Sites Analysis and Findings.*

City and Borough of Juneau (June 1, 2006) *Minutes Special Meeting Assembly Lands Committee*

City and Borough of Juneau (June 19, 2006) *Minutes Assembly Lands Committee*

City and Borough of Juneau (May 7, 2007) *Minutes Assembly Meeting*

City and Borough of Juneau (September 24, 2007) *Minutes Assembly Meeting*

City and Borough of Juneau (1997) *Parks and Recreation Plan*

Cunningham Group (2002) *University of Alaska Campus Facilities Master Plan* University of Alaska

Elliot, S. and D. Sterritt. (1991) *Coho Salmon Studies in Southeast Alaska, 1990: Auke Lake, Chilkoot Lake, Nahlin Ruiver, and Yehring Creek.* Alaska Department of Fish and Game. Division of Sport Fish. Anchorage, Alaska.

Ferlauto and Associates, Inc. (2001) *Mendenhall Watershed Action Strategy.* Mendenhall Watershed Partnership

Fukushima, M. (1996) *Effects of Density-Dependence, Environment and Species interaction Suring Spawning and Incubation on Population Dynamics of Pink and Sockeye Salmon in the Auke Lake System, Southeast Alaska.* University of Alaska Southeast.

Hood, C., USFS (2008) Personal Communication

Hood, E. and A. Jacobs. *Unpublished data. Auke Lake Depth Measurements Taken at the University of Alaska Southeast Dock.* UAS and National Weather Service collaborative project.

Judd, N. (2008) *Five Questions with UAS Chancellor John Pugh.* Capital City Weekly Wednesday, February 20, 2008

Kramer, Chin & Mayo, Inc. (1978) *Water Supply Study, Auke Lake Campus* University of Alaska

Lowery, A. (2008) Personal communication. City and Borough of Juneau Engineering Department.

Lum, J., S. Taylor. (2006) *Dolly Varden and Cutthroat Trout Migrations at Auke Creek in 2003, and Abundance of Cutthroat Trout in Auke Lake, Southeast Alaska.* Alaska Department of Fish and Game, Divisions of Sport Fish Research and Technical Services.

Mobley, C (1992) *Cultural Resource Investigations at Auke Bay, Juneau, Alaska* National Marine Fisheries Service, National Ocean and Atmospheric Administration

Moles, A. (2007) *Status Report on 2007 Watercraft Usage and PAH Chemistry in Auke Lake.* National Oceanic and Atmospheric Administration.

Moles, A. and Marty G. D. (2005) *Physiological Changes in Prickly Sculpin (Cottus asper) Inhabiting a Lake Used by Jet-Propelled Watercraft.* Bulletin of Environmental Contamination and Toxicology, 74: 1151-1158.

Monteith, D. (2007) *Auke Lake Trail Archeological Report* University of Alaska Southeast

Nelson, B. (2008) Email Correspondence

Paustian, S. J., K. Anderson, D. Blanchet, S. Brady, M. Cropley, J. Edgington, J. Fryxell, G. Johnejack, D. Kelliher, M. Kuehn, S. Maki, R. Olson, J. Seesz, and M. Wolanek (1992) *A Channel Type Users Guide for the Tongass National Forest, Southeast Alaska.* USDA Forest Service, Alaska Region R10 Technical Paper 26.

Redman, E. (1988) *History of the Mines and Miners in the Juneau Gold Belt.*

Rice, S.D., L. Holland, and A. Moles (2008) *Seasonal Increase in Polycyclic Aromatic Hydrocarbons Related to Two Stroke Engine Use in a Small Alaskan Lake.* Journal of Lake and Reservoir Management, Vol. 24:10-17.

Taylor, S.G. (2007) Climate *Warming Causes Phenological Shift in Pink Salmon, Oncorhynchus Gorbuscha, Behavior at Auke Creek, Alaska.* Global Change Biology, 14, 229-235.

Taylor, S.G. (2008) *Auke Creek Weir 2007 Annual Report, Operations, Fish Counts, and Historical Summaries.* National Marine Fisheries Service, Auke Bay Fisheries Laboratory,

Taylor, S.G. and B.L. Wing. (2008) Interview by N. Stichert and T. Brouwer. National Marine Fisheries Service, Auke Bay Fisheries Laboratory. Juneau, AK.

Trego, T. (2008) Phone Interview by T. Brouwer.

USKH, Inc. (2004) *Auke Bay Corridor Study-Reconnaissance Study Volume I of II* The Alaska Department of Transportation & Public Facilities

U.S. Fish and Wildlife Service (2007) AK_wet_poly metadata. Vector digital data. Washington, DC.

U.S. Forest Service, Tongass National Forest (2002) Auke_streams_comp shapefile metadata. Compiled by Liz Cabrera, Petersburg, AK.

Wanger, F. (2008) Phone Interview by T. Brouwer.

Wing, B.L., M.M. Masuda, and S. G. Taylor (2006) *Time Series Analysis of Physical and Environmental Records form Auke Bay, Alaska.* U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-166.

Williams, R. (1993) *Juneau Streams- A Water Quality Study* Alaska Department of Environmental Conservation

Wing, B.L., and J. J. Pella. (1998) *Time Series Analyses of Climatologically Records from Auke Bay, Alaska.* NOAA Technical Memorandum NMFS-AFSC-91

8. APPENDICES

Appendix A: Surface Water Rights Reserved in the Auke Lake Watershed (ADNR, no date).
Locations shown are in Copper River Meridian, Township 40 South, Range 65 East. Rates are in cubic feet per second (cfs) or gallons per day (gpd).

Water Right Permittee	Status Date	Waterbody	Use Type	Location	Rate
Alaska Department of Fish and Game	1/18/2007	Auke Creek	Instream flow reservation	SW 1/4, Section 23	Ranges from 3.5 cfs (January) to 29 cfs (May)
Private landowner	8/20/1984	Auke Creek	Family dwelling	NE 1/4, Section 23	500 gpd
National Marine Fisheries Service - Auke Bay Laboratory	6/16/1970	Auke Creek	Research and domestic	SW 1/4, Section 23	1,292,634 gpd
Alaska Department of Fish and Game	6/16/1970	Auke Creek	Fish hatchery	SW 1/4, Section 23	1,292,634 gpd
Private landowner	8/23/1982	Auke Lake	Family dwelling	NE 1/4, Section 23	500 gpd
Alaska Department of Fish and Game	3/7/2007	Lake Creek	Instream flow reservation	NE 1/4, Section 14	Ranges from 1 cfs (mid-January to end of February), to 24 cfs (May to mid-June)
National Marine Fisheries Service - Auke Bay Laboratory	6/3/1970	Lake Creek	Research on raft near creek mouth	SE 1/4, Section 14	7,200 gpd
Private landowner	12/5/1983	Little Auke Creek	Family dwelling	SE 1/4, Section 14	500 gpd
Private landowner	7/9/1981	"spring;" USS2386 Lot 1 Tract 11	Family dwelling	SW 1/4, Section 23	1,000 gpd

Appendix B: Auke Lake Watershed Channel Process Types and Management Considerations (U.S. Forest Service, 2002).
Channel type information and management considerations adapted from Paustian et al., 1992).

		Management Considerations		
Process Group	Channel Type	Hydrology	Aquatic Habitat	Riparian Management
ES3 - Estuarine	Narrow large substrate estuarine channel	Low stream energy. Deposition from upstream disturbances is likely.	Spawning habitat for pink and chum salmon and Dolly Varden char, coho rearing may also occur.	Relatively stable banks with moderate susceptibility to erosion.
HC1 - High Gradient Contained	Shallowly incised muskeg channel	Steep gradient and moderate stream energy. Sediment transport systems.	Occasional use by anadromous species at confluence with lower gradient channels. Fish habitat generally limited due to high flow velocities and steep gradient.	Streambanks are generally bedrock controlled and therefore stable.
HC4 - High Gradient Contained	Deeply incised muskeg channel	Rapid sediment transport channels, often scoured to bedrock. Flow response to rain or rain-on-snow events is rapid.	Limited fish access due to high flow velocity and presence of barriers. Barrier features are present at HC4 locations on Lake Creek.	Sideslope erosion may be a concern where weathered bedrock or unconsolidated glacial parent materials are found.
HC6 - High Gradient Contained	Deeply incised mountainslope channel	Rapid response to runoff events facilitates transport of sediment from steep, unstable sideslopes.	Virtually no spawning or rearing habitat available due to high stream gradient, migration barriers, and seasonally low water.	Slopes are steep and unstable. Riparian and upland vegetation disturbance can result in mass wasting.
MC1 - Moderate Gradient Contained	Narrow shallow contained channel	Sediment transport channels with moderate stream energy. Sediment storage/ retention is minor.	Spawning gravels occur in patches, separated by bedrock/boulder substrate. Coho salmon and Dolly Varden char spawn where habitat is available, and use pools for summer rearing.	Channels are generally stable, with significant bedrock control for banks and streambed.
MC2 - Moderate Gradient Contained	Moderate with and incision, contained channel	High stream energy, sediment transport channels.	Coho salmon, steelhead, and Dolly Varden char will spawn in isolated gravel areas, and rear in pools.	Moderate channel incision depth, shallow organic soils, and steep sideslopes contribute to bank instability.
MC3 - Moderate Gradient Contained	Deeply incised contained channel	High stream energy, sediment transport systems. Common channel features include steep gradient chutes, bedrock falls, and boulder-strewn cascades.	Spawning and rearing areas are generally limited due to low gravel bed and pool frequency. Dolly Varden and steelhead overwinter in deep scour pools.	Steep sideslopes may be extremely unstable but banks may consist of more stable material such as bedrock and large boulders.

PA1 - Palustrine	Narrow placid flow channel	Discharge is somewhat influenced by associated muskeg bogs. Sediment storage likely, as stream energy is low.	Fine substrate precludes good spawning habitat. Location of this channel type on Lake Creek is upstream of barrier falls.	Streambanks are composed of dense vegetative mats that are resistant to erosion if left intact.

Appendix C: Available Water Quality Data for Auke Lake and its Tributaries.

Agency	Water Quality Parameters	Waterbody	Dates	Notes and Source
ADF&G	Temperature	Lake Creek	Sept. 04 - April 05	Water temperature only, sporadic but readings taken throughout the day during sampling, 9/2/04 through 4/21/05. May be more indicative of substrate water temperature since they drive pipes into the substrate and take temperature there. (Jarrod Sowa, ADF&G, personal communication.)
ADF&G	pH, conductivity, alkalinity, turbidity, color, nutrients, selected cations, chlorophyll, zooplankton	Auke Lake	1985-86, 1989-99	Water quality data summary only. Analysis not completed, no published data available. (Dave Barto, ADF&G, personal communication.)
CBJ	Nutrients, conductivity, turbidity, chlorophyll-a, selected cations	Auke Lake	Selected dates, August-October, 1986	Adamus et al., 1987.
AKDEC	N/A	Auke Creek, Auke Lake	12/29/2006	AKDEC list both Auke Creek and Auke Lake as Category 3 Waterbodies – Waters for which there is insufficient or no data and information to determine if any designated use is attained.
NMFS	Polycyclic aromatic hydrocarbons	Auke Lake	Seasonal sampling, 1999 and 2003	Rice et al., no date.
NMFS	Heavy metals, dissolved oxygen, fecal coliform, benzene, toluene, ethylbenzene, xylene, ammonia, biological oxygen demand, and total suspended solids	Auke Creek, Auke Lake	9/15/03 and 2/20/02	Taken to analyze the water supply for the wet lab. Lake samples taken at the intake, at 9m depth in Auke Lake. (Adam Moles, NMFS, personal communication.)
NMFS	Temperature	Auke Creek	1962-2006	Temperature and ice-out information for Auke Creek included in Taylor (2008), and Wing et al. (2006).
Oregon State University	Temperature, dissolved oxygen, clarity, turbidity, pH, alkalinity and hardness, phosphate, nitrate, selected cations	Auke Lake	1962-1964, selected dates	Water temperature taken at 1 meter intervals to 12 meters. Dissolved oxygen and water quality taken at 5 meter intervals to 20 meters. Bucaria, 1968 (MS thesis).

USGS	Temperature, selected cations, nitrate, chlorine, fluorine, dissolved solids, hardness (carbonate and noncarbonate), conductivity, pH, color	Lake Creek and Auke Creek	1966-1967 (Auke Creek), 1963-1971 (Lake Creek)	Hard copy only--not online. Daily minimum and maximum temperatures for period of record. Water quality analyses for samples taken specific dates only (Auke Creek: 12/7/67, 3/14/68, 5/29/68, 7/30/68; Lake Creek: 9/15/71).

Appendix D: Auke Lake State Land Use Designations (Juneau State Land Plan, 1993).

Area #	Area Name	DNR Designation	Description
3e17	Small Northwest portion and shore of Auke Lake	Fish and Wildlife Habitat Fish and Wildlife Harvest Recreation-Dispersed One Beach Access Point	Dolly Varden, salmon and cutthroat trout Sportfishing; Lake Creek; Little Lake Creek and one unnamed creek, current or proposed site for fisheries habitat restoration; anadromous stream mouth and lake rearing habitat.
3e18	West and Southwest portion and shore of Auke Lake	Fish and Wildlife Habitat Fish and Wildlife Harvest Recreation-Dispersed One Beach Access Point	Salmon, Dolly Varden and cutthroat trout Sportfishing; anadromous fish rearing habitat.
3e19	North portion and shore of Auke Lake	Fish and Wildlife Habitat Fish and Wildlife Harvest Recreation-Dispersed Shoreline Use-Personal Use One Beach Access Point	Salmon, Dolly Varden and cutthroat trout harvest; five anadromous stream mouths; Lake Creek and one unnamed creek, current or proposed site for fisheries habitat restoration; anadromous fish rearing habitat.
3e20	East portion and shore of Auke Lake	Fish and Wildlife Habitat Fish and Wildlife Harvest Recreation-Dispersed One Beach Access Point	Sportfishing for Chinook salmon released from pens; Dolly Varden and cutthroat trout harvest; one anadromous fish stream mouth; lake rearing habitat.
3e27	Auke Creek	Fish and Wildlife Habitat Public Facilities-Reserved	UAS facilities; weir in Auke Creek.

Appendix E. Definitions of Land Use Designations in the Auke Lake watershed (2008 CBJ Comprehensive Plan)

Natural Park Area (NP)	Natural Area Parks are CBJ-owned lands characterized by areas of natural quality designed to serve the entire community by providing fish and wildlife habitat, open space/natural areas, access to water, and opportunities for passive and dispersed recreation activities.
Recreation Service Park (RS)	Recreation Service Parks include CBJ-owned lands with parks developed for active recreation and programmed use and/or community gardens, and may be a single use or activity area.
Conservation Area (CA)	Conservation Areas consist of CBJ-owned Parks and Recreation Department-managed lands with recognized high value environmental qualities that are set aside for the protection and management of the natural environment with recreation, such as fishing, hiking and non-motorized boating, as a secondary objective.
Stream Protection Corridor (SC)	On CBJ-owned lands, a SC-Stream Protection Corridor designation serves to protect anadromous streams and their tributaries from development that could cause pollution, erosion, depletion of groundwater infiltration or otherwise could degrade the stream corridor and its biological functions. Upon first designation, a 200 foot wide corridor on both sides of the bank would be included within the designated corridor along anadromous water bodies included within the Alaska Department of Fish and Game Inventory adopted by the CBJ Assembly.
Institutional and Public Use (IPA)	Land for major public institutional uses, such as the University of Alaska, Southeast: local, state and federal government uses; and for such public facilities as schools, libraries, fire stations, treatment plants, and public sanitary landfills.
Urban Low Density Residential (ULDR)	These lands are characterized by urban or suburban residential lands with detached single- family units, duplex, cottage or bungalow housing, zero lot line dwelling units and manufactured homes on permanent foundations at densities of one to six units per acre. Any commercial development should be of a scale consistent with a single-family residential neighborhood.
Rural Dispersed Residential (RDR)	These lands are characterized by dispersed, very low density development not provided with municipal sewer or water. Densities are intended to permit one dwelling unit per acre or larger lot sizes, based on existing platting or the capability of the land to accommodate on-site septic systems and wells. Uses may also include small-scale, visitor-oriented, seasonal recreational facilities.
Resource Development (RD)	Land to be managed primarily to identify and conserve natural

	resources until specific land uses are identified and developed; minimal residential development may occur.
Recreational Resource (REC)	Land primarily under federal or state management for a range of resources, such as timber, minerals, fish and wildlife and recreation uses, including recreation cabins. Uses may include small-scale, visitor-oriented, and/or seasonal recreational facilities. These lands should be zoned to prevent residential, commercial, and industrial development.
Marine Mixed Use (M/MU)	These lands are characterized by high density residential and nonresidential land uses in areas in and around harbors and other water-dependent recreational or commercial/industrial areas. Typically, neighborhood-serving and marine-related retail, marine industrial, personal service, food and beverage services, recreational services, transit and transportation services should be allowed and encouraged, as well as medium- and high-density residential uses at densities ranging from 10 to 60 residential units per acre.
Medium Density Residential (MDR)	These lands are characterized by urban residential lands for multifamily dwelling units at densities ranging from 5 to 20 units per acre. Any commercial development should be of a scale consistent with a residential neighborhood.

Appendix F: Auke Lake Public Meeting Notes
University of Alaska Southeast, Glacier View Room, 1/15/2008

About 20 people attended a community meeting hosted by the JWP regarding the Auke Lake Watershed Assessment on January 15, 2007. Community members had an opportunity to learn more about the watershed assessment as well as voice ways they use, what they value, and the concerns they have regarding Auke Lake.

I. Community Concerns about Auke Lake

- Concern about boat launch and wayside development.
- Worried a 14 foot boat launch is a big launch for little lake with a 16 foot boat size limit. Some believe the launch ramp will have a big foot print.
- Concerned CBJ tax dollars paying for project that isn't supported.
- Some individuals believe it will also result in an increase in motorized use on the lake (including snowmobiles).
- Worried this increased use caused by the launch ramp will result in more wildlife disruption, human danger, water pollution, sedimentation, ect, as has been identified in many of the concerns related to motorized use of the lake
- Think there has been a decrease in recreational use (non-motorized) on Auke Lake.
- Can't hear yourself think (loud). Increase in noise levels.
- Human safety (it is a small lake for fast motorized craft (boat, jet ski and snowmobile). Folks aren't comfortable on lake.
- An increase in hydrocarbon levels.
- Decrease in water quality
- Oily residue on lake/gas buildups, especially along Old Glacier Highway. Not clear if it is from snowmobiles, outboards/boats, planes or highway runoff.
- No vegetation or buffer along Old Glacier Highway. Someone would like to see a 20 ft vegetated rock fill buffer along road for trail and to catch runoff.---Apparently NMFS/NOAA is very concerned about this. The area is very important for rearing salmon.
- Increase in sedimentation because of lakeside development in past ten years.
- Increase in water level due to sedimentation/outflow problems.
- Increase in boat use (motorized)—disrupt wildlife.
- Wildlife disturbance
- Geese that that flee from hunters at the Mendenhall Wildlife Refuge are disturbed.
- Increased housing density (obtained a CBJ variance for 4 units in ½ acre, much higher than normal) causes a sewer problem because septic systems only catch so much (flows downstream).
- CBJ hasn't done sufficient research on sewer (problems/solutions) in area. No public sewer system capacity left. Infrastructure not in place to provide sewer hookup.
- Decrease in aesthetics…View sheds are negatively impacted by development and lake activity.
- Decrease in fish populations.
- Decrease in numbers of birds nesting around lake resulting from increase in noise/activity on lake.
- Decrease in health of birds due to increase in noise/activity on lake.
- Increase in erosion caused by wakes.
- Impact of new trail, including floating portion of trail.
- Increase in invasive weeds (mill foil)…. Will become worse with boat launch. Concerned folks will rinse their boats in lake after using them in salt water.
- Air pollution, noise pollution, water pollution from motorized activity on lake.
- Light pollution from increased development and potential develop along lake and of wayside/launch ramp.

- One of the few no dog trails it city was along Auke Lake and it has turned into a dog trail. Dog/human use will increase when trail is improved. Fecal matter drains into lake and dogs harass wildlife.
- Violations of the CBJ variance that prohibits development within the 50 ft lakeshore setback, including building and tree cutting.
- Concern 50 ft. setback/buffer is not enough.
- Use of Spaulding meadows by snowmobiles. Some of this area drains into watershed. Snowmobilers are planning to build a cabin in watershed. Spot marked with beer cans.
- Concern use/management is not model after Greenlake in Seattle. See Greenlake as an example of a city lake where numerous users (non motorized) co-exist peacefully on and around lake. A vision for Auke Lake.
- Concern the lake is not the way it was (there is more development and motorized use), but also concern it could be much more developed and heavily used, which would increase many of the concerns identified.

II. Community Uses: Past and Current
Fly fishing
Canoeing
Kids floating around in rubber rafts
Kayaking
Gold mining
Rope swing
Hiking
Ice skating
Ice fishing
Snow shoeing
Berry picking
Rowing
Sailing
XC skiing
Viewing
Peaceful contemplation
Photography
Listening to it
UAS campus backdrop---UAS community also uses lake for outdoor recreation.
UAS marketing
Marketing of Alaska
Place to look for sticklebacks
Bird watching
Place to connect kids with nature
Float plane takeoff/landing/storage
Jet skiing
Snowmobiling
Water skiing
Motor boating
Fisheries and water quality research (NOAA/NFMS/UAF/UAS)
Fishing
Housing
Kayak lessons
Pallet Parties
Northern light viewing

Chapel by the Lake backdrop
Tourism (tour bus stop and independent traveler stop)

III. Community Values---What do you value about Auke Lake?

- "Pristine?" lake ecology.
- It is a "healthy" watershed.
- Feels like a safer lake for recreation compared with Mendenhall Lake.
- Quiet place.
- The signs CBJ put up about lake use.
- Proximity of watershed/greenbelt to road system.
- One of the few outdoor recreation spots accessible by public bus.
- It is a microcosm of what Alaskans value.
- UAS values lake----it is a way to market university.
- UAS/UAF value it for the outdoor, environmental and fisheries educational opportunities.
- Valued by UAS as a backdrop and area to recreate.
- The diversity of uses.
- Being able to walk around it.
- It as a home for some (or all of Juneau).
- Being able to take kayak lessons in warmer water.
- Being able to watch the lake turn texture as the seasons/weather changes.
- The sound the ice makes.
- A place to watch the seasons change.
- Proximity of trees to lake.
- You can still see the glacier.
- A place to market Alaska.
- It is a spiritual place (Chapel by the Lake).
- Cultural importance (drumming by the lake).
- Historical importance.
- Area valued by Alaska Natives. Historically used the lake.
- Community use through time, including fox farming.
- A great place to grow up.

Appendix G: Auke Lake Watershed Assessment Community Survey Results

What activities do you do at Auke Lake? (i.e. fishing, boating, hiking, ice skating)
1: Kayaking, swimming, ice skating, cross country skiing, hiking the trail, walking on the frozen lake under the stars at night.
2: Swimming, canoeing, rowing, kayaking, ice skating, x-country skiing, snowshoeing, sitting on the beach, watching wildlife.
3: Kayak, ice skate, swim, ski, dog walks/swims.
4: Fishing, boating, hiking, ice skating, etc., kayaking, and activities sponsored by UAS.
5: Ice skating, canoeing
6: hiking, canoeing, skiing, watching aurora and waterfowl, contemplate beauty. Ice fishing, fly fishing, ice skating.
7: As a resident I don't indulge in the above. I just enjoy living on this beautiful quiet lake.

What do you like about Auke Lake?
1: Beauty, peacefulness, watching wildlife (otter, beaver, swans, ducks).
2: I like the forest shore, the waterfowl migration, the view, the times when it is quiet, the things one can see when paddling around, the walking, skating and skiing when the lake is frozen.
3.: Location, proximity to home, university connection, not crowded in winter only (compared to say twin lakes).
4.: Protected from SE winds and highway noise/dust, size, neighborhood, flora and fauna, that it is a part of a fresh water system on the road system in Juneau.
5: Its beauty from the dining room table or out on the deck.
6: Beauty, diversity of activities. I used to enjoy the bounty of waterfowl.
7: The beauty, serenity and proximity to shopping, church and friends good neighbors who cherish this lake as much as we do.

What, if any, are your concerns regarding Auke Lake, and the future of Auke Lake?
1: Too many motorized vehicles on such a small lake. Safety concerns are many particularly after dark (walking on frozen snow w/ a snowmachine coming toward me at 50 mph is scary). Also the decrease in wildlife on the lake many fewer ducklings than we had years ago.
2: I am concerned about the lake's capacity to handle increasing motorized traffic, particularly jet skis and the noise and pollution that goes with them. Something should be done to minimize activity during waterfowl migrations (peak period).
3: Biggest concern is continued pollution and effects on fish and wildlife and thence damage to long term studies at the Auke Creek weir.
4: Dogs on leash only-How can dogs swim with a leash on? Is that dock safe? Water quality? Connection to other water bodies.
5: Auke Lake is a "common" asset…open to many people, many uses. As such, limitations to non-motorized activity on the lake are logical such that this "common" area is not degraded.
6: Noise and hydrocarbon pollution. Loss of waterfowl families. Loss of otter and beaver activity on south end of lake.
7: The lack of loons nesting on the lake and less geese.
8: Concerns: Inordinate amount of noisy traffic on the lake especially in the summer because of high speed motor craft.
9. Future of Auke Lake: Maintain the quiet beauty of this lovely little lake that can be enjoyed by residents.

What changes, if any, would you like to see at Auke Lake?
1: Limit the size of motorized vehicles. Motorized vehicles off limits after sunset and during quiet times of 9 pm-9 am. No 2 stroke engines. No boat launch.

2: No jet skis, no motorboats during the fall and spring, complete the trail project with lakes waysides for hikers.
3. Drop the boat launch plan.
4: Winter maintenance ideally. Groomed trails and mopping for ice and night lights. Back to no-leash rule.
5: Remove the boat launch facility at Auke Creek and allow/construct only non-motorized boat entrance to the lake at a logical place on the lake. (i.e. kayaks, small row boats-boats that an individual person could carry). Take steps to make it a lake where only non-motorized vehicles are permitted.
6: When we moved onto the Lake in 1973, we were told it was a non-motorized lake. Its quiet beauty was the base of property values. Through the last 15 years, motorized use has continued to increase the noise making many evenings uncomfortable to converse in our home. I would ask that if motors are allowed on the lake that the city would consider restricting it to electric as many communities have on small urban lakes. This would reduce noise and hydrocarbons in the lake.
7: Make it a non motorized lake.
8: Limit or ban the use of high speed motor craft on the lake. The lake is too small to be used as a speedway for noisy water craft.

Other specific comments about Auke Lake and the Auke Lake Watershed
1: Don't stock with fish. Don't turn Auke Lake into another Twin Lakes Disney land.
2: We support improvements and regulations that reduce human impact on Auke Lake. Are the homes on Auke Lake using the municipal sewage system rather than septic systems?
3: I am concerned that a launch ramp will increase/encourage snow machine traffic, eliminating the cross country skiing and snowshoeing so many Juneauites love.