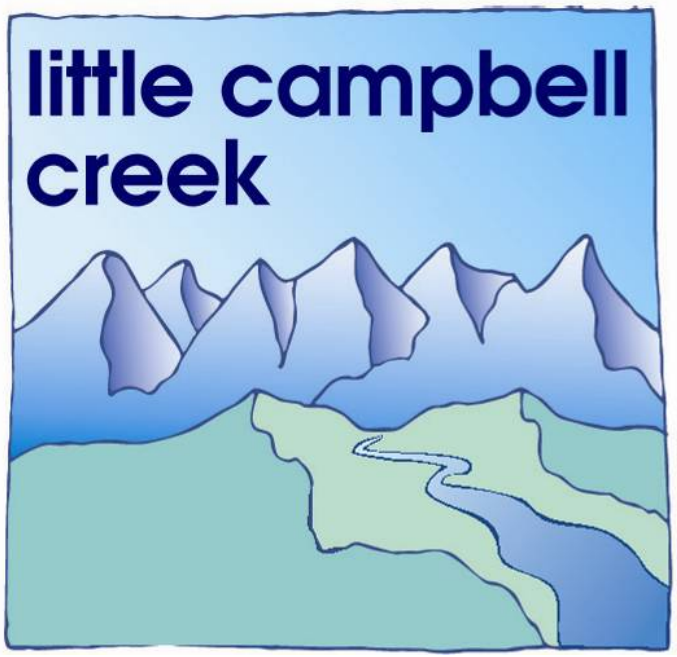

WATERSHED MANAGEMENT PLAN

December 2007

Table of Contents

List of Figures

List of Tables

Executive Summary

The Little Campbell Creek (LCC) Watershed is home to about 20,000 Anchorage residents and many businesses. It encompasses almost 19 square miles and contains 24 miles of stream habitat. The watershed supports a diversity of fish and wildlife species, and hosts numerous recreational opportunities. Coho and Chinook juveniles are the main salmon species that use the watershed for rearing habitat, although multiple fish passage issues decrease available habitat. Almost one-quarter of the watershed is parks and open space; residential and commercial density tends to be concentrated in the western or downstream areas, mainly in the North Fork and Lower Little Campbell drainages. These two drainages contain 40-65% impervious area, and untreated runoff from these parking lots, roads, and buildings significantly affects stream health. Many businesses and residences in these two drainages are also subject to flooding and icing hazards, either by loss of adjacent wetland area or existing constrictions. Water flow varies dramatically, with some areas experiencing no flow at certain times of the year. Water quality is of concern, especially during snowmelt or rain events.

The LCC is an impaired waterbody listed by the State, a classification that requires measures to maintain and restore the creek's water quality and functions. Recently documented fish kills and water quality and quantity issues have initiated concern as to the health of the watershed and also the productive fishery and recreationally important Campbell Creek.

The *Little Campbell Creek Watershed Management Plan* is a policy document meant to assist and guide the Municipality and the community in decision-making throughout the watershed. The plan describes the area's resources, addresses social and environmental issues that the watershed faces, and identifies implementation strategies that are beneficial to the watershed as a whole.

This Plan was created as a cooperative effort between Municipal Watershed Management Services (WMS) and a planning team comprised of water and biological resource experts from ten federal, state, and local agencies and nonprofits. Community input from flyers, website, and community councils were solicited to support the planning team with plan development. The Plan's vision, mission and goals, and prioritized projects are all based on this community participation.

Planning committee discussion, analysis, and characterization of available data, and current studies within the watershed lead to development of a prioritized list of projects intended to restore, preserve, or enhance the watershed. This list is the essence of the Plan's implementation and includes projects for each of the Plan's specific goals: water quality and quantity, terrestrial and aquatic habitat, recreational and economic opportunities, communication and coordination, open space and data acquisition. The recommended projects:

- Increase fish and small animal passage between habitats throughout the watershed
- Significantly decrease flood hazards for local businesses and residents
- Initiate preservation actions for important undeveloped areas near the creek
- Recommend stormwater entering the creek be treated to Municipal design criteria for all existing and future drainage projects to improve water quality and quantity
- Increase watershed management, public access, and awareness
- Increase our understanding of the watershed

The plan is expected to guide watershed planning and management efforts for the next ten years. It has widespread agency, community, and funding support. This Plan will also serve as a template for future watershed plans throughout the Municipality.

Acknowledgements

The *LLC Watershed Management Plan* was developed through a collaborative effort with help from the following individuals and agencies:

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1 Introduction

The LCC Watershed is composed of the land area and waterbodies that drain to the LCC. This area is home to about 20,000 residents[1] and many businesses. The watershed supports a wide range of fish and wildlife species from salmon to bears. Almost one quarter of the land area within the watershed is devoted to parks and open spaces, which are mainly located in the mid-to upper watershed. Some of these areas support trails for running, hiking, biking, skiing, and horseback riding.

The LCC suffers from a multitude of problems that harm the creek's biotic community, limit recreational and economic opportunities, and impair the aesthetic qualities of the watershed. Degraded water quality and quantity, loss of natural productivity, biodiversity, and important habitats are concerns for the entire watershed, especially the western portion. Even though much of the mid to upper watershed is designated as open space, there are few publicly-owned access points to the creek. Predominantly in the lower portion of the watershed, development has encroached upon creek-side habitat, and flood hazards are significant for local businesses.

The *LCC Watershed Management Plan* is a tool to help planners, scientists, and community members make decisions that will slow further declines in the health and ecological functions of the LCC and begin to restore it to a healthy, vibrant watershed. The plan describes the area's resources, addresses social and environmental issues that the watershed faces, and identifies implementation strategies that are beneficial to the watershed as a whole.

Regulations and Plans

A number of existing regulations and plans specifically call for watershed plans in Anchorage.

- In February 2001, the Municipality of Anchorage (MOA) adopted the *Anchorage 2020 Anchorage Bowl Comprehensive Plan* (*Anchorage 2020*), which is a guide for development. *Anchorage 2020* emphasizes the need for watershed management plans. It states, "[w]ater resources and land use planning shall be integrated through the development of watershed plans for Anchorage streams." This *LCC Watershed Management Plan* is written to meet the goals detailed in *Anchorage 2020*.
- MOA's National Pollutant Discharge Elimination System (NPDES) storm water permit which regulates storm water runoff requires planning. The NPDES states that watershed planning can help control pollution and minimize water quality problems. The permit also states that MOA "…shall evaluate new land use policies to reduce urban runoff pollution."

[1] MOA Planning Department.

- The *Anchorage Bowl Park, Natural Resource, and Recreation Facility Plan*. Park Strategy 7 refers to Stewardship of Natural Resources (p. 50-51). Both short-term and long-term strategies mirror the Implementation Plan elements of the *LLC Watershed Management Plan*.
- The LCC is listed on the State of Alaska's Category 4a List of Impaired Waterbodies for fecal coliform pollution.[2]
- Title 18, Chapter 70 of the Alaska Administrative Code provides standards for water quality that must be maintained in Alaska.
- Anchorage Municipal Code, including Title 21, Title 17, and Title 24, outlines regulations related to land use, including setback areas for stream protection, water quality protection, pollution, and construction requirements.

Taylor Starr-Enyard, 2nd grade, Taku Elementary

Importance of Watershed Planning

Watershed planning is essential for many reasons. An effective plan will:

- Supply guidance for balancing the environmental, social, and economic needs of the watershed
- Provide implementation strategies that will optimize future projects
- Facilitate compliance with federal, state, and local regulations
- Help secure funding for watershed projects
- Save time and money by identifying priority project

[2] ADEC, 2006. *Alaska's Final 2006 Integrated Water Quality Monitoring and Assessment Report*. p.49

2 Creation of the Plan

The *LCC Watershed Management Plan* was developed through a process that integrated data collection and analyses, literature review, and agency and public participation. Since the early 1960s, the MOA and other agencies have collected data on characteristics and changes in the LCC watershed. In the fall of 2005, the Anchorage Daily News reported that a large number of fish kills were observed in the LCC Watershed. Concurrently, a report prepared by the US Fish and Wildlife Service for the Great Land Trust described opportunities to restore the functions and values of LCC. Informed by the news article and the report, resource agencies and members of the public requested that the Municipality of Anchorage work with them to further evaluate and address the fish kill issue. The Municipal Watershed Task Force held a series of scoping meetings in January through April of 2006 to explore opportunities for restoring LCC. These initial efforts led to the creation of a planning team, coordinated by MOA WMS, charged with developing a watershed plan for LCC.

Agency Involvement

MOA Watershed Management Services (WMS) embarked on this effort with help from a planning team comprised of water resource experts from federal, state, and local agencies. The planning team and subcommittees first met in May 2006 and continued to meet throughout plan development. The team has been an integral component to make the plan a success. The Anchorage Watershed Task Force will review the yearly progress report of the plan's implementation to ensure that the plan is put into action.

The planning team is made up of representatives from the following agencies:

- Alaska Department of Environmental Conservation (ADEC)
- Alaska Department of Fish and Game (ADF&G)
- Alaska Department of Natural Resources, Office of Habitat Management and Permitting (DNR, OHMP)
- Anchorage Waterways Council (AWC)
- Bureau of Land Management (BLM)
- Municipality of Anchorage (MOA)
- National Oceanic & Atmospheric Administration (NOAA)
- U.S. Army Corps of Engineers (US ACOE)
- U.S. Environmental Protection Agency (US EPA)
- U.S. Fish and Wildlife Service (US FWS)

Community Involvement

Community input was gathered to support the planning team as they developed the plan. Community input was used to help set the plan's vision, mission and goals, and to prioritize projects. Stakeholders who contributed to this effort included representatives from the following organizations:

Desiah Patterson, 2nd grade, Taku Elementary

- Alaska Center for the Environment
- Alaska Fly Fishers
- Alaska Zoo
- Anchorage Waterways Council
- Churches
- Community Councils
- Equestrian Groups
- Friends of Far North Bicentennial Park
- Home Builders
- Homeowner Associations
- Knik Canoers and Kayakers
- Local Businesses
- Realtors
- Residents/Property Owners within the LCC Watershed
- Schools
- Tribal Groups
- University of Alaska Anchorage Environmental and Natural Resource Institute

A variety of outreach activities were undertaken to involve the public during the LCC Watershed planning process.

Community Council Meetings	Presentations on the watershed plan were conducted in 2006/2007 to introduce the process and gain input on problems from the community. All councils within the watershed were contacted and presentations were made by WMS and/or AWC.
Salmon in the City Festival	A public presentation was conducted in August, 2007 discussing the planning process and current projects in LCC as part of the Salmon in the City Festival. The Festival brochure included the watershed plan and 2,000 brochures were distributed at the festival, along with 25,000 as inserts in the Anchorage Press.
Postcards	Over 10,000 postcards about the *LCC Watershed Management Plan* were mailed to residences within the watershed boundary.
E-mails	About 200 stakeholders identified by the AWC as interested in LCC, and by the BLM as interested in Far North Bicentennial Park, were e-mailed information on the watershed plan.
Website	A plan website, www.littlecampbellcreek.com, was created to help keep the community informed about the watershed plan.
Public Meetings	Information about the *LCC Watershed Management Plan* was presented at community council meetings within the watershed.
Survey	In April 2007, a survey was conducted to gather public input on watershed issues and the plan. 300 people completed a phone version of the survey, and 41 people completed a written version.

Vision, Mission and Goals

The planning team, with direction from community input, determined a vision, mission, and goals to direct the watershed plan.

Vision

The *LCC Watershed Management Plan* provides management guidance for restoring a healthy watershed that will consist of a network of natural fish and wildlife habitat, residential neighborhoods, and commercial areas that benefit aesthetic, economic, and recreational aspects, and overall quality of life for Anchorage's residents. The waterways within this watershed should provide clean water and healthy habitat for recreation and aquatic life. This vision will be realized and preserved through the adoption and implementation of the goals of the *LCC Watershed Management Plan*.

Mission

The mission of the *LCC Watershed Management Plan* is to provide recommendations for promoting watershed awareness and encourage active stewardship by residents and businesses that improves watershed health, meets regulatory requirements and is supported by the community. The *LCC Watershed Management Plan* has identified a suite of implementation strategies to maintain and improve the future condition of the LCC Watershed. Goals and implementation strategies listed in this plan are meant to protect existing watershed functions and values while facilitating the recovery of degraded watershed conditions. The *LCC Watershed Management Plan* is an affordable and effective tool developed with input from residents and stakeholders, state and federal agencies, and local organizations.

Goals

Water Quality	Improve overall water quality in LCC and prevent further degradation.
Water Quantity	Ensure adequate flows are maintained to support aquatic life. Reduce the potential impacts of stormwater and flood events and maintain and improve creek function.
Terrestrial Habitat	Maintain and expand wildlife corridors and riparian habitat within the watershed.
Aquatic Habitat	Improve and maintain fish passage and channel habitat to support all life cycles of fish in the watershed.
Recreational and Economic Opportunities	Promote compatible development, recreation, and economic opportunities along LCC and throughout the watershed.
Communication and Coordination.	Promote watershed awareness and community stewardship for a healthy watershed.
Open Space	Protect and maintain lands that support healthy watershed functions and services.
Data Acquisition	Identify data gaps in watershed and create programs to obtain that data.

3 Watershed Characterization

The LCC is one of three subwatersheds that make up the Campbell Creek Watershed. This characterization of the LCC subwatershed includes summary information ranging from geographical and physical characteristics to land use and biotic quality. References for this information should be utilized to obtain more detailed information. References are archived at MOA WMS and can be requested for public review by contacting them.

Location and Watershed Features

The LCC Watershed extends from the mainstem of Campbell Creek between C Street and the Old Seward highway, north of East 76th Avenue, to above Glen Alps Drive (Figure 3.1). The watershed consists of approximately 12,000 acres. An estimated 6,900 acres is contained within the municipal boundaries and the remaining portion lies within Chugach State Park or BLM lands.[3] Water flows to the main stem of the LCC from its north and south forks. These forks are fed by a number of tributary drainages. The LCC Watershed is broken into five distinct drainages (Figure 3.1): [4]

- Lower LCC
- North Fork LCC
- Upper LCC
- Craig Creek
- South Campbell Tract

The LCC is the largest tributary to Campbell Creek, which drains to Campbell Lake and into Turnagain Arm. The LCC is 23.7 miles long and descends from its headwaters at 2,600 feet in the Chugach Mountains to its confluence with Campbell Creek at about 100 feet above sea level.[5] Figure 3.2 shows stream miles by drainage. Creek width is quite small compared to Campbell Creek, ranging from 8 feet wide near the confluence with Campbell Creek to only 1 to 2 feet wide near the headwaters.

Two lakes are located in the watershed: Lake of the Hills, a run-of-the creek lake in Upper LCC drainage, and Hideaway Lake (a closed basin lake in the Craig Creek drainage area).

[3] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

[4] MOA, 2007. *MOA Design Criteria Manual* and MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005.*

[5] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

Figure 3.1. Watershed Delineation

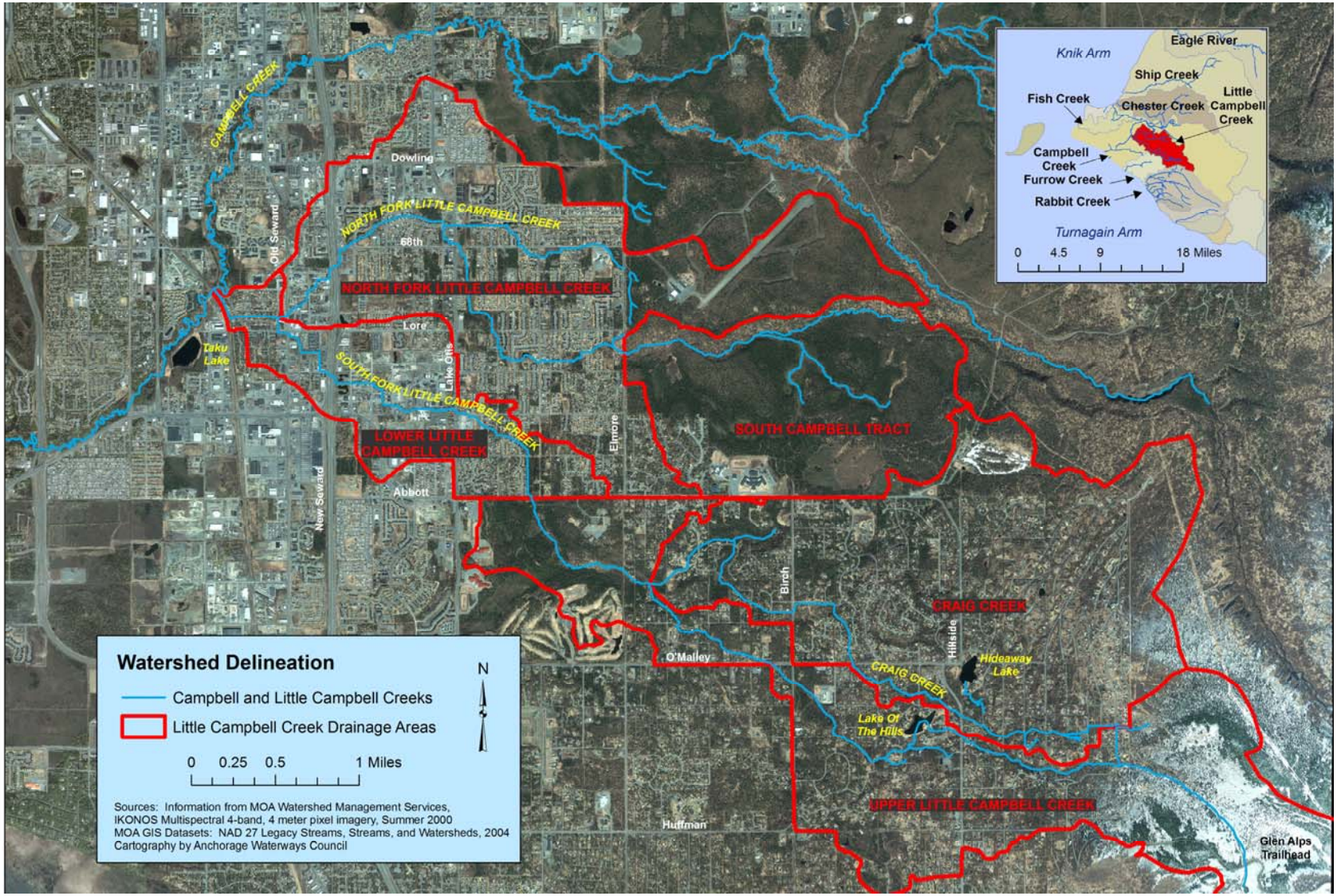
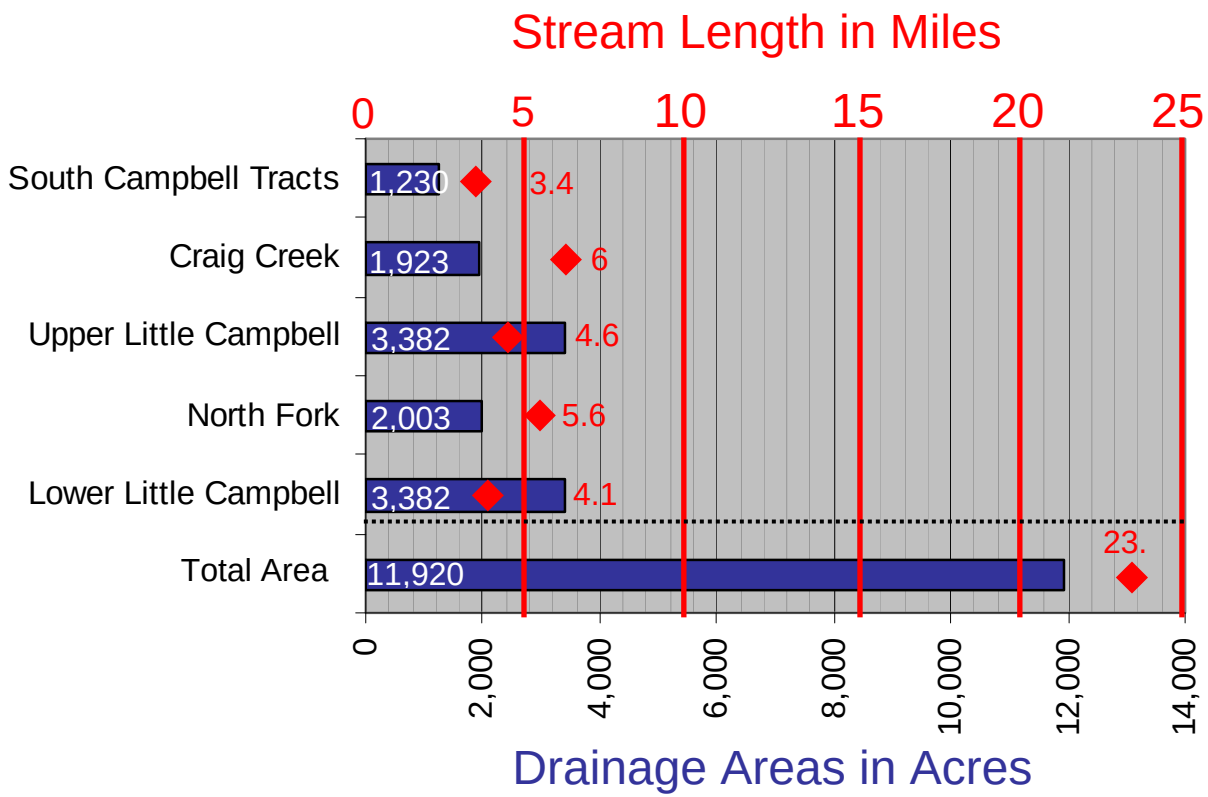


Figure 3.2. Drainage Area and Stream Length within the LCC Watershed



Climate and Soils

The MOA has conducted analyses of climate for watershed planning and stormwater management, the results of which are incorporated within the MOA Design Criteria Manual. [6] Climate variation within the LCC watershed is significant, with temperature and precipitation changing dramatically with elevation gain. For example, municipal design criteria compensated for precipitation intensity variation by elevation using a multiplication factor up to 2.0 times the precipitation intensity that falls at the Anchorage airport compared to the upper reaches of the LCC. [7] Winter snowfall and lower temperatures can stay up to a month longer at elevations above 1,000 feet. Climate summaries are available from various sources such as the National Weather Service in Anchorage.

From its headwaters, the creek flows through various landscape features of glacial origin before reaching its confluence with Campbell Creek. Soil type in the LCC Watershed is dominated by historic glacial processes. In the eastern section of the watershed where the creek flows down the foothills of the Chugach range, thin layers of soil cover bedrock. In the lowlands to the west, soils can be deeper than 30 feet. Some aspects of soil are:

- The headwaters of the South Fork are located in an area of glacial moraine. Here, surface material consists of a mix of sand, gravel, silt, clay, and boulders that were deposited by glaciers.
- The headwaters of the North Fork and the main stem of the South Fork drain through alluvial and outwash materials. Here, sand and gravel dominate with finer material mixed in.
- Craig Creek drains through an alluvial fan made up of sand and gravel. Water easily percolates through such materials.
- The lower reaches of the creek drain through historic lacustrine and estuarine materials made mostly of silts and clays. These materials have low permeability, making it hard for water to drain through them.[8]

The upper portions of the watershed above Abbott and Elmore Road are steeper in gradient, while the lower portions below Abbott and Abbott Loop Road have gentler slopes, typically less than 3%. More than 90% of the watershed has less than a 12% slope. [9]

[6] MOA, 2007. *MOA Design Criteria Manual*.

[7] MOA, 2007. *MOA Design Criteria Manual*.

[8] Dilley, Lorie and Thomas. 2000. *Guidebook to Geology of Anchorage, Alaska*. Publication Consultants.

[9] Ott Water Engineers, Inc 1983. *Little Campbell Creek Drainage Study*. Prepared for the MOA Department of Public Works.

Land Use and Population

As shown in Table 3.1, the dominant land use in the watershed is residential development, followed by parks and open space. While almost one-quarter of the watershed is parks and open space, residential and commercial density tends to be concentrated in the western or downstream areas of the watershed, mainly in the North Fork and Lower Little Campbell Drainages. The lower reaches of LCC downstream of Abbott Road and Abbott Loop Road are urbanized with many homes, roads, shops, businesses, and some light industrial areas. In this urbanized area there are many tracts of ditched and piped conveyances and few dedicated public green spaces.[10]

Table 3.1. Land Use in the LCC Watershed [11]

Land Use	Area (acres)	Percent of total
Residential	3,074.3	36 %
Parks and Open Space	1,948.5	23 %
Vacant	1,450.3	17 %
Rights of Way & Transportation	1,030.2	12 %
Institutional	634.7	7 %
Industrial	226.7	3 %
Commercial	172.9	2 %
Total	**8,537.6**	**100%**

Historic creek modifications resulted from development, and an estimate of where this took place can be seen in Figure 3.3, which shows current stream delineations (MOA stream delineations) and historic stream lines as interpreted from USGS topographic maps from 1962 with 1965 revisions at 1:25,000 scale. Care must be used when determining changes between the years because of the differences in scales or resolution drawn. Some of the larger changes can be determined; however, such as shrinkage of stream miles, straightening of the channel and channel relocation. Note that some changes to the stream (straightening and relocation) had already occurred by 1962 when the USGS published their map.

[10] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

[11] MOA, 2004. *MOA GIS LandUse Shapefiles as interpreted by: ADEC 2004. TMDL for Fecal Coliform in the Waters of Little Campbell Creek in Anchorage, Alaska.*

The Bureau of Land Management Campbell Tract, Ruth Arcand Park, and Far North Bicentennial Park make up much of the headwaters of the North Fork and the middle of the South Fork. The reaches above Elmore Road are dedicated parkland while the reaches above Abbott Road consist of Ruth Arcand Park and single family homes on large lots until reaching the Chugach State Park (Figure 3.4). Figure 3.5 illustrates land use within 100 feet of the creeks and highlights how the creek has been encroached upon in the lower part of the watershed.

Hailey Edmisten, 2nd grade, Taku Elementary

About 7% of the Anchorage population lives within the LCC Watershed.[12] Most of these residents live in the developed areas north of Abbott Road and between the New Seward Highway and Abbott Loop Road. The 2% of land use that is commercial tends to concentrate along the western end of the watershed area. The watershed also contains large portions of park area. The middle portion of the watershed is surrounded by the Bureau of Land Management's Campbell Tract, Ruth Arcand Park, and Bicentennial Park. The upper portion of the watershed is located in Chugach State Park.

[12] US Census 2000. *Census from 2000 data shapefiles as interpreted by: ADEC 2004. TMDL for Fecal Coliform in the Waters of Little Campbell Creek in Anchorage, Alaska.*

Figure 3.3. Historic Comparison

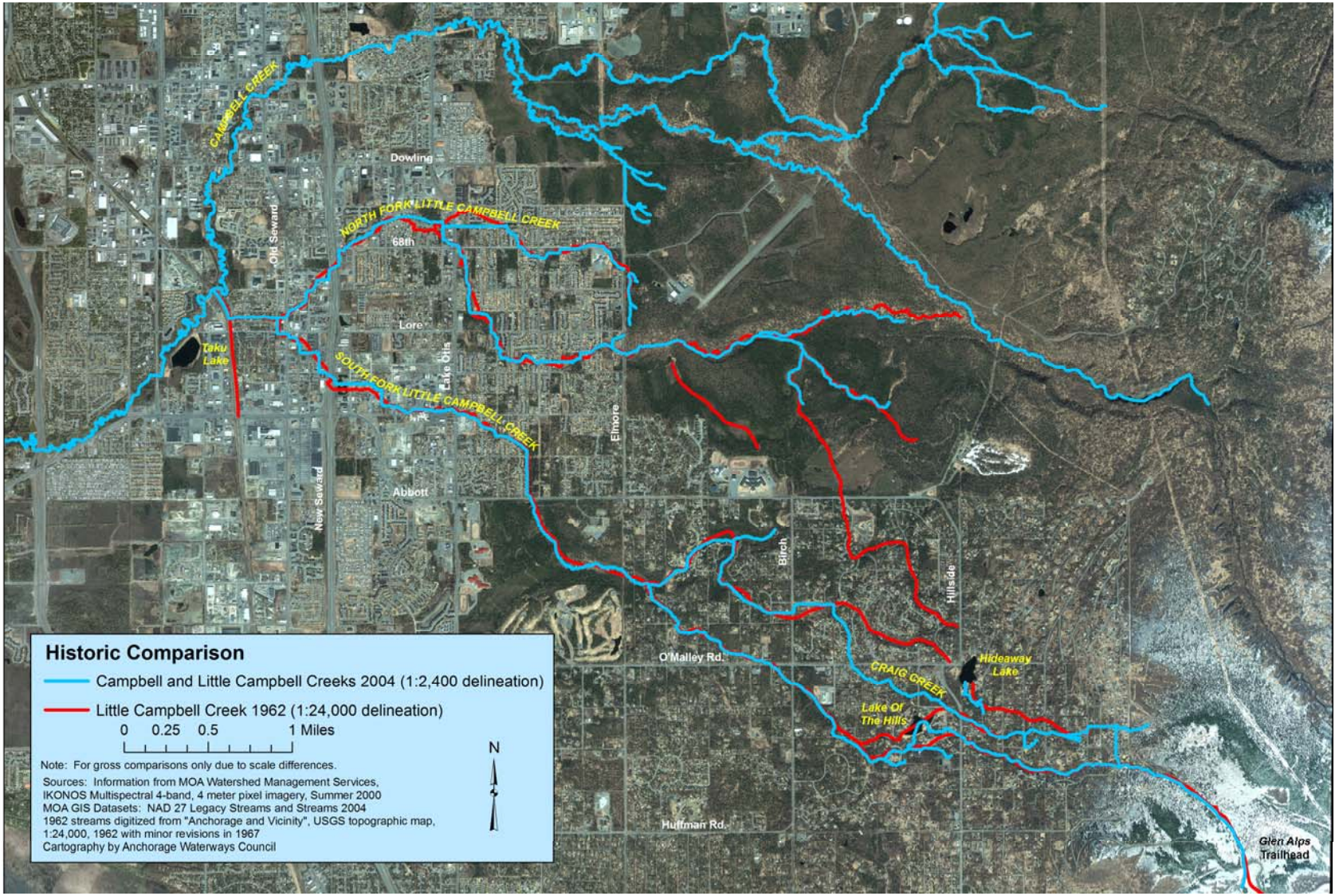


Figure 3.4. Landuse – 2004

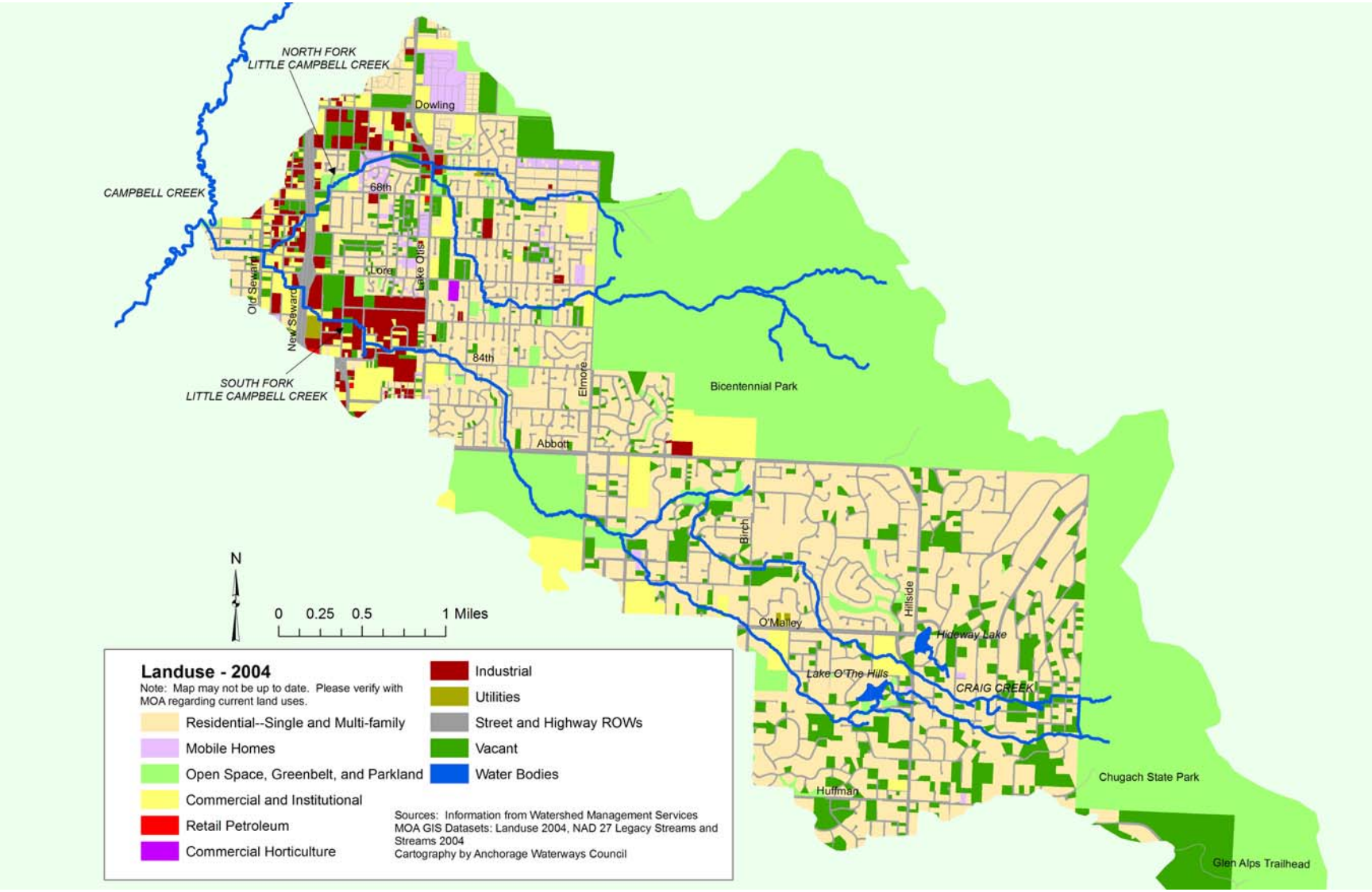
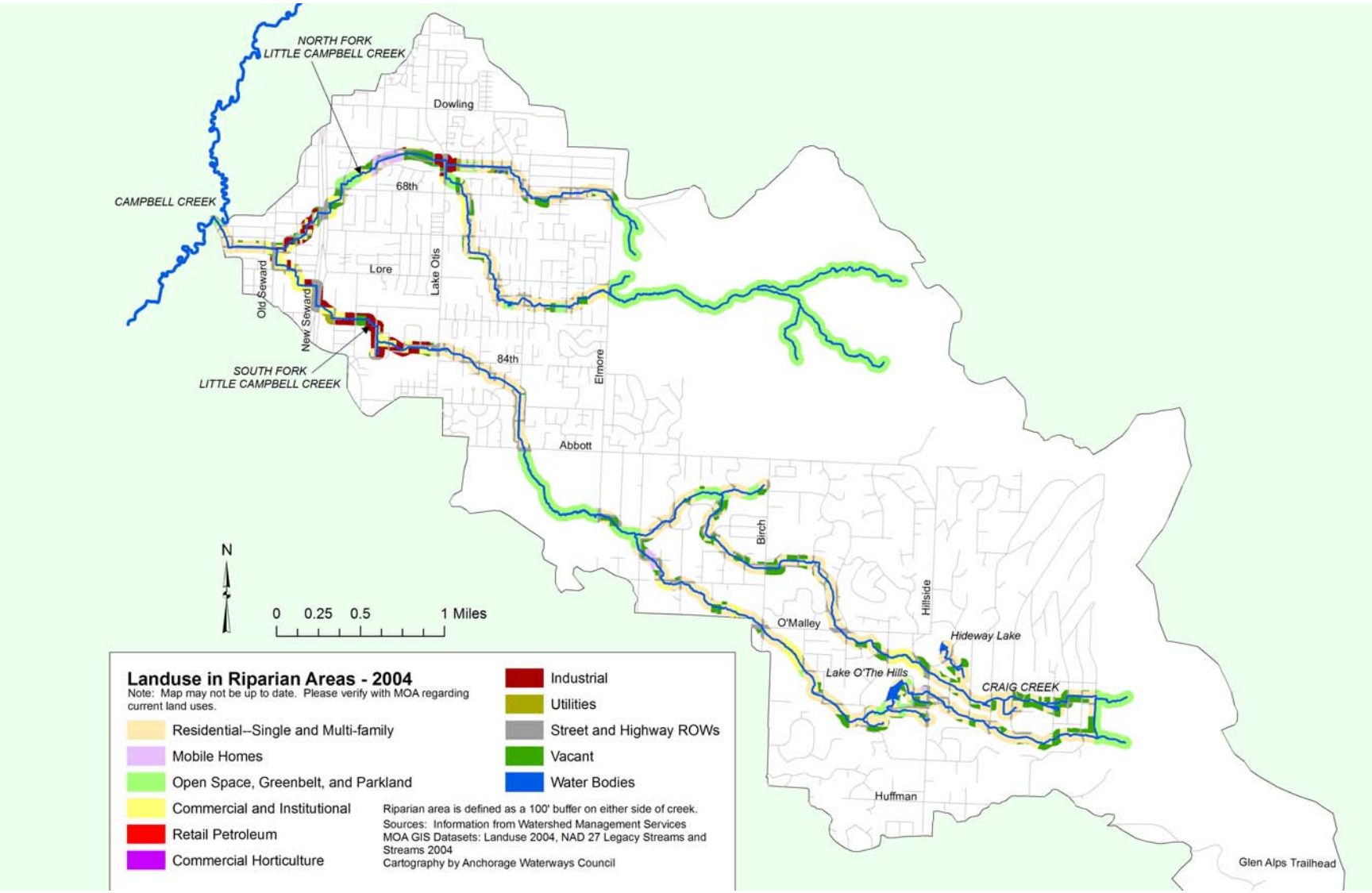


Figure 3.5. Landuse in Riparian Areas - 2004



Impervious Surfaces and Stormwater

Impervious surface mapping for the LCC watershed has been performed within the municipal management boundary for Lower LCC and two of the most developed drainages.[13] When looked at as a whole, approximately 23% of the entire LCC watershed is impervious (i.e. paved). Lawns make up 12% of the total watershed area, while 64% is undeveloped, the result of a large amount of the drainage area occurring within Bicentennial Park.

Table 3.2 and Figure 3.6 show the distribution by drainage area. The western portion of the watershed is the most developed portion, and almost all historic wetlands have now been filled for development in this area. Fill is often 10 feet thick or more over these historic wetlands.[14] Note that the Lower Little Campbell Drainage has 59% impervious surface, while the North Fork Drainage has 35%. These percentages are above the "highly impacted" impervious surface cover found nationally to be non-supporting. Non-supporting in this context recognizes that pre-development channel stability and biodiversity cannot be fully maintained, even when stormwater retrofits are applied.[15]

Table 3.2. Impervious Percent by Drainage Area

Item	Lower LCC	North Fork LCC	Upper LCC	South Campbell Tracts	Craig Creek
Impervious (Streets)	13%	10%	ND	ND	ND
Impervious (Buildings, Parking Lots, Driveways, Other)	46%	20%	ND	ND	ND
Total Impervious	59%	35%	ND	ND	ND
Pervious (Lawns/Landscaped/Dirt Parking Lots)	16%	21%	ND	ND	ND
Pervious (wetlands, undeveloped areas, open space)	25%	44%	ND	ND	ND
Total Pervious	41%	65%	ND	ND	ND
TOTAL AREA	3381 acres	2,003 acres	3382 acres	1230 acres	1923 acres

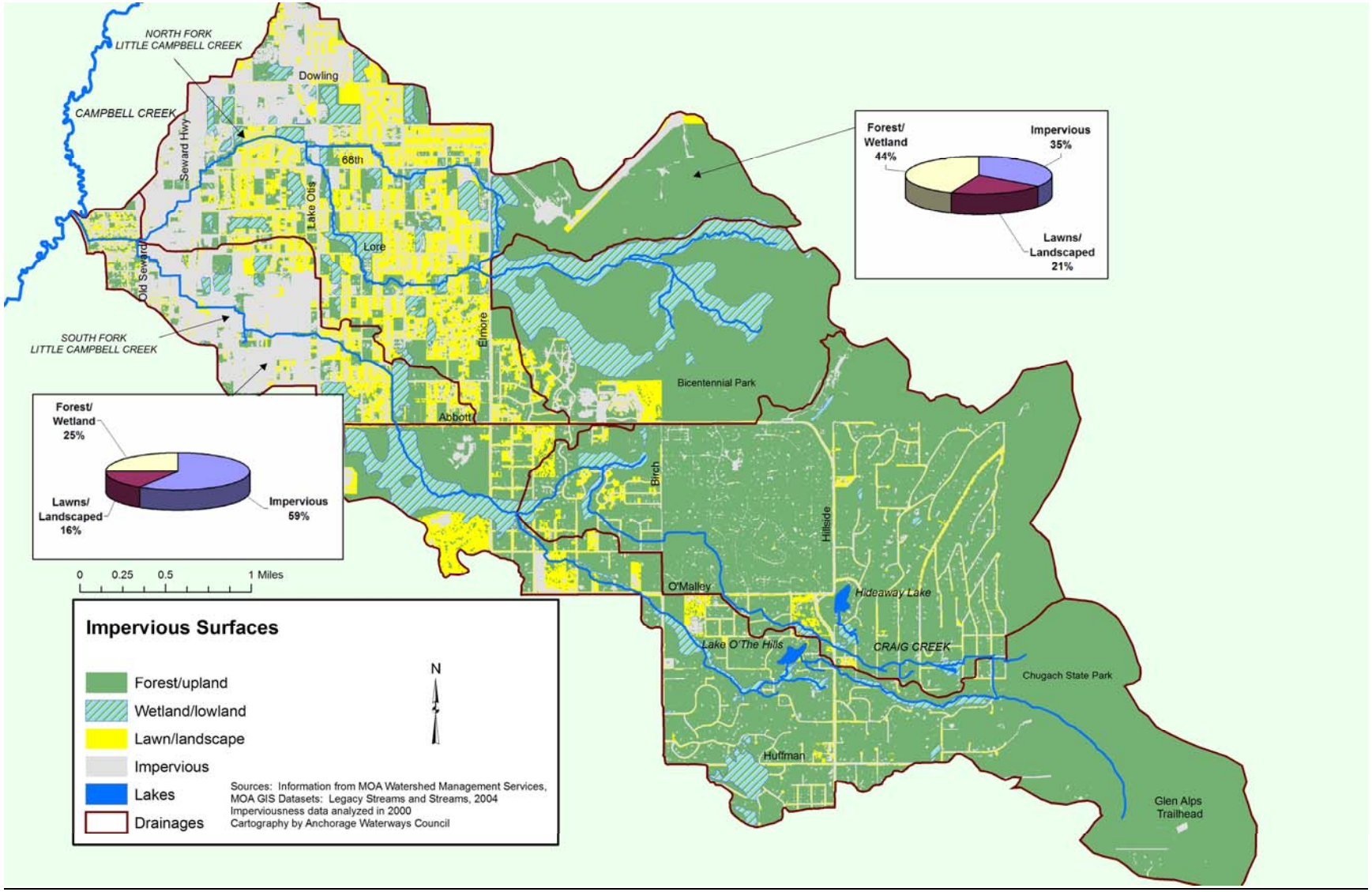
Note: ND means no data available or analyzed for Upper LCC, South Campbell Tracts, and Craig Creek Drainages.

[13] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

[14] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

[15] CWP, 2000. *The Importance of Imperviousness. Watershed Protection Techniques* 1(3): 100-111 *in* The Practice of Watershed Protection. Article 1. Center for Watershed Protection. 700 pp.

Figure 3.6. Impervious Surfaces



Mariah Lind, 8th grade, Polaris

The Lower Little Campbell and North Fork drainages are dominated by impervious surfaces resulting from a high density of streets, and residential and commercial land uses. Residential lots are typically small, greatly increasing the potential for direct connection of impervious surfaces (buildings, driveways, and parking lots) present on the lots. Almost all runoff is conveyed by piped storm systems within these two drainages, which discharge directly to the LCC. Figure 3.7 shows the existing stormwater system, individual subdrainage areas of the system, and remnant wetland areas. Locations where the stormwater system does not exist are ditched. Figure 3.8 also shows locations of the sedimentation ponds and their drainage areas.

The Craig Creek and Upper LCC drainages are dominated by low-density residential land uses. Residential lots are typically large and are drained almost exclusively by ditches. The South Campbell Tract drainage is undeveloped. For further information, reference MOA's *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005.*

Figure 3.9 shows MOA floods hazard areas as currently mapped in the watershed. Many areas are prone to flooding, and many areas still need to be mapped. Developed areas especially prone to flooding are apparent on the east and west side of the New Seward Highway to Lake Otis Parkway. In other areas, undeveloped land is flooded, which attenuates the flows for developed areas.

Figure 3.7. Stormwater Infrastructure

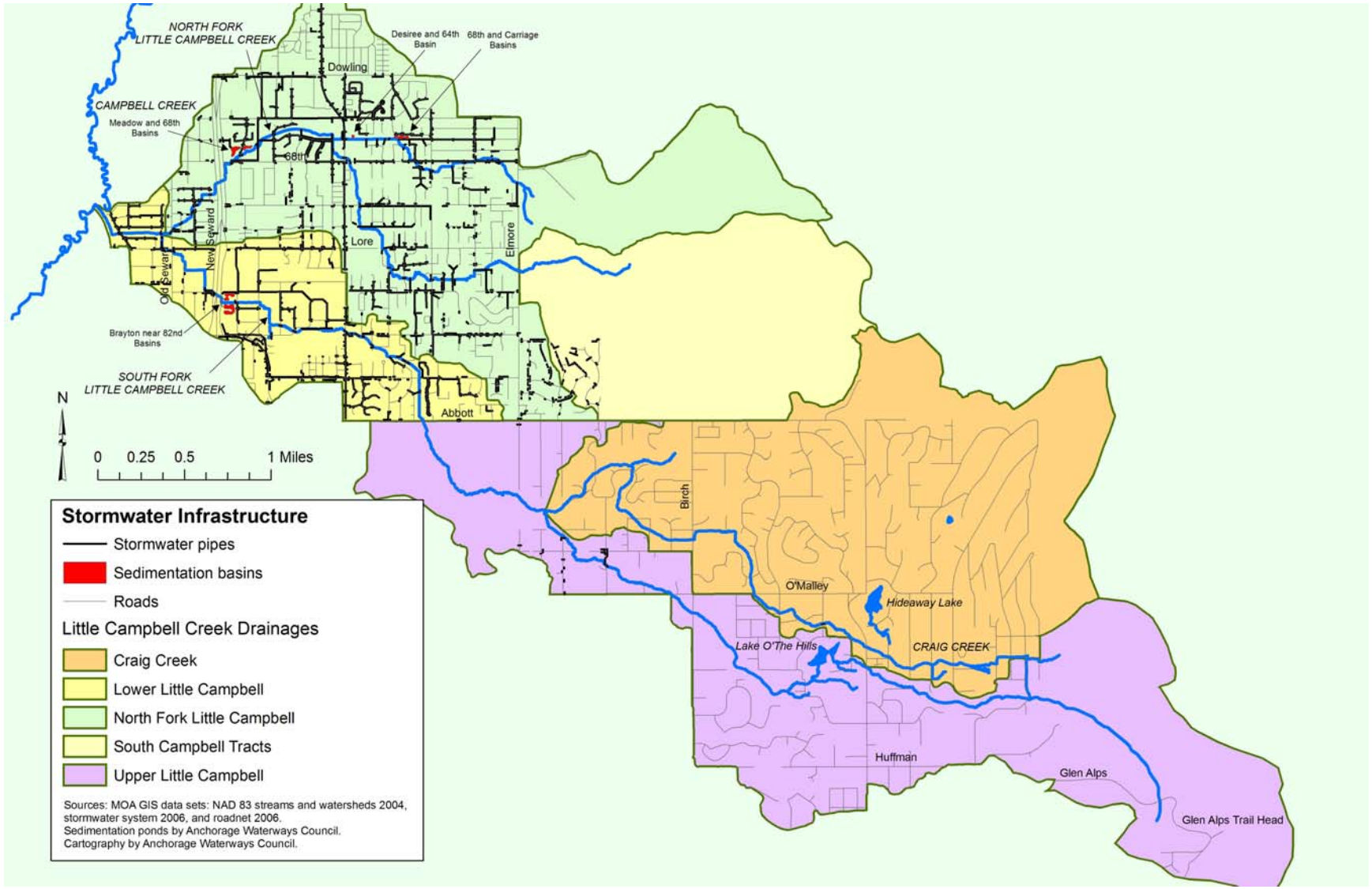


Figure 3.8. Sedimentation Ponds and Contributing Drainage Areas

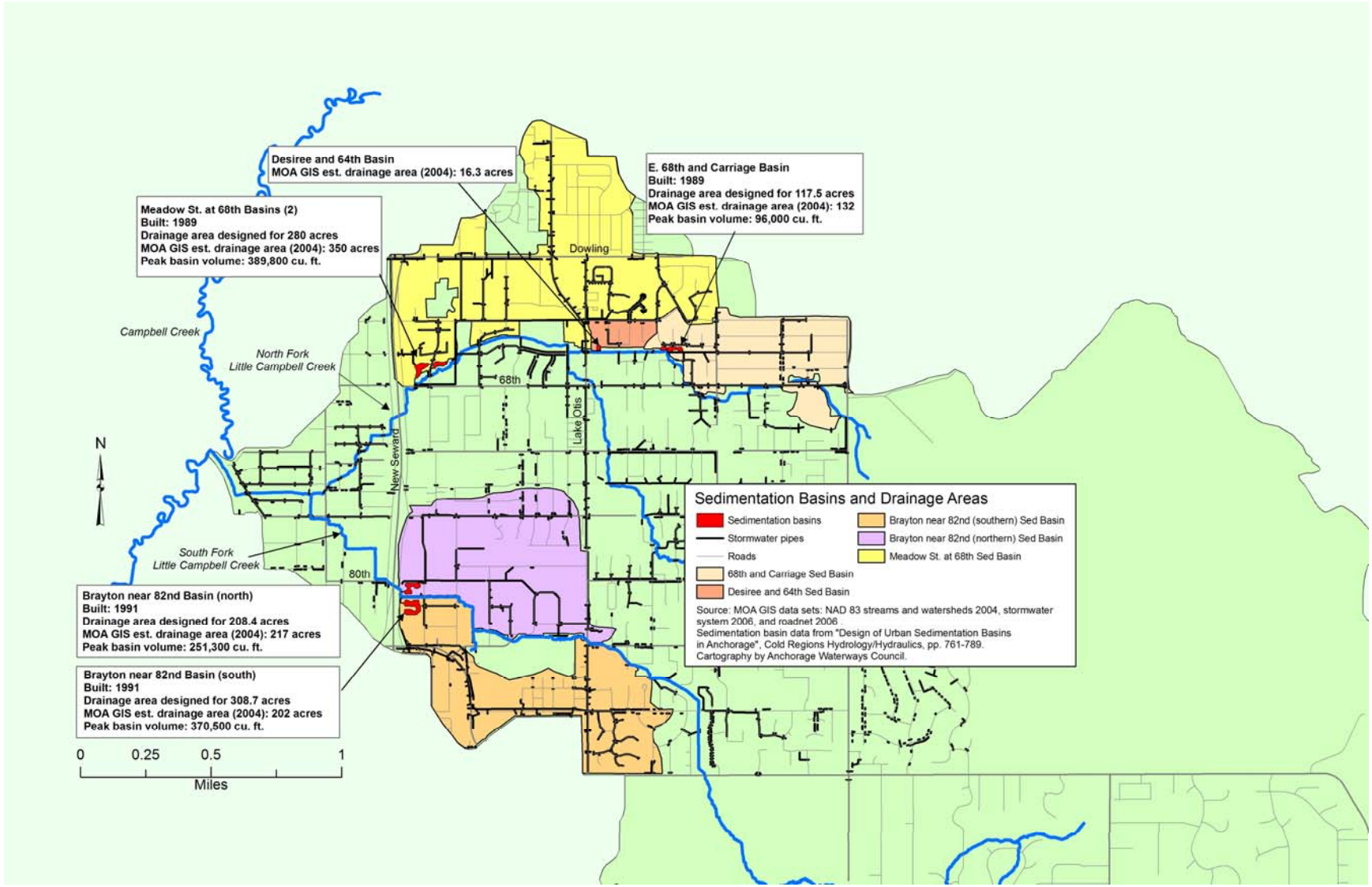
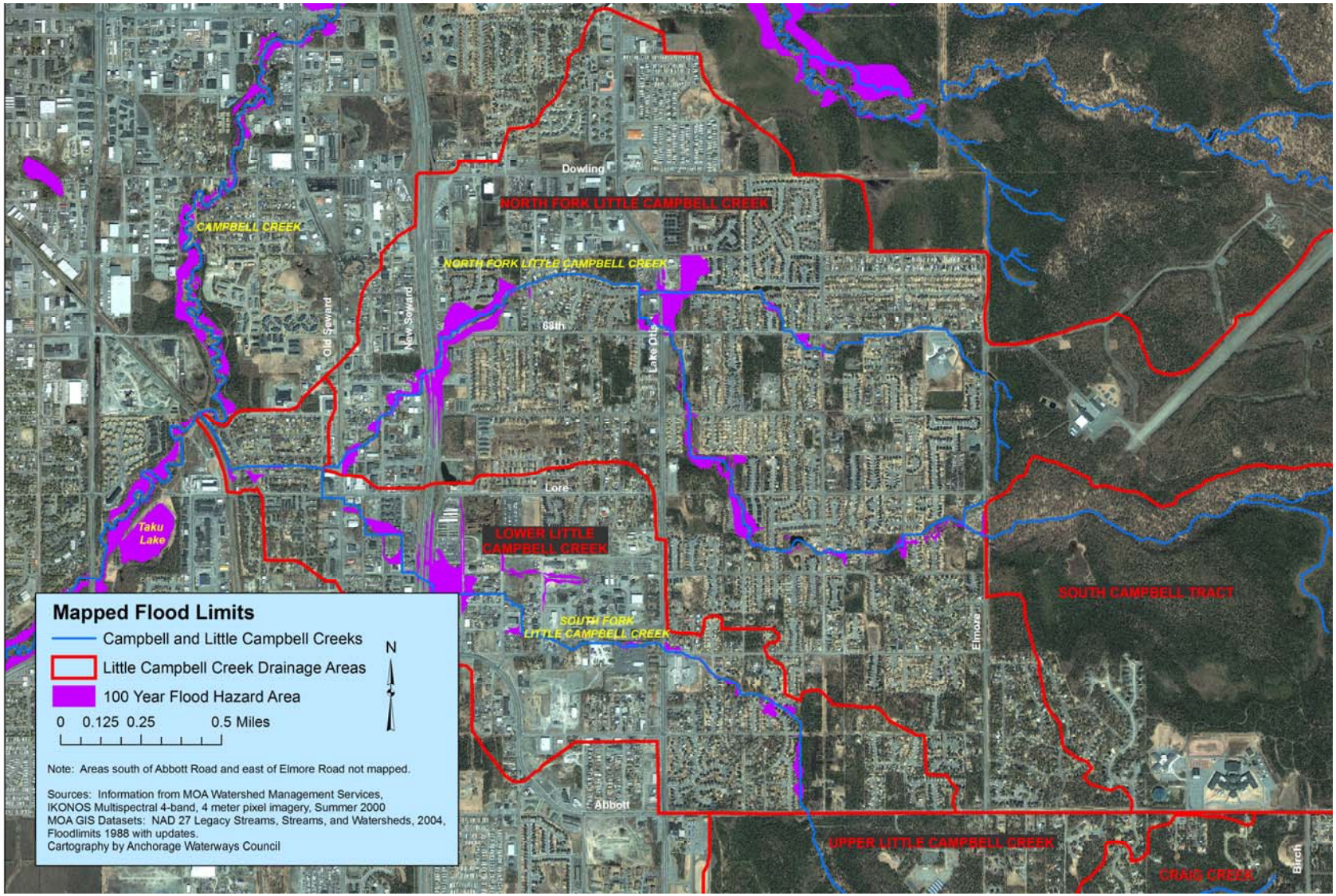


Figure 3.9. Mapped Flood Limits



Hydrology and Water Quantity

The LCC is the largest tributary of Campbell Creek, with about one-third of the contributing area of the Campbell Creek watershed. The stream gradient is relatively steep in its upper reaches, but flattens considerably in lower reaches.[16] Current flood hazard mapping is available for currently mapped areas, but the user is cautioned to obtain the most recent information from the Municipal Flood Hazard Program (Figure 3.9). Stream flow in the LCC varies on a seasonal basis. During winter, stream flow is sustained by groundwater that seeps into the creek.[17] There are several areas of the creeks that are prone to frequent icing, and MOA maintenance staff documents these areas for regular maintenance. Snowmelt in the mountains, beginning in May and continuing through summer, contributes considerably to flow. Flow declines throughout summer until rainfall in July and August increase flows. Some areas of the creek are prone to frequent icing. Base flow occurs during the frozen winter months and summer months. Figure 3.10 is an estimation of the water during the year in 2007 and shows some of the seasonal variation, and Figure 3.11 shows USGS flow data for the mouth of the watershed.

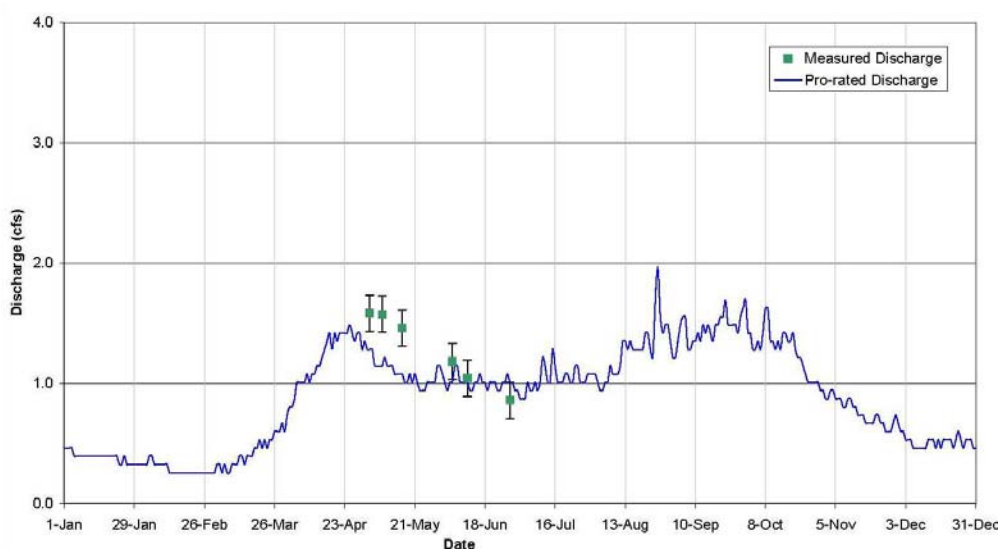
Currently, there are no instream flow reservations for aquatic habitat, and no water withdrawals permitted within the LCC. [18]

[16] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

[17] Ott Water Engineers, Inc 1983. *Little Campbell Creek Drainage Study*. Prepared for the MOA Department of Public Works.

[18] ADNR, Division of Mining, Land and Water. 2007. Water rights and temporary use authorizations website. Accessed December 17, 2007.

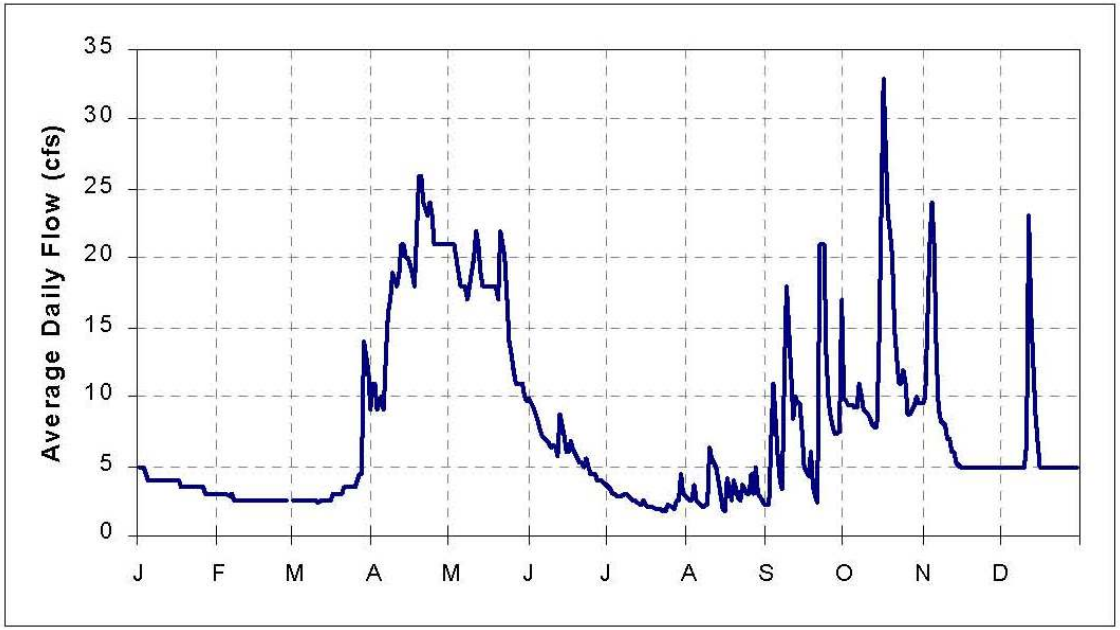
Figure 3.10. Estimated Annual Hydrograph for the LCC, Station 1NF-AL east of Elmore Road[19]



1) Pro-rated discharge was obtained by applying a correction factor to the mean daily mean discharge for Chester Creek USGS Station 15275100 period of record 1967-2006.
2) These are provisional data.

[19] MOA WMS, 2007. *Little Campbell Creek Hydrology Study and Identification of Sediment Sources in Little Campbell Creek Grant No. ACWA 07-01*.

Figure 3.11. Average daily stream flow at USGS gage 15274550, LCC at Nathan Drive (10/1/89-9/30/90)[20]



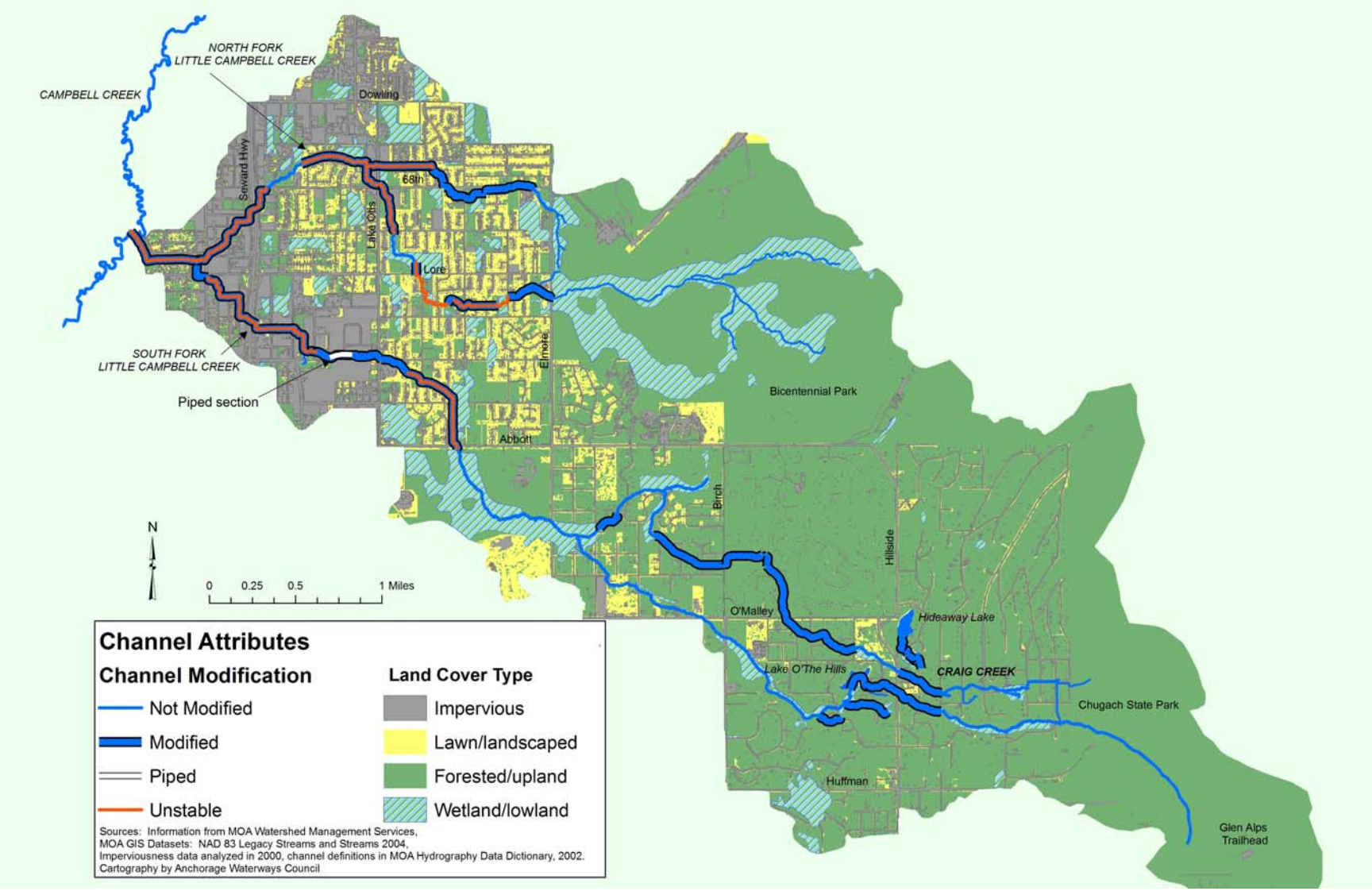
Channel Modifications

The Little Campbell Creek has been modified by urbanization, and Figure 3.3 can be used to see some of the larger estimated changes to the streams that have occurred over the past 70 years using comparisons from historic USGS topographic maps. Figure 3.12 shows where the channel has been documented as modified, unstable or piped and gives a more accurate account of what has happened over the years, as documented by MOA. Using MOA data, over half of the current creek length in the watershed has been modified in some way by development.[21]

[20] ADEC, 2004. *Total Maximum Daily Load for Fecal Coliform in the Waters of Little Campbell Creek in Anchorage, Alaska*. p.9.

[21] MOA, 2004. Municipal shapefiles for watersheds, streams, wetlands, etc. and MOA Data Dictionary GIS-based online at http://wms.geonorth.com/library/LibraryData.aspx

Figure 3.12. Channel Attributes



Biology and Vegetation

The LCC watershed contains many of the mammals and birds typical of Anchorage. As these animals move through the watershed, they encounter roads and developments where there are conflicts and vehicular collisions. Providing corridors for these animals is important to maintain population numbers and to reduce accidents. Some information on these corridors is provided in MOA's *Anchorage Watershed Catalogue Series—Campbell Creek* (2003), MOA's *Living with Wildlife* planning documents and maps, MOA Parks Planning documents for natural open space, and *Technical Report on Significant Open Space in the Anchorage Bowl: A Survey of Biologically Important Habitat and Areas Identified As Important to the Anchorage Community* (GLT 2000), all available at MOA Planning Department.

Coho (silver), Chinook (king), and sockeye (red) salmon have been documented in the LCC, and five species of Pacific salmon have been documented in Campbell Creek. [22] The other two salmon species may inhabit the lower part of the watershed intermittently, as they are found in Campbell Creek. Other fish found in both creeks include wild Dolly Varden, wild and hatchery rainbow trout, stickleback, and sculpin. Blackfish, an invasive species, has been documented in the creek. In 2000, pike were found in the western, lower sections of the LCC, but have not been documented since. [23]

The LCC is an important rearing area for the Campbell Creek watershed. While small numbers of adult coho salmon have been found to spawn in the lower LCC in recent years, these small numbers would not account for the number of juveniles observed throughout the summers. Consequency, many juvenile salmon are believed to originate from wild salmon spawning in Campbell Creek. The LCC appears to have habitats more favorable to rearing coho and Chinook salmon and, as a result, the LCC is an important rearing area for them and is critical in maintaining the wild population of coho salmon for the entire Campbell Creek watershed.

About 3,800 coho salmon return to Campbell Creek each year, and about 1,200 of these are caught by anglers. Campbell Creek also hosts an annual run of about 1,000 Chinook salmon, all of which are wild (not hatchery) fish. About 1,200 sockeye salmon also spawn in Campbell Creek. Adults from five species of salmon may spawn in the lower portions of the LCC, with emergent pink and chum salmon fry outmigrating to the open ocean in the spring. Young juvenile sockeye salmon likely migrate downstream to rear in Campbell Lake. Only juvenile coho and Chinook salmon have been documented in the LCC where they may rear for 1-3 years; however, one sockeye juvenile was documented in the 2006 study.[24] ADF&G coded wired tagged surveys show that the average

[22] Bosch, Dan, 2007. Personal Communication between Dan Bosch (ADF&G) and David Wigglesworth (MOA) for interpretive sign fabrication along Campbell Creek.

[23] MOA WMS, 2003. *Anchorage Watershed Catalogue Series—Campbell Creek, Document Number APg03005*.

[24] Project COHO (Community Outreach and Habitat Operation). 2006. A partnership between NOAA, USFWS, MOA, and AWC. Funding from NOAA Fisheries Community Habitat Protection Partnership (CHPPs) Project #1.

commercial harvest of stocked coho in Campbell Creek between 1992 and 2001 was over 3,000 fish annually, and ranged between 700 to 8,500 fish a year. [25]

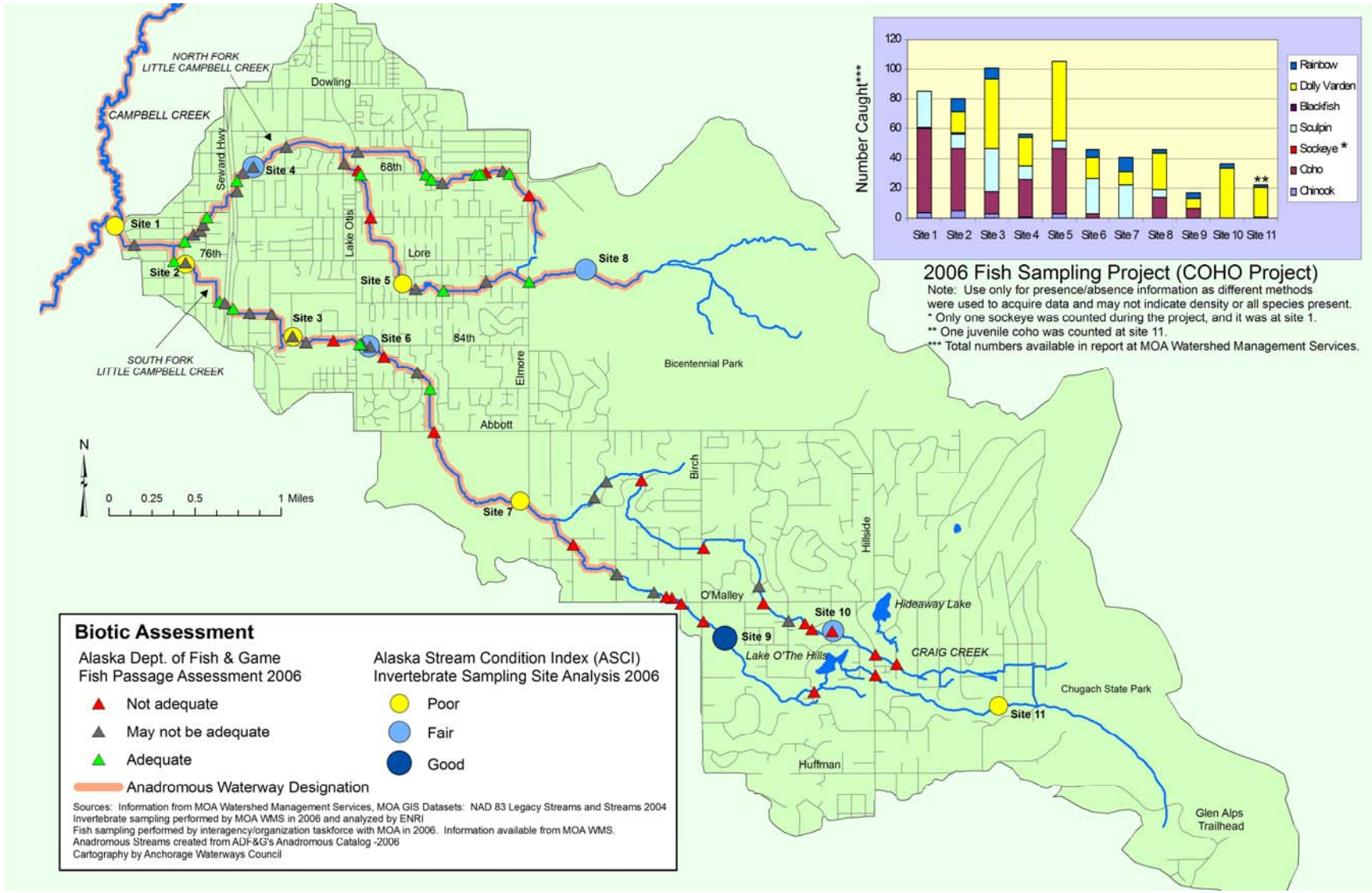
Information on fish and invertebrates from an assessment study in 2006 has been compiled in Figure 3.10. [26] Although the 2006 study was not set up for quantitative estimates, the results do show multiple species of fish, including rainbow trout, Dolly Varden char, blackfish, sculpin, sockeye, coho and Chinook juveniles, though not all species present may have caught at each site. Dolly Varden char were also documented in the high, upstream reaches of all drainages to the borders of Chugach State Park, including Craig Creek, which had not been previously documented. Two observations of coho salmon juveniles upstream of the existing extents of anadromous salmon documentation by ADF&G were documented and need formal application to the anadromous catalog. The invertebrate assessment resulted in Alaska Stream Condition Indexes (ASCI) of mainly fair to poor, generally showing degrading ecological condition from upstream to downstream sites. Further discussion of the ASCI index of the sites is found under the Water Quality section of this report.

Figure 3.10 also contains an ADF&G culvert inventory of potential barriers to salmon juveniles that can be used to further prioritize restoration and protection opportunities. There are sixty-five culverts within the LCC that were analyzed for fish passage. Seventeen culverts were considered not to have fish passage issues, while forty-eight culverts were determined to likely have some kind of fish passage issue.

[25] Bosch and Evens, 2006. Estimates of Commercial Sport Harvest and Escapement in 1999-2001 of Coho Salmon Stocked into Northern Cook Inlet Streams in 1998-2000. Fishery Data Series 06-25 Alaska Department of Fish and Game. 57 pp.

[26] Project COHO (Community Outreach and Habitat Operation). 2006. A partnership between NOAA, USFWS, MOA, and AWC. Funding from NOAA Fisheries Community Habitat Protection Partnership (CHPPs) Project #1.

Figure 3.13. Biotic Assessment



Vegetation in the LCC Watershed varies with elevation, soil type, aspect, water table level, and drainage. Mixed coniferous (needleleaf) and deciduous (broadleaf) forests dominate the well-drained soils in the upper reaches of the eastern part of the watershed. Wetlands were commonly found in the more poorly drained lowland areas to the west, but few remnant wetlands are still present, mainly along creeks. These wetlands have been delineated and documented in the Anchorage Wetlands Atlas, 2003, as well as in Municipal GIS shapefiles.[27]

Channel Habitat

An overview study of the LCC, called Project Community Outreach and Habitat Operation (COHO), was performed to gain information on the habitat present and used by macroinvertebrate and juvenile fish populations. Habitat quality at Project COHO sites were evaluated to give an indication of overall channel habitat present with the watershed. Overhanging vegetation (13% overall median observed) and undercut banks (3.5% median observed) were the most prevalent forms of habitat cover. Large and small woody debris constituted less than 2% of the observed habitat cover each. No deep pools, boulders, or in-stream vegetation were recorded. Limited side channels were recorded. The canopy cover median value of observed reaches was 10-20%. Spawning gravel was only located in isolated pockets. Mature forest or wetlands dominated the riparian areas, and large woody debris, while not a significant habitat cover, was a significant, but not dominant, geomorphic influence at most sites.[28] Values indicate a low amount of overhanging vegetation and canopy to provide shading, as is natural for wetland creeks in Southcentral Alaska, but highlight the importance of keeping what is present for riparian area to provide healthy habitat in the small stream environment.

Water Quality

Various studies have been performed in the past on the LCC. A study done by the U.S. Geological Service (USGS) in 1983 concluded that the LCC can be responsible for 10% to 50% of the flow in Campbell Creek. The same study found that much of the time from 50% to 100% of the suspended sediment load in Campbell Creek is contributed by the LCC.[29] Pollutant loads have been correlated to suspended sediment loads in Campbell Creek.[30] The 1983 USGS study also concluded that from 50% to 100% of fecal coliform loading in Campbell Creek is attributable to discharges from the LCC. To date, no comparisons have been performed with a reference watershed to compare sediment loads to undeveloped conditions.

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[27] MOA, 2004. Municipal shapefiles for watersheds, streams, wetlands, etc. GIS-based online at http://wms.geonorth.com/library/LibraryData.aspx

[28] Project COHO (Community Outreach and Habitat Operation). 2006. A partnership between NOAA, USFWS, MOA, and AWC. Funding from NOAA Fisheries Community Habitat Protection Partnership (CHPPs) Project #1.

[29] USGS, 1983. *Surface Water Quality in the Campbell Creek Basin, Anchorage, Alaska, Water Resources Investigations Report 83-4096.*

[30] James M. Montgomery, 1987. *Enhanced Monitoring of Little Campbell Creek, Project Work Request No. 3 Final Report for the MOA.*

More recently, limited turbidity sampling was performed in association with documented fish kills.[31] Higher turbidity levels and fish kills were associated with storm events. The fish kills were observed within the more developed and commercial areas west of Lake Otis Parkway. The cause of the fish kills is currently unknown.

Invertebrate information within the 2006 Project COHO study was used to produce an ASCI index to indicate the water quality, shown on Figure 3.10. The assessment found one study site of good quality (Site 9), while most were poor or fair. The poor results were consistent in the lower part of the watershed (downstream of Abbott and Abbot Loop Roads) with a past MOA study. [32] The undeveloped reference site at Bicentennial Park was documented as fair, and was in a natural peat bed and banks wetland portion of the creek, which may not naturally have the conditions to support invertebrates that result in a "good" score.

The State of Alaska included the LCC on the State Section 303(d) impaired waterbody list since 1990 for non-attainment of the State fecal coliform standard (AK 20401-017). Currently, no other impairment is noted by the State. A Total Maximum Daily Load (TMDL) for fecal coliform bacteria was developed and approved by EPA in March, 2004 and Table 3.3 summarizes the results.

Table 3.3. Results of Fecal Coliform Bacteria Total Maximum Daily Load Analyses

Season	Existing Load (colonies(FC)/season)	Loading Capacity (FC/season)	MOS (FC/season) (Margin of Safety)	Wasteload Allocation (FC/season)	Percent Reduction (for Wasteload Allocation)
Winter	3.43E+11	1.32E+11	1.32E+10	1.19E+11	65%
Spring	1.02E+12	2.39E+11	2.39E+10	2.15E+11	79%
Summer	3.08E+13	6.51E+11	6.51E+10	5.86E+11	98%
Total (FC/yr)	3.22E+13	1.02E+12	1.02E+11	9.20E+11	97%

[31] Schroeder, Mark, 2005. *Turbidity Monitoring in Little Campbell Creek, Summer 2005*.and Frequency and Distribution of Fish Kills in Little Campbell Creek, U.S. Fish and Wildlife Service. Anchorage Field Office.

[32] MOA WMS, 2000. *Anchorage Bugalogue*.

The LCC is now listed on the State of Alaska's Category 4a List of Impaired Waterbodies for fecal coliform pollution, which indicates an impaired waterbody with an associated TMDL.[33] The margin of safety was included explicitly as 10% of the loading capacity. Because stormwater discharges in the MOA are regulated by a NPDES stormwater permit for municipal separate storm sewer systems (MS4), watershed loads delivered to the LCC are addressed through the wasteload allocation component of this TMDL. Load allocation for the LCC fecal coliform TMDL is zero. The fecal coliform wasteload allocations for the LCC are provided as seasonal allocations for the entire watershed and are equal to the loading capacity minus the MOS.

Scarlett Gerdon, 2nd grade, Taku Elementary

The largest and most frequent exceedances of the water quality criteria for fecal coliform occur during summer months (July-September) due to the increased rain events, resulting stormwater runoff, and increased temperature and source activity (e.g., domestic animals, and wildlife). Fecal coliform concentrations in the creek are lower during colder winter months because of less stormwater runoff. Concentrations steadily increase during spring months, with increased surface runoff during spring thaw and breakup. Because of the substantial seasonal variation in fecal coliform levels, the LCC TMDL is developed on a seasonal basis to isolate times of similar weather, runoff, and in-stream conditions. The highest levels of bacteria in the LCC occur during the summer months.

Past monitoring efforts indicate that, along with coliform, more information is needed on other parameters in the LCC. Historic monthly point sampling has been performed by the Anchorage Waterways Council (AWC) Citizens Environmental Monitoring Program at Nathan Circle and at 72nd and Lake Otis Parkway since 1999. These efforts have documented temperatures above state standards

[33] ADEC, 2006. *Alaska's Final 2006 Integrated Water Quality Monitoring and Assessment Report*. p.49

for egg/fry incubation (13 degrees Celsius) and salmon migration routes (15 degrees Celsius) between July and September at both sites, with temperatures between 15 and 19 degrees Celsius. The length of time the creek had these temperatures is unknown as the data is not continuous. For the Nathan Drive site, dissolved oxygen was also below the state standard of 7 mg/L during some late winter and spring months. E. Coli results were above 1,000 CFU/100 ml during many of the monthly sampling events. Conductivity and turbidity were indeterminate and need continuous readings so that initial assessments can be made. Nitrate, pH, and orthophosphate were within state standards.[34]

Turbidity measurements recorded by an interagency team in 2005 showed frequent "spikes" in turbidity following rain events at numerous locations in the lower LCC watershed, and were closed related to associated fish kill observations. [35] In an effort to address questions on fish kills, sediment amount, sources, and coliform concentrations, MOA began a study of sediment sources in 2006. Initial results of this ongoing study have observed nonpoint sediment sources and documented measurable bank erosion, but no quantified assessment of sources has been performed.

[34] AWC, 2007. *Citizens Environmental Monitoring Program*. Little Campbell Creek at Nathan Circle off W 76th just E of ARR track and North Fork Little Campbell at Meadow St. http://www.anchoragecreeks.org/

[35] Schroeder, Mark, 2005. *Turbidity Monitoring in Little Campbell Creek, Summer 2005*.and Frequency and Distribution of Fish Kills in Little Campbell Creek, U.S. Fish and Wildlife Service. Anchorage Field Office.

4 Watershed Issues

As scientific studies, community input, and planning progressed, most issues within the watershed fell into the following categories:

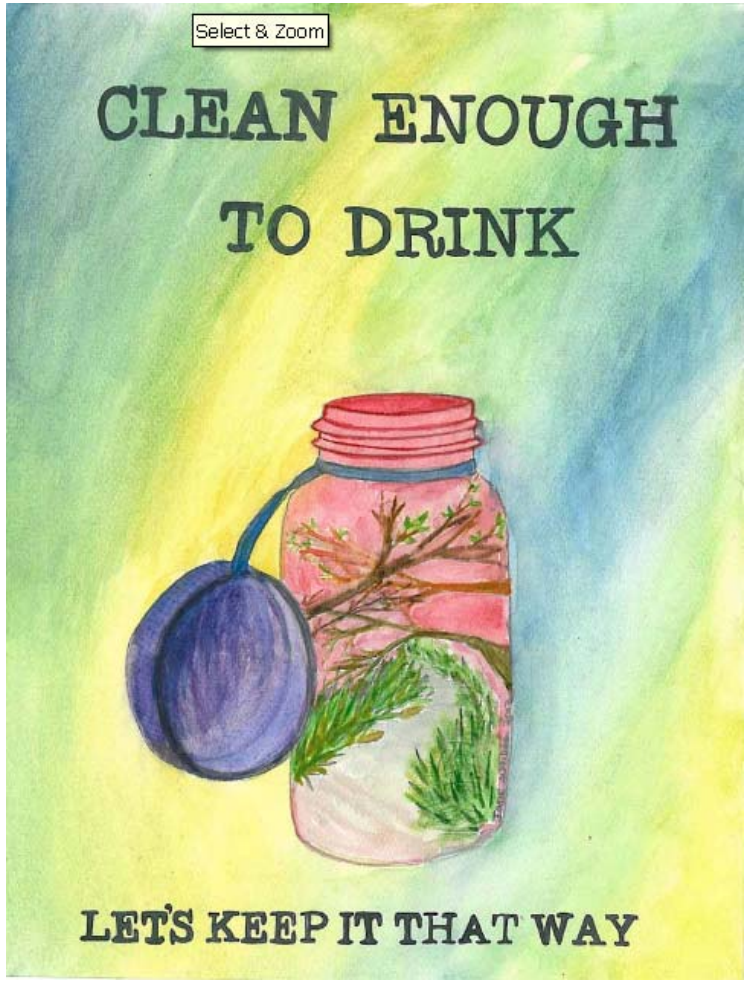
- Water Quality
- Water Quantity
- Terrestrial and Aquatic Habitat
- Recreational and Economic Opportunities and Open Space
- Communication and Coordination
- Data Acquisition

This chapter describes these issues, and the Implementation Plan (chapter 5) outlines goals and projects to address them.

Water Quality

The LCC provides habitat for fish and wildlife and recreational opportunities for residents and visitors; however, poor water quality, may increase associated human health risks, make the creek unsafe for recreation, reduce the aesthetic quality of the watershed, and adversely affect fish and wildlife habitat. Factors that affect water quality include natural components like nutrients, bacteria, and dissolved oxygen; pollutants such as pesticides, herbicides, metals, and oil; and temperature, pH, sediment load, and other physical characteristics. Alaska has established stream water quality standards that outline specific legal limits under three designated uses, which are: water supply, water recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife. These standards aim to maintain waterways at a level where they can support beneficial uses like fish and wildlife habitat, swimming, and fishing, while complying with federal water quality standards.

Evidence of water quality problems in the LCC include elevated turbidity and sedimentation, increased levels of certain bacteria, lack of abundance and diversity of aquatic invertebrates, chronic fish kills, and periodic depressed temperature and dissolved oxygen.



Jade Aldridge, Polaris K-12, 8th grade

Turbidity and Sedimentation

Turbidity is a measure of clarity of water caused by particles, typically caused by suspended sediments such as silt and clay. Turbidity and sediment levels have been linked to poor water quality in the LCC and may have negative impacts on fisheries, invertebrates, recreation and aesthetics. Based on current information and assessment, sediment levels or pollutants associated with sediment in runoff may contribute to chronic fish mortality[36] and may contribute significantly to the high concentrations of suspended sediment that are found downstream in Campbell Creek. [37]

The suspended sediment present in the LCC is currently thought to come from bank erosion and overland flows or sheet runoff from untreated stormwater from roads and developed areas that flows directly into the creek. [38] Overland and sheet flows increase when areas are urbanized and impervious surfaces increase, like portions of the LCC Watershed. Overland flows often contain pollutants, of which dirt and trash are most visible; however, unseen pollutants such as lead, zinc, copper, petroleum products, sand, salt, and fecal coliform may also be present. Some level of erosion is a natural process that benefits many organisms. For example, erosion helps to replace salmon spawning gravels. Excess sediment from development in addition to natural processes can result in habitat degradation. The amount and type of sediment that each contributes to the total sediment load of the LCC is unknown, as are the specific locations in the watershed that contribute the highest amounts.

[36] Schroeder, M., 2005. *Frequency and Distribution of Fish Kills in Little Campbell Creek, July – September 2005*. U.S. Fish and Wildlife Service, Fisheries/Ecological Services, Anchorage Fish and Wildlife Field Office.

[37] USGS: Brabets, TP, and Wittenberg, LA. 1983. *Water-Resources Investigations Report 83-4096. Surface-Water Quality in the Campbell Creek Basin, Anchorage, Alaska.*

[38] MOA WMS, 2007. *Identification of Sediment Sources in Little Campbell Creek Grant No. ACW A 07-01.*

Bacteria

The LCC is listed on the State of Alaska's Category 4a List of Impaired Waterbodies for fecal coliform pollution.[39] Fecal coliform presence in the LCC likely comes from a combination of pet, wildlife, and human feces.

Pet wastes, transported to the creek via snowmelt and rainfall, may be responsible for much of the fecal coliform load present in the creek.[40] Wildlife including moose, bears, and beaver, and waterfowl such as ducks and geese also contribute significantly to fecal coliform levels as, like pets, they deposit fecal matter directly into the LCC and onto land surfaces that drain to the creek.

Failing septic systems have the potential to contribute fecal coliform to receiving waters through surface breakouts and subsurface malfunctions; nevertheless, the majority of septic systems in the Anchorage area are located more than 100 feet away from streams. More than 95 percent of the homes within the LCC Watershed are connected to city sewer and do not use onsite septic systems. Currently, ADEC thinks it is unlikely that septic systems are a source of fecal coliform impacting the LCC. [41] City sewer systems that may cross the creek or go along it may pose a risk; however, further study of the sewer system would be needed to make an assessment. Currently, MOA assessments rule out the possibility along the North Fork, but do not rule out the possibility on the South Fork, as it has not been assessed.

To help bring fecal coliform levels within state water quality standards, ADEC has developed a TMDL for fecal coliform bacteria in the LCC.[42] The TMDL determined a carrying capacity, established waste load allocations from point sources, load allocations from non point sources and a 10% margin of safety. A past study showed that fecal coliform bacteria concentrations are higher in the LCC than in Campbell Creek and may account for most of the high coliform concentrations in Campbell Creek.[43]

Invertebrates

Invertebrate information within the 2006 Project COHO study was used to produce an ASCI that evaluates stream condition. Most study sites were rated with poor or fair quality. This is consistent with a year 2000 study by MOA on stream condition in the lower part of the watershed (downstream of Abbott and Abbot Loop Roads). [44]

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[39] ADEC, 2006. *Alaska's Final 2006 Integrated Water Quality Monitoring and Assessment Report*. p.49

[40] Stevens, Tim, 2007. Personal communication with ADEC Environmental Programs Specialist Tim Stevens regarding water quality in Little Campbell Creek.

[41] Kevin Kleweno, ADEC, Division of Environmental Health, Drinking Water & Wastewater Program, personal communication to Timothy Stevens, ADEC, January 31, 2003.

[42] ADEC, 2004. *Total Maximum Daily Load for Fecal Coliform in the Waters of Little Campbell Creek in Anchorage, Alaska*.

[43] USGS: Brabets, TP, and Wittenberg, LA. 1983. *Water-Resources Investigations Report 83-4096. Surface-Water Quality in the Campbell Creek Basin, Anchorage, Alaska.*

[44] MOA WMS, 2000. *Anchorage Bugalogue*.

Temperature

Elevated temperatures have been documented in the creek. Monthly point sampling by the AWC volunteer monitoring program has documented temperatures above state standards for egg/fry incubation and rearing of salmon during some summer months in the lower reaches of the LCC at both Nathan Drive and 72nd and Lake Otis Parkway. [45] The cause of these temperatures is unknown. Anthropogenic sources may contribute, or it may be a natural state of the creek. We also do not know how continuous this condition is at these sites over time or how prevalent it is throughout the watershed. Available data only alerts managers that there may be a problem. A watershed temperature study would need to be conducted to assess the temperature condition.

[45] Data collected by Anchorage Waterways Council Volunteer Monitoring Program from 1999 through 2006 at Nathan Drive and Lake Otis Parkway .

Dissolved Oxygen

Dissolved oxygen levels in the creek have been documented by the AWC volunteer monitoring program as being periodically below state standards during some winter and spring months at both the AWC monitoring program locations of Nathan Drive and 72nd and Lake Otis Parkway. Low dissolved oxygen levels may affect winter rearing habitat for juvenile fish, however, it is unknown how continuous this condition is at these sites or how prevalent throughout the watershed. Available data only alerts managers that there may be a problem, and a watershed temperature study would need to be conducted to assess the temperature condition.

Water Quantity

Water quantity refers not just to the amount of water that flows down a stream, but also to the frequency, duration, timing, and rate of change of that flow. Such variations in water quantity are often referred to as the flow regime. Flow regimes are a defining factor in ecosystems and an integral part of stream health. Flows increase after a rain or during breakup because water runs off into the creek at these times. In drier times, the creek relies on base flow from its headwaters, wetlands, and groundwater.

Residents and resource agency representatives are concerned about both high and low flow levels in the LCC. Flooding is a concern in some parts of the watershed and the creek going dry or experiencing extreme low flow periods is a problem in sections of the creek, negatively affecting fish, wildlife, habitat, and aesthetic quality.

As the LCC Watershed has become urbanized, much of its natural vegetation and top soil has been replaced by impervious surfaces such as roads, parking lots, and

Winner: Daniel Haider, 4th grade, Trailside Elementary

pavement, or has been compacted for lawns. These surfaces reduce the ability of the land to absorb and filter incoming rain and pollution, and allow water to flow quickly to the creek, altering the flow regime and the creek's shape, which is typically a wider, shallower creek in an urban setting. Additionally, development has typically diverted the creek to the margin of properties for development. Some of these developments have changed the dimension, pattern and profile of the creek, and it has had to reach a new equilibrium with the speed and volume of water it experiences. The altered regime in urbanized areas consists of higher and more frequent peak flows that can cause higher rates of bank erosion, and lower base flows that can make the stream uninhabitable for fish at crucial times of the year. Urbanization typically leads to lower base flow which could be exacerbating low flow conditions in the LCC. The urbanized hydrology also likely contributes to increases in bank erosion as easily erodable peat streambanks are common in the LCC watershed.

Residents and resource agency representatives are concerned about both high and low flow levels in the LCC. Creek flows can go dry in certain areas during dry years, for instance, the area near Lake Otis Parkway and 84th Ave. Flooding is a concern in some parts of the watershed and dewatering is a problem in a section where the creek has been observed to go dry, negatively affecting fish, wildlife, habitat, and aesthetic quality.

Flooding

There are three primary flood issues in the LCC watershed. One issue is that the Lake of the Hills Dam located south of Hillside Drive and east of O'Malley Road , which has the potential to collapse during a seismic event. Such a collapse would lead to the inundation of a dozen or more homes. The earthen dam was built in the 1950s and has failed in the past. One failure, in the 1970's, led to a fatality. The dam has been retrofitted, but engineering analyses show that it continues to be a potential problem.

The second flood issue occurs along the mid-section of the North Branch. This channelized section of creek has inadequately sized culverts and in winter icing and flooding can occur.

The third flood issue are the culverts that run under the Seward Highway and the culvert under D&S Concrete. These culverts are undersized, and the modified channels lack floodplain capacity. This combination of factors would lead to severe flooding east of the Seward Highway to Lake Otis Parkway if a 100 year flood event were to occur[46].

Low Flow

The channel of the South Fork of the LCC adjacent to 84th Avenue was dry for a period during the summers of 2003 and 2004. Since those summers, monitoring has occurred to find out if, exactly where, and why the creek goes dry. Although the creek did not go dry in the summers of 2005 and 2006. Some researchers think that the South Fork of the LCC appears to lose water throughout its length. This creek channel is formed in permeable gravels with a deep water table so creek water is able to percolate through stream bed

[46] Federal Emergency Management Agency. 1990. *Flood Insurance Rate Map Municipality of Anchorage, Alaska. Community Panels 020005 0241C and 020005 0243C of 625*.

materials into the ground, lowering creek water levels. The main driver of increased summer water levels in the South Fork of the LCC is rain. In a very dry summer with no rain, percolation may lead to the South Fork of LCC going dry in late August or early September.[47] Whether these no flow conditions are natural, caused or exacerbated by channel or road crossing modifications is still unknown and studies are ongoing. Additionally, other causes of low flow conditions need to be investigated, such as potential drawdowns by the golf course at Abbott Road, channel changes and water quality issues within the zoo.

Terrestrial and Aquatic Habitat

Many Anchorage residents feel that their quality of life is enhanced by having healthy fish and wildlife populations in the Anchorage Bowl. [48] The LCC Watershed provides terrestrial habitat for local fish and wildlife populations; however, urbanization has encroached on the riparian areas of the watershed, eliminating and fragmenting habitat.

Long or perched culverts, dewatered areas, and debris jams including harmful materials such as paint or plastic netting, can block fish passage. These barriers block fish from reaching formerly productive wetlands and rearing habitats. As more access to these upstream habitats are lost, fish are forced to compete for limited downstream habitat.

Extensive ditching and straightening of the channel has decreased in-stream habitat diversity, as shown in Figure 3.9 as "modifications". As the channel has been ditched and straightened, overhanging banks and pools that provide shelter for fish and wildlife can be eliminated and the total habitat area reduced. Altered stream channels also decrease habitat for invertebrates. Over time, channelization has eliminated many back water areas important to fish seeking refuge from periods of poor water quality and high or low flow conditions.

Foreign debris in, or immediately adjacent to, the LCC negatively impacts fish and other aquatic organisms. Foreign debris commonly found in the creek includes harmful materials such as oil, paint, litter, and lawn waste. Once in the stream, these materials impair water quality, create unnatural obstructions to stream flow, and increase erosion.

Wetlands provide essential habitat for fish and wildlife populations. The LCC Watershed has lost a substantial portion of its wetlands since 1982, and now less than 200 acres of wetlands remain contiguous with the creek[49]. The lack of adjacent wetlands result in an increase in stream temperature, a reduction in nutrient loading, a reduction in the buffering of large precipitation events, a reduction in flow contributions during periods of low rainfall, and a reduction in filtering of pollutants before they reach the creek. These factors impair habitat quality and stormwater attenuation.

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[47] HDR Alaska, Inc., 2007. *South Fork of Little Campbell Creek Water Level Study*.

[48] ADF&G, 2000. *Living with Wildlife in Anchorage: A Cooperative Planning Effort.*

[49] [49] MOA, 2004. Municipal shapefiles for watersheds, streams, wetlands, etc. GIS-based online at http://wms.geonorth.com/library/LibraryData.aspx

Riparian areas, the creek itself and the land directly adjacent to it, are particularly valuable habitats for wildlife as they provide food, water, shelter, and corridors through which wildlife can move throughout the watershed Urbanization has encroached on the watershed, eliminating and fragmenting habitat.

Recreational and Economic Opportunities and Open Space

The LCC Watershed supports residential areas, businesses, tourism, and recreational activities that enhance the economy and quality of life in Anchorage. Scientists, planners, and citizens are looking for ways to make recreational and economic goals compatible with protection of natural features and functions of the watershed.

Anchorage residents enjoy the unique atmosphere of a high functioning city mingled with open space and an abundance of urban wildlife. Many tourists come to Anchorage to experience this atmosphere. In order to sustain healthy fish and wildlife and open spaces within Anchorage, development needs to be compatible with protection of natural features and functions of the watershed.. The numerous problems evident in the LCC clearly demonstrate that this has not always been the case.

Currently there are few public access points along the creek and there is not widespread knowledge about existing creek access. Increasing public awareness about existing creek access, and creating new public access points, could allow more people to enjoy the creek and take ownership in watershed health.

Grace Mitton, 7th grade, Northern Lights ABC Elementary

There is little greenbelt, especially in the lower reaches of the watershed. Greenbelts not only provide open space for people to recreate, but they also decrease the amount of impervious surfaces within an area, allowing filtering and percolation of runoff, as well

as provide necessary habitat for fish and wildlife and buffers that help stabilize stream banks and filter stormwater. There are also commercial and sport fishing benefits from having greenbelts that keep habitat healthy for the State fisheries.

There are many businesses and residences along the LCC. Creeks are a natural feature that people are drawn to, and development and maintenance along the creek can occur in ways that respect the natural features of the watercourse. Businesses and residences alike may need education about their unique location and how it can be used to help draw customers, increase property values, and protect and enhance the character of the community.

Communication, Coordination, and Data Acquisition

In order to share information and coordinate efforts, communication and coordination between these stakeholders is essential. It is also is important to continue study of the creek so that projects and policies can be based on sound scientific findings. In order to better coordinate, information about the watershed data could be compiled and uploaded to a central access point. Agencies could be contacted for their references.

While much is known about the LCC, there is still much to learn. To better understand and manage the watershed, the following information is needed both temporally and geographically across the watershed:

- Continuous monitoring of water quality parameters
- Abundance and distribution of fish populations, invasive species
- Assessment of important habitat such as rearing, spawning and wintering areas
- Fish population response to poor water quality conditions
- Evaluation of stormwater runoff pollutants into the creek.
- Continued evaluation of sediment sources.
- Periodic monitoring of aquatic invertebrates.
- Continuous monitoring of dissolved oxygen and temperature.
- Functional evaluation of migration corridors for water-dependent species (beaver, mink, dippers, etc.)
- Evaluate importance of key wetlands in minimizing flooding
- Effectiveness of current sedimentation basins and evaluation of drainages sub-basins for largest contributors
- Conduct water quantity determinations for instream flow requirements and allowable withdrawals.

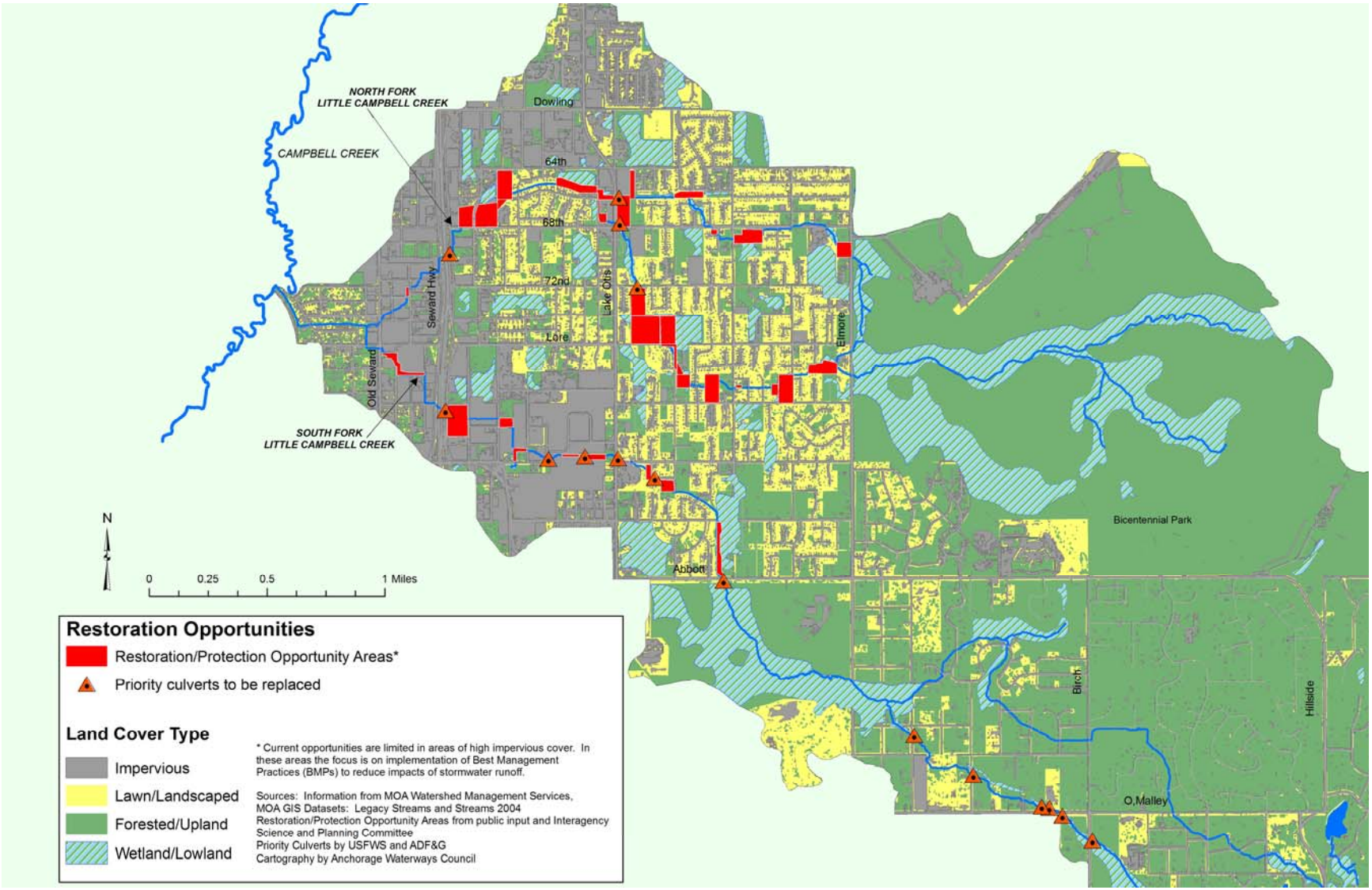
5 Plan Implementation

The following strategy has been created to address the highest priorities that accomplish the mission, vision and goals of *the LCC Watershed Plan*. The strategies listed in the plan were developed through stakeholder and planning team input. While the strategies listed do not include all activities that could, or need to be, performed in the watershed, those listed by the planning team are projects that are considered top priorities.

The implementation plan is organized by issue category. Goals, which were determined throughout the planning process, are outlined. Implementation strategies that address plan issues and achieve plan goals are listed. Each implementation strategy has been prioritized and contains a list of action items, tangible projects, that when completed will help achieve plan goals. The full project list that was evaluated is available from WMS, and areas of potential projects are illustrated in Figure 5.1.

WMS in conjunction with the Watershed Taskforce will assume the lead in following and implementing the plan. The implementation plan is expected to be reviewed annually and updated each year, with a running quantification of projects completed and watershed improvements made for each goal. A set of indicators will be established to provide quantifiable accomplishments and note plan progress.

Figure 5.1. Restoration Opportunities



Water Quality

Goal: Improve overall water quality in Little Campbell Creek and prevent further degradation.

Strategy: Identify and implement projects that reduce sediment and other pollutants by reducing point and non-point sources.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	1.1. Identify and analyze LCC subbasins, stream banks and channel for hydrologic, sediment and other select pollutant contributions. Prioritize to mitigate quantified impacts above reference condition.	• Verify/modify current subbasin delineation • Model pollutant/stormwater runoff with SWMM using values and select pollutants from Chester Creek model with ditch areas added • Determine subbasins with most pollutants/stormwater runoff and map • Evaluate sediment contribution by stream banks/channel and compare to a stable reference condition • Determine erosion rates on stream and if it is above a reference condition and map • Prioritize subbasins/ channel issues by cost/benefit and strategize mitigation measures	*Start* 2009 *End:* 2012	$150k for modeling and FWS assistance with WMS staff on sediment estimates	*Milestones:* - RFP to WTF/WMS for review - Obtain Funding - Report and Map - WTF formal recommendation - Selection of top three projects.
2	1.2. Based on results identified in 1.1a prioritization, implement first three projects.	• Design (Drawings, Specs, Report, Bid Document, Cost) for each project • Put projects on CIP list • Construct projects	*Start:* 2011 *End:* 2013	Design: $140 - $200k	*Milestones:* - Obtain Funding - Top three on CIP list for 2011 - Projects constructed by 2012
3	1.3 Incorporate BMPs into existing and future drainage projects.	• Incorporate end-of-pipe treatment to all new and retrofit projects (i.e. OGS) • Strategize and make recommendations on current projects in RFP 27-P041 for 64th, 72nd, and 88th Ave. drainage improvement projects. • Implement Low Impact Development strategies and Action Plan	*Start:* 2007 *End:* Ongoing	Incorporate as part of cost estimates for CIP projects.	*Milestones:* - Each drainage improvement utilizes best practices.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones

4	1.3. Improve existing sedimentation ponds to current MOA design criteria standards (i.e. wetland incorporation, sizing criteria).	• Design Study Reports on improvement options and preferred alternative with concept costs on sedimentation ponds:
		  • Eastwood Park (Meadow St. at 68th)
		  • Brayton near 82nd St. north of Dimond.
		  • Pebblebrook (68th and Carriage St.)
		  • Desiree and 64th
		• Design (Drawings, Specs, Report, Bid Document)
		• Construct Projects
			Start:
			February 2009 *(after CIP priority list is completed)*
				Design - $75k per sediment pond
				
				Construct of wetlands only - $100k/basin
					Milestones:
					- Funding Obtained
					- One project/year starting in 2009
					- Constructed 2012

Water Quantity

Goal: Reduce flood hazards and prevent habitat degradation.

Strategy: Maintain existing floodplains and widen existing floodplains where applicable.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	2.1. Preserve existing floodplain and restore or recreate historic floodplain.	• Preserve undeveloped floodplain lands through conservation easements from owners for priority areas identified by WMS, Flood Hazard Program, Taskforce subcommittee, GLT and WAG – first is the Vander Court area and near Eastwood Park. • Identify MOA and private properties with floodplains and work to preserve areas identified as important for reducing flood hazards.	2007 and ongoing	Varies	- Complete Vander Court area by Spring 2008 (GLT) - Evaluate critical floodplain for acquisition winter, 2008 - Acquire critical floodplain areas as able
2	2.2. Update floodplain data and mapping.	• Create updated floodplain mapping for entire LCC. • Implement Action Item 1.1 to identify stormwater runoff mitigation areas	*Start:* 2007 *End:* 2012	Varies depending on current information	- Evaluate current HDR /Shannon Wilson floodplain mapping in 2008.
3	2.3. Remove restrictions to flood flows.	• DOT to replace culverts under New Seward Highway to minimize current flood hazard issues. • Design Report evaluating other flood flow restrictions, alternatives, improvements to public safety and cost benefit of removal. • Design and Construct top three restrictions.	DOT current upgrade project *Start:* 2007 Others *Start:* 2008 and ongoing	$150k Design Study Report for overall evaluation.	- Design Report complete by 2010. - Design and Construct top three by 2014.

Terrestrial Habitat

Goal: Evaluate and maintain wildlife corridors and expand where appropriate for the benefit of wildlife and people.

Strategy: Establish a Little Campbell Creek greenbelt; preserve and enhance wildlife corridors and existing riparian habitat.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	3.1. Identify and prioritize lands for inclusion in LCC riparian corridor.	• Municipal land managers prioritize lands • Work with public and private entities to preserve areas identified.	*Start:* In process	Varies	Acres and linear feet of creek preserved. *Milestones:* -Have a greenbelt plan the end of 2008.
2	3.2. Identify, map, and maintain wildlife corridors.	• Planning to evaluate current MOA mapping and update.	*Start:* 2008	In-house in coordination with AF&G	Map in early 2008.
3	3.3. Create program that offers assistance for restoration of riparian habitats.	• Program created with local nurseries and the State Plant Material Center to provide riparian species to MOA and landowners • Create a pamphlet for landowners that explains the benefits of riparian buffers and suggested plants for distribution through local nurseries.	*Start:* February 2008	~$30K	*Milestones:* - Educational pamphlet complete in 2008.
4	3.4. Improve small animal passage along creek corridors.	• Incorporate small animal passage in new or retrofit projects for road crossings.	*Start:* *January 2008*	Varies	*Milestones:* - Small animal passage included for identified fish passage projects.

Aquatic Habitat

Goal: Improve fish passage, channel habitat maintain flows to support fish and creek function in the watershed.

Strategy: Provide unimpeded fish passage, restore straightened channels, protect and increase wetland habitat.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones

1	3.1. Upgrade culverts identified in ADF&G culvert survey that impede fish passage.	• Design and construct top 10 prioritized culverts – first eight are (AF&G ID):
		  • #103- North Fork (Abbott Road)
		  • #105-South Fork (Atkins/near 85th)
		  • #150- North Fork (Lake Otis Pkwy/72nd)
		  • The other culverts identified are: #99, 107, 126, 125, 124
		• Ensure fish passage through Alaska Zoo
		• Ensure fish passage along new Elmore Road
		• New Seward Highway culverts – work with DOT to produce best design possible -has highest long-term impact for fish passage.
			Start: February 2008
			(Road upgrade schedule applies)
				$1.5 million first 5 culverts in SSSP grant.
				
				DOT cost unknown for #103 or New Seward Highway replacements. All other culverts on municipal streets.
					Evaluation Methods:
					- Culverts replaced
					- Miles restored
					Milestones:
					- Top 3 culverts 2009
					- Top 10 culverts 2012

2	3.2a. Restore modified channels for habitat improvements.	• Assess, design and construct the top creek restoration projects – first five are:
		  • 1st : Replace 360 foot long culvert at DNS concrete with open channel.
		  • 2nd: Parcel-72nd South of Parcel
		  • 3nd: Parcel-Galatea Estates
		  • 4rd: Turinski Parcel east of Lake Otis Parkway
		  • 5th: Channel South of 88th. Ave.
			Start: June 2008		*Evaluation:*
					- Linear feet restored
					Milestones:
					- First restoration in 2008
					- Top three 2011

3	3.3a. Construct, restore, and preserve wetlands and open water habitats.	• Acquisitions and protections related to 2.1. • Support AF&G in-stream flow gauging and apply for instream flows.	2007 and ongoing	$40k for gauging	In-stream flow reservation by 2010

Note: Culvert designations are found at http://www.sf.adfg.state.ak.us/SARR/Fishpassage/FP_mapping.cfm

Recreational and Economic Opportunities

Goal: Promote recreational and economic benefits of healthy watersheds.

Strategy: Promote benefits of the link between healthier watersheds and recreational and economic benefits to the community.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	5.1. ID specific cost/benefits of LCC to Anchorage economic sectors	• Create a study of the value of LCC creeks and riparian areas to the community. • Distribute the results of the study to local business and residential groups.	*Start:* 2008	Varies	Program evaluation by 2009
2	5.2. Create a business partnership program for businesses located on the banks of LCC.	• Annual program to meet business owners, distribute information on LCC and make recommendations as appropriate. • "Creek Steward" sticker program with participating businesses and related advertising of them. • Work with businesses to distribute benefit data to other groups.	*Start:* 2007	$30k per year	Program established for 5-year 2007-2012
3	5.3. Create wetland preservation incentives.	• Evaluate current wetland mitigation program and ways to improve it. • Evaluate subdivision guidelines for wetland preservation.	*Start:* In process	Varies	Program evaluation by 2009
4	5.4. Create public access awareness and access points as appropriate.	• Create a public access map in relation to Park and other access areas. • Evaluate with Parks Dept. potential for more access points. • Update map and make available for LCC outreach programs. • Include LCC information on interpretive displays in Campbell Creek and other restoration projects within the watershed.	*Start:* 2008	In house	Complete in 2009 and as restoration projects are completed.

Communication and Coordination

Goal: Promote watershed awareness and community stewardship.

Strategy: Increasing public involvement in stewardship activities.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	6.1. Promote LCC Watershed Management Plan implementation within the municipality.	• WMS assigns responsibility for plan implementation. • Coordinate with Watershed Task Force (WTF) to promote plan projects. • WMS prepares annual State of the LCC Watershed Report for review by WTF. Partners will provide support in development of this report. • WTF review report and makes recommendations for plan updates, revision and priorities to Mayor.	*Start:* 2008	Varies	*Milestones:* - Plan being implemented. - Report ready for WTF to review. - Report recommended to Mayor. - Report available to public.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
2	6.2. Increase community understanding of watershed problems and solutions within watershed.	• Provide support and funding to watershed education programs. • Workshops with local utilities, MOA departments, business, contractors on watershed issues and solutions. • Create a "Creekside Stewardship" program and offer to people who own land adjacent to LCC to promote a positive stewardship ethic. Give out "care of your creek" information packet. • 2-3 workshops with real estate community to create an information packet on "care of your new creek" to go to new land owners. • Work with ASD and ADF&G to develop riparian buffer studies, a "Salmon in the Classroom" program, and "It Takes a Watershed to Raise a Fish" curricula and/or other programs. • Create an "Adopt-a-Stream" program with local schools	*Start:* 2008	Varies	Start in 2007. Continue program for 5 years.
3	6.3. Increase outreach and education program within the Municipality	• Hire WMS outreach staff person. • Increase partnering with agencies, nonprofits and other entities to deliver stewardship messages. • Update WMS website on a regular basis.	*Start: 2008*	$100k/year	Hire staff person in 2008. Update website in 2008.

Open Space

Goal: Protect and maintain lands that support healthy watershed functions and services.

Strategy: Healthy, sustainable watershed functions that can be self-maintaining and actively used for recreation.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	7.1. Identify, map and prioritize parcels for potential preservation, restoration and recreational open space.	• Implement Action Items in Goals "Terrestrial Habitat (Priority 1)", "Aquatic Habitat (Priority 3)" and "Recreational and Economic Opportunity (Priority 3)".	2007 and ongoing with yearly evaluation and task responsibilities	Varies	- Yearly updates of priority list and CIP list
2	7.2. Implement acquisitions and easement plan	• Implement Action Item in 7.1.	2007 and ongoing.	Varies	- One area conserved on a yearly basis.

Data Acquisition

Goal: Identify significant gaps in data and create programs to acquire data.

Strategy: Create a database for Little Campbell Creek from which management decisions can be made based on science.

Priority	Implementation Strategy	Action Items	Anticipated Start/End	Cost Estimate	Evaluation Methods /Milestones
1	8.1. Obtain data necessary to maintain watershed health.	• Evaluate sediment source inputs as discussed in Action Items of 1.1 as surrogate for all pollutants. • Evaluate fecal coliform concentrations in LCC. • Implement a continuous DO and temperature program to note seasonal changes in evaluation of fish habitat for natural and impacted conditions. • Determine highest sediment and pollutant inputs as discussed in 1.1. • Continue fish and invertebrate monitoring every 3 years. • Conduct a reach-by-reach habitat assessment.	2007 and ongoing	Varies	- Sediment/coliform input report 2010. - DO and Temperature 2008-2010. - Fish/ Invertebrate Report 2009. - Habitat Assessment by 2010.
2	8.2. Create, maintain and make accessible to public all data on LCC.	• Create website of data access online. • Contact all resource agencies and both local universities for their data and/or references regularly. • Compile and upload all data to MOA website. • Maintain list.	*Start::* 2008 *End:* 2009	$40k	Maintain yearly.
3	8.3. Evaluate ADF&G's grey designated culverts in LCC for fish passage issues.	Complete project between MOA and Alaska Department of Fish and Game.	*Start:* February 2008 *End:* 2009	$70k	Evaluation finished in 2009.