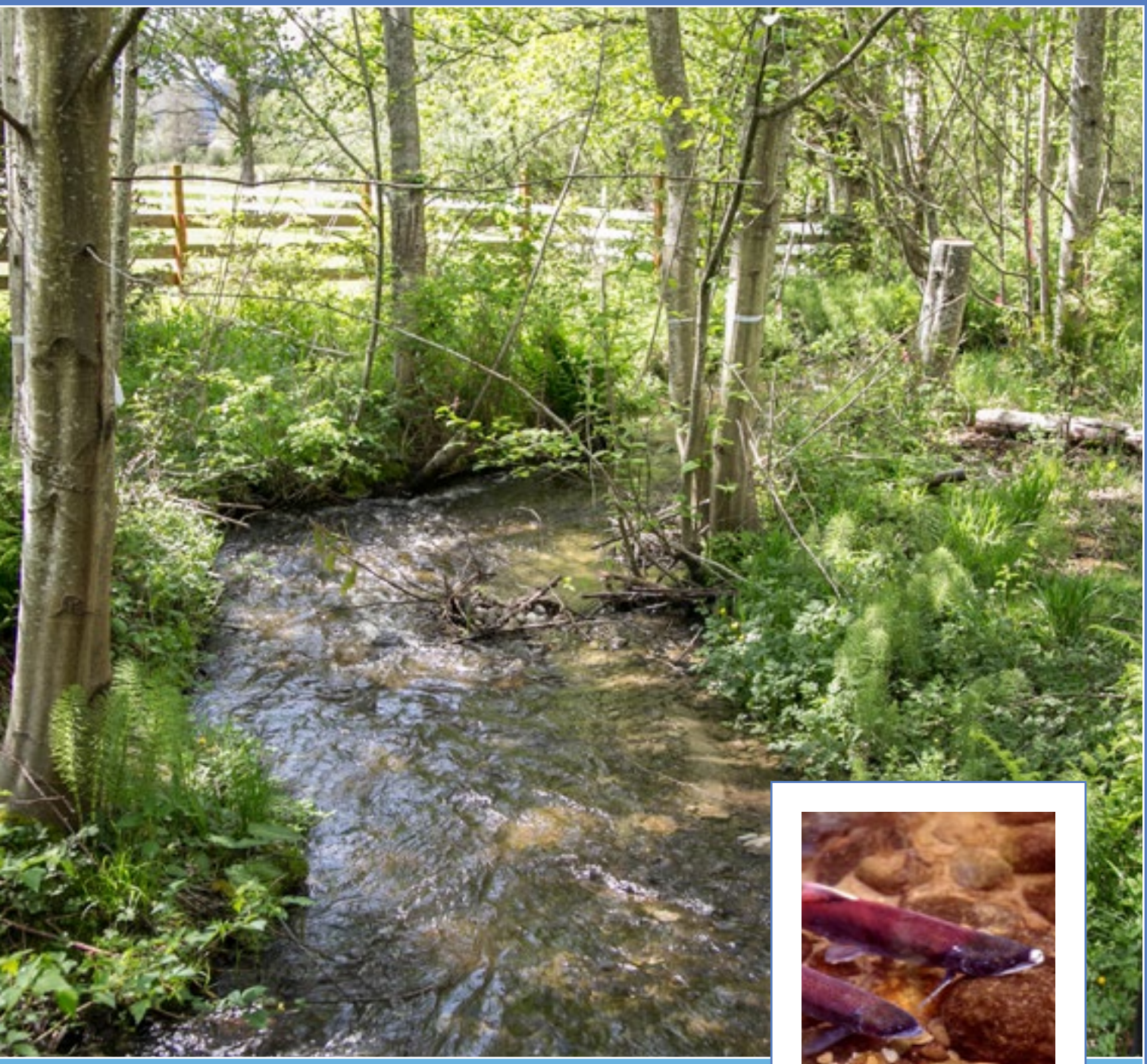
August 2014



Blueprint for the Restoration and Enhancement of Lake Sammamish Kokanee Tributaries

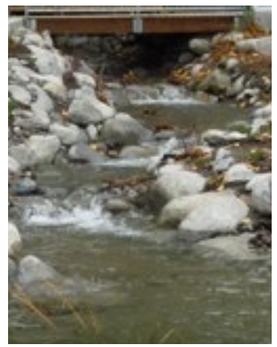
LAKE SAMMAMISH KOKANEE WORK GROUP *Protect · Reconnect · Restore*

Spawning Kokanee

Ebright Creek

Tibbetts Creek

South end of Lake Sammamish, early - mid 1930s



Sammamish Tributaries

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EBRIGHT CREEK- Category One Stream		
1	Lower Reach Stream Enhancement	Reduce bank armoring and flow velocity between parkway and lake.
2	Lower Reach Habitat Protection	Expand lower reach enhancements to protect kokanee habitat.
3	Culvert Replacement at East Lake Sammamish Trail	Replace culvert to improve fish passage and sediment transport.
4	Culvert Replacement at East Lake Sammamish Parkway	Replace culvert to improve fish passage and sediment transport.
5	Middle Reach Restoration	Enhance and restore spawning habitat upstream of parkway.
6	Driveway Bridge Replacement	Repair or replace driveway bridge for fish passage and sediment/wood transport.
7	Culvert Replacement at 12th Street	Replace culvert to modulate stream flow/velocity.
8	Upper Reach Habitat Protection	Protect spawning habitat and prevent or minimize direct impacts to kokanee eggs.
LAUGHING JACOBS CREEK - Category One Stream		
1	Assessment of Reroute Option	Evaluate feasibility of rerouting stream.
2	Lower Reach Restoration	Reroute channel or enhance current channel to improve spawning.
3	Assessment of Parkway Culvert	Evaluate hydraulics and fish passage of culvert under parkway.
4	Restoration in Hans Jensen Park	Install pool-forming structures and spawning gravel to enhance stream channel.
LEWIS CREEK - Category One Stream		
1	Lower Spawning Reach Restoration	Install a series of instream grade-control structures.
2	Upper Spawning Reach Restoration	Install a series of instream grade-control structures.
3	Protection of Riparian Corridor	Develop a landowner stewardship project to help protect the riparian corridor.
4	Trash Rack at I-90 Culvert	Replace or modify existing trash rack.
5	Upper Basin Hydrological Assessment	Assess upper basin to improve stormwater management.
PINE LAKE CREEK - Category One Stream		
1	Pine Lake Creek Basin Assessment/Plan	Assess watershed to identify limiting factors for kokanee.
2	Reach Restoration Downstream of Parkway	Restore or enhance kokanee staging and spawning habitat.
3	Culvert Replacement/improvement at East Lake Sammamish Shore Lane SE	Replace or modify culvert to improve fish passage.
4	Culvert Replacement/improvement at East Lake Sammamish Trail	Replace or modify culvert to improve fish passage.
5	Reach Restoration Upstream of Parkway	Restore or enhance kokanee spawning habitat.
6	Pine Lake Creek Reintroduction	Supplement or reintroduce kokanee into this creek system.
ISSAQUAH CREEK - Category Two Stream		
1	Pickering Reach Habitat Restoration	Improve habitat: remove riprap, add large woody debris, restore native vegetation.
2	Cybil-Madeleine Reach Restoration	Improve habitat: regrade banks, add large woody debris, create side-channel.
3	East Fork Issaquah Confluence Reach Restoration	Improve habitat: regrade banks, add large woody debris and gravel.
4	Issaquah Creek Reintroduction	Supplement or reintroduce kokanee into this creek system.
TIBBETTS CREEK- Category Two Stream		
1	Water Quality Monitoring and Assessment	Continue water quality sampling.
2	NW Poplar Way Stream Restoration	Restore stream channel to provide stream complexity (large woody debris, pools, riffles).
GEORGE DAVIS CREEK - Category Three Stream		
1	Habitat Assessment	Assess habitat conditions to determine potential for kokanee use.
IDYLWOOD CREEK - Category Three Stream		
1	Enhancement of the Idylwood Beach Park Reach	Add gravel to the stream to improve spawning success.
VASA CREEK - Category Three Stream		
1	Hydrologic and Habitat Assessment	Assess hydrologic and habitat conditions for potential kokanee use.
ZACCUSE CREEK - Category Three Stream		
1	Culvert Replacement at East Lake Sammamish Shore Lane	Replace culvert to improve fish passage and natural sediment transport.
2	Culvert Replacement at East Lake Sammamish Trail	Replace culvert to restore fish passage at all flows and natural sediment transport.
3	Culvert Replacement at East Lake Sammamish Parkway	Replace culvert to restore fish passage and natural sediment transport.
4	Channel Reconstruction Through Wetland	Restore channel through forested wetland.
5	Zaccuse Creek Reintroduction	Supplement or reintroduce kokanee into this creek system.

Summary Table of All Kokanee Habitat Projects. NOTE: Project numbers indicate location from downstream to upstream, NOT priority or schedule.

Executive Summary

Introduction and Purpose

The Lake Sammamish native kokanee salmon (*Oncorhynchus nerka*) population is declining precipitously. Unlike their larger relative sockeye salmon, kokanee spend their entire lifecycle in freshwater. They migrate to Lake Sammamish as inch-long fry and spend three to four years in Lake Sammamish before spawning in the late fall and early winter in their natal streams. In the recent decades, their numbers have plummeted and their distribution has been reduced from a large portion of the Lake Washington watershed to only Lake Sammamish and several of its tributary streams.

In 2007, local jurisdictions, government agencies, tribes, community groups, and kokanee advocates in the watershed formed the Lake Sammamish Kokanee Work Group (KWG) to work together to reverse the decline. The KWG established a goal for rebuilding the population: prevent the extinction and improve the health of native kokanee population such that it is viable and self-sustaining, and then supports fishery opportunities. Over the past several years, the KWG and its members have assembled the best science available, conducted assessments, implemented a short-term population supplementation program, supported a series of restoration projects, and reached out to the larger community to educate others on kokanee needs in the watershed.

The purpose of the Kokanee Blueprint is to recommend a new set of restoration actions that build on the latest science and current efforts to move the population closer to recovery. It is critical to have sufficient habitat restored to support a robust, self-sustaining population, particularly once the supplementation program is discontinued by 2021.

Historic Context

The estimated historic extent of spawning areas for native kokanee included several tributaries to Lake Washington, the Sammamish River and tributaries, and Lake Sammamish and several of its tributaries. Native kokanee are now known to spawn consistently in only Lewis Creek, Laughing Jacobs Creek, Ebright Creek, Pine Lake Creek, occasionally in Tibbetts and Vasa Creeks, and along some shoreline areas in Lake Sammamish. This drastic reduction in the geographic distribution of spawning areas significantly raises the potential for a single catastrophic event – whether natural or human-caused – to completely eradicate native kokanee from the watershed. In fact, recent data indicate that two runs of native Lake Sammamish kokanee are likely already extinct. It appears that only the winter/late run kokanee still remains.

Scope and Strategies

The KWG is first focusing on securing the existing, known native kokanee population and the stream habitats it currently relies upon to maintain its existence. Therefore, the geographic scope of this document encompasses the Lake Sammamish basin, which includes the lake and its tributaries. Over the long term, the KWG may expand the Blueprint to address a broader geography to further restore and sustain all the native kokanee populations.

Recovery efforts currently emphasize two strategies: a short-term supplementation program that uses the Issaquah Salmon Hatchery to help stabilize and start rebuilding the population, and a longer term effort to improve or maintain habitat conditions that support the entire kokanee lifecycle. Started in 2009, the intent of the supplementation program is to maintain kokanee populations in natal streams for 12 years (three to four generations of the kokanee population) while habitat conditions are improved to maintain the population naturally. The supplementation program will sunset after the return of kokanee in 2021.

Habitat improvements are essential to restoring a stable and self-sustaining population, both in tributaries that currently support spawning as well as in tributaries infrequently or never used but that could provide spawning opportunities. The Blueprint presents a list of stream restoration and

enhancement projects that are necessary to improve the viability of Lake Sammamish kokanee populations.

Monitoring of the kokanee population and their habitat (e.g., spawner surveys, fry trapping, and water quality) are an integral component of assessing the effectiveness of stream restoration and enhancement projects. Such projects are beyond the focus of this document and will be addressed separately.

It should be noted that land use and stormwater management can have dramatic effects on the stream systems described in this document. In particular, the Lake Sammamish tributaries that support kokanee are threatened by hydrologic impacts resulting from deforestation and bank armoring, increased impervious area, and the timing and delivery of stormwater. The ultimate effectiveness of the actions in this Blueprint will be heavily influenced by the efforts of watershed residents and governments to avoid or mitigate for such impacts. Habitat protection – through, for example, Critical Areas Ordinances, Shoreline Master Programs, Clearing and Grading Ordinances, stormwater management plans, Transfer of Development Rights programs, conservation easements, and other regulatory and non-regulatory tools – is paramount to ensure that investments of public and private funding in Lake Sammamish kokanee restoration projects are not wasted.

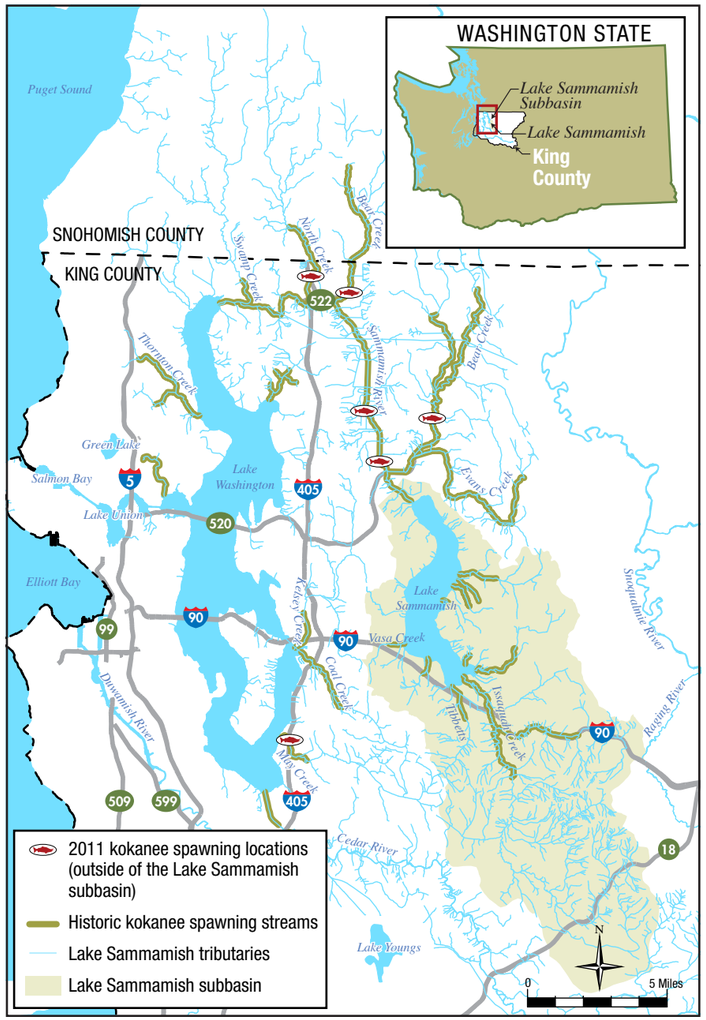


Figure 1. Historic kokanee spawning streams in the Lake Washington basin. The focus of this document is the Lake Sammamish subbasin.

Because the native kokanee salmon spend their entire lifecycle in the Lake Sammamish basin, individual and collective actions have a measureable and direct impact on kokanee recovery and sustainability. The Blueprint offers a set of habitat restoration actions that directly contribute to the recovery of kokanee salmon in Lake Sammamish.

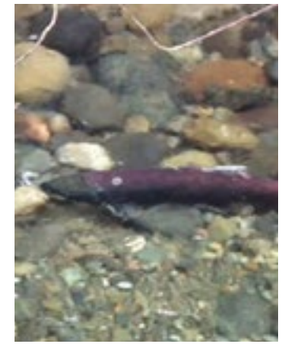
Introduction

There has been a continuing and dramatic decline in the abundance, distribution, and diversity of native kokanee (*Oncorhynchus nerka*) in the Lake Sammamish watershed. In 2007, local jurisdictions, government agencies, tribes, community groups, and kokanee advocates in the watershed formed the Lake Sammamish Kokanee Work Group (KWG) in an effort to work together to reverse the decline. The KWG established a goal for rebuilding the population: prevent the extinction and improve the health of native kokanee population such that it is viable and self-sustaining, and then supports fishery opportunities. Over the past several years, the KWG and its members have assembled the current science and implemented and supported a series of projects and other actions focused on achieving the goal. The purpose of this Blueprint is to recommend a new set of actions that are expected to build on the best science available and prior actions to move the population closer to recovery.

Historical Context

Historically, kokanee were found in many streams throughout the Lake Washington basin (Figure 1) and were represented by three distinct run timings (summer/early-run, winter/late-run, and fall/middle-run). The summer/early run, which spawned primarily in Issaquah Creek, has not been observed in recent years and is considered extinct. The winter/late run spawns in small tributaries to Lake Sammamish and is the focus of this document.

The fall/middle run spawned in tributaries to Lake Washington, including the Sammamish River and its tributaries. In recent years, few kokanee-like fish have been observed and genetic analyses suggest they may actually be residual sockeye salmon. However, in 2011, good numbers of kokanee-like fish were observed in five locations in the Sammamish River and its tributaries (a few were also observed in May Creek). Because they were spawning in December and many had bright red coloration, they appeared to be more like kokanee than residual sockeye salmon. Genetic samples were taken from a total of 217 fish from six sites (Figure 1), which represented a small portion of the total run. Genetic analyses of these fish are not complete, but a preliminary analysis indicates they are distinct from Lake Sammamish kokanee. It is unclear if the kokanee-like fish in the Sammamish River and its tributaries represent a separate kokanee population or are residual sockeye salmon. Because of the uncertainty of the origins of the Sammamish River fish, we have decided to include only the winter/late-run kokanee in this document.



Geographic Scope

The geographic scope of this Blueprint encompasses the Lake Sammamish watershed, including all waters (i.e., the lake and its tributaries and their subbasins) upstream of the weir at the north end of Lake Sammamish, where the lake discharges to the Sammamish River and eventually Lake Washington (Figure 1). This geographic scope reflects the initial interest of the KWG in securing the existing, known native kokanee population and the stream habitats it currently relies upon for its ongoing existence. Over the long term, the KWG may seek to expand this Blueprint to include a broader geography as a means to further restore and sustain native kokanee populations.

Recovery Strategies and Focus of the Blueprint

Recovery efforts for Lake Sammamish kokanee currently emphasize two strategies: a short-term supplementation program to help rebuild the population and a longer term effort to improve or maintain habitat conditions in streams and the lake, such that all stages of kokanee are supported (Figure 2). The supplementation program involves collecting gametes from spawners in Lake Sammamish tributaries and incubating them at the Washington Department of Fish and Wildlife's Issaquah Creek Hatchery to increase egg-to-fry survival rates relative to those in natal streams. The supplementation program was initiated in 2009 and is scheduled to run for 12 years or three to four generations of the kokanee population, which means the 2021-2022 return will be the final return from which hatchery production is currently anticipated.

Habitat improvements to spawning tributaries are essential to restoring a stable and self-sustaining population. In particular, habitat improvements are needed in tributaries that currently support spawning as well as tributaries that are infrequently or never used but could provide spawning opportunities critical to sustaining a stable, robust kokanee population. In this document, we present a list of suggested stream restoration and enhancement projects needed to help improve the health of native kokanee populations. Listed projects were drawn from a series of meetings and discussions involving KWG members including landowners and watershed residents; staff from local, state, federal and tribal government agencies; non-governmental organizations; and others to gather information on viable projects to help recover kokanee populations. Biological monitoring projects (spawner surveys, fry trapping, etc.) of kokanee populations are an integral component of assessing the effectiveness of stream restoration and enhancement projects but are beyond the focus of this document.

This Blueprint focuses primarily on new opportunities and priorities for restoration projects or assessments that would inform the development and implementation of restoration projects. The KWG encourages the recognition by users of this Blueprint that the stream systems in which these projects will be implemented are prone to degradation as a result of land use and stormwater management actions in their immediate vicinity and upstream. In particular, the Lake Sammamish tributaries that support kokanee are threatened by hydrologic impacts resulting from deforestation, increased impervious area, and inter-basin transfers of stormwater. The ultimate effectiveness of the actions in this Blueprint will be heavily influenced by the efforts of watershed residents and governments to avoid or mitigate for such impacts. Habitat protection -- through for example critical areas ordinances, Shoreline Master Programs, clearing and grading ordinances, stormwater management plans, transfer of development rights programs, conservation easements, and other regulatory and non-regulatory tools -- is paramount to ensure that investments of public and private funding in Lake Sammamish kokanee restoration projects and supporting assessments do not merely result in "treading water."

Organization of Blueprint

For the purposes of understanding the opportunities for action, Lake Sammamish tributaries were divided into four categories based on current and potential kokanee use (Figure 3):

Category 1

Primary current kokanee spawning streams - over the past 18 years (period of consistent monitoring), the vast majority of late-run kokanee spawned in these streams (Ebright Creek, Laughing Jacobs Creek, Lewis Creek, and Pine Lake Creek).

Category 2

Large streams in the south end of the Lake Sammamish basin that currently do not support many kokanee but have the potential to support a large run (Issaquah Creek and Tibbetts Creek).

Category 3

Small secondary streams that have potential for kokanee spawning. During the 2012-13 spawning season, some kokanee were observed in each of these creeks.

Category 4

Other small tributaries with little to no recent information and likely have limited potential for kokanee spawning.

Within these four categories, each listed tributary has its own sub-section that features the following:

- Goal/vision
- Description of the tributary's role for kokanee
- Map of proposed projects
- Table briefly describing and classifying proposed projects (assessment, culvert replacement/modification, or stream restoration);
- List that further explains each project and provides, as a starting point and where available, estimated planning level costs, funding needs, duration and project lead if known;
- Another table that suggests project timelines;
- Team members who developed the project list; and
- Pertinent references.

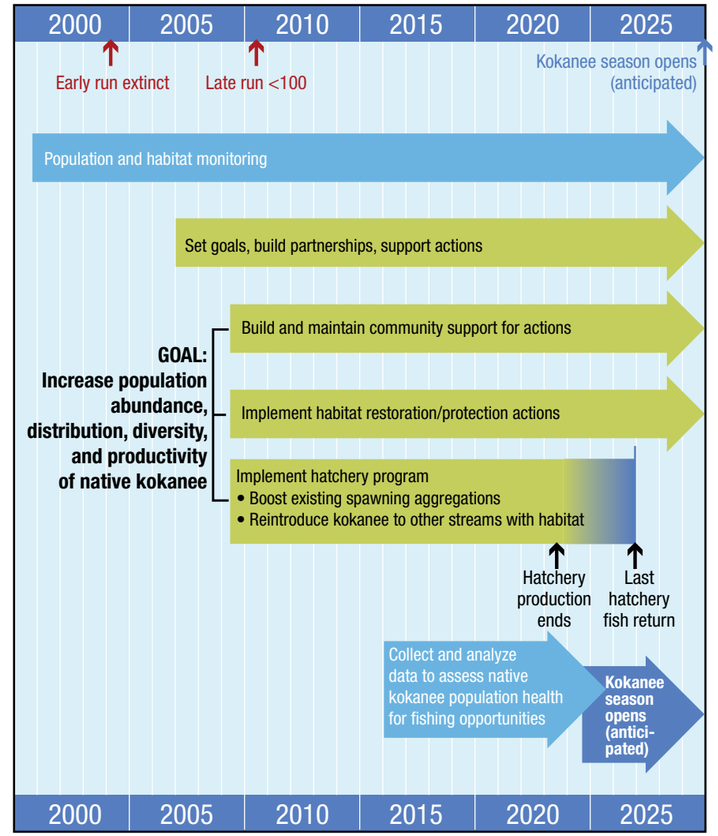


Figure 2.
Expected timeline for recovery of Lake Sammamish kokanee.

Figure 3. Locations of Lake Sammamish tributaries assessed for potential restoration/ enhancement projects to benefit kokanee populations.

Category 1 Streams

Primary Kokanee Spawning Streams

- Ebright Creek
- Laughing Jacobs Creek
- Lewis Creek
- Pine Lake Creek

Ebright Creek

Goal/Vision

The goal for Ebright Creek is to increase the number of kokanee spawning in Ebright Creek and greatly expand and improve the extent, connectivity, and stability of the stream habitat that kokanee can use to spawn.

Ebright Creek (WRIA #08.0149) is on the east side of Lake Sammamish and is located about 2,000 ft north of 8th Street off of the East Lake Sammamish Parkway in the City of Sammamish (Figure 4). Ebright Creek has two major culverts (East Lake Sammamish Trail and Parkway) that may impede fish passage under some flow conditions (Table 1). Stream segments upstream of these culverts are in need of stabilization and/or habitat restoration.

Ebright Creek is one of the four primary spawning streams for Lake Sammamish kokanee. The stream is smaller than Laughing Jacobs and Lewis creeks but in recent years has often had more spawners than one or both of these other streams. Among all Lake Sammamish tributaries, the highest kokanee escapement has been in Ebright Creek for three out of the past five brood years (2009-10 to 2013-14). During the past 18 brood years, the peak kokanee escapement was 6,694 (7-day stream-life estimate) in 2012-13.

In July 2012, a critically important passage and restoration project was completed on Ebright Creek by a private land owner, Wally Pereyra. The project site is located several hundred feet upstream of East Lake Sammamish Parkway. The project involved the replacement of an undersized and perched culvert, which blocked fish passage under most conditions and impeded natural sediment transport, with a new bottomless concrete arch. In the fall of 2012, all returning kokanee could more easily migrate past this site to the upstream spawning reaches than they had been able to in decades with the old culvert. Additionally, work was initiated in the fall of 2012 to enhance and restore spawning habitat within the middle reach of Ebright Creek (Project 4) just downstream of the culvert project. This initial work included removal of invasive non-native vegetation along riparian areas and replanting with native trees and shrubs. Additional work in this reach may include placement of large wood or other pool forming structures.

Projects Associated with Ebright Creek

(in order from the creek mouth to the most upstream; potential timelines are given in Table 2)

1 **Lower Reach Stream Enhancement** – Reducing the amount of bank armoring/hardening and sloping back banks to reduce the velocity of flows in the lower reaches of the creek below the parkway will increase the amount of viable spawning area in lower Ebright Creek and potentially increase the number of kokanee produced during each spawning season.

- Estimated Project Cost (planning & design) in 2012 dollars. $25,000
- Estimated Project Cost (construction) in 2012 dollars. $125,000
- Funds Acquired:
- Funds Needed: $150,000
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead:

Lower Reach Habitat Protection – The lower reach stream enhancement in Ebright Creek could be more fully realized with the acquisition of adjacent properties from willing sellers. The acquisition of stream-adjacent properties would allow for greater enhancement and/or restoration and protection of this critical reach for kokanee migration upstream

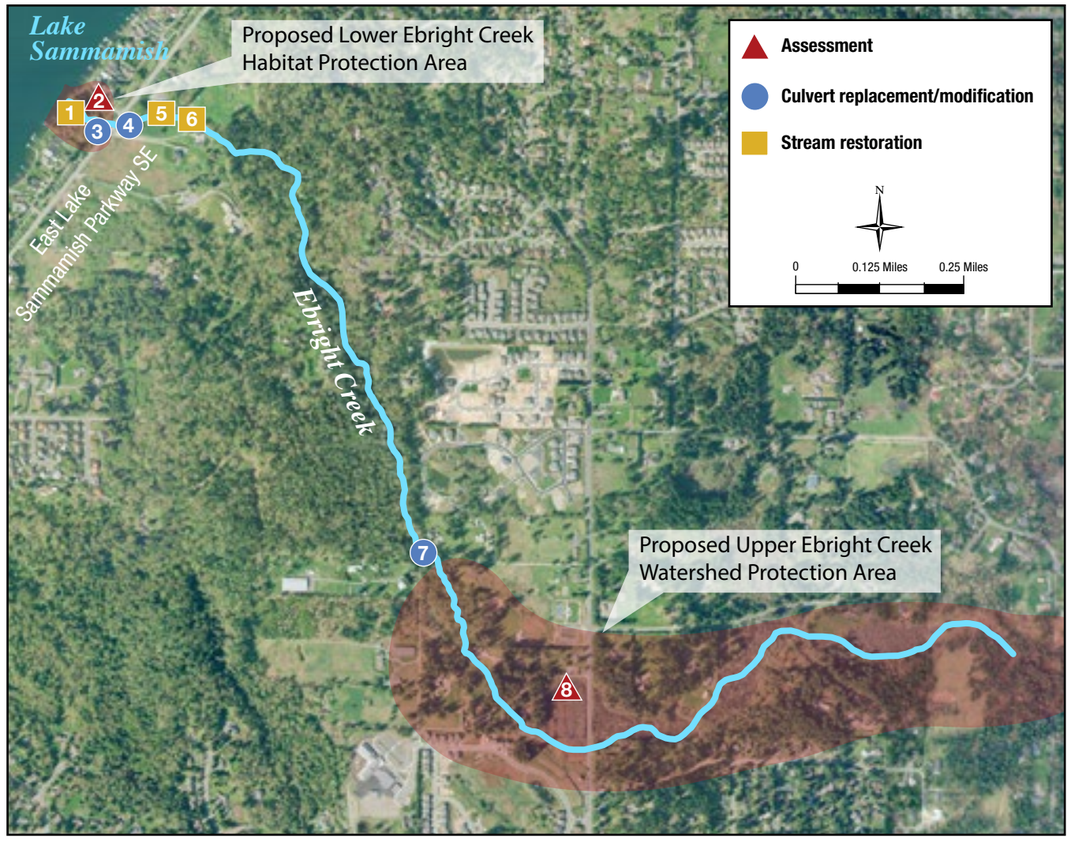


Figure 4. Locations of identified restoration/enhancement projects on Ebright Creek.

Ebright — ▲ Assessment ● Culvert replacement/modification ■ Stream restoration

Project #	Project Type	Name of Project	Description
1	■	Lower Reach Stream Enhancement	Reduce bank armoring and flow velocity between parkway and lake.
2	▲	Lower Reach Habitat Protection	Allow expansion of lower reach stream enhancements and increase long-term protection of kokanee habitat.
3	●	Culvert Replacement at East Lake Sammamish Trail	Replace culvert to improve fish passage and sediment transport.
4	●	Culvert Replacement at East Lake Sammamish Parkway	Replace culvert to improve fish passage and sediment transport.
5	■	Middle Reach Restoration	Enhance and restore spawning habitat upstream of parkway.
6	■	Driveway Bridge Replacement	Repair or replace driveway bridge to ensure adequate fish passage and sediment and wood transport.
7	●	Culvert Replacement at 12th Street	Replace culvert to modulate stream flow/velocity.
8	▲	Upper Reach Habitat Protection	Protect spawning habitat and prevent or minimize direct impacts to kokanee eggs.

Table 1. List of eight proposed projects to restore or enhance kokanee fish passage and spawning habitat on Ebright Creek. Project numbers indicate relative location on the stream (downstream to upstream) and do not indicate priority or schedule of implementation.

to the upper watershed. The KWG will need to work with the landowner to evaluate opportunities and willingness to sell (recognizing that the acquisition could be an easement or fee interest).

- Estimated Project Cost (acquisition) in 2012 dollars. $1,000,000
- Funds Acquired:
- Funds Needed: $1,000,000
- Estimated Project Duration:
- Current or Potential Project Lead:

3 Culvert Replacement at East Lake Sammamish Trail – The culvert under East Lake Sammamish Trail obstructs natural sediment transport and may impede kokanee under some flow conditions from accessing upstream spawning grounds. Replacing this culvert, as well as the culvert in project 4 and the bridge in project 6, will restore more natural sediment transport and channel formation. Depending on the replacement design, additional spawning habitat could also be restored within the footprint of this crossing. The project site is approximately 200 ft upstream from the mouth of the creek and 50 ft downstream of project 4 (parkway culvert).

- Estimated Project Cost (planning & design): $30,000 (50% design) + $10,000 (90% design) + $5,000 (final)
- Estimated Project Cost (construction): $90,000
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: King County DNRP

4 Culvert Replacement at East Lake Sammamish Parkway – The culvert under East Lake Sammamish Parkway obstructs natural sediment transport and may impede kokanee under some flow conditions from accessing upstream spawning grounds. Replacing the culvert, as well as the culvert in project 3 and bridge in project 6, will restore more natural sediment transport and channel formation. Depending on the replacement design, additional spawning habitat could also be included within the footprint of this crossing. The project site is approximately 250 ft upstream from the mouth of the creek.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (construction):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: City of Sammamish

5 Middle Reach Restoration – Restoration of the middle reach of Ebright Creek will improve spawning habitat currently available to kokanee. This reach extends from the parkway culvert upstream to the driveway bridge on the Pereyra property.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (construction):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: City of Sammamish

6 Driveway Bridge Replacement – The driveway bridge on the Pereyra property is reaching the end of its lifespan. Repairing/replacing this bridge will ensure upstream fish passage is maintained through this reach, create spawning habitat under the footprint of the new bridge, as well as restore more natural sediment and wood transport and channel formation.

- Estimated Project Cost (planning & design): $15,000
- Estimated Project Cost (construction): $75,000
- Funds Acquired:
- Funds Needed: $100,000
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):

- Current or Potential Project Lead: City of Sammamish and landowner

7 Culvert Replacement at 12th Street – Replacing the 12th Street culvert, which influences the flows within downstream spawning reaches of the creek, will reduce the chances of scouring events wiping out the redds/alevins in downstream reaches. The culvert is located just downstream of Ebright Creek Park.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (construction):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: City of Sammamish

8 Upper Reach Habitat Protection – The upper reach of Ebright Creek, and consequently all downstream habitat, is susceptible to developmental impacts. Protection of intact habitats, preventing or minimizing bank stabilization and upslope impacts, and ensuring stream water quality is maintained or improved are key to supporting continued use of the watershed by kokanee. Land acquisition, purchase of development rights, and conservation easements are possible approaches that could be used to achieve this action.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (easements/acquisitions):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (easements/acquisitions):
- Current or Potential Project Lead:

Zaccuse, Ebright, Pine Lake (ZEP) Team Members:

Don Gerend, Tom Odell, Eric Lafrance (City of Sammamish); Wally Pereyra (private landowner); Matt Baerwalde (Snoqualmie Tribe); Jeff Chan, Brad Thompson, Paul Bakke (USFWS); Erica Tiliacos (Save Lake Sammamish); Ilene Stahl (Friends of Pine Lake); and Mark Taylor (Trout Unlimited)

Reference

King County. 2013. Kokanee and Chinook restoration projects, Sammamish Watershed. http://www.kingcounty.gov/environment/animalsAndPlants/restoration-projects/kokanee-chinook-projects.aspx

Ebright Project #	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Planning	Planning	Permitting	Implementation					
2	Assessment	Planning	Planning	Implementation					
3			Planning		Permitting	Implementation			
4			Planning		Permitting	Implementation			
5			Planning	Planning	Permitting	Implementation			
6		Planning	Permitting	Implementation					
7	Planning	Permitting	Implementation						
8		Planning	Planning	Planning	Implementation				

Assessment
Culvert replacement/modification
Stream restoration
Planning
Permitting
Implementation

Table 2. Potential timeline for kokanee restoration/enhancement projects in Ebright Creek. Projects are listed in order from the creek mouth to the most upstream and scheduling is independent for each project.

Laughing Jacobs Creek

Goal/Vision

The goal for Laughing Jacobs Creek is to protect and enhance the self-sustaining kokanee population in this creek. Projects will stabilize and improve habitat conditions in the spawning area and directly enhance the kokanee population through supplementation. As recovery actions are implemented, we expect 500 to 1,000 adults will use Laughing Jacobs Creek each year.

Laughing Jacobs Creek (WRIA #08.0166) enters the lake on its southeastern shore, on the northern edge of Lake Sammamish State Park near the boat launch (Figure 5). The lower part of the stream is in the City of Issaquah, while the upper part (above the canyon) is in the City of Sammamish. The lowest approximately 800 feet of the stream are on private property. Immediately upstream, the stream goes under the East Lake Sammamish Trail and East Lake Sammamish Parkway. The twin culverts—one for Laughing Jacobs Creek and the other for the adjacent but much smaller Many Springs Creek—under East Lake Sammamish Parkway are currently not fish barriers. The Laughing Jacobs Creek culvert was constructed in 1988 when the parkway was widened and the creek moved from a much longer culvert that ran diagonally under the old two-lane road. The next 0.8 miles of stream length are in Lake Sammamish State Park (Hans Jensen Group Area). Upstream of this reach, fish passage is blocked by natural falls (William et al. 1975). The upper watershed is largely built out with residential home developments. This area also contains wetlands and Laughing Jacobs Lake, which appear to attenuate high-flow events.

Laughing Jacobs Creek is one of the four primary spawning streams for Lake Sammamish kokanee (Figure 6). In most brood years, the spawning numbers have been lower in Laughing Jacobs Creek than in Lewis or Ebright creeks but higher than in Pine Lake Creek. Over the past 18 brood years, the escapement has ranged from 0 in 1998-99 to 1,384 fish (7-day stream-life estimate) in 2012-13. The main spawning area for kokanee in Laughing Jacobs Creek is upstream of the East Lake Sammamish Parkway in the Hans Jensen Group Area.

The exact list of restoration projects for Laughing Jacobs Creek depends on whether the stream channel is rerouted (Table 3). This large restoration project would involve rerouting the stream in the Hans Jensen Group Area to the south and the stream would enter the lake to the southwest of the boat ramp area. A new culvert would have to be built under East Lake Sammamish Trail and East Lake Sammamish Parkway. If completed, the lower part of the stream would be completely in state park lands and there would be ample room to construct an improved stream channel. Preliminary analysis indicates there are no significant issues with constructing

a new box culvert under the parkway and trail, other than the high cost. Channel gradient upstream of the parkway would be about 4%. However, below the parkway it would be less than 1% because the box culvert would need to be placed about 9 feet below the road surface to avoid the many utilities within the right-of-way, reducing the slope in the lower reach. This may result in less than optimum spawning habitat due to finer sediment deposition.

Additional information on Laughing Jacobs Creek and its restoration projects can be found in the following reports: City of Issaquah (2011), King County (2013), and The Watershed Company (2005, 2006).

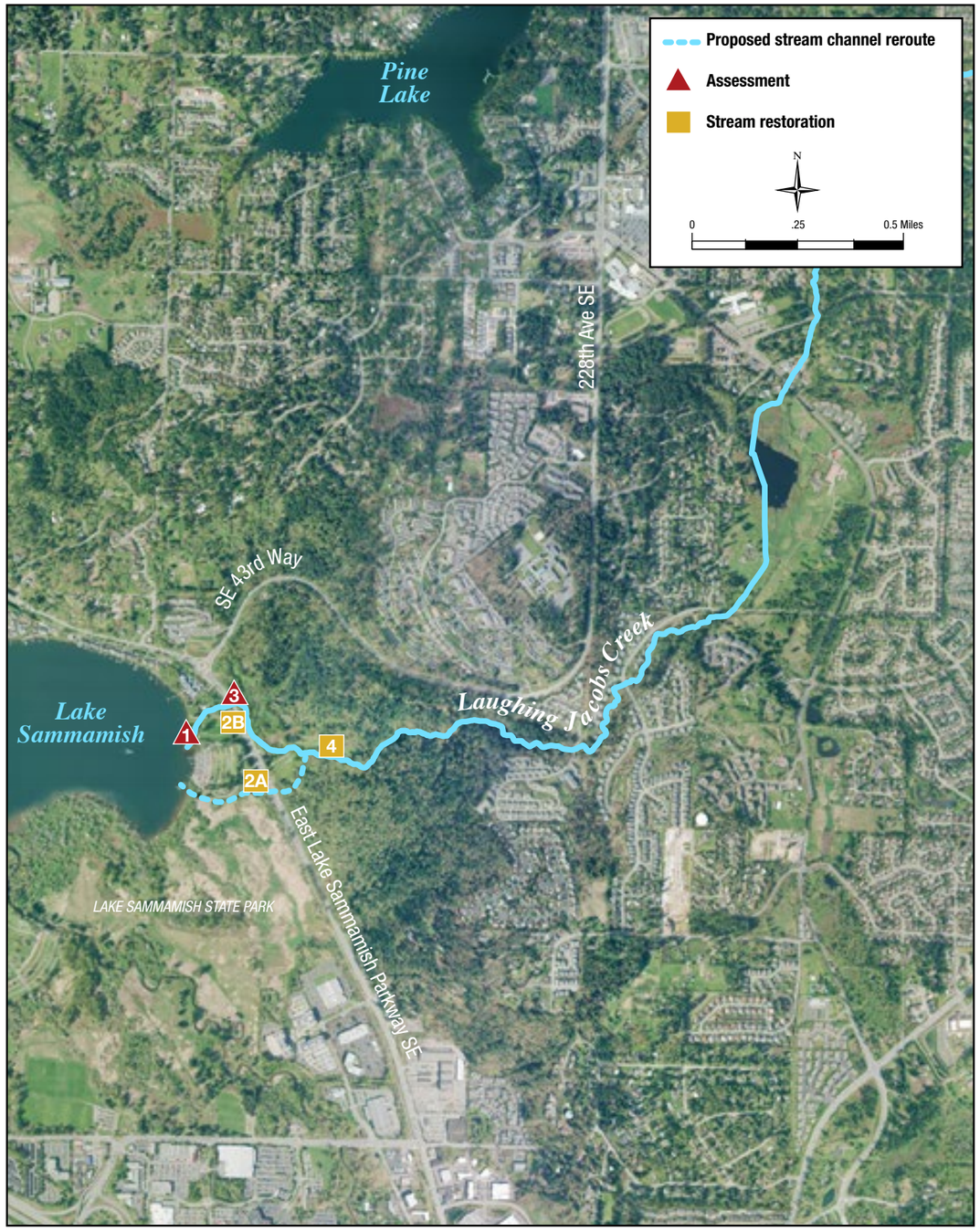


Figure 5. Locations of identified restoration/enhancement projects on Laughing Jacobs Creek.

Figure 6. The kokanee spawning reach of Laughing Jacobs Creek in Lake Sammamish State Park (Hans Jensen Group Area), November 2011 (photo credit: Roger Tabor, USFWS).

Laughing Jacobs	▲ Assessment ■ Stream restoration		
Project #	**Project Type**	**Name of Project**	**Description**
1	▲	Assessment of Reroute Option	Evaluate feasibility of rerouting stream.
2	■	Lower Reach Restoration	Reroute channel or enhance current channel to improve spawning.
3	▲	Assessment of Parkway Culvert	Evaluate hydraulics and fish passage of culvert under parkway.
4	■	Restoration in Hans Jensen Park	Enhance stream channel by installing pool-forming structures and addition of spawning gravel.

Table 3. List of four proposed projects to aid in the restoration or enhancement of kokanee spawning habitat on Laughing Jacobs Creek. Project numbers indicate relative location on the stream (down-stream to upstream) and do not indicate priority or schedule of implementation.

Projects Associated with Laughing Jacobs Creek

(in order from the creek mouth to the most upstream; potential timelines are given in Table 4)

1 Assessment of Reroute Option – Evaluate feasibility of rerouting stream to go south of boat ramp so lower reach will be completely on state parks lands, creating about 1,600 feet of new channel.

- Estimated Project Cost:
- Funds Acquired: $0
- Funds Needed:
- Estimated Project Duration:
- Current or Potential Project Lead:

2 Lower Reach (Downstream of Parkway) Restoration – There are two possibilities to restore the lower reach: 1) channel rerouted to go south of boat ramp and lower reach will be completely on state parks lands, creating about 1,600 feet of new channel, or 2) enhance current lower section to improve pool-forming features and improve riparian vegetation. The first option would also include building a new culvert system for the parkway and trail. Landowner support for either option is unknown at this time.

A. Reroute option

- Estimated Project Cost: $1 million or more
- Funds Acquired: $0
- Estimated Project Duration (planning & design): not scheduled
- Estimated Project Duration (construction): not scheduled
- Current or Potential Project Lead: City of Issaquah

B. Restoration of existing channel option

- Estimated Project Cost: $200,000
- Funds Acquired: $0
- Funds Needed: $200,000
- Estimated Project Duration (planning & design): 36 months
- Estimated Project Duration (construction): 36 months
- Current or Potential Project Lead: City of Issaquah

3 East Lake Sammamish Parkway Culvert Assessment – Evaluate hydraulics and fish passage of the current culverts under East Lake Sammamish Parkway and recommend options. Evaluation of this project would be done as part of 1 above.

- Estimated Project Cost: $15,000
- Funds Acquired: $0
- Funds Needed: $15,000
- Estimated Project Duration (planning & design):
- Estimated Project Duration: Next year
- Current or Potential Project Lead: City of Issaquah

4 Stream Restoration in Hans Jensen Park – Enhance existing stream channel by installing pool-forming structures, bank softening measures, and additional spawning gravel. The scope of this project will depend if the reroute project is undertaken. If the reroute project is undertaken, this project would start at the small bridge and extend upstream about 1,000 feet. If the reroute project is not undertaken, then this project will start at the parkway and extend upstream to the same end point. This project will also include removal of bank armoring between the park residence and the parkway, if the reroute is not undertaken.

A. Reroute option - Restoration of existing channel downstream to start of reroute channel (project would be included in 2A, above)

B. Without Reroute option - Restoration of existing channel downstream to parkway

- Estimated Project Cost: $350,000
- Funds Acquired: $0
- Funds Needed: $350,000
- Estimated Project Duration (planning & design): 36 months
- Estimated Project Duration (construction): six months
- Current or Potential Project Lead: City of Issaquah

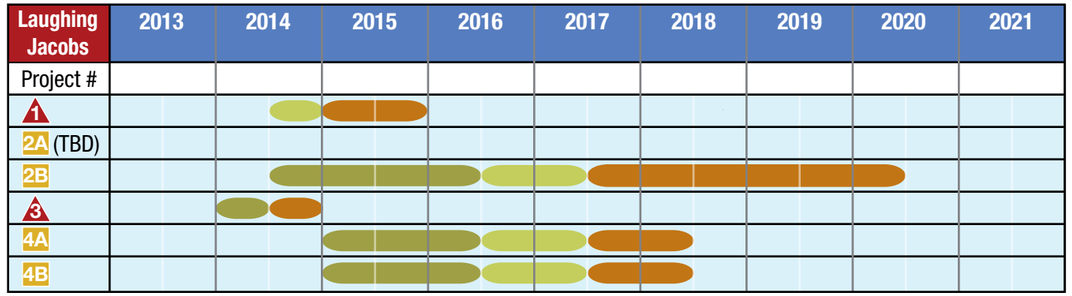


Table 4.— Potential timeline for kokanee restoration projects in Laughing Jacobs Creek. Projects are listed in order from the creek mouth to the most upstream and scheduling is independent for each project.

Laughing Jacobs Team Members:

Kerry Ritland (City of Issaquah); Roger Tabor, Jeff Chan, Brad Thompson (USFWS); and Hans Berge (King County)

References

City of Issaquah. 2011. State of our waters, fourth report. Issaquah Aquatic Resources Monitoring Report 1999-2010. Public Works Engineering Department and Resource Conservation Office, Issaquah, Washington.

King County. 2013. Kokanee and Chinook restoration projects, Sammamish Watershed. http://www.kingcounty.gov/environment/animalsAndPlants/restoration-projects/kokanee-chinook-projects.aspx

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Lewis Creek

Goal/Vision

It is our (KWG) intention that by implementing the following projects we will assist the recovery of the self-sustaining kokanee population in Lewis Creek to previously observed numbers of spawners. Projects will stabilize and improve habitat conditions in the spawning area, stabilize natural processes throughout the system, and directly enhance the kokanee population through supplementation. As some of the recovery efforts are being implemented, we expect Lewis Creek to support at least 500 adults each year. Once all these measures have been implemented, we expect that the system will be able to support over 1,000 spawners each year. Additionally, we expect the egg-to-fry survival rate to increase from a range of 4–12% at present to 10–20%.

Lewis Creek (WRIA #08.0162) is located in the southwest part of the Lake Sammamish basin in an area known as Greenwood Point. The lower part of the stream (north of I-90/West Lake Sammamish Parkway) is in the City of Issaquah, while the upper part is primarily in the City of Bellevue (Figure 7). Over the last few decades this stream has seen a large increase in urban development. Kokanee spawn in the lower 4,125 feet of the creek up to West Lake Sammamish Parkway. Land use along this stream reach is all low density residential development and the stream bed and riparian area is owned by over 30 separate landowners. The residential development has constrained the floodplain and reduced natural processes. Upstream of this is one large major culvert under I-90 and West Lake Sammamish Parkway that completely stops upstream fish passage. Upstream of the culvert there is a limited amount of potential kokanee spawning habitat within the steep, unstable ravine. Even with extensive riparian parklands, this ravine is prone to large erosion and landslide events. Because there is not extensive spawning habitat above the culvert and fixing the culvert would be a large, expensive project, the KWG does not consider this a feasible recovery project in the next 15 years.

Lewis Creek is one of the four primary spawning streams for Lake Sammamish kokanee. From brood year 1996-97 to 2008-09, kokanee escapement was highest in Lewis Creek 10 out of 13 years. However in the past five brood years, the highest kokanee escapement has been in either Ebright or Laughing Jacobs creeks. During the past 18 brood years, the peak kokanee escapement was 6,495 (7-day stream-life estimate) in 2012-13.

Completed restoration projects in Lewis Creek include a fish passage project completed by the City of Issaquah in July 2008. The project site is located just downstream of SE 44th Street, about midway between the lake and I-90. The project involved the construction of five rock

weirs in the channel below the passage barrier to create a series of steps that fish can successfully navigate (the old barrier was about 2 feet high). This now allows kokanee to access habitat upstream of West Lake Sammamish Parkway during all flow conditions.

A major restoration project is currently planned for Lewis Creek (Table 5) which involves the installation of a series of instream grade-control structures to make the channel bed more resistant to high flows and also to capture fine sediments, thus improving kokanee spawning habitat. Accumulated sediment near the mouth would also be removed. Background information on this large project can be found in a report by Northwest Hydraulics Consultants (2011).

Additional information on Lewis Creek can be found in a report prepared by King County (2013) and The Watershed Company (2006).

Figure 7. Locations of identified restoration/enhancement projects on Lewis Creek.

Lewis	▲ Assessment ● Culvert replacement/modification ■ Stream restoration		
Project #	**Project Type**	**Name of Project**	**Description**
1	■	Lower Spawning Reach Restoration	Install series of instream grade-control structures.
2	■	Upper Spawning Reach Restoration	Install series of instream grade-control structures.
3	▲	Protection of Riparian Corridor	Develop landowner stewardship project to help protect the riparian corridor.
4	●	Trash Rack at I-90 Culvert	Replace or modify existing trash rack.
5	▲	Upper Basin Hydrological Assessment	Assess upper basin to improve stormwater management.

Table 5. List of five proposed projects to aid in the restoration or enhancement of kokanee spawning habitat on Lewis Creek. Project numbers indicate relative location on the stream (downstream to upstream) and do not indicate priority or schedule of implementation.

Projects Associated with Lewis Creek

(in order from the creek mouth to the most upstream; potential timelines are given in Table 6)

1 Lower Spawning Reach (1,740 feet of stream; Reach 3 and 4) – Phase 1 – City of Issaquah proposes to install a series of instream grade-control structures to capture fine sediments along with sediment removal near the mouth to improve kokanee spawning habitat (Northwest Hydraulics Consultants 2011). This project has landowner support.

- Estimated Project Cost: $325,000
- Funds Acquired: $125,000 (City of Issaquah)
- Funds Needed: $200,000
- Estimated Project Duration (planning & design): six months
- Estimated Project Duration (construction): 18 months
- Current or Potential Project Lead: City of Issaquah

2 Upstream Spawning Reach (2,385 feet of stream; Reach 1 and 2) – Phase 2 – This is a continuation of Project #1 except this project will enhance the kokanee spawning area immediately upstream of Project #1 to the West Lake Sammamish Parkway. Another series of instream grade-control structures will be installed to capture fine sediments and thus improve kokanee spawning habitat. No project planning or landowner contacts have been made on this project.

- Estimated Project Cost: $400,000
- Funds Acquired: $0
- Funds Needed: $400,000
- Estimated Project Duration (planning & design): One year
- Estimated Project Duration (construction): One year
- Current or Potential Project Lead: City of Issaquah

3 Protect Riparian Corridor of Spawning Reach – Further development of a landowner stewardship project to help protect the riparian corridor of the spawning reach (creek mouth to West Lake Sammamish Parkway). Ongoing partnership with the Meadowbrook Point Homeowners Association (encompasses the lower half of the spawning reach) will help protect much of the riparian corridor. Developing partnerships with landowners in the upper spawning reach is needed.

- Estimated Project Cost: No cost
- Estimated Project Duration (planning & design): None
- Estimated Project Duration: next seven years
- Current or Potential Project Lead: City of Issaquah

4 Trash Rack at I-90 Culvert – The current trash rack upstream of the I-90 culvert occasionally becomes plugged with debris during a high-flow event. Once debris is removed by WSDOT maintenance crews, a high discharge event can occur and cause scour to kokanee redds. The last major event was in 2007. Further discussions with WSDOT are needed to move this project forward.

- Estimated Project Cost: $100,000
- Funds Acquired: $0
- Funds Needed: $100,000
- Estimated Project Duration (planning & design): One year
- Estimated Project Duration (construction): One year
- Current or Potential Project Lead: WSDOT

5 Upper Basin Hydrological Assessment – An assessment of the upper basin will provide recommendations on the best methods to manage stormwater and maintain and stabilize natural processes.

- Estimated Project Cost: $100,000
- Funds Acquired: $0
- Funds Needed: $100,000
- Estimated Project Duration (planning & design): Six months
- Estimated Project Duration (construction): Two years
- Current or Potential Project Lead: City of Bellevue

Lewis and Vasa Team Members:

Kerry Ritland (City of Issaquah); Kit Paulsen, Glenn Kost (City of Bellevue); Kirk Lakey (WDFW); Roger Tabor, Brad Thompson (USFWS); and Hans Berge (King County)

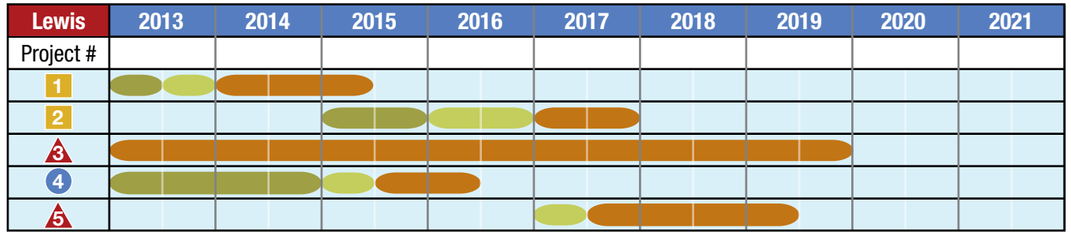

Table 6. Potential timeline for kokanee restoration projects in Lewis Creek. Projects are listed in order from the creek mouth to the most upstream and scheduling is independent for each project.

References

King County. 2013. Kokanee and Chinook restoration projects, Sammamish Watershed. http://www.kingcounty.gov/environment/animalsAndPlants/restoration-projects/kokanee-chinook-projects.aspx

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The Watershed Company. 2006. Stream and riparian areas restoration plan. Report of the Watershed Company to the City of Issaquah, Washington.

Pine Lake Creek

Goal/Vision

It is our (KWG) intention that by implementing the following projects we will not only greatly expand our knowledge of Pine Lake Creek, we will also be able to supplement kokanee into the system and help establish a self-sustaining spawning aggregation.

Pine Lake Creek (WRIA #08.0152) is on the east side of Lake Sammamish and is located about 500 ft south of 8th Street off of the East Lake Sammamish Parkway in Sammamish (Figure 8). Pine Lake Creek has three known culverts that may impede fish passage, but a major habitat assessment of the creek is necessary to determine the creek's current and potential capacity to support kokanee (Table 7). The three culverts are the East Lake Sammamish Shore Lane SE pipe culvert, the East Lake Sammamish Trail culvert, and the East Lake Sammamish Parkway box culvert.

Pine Lake Creek is one of the four primary spawning streams for Lake Sammamish kokanee, although it generally has substantially fewer spawners than each of the other three creeks. Historically, kokanee returned to spawn in Pine Lake Creek in significant numbers. However, over the last few years that this creek has been monitored, fewer than 10 kokanee returned to spawn in 11 of 18 years. During the 2012-13 spawning season, an estimated 485 kokanee returned (7-day stream-life estimate), thus indicating this creek may be capable of supporting a good run of kokanee.

Figure 8. Locations of identified restoration/enhancement projects on Pine Lake Creek.

Pine Lake ▲ Assessment ● Culvert replacement/modification ■ Stream restoration ⬢ Supplementation/reintroduction

Project #	Project Type	Name of Project	Description
1	▲	Pine Lake Creek Basin Assessment/Plan	Assess watershed to identify limiting factors for kokanee.
2	■	Reach Restoration Downstream of Parkway	Restore or enhance kokanee staging and spawning habitat.
3	●	Culvert Replacement/Improvement at East Lake Sammamish Shore Lane SE	Replace or modify culvert to improve fish passage.
4	●	Culvert Replacement/improvement at East Lake Sammamish Trail	Replace or modify culvert to improve fish passage.
5	■	Reach Restoration Upstream of Parkway	Restore or enhance kokanee spawning habitat.
6	⬢	Pine Lake Creek Reintroduction	Supplement or reintroduce kokanee into this creek system.

Table 7. List of the seven proposed major projects for kokanee fish passage and spawning habitat enhancement on Pine Lake Creek. Project numbers indicate relative location on the stream (downstream to upstream) and do not indicate priority or schedule of implementation.

Projects Associated with Pine Lake Creek

(in order from the creek mouth to the most upstream; potential timelines are given in Table 8)

1 **Pine Lake Creek Basin Assessment/Plan** – The Pine Lake Creek Basin Plan will assess the basin as a whole, and in doing so will identify problems which occur in the basin that could directly affect the long-term survival of kokanee. The City of Sammamish will lead the completion of the Pine Lake Creek Basin Plan.

- Estimated Project Cost: $300,000
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration:
- Current or Potential Project Lead: City of Sammamish

2 **Reach Restoration Downstream of Parkway** – The reaches of Pine Lake Creek downstream of the parkway historically supported spawning kokanee. Although some restoration improvements have been implemented in this reach, placement of additional wood and additional riparian planting in parts of this reach would increase instream cover, control bedload movement, and provide additional holding pools.

- Estimated Project Cost (planning & design): $10,000
- Estimated Project Cost (construction): $65,000
- Funds Acquired:
- Funds Needed: $75,000
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead:

3 **Culvert Replacement/ Improvement at E. Lake Sammamish Shore Lane** – The culvert under East Lake Sammamish Shore Lane SE may impede kokanee from accessing upstream spawning grounds in some instances (Figure 9). Modification of the culvert, as well as the culverts in project 4, will allow kokanee to more freely access the upper reaches of the creek. The project site is approximately 200 ft upstream from the mouth of the creek and 100 ft downstream of the East Lake Sammamish Trail culvert.

- Estimated Project Cost (planning & design): $25,000
- Estimated Project Cost (construction): $150,000
- Funds Acquired:
- Funds Needed: $175,000
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: City of Sammamish

4 **Culvert Replacement/ Improvement at East Lake Sammamish Trail** – The culvert under East Lake Sammamish Trail may impede kokanee from accessing upstream spawning grounds during some flows (Figure 9). Replacement or modification of the culvert, as well as the culvert in project 3, will allow kokanee to more freely access the upper reaches of the creek. Depending on the replacement/modification design, additional spawning habitat could also be restored within the footprint of this crossing. The project site is approximately 200 ft upstream from the mouth of the creek and 100 ft downstream of the East Lake Sammamish Parkway box culvert.

- Estimated Project Cost (planning & design): $30,000 (50% design) + $10,000 (90% design) + $5,000 (final)
- Estimated Project Cost (construction): $90,000
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: King County DNRP

5 **Reach Restoration Upstream of Parkway** – The reaches of Pine Lake Creek upstream of the parkway historically supported spawning kokanee. Improving instream and riparian habitat in this reach is targeted to maintain and increase this use. Removing man-made armoring along portions of the stream bank and bed, increasing riparian planting, and creating pool-forming structures will enhance the successful spawning and incubation of kokanee in this creek.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (construction):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead:

6 **Pine Lake Creek Reintroduction** – Supplementation or reintroduction of kokanee into Pine Lake Creek using the supplementation program is the most efficient way of increasing abundance of or re-establishing the spawning run of kokanee within this stream. The Issaquah Creek Hatchery will oversee egg incubation and fry rearing for this effort. Cost will vary depending upon availability of recirculating RSI units at the hatchery and any necessary infrastructure upgrades.

- Estimated Project Cost (planning & design): $36,000 (construction of additional RSI incubator system)
- Estimated Project Cost (implementation): $18,000/year (operation & maintenance)
- Funds Acquired: None
- Funds Needed: $36,000 + $72,000 (four years of operation & maintenance for one kokanee generation) + $144,000 (eight additional years of operation & maintenance for two additional kokanee generations)
- Estimated Project Duration (planning & design): 45 days
- Estimated Project Duration (implementation): Up to 12 years (may be less, subject to population response)
- Current or Potential Project Lead: WDFW, USFWS, and King County DNRP

Zaccuse, Ebright, Pine Lake (ZEP) Team Members:

Don Gerend, Tom Odell, Eric Lafrance (City of Sammamish); Wally Pereyra (private landowner); Matt Baerwalde (Snoqualmie Tribe); Jeff Chan, Brad Thompson, Paul Bakke (USFWS); Erica Tiliacos (Save Lake Sammamish); Ilene Stahl (Friends of Pine Lake); and Mark Taylor (Trout Unlimited)

Pine Lake	2013	2014	2015	2016	2017	2018	2019	2020	2021
Project #									
1									
2									
3									
4									
5									
6									

Assessment
Culvert replacement/modification
Stream restoration
Supplementation/reintroduction
Planning
Permitting
Implementation

Table 8. Potential timeline for kokanee restoration projects in Pine Lake Creek. Projects are listed in order from the creek mouth to the most upstream and scheduling is independent for each project.

Figure 9. Two potential culvert replacement projects on Pine Lake Creek (photo credit: Rachel Brooks; December 16, 2013). The left photograph is the culvert under the East Lake Sammamish Trail and the right photograph is the culvert under East Lake Sammamish Shore Lane SE. Both photographs were taken looking upstream.

Category 2 Streams

Large streams in the south end of the Lake Sammamish Basin that currently do not support many kokanee but have the potential to support a large run.

- Issaquah Creek
- Tibbetts Creek

Issaquah Creek

Goal/Vision

The goal for Issaquah Creek is to have a self-sustaining kokanee spawning aggregation (estimated capacity: 10,000 adults/year) that spawns throughout the basin and is maintained in the long term by natural production. Historic observations (circa 1930s) indicated there was a strong summer/early run of kokanee run in Issaquah Creek. The KWG anticipates that a winter/late kokanee population in Issaquah Creek can be established to previously observed levels of kokanee spawners.

Issaquah Creek (WRIA #08.0178) is the largest tributary to Lake Sammamish and is located in the south part of the Lake Sammamish basin (Figure 10). Headwaters include Carey Creek and Holder Creek; where these two streams meet is the start of Issaquah Creek. The WRIA 8 stream catalog (Williams et al. 1975) classifies Holder Creek as the upper mainstem of the Issaquah Creek system. Issaquah Creek extends over 11 stream miles from Lake Sammamish to the confluence of Holder Creek and Carey Creek. Holder Creek extends an additional 6 miles. Other major tributaries include McDonald Creek, Fifteen Mile Creek, East Fork Issaquah Creek, and North Fork Issaquah Creek. The mouth of Issaquah Creek and the lower mile of the creek are in the Lake Sammamish State Park. Much of East Fork Issaquah Creek runs in close proximity to I-90. The Issaquah Fish Hatchery is located on the mainstem of Issaquah Creek at approximately rivermile 3. The lower part of the basin, which is within the Urban Growth Area, is urbanized with numerous residential, commercial, and light industrial developments. Land use in the upper basin, which is outside the Urban Growth Area, consists primarily of low-density residential and open space or state park.

Historically, Issaquah Creek was primarily used by summer/early-run kokanee (Berge and Higgins 2003). These fish began spawning during the first week of August, with the peak of spawning during the last week of August, and the end of spawning occurring during the second week of September. An estimated 15,000 summer/early-run kokanee were present in Issaquah Creek in 1975 but by 2001, no kokanee were observed. The summer/early-run is currently presumed extinct. Historic records indicate that winter/late-run kokanee did not appear to appreciably use Issaquah Creek.

Although Issaquah Creek is a large system with a large amount of potential spawning area, few adult kokanee have been observed in recent years. However, there has been little effort to directly monitor their abundance in this system. Issaquah Creek is more difficult to survey than other kokanee creeks because of its larger size and deeper waters. In recent years, kokanee have been occasionally observed in East Fork Issaquah Creek and at the Issaquah Fish Hatchery.

There are no major obstacles to kokanee migration in Issaquah Creek. A fish ladder at the Issaquah Fish Hatchery weir allows fish to migrate further upstream (Figure 10). When anadromous salmonids are being diverted at the weir into holding ponds, some kokanee may be diverted as well. These kokanee are often collected and moved upstream of the hatchery. The diversion dam (approximately rivermile 3.7) for the Issaquah Fish Hatchery's water supply was removed in 2013 and replaced with a series

of rock weirs to restore fish passage to upstream reaches.

With the completion of the passage project at the weir, the major enhancement project for Issaquah Creek is a supplementation program to help re-establish a viable kokanee population (Table 9). The large kokanee run in other tributaries in 2012-13 allowed for an unanticipated opportunity to release kokanee fry into Issaquah Creek in the spring of 2013. Broodstock for Issaquah Creek were taken from Ebright, Laughing Jacobs, Lewis, and Zaccuse creeks. Approximately 84,700 kokanee fry were released into Issaquah Creek at the Issaquah Fish Hatchery. This project will continue during the upcoming years if a large kokanee run is present in other tributaries and the egg-take goals for the main spawning tributaries are met.

More comprehensive spawning surveys of Issaquah Creek and its tributaries are also needed to determine the extent that adult kokanee are currently using this stream system. This will be especially valuable in light of both the recent restoration of passage above the Issaquah Fish Hatchery diversion and the spring 2013 release of fry in the creek. The latter could result in a substantial number of kokanee returning to the creek in the fall of 2015.

Additional information on Issaquah Creek can be found in the following reports: City of Issaquah (2011), King County (1996, 2013), and The Watershed Company (2005, 2006).

Figure 10. Issaquah Creek at the WDFW Issaquah Fish Hatchery weir system, November 10, 2009 (photo credit: Roger Tabor, USFWS).

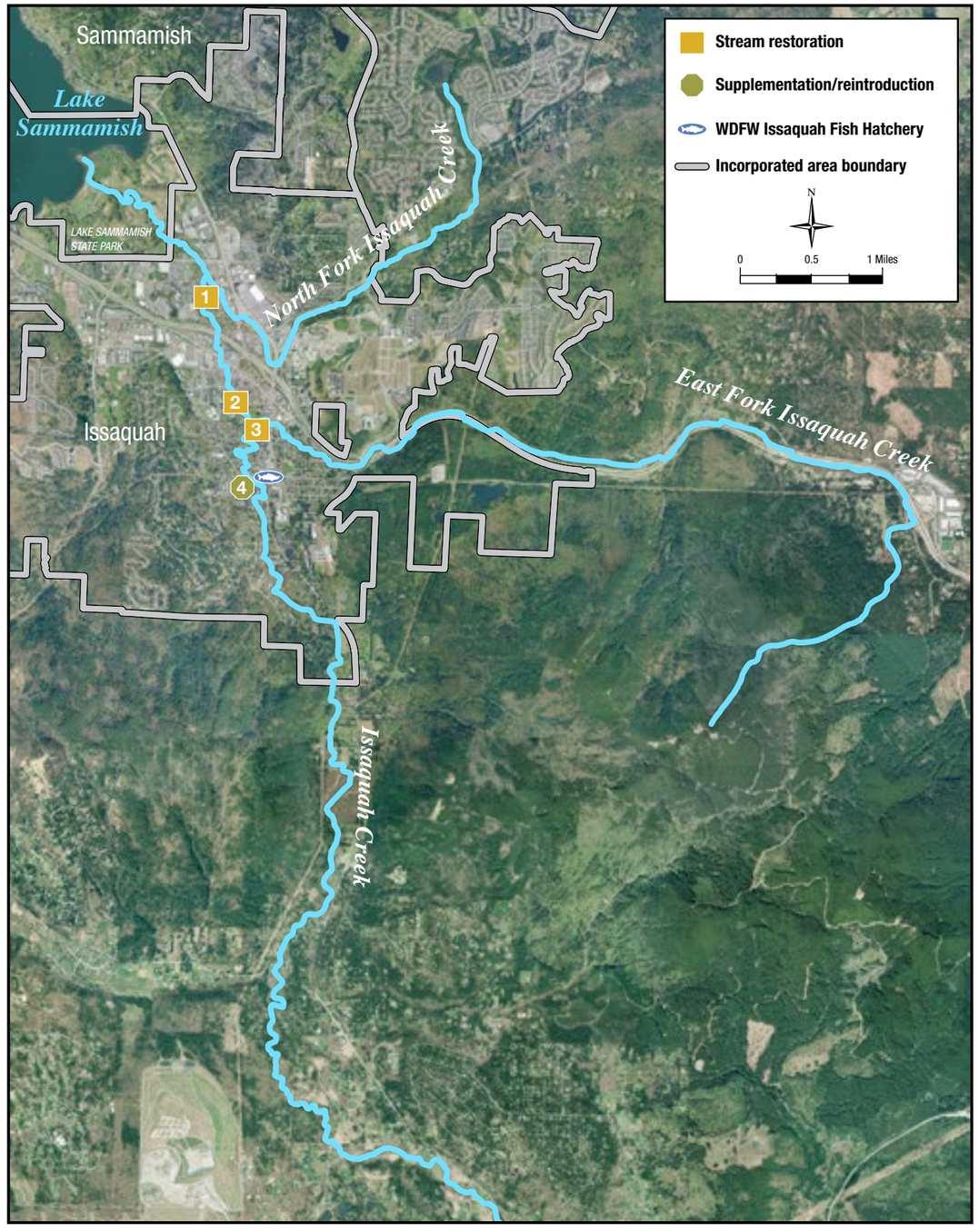

Figure 11. Locations of identified restoration/enhancement projects in the Issaquah Creek basin.

Projects Associated with the Issaquah Creek Basin

(in order from the creek mouth to the most upstream)

Issaquah — Stream restoration — Supplementation/reintroduction

Project #	Project Type	Name of Project	Description
1	■	Pickering Reach Habitat Restoration Project	Improve habitat conditions including removal of riprap, add large woody debris, and restore native vegetation.
2	■	Cybil-Madeleine Reach Restoration Project	Improve habitat conditions including regrade banks, add large woody debris, and create side-channel.
3	■	East Fork Issaquah Confluence Reach Restoration Project	Improve habitat conditions including regrade banks, add large woody debris, and addition of gravel.
4	●	Issaquah Creek Reintroduction	Supplement or reintroduce kokanee into this creek system.

Table 9. List of four proposed projects to aid in the restoration of kokanee in the Issaquah Creek basin. Project numbers indicate relative location on the stream (downstream to upstream) and do not indicate priority or schedule of implementation.

1 Issaquah Creek Pickering Reach Habitat Restoration - In the near future, the City of Issaquah will start pursuing a large scale restoration project in the Pickering Reach, located between SE 56th Street and I-90. This reach is part of the historic Pickering Farm and as such, the channel was straightened and armored in places. The City controls the west bank through an easement, and property acquisitions are currently being pursued on the east bank (Bush Lane area). Once land is secured through title or landowner commitments, the City will seek grants to initiate design. Restoration would significantly improve floodplain habitat elements, including removal of riprap and floodplain fill, adding LWD to improve instream habitat, and restoring native vegetation.

- Estimated Project Cost: $1.5 million
- Funds Acquired: $0 (City of Issaquah)
- Funds Needed: $1.5 million
- Estimated Project Duration (planning & design): 36 months
- Estimated Project Duration (construction): 24 months
- Current or Potential Project Lead: City of Issaquah

2 Issaquah Creek Cybil-Madeleine Park Reach Restoration Project – City of Issaquah plans to regrade the banks to a gentler slope, add LWD and other pool-forming features, and create side-channel habitat with spawning gravel.

- Estimated Project Cost: $1.6 million
- Funds Acquired: $ 1.6 million (City of Issaquah and grants)
- Funds Needed: $0
- Estimated Project Duration (planning & design): Design completed in 2013
- Estimated Project Duration (construction): Construction scheduled for summer 2014
- Current or Potential Project Lead: City of Issaquah

3 East Fork Issaquah Creek Confluence Reach Project – City of Issaquah plans to remove bank armoring and re-grade the bank to a flatter slope to increase connection to floodplain. Also, large wood will be added to the channel to create pool habitat and native riparian species will be planted on the banks to promote future wood recruitment. Gravel will be excavated from the confluence and redistributed upstream to encourage kokanee spawning.

- (Funding included in project #2.)

4 Supplementation Project – WDFW, King County, and USFWS plan to re-establish the Issaquah Creek kokanee run through a supplementation project. Broodstock will be collected from other Lake Sammamish streams and brought to the Issaquah Fish Hatchery.

- Estimated Project Cost: $16,000/year
- Funds Acquired: $0
- Funds Needed: $16,000/year
- Estimated Project Duration (planning & design): Not scheduled
- Estimated Project Duration (supplementation): Not scheduled
- Current or Potential Project Lead: WDFW

Issaquah Team Members:

Kerry Ritland (City of Issaquah); Kirk Lakey (WDFW); Roger Tabor, Brad Thompson, Jeff Chan (USFWS); and Hans Berge (King County)

References

Berge, H. B., and K. Higgins. 2003. The current status of kokanee in the greater Lake Washington Watershed. King County Department of Natural Resources and Parks, Water and Land Resources Division, Seattle, Washington.

City of Issaquah. 2011. State of our waters, fourth report. Issaquah Aquatic Resources Monitoring Report 1999-2010, Public Works Engineering Department and Resource Conservation Office, Issaquah, Washington.

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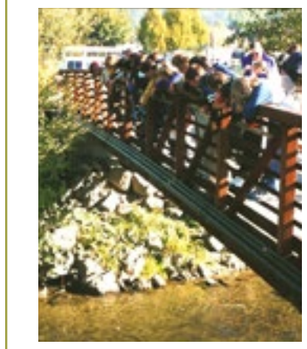
The Watershed Company. 2005. Lake Sammamish State Park wetland, stream and lakeshore restoration plan. Report of the Watershed Company to the Washington State Parks & Recreation Commission.

The Watershed Company. 2006. Stream and riparian areas restoration plan. Report of the Watershed Company to the City of Issaquah, Washington.

Williams, R. W., R. M. Laramie, and J. J. Ames. 1975. A catalog of Washington streams and salmon utilization, volume 1, Puget Sound Region. Washington Department of Fisheries, Olympia.



Tibbetts Creek

Goal/Vision

The goal for Tibbetts Creek is to have a self-sustaining kokanee spawning aggregation (1,000 to 5,000 adults/year) that spawns upstream of the I-90 bridge and is maintained by natural habitat-forming processes. Historic observations (circa 1930s) indicated a strong kokanee run. The KWG anticipates that the kokanee population in Tibbetts Creek can be restored to previously observed levels of spawners.

Tibbetts Creek (WRIA #08.0169) enters Lake Sammamish along its southwestern shoreline (Figure 12). The stream is roughly 4 miles long and originates on Squak Mountain at an elevation of 1,080 feet. The Tibbetts Creek basin is primarily in the City of Issaquah. The creek mouth and lower half mile of the creek are in the Lake Sammamish State Park. The lower part of the basin is in a floodplain shared with Issaquah Creek, while the upper part of the basin is mostly steep terrain that is part of the uplands of Squak and Cougar mountains. The lower part, located within the Urban Growth Area, is mostly urbanized with numerous commercial and residential developments, while the upper basin, located in a rural area, consists of low density residential development, open space, and parklands.

Although Tibbetts Creek is a relatively large system with a large amount of potential spawning area and no major fish passage issues, adult kokanee were not observed over the last two decades until 2012. However, there has been little focused effort to monitor their abundance in this creek. In 2012, over 400 adult kokanee were present in Tibbetts Creek between rivermile 0.6 and 1.6 (Figure 13 and Figure 14). In the 2013-14 return-year, an estimated 167 kokanee (7-day stream-life estimate) spawned in Tibbetts Creek, which was more than in any other stream in the Lake Sammamish system. In addition to the mainstem, kokanee have also been observed in Pickering Creek (WRIA 08.0170), a small low-gradient tributary located in the lower part of the basin. Kokanee were not known to use this small tributary prior to 2012. Eleven kokanee were observed in Pickering Creek (I-90 culvert to 12th Avenue) on a spot check on December 12, 2012. It is unknown if kokanee spawn in other tributaries of Tibbetts Creek, such as Anti-Aircraft Creek (WRIA #08.0169A) or West Fork Tibbetts Creek (WRIA #08.0171).

Several habitat restoration projects have been completed on Tibbetts and Pickering creeks during the last 10 years as part of the Tibbetts Creek Greenway Project. This includes several culvert replacements (NW Sammamish Road, I-90, and Newport Way) and channel restorations (Lake Sammamish State Park, Rowley Properties, and Tibbetts Manor). Currently, a channel relocation project has been proposed for the reach upstream of NW Poplar Way near the I-90 Bridge (Table 10). This is the final remaining Greenway reach, termed Lower Reach 3. Other potential projects include: 1) reconfiguration of the stream channel at the Lake Sammamish State Park entry to increase riparian buffers, and 2) fish passage improvement on West Fork Tibbetts Creek. These later projects are currently in their infancy and further evaluation is needed.

At some stream locations (e.g., near the creek mouth and at NE Gilman Blvd), beaver dams may limit upstream migration of kokanee and inundate spawning riffles. In 2012 and 2013, beaver dams did not appear to limit kokanee migrations and the amount of spawning habitat did not appear to be significantly reduced. At this time, no specific project is proposed but some sites need to be monitored and evaluated.

A major concern for kokanee populations in Tibbetts Creek is water quality. Previous water quality sampling has indicated the basin has relatively high sedimentation and subsequent high turbidities, high nitrate and ammonia concentrations, elevated fecal coliforms, and low dissolved oxygen concentrations (City of Issaquah 2011). Additional monitoring of water quality is needed to determine if conditions have improved.

Additional information on Tibbetts Creek can be found in the following reports: City of Issaquah (2011), King County (1996), and The Watershed Company (2005, 2006).

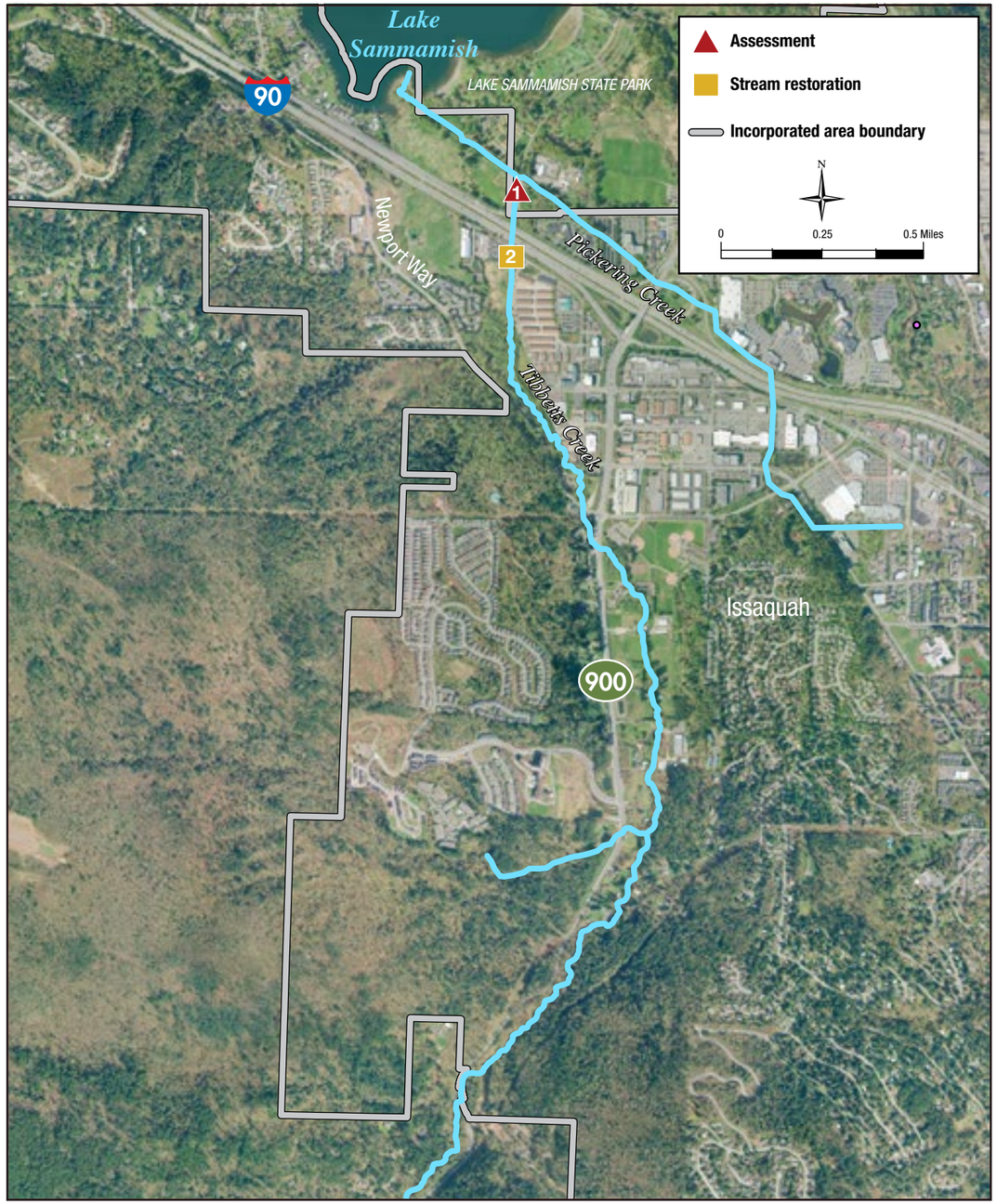


Figure 12. Location of identified restoration/enhancement projects on Tibbetts Creek. Pickering Creek is also shown (adult kokanee have been observed in this tributary).

Figure 13. Kokanee spawning reach in Tibbetts Creek, December 2012. The left photograph is looking upstream from NW Popular Way near the I-90 Bridge. This is the site of the proposed stream relocation project (Tibbetts Creek Greenway Lower Reach 3). The right photograph was taken just upstream of 17th Avenue NW in the Tibbetts Valley Park (photo credit: Roger Tabor, USFWS).

Projects Associated with Tibbetts Creek

(in order from the creek mouth to the most upstream)

1 **Water Quality Monitoring and Assessment** – Continued water quality sampling will help measure changes and trends in aquatic resource health. Also, this monitoring will help evaluate the effectiveness of current and future stormwater management and habitat restoration programs. This project will be conducted by the City of Issaquah.

- Estimated Project Cost: ongoing ambient monitoring program – no funds needed
- Current or Potential Project Lead: City of Issaquah

2 **Stream relocation above NW Poplar Way Bridge** (Tibbetts Creek Greenway Lower Reach 3) – City of Issaquah plans to relocate and restore the stream channel to provide stream complexity (LWD, pools, riffles). This project is contingent on landowner cooperation, which has not been possible in the past. Development proposals for the properties may provide an opportunity in the next few years.

- Estimated Project Cost: $350,000
- Funds Acquired: $0 (City of Issaquah)
- Funds Needed: $350,000
- Estimated Project Duration (planning & design): Not scheduled
- Estimated Project Duration (construction): Not scheduled
- Current or Potential Project Lead: City of Issaquah

Figure 14. Kokanee spawning reach (between 12th Avenue and I-90 culvert) in Pickering Creek, December 2012 (photo credit: Roger Tabor, USFWS).

Tibbetts — ▲ Assessment ■ Stream restoration

Project #	Project Type	Name of Project	Description
1	▲	Water Quality Monitoring and Assessment	Continue water quality sampling.
2	■	NW Poplar Way Stream Restoration	Restore stream channel to provide stream complexity (large woody debris, pools, riffles).

Table 10. List of two proposed projects to aid in the restoration or monitoring of kokanee spawning habitat on Tibbetts Creek. Project numbers indicate relative location on the stream (downstream to upstream) and do not indicate priority or schedule of implementation.

Tibbetts Team Members:

Kerry Ritland (City of Issaquah); Kirk Lakey (WDFW); Roger Tabor, Brad Thompson, Jeff Chan (USFWS); and Hans Berge (King County)

References

City of Issaquah. 2011. State of our waters, fourth report. Issaquah Aquatic Resources Monitoring Report 1999-2010, Public Works Engineering Department and Resource Conservation Office, Issaquah, Washington.

King County. 1996. Final Issaquah Creek Basin and nonpoint action plan. King County Department of Natural Resources and Issaquah/East Lake Sammamish Watershed Management Committee, Seattle, Washington.

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The Watershed Company. 2006. Stream and riparian areas restoration plan. Report of the Watershed Company to the City of Issaquah, Washington.

Category 3 Streams

Small secondary streams that have potential for kokanee spawning.

- George Davis Creek
- Idylwood Creek
- Schneider Creek
- Vasa (Squibbs) Creek
- Zaccuse Creek

George Davis Creek

George Davis Creek (WRIA #08.0144) is currently not considered a critical spawning stream for kokanee (Figure 15). Kokanee spawners have intermittently returned to the accessible portion of the creek following a recent restoration project of the lower reach (Figure 16). However, a habitat assessment and spawner monitoring effort is needed before the KWG can reach a conclusive decision on the stream's overall potential as a kokanee spawning stream and whether it can support a self-sustaining kokanee spawning aggregation.

The mouth of George Davis Creek is along the east shoreline of Lake Sammamish and is located about 0.25 miles northeast of the mouth of Zaccuse Creek. The stream is within the City of Sammamish. Only about 100 feet of George Davis Creek is currently accessible to kokanee and provides potential spawning habitat. The stream flows through a culvert/vault upstream of the accessible reach, preventing further upstream migration of kokanee. The stream is relatively small and there are few holding pools for adult kokanee. Land use along the inaccessible stream reaches is a mix of residential development and intact green space.

At this time, pending further assessment of the creek, there is no further suggested restoration project for kokanee in George Davis Creek. An assessment of habitat conditions throughout George Davis Creek is needed before any proposal is added to the list of kokanee restoration projects. The currently accessible reach was restored by The Watershed Company in 2009 (http://www.watershedco.com/shorelines/lksamm-res.php). The major restoration efforts would involve replacing culverts under King County's East Lake Sammamish Trail and the City of Sammamish's East Lake Sammamish Parkway. However, this would be an expensive project and the amount of habitat that would become available to kokanee is currently not known.

Adult kokanee have occasionally been observed in George Davis Creek since 2009 and use there has generally been monitored by the landowner at the stream mouth. However, there has not been any focused agency effort to monitor adult kokanee abundance in George Davis Creek due to the program emphasis on the primary spawning streams. In some years, several adult kokanee have been observed to move into the creek at night and then leave the next day. In 2012, a peak of 15 kokanee was observed in George Davis Creek and they appeared to be actively spawning in the stream.

Figure 15. Location of identified restoration/enhancement projects on George Davis Creek.

Figure 16. Kokanee spawning reach (looking upstream and downstream) in George Davis Creek, December 2012. As a point of reference, the wooden plank over the stream can be seen in both photographs (photo credit: Roger Tabor, USFWS).

Project Associated with George Davis Creek

(Potential timeline is given in Table 11)

1 **George Davis Creek Habitat Assessment** – Assess habitat conditions to determine the potential for kokanee to be self-sustaining in George Davis Creek.

- Estimated Project Cost: $35,000
- Funds Acquired: $0
- Funds Needed: $35,000
- Estimated Project Duration (planning & design): Three months
- Estimated Project Duration (assessment): one year
- Current or Potential Project Lead: City of Sammamish

George Davis Team Members:

Don Gerend, Tom Odell, Eric Lafrance (City of Sammamish); Matt Baerwalde (Snoqualmie Tribe); Jeff Chan, Brad Thompson, Paul Bakke (USFWS); Erica Tiliacos (Save Lake Sammamish); and Mark Taylor (Trout Unlimited)

George Davis	2013	2014	2015	2016	2017	2018	2019	2020	2021
Project #									
1									

Assessment
Planning
Implementation

Table 11. Potential timeline for kokanee restoration project in George Davis Creek.

Idylwood Creek

Idylwood Creek (WRIA #08.0143) is a small creek in the northwest corner of the Lake Sammamish basin that currently does not support a significant number of kokanee spawners. Before 2012, adult kokanee had rarely been observed to use Idylwood Creek; however, there had been little effort to monitor their abundance in this creek. In November-December 2012, several kokanee were observed spawning in this creek with a peak count of approximately 25 fish.

The mouth of Idylwood Creek is on the northwest shoreline of Lake Sammamish, about 0.6 miles south of the outlet of the lake to the Sammamish River. The lower part of the Idylwood Creek watershed is located in the City of Redmond, while the headwaters are in the City of Bellevue (Figure 17). Land use along most of the stream and throughout the watershed consists of residential development. A bypass pipeline takes high flows from above 172nd Avenue NE and NE 28th Street to West Lake Sammamish Parkway to help reduce the impacts of high-flow events. Restoration of the stream reach between 172nd Avenue NE and NE 28th Street to West Lake Sammamish Parkway was completed in 2005 and consisted of installation of log weirs, substrate enhancement, and riparian plantings. The culverts under West Lake Sammamish Parkway and NE 36th St have also been modified to improve fish passage.

The lower 800 feet of Idylwood Creek is within the Idylwood Beach Park (City of Redmond) and is where all kokanee spawning activity was observed in 2012. Immediately downstream of West Lake Sammamish Parkway there are a series of concrete weirs that may be a partial barrier to kokanee moving upstream (Figure 18). In 2012, most kokanee were below the weirs while a few were in between the weirs (Figure 19). Because stream reaches upstream of West Lake Sammamish Parkway were

Figure 17. Location of identified restoration/enhancement projects on Idylwood Creek.

not surveyed, it is unclear if kokanee were able to migrate past the concrete weirs below the parkway. A restoration project (log weir installation and riparian plantings) of the Idylwood Beach Park reach was completed in 2002.

At this time, the only suggested major restoration project for kokanee in Idylwood Creek is a gravel enhancement project for the Idylwood Beach Park reach to improve kokanee spawning success. Maintenance at the high-flow bypass pipeline removes gravel from the headwaters and the lower reaches appear to have little gravel substrate. Additionally, the City of Redmond proposes to remove a logjam just upstream of NE 36th Street near West Lake Sammamish Parkway to improve fish passage. This work will be undertaken by the City of Redmond with minimal cost.

More comprehensive spawning surveys of Idylwood Creek are needed to determine the extent that adult kokanee are using this stream. The City of Redmond is planning to undertake this task with existing staff. A fish passage evaluation of the concrete weirs in Idylwood Beach Park is also needed.

Figure 18. Concrete weirs downstream of West Lake Sammamish Parkway (photo credit: Tom Hardy, City of Redmond).

Figure 19. Idylwood Creek upstream of NE 36th Street (photo credit: Tom Hardy, City of Redmond).

Project Associated with Idylwood Creek

(Potential timeline is given in Table 12)

1 **Gravel Enhancement of the Idylwood Beach Park Spawning Reach** – City of Redmond proposes to add gravel to the stream near West Lake Sammamish Parkway to improve kokanee spawning success. All funds are expected to come from the City of Redmond.

- Estimated Project Cost: $5,000
- Funds Acquired: $0 (City of Redmond)
- Funds Needed: $5,000
- Estimated Project Duration (planning & design): three months
- Estimated Project Duration (construction): one month
- Current or Potential Project Lead: City of Redmond

Idylwood	2013	2014	2015	2016	2017	2018	2019	2020	2021
Project #									
1									

Table 12. Potential timeline for kokanee restoration project in Idylwood Creek.

Stream restoration
Planning
Permitting
Implementation

Idylwood Team Members:

Peter Holte, Roger Dane, Tom Hardy (City of Redmond); Hans Berge (King County); and Roger Tabor (USFWS).

References

R.W. Beck, Inc. 2001. Idylwood Creek Restoration Design Report. Report of R.W. Beck, Inc. to the City of Redmond, Washington.

Schneider Creek

Schneider Creek is a small creek that enters Lake Sammamish along its southwestern shoreline and does not support a significant number of kokanee spawners. Adult kokanee were not documented to use Schneider Creek until 2012; however, there has been little focused effort to monitor their abundance in this creek. In 2012, kokanee were observed spawning in this stream and a peak spawner abundance of 12 fish (8 live and 4 dead) was observed on December 11, 2012. All fish were downstream of the West Lake Sammamish Parkway/I-90 culvert.

Schneider Creek (Figure 20) is located within the City of Issaquah. The mouth of Schneider Creek is about 0.12 miles west of the mouth of Tibbetts Creek in the southwest corner of the lake. The lower 440 feet of the stream has a very low gradient with fine substrates and therefore likely does not currently provide any kokanee spawning habitat (Figure 21). This stream section forms the property line between a residential home to the west and the City of Issaquah's open-space parcel to the east. The next 175 feet of stream habitat runs along West Lake Sammamish Parkway and has a steeper gradient than the lower section (Figure 21). This short stream section is where all spawning activity was observed in 2012.

The culvert under West Lake Sammamish Parkway/I-90 does not appear to be a fish passage barrier. Just upstream of the parkway/I-90 culvert there are two small tributaries or ditches that enter Schneider Creek. There is a short section of about 200 feet of Schneider Creek that runs along I-90 that could provide some spawning habitat but upstream of this, the stream is quite small and may not support kokanee spawning. Also, the stream habitat is severely degraded due to neighboring land use practices (e.g., agricultural activities).

At this time, there is no kokanee restoration project listed for Schneider Creek. An assessment of habitat conditions throughout Schneider Creek is needed before any proposal is added to the list of kokanee restoration projects. One possible project is to move the lower section of the stream to the east so it is entirely located within public lands (Sammamish Cove Park) and restored to maximize kokanee spawning habitat. In addition, the large undeveloped property south of I-90 that Schneider Creek flows through is currently slated for development into multifamily housing; creek enhancements within a 100-foot buffer will likely be required of the developer as mitigation and could provide considerable kokanee spawning habitat. Further evaluation of these possible projects is needed. Additionally, more comprehensive spawning surveys of Schneider Creek are needed to determine the extent that adult kokanee are using this stream.

Schneider Team Members:

Kerry Ritland (City of Issaquah) and Roger Tabor (USFWS)

Figure 20. Map of Schneider Creek. The map also shows two ditches that appear to supply some flow to Schneider Creek during the fall and winter. Adult kokanee have been observed only below the West Lake Sammamish Parkway/I-90 culvert.

Figure 21. Schneider Creek: The left photograph is of the low-gradient reach near the mouth of the creek (photo credit: Rachel Brooks, USFWS; Dec. 16, 2013). The right photograph is of the kokanee spawning reach near the West Lake Sammamish Parkway (photo credit: Roger Tabor, USFWS; December 11, 2012).

Vasa (Squibbs) Creek

Vasa Creek (WRIA 08.0156) currently does not support a significant number of kokanee spawners. However, an assessment of habitat conditions and a spawner monitoring effort is needed before the KWG can reach a conclusive decision on the stream's potential as a kokanee spawning stream and support for a self-sustaining kokanee spawning aggregation.

The mouth of Vasa Creek is along the southwest shoreline of Lake Sammamish, just north of Vasa Park (Figure 22), about one mile northwest of the mouth of Lewis Creek. The stream sub-basin is located in the City of Bellevue. The approximate lower half mile of Vasa Creek is potential spawning habitat with adequate spawning gravels (Figure 23). However, the stream is relatively small (about one quarter the size of Lewis Creek) and there are few holding pools for adult kokanee. Land use along this stream reach is all residential development and the streambed and riparian area are owned by individual landowners. The houses were built prior to environmental regulations, resulting in reduced riparian vegetation, stream channelization, and bank armoring. Upstream of the lower reach, the stream is steep and quite small and not considered a potential kokanee spawning site. A bypass pipeline taking high flows from just below I-90 directly to Lake Sammamish helps reduce high-flow events in the lower reach.

At this time, there is no suggested restoration project for kokanee in Vasa Creek. An assessment of hydrologic and habitat conditions throughout Vasa Creek is needed before any proposal is added to the list of kokanee restoration projects. The

culvert under West Lake Sammamish Parkway was modified in the late 1990s to allow for improved sediment transport and fish passage. An assessment of the effectiveness of this culvert for fish passage is needed. The City of Bellevue also completed stream stabilization for approximately 800 feet of stream above I-90 in 2011. An assessment of the upper basin of Vasa Creek is needed to determine if anything else needs to be done to maintain stream stability.

Adult kokanee have occasionally been observed in Vasa Creek; however, there has not been any consistent effort to monitor their abundance. Surveys have commonly consisted of spot checks from a bridge along West Lake Sammamish Parkway, augmented by periodic reports from neighboring landowners. In December 2012, the lower reach was surveyed a few times and approximately 15-20 adult kokanee were observed in the creek during each survey. More comprehensive surveys by USFWS and King County were started in 2013 and are expected to continue.

Figure 22. Vasa Creek (photo credit: Rachel Brooks, Dec. 16, 2013). The left photograph is looking upstream from the mouth. The right photograph was taken just downstream from the West Lake Sammamish Parkway.

Figure 23. Location of identified restoration/enhancement projects on Vasa Creek.

Project Associated with Vasa Creek

(Potential timeline is given in Table 13)

1 **Vasa Creek Hydrologic and Habitat Assessment** – To determine the potential for kokanee in Vasa Creek, an assessment of hydrologic and habitat conditions throughout the basin is needed. The City of Bellevue has initiated these studies, with project planning and flow gauge installation in 2013. Project is anticipated to be completed in 2014.

- Estimated Project Cost: $50,000
- Funds Acquired: $50,000
- Funds Needed: $0
- Estimated Project Duration (planning & design): Six months
- Estimated Project Duration (assessment): 1.5 years
- Current or Potential Project Lead: City of Bellevue

Lewis and Vasa Team Members:

Kerry Ritland (City of Issaquah); Kit Paulsen, Glenn Kost (City of Bellevue); Kirk Lakey (WDFW); Roger Tabor, Brad Thompson (USFWS); and Hans Berge (King County)

Vasa	2013	2014	2015	2016	2017	2018	2019	2020	2021
Project #									
1									

▲ Assessment
Planning
Implementation

Table 13.— Potential timeline for the kokanee assessment project in Vasa Creek.

Zaccuse Creek

Goal/Vision

It is our (KWG) intention that by implementing the following projects we will reintroduce kokanee into Zaccuse Creek and promote the establishment of a self-sustaining population through expansion and improvement of the ecological processes that benefit the long-term existence of kokanee and allow natural processes to persist.

Zaccuse Creek (WRIA #08.0148) is on the east side of Lake Sammamish and is located about 500 ft. south of Lewis Thompson Road in Sammamish. There is little to no urbanization on or immediately adjacent to much of Zaccuse Creek (see Figure 24).

The lower section of Zaccuse Creek has three major culverts that likely impede fish passage under some or all conditions present during the spawning season (Figure 25). Based on results from the 2012-13 spawning season, under certain conditions kokanee currently can migrate past the culverts under East Lake Shore Lane and East Lake Sammamish Trail but not above the East Lake Sammamish Parkway culvert. The KWG is concerned about the current potential for the two lower culverts to periodically block passage, and about the potential that improvements to the East Lake Sammamish Parkway culvert and habitat upstream of that culvert could create sediment or flow conditions that would impact passage at these culverts in the long term (Table 14). The stream segments upstream of the culverts (approximately 700 ft.) require re-location away from the East Lake Sammamish Parkway road ditch and alteration of channel morphology to enhance the way the stream transports and retains its sediment load (Figure 25), and the way large wood and sediment interact to create and sustain kokanee spawning habitat. This stream section has the majority of the potential spawning habitat in Zaccuse Creek and is owned by a private citizen (Mr. Walter Pereyra) who is working closely with the KWG. At the eastern edge of Mr. Pereyra's property is a steep stream section where the bed elevation falls 5.2 ft. over a horizontal distance of 17 ft. (Anderson 2012). It is unclear whether kokanee would be able to migrate past this section. Further upstream, a culvert under 206th Ave NE would also be a barrier to kokanee migration.

In recent years, kokanee have rarely been observed in Zaccuse Creek; however, there has not been any consistent effort to monitor their abundance. During the large Lake Sammamish kokanee run in 2012-13, good numbers of spawners were observed in Zaccuse Creek from November to January. The peak count in 2012-13 was approximately 60 kokanee. Because there is currently limited spawning habitat in Zaccuse Creek, it is unclear if most of the kokanee spawned in the creek or moved to another tributary to spawn.

Additional information on Zaccuse Creek can be found in the following reports: Anderson (2012) and King County (2013).

Zaccuse Creek (photo credit: Glenn Anderson).

Figure 24. Locations of identified restoration/enhancement projects on Zaccuse Creek.

1 Looking upstream to culvert under East Lake Sammamish Shore Lane.

2 Looking upstream to culvert under multi-use path. This culvert impedes fish passage due to vertical water drops at both the inlet and outfall, as well as high velocities within the pipe itself during high water streamflows.

3 Looking downstream at culvert under East Lake Sammamish Parkway. The stream channel takes a 90° turn into the culvert, which creates problems with sediment transport and debris accumulation. In addition, velocities in this culvert are high during moderate peak flows, and the culvert outfall has a drop that impedes fish passage.

4 Wetland area directly upstream from the East Lake Sammamish Parkway, which lacks a well-defined channel.

Figure 25. Possible restoration sites on Zaccuse Creek (photo credit: Glenn Anderson).

Zaccuse

● Culvert replacement/modification ■ Stream restoration ⬢ Supplementation/reintroduction

Project #	Project Type	Name of Project	Description
1	●	Culvert Replacement at East Lake Sammamish Shore Lane	Replace culvert to improve fish passage and natural sediment transport.
2	●	Culvert Replacement at East Lake Sammamish Trail	Replace culvert to restore fish passage at all flows and restore natural sediment transport.
3	●	Culvert Replacement at East Lake Sammamish Parkway	Replace culvert to restore fish passage and natural sediment transport.
4	■	Channel Reconstruction through Wetland	Restore channel through forested wetland.
5	⬢	Zaccuse Creek Reintroduction	Supplement or reintroduce kokanee into this creek system.

Table 14. List of five identified projects to restore or enhance kokanee fish passage and spawning habitat on Zaccuse Creek. Project numbers indicate relative location on the stream (downstream to upstream) and do not indicate priority or schedule of implementation.

Projects Associated with Zaccuse Creek

(In order from the creek mouth to the most upstream; potential timelines are given in Table 15.)

1 Culvert Replacement at East Lake Sammamish Shore Lane – The culvert under East Lake Sammamish Shore Lane may impede kokanee from accessing the watershed upstream of the East Lake Sammamish Parkway and obstruct natural sediment transport. Replacement of the culvert with a much wider one, preferably a "stream simulation" design, in conjunction with replacement of the culverts described in projects 2 and 3, will restore access for kokanee to the upper reaches of this creek and restore more natural sediment transport and channel formation. Depending on the replacement design, additional spawning habitat could also be restored within the footprint of this crossing. Without the removal or replacement of these three culverts, kokanee will be unable to access the majority of habitat provided by the creek. The project site is approximately 150 ft upstream from the mouth of the creek and 150 ft downstream of the East Lake Sammamish Parkway.

- Estimated Project Cost (planning & design): $30,000 (50% design) + $10,000 (90% design) + $5,000 (final)
- Estimated Project Cost (construction): $155,000
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: King County Department of Natural Resources and Parks in association with East Lake Sammamish Shore Lane homeowners

2 Culvert Replacement at East Lake Sammamish Trail – The culvert under East Lake Sammamish Trail may impede kokanee from accessing upstream spawning grounds and obstruct natural sediment transport. Replacement of the culvert, in conjunction with the culverts described in projects 1 and 3, will restore access for kokanee to the upper reaches of this creek and restore more natural sediment transport and channel formation. Depending on the replacement design, additional spawning habitat could also be restored within the footprint of this crossing. Without the removal or replacement of these three culverts, kokanee will be unable to access the majority of habitat provided by the creek. The project site is approximately 200 ft upstream from the mouth of the creek and 100 ft downstream of the East Lake Sammamish Parkway.

- Estimated Project Cost (planning & design): $30,000 (50% design) + $10,000 (90% design) + $5,000 (final)
- Estimated Project Cost (construction): $90,000
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: King County Department of Natural Resources and Parks

3 Culvert Replacement at East Lake Sammamish Parkway – The culvert under East Lake Sammamish Parkway may impede kokanee from accessing upstream spawning grounds and obstruct natural sediment transport. Replacement of the culvert with a much wider one, preferably a "stream simulation" design that has a lower inlet elevation than currently exists, will allow for establishment of a stream bed profile (slope) that allows for improved transport and retention of spawning gravels in the lower reaches of Zaccuse Creek, including the reach immediately upstream of the parkway (Project 4). Depending on the replacement design, additional spawning habitat could also be restored within the footprint of this crossing. If done in conjunction with replacement of the culverts in projects 2 and 3, this action will allow kokanee access to spawning reaches upstream of the East Lake Sammamish Parkway. The project site is approximately 300 ft upstream from the mouth of the creek.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (construction):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):
- Estimated Project Duration (construction):
- Current or Potential Project Lead: City of Sammamish

4 Channel Restoration through Forested Wetland – The wetland area upstream of the East Lake Sammamish Parkway is a stream segment that historically supported spawning kokanee, but currently does not have channel morphology conducive to maintaining sediment transport, fish passage, or retention of spawning-sized gravels. Reconstruction of the channel will significantly increase the area available for kokanee spawning in Zaccuse Creek. The project site is approximately 1,500 ft upstream of the creek mouth.

- Estimated Project Cost (planning & design):
- Estimated Project Cost (construction):
- Funds Acquired:
- Funds Needed:
- Estimated Project Duration (planning & design):

5 Zaccuse Creek Reintroduction – The reintroduction of kokanee into Zaccuse Creek using the supplementation program provides an opportunity to "jumpstart" recolonization of the reach upstream of the East Lake Sammamish Parkway. The Issaquah Creek Hatchery will oversee egg incubation and fry rearing for this effort. Cost will vary depending upon availability of recirculating RSI units at the hatchery and any necessary infrastructure upgrades.

- Estimated Project Cost (planning & design): $36,000 (construction of additional RSI incubator system)
- Estimated Project Cost (implementation): $18,000/year (operation & maintenance)
- Funds Acquired: None
- Funds Needed: $36,000 + $72,000 (four years of operation & maintenance for one kokanee generation) + $144,000 (eight additional years of operation & maintenance for two additional kokanee generations)
- Estimated Project Duration (planning & design): 45 days
- Estimated Project Duration (implementation): Up to 12 years (may be less, subject to population response)
- Current or Potential Project Lead: WDFW, USFWS, and King County DNRP

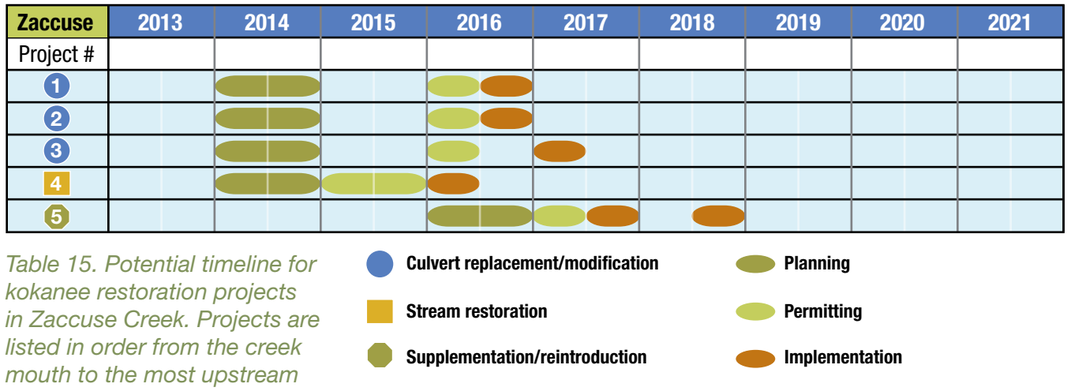

Table 15. Potential timeline for kokanee restoration projects in Zaccuse Creek. Projects are listed in order from the creek mouth to the most upstream and scheduling is independent for each project.

Zaccuse, Ebright, and Pine Lake (ZEP) Team Members:

Don Gerend, Tom Odell, Eric Lafrance (City of Sammamish); Wally Pereyra (private landowner); Matt Baerwalde (Snoqualmie Tribe); Jeff Chan, Brad Thompson, Paul Bakke (USFWS); Erica Tiliacos (Save Lake Sammamish); Ilene Stahl (Friends of Pine Lake); and Mark Taylor (Trout Unlimited)

References

Anderson, G. S. 2012. Design guidance for culvert replacement projects and possible realignment and re-grading of Zaccuse Creek upstream of the culvert replacement projects. Technical Memorandum of R2 Resource Consultants, Inc., Redmond, Washington to Walter T. Pereyra.

King County. 2013. Kokanee and Chinook restoration projects, Sammamish Watershed. http://www.kingcounty.gov/environment/animalsAndPlants/restoration-projects/kokanee-chinook-projects.aspx

Category 4 Streams

Other small streams that have little to no recent spawner information and that likely have some limited potential for kokanee spawning.

The streams addressed in this section are generally smaller than those addressed in the prior sections. There is no recent anecdotal or formal record of kokanee use of these streams for spawning and they are not currently a focus of directed spawner monitoring. These streams are included in this Blueprint to recognize their potential, with some level of improvement in habitat conditions, to provide opportunities for periodic spawning use by relatively small numbers of kokanee and other salmonids.

Other East Shore Tributaries

At this time, there is no suggested restoration project for kokanee in any of these creeks. An assessment of habitat conditions in these tributaries is needed before any proposal is added to the list of kokanee restoration projects. The shoreline area near most streams along the east shore is highly developed and it may be quite difficult to make any significant improvements.

Southeast Tributaries

Within one mile northeast of the mouth of Laughing Jacobs Creek there are two small tributaries that could have some potential for kokanee spawning (Figure 26). These tributaries appear to have reasonable sized watersheds that may warrant further investigation into their spawning potential. Close to Laughing Jacobs Creek is Many Springs Creek (WRIA 08.0164); however, little information is available for this stream. The other tributary is stream 0163 (WRIA 08.0163), which is known to be a fish-bearing stream (Buitrago et al. 2008). Current use of this stream by kokanee is unknown. Culverts and weirs near the mouth of the creek and under the East Lake Sammamish Trail appear to be fish barriers. Replacement of the culvert under the East Lake Sammamish Trail to meet WDFW fish passage standards is considered feasible (Buitrago et al. 2008). The name of Stream 0163 is likely Alexander's Creek, which was listed as a historical kokanee spawning stream by Berge and Higgins (2003), although it appears to be mislabeled in that report.

Another possible stream in the southeast area is an unnamed tributary near SE 26th Street that was identified as a fish-rearing stream by Buitrago et al. (2008). The culvert under the East Lake Sammamish Trail is a fish barrier and replacement to meet WDFW fish passage standards is not considered feasible.

Northeast Tributaries

North of George Davis Creek there are also a few small tributaries within relatively small watersheds (Figure 26). These streams appear to have mostly a steep gradient but there may be some lower gradient areas near the mouth that could support kokanee spawning. Their potential for kokanee spawning is unknown but is likely very limited. Four streams (WRIA 08.0143F, H, M and an unnamed tributary) are known to be fish-bearing streams (Buitrago et al. 2008); however, their potential for kokanee spawning is not known. For all four streams, a culvert under the East Lake Sammamish Trail is a fish barrier. Only the culvert on stream 0143H is considered feasible for replacement to meet WDFW fish passage standards.

Figure 26.
Map of the Lake Sammamish basin displaying other potential kokanee tributaries.

Other West Shore Tributaries

Most other streams along the west shoreline of Lake Sammamish are generally small and have steep gradients and likely have limited habitat for kokanee spawning. At this time, there is no suggested restoration project for kokanee in any of these creeks.

A few streams that need further investigation include:

- **Phantom Lake outlet (WRIA 08.0154)**
  The mouth of this small stream is 1.2 miles north of the mouth of Vasa Creek. This stream has a steep gradient but may be able to support a few kokanee spawners near the stream mouth.
- **Unnamed Tributaries in Southwest Shoreline of Lake Sammamish**
  There are two small unnamed tributaries within the City of Issaquah in the southwest shoreline that need further investigation. Both tributaries drain off of Cougar Mountain. The first tributary enters Lake Sammamish about 0.2 miles west of the mouth of Schneider Creek. This stream has a steep gradient but may be able to support a few kokanee spawners near the stream mouth. The mouth of the second tributary is located about 0.3 miles northwest from the first tributary. The second tributary only has about 260 feet of open stream channel at its mouth. This stream section has a low gradient and may be able to support a few kokanee spawners.
- **Tosh Creek (WRIA 08.0141)**
  The outlet of Tosh Creek is in the Sammamish River slough above the weir (0.6 miles from the lake; Figure 26). Tosh Creek is located in the City of Redmond. The stream has a gradual gradient and is in relatively good condition. Fish passage at the West Lake Sammamish Parkway culvert was improved in 2013. Whether Lake Sammamish kokanee would use this stream is uncertain. Because water velocities are generally low in the slough, fish can easily move between the stream outlet and the lake. However, adult kokanee would have to migrate downstream through the slough to reach this stream and then fry would have to migrate upstream to reach the lake. Given its downstream location, it seems unlikely that this stream would be used by kokanee from Lake Sammamish; however, it would be prudent to conduct spawner surveys in Tosh Creek when kokanee are abundant in other streams. For example, if several kokanee have been observed in nearby Idylwood Creek, then Tosh Creek should be surveyed within the next few days.

References

Berge, H. B., and K. Higgins. 2003. The current status of kokanee in the greater Lake Washington Watershed. King County Department of Natural Resources and Parks, Water and Land Resources Division. Seattle, Washington.

Buitrago, C., J. Friebel, and P. Lawson. 2008. East Lake Sammamish Master Plan Trail. Project Number 554-1521-075. Technical Memorandum of Parametrix to King County, Seattle, Washington.

LAKE SAMMAMISH KOKANEE WORK GROUP *Protect · Reconnect · Restore*

We're partnering to save kokanee

City of Issaquah Washington

Washington Department of Fish and Wildlife

Washington State Parks

King County

City of Bellevue Washington

City of Issaquah Washington

City of Redmond Washington

City of Sammamish Washington

Snoqualmie Tribe

Trout Unlimited

Friends of the Issaquah Salmon Hatchery

SaveLakeSammamish

Friends of Pine Lake

Mountains to Sound Greenway

Lake Washington Cedar Sammamish Watershed

Blueprint for the Restoration and Enhancement of Lake Sammamish Kokanee Tributaries