



DRAINAGE SYSTEMS ANALYSIS

Fish Passage Barriers
Technical Memorandum
June 26, 2019



**Seattle
Public
Utilities**

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To: Holly Scarlett, SPU Project Manager

From: Betsy Lyons, Creek Culvert Program Manager
Seattle Public Utilities

Copy to: Mike Milne, Brown and Caldwell Project Manager

Prepared by: Betsy Lyons, Creek Culvert Program Manager
Seattle Public Utilities

Reviewed by:

 7/17/19

Leslie Webster, Planning Program Manager, SPU

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Abbreviations

Barrier	total fish passage barrier
City	City of Seattle
DSA	Drainage Systems Analysis
ESA	Endangered Species Act
GIS	geographic information system
ISP	Integrated System Plan
pt	point
SDOT	Seattle Department of Transportation
SME	subject matter exp
SPU	Seattle Public Utilities
State	State of Washington
TM	technical memorandum
US	United States
USACOE	United States Army Corps of Engineers
WFC	Wild Fish Conservancy
WDFW	Washington Department of Fish and Wildlife

1. Introduction

The objective of the Fish Passage Barriers Topic Area analysis is to update and summarize locations and ecological priorities for addressing fish passage barriers on urban creeks within the City of Seattle (City). This analysis identifies known fish passage barriers (public and private) on the main salmon streams in Seattle (Pipers, Thornton, Taylor, Longfellow and Fauntleroy), plus several other streams (Licton, Schmitz, and Yesler) that historically or currently support other fish. The analysis categorizes those barriers based on ownership, stream, type of barrier, and location. It also describes newly updated prioritization criteria used to rank the barriers in terms of importance for fish.

This technical memorandum (TM) presents background information on the Fish Passage Barriers Topic Area, the analysis method, results of the analysis, a discussion of results, and recommendations on how the results could be used for Seattle Public Utilities' (SPU) upcoming Integrated System Plan (ISP). Additional information is also provided on data gaps, potential future work associated with fish passage barriers and other possible uses for this information outside of the ISP.

2. Background

Over the past century, as the City's transportation and drainage networks were developed and its population expanded rapidly, most of Seattle's urban creeks were significantly modified. Many of the creeks were realigned into straightened channels; moved underground into pipes; armored and disconnected from their historic floodplains; restricted by culverts, bypass structures, or natural debris dams; or filled in entirely. These modifications created barriers to the movement of water, wood and sediment downstream, and to the movement of fish upstream.

Fish passage barriers restrict longitudinal connectivity within a creek and prevent native fish, including Endangered Species Act (ESA)-listed species such as Chinook salmon, from accessing available upstream habitat, which is often higher quality (this is especially true for Thornton North Branch, Longfellow, and Taylor creeks). Many of the fish passage barriers are culverts or weirs, but barriers can also be physical features such as steep drops, debris dams, tree roots growing into the channel, or other obstructions. Barriers can also be caused by extremely low water depths or high velocities, both of which can prevent fish from passing through a section of stream. Total barriers completely block passage to all life stages and species of fish at all times, whereas partial barriers may only prevent access at certain times of the year for some species or some life stages (e.g., juvenile vs. adult). This distinction is important from an ecological perspective although regulatory agencies treat total and partial barriers the same in evaluating applications for permits or approvals.

Fish passage barriers have contributed to the formal ESA listing of Chinook salmon and, steelhead trout and to declines in other salmon species and threaten treaty fishing rights of the Native American tribes. In Seattle, affected tribes include the Muckleshoot Indian Tribe, Suquamish Tribe and Tulalip Tribe. In Washington, protection of fish life (including fish passage and aquatic habitat in urban creeks) is regulated primarily by the U.S. Army Corps of Engineers (USACOE) and Washington Department of Fish and Wildlife (WDFW). USACOE issues permits and other authorizations for all structures or work within navigable

waterways (Section 10 of the Rivers and Harbors Act) and for the disposal of dredged or fill material (Section 404 of the Clean Water Act) in waters of the United States (US). WDFW issues Hydraulic Project Approvals for work above or below the ordinary high-water marks of regulated watercourses.

State and federal statutes regulating fish passage have not changed significantly in recent years. However, as a result of recent court rulings, including a 2013 federal injunction against the State of Washington, enforcement of existing laws has increased, and regulators now give heightened consideration of tribal comments in the permit application review process than in previous decades (Washington State Department of Transportation 2019). The 2013 injunction requires the State to significantly increase efforts to repair or replace state-owned culverts that block habitat for salmon and steelhead by 2030. The injunction does not directly apply to local agencies such as SPU, but it has raised awareness about tribal treaty rights and affected the willingness of regulatory agencies to issue permits for repairs that would extend the life of drainage structures that are barriers.

In recent years, SPU experienced several challenges on creek culvert projects as the WDFW and USACOE have stopped issuing permits for culvert repairs that extend the life of culverts unless the repairs also resolve the fish passage barriers. SPU's creek culvert manager has met with WDFW biologists and engineers at several culvert sites on Hamlin, Mapes and Thornton creeks to discuss culvert problems and potential repair options. These sites were all identified as barriers, and WDFW staff indicated they would not be able to issue permits for any major culvert repairs that did not address the barriers. WDFW staff reiterated this in various email exchanges with SPU as well. Based on these discussions, there appears to be some flexibility for minor repairs such as headwall repairs that do not extend the life of a barrier. However, most culvert repairs, such as lining or grouting, are no longer permitted if the culverts are barriers. For many creek culverts in the City's urbanized landscape, it is often not possible to correct the barrier without replacing the entire culvert. Many of SPU's older culverts are undersized for current and future drainage needs. As they are replaced, they often need to be replaced with larger, expensive structures in order to meet current fish passage design requirements and provide adequate future capacity.

3. Method

In the early 2000s, SPU contracted with Wild Fish Conservancy (WFC) to complete a stream typing inventory following protocols established by the Department of Natural Resources and to identify all fish passage barriers (public and private) in the five major salmon-bearing urban watersheds following protocols by WDFW. Barriers in the inventory include culverts, mainline pipes (i.e., pipes connected by maintenance holes), weirs, fish ladders, bypass pipes, and other instream structures, as well as natural barriers such as waterfalls. Pipes or culverts that were too long and/or too small to be surveyed by foot, or by eye, were excluded from the inventory and labeled "unknown" with respect to fish passage. The original WFC barrier inventory was based on the WDFW protocol, but in some instances, WFC disagreed with the outcomes and provided their own interpretation. The final barrier status assignment was determined by SPU subject matter experts (SMEs) who also considered observations of fish use and local knowledge. For example, if there were structures identified as unknown barriers, and fish were only observed downstream, but the stream was typed fish-bearing above a structure, the status may have been changed by SPU SMEs to indicate a barrier.

In 2004, after completion of the inventory, SPU SMEs developed criteria for prioritizing the barriers in the inventory based on their ecological importance. SPU relies on the resulting prioritized barrier inventory to inform creek culvert project planning, to support salmon recovery planning efforts, and to implement capital projects (design, permitting, construction, and operations).

The following steps were taken as part of this 2019 analysis to create updated maps of fish passage barriers in SPU's Geographical Information Systems (GIS) and to update the prioritized inventory of barriers:

1. SPU subject matter experts (SMEs) reviewed and updated the original WFC inventory with readily available information. Three barriers were fixed since the original inventory was completed and were removed from the inventory. No new field investigations were done, and no updates from other agencies or organizations were made.
2. Confirmed the barrier status of several mainline pipes; some of the longer mainline pipes were not included in original WFC inventory, and the final determination for others was listed as unknown. The state protocols for identifying fish passable barriers are not well suited for evaluating long culverts or mainline pipes. Under a separate contract from the Drainage System Analysis (DSA) (16-022-S Fautleroy Creek Culverts Replacement; Davido Consulting), a small number of mainlines were evaluated to see whether they are fish passage barriers. Results of this evaluation have been submitted as a draft TM, "*Contract 16-022-S Task 9: Barrier Status of SPU Mainlines and Culverts*". Once finalized, this TM will be archived in the Creek Culvert Program files and uploaded to the DSA SharePoint site.
3. Revised the GIS data layer and create a map to reflect the updated inventory of barriers.
4. In addition to updating the barrier status for individual culverts, the original prioritization criteria and scoring rubric were also reevaluated by SPU SMEs and slightly revised as shown in Table 3.1. Below is a short description of each of the criteria.
 - a. *Barrier status*: Barriers were identified as either total barriers (barriers) or partial barriers. Total barriers completely block access, whereas partial barriers may allow some species or some life stages of fish to pass or may be temporary in nature.
 - b. *Relative location*: In GIS, the urban watercourse layer was divided into equal segments by length *S*, and the location of the culvert was identified as being in the lower, middle, or upper segments.
 - c. *Number of downstream barriers*: The number of barriers downstream of each barrier was calculated in GIS using the updated layer of barriers.
 - d. *Salmon and other fish nearby*: The prioritization criterion for "salmon nearby" was modified to include more recent stream typing and fish use data, and to give a higher weight to ESA-listed species (Chinook salmon and steelhead). The stream typing creates a consistent method for scoring and is based in part on updated fish use data.
 - e. *Relative gradient upstream*: This new criterion was added. Stream gradient can be an indicator of habitat quality with lower gradient areas generally providing better spawning and rearing habitat. Stream gradient data were pulled from the 2007 State of the Waters report (SPU 2007), which characterized streams based on a variety of features including stream gradients.

f. *Quality of upstream habitat*: This criterion is based on data from the 2007 State of the Waters report which included a measure of instream habitat quality used as the prioritization score for the quality of upstream habitat.

5. Updated the GIS attribute data on barriers to include the score and final rank calculated in this analysis.

In addition to the ranking criteria, Appendix C includes information on the distance of the barrier from the creek mouth and the distance to the next upstream total barrier. This information was not available for all culverts and so was not used in the ranking, but does provide additional context that may be useful for planning and sequencing barriers. Each of the barriers in the updated inventory was rescored using the revised criteria. Each barrier was also assigned a rank, which is not necessarily a unique number because several barriers received the same prioritization score.

Table 3-1. Prioritization Criteria and Scoring Rubric

Prioritization Criteria	Score	Data Source
Barrier status	8 pts. – Total Barrier 1 pt. – Partial barrier	Wild Fish Conservancy Report
Relative location in creek	10 pts. – Lower third 5 pts. – Middle third 1 pt. – Upper third	Calculated using GIS
Number downstream barriers	10 pts. – 0-1 5 pts. – 2-34 1 pt. – 4 or more	Calculated using GIS
Salmon nearby	12 pts. – Type F waters, ESA-listed species (Chinook, steelhead) 8 pts. – Type F waters, (coho, chum, sockeye) 4 pts. – Type F waters, other native fish species 1 pt. – no salmon	Based on SPU fish inventory data (most upstream fish use) and stream typing GIS layer (included in DSA tech memo on Aquatic Habitat)
Relative gradient upstream	10 pts. – 0-2% 7 pts. – 3-4% 4 pts. – 5-8% 1 pt. – greater than 8%	State of the Waters Stream Gradient GIS layer
Quality of upstream habitat	10 pts. – High 5 pts. – Medium 1 pt. – Low	State of the Waters Instream Habitat Quality GIS layer (included in DSA tech memo on Aquatic Habitat)

Note: Items in bold are modified or added since original 2004 prioritization; pt = points.

4. Results

The products resulting from this work include:

- GIS layer of known barriers [located on the DWW Drainage Systems Analysis SharePoint site (<https://seattle.gov.sharepoint.com/sites/spu-D1/Planning/DWW%20GIS%20Library/Forms/AllItems.aspx>)]
- Scores for individual barriers used to prioritize the inventory (Appendix A).

- PDF maps of known barriers on the five main salmon streams in the City (Pipers, Thornton, Taylor, Longfellow, and Fauntleroy) and barriers on several smaller creeks that historically or currently support other fish species (Schmitz, Yesler, and Licton) (Appendix B)
- A prioritized inventory of fish passage barriers in the City (Appendix C) [located on the DWW Drainage Systems Analysis SharePoint Site (<https://seattlegov.sharepoint.com/:x:/r/sites/spu-D1/DSA/PPL/Ranked%20Fish%20Passage%20Barriers.xlsx?d=wba329538efc242aa94fc28d351cdc6d5&csf=1>)]. This information is current as of May 17, 2019.
- As new information becomes available or as barriers are corrected, updates will be made by the Creek Culvert Program in the following location: (Q:\Programs_Capital\C333-Beneficial Use\Planning_Basis\Reference material\Fish_Passage\Current Fish Passage Barrier list), where it is actively updated and managed.

There are 138 known fish passage barriers in the City, 63 of which are owned by SPU. Many of the barriers are culverts (this category includes individual culverts and mainline systems), but they also include weirs, natural barriers such as elevation drops, or other structures (e.g., dams, bypasses, or other instream structures). Table 4.1 shows fish passage barriers by barrier status, and Table 4.2 shows fish passage barriers by type.

Table 4-1. Fish Passage Barrier Status by Owner			
Owner	Total Barrier	Partial Barrier	Total
SPU	37	26	63
Other Public	19	22	41
Private	5	25	30
Unknown	1	3	4
Total	62	76	138

Table 4-2. Types of Fish Passage Barriers by Type					
Owner	Culvert	Weir	Other	Natural	Total
SPU	48	13	2	0	63
Other Public	11	15	2	13	41
Private	17	12	1	0	30
Unknown	4	0	0	0	4
Total	80	40	5	13	138

Figure 4.1 below shows the distribution of barriers by score.

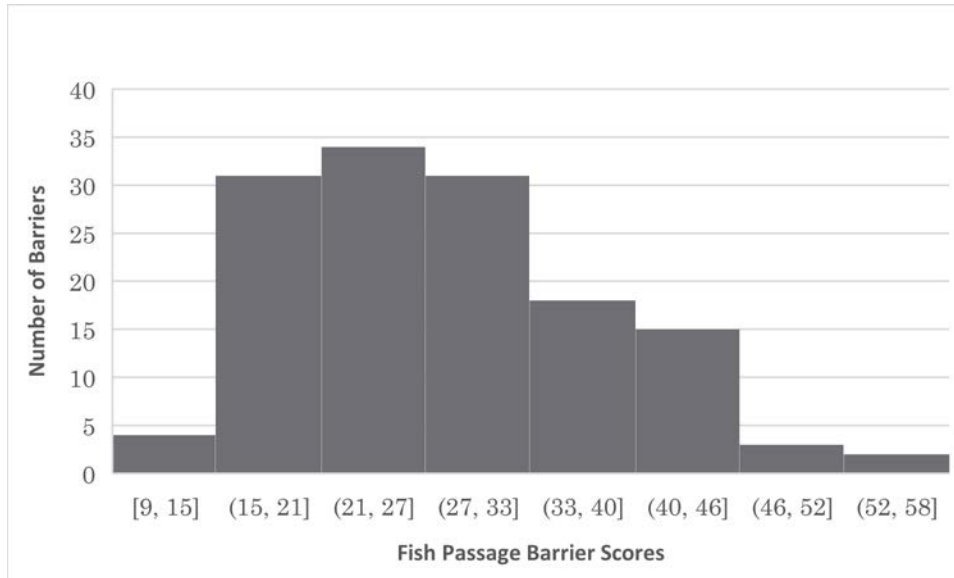


Figure 4-1. Distribution of fish passage barriers by prioritized score

Note that an individual barrier may be composed of multiple connected structures and is defined without regard for ownership changes. For instance, a creek culvert with a trash rack, two culvert barrels, and a connection to a private pipe may be tracked in Maximo with three distinct SPU asset numbers (plus the private pipe) but would appear in the fish passage inventory as a single barrier. For this reason, the total number of SPU assets identified as barriers in GIS, Maximo, or in the Creek Culvert Asset Management Plan will be higher than the number of barriers identified here.

5. Discussion

There are likely more barriers than those included in the inventory, which focused on the five main salmon streams in Seattle and a small number of barriers on other streams (Licton, Schmitz, and Yesler). This analysis did not consider the remaining 39 urban creeks in the City, some of which are also known to support salmon (e.g. lower Mapes Creek) and some of which might be considered "Type F" waters such as Puget, Yesler, Licton, and Schmitz creeks. Type F waters are streams or sections of streams that are known to support fish (not just salmon) or have physical characteristics capable of supporting fish. Based on work being done in support of SPU's draft Creek Culvert Asset Management Plan, there are nearly 50 creek culvert assets on Type F creeks with unknown barrier status and some creeks that have an unknown stream typing designation. A separate DSA Topic Area (Aquatic Habitat) is developing an updated Stream Typing GIS layer that will identify the creeks or portions of creeks that are identified as Type F and must therefore comply with fish passage regulations.

The original and revised prioritization criteria were developed from the perspective of fish habitat. The prioritization did not consider social equity, feasibility, or culvert condition in the ranking, although all of these should be considered as the ISP is developed and individual projects are identified, scoped, and implemented.

6. Recommendations for Future Use

This section includes recommendations on how this information on fish passage barriers can be used to support the ISP and how it might also be used for purposes beyond the ISP.

6.1 How information could be used for ISP

Fish passage barriers are considered in the DSA because of the cost and complexity associated with the maintenance, repair, and/or replacement of each one. Barriers also represent important opportunities for SPU and the City to make progress on salmon recovery and tribal treaty rights, while upgrading drainage infrastructure assets in ways that plan for system resilience with respect to public safety, fish passage, and climate change.

Information on barriers can be used in the ISP to:

- Advance the City's voluntary commitment to aid in the recovery of Chinook and other salmon by removing priority barriers and improving salmon habitat.
- Identify areas where culvert replacement could also improve drainage system capacity. Correction of barriers may offer opportunities to increase the capacity and resiliency of the drainage system to handle future flows expected as a result of climate change (higher peak flows and lower summer flows). Many of the culvert barriers are undersized; replacing them usually involves making them larger, which increases system capacity.
- Identify potential funding for correcting SPU barriers from other agencies requiring mitigation for their project impacts. For instance, Seattle Department of Transportation (SDOT) is proposing to build a pedestrian bridge across I-5 in a location that would impact a stream. SDOT's proposed modifications did not meet current fish passage requirements. As a result, SDOT is required by regulatory agencies to make fish passage improvements at another location in the Thornton Creek watershed to mitigate for the impacts to fish passage caused by the pedestrian bridge.
- Identify potential partnership opportunities that would expand on or complement SPU culvert replacement projects (e.g., broader creek restoration, improved access or public use, or environmental education).
- Facilitate correction of high priority barriers owned by others by sharing our information on the status of barriers, developing partnerships around projects to correct high priority fish passage barriers, and/or considering high priority fish passage barriers when there are opportunities for mitigation or other sources of funding not traditionally available for this work.
- Identify and support culvert replacement projects in the ISP and SPU's Creek Culvert that prioritize tribal treaty rights to fish, a long-standing social equity issue in western Washington and in the City.

6.2 How information could be used outside of ISP

Information on fish passage barriers could be used outside of the ISP by SPU and other agencies and organizations to:

- Inform near-term SPU-specific projects or Creek Culvert Program planning and assessment work including ongoing work to develop a project-sequencing strategy for SPU's creek culverts. This strategy

will recommend project sequencing to address creek culvert and fish passage needs (including private barriers). This work will eventually be coordinated with the ISP as SPU considers where future buyouts, outreach, mitigation, policies, or partnerships could be pursued.

- Demonstrate the need for increased state, federal and local funding to correct barriers.
 - SPU can use this information to identify the magnitude of funding needed to address fish passage barriers.
 - SPU could submit this information to WDFW for inclusion in their [Washington State Fish Passage Barrier](#) mapping site as a way of demonstrating the high density of barriers in urban areas and need for more funding for this work. WDFW uses this interactive tool to demonstrate progress on improving fish passage and to illustrate funding need.
- Support state legislative requests for increased funding for the Fish Passage Barrier Removal Board by the City's lobbyist.
- Support local and regional salmon recovery and habitat restoration planning efforts by highlighting needed barrier removal projects in regional salmon recovery plans including the 4-year work plans developed by King County (local Lead Entity for salmon recovery). SPU has assigned staff who coordinate with local lead entities in our area and who could work to ensure fish passage needs are identified in the local and regional plans.
- Support project-specific funding requests and grant applications by referencing priority of individual barriers.
- Serve as a source of information on potential fish passage mitigation projects that could be used by public or private entities in need of mitigation or looking for mitigation sites.
- Consider working with local governments, interested parties and regulatory agencies to develop a regional fish passage mitigation program. In dense urban areas, meeting fish passage requirements can be difficult and costly. SPU and other jurisdictions struggle to meet fish passage requirements in a cost-effective way. King County, for example, has several current projects that are unable to accommodate fish passage for various technical reasons, and in some cases the County is being required to invest significant funding in what are thought to be low-benefit fish passage improvements. A preferred option would be to spend fish passage dollars on at higher benefit fish passage sites perhaps via a mitigation credit program; however, there is presently no local or regional program that offers credits for fish passage impacts (not to be confused with fish habitat).

7. Additional Information

This section describes how the Fish Passage Barrier TM relates to other Topic Areas and identifies some additional work or data gaps SPU should consider.

7.1 Related DSA Topic Areas

Related topic areas include Floodplain Reconnection (4.0) and Aquatic Habitat (6.0).

7.2 Additional Work/Data Gaps

The fish passage barriers inventory and map are based on field inventory data from the early 2000s that focused primarily on barriers on the main salmon streams. There are several work/data gaps that could be addressed to improve comprehensiveness and accuracy of our data, and to align our knowledge more closely with data used by tribes and by federal and state agencies to make permit decisions. A three-year term-limited position (Senior Environmental Analyst) at SPU was recently filled to help address these data gaps and inform future project and planning work. Data gaps include:

- Ground-truth existing data as needed (particularly partial barriers) because the original inventory was completed nearly 20 years ago. This would involve site visits and completion of field assessments (Level A and/or B) using WDFW protocols in the Fish Passage and Surface Water Diversion Screening Assessment and Prioritization Manual (Washington Department of Fish and Wildlife 2009)
- Cross-reference SPU's inventory of fish passage barriers with information from external agencies including WDFW and Muckleshoot Indian Tribe.
- Reevaluate culverts and mainlines that have an unknown barrier status.
- Assess the status of culverts on creeks that were not included in the original inventory, including culverts on small creeks identified as Type F waters.
- Evaluate creeks with unknown stream typing and if any are identified as Type F, then inventory potential fish passage barriers on those.
- More work could be done to categorize, at a high level, the feasibility or complexity of potential barrier replacements (e.g. high, medium, or low complexity or cost).
- The fish passage barrier GIS layer produced as part of this Topic Area was based on SPU's Urban Watercourse layer, which is known to be incorrect in some areas. As a result, exact locations of individual barriers may not be correct. SPU's Drainage and Wastewater GIS staff are currently updating the Urban Watercourse layer and expect to have this completed in 2019. As is the Urban Watercourse layer is updated, the location, type and status of the barriers should be reviewed and updated to reflect the new geography of the creeks and any other updates to GIS since publication of this TM.

7.3 Other (optional)

Additional details on creek culverts and fish passage barriers are also available in the draft Creek Culvert Asset Management Plan which can be found in the Asset Management Plan SharePoint Site.

(<https://seattlegov.sharepoint.com/sites/spu-D1/AMP/SitePages/Home.aspx>)

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Appendix A: Prioritized Inventory of Fish Passage Barriers

SPU Drainage System Analysis

Fish Passage Barriers

Table A-1. Prioritized Inventory of Fish Passage Barriers

Rank	Unique ID	Ownership	Stream	Type	Location	Comment
1	LFMA-BA07	Seattle Parks & Recreation	Longfellow	OTHER	WEST SEATTLE GOLF COURSE DAM	WPA DAM W/OLD FISH LADDER
2	PIMA-BA02	Seattle Public Utilities	Pipers	WEIR	CARKEEK PARK	CONCRETE SEWER LINE CROSSING, 1FT DROP (STA. 340)
3	LFMA-BA06	Seattle Parks & Recreation	Longfellow	CULVERT	W SEATTLE GOLF COURSE 12TH FAIRWAY	FAIRWAY CULVERT
3	LFML-BAB	Seattle Public Utilities	Longfellow	CULVERT	GENESEE ST	BARRIER - SLOPE 0% PASSABLE BASED ON LENGTH & OVERALL SLOPE AND MAX SLOPE- BUT COHO & CHUM U/S, POND @ OUTLET BACKS WATER INTO CULVERT
4	LFML-BAA	Seattle Public Utilities	Longfellow	CULVERT	NUCOR STEEL MILL/ANDOVER	BARRIER SLOPE AND WIDTH; TOO LONG TO ASSESS, BUT COHO & CHUM USE
5	TNMA-BA02	Seattle Public Utilities	Thornton - North Branch	CULVERT	NE 115TH ST	ROADWAY CULVERT W. BAFFLES & CONCRETE WEIRS (STA. 2017)
6	PIBP-BA01	Seattle Parks & Recreation	Pipers	CULVERT	CARKEEK PARK	581' BYPASS PIPE (OUTLET ~2122)+INTAKE GRATE (~2703) @METRO STN
6	PIMA-BA04	King County	Pipers	CULVERT	METRO TREATMENT PLANT	342'METRO PUMP STN CULVT OUTLET STA.~2122, INLET ~2464
7	SCML-BAA	Seattle Public Utilities	Schmitz	CULVERT	OUTFALL to 57TH	BARRIER - SLOPE, WATER SURFACE AND WIDTH; 3' STEMPIPE @ CULVERT INLET (=3JUMP W/O POOL) + OUTLET LOCATED FAR OFFSHORE & @ DEPTH - NOT TYPED AS TYPE F DUE TO WETTED WIDTH
7	TNMA-BA03	Private	Thornton - North Branch	WEIR	BEHIND 3RD OR 4TH HOUSE NORTH OF NE 115TH ST	PRIVATE WEIR BEHIND RESIDENCE; ADULT CUTTS U/S (STA. 2353)
8	LFMA-BA09	Seattle Parks & Recreation	Longfellow	CULVERT	SOUTH END WSGC ACCESS RD CROSSING	ROADWAY CULVERT
8	TNMA-BA01	Private	Thornton - North Branch	WEIR	APPROX. 100FT US OF LITTLEBROOK CONFLUENCE	SERIES OF 4 WEIRS, 2 HAVE SIGNIFICANT DROPS: CHINO (STA. 1908-2005)
9	PIMA-BA05	Seattle Parks & Recreation	Pipers	OTHER	CARKEEK PARK U/S PLANT CULVERT INLET	METRO PUMP PLANT DIVERSION INTAKE (STA. ~2623)
9	PIMA-BA06	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S PLANT CULVERT INLET	ROCK WEIR/PARTIALLY DISMANTLED (STA. 2670)
9	TMMP-BA01	Private	Thornton - Maple	WEIR	4819 NE 93RD ST	CONCRETE WEIR, 2FT DROP (STA. 0)
9	TSMA-BA10	Seattle Parks & Recreation	Thornton - South Branch	NATURAL	THORNTON CR. PARK #2, BETWEEN NE 102ND & 103RD ST	NATURAL LOG JAM, 4FT DROP (STA. 6692)
10	LIML-BAA	Seattle Public Utilities	Licton	CULVERT	88th to GREEN LAKE	BARRIER-SLOPE AND CULVERT WIDTH
10	TMMP-BA02	Seattle Public Utilities	Thornton - Maple	CULVERT	SANDPOINT WAY NE	ROADWAY CULVERT
10	TNLB-BA02	Seattle Public Utilities	Thornton - Littlebrook	CULVERT	NE 115TH ST	ROADWAY CULVERT
10	YSML-BAA	Seattle Public Utilities	Yesler	CULVERT	SANDPOINT to LAKE WASHINGTON	BARRIER - WATER SURFACE DROP; SLOPE; CULVERT WIDTH; NO INFORMATION AVAILABLE ON EXISTING STREAM WIDTH. DOES HAVE. FISH HABITAT PRESENT-NO FISH SAMPLED
11	LFBP-BA01	Seattle Public Utilities	Longfellow	CULVERT	SW FINDLAY ST	INLET OF BYPASS PIPE
11	TSMA-BA08	Private	Thornton - South Branch	OTHER	10301 RAVENNA AVE NE	SEWER CROSSING (STA. 3287)
12	SCML-BAB	Seattle Public Utilities	Schmitz	CULVERT	UPPER CULVERT	BARRIER - SLOPE, WATER SURFACE AND WIDTH; 3' STEMPIPE @ CULVERT INLET (=3JUMP W/O POOL) + OUTLET LOCATED FAR OFFSHORE & @ DEPTH - NOT TYPED AS TYPE F DUE TO WETTED WIDTH
13	TAMA-BA03	Private	Taylor	CULVERT	10018 RAINIER AVE S	DRIVEWAY ACCESS
13	TNMA-BA11	Seattle Public Utilities	Thornton - North Branch	CULVERT	25TH AVE NE	ROADWAY CULVERT
14	FAMA-BA02	Seattle Public Utilities	Fauntleroy	CULVERT	45TH AVE SW	CHALET APT PARKING LOT
14	PIMA-BA08	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	ROCK WEIR 4.2' RIPRAP WEIR X CREEK & FLOODPLAIN
14	PIMA-BA09	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	ROCK WEIR 3.5' MANMADE BOULDER CASCADE/RK WEIR ~3331
14	TAMA-BA05	Seattle Public Utilities	Taylor	CULVERT	RAINIER AVE SE	ROADWAY CULVERT
15	PIMA-BA11	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	ROCK WEIR 4' MANMADE BOULDER CASCADE/RK WEIR ~3822
15	PIMA-BA14	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	4' RIPRAP WEIR X CREEK & FLOODPLAIN ~STA. 4252
15	PIMA-BA17	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	5' RIPRAP BOULDER WEIR/DAM X CK & FLOODPLAIN ~STA. 4696
15	PIMA-BA18	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	4' RIPRAP BOULDER WEIR/DAM X CK & FLOODPLAIN ~STA. 4942
15	PIVE-BA02	Seattle Parks & Recreation	Pipers - Venema	NATURAL	CARKEEK PARK	LWD JAM - NOT ASSESSED, 6 - 8FT DROP (STA. 2075)
15	TSKR-BA02	Private	Thornton - Kramer	CULVERT	10703 30TH AVE NE	DRIVEWAY ACCESS

SPU Drainage System Analysis

Fish Passage Barriers

Table A-1. Prioritized Inventory of Fish Passage Barriers

Rank	Unique ID	Ownership	Stream	Type	Location	Comment
15	TSKR-BA03	Private	Thornton - Kramer	CULVERT	10715 30TH AVE NE	DRIVEWAY ACCESS
16	TAMA-BA04	Seattle Public Utilities/private	Taylor	CULVERT	10020 RAINIER AVE SE	PRIVATE RESIDENCE
16	TAWF-BA02	Seattle Public Utilities	Taylor - West Fork	CULVERT	RENTON AVE SE	ROADWAY CULVERT
17	TNLB-BA04	Seattle Public Utilities	Thornton - Littlebrook	CULVERT	NE 123RD ST	ROADWAY CULVERT
17	TNLB-BA06	Seattle Public Utilities	Thornton - Littlebrook	OTHER	35TH AVE NE & 125TH AVE NE	SLOPE BARRIER
17	TNMA-BA13	Seattle Public Utilities	Thornton - North Branch	CULVERT	NE 125TH ST	ROADWAY CULVERT
18	LFGC-BA01	Seattle Parks & Recreation	Longfellow	CULVERT	WSGC GOLF CART ACCESS ROAD	TRIBUTARY CULVERT
18	TAMA-BA06	Seattle Public Utilities/private	Taylor	CULVERT	10028 68TH AVE SE	CULVERT WITH CONCRETE WATERFALL
18	TNMA-BA05	Private	Thornton - North Branch	WEIR	3114 NE 117TH ST	CONCRETE SEWER LINE (STA. 3287)
18	TSUE-BA01	Seattle Public Utilities	Thornton -Trib to Willow	CULVERT	RAVENNA AVE NE & NE 98TH ST	ROADWAY CULVERT
19	TAWF-BA01	Seattle Parks & Recreation	Taylor - West Fork	WEIR	LAKERIDGE PARK	BOULDER CASCADE, 3.5FT DROP (STA. 4123)
20	LFML-BAC	Seattle Public Utilities	Longfellow	CULVERT	JUNEAU bypass	PARTIAL-1% FOR 65'-LIKELY A VELOCITY BARRIER W/SMOOTH WALLS. STEEL PLATE PARTIALLY COVERS INLET, CATCHES DEBRIS-FLOOD PRONE; WATER SURFACE DROP
20	LFML-BAD	Seattle Public Utilities	Longfellow	CULVERT	JUNEAU roadway culvert	EVIDENCE OF SALMON UPSTREAM OF STRUCTURE DEMONSTRATES STRUCTURE IS PASSABLE IN SOME CONDITIONS
20	LFML-BAE	Seattle Public Utilities	Longfellow	CULVERT	SW MYRTLE ST	BARRIER - water surface drop, slop and culvert width
20	TMUA-BA02	Private	Thornton - Matthew	CULVERT	9138 MATTHEWS AVE NE	DRIVEWAY CULVERT: UNDERSIZED
20	TNLB-BA03	Seattle Public Utilities	Thornton - Littlebrook	CULVERT	NE 120TH ST	ROADWAY CULVERT
20	TSKR-BA04	Private	Thornton - Kramer	CULVERT	10721 30TH AVE NE	DRIVEWAY ACCESS
21	FAMA-BA03	Seattle Public Utilities	Fauntleroy	CULVERT	CALIFORNIA WAY SW	LONG CULVERT; UNDERSIZED
21	LFMA-BA25	Seattle Public Utilities	Longfellow	WEIR	SW WEBSTER ST	ROCK WEIR, 3.75FT DROP (STA. 18298)
21	PIMA-BA10	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	ROCK WEIR 3' VERTICAL BOULDER STEP ~ STA. 3542
21	PIUH-BA01	Seattle Parks & Recreation	Pipers	CULVERT	CARKEEK PARK	TRAIL CULVERT
21	TMMP-BA04	Private	Thornton - Maple	CULVERT	9226 MATTHEWS AVE NE	ROADWAY CULVERT
21	TNLI-BA05	Private	Thornton - Littles	CULVERT	14041 15TH AVE NE	PARKING LOT CULVERT
21	TNLI-BA07	Seattle Parks & Recreation	Thornton - Littles	CULVERT	JACKSON PARK GOLF COURSE	GOLF COURSE DETENTION POND OUTLET
21	TNMA-BA15	Seattle Public Utilities	Thornton - North Branch	CULVERT	19TH AVE NE	ROADWAY CULVERT
21	TNMA-BA17	Seattle Public Utilities	Thornton - North Branch	CULVERT	15TH AVE NE	ROADWAY CULVERT & WEIR W. 1.33FT DROP
21	TSWI-BA01	Seattle Public Utilities	Thornton - Willow	WEIR	NE 100TH ST	ROCK WEIR, 1 - 1.5FT DROP (STA. 142)
22	PIMA-BA13	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	3' RIPRAP BOULDER WEIR ~STA 4074
22	PIMA-BA15	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	3' RIPRAP WEIR X CREEK & FLOODPLAIN ~STA. 4436
22	PIMA-BA19	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	2' RIPRAP BOULDER WEIR/DAM X CK & FLOODPLAIN ~STA. 5112
22	TMMP-BA03	Private	Thornton - Maple	WEIR	9226 MATTHEWS AVE NE	ROCK WEIR, 2FT DROP (STA. 469)
22	TMMP-BA07	Seattle Public Utilities	Thornton - Maple	OTHER	2523 NE 93RD ST	MAN MADE DAM, 5FT DROP (STA. 917)
22	TMMP-BA08	Seattle Public Utilities	Thornton - Maple	CULVERT	45TH AVE NE	ROADWAY CULVERT
22	TNMA-BA21	Seattle Public Utilities	Thornton - North Branch	CULVERT	10TH AVE NE	2X CULVERTS
23	PIMA-BA21	Unknown	Pipers	CULVERT	ABANDONED ROAD	ABANDONED ROAD-CAMEL'S HUMP CULVERT ~ STA 6073
23	TAEF-BA03	Seattle Public Utilities	Taylor - East Fork	CULVERT	SE 115TH ST	ROADWAY CULVERT
23	TSKR-BA05	Private	Thornton - Kramer	CULVERT	10725 30TH AVE NE	DRIVEWAY ACCESS

SPU Drainage System Analysis

Fish Passage Barriers

Table A-1. Prioritized Inventory of Fish Passage Barriers

Rank	Unique ID	Ownership	Stream	Type	Location	Comment
23	TSWI-BA07	Seattle Public Utilities/WA State Dept of Transportation	Thornton - Willow	CULVERT	LAKE CITY WAY NE BETWEEN NE 92TH AND 95TH ST NE	2ND CULVERT PARALLEL TO LAKE CITY WAY ; NOT ASSESS
24	FAMA-BA04	Seattle Parks & Recreation	Fauntleroy	NATURAL	FAUNTLEROY PARK	LWD JAM, 2FT DROP (STA. 2623)
24	FAMA-BA05	Seattle Parks & Recreation	Fauntleroy	NATURAL	FAUNTLEROY PARK	LWD JAM, 3FT DROP (STA. 2678)
24	LFMA-BA26	Seattle Public Utilities	Longfellow	WEIR	SW WEBSTER ST	ROCK WEIR, 4FT DROP (STA. 18335)
24	LFMA-BA27	Seattle Public Utilities	Longfellow	WEIR	SW WEBSTER ST	ROCK WEIR, 3.5FT. DROP (STA. 18383)
24	PIMA-BA12	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	ROCK WEIR 2' MANMADE ROCK STEP ~ STA. 3970
24	PIMA-BA16	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	3' RIPRAP BOULDER WEIR ~STA 4612
24	TAMA-BA14	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 1.5FT DROP (STA. 1963)
24	TAMA-BA15	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 3.5FT DROP (STA. 2126)
24	TAMA-BA16	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 2.5FT DROP (STA. 2598)
24	TMMP-BA06	Seattle Parks & Recreation	Thornton - Maple	CULVERT	BURKE-GILMAN TRAIL	TRAIL CULVERT
24	TNMA-BA25A	WA State Dept of Transportation	Thornton - North Branch	CULVERT	I5 EXIT RAMP, SOUTH OF NE 145TH ST	TOO LONG TO EVALUATE
24	TNMA-BA25B	WA State Dept of Transportation	Thornton - North Branch	CULVERT	I5 EXIT RAMP, SOUTH OF NE 145TH ST	TOO LONG TO EVALUATE
25	TSUE-BA03	Seattle Public Utilities	Thornton -Trib to Willow	CULVERT	NE 95TH ST & 27TH AVE NE	ROADWAY CULVERT
26	PIMA-BA20	Seattle Parks & Recreation	Pipers	WEIR	CARKEEK PARK U/S METRO PUMP PLANT	3' RIPRAP STEP UP ~STA. 5344 @ TWIN PIPES OUTLET
26	TAMA-BA10	Seattle Public Utilities	Taylor	WEIR	TAYLOR CREEK RESTORATION AREA	LOG WEIR (STA.1434)
26	TAMA-BA11	Seattle Public Utilities	Taylor	WEIR	TAYLOR CREEK RESTORATION AREA	LOG WEIR (STA. 1455), 1.4 FT DROP
26	TNMA-BA06	Seattle Public Utilities	Thornton - North Branch	WEIR	LAKE CITY WAY NE (NORTH BRANCH)	CONCRETE WEIR, 1.3 FT DROP (BEFORE 2.6 FT DROP) (STA 4165)
26	TNMA-BA08	Seattle Public Utilities	Thornton - North Branch	CULVERT	LAKE CITY WAY NE	ROADWAY CULVERT
26	TNMA-BA09	Private	Thornton - North Branch	WEIR	12036 25TH AVE NE	ASPHALT WEIR, 1.5FT DROP (STA. 5579); AD CUTTS U/S
26	TSWI-BA05	Seattle Public Utilities	Thornton - Willow	CULVERT	98TH AVE NE & LAKE CITY WAY NE	ROADWAY CULVERT
26	TSWI-BA06	Seattle Public Utilities/WA State Dept of Transportation	Thornton - Willow	CULVERT	LAKE CITY WAY NE BETWEEN NE 96TH AND 97TH ST NE	CULVERT PARALLEL TO LAKE CITY WAY NE
27	LFMA-BA30	Seattle Public Utilities	Longfellow	WEIR	SW HOLDEN ST	LOG WEIR, 1.3FT DROP (STA. 19089)
27	LFMA-BA31	Seattle Public Utilities	Longfellow	WEIR	SW HOLDEN ST	LOG WEIR, 1.2FT DROP (STA. 19121)
27	PIMA-BA23	Seattle Public Utilities	Pipers	CULVERT	NW HOLMAN RD	ROADWAY CULVERT; 2.1' STEMPIPE AT INLET NEG. PERCH
27	PIMA-BA24	Private	Pipers	WEIR	9557 7TH AVE NW	CONCRETE DAM, 2.8FT DROP
27	TNLI-BA01	Seattle Public Utilities	Thornton - Littles	CULVERT	15TH AVE NE	DRAINAGE MAINLINE CONNECTION POINT
27	TNLI-BA08	Seattle Public Utilities/King County	Thornton - Littles	CULVERT	NE 145TH ST	ROADWAY CULVERT
27	TNMA-BA18	Private	Thornton - North Branch	WEIR	15TH AVE NE (BRIDGEHAVEN CONDO COMPLEX)	LOG WEIR, 3FT DROP (STA. 11120)
27	TNMA-BA19	Private	Thornton - North Branch	WEIR	15TH AVE NE (BRIDGEHAVEN CONDO COMPLEX)	LOG WEIR, 2.5FT DROP (STA. 11266)
27	TSKR-BA06	Private	Thornton - Kramer	CULVERT	10731 30TH AVE NE	DRIVEWAY ACCESS/OFTEN FLOODS YARD
28	FAMA-BA06	Seattle Parks & Recreation	Fauntleroy	NATURAL	FAUNTLEROY PARK	LWD JAM, 4FT DROP (STA. 3152)
28	TAMA-BA17	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 3FT. DROP (STA. 3167)
28	TAMA-BA18	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 3FT DROP (STA. 3416)

SPU Drainage System Analysis

Fish Passage Barriers

Table A-1. Prioritized Inventory of Fish Passage Barriers

Rank	Unique ID	Ownership	Stream	Type	Location	Comment
28	TAMA-BA19	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 3FT DROP (STA. 3680)
28	TAMA-BA20	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 2.5FT DROP (STA. 3893)
28	TAMA-BA21	Seattle Parks & Recreation	Taylor	NATURAL	LAKERIDGE PARK	LWD JAM, 2.5FT DROP (STA. 3913)
28	TMMP-BA05	Private	Thornton - Maple	WEIR	9218 MATTHEWS AVE NE	WOOD WEIR, 2FT DROP (STA. 600)
28	TSWI-BA02	Seattle Public Utilities	Thornton - Willow	WEIR	NE 100TH ST	ROCK WEIR, 2.5FT DROP (STA. 154)
28	TSWI-BA03	Seattle Public Utilities	Thornton - Willow	CULVERT	NE 100TH ST	ROADWAY CROSSING
29	TAEF-BA01	Seattle Parks & Recreation	Taylor - East Fork	CULVERT	LAKERIDGE PARK- OLD ROAD GRADE	ABANDONED ROAD
29	TAMA-BA09	Seattle Public Utilities	Taylor	CULVERT	68TH AVE SE	NEW CULVERT
29	TSKR-BA09	Seattle Public Utilities	Thornton - Kramer	CULVERT	NE 110TH ST	ROADWAY CULVERT
29	TSKR-BA10	Private	Thornton - Kramer	CULVERT	2830 NE 110TH ST	DRIVEWAY ACCESS
29	TSKR-BA11	Private	Thornton - Kramer	CULVERT	2820 NE 110TH ST	DRIVEWAY ACCESS
29	TSKR-BA14	Seattle Public Utilities	Thornton - Kramer	CULVERT	28TH AVE NE & NE 110TH ST	ROADWAY CULVERT
29	TSUE-BA02	Private	Thornton -Trib to Willow	WEIR	9522 25TH AVE NE	ROCK WEIR, 2FT DROP (STA. 950)
29	TSWI-BA04	Private	Thornton - Willow	CULVERT	2503 NE 100TH ST	DRIVEWAY ACCESS
30	PIMA-BA22	Seattle Public Utilities	Pipers	CULVERT	NW 100TH PL	CULVERT NOT COMPLETELY ASSESSED; CALL BASED ON MEM
30	TNLB-BA07	Seattle Public Utilities	Thornton - Littlebrook	CULVERT	NE 125TH ST & 35TH AVE NE	OUTLET FROM NE 125TH ST DETENTION POND
30	TNLI-BA02	Unknown/Private	Thornton - Littles	CULVERT	15TH AVE NE, SOUTH OF NE 140TH ST	GREEN TREE VILLAGE CULVERT
30	TNLI-BA03	Seattle Public Utilities	Thornton - Littles	CULVERT	NE 140TH ST	ROADWAY CULVERT
30	TNLI-BA04	Private	Thornton - Littles	CULVERT	14017 15TH AVE NE	APARTMENT COMPLEX DRIVEWAY ACCESS
30	TNMA-BA20	Private	Thornton - North Branch	WEIR	15TH AVE NE (BRIDGEHAVEN CONDO COMPLEX)	LOG WEIR, 1.5FT DROP (STA. 11320)
30	TSKR-BA12	Private	Thornton - Kramer	CULVERT	2814 NE 110TH ST	DRIVEWAY ACCESS
30	TSWI-BA11	Seattle Public Utilities	Thornton - Willow	CULVERT	NE 86TH ST & RAVENNA AVE NE	ROADWAY CULVERT
31	TNMA-BA24A	Seattle Public Utilities	Thornton - North Branch	CULVERT	5TH AVE NE	ROADWAY CULVERT
31	TNMA-BA24B	Seattle Public Utilities	Thornton - North Branch	CULVERT	5TH AVE NE	ROADWAY CULVERT
32	TSKR-BA07	Private	Thornton - Kramer	CULVERT	10739 30TH AVE NE	DRIVEWAY ACCESS
32	TSKR-BA08	Private	Thornton - Kramer	CULVERT	10749 30TH AVE NE	DRIVEWAY ACCESS
32	TSKR-BA13	Private	Thornton - Kramer	CULVERT	2804 NE 110TH ST	DRIVEWAY ACCESS
32	TSMA-BA22	Unknown	Thornton - South Branch	CULVERT	NORTH SEATTLE COMMUNITY COLLEGE	TRAIL XING-SEDIMENT IN CULVERT FACILITATES PASSAGE
33	TAEF-BA04	Unknown	Taylor - East Fork	CULVERT	S 116TH PL	ROADWAY CULVERT
32	TNMA-BA16	Seattle Public Utilities	Thornton - North Branch	WEIR	1511 NE 130TH ST	CONCRETE WEIR, 2FT DROP (STA. 10791)
34	LFMA-BA28	Seattle Public Utilities	Longfellow	WEIR	SW WEBSTER ST	ROCK WEIR, 3FT DROP (STA. 18503)
35	PIMA-BA29	Seattle Public Utilities	Pipers	CULVERT	6TH AVE NW & 95TH AVE NW	CULVERT

Appendix B: Fish Passage Barrier Prioritization Criteria

SPU Drainage System Analysis

Fish Passage Barriers

Table B-1. Fish Passage Barrier Prioritization Criteria

Unique ID	Barrier Status	Points Barrier Status	Distance from Creek Mouth (ft)	Relative Location	Points Relative Location	No. Downstream Barriers	Points Downstream Barriers	Salmon and Other Fish Nearby	Points Salmon and Other Fish Nearby	Relative Gradient Upstream	Points Relative Gradient Upstream	Distance to Next Total Upstream Barrier	Quality of Upstream Habitat	Points Quality of Upstream Habitat	Total Score	Rank
LFMA-BA07	Barrier	8	5700	L	10	1	10	Type F (salmon)	8	0-2%	10	4049	H	10	56	1
PIMA-BA02	Partial Barrier	1	340	L	10	0	10	Type F (listed salmon)	12	0-2%	10	1782	H	10	53	2
LFMA-BA06	Barrier	8	5373	L	10	0	10	Type F (salmon)	8	0-2%	10	327	M	5	51	3
LFML-BAB	Barrier	8		L	10	1	10	Type F (salmon)	8	0-2%	10		M	5	51	3
LFML-BAA	Barrier	8		L	10	0	10	Type F (salmon)	8	0-2%	10		L	1	47	4
TNMA-BA02	Partial Barrier	1	9177	L	10	1	10	Type F (listed salmon)	12	3-4%	7	336	M	5	45	5
PIBP-BA01	Barrier	8	2122	L	10	1	10	Type F (salmon)	8	3-4%	7	501	L	1	44	6
PIMA-BA04	Barrier	8	2122	L	10	1	10	Type F (salmon)	8	3-4%	7	501	L	1	44	6
SCML-BAA	Barrier	8		L	10	0	10	Type F (trout and other)	4	0-2%	10		L	1	43	7
TNMA-BA03	Partial Barrier	1	9513	L	10	2	5	Type F (listed salmon)	12	0-2%	10	934	M	5	43	7
LFMA-BA09	Barrier	8	9749	M	5	2	5	Type F (trout and other)	4	0-2%	10	8549	H	10	42	8
TNMA-BA01	Partial Barrier	1	9068	L	10	0	10	Type F (listed salmon)	12	5-8%	4	109	M	5	42	8
PIMA-BA05	Partial Barrier	1	2623	L	10	2	5	Type F (salmon)	8	3-4%	7	47	H	10	41	9
PIMA-BA06	Partial Barrier	1	2670	L	10	3	5	Type F (salmon)	8	3-4%	7	469	H	10	41	9
TMMP-BA01	Partial Barrier	1	1027	L	10	0	10	Type F (listed salmon)	12	3-4%	7	206	L	1	41	9
TSMA-BA10	Partial Barrier	1	13882	M	5	1	10	Type F (salmon)	8	3-4%	7	1069	H	10	41	9
LIML-BAA	Barrier	8	0	L	10	0	10	Type F (trout and other)	4	3-4%	7	0	L	1	40	10
TMMP-BA02	Barrier	8	1233	L	10	1	10	Type F (trout and other)	4	3-4%	7	263	L	1	40	10
TNLB-BA02	Barrier	8	9111	L	10	0	10	Type F (trout and other)	4	3-4%	7	1586	L	1	40	10
YSML-BAA	Barrier	8		L	10		10	No	1	0-2%	10		L	1	40	10
LFBP-BA01	Barrier	8	11057	M	5	3	5	No	1	0-2%	10	7241	H	10	39	11
TSMA-BA08	Partial Barrier	1	10477	M	5	0	10	Type F (listed salmon)	12	0-2%	10	3405	L	1	39	11
SCML-BAB	Barrier	8		M	5	1	10	Type F (trout and other)	4	0-2%	10		L	1	38	12
TAMA-BA03	Partial Barrier	1	420	L	10	0	10	Type F (salmon)	8	3-4%	7	85	L	1	37	13
TNMA-BA11	Barrier	8	13404	M	5	7	1	Type F (salmon)	8	0-2%	10	658	M	5	37	13
FAMA-BA02	Barrier	8	1290	M	5	0	10	Type F (salmon)	8	5-8%	4	693	L	1	36	14
PIMA-BA08	Barrier	8	3139	M	5	4	1	Type F (salmon)	8	5-8%	4	192	H	10	36	14
PIMA-BA09	Barrier	8	3331	M	5	5	1	Type F (salmon)	8	5-8%	4	211	H	10	36	14
TAMA-BA05	Barrier	8	560	L	10	2	5	Type F (salmon)	8	5-8%	4	302	L	1	36	14
PIMA-BA11	Barrier	8	3822	M	5	7	1	Type F (trout and other)	4	3-4%	7	148	H	10	35	15
PIMA-BA14	Barrier	8	4252	M	5	10	1	Type F (trout and other)	4	3-4%	7	184	H	10	35	15
PIMA-BA17	Barrier	8	4696	M	5	13	1	Type F (trout and other)	4	3-4%	7	246	H	10	35	15
PIMA-BA18	Barrier	8	4942	M	5	14	1	Type F (trout and other)	4	3-4%	7	170	H	10	35	15
PIVE-BA02	Partial Barrier	1	3039	M	5	1	10	Type F (salmon)	8	9-20%	1	1634	H	10	35	15
TSKR-BA02	Partial Barrier	1	8767	M	5	0	10	Type F (salmon)	8	0-2%	10	74	L	1	35	15

SPU Drainage System Analysis

Fish Passage Barriers

Table B-1. Fish Passage Barrier Prioritization Criteria

Unique ID	Barrier Status	Points Barrier Status	Distance from Creek Mouth (ft)	Relative Location	Points Relative Location	No. Downstream Barriers	Points Downstream Barriers	Salmon and Other Fish Nearby	Points Salmon and Other Fish Nearby	Relative Gradient Upstream	Points Relative Gradient Upstream	Distance to Next Total Upstream Barrier	Quality of Upstream Habitat	Points Quality of Upstream Habitat	Total Score	Rank
TSKR-BA03	Partial Barrier	1	8841	M	5	1	10	Type F (salmon)	8	0-2%	10	34	L	1	35	15
TAMA-BA04	Partial Barrier	1	505	L	10	1	10	Type F (salmon)	8	5-8%	4	55	L	1	34	16
TAWF-BA02	Barrier	8	5190	U	1	16	1	Type F (trout and other)	4	0-2%	10	2935	H	10	34	16
TNLB-BA04	Barrier	8	11428	M	5	2	5	Type F (trout and other)	4	0-2%	10	385	L	1	33	17
TNLB-BA06	Barrier	8	11813	M	5	3	5	Type F (trout and other)	4	0-2%	10	0	L	1	33	17
TNMA-BA13	Barrier	8	14062	M	5	8	1	Type F (salmon)	8	0-2%	10	2584	L	1	33	17
LFGC-BA01	Barrier	8	6528	L	10	2	5	No	1	3-4%	7	671*	L	1	32	18
TAMA-BA06	Barrier	8	862	L	10	3	5	Type F (trout and other)	4	5-8%	4	475	L	1	32	18
TNMA-BA05	Partial Barrier	1	10447	L	10	3	5	Type F (trout and other)	4	3-4%	7	878	M	5	32	18
TSUE-BA01	Barrier	8	11874	M	5	1	10	Type F (trout and other)	4	5-8%	4	852	L	1	32	18
TAWF-BA01	Barrier	8	4123	U	1	15	1	Type F (trout and other)	4	3-4%	7	1067	H	10	31	19
LFML-BAC	Barrier	8		M	5	3	5	No	1	0-2%	10		L	1	30	20
LFML-BAD	Partial Barrier	1		M	5	2	5	TYPE F (SALMON)	8	0-2%	10		L	1	30	20
LFML-BAE	Barrier	8		U	1	3	5	Type F (salmon)	8	3-4%	7		L	1	30	20
TMUA-BA02	Partial Barrier	1	NS	L	10	0	10	Type F (trout and other)	4	5-8%	4	UNKNOWN	L	1	30	20
TNLB-BA03	Partial Barrier	1	10697	L	10	1	10	Type F (trout and other)	4	5-8%	4	731	L	1	30	20
TSKR-BA04	Partial Barrier	1	8875	M	5	2	5	Type F (salmon)	8	0-2%	10	87	L	1	30	20
FAMA-BA03	Barrier	8	1983	M	5	1	10	Type F (trout and other)	4	9-20%	1	640	L	1	29	21
LFMA-BA25	Barrier	8	18298	U	1	3	5	Type F (trout and other)	4	0-2%	10	37	L	1	29	21
PIMA-BA10	Partial Barrier	1	3542	M	5	6	1	Type F (salmon)	8	5-8%	4	280	H	10	29	21
PIUH-BA01	Barrier	8	3189***	M	5	5	1	Type F (trout and other)	4	9-20%	1	UNKNOWN	H	10	29	21
TMMP-BA04	Barrier	8	1562	L	10	3	5	Type F (trout and other)	4	9-20%	1	65	L	1	29	21
TNLI-BA05	Barrier	8	13357	M	5	9	1	Type F (trout and other)	4	0-2%	10	282	L	1	29	21
TNLI-BA07	Barrier	8	13639	M	5	10	1	Type F (trout and other)	4	0-2%	10	1384	L	1	29	21
TNMA-BA15	Barrier	8	16646	M	5	9	1	Type F (trout and other)	4	0-2%	10	1305	L	1	29	21
TNMA-BA17	Barrier	8	17968	M	5	11	1	Type F (trout and other)	4	0-2%	10	312	L	1	29	21
TSWI-BA01	Partial Barrier	1	11287	M	5	1	10	Type F (trout and other)	4	5-8%	4	12	M	5	29	21
PIMA-BA13	Partial Barrier	1	4074	M	5	9	1	Type F (trout and other)	4	3-4%	7	178	H	10	28	22
PIMA-BA15	Partial Barrier	1	4436	M	5	11	1	Type F (trout and other)	4	3-4%	7	176	H	10	28	22
PIMA-BA19	Partial Barrier	1	5112	M	5	15	1	Type F (trout and other)	4	3-4%	7	232	H	10	28	22
TMMP-BA03	Partial Barrier	1	1496	L	10	2	5	Type F (trout and other)	4	3-4%	7	66	L	1	28	22
TMMP-BA07	Barrier	8	1944	L	10	6	1	Type F (trout and other)	4	5-8%	4	270	L	1	28	22
TMMP-BA08	Barrier	8	2214	L	10	7	1	Type F (trout and other)	4	5-8%	4	1026	L	1	28	22
TNMA-BA21	Partial Barrier	1	19813	M	5	15	1	Type F (trout and other)	4	3-4%	7	3721	H	10	28	22
PIMA-BA21	Barrier	8	6073	U	1	17	1	Type F (trout and other)	4	3-4%	7	890	M	5	26	23

SPU Drainage System Analysis

Fish Passage Barriers

Table B-1. Fish Passage Barrier Prioritization Criteria

Unique ID	Barrier Status	Points Barrier Status	Distance from Creek Mouth (ft)	Relative Location	Points Relative Location	No. Downstream Barriers	Points Downstream Barriers	Salmon and Other Fish Nearby	Points Salmon and Other Fish Nearby	Relative Gradient Upstream	Points Relative Gradient Upstream	Distance to Next Total Upstream Barrier	Quality of Upstream Habitat	Points Quality of Upstream Habitat	Total Score	Rank
TAEF-BA03	Barrier	8	NS	U	1	16	1	No	1	0-2%	10	NS	M	5	26	23
TSKR-BA05	Partial Barrier	1	8962	M	5	3	5	Type F (trout and other)	4	0-2%	10	32	L	1	26	23
TSWI-BA07	Barrier	8	NS	M	5	7	1	Type F (trout and other)	4	3-4%	7	UNKNOWN	L	1	26	23
FAMA-BA04	Partial Barrier	1	2623	U	1	2	5	Type F (trout and other)	4	5-8%	4	55	H	10	25	24
FAMA-BA05	Partial Barrier	1	2678	U	1	3	5	Type F (trout and other)	4	5-8%	4	474	H	10	25	24
LFMA-BA26	Barrier	8	18335	U	1	4	1	Type F (trout and other)	4	0-2%	10	48	L	1	25	24
LFMA-BA27	Barrier	8	18383	U	1	5	1	Type F (trout and other)	4	0-2%	10	120	L	1	25	24
PIMA-BA12	Partial Barrier	1	3970	M	5	8	1	Type F (trout and other)	4	5-8%	4	104	H	10	25	24
PIMA-BA16	Partial Barrier	1	4612	M	5	12	1	Type F (trout and other)	4	5-8%	4	84	H	10	25	24
TAMA-BA14	Partial Barrier	1	1963	M	5	7	1	Type F (trout and other)	4	5-8%	4	163	H	10	25	24
TAMA-BA15	Partial Barrier	1	2126	M	5	8	1	Type F (trout and other)	4	5-8%	4	472	H	10	25	24
TAMA-BA16	Partial Barrier	1	2598	M	5	9	1	Type F (trout and other)	4	5-8%	4	569	H	10	25	24
TMMP-BA06	Barrier	8	1761	L	10	5	1	Type F (trout and other)	4	9-20%	1	183	L	1	25	24
TNMA-BA25A	Barrier	8	23696	U	1	18	1	Type F (trout and other)	4	0-2%	10	2030	L	1	25	24
TNMA-BA25B	Barrier	8	25726	U	1	19	1	Type F (trout and other)	4	0-2%	10	820	L	1	25	24
TSUE-BA03	Barrier	8	12997	M	5	3	5	No	1	5-8%	4	0*	L	1	24	25
PIMA-BA20	Partial Barrier	1	5344	M	5	16	1	Type F (trout and other)	4	3-4%	7	729	M	5	23	26
TAMA-BA10	Partial Barrier	1	1434	M	5	5	1	Type F (trout and other)	4	3-4%	7	21	M	5	23	26
TAMA-BA11	Partial Barrier	1	1455	M	5	6	1	Type F (trout and other)	4	3-4%	7	508	M	5	23	26
TNMA-BA06	Partial Barrier	1	11325	M	5	4	1	Type F (trout and other)	4	3-4%	7	43	M	5	23	26
TNMA-BA08	Partial Barrier	1	11368	M	5	5	1	Type F (trout and other)	4	3-4%	7	1371	M	5	23	26
TNMA-BA09	Partial Barrier	1	12739	M	5	6	1	Type F (trout and other)	4	3-4%	7	665	M	5	23	26
TSWI-BA05	Barrier	8	11838	M	5	5	1	Type F (trout and other)	4	5-8%	4	UNKNOWN	L	1	23	26
TSWI-BA06	Barrier	8	NS	M	5	6	1	Type F (trout and other)	4	5-8%	4	UNKNOWN	L	1	23	26
LFMA-BA30	Partial Barrier	1	19089	U	1	7	1	Type F (trout and other)	4	0-2%	10	32	M	5	22	27
LFMA-BA31	Partial Barrier	1	19121	U	1	8	1	Type F (trout and other)	4	0-2%	10	1660	M	5	22	27
PIMA-BA23	Barrier	8	7805	U	1	19	1	Type F (trout and other)	4	3-4%	7	883	L	1	22	27
PIMA-BA24	Barrier	8	NS	U	1	20	1	Type F (trout and other)	4	3-4%	7	UNKNOWN	L	1	22	27
TNLI-BA01	Partial Barrier	1	10808	M	5	5	1	Type F (trout and other)	4	0-2%	10	1834	L	1	22	27
TNLI-BA08	Partial Barrier	1	15023	M	5	11	1	Type F (trout and other)	4	0-2%	10	478	L	1	22	27
TNMA-BA18	Partial Barrier	1	18280	M	5	12	1	Type F (trout and other)	4	0-2%	10	146	L	1	22	27
TNMA-BA19	Partial Barrier	1	18426	M	5	13	1	Type F (trout and other)	4	0-2%	10	54	L	1	22	27
TSKR-BA06	Partial Barrier	1	8994	M	5	4	1	Type F (trout and other)	4	0-2%	10	98	L	1	22	27
FAMA-BA06	Partial Barrier	1	3152	U	1	4	1	Type F (trout and other)	4	5-8%	4	0	H	10	21	28
TAMA-BA17	Partial Barrier	1	3167	U	1	10	1	Type F (trout and other)	4	5-8%	4	249	H	10	21	28

SPU Drainage System Analysis

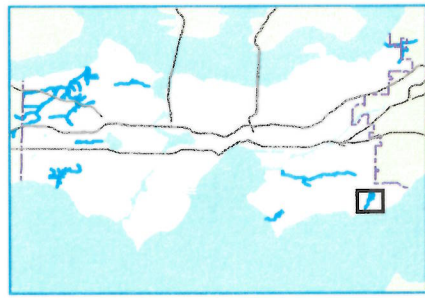
Fish Passage Barriers

Table B-1. Fish Passage Barrier Prioritization Criteria

Unique ID	Barrier Status	Points Barrier Status	Distance from Creek Mouth (ft)	Relative Location	Points Relative Location	No. Downstream Barriers	Points Downstream Barriers	Salmon and Other Fish Nearby	Points Salmon and Other Fish Nearby	Relative Gradient Upstream	Points Relative Gradient Upstream	Distance to Next Total Upstream Barrier	Quality of Upstream Habitat	Points Quality of Upstream Habitat	Total Score	Rank
TAMA-BA18	Partial Barrier	1	3416	U	1	11	1	Type F (trout and other)	4	5-8%	4	264	H	10	21	28
TAMA-BA19	Partial Barrier	1	3680	U	1	12	1	Type F (trout and other)	4	5-8%	4	213	H	10	21	28
TAMA-BA20	Partial Barrier	1	3893	U	1	13	1	Type F (trout and other)	4	5-8%	4	20	H	10	21	28
TAMA-BA21	Partial Barrier	1	3913	U	1	14	1	Type F (trout and other)	4	5-8%	4	52*	H	10	21	28
TMMP-BA05	Partial Barrier	1	1627	L	10	4	1	Type F (trout and other)	4	5-8%	4	134	L	1	21	28
TSWI-BA02	Partial Barrier	1	11299	M	5	2	5	Type F (trout and other)	4	9-20%	1	60	M	5	21	28
TSWI-BA03	Partial Barrier	1	11359	M	5	3	5	Type F (trout and other)	4	9-20%	1	105	M	5	21	28
TAEF-BA01	Barrier	8	4108	U	1	15	1	Type F (trout and other)	4	9-20%	1	UNKNOWN	M	5	20	29
TAMA-BA09	Partial Barrier	1	1337	M	5	4	1	Type F (trout and other)	4	5-8%	4	97	M	5	20	29
TSKR-BA09	Barrier	8	9265	M	5	7	1	Type F (trout and other)	4	9-20%	1	91	L	1	20	29
TSKR-BA10	Barrier	8	9356	M	5	8	1	Type F (trout and other)	4	9-20%	1	57	L	1	20	29
TSKR-BA11	Barrier	8	9413	M	5	9	1	Type F (trout and other)	4	9-20%	1	83	L	1	20	29
TSKR-BA14	Barrier	8	9674	M	5	12	1	Type F (trout and other)	4	9-20%	1	0*	L	1	20	29
TSUE-BA02	Partial Barrier	1	12726	M	5	2	5	Type F (trout and other)	4	5-8%	4	271	L	1	20	29
TSWI-BA04	Partial Barrier	1	11464	M	5	4	1	Type F (trout and other)	4	5-8%	4	374	M	5	20	29
PIMA-BA22	Barrier	8	6963	U	1	18	1	Type F (trout and other)	4	5-8%	4	842	L	1	19	30
TNLB-BA07	Partial Barrier	1	NS	M	5	4	1	Type F (trout and other)	4	3-4%	7	UNKNOWN	L	1	19	30
TNLI-BA02	Partial Barrier	1	12642	M	5	6	1	Type F (trout and other)	4	3-4%	7	335	L	1	19	30
TNLI-BA03	Partial Barrier	1	12977	M	5	7	1	Type F (trout and other)	4	3-4%	7	225	L	1	19	30
TNLI-BA04	Partial Barrier	1	13202	M	5	8	1	Type F (trout and other)	4	3-4%	7	155	L	1	19	30
TNMA-BA20	Partial Barrier	1	18480	M	5	14	1	Type F (trout and other)	4	3-4%	7	1333	L	1	19	30
TSKR-BA12	Partial Barrier	1	9496	M	5	10	1	Type F (trout and other)	4	3-4%	7	88	L	1	19	30
TSWI-BA11	Partial Barrier	1	NS	M	5	8	1	No	1	0-2%	10	UNKNOWN	L	1	19	30
TNMA-BA24A	Partial Barrier	1	23534	U	1	16	1	Type F (trout and other)	4	0-2%	10	59	L	1	18	31
TNMA-BA24B	Partial Barrier	1	23593	U	1	17	1	Type F (trout and other)	4	0-2%	10	103	L	1	18	31
TSKR-BA07	Partial Barrier	1	9092	M	5	5	1	Type F (trout and other)	4	5-8%	4	77	L	1	16	32
TSKR-BA08	Partial Barrier	1	9169	M	5	6	1	Type F (trout and other)	4	5-8%	4	96	L	1	16	32
TSKR-BA13	Partial Barrier	1	9584	M	5	11	1	Type F (trout and other)	4	5-8%	4	90	L	1	16	32
TSMA-BA22	Partial Barrier	1	22500	U	1	2	5	No	1	3-4%	7	456	L	1	16	32
TAEF-BA04	Partial Barrier	1	NS	U	1	17	1	No	1	5-8%	4	NS	M	5	13	33
TNMA-BA16	Partial Barrier	1	17951	M	5	10	1	Type F (trout and other)	4	9-20%	1	17	L	1	13	32
LFMA-BA28	Partial Barrier	1	18503	U	1	6	1	Type F (trout and other)	4	5-8%	4	586	L	1	12	34
PIMA-BA29	Partial Barrier	1	NS	U	1	21	1	NO	1	5-8%	4	NS	L	1	9	35

Appendix C: Maps of Known Fish Passage Barriers in Seattle

https://seattlegov.sharepoint.com/:b:/r/sites/spu-D1/Planning/DWW%20GIS%20Library/DSA/Figures/Task%204/Task4_FishPassageBarriers.pdf?csf=1&e=sy8BrV

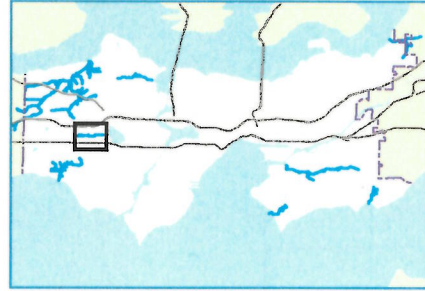


LEGEND

Barrier Status (shape)	Owner (color)
● Full Barrier	■ SPU
◐ Partial Barrier	■ Other Public
	■ Private
	■ Unknown

↘ Barrier Mainlines
~ Stream
⊕ Parks

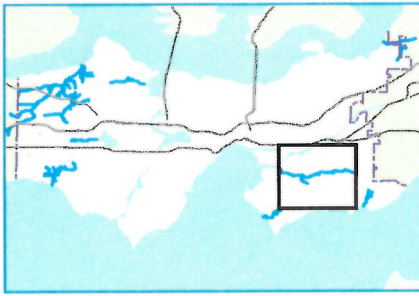
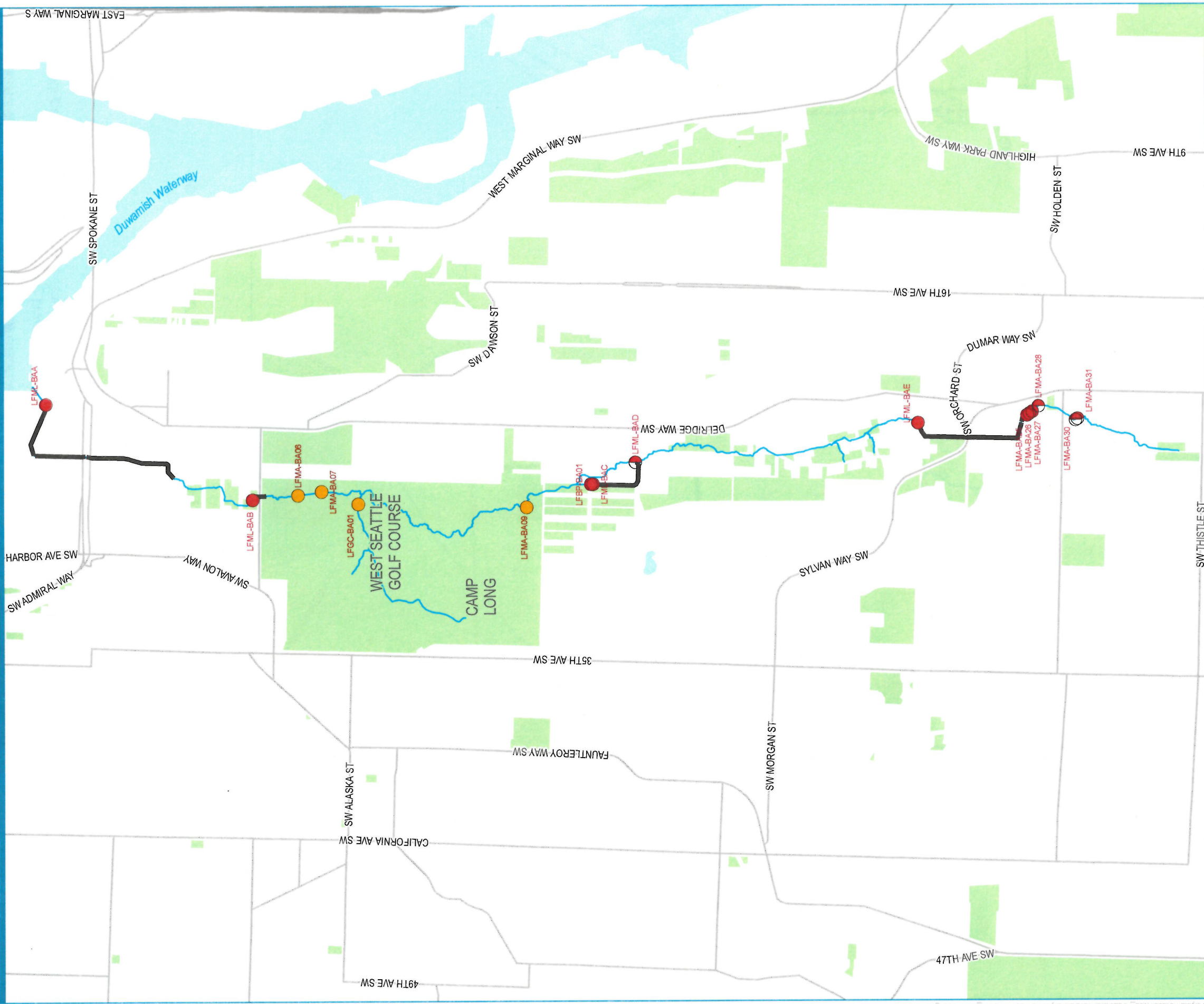
Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



LEGEND

Barrier Status (shape)	Owner (color)	Barrier Mainlines
● Full Barrier	■ SPU	▬ Barrier Mainlines
○ Partial Barrier	■ Other Public	▬ Stream
	■ Private	■ Parks
	■ Unknown	

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



LEGEND

Barrier Status (shape)

- Full Barrier
- Partial Barrier

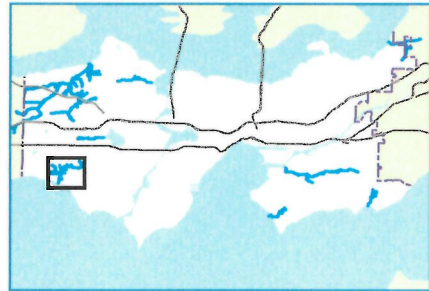
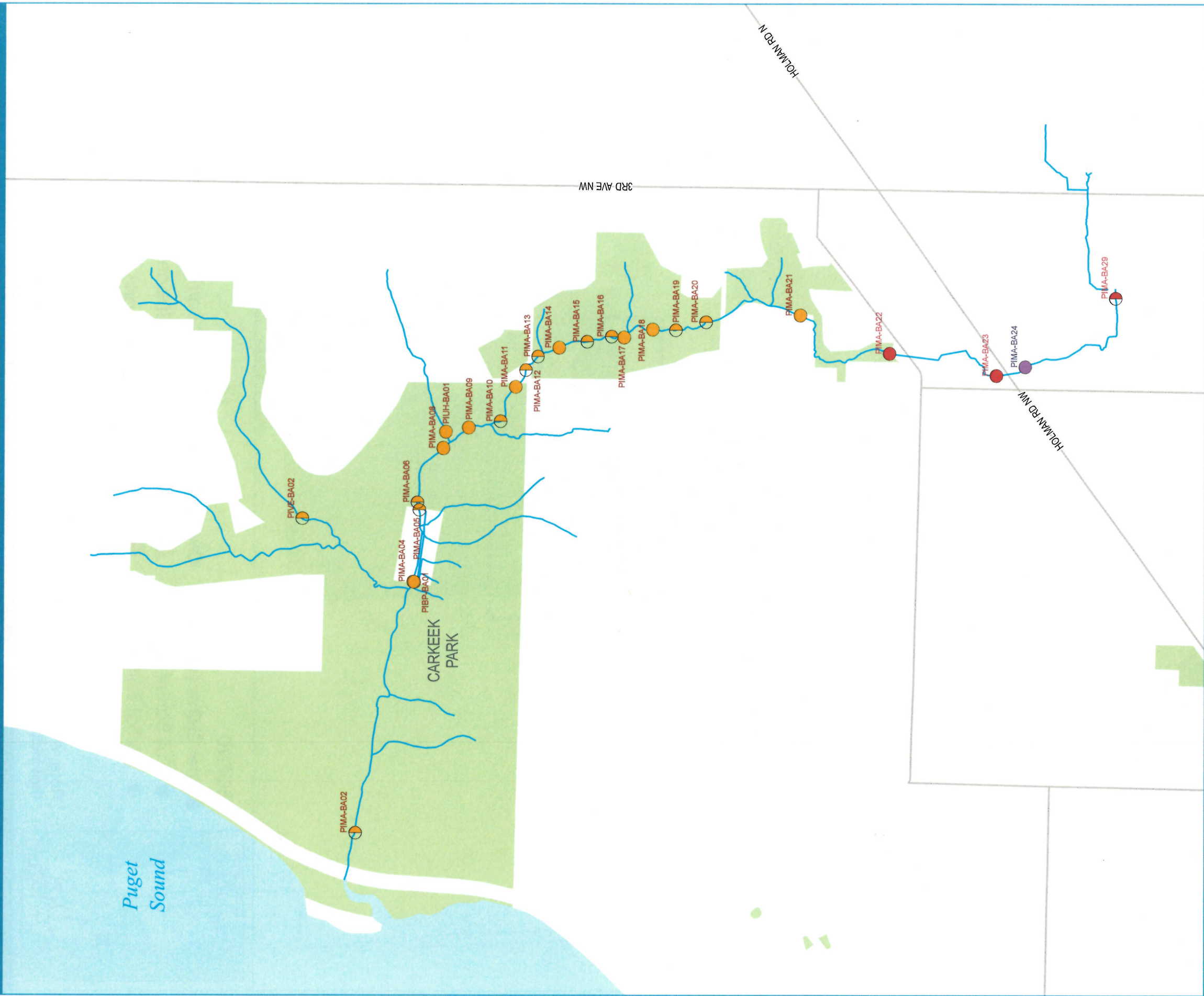
Owner (color)

- SPU
- Other Public
- Private
- Unknown

Barrier Mainlines

- ▬ Stream
- ▬ Parks

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



LEGEND

Barrier Status (shape)

- Full Barrier
- Partial Barrier

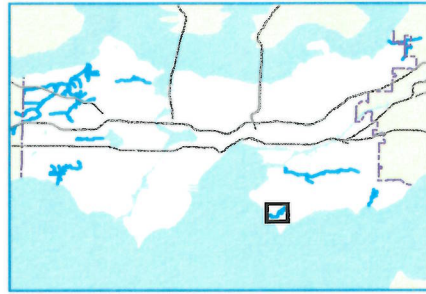
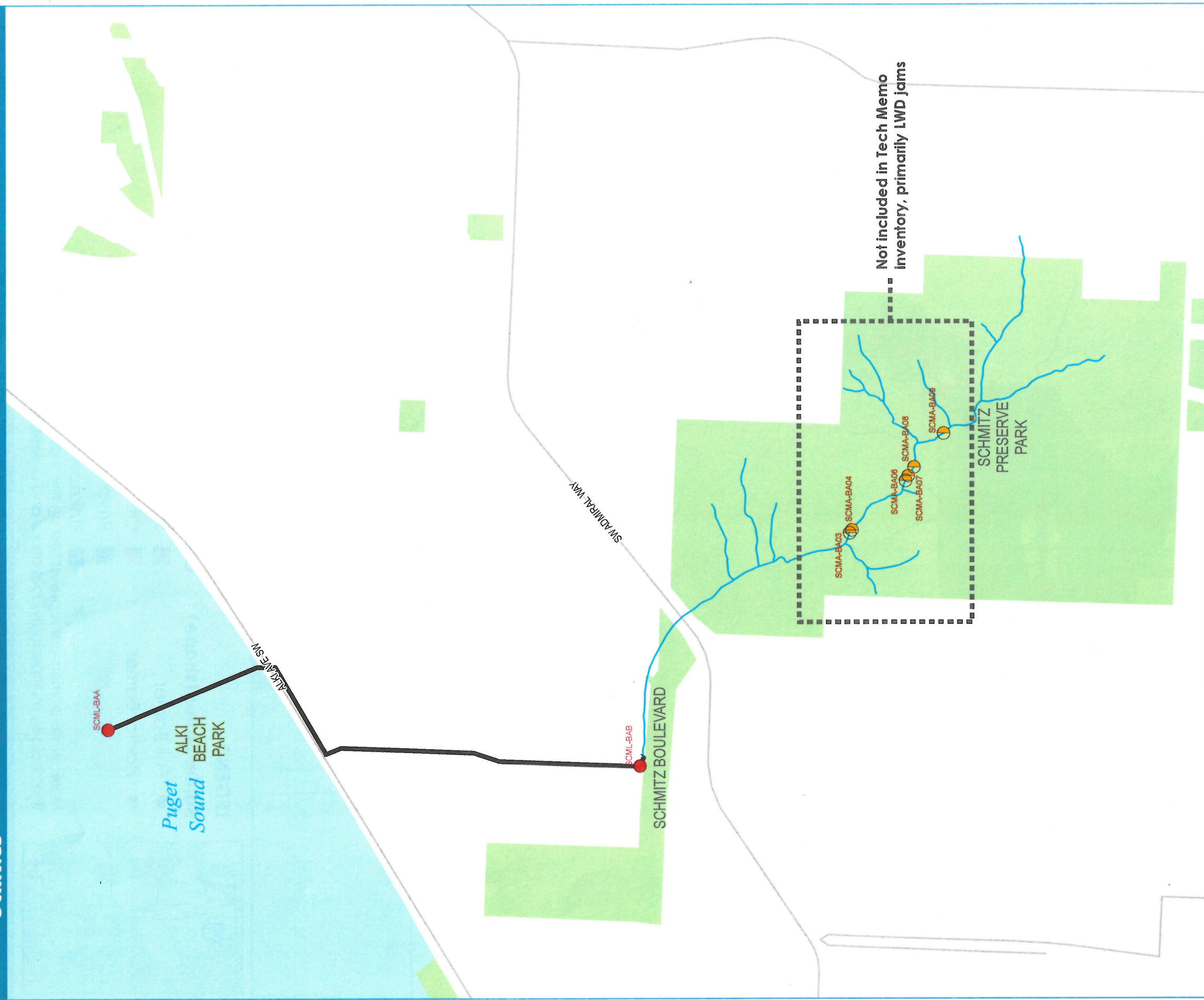
Owner (color)

- SPU
- Other Public
- Private
- Unknown

Barrier Mainlines

- ▬ Stream
- ▬ Parks

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



LEGEND

Barrier Status (shape)

- Full Barrier
- ◐ Partial Barrier

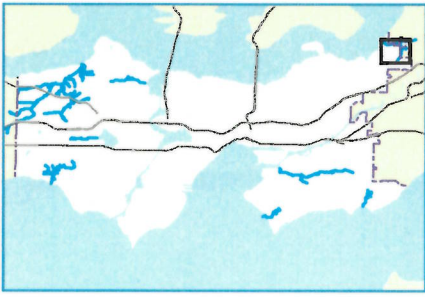
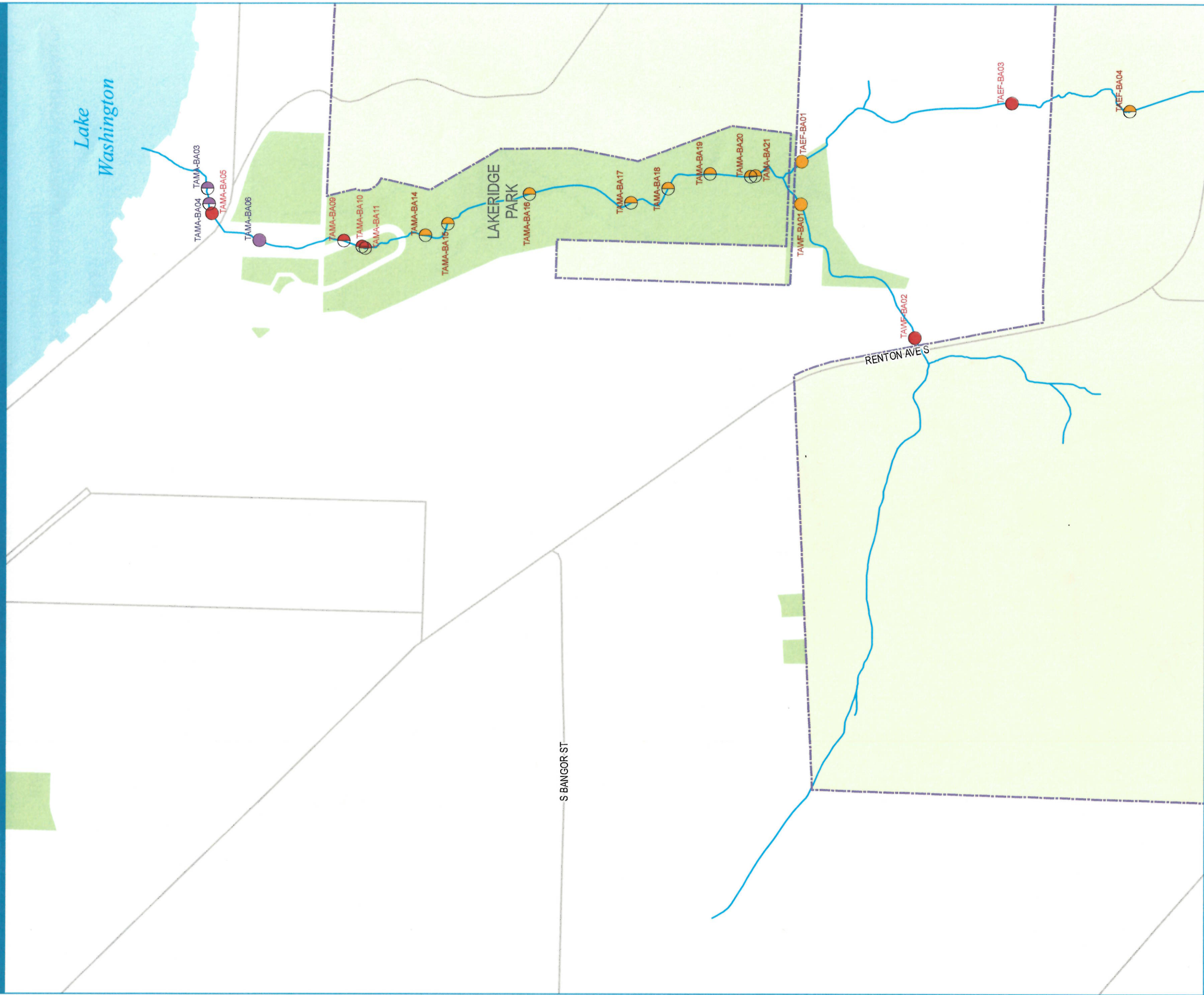
Owner (color)

- SPU
- Other Public
- Private
- Unknown

Barrier Mainlines

- ~ Stream
- Parks

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



LEGEND

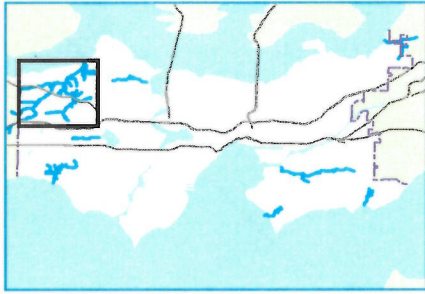
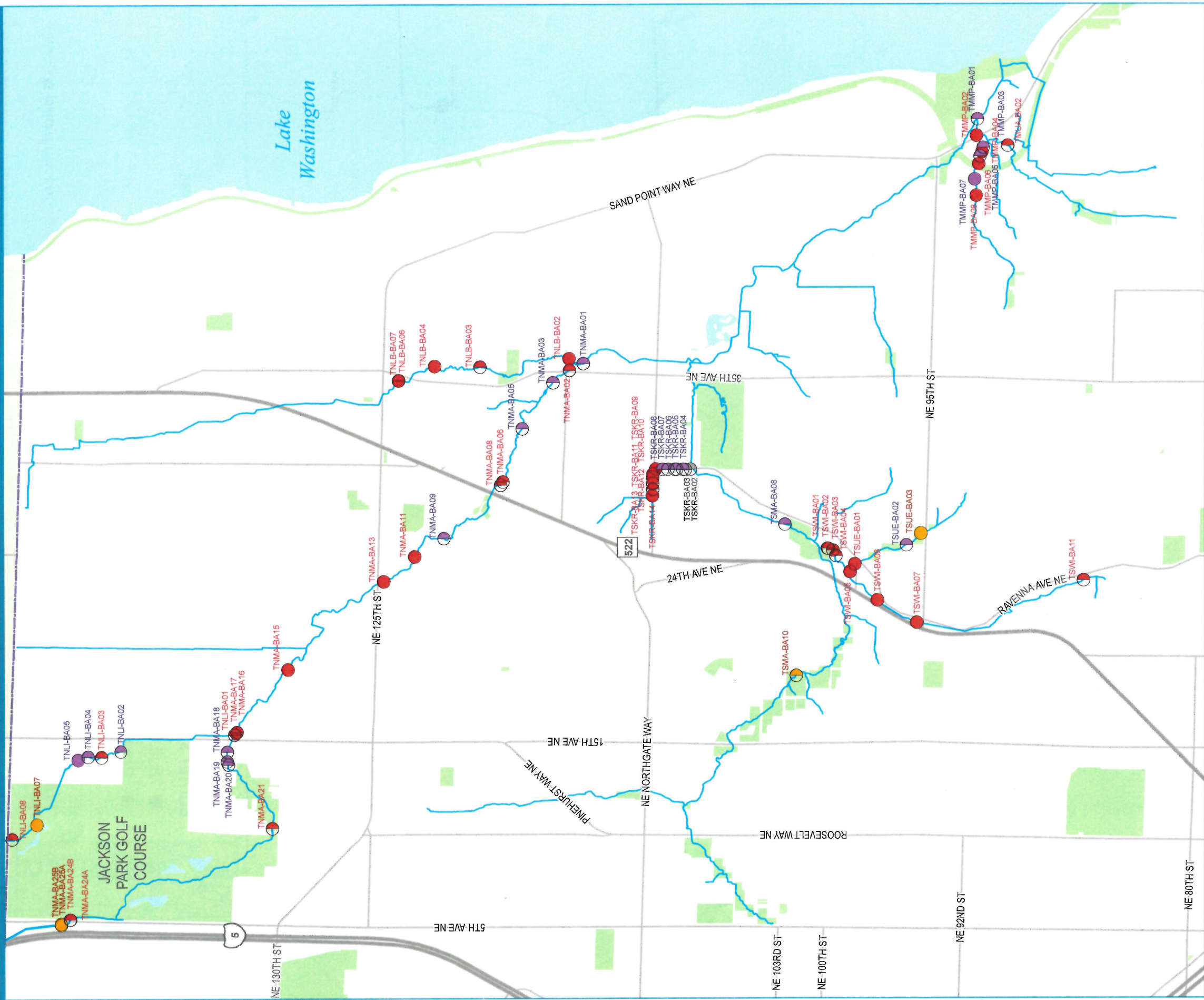
Barrier Status (shape)	Owner (color)
● Full Barrier	■ SPU
○ Partial Barrier	■ Other Public
	■ Private
	■ Unknown

Barrier Mainlines
~ Stream
- - - City Limits
■ Parks

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



Thornton Creek



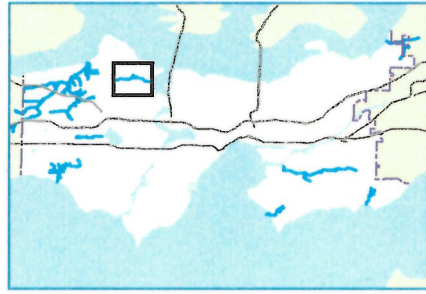
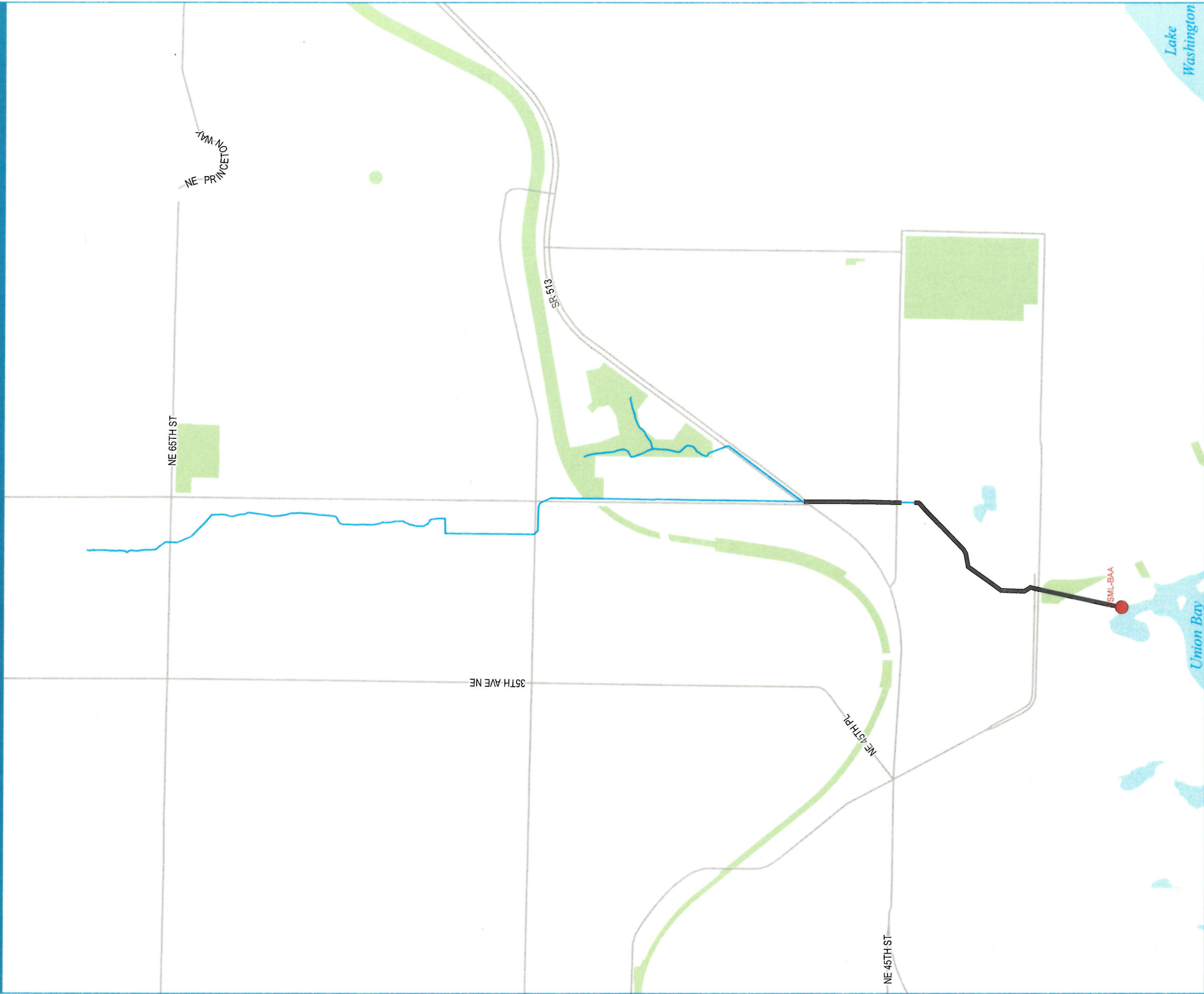
LEGEND

- Barrier Status (shape)**
- Full Barrier
 - ◐ Partial Barrier

- Owner (color)**
- SPU
 - Other Public
 - Private
 - Unknown

- Barrier Mainlines**
- ~ Stream
 - - - City Limits
 - Parks

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.



LEGEND

Barrier Status (shape)

- Full Barrier
- Partial Barrier

Owner (color)

- SPU
- Other Public
- Private
- Unknown

Barrier Mainlines

- ▬ Stream
- ▬ Parks

Note: While barriers are represented on the map as points, they may actually be long piped systems that include multiple individual assets and potentially have shared ownership.