RESULTS

Data from the habitat assessments are summarized for each stream segment. Data summaries are presented in bulleted lists, and readers will find additional, more detailed data in the tables.

The Juanita Creek assessments began where Juanita Creek enters Lake Washington, and ended approximately 100 m upstream of I-405. An average of 35% of each segment (range: 27%-48%) was surveyed (Table 1, Figure 3). (For a complete description of the start and ending locations of the assessed reaches, see Appendix A.)

Table 1. Juanita Creek SSHIAP Segment Descriptions

Segment Number	Description	Length (km)	Length Surveyed (km)	Percent Surveyed	SSHIAP Gradient/ Confinement Category*
1	Mouth to 1st RR† tributary (near 1st crossing of 120th)	0.55	0.204	37	0-1 %, U
2	Ends just d.s. ‡ of 126th St. crossing.	0.85	0.412	48	0-1 %, U
3	Ends at confluence with 2nd RR tributary (near 108th)	1.34	0.453	34	1-2 %, U
4	Ends just d.s. of 141st.	0.79	0.215	27	1-2 %, U
5	To approximately 100 m u.s. ‡ of I-405	1.34	0.498	37	2-4 %, U

Segments are contiguous–one segment starts where the previous segment ends.

* Segment breaks coincide with SSHIAP breaks. U is unconfined, floodplain greater than 4X the channel width.

† RR is river right

‡ d.s. is downstream, u.s is upstream.

Data Overview

A summary of bank stability, bankfull width to depth ratios, riparian forest coverage, LWD frequency, and pool quality data is presented and these data are compared to natural, or NMFS "properly functioning conditions" values in Table 2 (see page 8 for a explanation of properly functioning conditions. Data which could be compared to literature or NMFS properly functioning conditions standards either did not meet natural, or properly functioning condition levels or fell in the NMFS "at risk" category. The percentage of stream banks rated stable in each segment ranged from 43 to 90%. Riparian forest cover, estimated visually from the stream channel, ranged from 21 to 72%. Bankfull width to depth ratios ranged from 3:1 to 10:1. The frequency of LWD in all of the segments was below natural frequencies (Murphy and Koski 1989, Ralph et al. 1994). Although the percentage of riparian forest cover in the upper segments was high, LWD frequencies remained low in all segments. The frequency of pool habitat was mostly higher than values suggested by NMFS' "properly functioning conditions," which is 35/km for Juanita Creek (NOAA 1996). A suggested optimal ratio of pool to riffle habitat is 1:1 (Peterson et al. 1992), suggesting that 40-60% by area for each habitat type is a target condition. Although segments 1 and 3 have 40-60% pool and riffle habitat, the mean pool quality for each of these segments is low. Segments 2, 4, and 5 do not meet the percent area criteria, but do meet NMFS frequency criteria, which indicates that the pools that were present in these segments were generally small.

Table 2. A data overview of Juanita Creek segments, that compares the study data with published values from natural conditions, or NMFS matrix of properly functioning conditions (pfc).

	Bank stability	BFW/BFD Ratios**	Forested Riparian vegetation‡	LWD frequency	Pool frequency	Pool quality
Data standard	> 90% stable*	< 10:1	>80% intact, adequate source of LWD*	150 pieces/km†	35 pools/km*	> 1 m deep*
Segment Number						
1	43%, not pfc.	6:1, pfc.	21%, not pfc.	12, not nl. †	39, at risk	1 > 1m, not pfc.
2	68%, not pfc.	3:1, pfc.	44%, not pfc.	29, not nl.	44, at risk	0, not pfc.
3	90%, at risk	10:1, pfc.	72%, not pfc.	29, not nl.	42, at risk	0, not pfc.
4	75%, not pfc.	4:1, pfc.	62%, not pfc.	55, not nl.	46, at risk	0, not pfc.
5	73%, not pfc.	6:1, pfc.	71%, not pfc.	23, not nl.	28, not pfc.	1, not pfc.

** Bankfull Width to Depth ratios

‡ the data compared with the standard 'intact' forest, was total forested reaches, the majority of which was deciduous along Juanita Creek. It is unlikely that deciduous riparian vegetation would be considered a significant part of an intact riparian corridor.

* pfc.—properly functioning conditions, see Appendix B for explanation of criteria (NOAA 1996).

† nl.–natural levels, multiple references: a range of 150-460/km in Murphy and Koski 1989, a range of 150-400/km in Ralph et al. 1994, and 140-670/km for streams of similar size and gradient calculated from Beechie and Sibley 1997.

Riparian Vegetation

The riparian corridor of Juanita Creek is fragmented, with a maximum of 72% forest coverage found in segment 3. Very little of this remaining riparian forest is coniferous, which suggests that adequate long lasting LWD are not present in this stream ecosystem.

- The riparian corridor of Juanita Creek segments was generally increasingly forested (21%-72%) as one moved upstream
- The riparian corridor of segment 1 was classified as only 21% forested, entirely by deciduous tree species. Most riparian cover in this segment was classified as tall, herbaceous (Table 3, Figure 4).
- The riparian corridor of segment 2 was classified as 44% forested, primarily by deciduous species. The second most predominant vegetation class was shrubs.
- Segments 1-4 had very little of the riparian corridor forested by coniferous species (0-9%).
- A substantial coniferous component was present in segment 5 (41%).
- Blackberry (*R. discolor* or *R. laciniatus*) was present in all segments, and dominant in many reaches (Table 4).

Table 3. Riparian landcover on Juanita Creek, numbers are percentages of the total assessed segment length.

Segment	Tot. Forested	Forest. Decid.	Forest. Mixed	Forest. Conif.	Landscaped	Imperv.	Herb. Short	Herb. Tall	Shrub
1	21	21	--	--	--	--	7	57	14
2	44	39	4	4	--	--	9	11	33
3	72	58	5	9	4	--	--	9	15
4	62	58	4	--	13	25	--	--	--
5	71	30	--	41	4	2	11	4	8

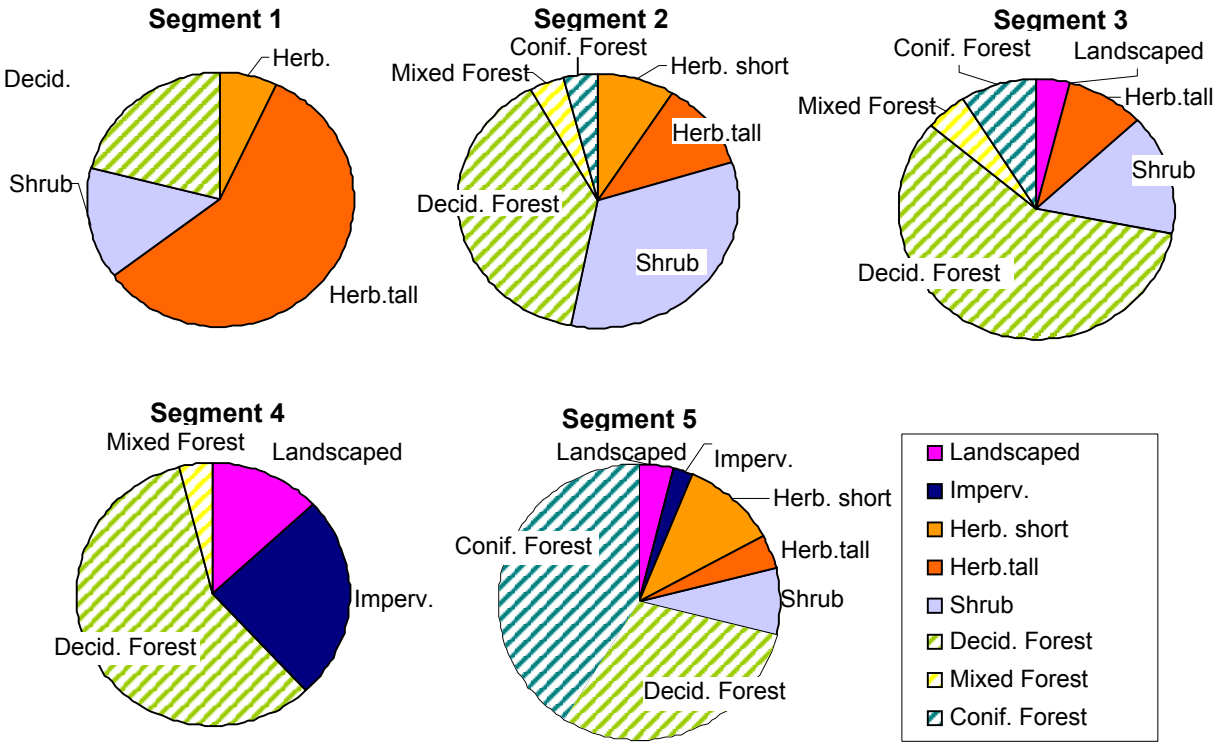

Figure 1. Riparian vegetation composition in Juanita Creek assessment segments.

Table 4. Invasive species present on Juanita Creek. More ++ indicate increasing general abundance. [1]

Segment	Himalayan Blackberry	Evergreen Blackberry	Japanese Knotweed	Field Bindweed	Bitter Nightshade	English Ivy	Reed Canary grass	Policeman's Helmet	Purple Loosestrife
1	++++		++	++	+				+
2	+++++		+	+++	++	+	+	+	
3	+++++	++++	+	+				+	+
4	++			+		+	+		
5	+++++			+	++	+	+		

Large Woody Debris

No segments of Juanita Creek contained enough LWD to fall within the published natural frequency ranges of 150 to 670 pieces/km (Murphy and Koski 1989, Ralph et al. 1994, *calculated from* Beechie and Sibley 1997). All segments were *one fifth* to *one tenth* of the low end of the range (Table 5).

- Segment 4 had the greatest LWD and large diameter LWD frequency (55 and 9 pieces/km, respectively).
- Segment 1 had the lowest LWD frequency (12 pieces/km).
- The frequency of large LWD pieces was well below "properly functioning conditions" (50 pieces/km) (NOAA 1996) in all segments (< 10 pieces/ km in all segments) (Table 5).

Table 5. LWD frequency in Juanita Creek. 150 pieces per kilometer is the low end of natural occurring frequency ranges (Murphy and Koski 1989, and Ralph et al. 1994, *calculated from* Beechie and Sibley 1997): all segments in Juanita Creek were below this range.

Segment	# LWD/ km	# >/= 0.5m diameter /km
1	12	2
2	29	5
3	29	0
4	55	9
5	23	5

Channel Morphology

Channel complexity and connectivity with the floodplain are reduced in Juanita Creek by streambank armoring (Figure 5). Mean segment bankfull width to depth ratios are generally not greater than 12 (Table 6), which suggests "properly functioning conditions," though without comparing current

[1] Scientific names of the invasive species are (in order listed, starting from the left): *Rubus discolor, Rubus lacinatus, Polygonum cuspidatum, Convolvulus arvensis, Solanum dulcamara, Hedera helix, Impatiens glandulifera, Lythrum salicaria.*

values to data from previous decades, it is difficult to determine whether the stream channel is unstable and enlarging or incising.

Bankfull Width to Depth Ratios

The bankfull width to depth ratios for Juanita Creek did not exceed 10, although the ratio for segment 3 was equal to 10. The ratios of the other segments ranged from 3 to 6 (Table 6).

Table 6. Bankfull width to depth (BFW:BFD) ratios for Juanita Creek segments. Values below 10 are suggested by the NMFS Matrix of Pathways and Indicators as indicative of "properly functioning conditions", between 10 and 12 the stream is "at risk", and above 12 conditions are not properly functioning.

Segment	BFW	BFW:BFD
1	5.6	6:1
2	5.3	3:1
3	6.3	10:1
4	5.0	4:1
5	6.9	6:1

Streambank Stability

Stable streambanks were the dominant condition in four of five segments of Juanita Creek. The percentage of streambank armoring was less than 20% in all segments, except segment 1 where 57% of the banks were armored. (Figure 5).

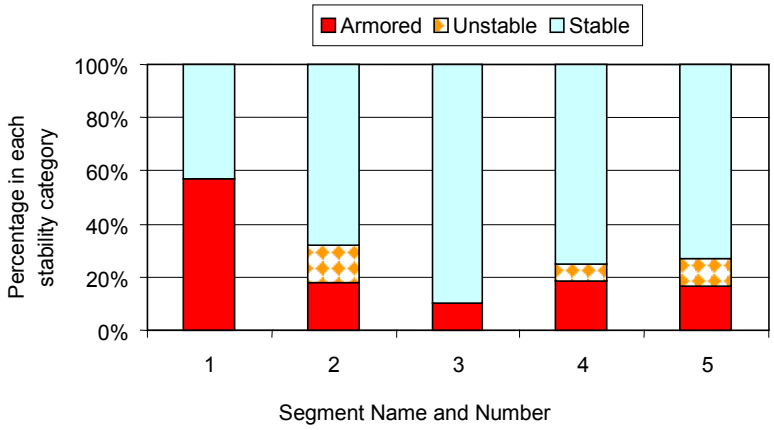

Figure 2. Streambank stability of Juanita Creek segments.

Sediment Quality

Sediment deposition from the creek is evident at the park at the mouth of the creek. Gravels suitable for salmon spawning were noted at two single assessed locations in segments 1 and 4. Three other site-specific notations relate the presence of fines and sand in segments 3 and 4. All summary comments described the presence of fines in the channel substrate (Table 7).

Table 7. Substrate quality field notes.

Segment	Distance from segment start (m)	Field Notes
1	203.6	Gravels, possibly suitable spawning habitat
1	Summary	Large unstable sediment load in segment
2	Summary	Many fines on stream bottom
3.C*	75	Nice pool, but loaded with fines
3	Summary	Lots of fines
4	4.8	Gravels, possibly suitable spawning habitat
4	101	Lots of sand and fines
4	111.8	Deep pool, fines dominant
4	Summary	Large amount of unstable fines and sands
5	Summary	Lots of fines

*The letter indicates the survey day; i.e., 3.C is the third day of surveying segment 3.

Pool Habitat

Pool to riffle ratios in Juanita Creek ranged from 2:1 to 1:2 (segment 2 and segments 4 and 5, respectively). Segments 1 and 3 had ratios of 1:1. Pool frequencies met suggested "properly functioning conditions" of 35/km (NOAA 1996) in every segment but segment 5 which had 28 pools /km. The percentage of riffle habitat in Juanita Creek was greater than or equal to 40% in four out of five segments (Figure 6). Mean pool depths were less than 0.5 m in all segments (Table 8). The distribution of the pool depths indicate that 69% of the pools were less than 0.5 m in depth and only 1% of the pools were greater than 1 m in depth (Figure 7).

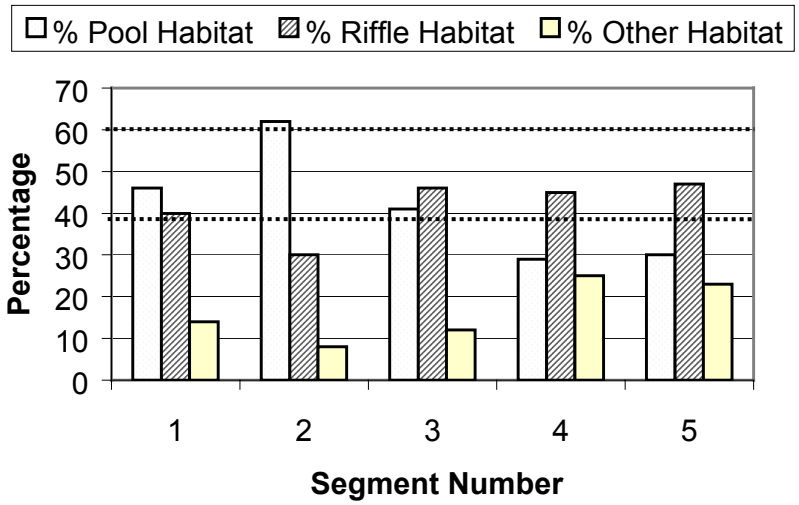

Figure 3. The percent habitat composition by area of Juanita Creek segments. Optimal habitat distribution is 1:1 pool to riffle ratio; the percentage of each should be between 40% and 60%. Glides are the predominant habitat classified as "other," however, runs are also categorized as other (Peterson et al. 1992).

Pool Quality Index

Although pool frequencies in four of the five segments met the NMFS' properly functioning conditions, the quality of the pools was generally poor. Pools received a higher Pool Quality Index

(PQI) rating if they were deep, large in relation to the size of the channel, and had additional features that would provide cover for fish such as woody debris, overhanging banks, or vegetation. The mean pool quality index was 2, which reflects low overall pool quality, and only two pools out of 68 were rated 5. Seventy-three percent of the pools assessed were rated 1 or 2 (Figure 8, Table 8).

Table 8. The average pool frequency and PQI of Juanita Creek segments. Pool quality index scale ranged from 1 to 5, with 5 being the highest pool quality (modified from Platts et al. 1983).

Segment	Pool frequency #/km	Average Pool Depth	Average Pool Quality Index
1	39	0.44	1
2	44	0.47	2
3	42	0.36	2
4	46	0.29	3
5	28	0.33	2

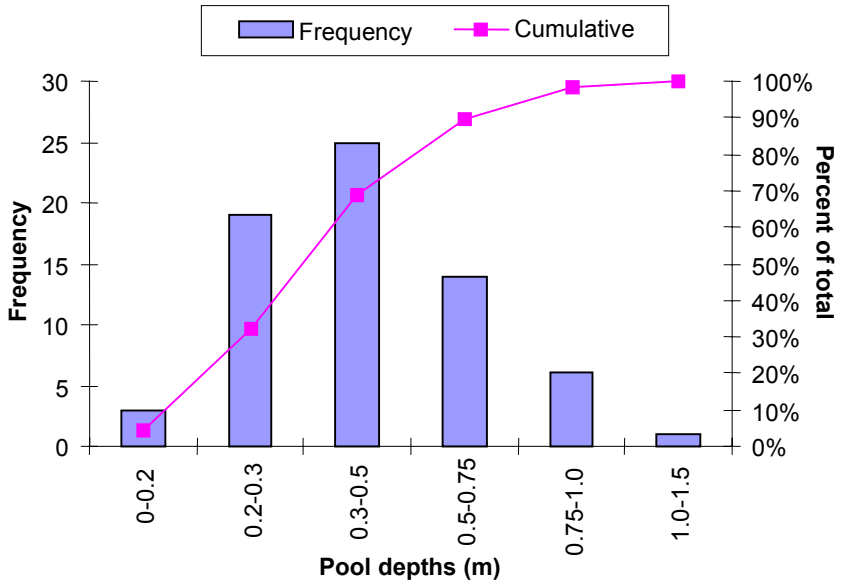

Figure 4. The distribution of pool depths in all assessed reaches of Juanita Creek. The cumulative distribution is shown by the line graph. Sixty-nine percent of the pools assessed were 0-0.5 meters deep.

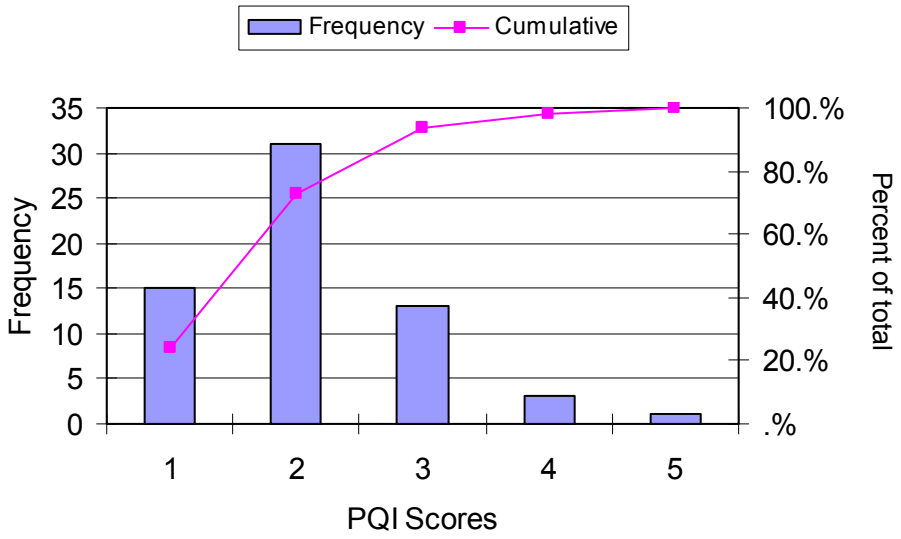

Figure 5. The distribution of PQI scores in all assessed reaches of Juanita Creek. The cumulative distribution is shown by the line graph. Seventy-three percent of the pools assessed were rated low (1 or 2).

Water Quality

Juanita Creek has been classified by the Department of Ecology as a Class AA (extraordinary) stream (Chapter 173-201A WAC). During this assessment, pH, conductivity, temperature, and dissolved oxygen were measured, and compared to Class AA water quality standards (Table 9). Mean values of temperature and pH met AA water quality standards, but conductivity did not and DO did only in segment 5 (Table 9).

Table 9. Water quality monitoring results from Juanita Creek. Numbers presented are means of duplicate samples. Surface water quality standards are listed in the right hand column (WAC 173-201A-030; HACH Company 2000).

Sample Number	1	2	3	4	5	Juanita Creek Mean	AA Water Quality Standards
Juanita Creek Seg.	1	2	2	3	3		
pH	7.9	7.7	7.8	7.3	8.1	7.8	6.5-8.5
Conductivity (µS/cm)	212	213	217	166	228	207	10-100
Temperature (^{o}C)	15.3	14.5	14.9	14.8	14.4	14.8	< 16*
DO (mg/L)	8.4	8.1	9.4	9.2	9.7	8.9	> 9.5

Data are available for comparison from King County Metro water quality monitoring studies on Juanita Creek. Data are available from 1986 to the present. Samples were obtained by Metro at the bridge on NE 128th Street east of 100th Avenue NE, which is located in segment 3 of this habitat assessment. Data from 1986 to 1992 (obtained during the same months as samples taken for this assessment) are shown in Table 10.

Table 10. October/November Metro water quality data from Juanita Creek (Quality of Local Lakes and Streams, 1987-1994). No data are available for October/November in 1989 and 1993.

Year	pH	Conductivity (µS/cm)	Temperature (^{o}C)	DO (mg/L)
1986	7.7	195	9.5	11.1
1987	7.7	200	10.0	9.5
1988	7.6	195	12.0	10.8
1990	7.2	130	10.4	10.0
1991	7.7	206	12.6	9.3
1992	7.1	114	12.8	10.0

For comparison, Table 11 (below) contains data from samples taken upstream and downstream of the Metro sampling location, during the same months of the year.

Table 11. Water quality data from Juanita Creek, near Metro sampling locations (samples taken October/ November).

Location	pH	Conductivity (µS/cm)	Temperature (^{o}C)	DO (mg/L)
NE 129th Pl.	7.3	166	14.8	9.2
NE 124th St.	7.8	217	14.9	7.2

Although the water quality data were only part of a preliminary sampling effort, the results suggest that a more complete water quality study may be warranted. Temperatures were generally higher, and dissolved oxygen was generally lower than measurements taken from 1986-1993. During the Metro study (1986-1993), October water temperature values ranged from 9.5^{o}C –12.8^{o}C. The sampling for this habitat assessment in October produced an average reading of 14.8^{o}C. Stream temperatures between 13.9^{o}C and 17.8^{o}C indicate that stream habitat conditions may be "at risk" of not properly functioning (NOAA 1996). All temperatures measured in this habitat assessment were in this "at risk" range. In addition, all but one of the dissolved oxygen levels during November of the Metro study were above 9.5 = mg/L (1991 at 9.3 mg/L), the minimum water quality standard for a Class AA stream. Four out of five samples taken for this habitat assessment were below this minimum level.

Biology

Salmonids were seen in all five segments. Although many fish were not identified to species, the following categories of aquatic biota were identified: salmonids, cutthroat trout, and crayfish. Table 12 presents specific notations on fish sightings.

Table 12. Biotic sightings in Juanita Creek.

Segment	Distance from segment start (m)	Field Notes
1	116.2	Crayfish sighted
1	141.5	Salmonids sighted
1	178.5	Salmonids sighted
1	196.2	Crayfish and cutthroat trout sighted
2	173.8	Approximately 20 juvenile salmonids sighted
2	Unavailable	Scattered salmonids seen in pools
3	115.4	Small salmonids sighted
3	Unavailable	Salmonids sighted
4	75.0	Juvenile salmonids sighted
5	25.0	Adult salmonids sighted (estimated five years)
5	113.0	Salmonids sighted
5	126.0	Salmonids/resident
5	239.0	Salmonids sighted
5	347.6	Juvenile salmonids sighted

Two possible habitat enhancement sites and four fish blockages were identified during the stream assessments (Table 13).

Table 13. Possible fish blockages and potential restoration sites on Juanita Creek

Segment	Distance from segment start (m)	Field Notes
2	100 (approx.)	Potential planting project near the Village Condominiums
4	150	Potential restoration site at Helen Keller Elementary
5	216.3	Dam is possible fish blockage, potential restoration site, 14206–110th Ave NE
5	312.1	Possible fish blockage
5	320	Possible fish blockage, LWD
5	Unavailable	Stormwater pond is possible fish blockage, in Highland Park, where creek flows under I-405