2008 Juanita Creek Reconnaissance and B-IBI Report

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Introduction

King County is working with the City of Kirkland on a hydrological assessment to better understand the relationship between stormwater, hydrology, and natural conditions in Juanita Creek. In June 2008, we visited many sites throughout the Juanita Creek Basin to investigate habitat conditions for salmonids, channel shape and form, hydromodifications, and to get a sense of how habitat conditions have changed in Juanita Creek since 2001 when King County conducted habitat surveys in Juanita Creek.

Background

The Juanita Creek basin covers approximately 6.6 mi^2 (17.14 km^2) and extends north to Simonds Road, South to 116th Street, east to 132nd NE, and west to 84th Avenue NE (Figure 1). The mainstem of Juanita Creek originates east of Interstate 405, and flows west and south entering the northeast portion of Lake Washington immediately west of Juanita Beach Park into Juanita Bay. Repeated logging and residential and commercial development (especially since the 1960's) has reduced the forest coverage to approximately 12% (Rush et al. 2002). Despite this lack of forest cover, the watershed is still home to many native fish species, including coho (*Oncorhynchus kisutch*), cutthroat (*O. clarki*), and sockeye (*O. nerka*) salmon (Ajwani 1956; Williams et al. 1975; Vanderhoof 2002).

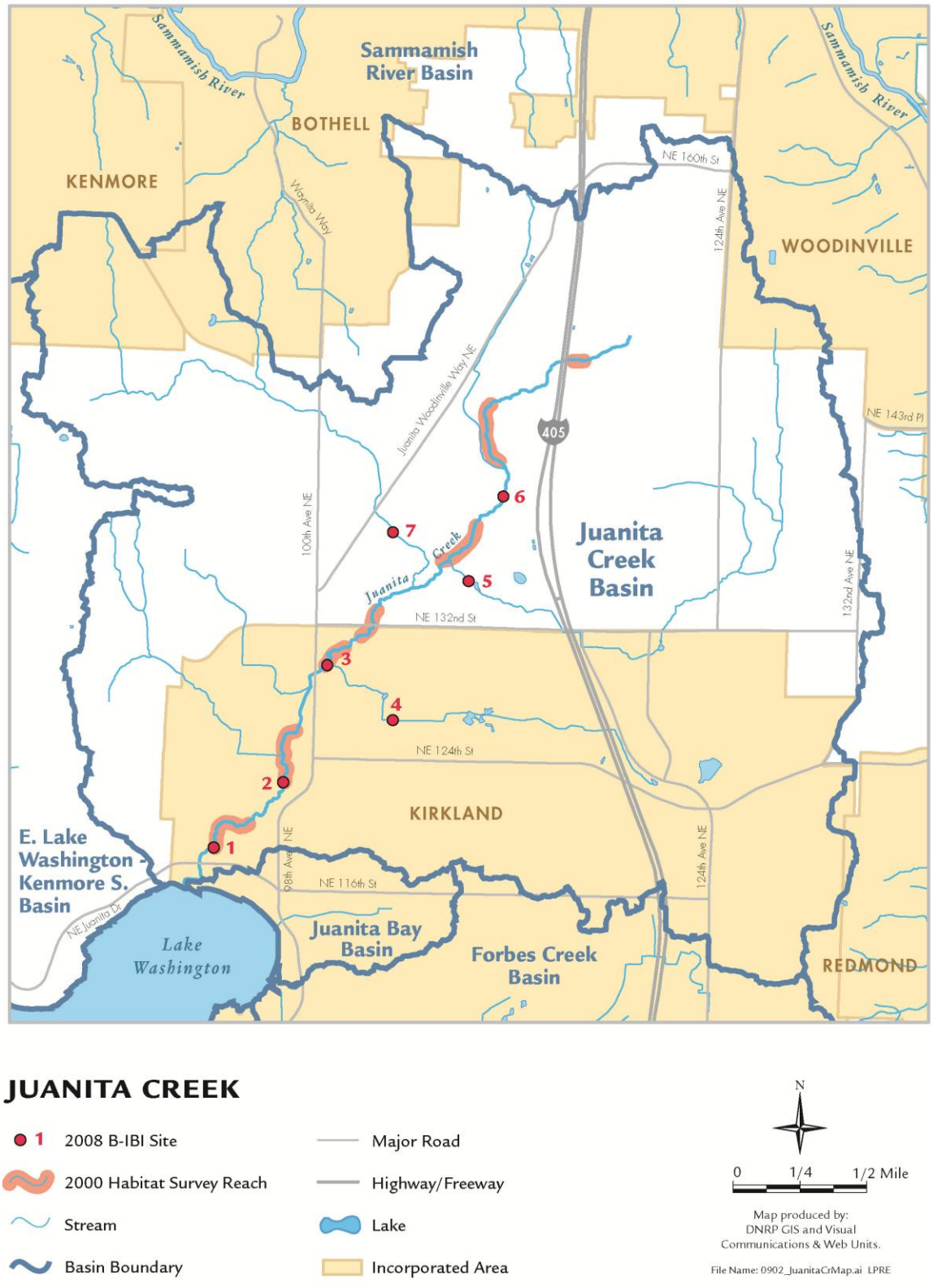

Figure 1. Map of Juanita Creek including King County 2008 B-IBI sampling sites.

Methods

We conducted a rapid assessment of the basin based on publicly accessible points (road crossings, and publicly held lands) to investigate relative habitat quality throughout the watershed and any opportunities for habitat restoration. We observed channel dimensions, wetted width and depth, riparian vegetation, and presence or absence of woody debris.

In September 2008, we collected macroinvertebrate samples from seven sites (Figure 1) in Juanita Creek following the protocols of Karr and Chu (1999). The purpose of macroinvertebrate sampling was to assess the relative benthic index of biotic integrity (B-IBI) of Juanita Creek in comparison to other Puget lowland streams. We compared these data to those collected by the City of Kirkland using the same methods (in 2001-2007) at 3 sites in the same vicinity as our collections in 2008.

Results

Results of the reconnaissance were consistent with the data collected in 2001 (Rush et al. 2002). Specifically, riparian vegetation was poor in general, although a trend of increasing riparian vegetation with distance upstream was evident. Blackberries (*Rubus discolor* and *R. laciniatus*) were common throughout the creek. Reed canary grass (*Phalaris arundinacea*) was common in smaller tributaries, and adjacent to wetlands and stormwater facilities. Coniferous vegetation was largely absent; although at site 7 (Figure 1) there was a relatively healthy second growth riparian zone around the stream. In-channel structure (e.g. large woody debris) and associated pools were severely lacking throughout the stream. In addition, fines (sand and silt) were pervasive in almost all stream reaches as was no obvious point sources.

Results from macroinvertebrate samples collected from Juanita Creek in 2008, include B-IBI ratings of very poor (10-16), poor (18-26), fair (28-36), and good (38-44). Replicates collected in 2008 at sites one through three and site 7, suggest that B-IBI scores can be variable within the same reach and on the same date (Figure 2). None of the sites in Juanita Creek have been classified as excellent (46-50).

Nonetheless, cutthroat fry were observed in the lower half of the mainstem while trout fry were present further upstream just below the confluence of the three head-water tributaries. Fingerlings were found 0.5-miles upstream of the confluence in the northwestern head-water tributary. However the two lowest right-bank tributaries identified in Figure 1, plunge to the mainstem with greater than 3-feet elevation drop from protruding corrugated metal pipe culverts.

Channel geometries were predominantly trapezoidal in shape for the mainstem, with tributaries to Juanita creek ranging from trapezoidal, rectangular with heavy bank armoring, to fully piped with intermittent day-lighting.

During the reconnaissance done in late June 2008, summer base flows (3.5-cfs) were near their typical minimums (~ 3-cfs). In all but one of the headwater catchments, flow rates were estimated to be on the order of 0.10-cfs. Negligible flows were found in the

headwaters stream channel connecting Totem Lake to a large wetland area. Coincidently, the majority of commercial land use is also located in this catchment.

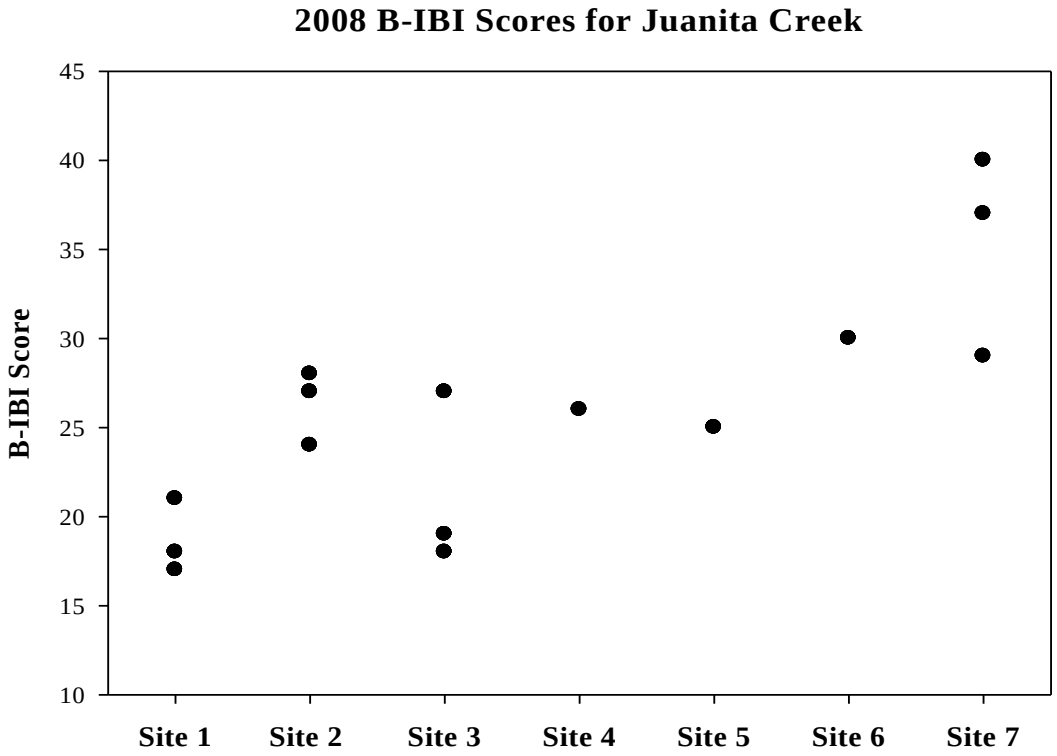

Figure 2. B-IBI scores for seven sites sampled in Juanita Creek in September 2008 by King County.

Indices other than B-IBI may be useful in describing diversity and stress associated with anthropogenic change. A community dominated by one or two species, is less diverse than one with several different species with relatively even proportions. Evenness is a measure of the abundance of different species making up the richness for a particular area, or sample in our case. Diversity indices are a combination of evenness and richness. The Hilsenhoff diversity index generally increases with increasing ecosystem stress (Hilsenhoff 1988), while the Shannon diversity index generally decreases in values with increasing stress. Simpson's D in comparison, simply refers to equitability of families represented, and a score of 0 represents infinite diversity and a score of 1 represents no diversity. In Juanita Creek, the diversity indices show much more variability than the B-IBI scores (Table 1).

Table 1. Diversity metrics for macroinvertebrate samples collected in Juanita Creek in 2008. B-IBI scores represent mean values (three samples) at sites 1-3, and site 7.

Location	Number of Samples	Evenness	Shannon Diversity	Simpson's D	Hilsenhoff Biotic Index	B-IBI Score (10 - 50)
Site 1	3	0.7750	1.9140	0.8064	5.5928	18. 7
Site 2	3	0.7180	2.1237	0.8128	5.4166	26.3
Site 3	3	0.6123	1.5713	0.6722	6.1759	21.3
Site 4	1	0.4560	1.1330	0.5026	7.3955	26
Site 5	1	0.2720	0.5970	0.2506	4.2823	25
Site 6	1	0.6280	1.8160	0.7789	5.9481	30
Site 7	3	0.7600	2.0570	0.7832	5.3671	35.3

B-IBI scores calculated from 2001 to 2008 are useful in understanding the ecological condition of Juanita Creek (Table 2). Despite some interannual variability at sampling sites (Figure 3), the overall trend is that sites in Juanita Creek are generally poor (Table 2). In 2008 samples, site 3 appears to be much higher than in previous years, and may be due to interannual variability. This site is at a park, and is surrounded by established deciduous riparian zone and may be improving over time. In addition, site 4 is above a fish barrier.

Table 2. B-IBI scores from 2001 through 2008 in Juanita Creek. 2001-2007 data are from the City of Kirkland (Betsy Adams, Kirkland, unpublished data) at locations that correspond to (sites 1 and 3), and are nearby (site 2) 2008 King County sampling sites. ***NS*** = not surveyed that year. Each value represents one sample collected at that site for years 2001-2007, and three samples averaged for 2008.

Location	2001	2002	2003	2004	2005	2006	2007	2008
Site 1	16	16	18	***NS***	18	20	19	19
Site 2	14	14	22	***NS***	18	20	19	21
Site 3	16	16	***NS***	10	16	20	15	26

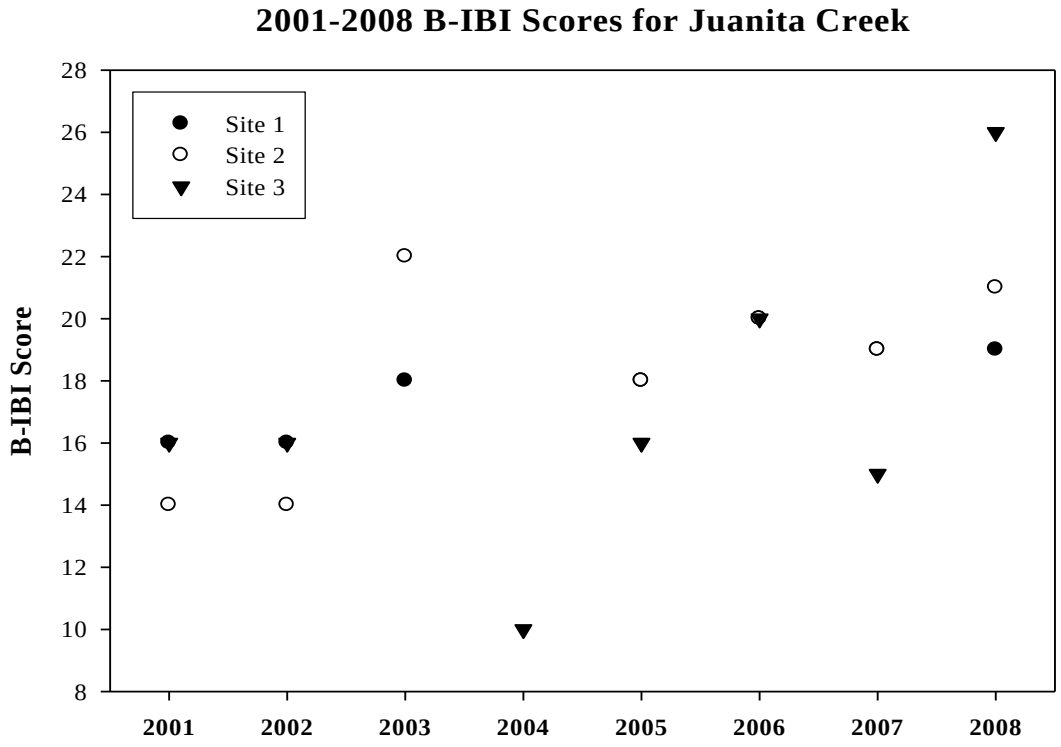

Figure 3. B-IBI scores from 2001 through 2008 in Juanita Creek. 2001-2007 data are from the City of Kirkland (Betsy Adams, Kirkland, unpublished data). Each value represents one sample collected at that site for years 2001-2007, and three samples averaged for 2008.

Discussion

These findings are consistent with the work of Rush et al. (2002) in summarizing the condition of aquatic habitats in Juanita Creek as lacking the complex habitat structure necessary to support and sustain salmon. In addition, supporting work with a FIBI (fish index of biotic integrity) confirmed the same result, that Juanita Creek provides relatively poor diversity of fish species (Matzen and Berge 2008). Despite poor physical habitat (Rush et al. 2002), biological integrity (Matzen and Berge 2008), and water quality (Rush et al. 2002), Juanita Creek still provides fish habitat.

Like other urbanized streams in the Puget Sound lowlands, Juanita Creek is lacking in riparian corridor, channel stability, large woody debris, and riparian vegetation. Fine sediments were located throughout the stream, reducing the amount of productive spawning habitats sites. Efforts focused on rehabilitation in Juanita Creek need to address reestablishing natural processes that create and maintain fish habitat. Modifying the current flow regime to create one that is more supportive of these natural processes would form an important element in any plan to significantly improve habitat in Juanita Creek. The work being done now to measure and model flow and water quality

relationships will better inform management plans to improve Juanita Creek's habitat for native species.

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