CHAPTER 8.
BASIN SUMMARY AND VULNERABILITY ANALYSIS

8.1 SUMMARY OF FINDINGS

The findings on stream habitat, water quality, geomorphology, and drainage and erosion problems, as outlined in the preceding chapters, are summarized here to provide an overall characterization of existing conditions in the Boise Creek Basin

8.1.1 Stream Habitat

Much of the upper Boise Creek Basin is believed to be in good condition based on aerial photographs and because it is located in a forest reserve area. Much of the lower basin downstream of RM 4.2 has been disturbed.

Chinook salmon, coho salmon, and steelhead use the lower portion of the basin. They are restricted from using the creek upstream of RM 4.4 because of a natural waterfall barrier approximately 15 feet high. Rainbow and cutthroat trout inhabit the stream reaches upstream of the waterfall.

Impairments to Boise Creek are the result of piping, channelization and straightening, construction of levees, and removal of riparian vegetation. A flow-split structure at the Weyerhaeuser Mill near RM 6.2 directs the base flows for Boise Creek to a 42-inch pipe system that crosses the mill site. This pipe system is not fish-passable. The Boise Creek channel has also been straightened and channeled in places from RM 6.2 to the outfall. This has removed much of the natural sinuosity of the stream, reduced habitat complexity, and eliminated some side channel habitats. The removal of riparian vegetation from the stream has had a compounding effect on habitat quality in the stream. Riparian vegetation provides overhead cover, shades the stream from sunlight, stabilizes the banks, and provides a significant source of large woody debris (LWD). There is very little LWD from RM 1.0 to RM 4.2. Projects recommended to help restore riparian vegetation, increase LWD in the channel, and remove fish passage barriers are outlined in Chapter 6.

8.1.2 Geomorphology

The Boise Creek Basin's total drainage area is 9,861 acres. Elevations vary from 3,900 feet above mean sea level to approximately 630 feet at the confluence of Boise Creek and the White River. The primary soil types in the upper watershed east of the Enumclaw Golf Course are Barneston, Kanasket, Pitcher, and Playco. The lower watershed soil types are primarily Alderwood and Everett gravelly sandy loam. Figures 2-6 and 2-7 show basin soil types and topography.

The upper watershed is relatively steep, and sediment transported from Subbasins 6 and 7 is mostly deposited in the ponds upstream of the Weyerhaeuser plant or in the large side channel around the old mill pond. Some suspended sediment may be transferred downstream of Highway 410 by the 42-inch pipe system conveying flow across the mill site or by the large channel around the mill pond. The channel reach between Highway 410 and

the Enumclaw Golf Course was partially realigned when Highway 410 was constructed in 1936. This reach has been eroding in the past and has caused downstream sediment deposition problems. Downstream of RM 3.2, the channel has been straightened and the stream gradient is very flat. The average stream velocity in this reach is approximately 2 feet per second. Downstream of RM 1.2, the channel steepens to a 2.2-percent slope to the White River.

Subbasins 1, 2, and 4 either exceed 10 percent EIA or have a forest cover less than 65 percent. The Boise Creek channel has been altered in all of these subbasins. Subbasins 1 and 2 are unlikely to change in the future because of the deep ravine and channel slope in Subbasin 1 and the agricultural practices and development along the stream in Subbasin 2. Channel changes in Subbasin 4 are possible in the future mainly because of the sediment deposition and the stream gradient in this subbasin. Recommended improvements have been developed that would help reduce sediment deposition in Subbasins 2 and 4, help control stream flows downstream of Highway 410, and stabilize the stream channel in Subbasins 1, 4, and 5.

8.1.3 Water Quality Problems

The detailed listings of the 1998 and 1994 305(b) reports were used to review beneficial uses, impairments, and 303(d) status of Boise Creek. Boise Creek is tributary to the White River, which has been designated as a watershed of concern by the Department of Ecology. The White and Puyallup Rivers and their tributaries have been experiencing declining flows due to growth pressure and increased demand for water.

Boise Creek is classified as a Class A freshwater stream. Six King County water quality sampling stations and one USGS sampling station were used to evaluate the water quality of Boise Creek. No sampling data was available for the upper Boise Creek watershed. The upper watershed is largely forested, with little impairment from urban development or agriculture.

The state's 1998 303(d) list identifies Boise Creek as an impaired water body for temperature. The 303(d) worksheet indicated that a TMDL study was needed for Boise Creek. Salmonid spawning was listed as an impaired use, with thermal modifications listed as the cause. Low dissolved oxygen (DO) levels have occurred in association with thermal modifications. Low DO could also occur with BOD or COD; however, BOD and COD data are not available.

Fecal coliform was measured at the Ecology station at Buckley. Although the geometric mean met the 100 colonies per 100 ml standard, more than 10 percent of the measurements were above 200 colonies per 100 ml. Sampling for nutrients, fecal coliform, and other parameters as they relate to agriculture and open space management is recommended.

Most of the projects recommended in this report will improve the water quality of Boise Creek by providing shade that will help reduce the water temperature, help reduce erosion, and establish buffers to help prevent nutrients from entering Boise Creek.

8.1.4 Drainage and Erosion Problems

The drainage and erosion problems in the Boise Creek Basin were identified from discussions King County and other agency staff and review of past complaints about drainage problems and the County's current CIP. Some of the problem areas were field-investigated, and the HSPF hydrology model was used to help estimate flows at some of the identified problem areas.

A list of high priority projects was developed for further analysis. One project addresses a culvert capacity problem and two projects address erosion problems.

8.2 WATERSHED VULNERABILITY ANALYSIS

The Center for Watershed Protection (CWP) developed an eight-step analysis for assessing the environmental condition of subbasins and their suitability for efforts to improve those conditions. The analysis classifies subbasins as one of the following:

- Sensitive—Impervious cover is less than 10 percent of the subbasin's area and streams are of high quality, with excellent habitat and water quality
- Impacted—Impervious cover is 10 to 25 percent of the subbasin's area and streams show signs of degradation attributable to urbanization, such as higher storm flows, unstable banks, reduced habitat and diminished water quality.
- Non-Supporting—Impervious cover exceeds 25 percent of the subbasin's area and streams can no long support diverse biological communities.

In addition to classifying the subbasins as one of these three categories, the analysis defines each basin as restorable (having enough retrofit potential for meaningful improvements in hydrology and pollutant loading) or not. The eight-step analysis provides the following information for each subbasin:

- An initial classification, based solely on impervious area
- A final classification, based on more detailed assessments of conditions along the stream corridor and throughout the subbasin
- A ranking of subbasin vulnerability to impacts from future changes, based on expected future development
- A priority ranking for which subbasins most merit prompt restoration activities.

Appendix E includes the CWP's description of the analysis process and a spreadsheet showing the results for the subbasins in the Boise Creek Basin. Table 8-1 summarizes these results.

TABLE 8-1.
RESULTS OF WATERSHED VULNERABILITY ANALYSIS

Subbasin	Classification		Vulnerability Rank[a]	Priority Rank for Restoration Activities[b]
	Initial	Final		
1	Impacted	Impacted & Restorable	4	4
2	Impacted	Impacted & Restorable	3	1
3	Sensitive	Sensitive & Restorable	1	3
4	Impacted	Impacted & Restorable	4	2
5	Sensitive	Sensitive & Restorable	4	5
6	Sensitive	Sensitive & Restorable	2	6
7	Sensitive	Sensitive & Restorable	4	7

a. 1 = most vulnerable to impacts from future development; Subbasins 1, 4, 5, and 7 are ranked the same because the analysis for vulnerability showed no difference between them.
b. 1 = highest priority for restoration activities.