CHAPTER 4.
GEOMORPHOLOGY

The observations and conclusions in this chapter are based on a review of existing geologic soil maps, USGS topography maps, aerial photography, and estimated changes in the EIA for future buildout. Only limited field observations were possible.

4.1 GEOLOGY AND SOIL TYPE

The Patterson Creek Basin was largely formed by glacial deposits during the Vashon Period of the Fraser Glaciation 13,000 to 20,000 years ago, although some deposits predate that period. The basin originally had a full forest cover, but logging began in the region in the late 1800s.

The primary soil units in the study area are listed in Table 4-1 and shown in Figure 2-5. Based on the King County Soil Survey, the predominant soils in the upper reach and plateau area of the watershed are in the Alderwood association. In the middle reach of the system that generally parallels Redmond-Fall City Road, soils in the Alderwood-Kitsap-Indianola association are predominant. In the lower reach of the system from the bridge to the confluence with the Snoqualmie River, soils in the Oridia-Seattle-Woodinville association are predominant. Glacial deposits in the basin are 79 percent till and 13 percent outwash.

Table 4-1.
Primary Soils In Patterson Creek Basin and Corresponding HSPF Soil Group

Soil Name	Hydrologic Soil Group	Soil Name	Hydrologic Soil Group
Alderwood gravelly sandy loam	C	Ovall gravelly loam	C
Bellingham silt loam	C	Puget silty clay loam	D
Everett gravelly sandy loam	A	Puyallup fine sandy loam	B
Indianola loamy fine sand	A	Ragnar fine sandy loam	B
Kitsap silt loam	C	Sammamish silt loam	D
Mixed alluvial land	C	Seattle muck	D
Nooksack silt loam	C	Shalcar muck	D
Norma sandy loam	C	Snohomish silt loam	D
Orcas peat	D	Tukwila muck	D
Oridia silt loam	D	Water	Water

4.2 GEOMORPHOLOGY CHARACTERISTICS

Figure 2-6 shows the topography of the Patterson Creek Basin. The total drainage area is 12,711 acres and the elevations vary from approximately 70 feet above mean sea level at the confluence of Patterson Creek and the Snoqualmie River to 1,400 feet in subbasin 5.

The basin areas to the north and east are relatively flat, draining Union Hill and the Sammamish Plateau. Many of the tributaries originate in upland lakes or wetlands. The basin area to the south is relatively steep, draining the north slope of Mitchell Hill. The basin area to the west originates near 264th Avenue NE and is moderately steep as it drains to Patterson Creek. The main channel of Patterson Creek is relatively flat with lateral wetlands extending nearly the entire length of the system from Redmond Fall City Road to the confluence with the mainstem of the Snoqualmie River. Agricultural development in the Patterson Creek valley has modified the creek channel by straightening, dredging, and removing vegetation.

4.3 GEOMORPHOLOGY ANALYSIS

Each subbasin was examined to determine if channel changes have occurred and if any future actions are required to improve the system. Table 4-2 summarizes the results of this quick examination.

TABLE 4-**2**.
STREAM REACH DESCRIPTIONS

Subbasin	Primary Soil Unit	Channel Conditions	Possible Channel Impacts Based on Future Buildout
1	Alderwood Gravelly Sandy Loam and Briscot Silt Loam	Channel slope in the headwaters is low gradient, flowing through several wetlands in the upland plateau. The middle reach flows through a steep channel with a slope of 5.6 percent and sparse LWD. Channel incision up to 1 foot and localized scouring have occurred. The lower reach is low gradient flowing through Wetland4836.	Increased channel incision and scour are likely to occur in the middle section of this subbasin due to steep channel gradient and higher flow rates. Sediment will likely be transported to the lower reach of the subbasin.
2A	*Main channel:* Seattle Muck *Tributaries:* Alderwood Gravelly Sandy Loam and Kitsap Silt Loam	The main channel slope in this subbasin is 0.2 percent. The channel is 2.5 feet deep with 2:1 side slopes. Dry Creek is tributary to the main stem, with an average slope of 4.5 percent. Dry Creek has been channelized along Ames Road.	Significant contributions of sediment to Patterson Creek will likely increase from development in the Dry Creek drainage area. Erosion of Dry Creek along Ames Lake Road will likely increase due to steep channel gradient and higher flow rates.
2B	*Main channel:* Seattle Muck *Tributaries:* Alderwood Gravelly Sandy Loam and Everett gravelly sandy loam	The main channel slope in this subbasin is 0.2 percent. The channel is 2.5 feet deep with 2:1 side slopes. The channel is surrounded by wetlands. Tributary 0376F has an average slope of 2.75 percent. The tributary at River Mile (RM) 6.5 has a slope of 19.9 percent. Tributary 0376C has an average slope of 7.0 percent	Least impacted of all subbasins with only 5 percent increase in EIA under future buildout. Tributary at RM 6.5 may be impacted by localized scour and sloughing due to steep slope.

TABLE 4-2 (continued).
STREAM REACH DESCRIPTIONS

Subbasin	Primary Soil Unit	Channel Conditions	Possible Channel Impacts Based on Future Buildout
2C	*Main channel:* Seattle Muck *Tributaries:* Alderwood Gravelly Sandy Loam	The main channel slope in this subbasin is 0.2 percent. The channel is 2.5 feet deep with 2:1 side slopes. The upper channel is surrounded by wetlands. Tributaries 0376A and 0376B have slopes of 8.1 percent and 14.5 percent, respectively.	Smaller tributaries that drain the southeastern portion of the subbasin may be impacted by scour and sloughing due to uphill development.
3	Alderwood Gravelly Sandy Loam and Everett gravelly sandy loam	Canyon Creek has an average gradient of 4.9 percent. One of the tributaries drains a low-gradient upland plateau fed by wetlands and lakes. The western upper reaches are primarily park land.	Future buildout in Subbasin 3 will increase EIA to 8.1 percent. Because much of the watershed is park, localized EIA (outside of the park areas) will likely be over 10 percent, which may impact Canyon Creek and tributaries in these areas.
4	Alderwood Gravelly Sandy Loam, Everett gravelly sandy loam, Kitsap silt loam	Two distinct regions characterize this subbasin—a steep forested area to the south draining Mitchell Hill and a low-gradient area to the north that flows through wetlands to the confluence with Patterson Creek. Three tributaries in the subbasin, 0377, 0378, and 0379, have average slopes of 6.1 percent, 6.5 percent and 23.5 percent, respectively.	Future buildout will almost double EIA from 1.7 percent to 3.2 percent. Significant reduction in forest cover is likely with development in upper reaches. Steeper reaches of tributaries may be impacted.
5	*Main channel:* Nooksack silt loam and Puget silty clay loam *Tributaries:* Alderwood Gravelly Sandy Loam, Everett gravelly sandy loam, Kitsap silt loam	The main channel slope in this subbasin is 0.2 percent with 2:1 side slopes. The upper reach channel is 2.5 feet deep. The lower reach is much deeper, approximately 15 feet. Right bank tributaries are steeper, draining the hills to the south.	Most impacted of all subbasins by reduction of forest cover to only 34 percent, mostly along the main channel, due to agricultural uses. Deepening and channelization in the lower reaches has significantly reduced floodplain connectivity. Steeper upper reaches of tributaries may be impacted by development.

4.4 RECOMMENDATIONS FOR FURTHER ACTION

The geomorphology analysis should be viewed as preliminary. Its purpose is to identify areas most likely impacted by future development in the Patterson Creek Basin for more in-depth study, specifically field survey of channel type, localized slope, channel and floodplain geometry, spawning gravel, and LWD.

Based on this analysis, the stream geomorphology in all the subbasins of Patterson Creek except for Subbasin 1 has likely been impacted by development through the reduction of forest cover. The impacts are most apparent in tributaries with erosion problems or that have been channelized to correct erosion problems.
Table 4-3 identifies the subbasins most likely to be impacted by future buildout based on increase in EIA. Subbasins with forest cover less than 65 percent and EIA increase greater than 50 percent are recommended for further investigation. A more detailed analysis of stream geomorphology, including field survey, is recommended for Subbasins 2C, 3, and 4 especially in the steeper tributary reaches that drain plateau areas for erosion and in the lower reaches of the system for sedimentation.

TABLE 4-3.
SUBBASINS MOST LIKELY IMPACTED BY FUTURE BUILDOUT

Subbasin	Forest Cover <65%	Percent Increase in EIA	Actual Increase in EIA (acres)	Comments
1	No	52%	15	
2A	Yes	34%	11	
2B	Yes	5%	4	
2C	Yes	63%	61	Field survey recommended
3	Yes	76%	72	Field survey recommended
4	Yes	88%	43	Field survey recommended
5	Yes	20%	5	
Entire Basin	Yes	53%	146	