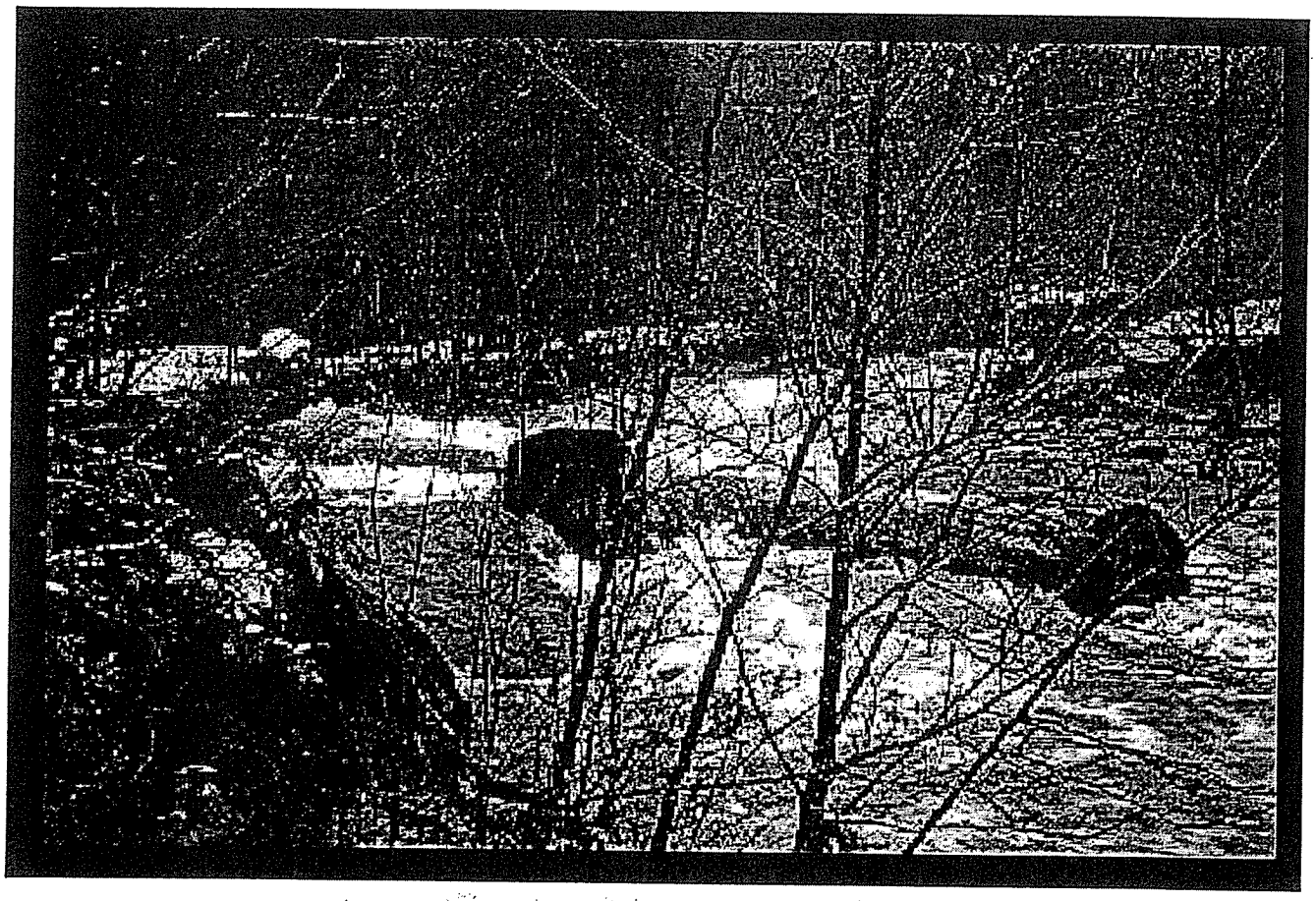
IIB. Hydrology



Devil's Creek - Februrary 1996

B. Hydrology

1. Characterization

*a) *What are the dominant hydrologic characteristics (e.g. total peakflows, discharge, minimum flows)? *Other notable hydrologic features and processes in the watershed (e.g. cold water seeps, ground water recharge areas).*

The Breitenbush's hydrology is similar to other documented watersheds within the Western Cascades. Peak flows occur during rain-on-snow events in the transient snow zone which is estimated to occur between 2,400 and 4,800 feet elevation (Christner and Harr, 1982). Approximately 75 percent of the watershed is within this transient snow zone. For the remainder of the watershed, nine percent is below 2400 foot elevation and 16 percent is higher than 4,800 feet elevation.

Water storage in this watershed is provided by deeper upland soils, terraces, flood plains and numerous headwater lakes. Glacial soils, terraces, and flood plains act like sponges, retaining water and releasing it slowly during periods of low precipitation. Annual precipitation for the area averages 77 inches with intensities as much as 3.7 inches per 24 hours, which can be expected on the average once every two years (Slack; et al U.S.G.S. 93-4076). Intense precipitation is episodic in nature, and it often generates peakflows which are a major disturbance mechanism for stream channels and associated riparian areas.

Average annual discharge for the watershed is 578 cubic feet per second. Between 1932 to 1987, discharge exceeded: 5,000 cubic feet per second 27 times; 7,000 cubic feet per second 15 times; 10,000 cubic feet per second two times; and 16,900 cubic feet per second once. During the same period, flow in the Breitenbush River was below 100 cubic feet per second 14 times and below 90 cubic feet per second seven times. The lowest recorded flow was 87 cubic feet per second. This wide range of variability in stream discharge reflects the maritime climate and the corresponding flow regime that changes dramatically with the seasons.

Geothermal areas provide a unique hydrology to a few locations in the valley bottoms along the Breitenbush River. Hot, highly mineralized water surfaces as seeps or springs in these areas.

2. What values are associated with hydrology?

a) Water storage and regulation systems; the amount and timing of water flow; and sediment budgets have ecological value.

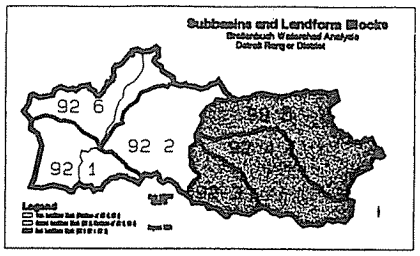
3. What are the highest priority issues or resource concerns associated with hydrology?

a) The highest priority issue is flow of water, especially peak flows and low flows.

4. What are the management direction/activities, human uses, or natural processes that affect hydrology?

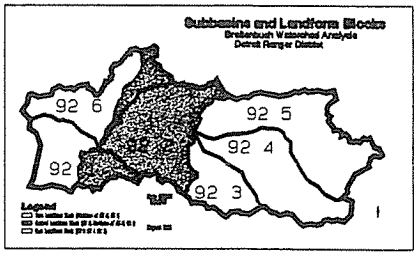
a) Current Conditions

*i) *What are the current conditions and trends of the dominant hydrologic characteristics prevalent in the watershed?*



Eastern Landform Block: Sixth field subwatersheds in the landform block are Devil's Creek (*subwatershed # 92 3*), South Fork Breitenbush River (*subwatershed # 92 4*), and North Fork Breitenbush River (*subwatershed # 92 5*). Due to the orientation of the landform block in relation to weather patterns, only portions of the subwatersheds are susceptible to rain-on-snow events that result in peak flows. The orientation and elevation of the headwaters portion of the North and South Forks of the Breitenbush are such that they are not subject to rain-on-snow events.

This landform block has a high water table because of glacially-dominated headwaters, as evidenced by numerous lakes (23 named and over 100 unnamed lakes), ponds or potholes, and wetland areas (Source; USGS Map). This glacial material provides a water storage potential that allows many streams to have considerable flow into the latter part of the summer months. A large meadow/lake complex illustrates this groundwater storage, in the headwaters of the North Fork Breitenbush. Below these storage areas, steeper valley walls, contain more shallow soils and numerous forested wetlands.

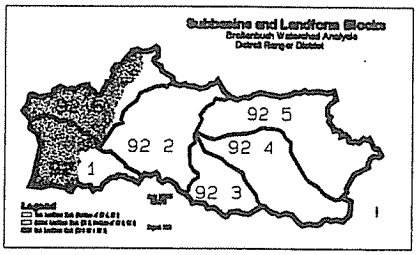


Central Landform Block: This landform block contains the following sixth field subwatersheds: Middle Breitenbush (*subwatershed # 92 2*), a portion of Humbug Creek (*subwatershed # 92 6*) and part of the Lower

Breitenbush (*subwatershed # 92 1*). These subwatersheds are very susceptible to rain-on snow events, so peak flows are a common occurrence in this landform block.

The landscape is dominated by stabilized earth flow complexes. Lakes and wetlands in this area are associated with unstable areas. There are two named lakes in this landform block, Short and Leone, both of which have their origins as sag ponds created from depressions related to slump block topography.

The water table (groundwater hydrology) here is complex because of the earthflow processes. Geologic benches from slump blocks, create local water storage areas and sag ponds. Adjacent streams respond to these storage areas by flowing for a longer duration in the drier portion of the year. Other water storage areas include terraces that occur upstream of earthflows where stream blockages result in upstream deposition and wider valley bottoms. These wider valleys often support forested wetlands associated with meandering stream channels.



Western Landform Block: This landform block contains most of the Lower Breitenbush (*subwatershed # 92 1*) and Humbug Creek (*subwatershed # 92 6*) sixth field subwatersheds. These subwatersheds are very susceptible to rain on snow events and subsequent peak flows. The dominant parent material for this area is volcanic in origin, so soils are skeletal and shallow. Water storage in the soils is less than in the central and eastern landform blocks. Dunlap lake and nine potholes/ponds, all of glacial origin, are shown on the USGS map for this area.

The shallow soils, which saturate easily, combine with rain-on-snow events, to quickly produce peak flow conditions early in the wet portion of the year. Stream flows recede much earlier in the year in this landform block than most of the rest of the Breitenbush. Small water storage areas exist as forested wetlands, commonly associated with older debris torrent deposits.

Finally, a reminant glacial terrace exists in the northwestern portion of this landform block. This reminant has the character of the Eastern landform block headwaters area. The size of the area is small, so it has little effect on groundwater storage.

b) Reference Conditions

*i) *What are the historical hydrologic characteristics (e.g., total discharge, peak flows, minimum flows) and features (e.g., cold water seeps, ground water recharge areas) in the watershed?*

Peak flows occurred much as they do now, during rain-on-snow events in the transient snow zone.

In the past, large scale fires burned vast areas of the watershed, stripping them of their vegetation. The removal of this vegetation, in combination with rain-on-snow events, resulted in increased volumes of water coming off the hillsides and entering stream systems. Because of the increased water volumes, streams occupied a greater portion of their floodplains during these events, resulting in high water tables and numerous wet areas in depressions. In addition, water storage was provided by lakes, potholes/ponds, sag ponds and depressions associated with earthflows, in the glacial headwaters of the watershed.

Specific data on stream discharge for the reference time period is not available. Presumably, the average flows were higher than they are now, since peak flows were higher because of fires and rain-on-snow events, and low flows were likely higher because of increased water storage capacity.

c) Comparison of Current and Reference Conditions

*i) *What are the natural and human causes of change between historical and current hydrologic conditions?*

It appears that peak flows have decreased over historic conditions, probably as a result of fire suppression allowing vegetation to persist on the landscape. Vegetation changes the rate at which water reaches stream channels and the amount of water available during minimal flow periods. Timber harvest has countered the effects of fire suppression to some extent by removing vegetation, but not to the same degree that fire once did.

Second, flood plain water storage areas have been reduced within the broad valley areas. Historically large wood allowed these area to be connected to their flood plains. Management resulted in active removal of wood following the 1964 storm event allowing streams to erode their floodplains. This affected both water storage capacity and the number of wetlands, thus drying the floodplains.

Finally, because of higher peak flows and more water storage areas, minimum flows may have been higher in the past than they are now, but no data is available to prove this.