Snohomish County

Allen Creek Drainage Needs Report

Executive Summary

Executive Summary

The Allen Creek Drainage Needs Report (DNR) is one of a series of 11 drainage plans completed for most of Snohomish County's Urban Growth Areas (UGAs). The purpose of this plan is to identify flooding and surface water problems and to recommend solutions.

In order to gain a better understanding of the drainage systems, streams, and wetlands within the unincorporated UGAs of Snohomish County, the Snohomish County Council authorized, in 2001, the accelerated development of drainage plans for these areas. The purpose of the DNR project is to plan for existing and future drainage infrastructures to reduce road and property flooding, protect and enhance aquatic habitat, and reduce stormwater pollution. This Allen Creek DNR project is one of a series of 11 individual reports that were prepared, in addition to a summary report, for the entire DNR project.

Overview

The Allen Creek DNR study area consists of the unincorporated UGA within the Allen Creek basin (see Figure 1-2). The Allen Creek basin is located in west-central Snohomish County, north of the lower Snohomish River. Allen Creek drains an area of about 7,040 acres (11 square miles). The main tributaries are South Fork Allen Creek, North Fork Allen Creek, Dry Creek, Munson Creek, and Jones Creek.

Scope of Analyses: For the Allen Creek DNR study area, detailed hydrologic and hydraulic models were created to analyze flooding problems for many of the major stream channels and drainage systems located within or downstream of the unincorporated UGA study area. Less detailed analyses were also conducted to assess habitat, water quality, and erosion problems in this study area.

The upper reaches of the Allen Creek basin consist primarily of agricultural and rural land uses, whereas the lower reaches are rapidly urbanizing with residential, commercial, and limited industrial development. The middle and lower portions of the basin are mostly within the City of Marysville, which is largely developed. The city and the surrounding unincorporated areas are experiencing rapid growth as many forested, pasture, and agricultural areas of the watershed are being developed.

Table ES-1
Recommended CIP Projects for Allen Creek

7	Flooding Projects	$2,559,000
10	Habitat Projects	$2,471,000
2	Water Quality Projects	$340,000
2	Erosion Project	$412,000
8	Flooding/Habitat Projects	$6,017,000
Total Recommended 29	**Projects**	**$11,799,000**

The DNR study identified a total of 94 problems in the Allen Creek DNR study area. The number of problems found in Allen Creek is fairly typical of urbanizing areas. Many of these problems have occurred due to the incremental development of the area, where existing drainage systems and streams are unable to handle the

increased stormwater. Of these, 17 are flooding problems, most of which are storm drains or culverts with insufficient conveyance capacities. Other common flooding problems include channel, storm drain, and culvert obstructions due to heavy siltation and damaged culvert ends.

As a result of the habitat assessments, 48 specific habitat problems were identified in the Allen Creek basin. Some of these problems include road culverts that are barriers to fish passage, moderate to poor condition of near-stream riparian habitat indicated by low stream shade and low large woody debris (LWD) recruitment potential, low salmon productivity, and a variety of other issues.

Existing water quality data analysis indicates that the overall water quality of Allen Creek is poor. Although these are ubiquitous in the basin, 18 water quality problems were identified within the Allen Creek basin.

The recommended plan for the Allen Creek DNR study area addresses the most significant flooding problems as well as some of the more significant habitat, water quality, and erosion problems. As indicated in Table ES-1, the recommendations include a total of 29 projects, nine of which address more than one type of problem. The projects that address flooding problems generally consist of replacing existing drainage pipes, culverts, and ditches with larger ones to increase conveyance capacities. Typical habitat projects consist of upgrading culverts to remove fish passage barriers and improving vegetation along some stream channels or adjacent riparian corridors. A typical water quality project consists of retrofitting roadside ditches into biofiltration swales so that they more effectively treat stormwater runoff. Projects that address both habitat and water quality problems include several stream relocation projects along the North Fork of Allen Creek that would better use floodplain storage and reduce downstream flows as well as improve stream habitat conditions.

The estimated implementation cost of these recommended projects is approximately $11.8 million. In order to implement the recommended projects, a number of issues will need to be resolved, such as available funding, project responsibility, prioritization of projects, detailed design, construction sequence, and permits. The recommended plan for Allen Creek also includes several nonproject recommendations, such as additional maintenance or additional studies.

Study Area

The study area for this DNR consists of the unincorporated UGA within the Allen Creek basin (see Figure 1-2). Although the analyses for this DNR focused on the unincorporated UGA, areas within the Allen Creek basin that lie outside of the unincorporated UGA area were also analyzed in cases where they either affected or were affected by conditions in the unincorporated UGA.

The Allen Creek basin is located in west central Snohomish County north of the lower Snohomish River. Allen Creek drains an area of about 11 square miles west of the Getchell Plateau. The stream originates in unincorporated areas and flows through the heavily developed areas of the City of Marysville, where it then discharges into Ebey Slough through the tide gates. The main stem of Allen Creek is approximately 6 miles long, with the headwaters located just above 119th Street NE near 81st Avenue NE. The main tributaries are South Fork Allen Creek, North Fork Allen Creek, Dry Creek, Munson Creek, and Jones Creek.

Groundwater plays an important role in surface water conditions in the Allen Creek basin. Because of soil and regional aquifer conditions, the groundwater table seasonally fluctuates. During rainy seasons, the groundwater table rises to the ground surface, restricts rainwater from infiltrating, and contributes to local flooding problems. During nonrainy periods, groundwater inflow can represent a significant portion of the flows in the streams.

Flooding

For the County's DNR project, detailed hydrologic and hydraulic models were developed to quantify existing and future surface water conditions within or related to the DNR study area and to evaluate potential solutions to identified problems. In general, hydrologic models were used to estimate the amount of stormwater runoff that would be generated during a storm or series of storms. These data were then input to the hydraulic models that were used to simulate routing through the stormwater conveyance system (including stream channels, wetlands, ditches, culverts, and enclosed storm drain systems). The combination of hydrologic and hydraulic modeling and analysis facilitated evaluating current and potential future flooding problems as well as alternative solutions to those problems.

Seventeen flooding problems were identified in the Allen Creek basin. Of these, 13 were related to storm drains or culverts with insufficient conveyance capacities. Other common flooding problems included channel, storm drain, and culvert obstructions due to heavy siltation and damaged culvert ends. The flooding problem areas and the estimated frequency of flooding are described in Section 8.0.

The majority of the Capital Improvement Program (CIP) projects developed to solve identified flooding problems consisted of replacing existing culverts with larger culverts, regrading existing ditches or channels, constructing bypass storm drains, and replacing existing storm drains with larger diameter pipes.

The combined effects of the CIP projects were evaluated by grouping projects into modeling alternatives for the Allen Creek basin. The first alternative, identified as CIP Modeling Alternative 1, includes 11 projects that address flooding and fish passage problems within the Allen Creek DNR study area primarily by increasing the capacity of the conveyance system with a small amount of compensatory storage. The second alternative, CIP Modeling Alternative 2, includes 19 projects that address these problems by combining conveyance improvements with significant floodplain and detention storage. CIP Modeling Alternative 2 also includes stream relocation along the North Fork of Allen Creek upstream of 100th Street NE and a regional detention facility located on a tributary of the creek (Tributary 70074). Both alternatives were evaluated using the hydrologic and hydraulic models that were developed for this basin.

The proposed conveyance improvements in Alternative 1 generally cause an increase in peak flows in the main stem of Allen Creek (below 67th Avenue NE) of roughly 1 to 5 percent, depending on the location and the frequency of the event. The existing erosion problems that were identified along the main stem would likely be exacerbated by the increase in peak flows, which would likely result in downstream sediment and impacts to fish habitat. Within the North Fork of Allen Creek, peak flows are actually reduced for Alternative 1 between 108th Street NE and 67th Avenue NE due to the small increase in floodplain storage proposed upstream of 108th Street NE.

For Alternative 2, the detention provided by the stream relocation projects in the North Fork of Allen Creek, as well as the regional detention pond located on Tributary 70074 more than offset the increases in peak flows that would be caused by the proposed conveyance improvements. Peak flows in the North Fork of Allen Creek, within and downstream of the proposed stream relocation projects, would be reduced by between 5 to 25 percent. Within the main stem of Allen Creek, the combined effect of both the stream relocation and the regional detention pond would reduce peak flows by roughly 1 to 20 percent.

Comparing the two alternatives, both would solve the same existing flooding and fish passage problems. Alternative 1 would cause increased flows along the main stem of Allen Creek that would likely result in some erosion and habitat impacts. Alternative 2 would more than offset the increased flows from the proposed conveyance improvements, but it would also cost roughly three times as much as Alternative 1. In order to offset the increased flows and minimize costs, only one of the two detention features in Alternative 2 is recommended. Since the proposed regional detention pond costs more than the stream relocation and restoration projects along the North Fork of Allen Creek, and since the relocation projects would provide a significant benefit to habitat and could potentially improve traffic safety, the stream relocation projects are recommended over the regional detention pond. Therefore, Alternative 2 is the recommended alternative but without the regional detention facility on tributary 70074. The recommended alternative would include a total of 18 projects, of which 15 address flooding problems.

Habitat

The habitat assessment for the Allen Creek basin involved selecting sites that represent the variety of habitat conditions found within the Allen Creek basin. Areas outside the unincorporated UGA were examined if they had the potential to significantly affect areas within the unincorporated UGA. A total of 3.5 miles of fish-bearing stream within the Allen Creek basin was surveyed. The habitat assessment at these sites primarily focused on instream habitat, biotic integrity, and fish passage issues. In addition, riparian areas along fish-bearing streams and wetlands within the unincorporated areas of the Allen Creek basin were evaluated using recent aerial photographs and limited field verification. Analysis was then performed to examine relationships between habitat components and factors that could affect habitat quality.

As a result of the habitat assessments, the following 48 specific habitat problems were identified in the Allen Creek basin:

- Generally low LWD density, high percent fines in riffles downstream of functional pools, low densities of pools, and no off-channel habitat, all of which indicate poor habitat quality in surveyed reaches
- Low salmon productivity
- Poor or very poor habitat quality indicated by low score of stream biological integrity
- Road culverts that are barriers to fish passage
- Generally moderate to poor condition of near-stream riparian habitat indicated by low stream shade and LWD recruitment potential

These habitat problems were reviewed with County staff to determine which would be developed into CIP projects. Solutions for some of the problems were not addressed because they were located outside of the study area, although further investigation or coordination of these problems were recommended. A total of 14 potential CIP projects were developed to address some of the identified habitat problems. Recommended habitat CIP projects include replacing fish barrier culverts, installing log weirs and LWD in streams, removing invasive riparian vegetation, planting native trees and shrubs within unforested riparian corridors, and installing livestock control fences. A total of nine habitat CIP projects are included in the recommended plan for the Allen Creek basin.

In addition to the Allen Creek basin, aquatic habitat assessments were performed in many drainage basins within the County. Data from these assessments were combined into a regional analysis to explore relationships among physical, habitat, and biological variables over a broader range of conditions than would be found in any one drainage area. The results of the regional analysis conducted for the DNR project are provided in a separate document, *Aquatic Habitat Summary: Current and Future Conditions of Urban and Urbanizing Streams of Snohomish County* (Snohomish County, 2002).

Water Quality

Existing water quality conditions and associated problems within the Allen Creek basin were assessed. This assessment included characterizing existing water quality conditions in surface waters of the basin, as well as discussing general and specific water quality problems in the DNR area. The water quality analysis is primarily based on reviewing available data and reports with limited field observation. Although the existing water quality conditions characterization is based on information covering the entire Allen Creek basin, the identification of specific water quality problems focused primarily on the DNR study area.

The data evaluation indicates that the overall water quality of Allen Creek is poor. Sampling has shown that the stream is not meeting Washington State Class A criteria for fecal coliform and dissolved oxygen (DO). Segments of the stream are on the Washington State Department of Ecology (Ecology) 1998 303(d) list for both fecal coliform bacteria and DO for various stream segments. Elevated levels of nutrients (nitrate- and nitrite-nitrogen and total phosphorus) are regularly detected in the surface waters and suspected of contributing to the stream's low DO concentrations. Metals such as copper, lead, and zinc have also been detected in the water and sediment samples from the basin. Impaired uses of Allen Creek include swimming, wading, and salmon and other fish spawning, migration, rearing, and harvesting. The primary sources of these contaminants are urban and commercial runoff, roadways, excess sediment from eroding stream banks and construction sites septic system failures, manure, fertilizers, and animal access to the streams. All of these sources are present in Allen Creek, with agriculture appearing to be the largest contribution to its poor water quality.

A total of 18 water quality problems were identified within the Allen Creek basin. Most of these problems were associated with untreated runoff from high-use roadways. In addition, other problems were a result of agricultural and pasture land runoff, livestock access to creeks, livestock feeding areas near streams, and pollution generated by residences and new developments. A limited number of water quality CIP projects were developed because flooding and habitat projects will or can include water quality benefits. An example of a project that will address water quality, flooding, and habitat issues is stream channel relocation. Two CIP projects, specific to water quality, were

chosen for the Allen Creek DNR recommended plan, these include retrofitting three existing retention/detention (R/D) stormwater ponds.

Erosion and Sedimentation

Channel erosion and sedimentation along the streams in the basin were assessed through a geomorphic channel evaluation. The channel evaluation was based on the results of a field reconnaissance, review of hydraulic and habitat information provided by Snohomish County and the consultant team, and published reports and maps.

The results of the evaluation indicate transport and sporadic deposition of sediment in the upper reach of Allen Creek (upstream of 67th Avenue NE), bank erosion and transport through the middle reach (67th Avenue NE to confluence with Munson Creek), and significant deposition and channel infilling in the lower reach (downstream of Munson Creek). Bank erosion supplies sediment to the stream, adding to downstream deposition, channel infilling, and further bank erosion.

The lower reach is particularly susceptible to sediment deposition and channel infilling. In large part, this condition is a result of very low channel gradients and the large volume of sediment entering the reach from upstream sources. However, the apparent rates of channel infilling in the lower reach have probably increased greatly since tide gates were installed at the mouth of the channel, resulting in “backwater” conditions.

Eleven erosion and sedimentation problems were identified within the Allen Creek basin. The erosion problems varied greatly, ranging from deflected streamflows from logs, a collapsed footbridge, and an overturned tree due to failing bank protection.

A limited number of CIP projects were developed to solve the identified erosion and sedimentation problems. Two erosion-specific projects were included in the Allen Creek DNR recommended plan.

Recommended Plan

Since the total cost of the recommended projects exceeds the County’s ability to fund all of the identified CIP projects using current revenue sources, it was necessary to prioritize the projects into a recommended plan. Sections 9.0 and 10.0 provide details of this selection process. Table ES-1 summarizes the recommended CIP projects for Allen Creek.

Successful implementation of all 29 CIP projects within the Allen Creek basin will result in reduction of 13 identified flooding problems, improvement of existing habitat problems, and modest improvements to water quality and erosion. The recommended list includes some projects that would primarily benefit private property owners, which the County would not be responsible to implement.

An important consideration is that the construction of CIP projects, which the County would implement, depends on the availability of public funds. Based on the current allocation of County revenues for surface water purposes, the County does not have sufficient funds allocated to implement all recommended County-funded CIP projects. The County will need to consider the relative importance of the recommended projects in the Allen Creek DNR with the rest of DNR study areas in order to use the limited funds most effectively. Since a funding analysis was beyond the scope of the DNR project, the

County will need to perform a separate evaluation to determine how much funding would be available to construct the recommended County CIP projects.

The following other actions are recommended to be implemented:

- Maintain the drainage infrastructure
- Further analyze all recommended flooding and fish passage CIP projects during the preparation of construction plans
- Further analyze to evaluate the need to retrofit ravine-top discharges to reduce erosion
- Further analyze to evaluate the need to retrofit existing detention ponds to improve water quality and/or increase storage capacities
- Further analyze to evaluate the need to retrofit existing ditches to improve water quality