Snohomish County

Swamp Creek Drainage Needs Report

Executive Summary

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The Swamp 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 these plans 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, known as the Drainage Needs Reports (DNRs) project. The purpose of the DNR Project is to plan for existing and future infrastructure needs in a way that reduces road and property flooding, protects and enhances aquatic habitat, and reduces stormwater pollution. This Swamp Creek DNR is one of the 11 individual reports that were prepared as part of Snohomish County's DNR Project.

Overview

The Swamp Creek Basin is located in the Lake Washington Basin, primarily in south Snohomish County, although the southern end of the basin crosses into north King County. The total area covers approximately 16,250 acres (25.4 square miles), with roughly two-thirds of the basin in unincorporated Snohomish County. The rest of the basin lies in the cities of Everett, Lynnwood, Brier, Bothell, Mountlake Terrace, and Kenmore. Although the Chase Lake area is not contiguous to the rest of the study area, it was included in this DNR study area.

Scope of Analyses: For the Swamp Creek study area, detailed hydrologic and hydraulic models were created to analyze flooding problems along the entire main stem of Swamp Creek, most of the major tributaries, including Scriber and Martha creeks, and in some of the major drainage systems. In addition, the study area included an isolated portion of unincorporated Snohomish County near Chase Lake that is bordered on all sides by the City of Edmonds. Many of the smaller, local drainage systems in the study area were not analyzed. Habitat and water quality analyses were conducted but erosion issues were not specifically analyzed.

The Swamp Creek Basin is extensively developed, with the majority of the development having occurred prior to 1990. Existing land use in the Swamp Creek Basin consists of a mixture of highly urbanized commercial and industrial land uses and suburban residential areas. A significant fraction of the watershed has remained undeveloped, however, with 18 percent forest cover remaining. In general, future land uses in the study area are expected to be dominated by medium- and high-density residential development, though some areas would also include commercial/industrial uses.

The DNR Study identified a total of 153 surface water problems in the Swamp Creek study area. Of these, 94 are flooding problems within the study area, most of which are due to undersized pipes and channels in the developed areas of the basin. In addition, the study found 46 habitat problems, such as fish barrier culverts and inadequate

vegetation to provide good habitat. Overall, water quality of Swamp Creek is degraded. Thirteen specific water quality problems were identified in the study area.

The number of problems found in Swamp 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. In general, there are relatively few problems along the main stem of Swamp Creek, due in large part to the presence of significant riparian wetlands that help to reduce potential flooding problems and that provide water quality and habitat benefits. Since only the major drainage conveyance systems were analyzed, the analysis of the remaining drainage systems in the basin would likely identify additional flooding problems and projects.

Table ES-1
Recommended CIP Projects for the Swamp Creek Basin

35	Flooding Projects	$13,023,000
14	Habitat Projects	$6,001,000
5	Water Quality Projects	$744,000
10	Flooding/Habitat Projects	$2,245,000
5	Flooding/Water Quality Projects	$6,289,000
69	**Total Recommended Projects**	**$28,302,000**

The recommended plan for the Swamp Creek study area addresses significant flooding, habitat, and water quality. It also recommends a number of non-project actions to improve water quality. As indicated in Table ES-1, the recommended plan includes a total of 69 projects, which were divided into five different categories based on the types of problems addressed, many of which address multiple problems. The estimated cost of these recommended projects is $28.3 million.

To address the identified flooding and fish passage problems, two alternative solutions were developed for each subbasin, which generally consist of different combinations of conveyance and detention improvements. The recommended alternative generally consists of replacing existing drainage pipes, culverts, and ditches with larger ones, along with constructing a few detention facilities where they can cost-effectively reduce stream flows. Because this area is already well developed, it was generally difficult to find suitable locations to install detention ponds. Because of surrounding development, it was also difficult to expand or retrofit many of the smaller, neighborhood detention and water quality ponds that were designed to previous standards and that provide only modest control of runoff.

Typical habitat projects consist of culvert upgrades to remove fish passage barriers and revegetation improvements along some stream channels and/or adjacent riparian corridors. A typical water quality project consists of retrofitting roadside ditches into biofiltration swales to treat stormwater runoff more effectively.

It should be noted that none of the projects included in the recommended plan are actually required to be implemented under current County code. 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 sequencing, and permits. These issues are discussed in Section 10.

Study Area

The Swamp Creek watershed is located in the Lake Washington Basin, primarily in south Snohomish County, although the southern end of the watershed crosses into north King County. The main stem of Swamp Creek extends approximately 14.6 miles through the center of the watershed. Two major tributaries, Scriber Creek and Martha Creek, drain the western and eastern portions of the watershed, respectively. The total area directly tributary to the main stem of Swamp Creek (including Scriber and Martha creeks) is approximately 25.4 square miles, roughly two-thirds of which lie directly within unincorporated Snohomish County. This area includes the unincorporated UGA within the Swamp Creek Basin (see Figure 1-1). For the purposes of this DNR, the Swamp Creek Basin was divided into five major subbasins: Scriber Creek, Martha Creek, North Swamp Creek, Middle Swamp Creek, and South Swamp Creek. The Swamp Creek study area also includes the Chase Lake area. Although it is not located directly within the Swamp Creek Basin, it is included in this report because it is an area that is too small to warrant a separate DNR.

Scriber Creek Subbasin

The Scriber Creek Subbasin is located in the southwest portion of the Swamp Creek Basin and encompasses a total area of approximately 4,250 acres. Roughly one-third of the subbasin lies in unincorporated Snohomish County while the remaining two-thirds lie within the City of Lynnwood. The main tributaries of Scriber Creek are Poplar Creek and Golde Creek.

Martha Creek Subbasin

The Martha Creek Subbasin is located in the northeast portion of the Swamp Creek Basin and drains approximately 1,293 acres. In addition to Martha Creek, this subbasin contains a 60-acre lake, Martha Lake, at the headwaters of Martha Creek.

North Swamp Creek Subbasin

The North Swamp Creek Subbasin encompasses the upper third of the main stem of Swamp Creek and drains approximately 3,328 acres. The northern half of the subbasin lies in south Everett while the southern half lies in unincorporated Snohomish County. Lake Stickney, a 24-acre lake located at the south end of the North Swamp Creek Subbasin, is the only significant water body in the subbasin.

Middle Swamp Creek Subbasin

The Middle Swamp Creek Subbasin encompasses the middle third of the main stem of Swamp Creek, which includes a large detention facility and wetland complex. The subbasin drains approximately 3,008 acres and includes the confluence with Martha Creek as well as several small tributaries, such as Alder Creek.

South Swamp Creek Subbasin

The South Swamp Creek Subbasin includes the southern third of the main stem of Swamp Creek, extending from the confluence with Scriber Creek to the Sammamish River. The subbasin drains approximately 4,160 acres, roughly two-thirds of which lie within Snohomish County. This subbasin lies within portions of the cities of Brier, Bothell, and Kenmore.

Chase Lake Area Subbasin

The Chase Lake Subbasin covers less than a square mile of older urban neighborhoods and is located southwest of the Swamp Creek Basin. This area is not defined by stream basin boundaries but rather by the municipal boundaries between the City of Edmonds and unincorporated Snohomish County.

Flooding

Detailed hydrologic and hydraulic models were developed for the Swamp Creek DNR to help quantify existing and future surface water conditions within or related to the 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 into the hydraulic models, which were used to assess how runoff moves through the stormwater conveyance system (including stream channels, wetlands, ditches, culverts, and enclosed storm drain systems).

A total of 94 flooding problems were identified throughout the Swamp Creek study area. Complete descriptions of flooding problem areas and the estimated flooding frequency are provided in Section 8.0. The number of problems identified exceeded the number of problems that could be analyzed within the scope of this DNR project. For this reason, CIP projects were developed to address 35 of the higher priority flooding problems. An additional 15 projects address flooding and habitat or flooding and water quality problems.

Two alternatives were proposed to address flooding problems within each subbasin. Alternative 1 generally proposed to address these flooding problems, as well as some fish passage problems, by replacing existing culverts, which would increase the capacity of the existing conveyance system. Alternative 2 proposed the same conveyance improvements along with some detention facilities, where suitable sites could be located. The detention facilities would help to offset the increase in flows caused by the conveyance improvements. Although Alternative 2 has a higher cost than Alternative 1, Alternative 2 is generally preferred in order to offset the increase in flows caused by the conveyance improvements and therefore limit downstream flooding and habitat impacts. The proposed detention facilities in Alternative 2 would also help to improve water quality in each subbasin.

Scriber Creek Subbasin

A total of 21 flooding problems were identified in the Scriber Creek Subbasin. Of these, 20 result from inadequate conveyance capacity at roadway or driveway culvert crossings. In addition to the recommended culvert replacements, a new off-line detention pond would be constructed to detain flow from an unnamed tributary to offset flow increases caused by future development and conveyance upgrades.

Martha Creek Subbasin

All 23 flooding problems identified in the Martha Creek Subbasin were the result of inadequate conveyance capacity at roadway or driveway culvert crossings. In addition to the recommended culvert replacements, an off-line detention pond would be constructed near 6th Avenue W to offset flow increases caused by future development and conveyance upgrades.

North Swamp Creek Subbasin

All 16 flooding problems identified in the North Swamp Creek Subbasin were the result of inadequate conveyance capacity at roadway or driveway culvert or bridge crossings. In addition to the recommended culvert and bridge replacements, an off-line detention pond would be constructed along the North Tributary, upstream from Center Road, to offset flow increases caused by future development and conveyance upgrades. Constructing a berm along the North Tributary south of 112th Street SW, as well as raising the elevation of an existing roadway and constructing a berm along the West Tributary (York Creek), were also recommended.

Middle Swamp Creek Subbasin

Of the 16 flooding problems identified in the Middle Swamp Creek Subbasin, five occur along the main stem of Middle Swamp Creek and 11 occur along the Alder Creek tributary. All flooding problems are due to inadequate conveyance capacity. The Maple Road culvert is influenced by high flood levels downstream from the culvert, further reducing capacity and, under extreme conditions, contributing to the flooding in the vicinity of Maple Road. While some culverts would be replaced, no detention ponds are being recommended along the principal drainage pathways within the Middle Swamp Creek Subbasin.

South Swamp Creek Subbasin

All seven flooding problems identified in the South Swamp Creek Subbasin were the result of inadequate conveyance capacity. The only flooding problem along the main stem of Swamp Creek was located at a pedestrian bridge crossing. The other flooding problems occur at the pipe-and-ditch system that was analyzed near Logan Road and Crawford Road. Besides replacing some of the existing drainage system, an existing detention pond along the tributary by Logan Road would be expanded to offset flow increases caused by future development and conveyance upgrades.

Chase Lake Area Subbasin

Of the 11 flooding problems identified in the Chase Lake Subbasin, two were the result of inadequate conveyance capacity at roadway or driveway culvert crossings, four were the result of inadequate conveyance capacity of enclosed pipe systems, four were the result of undersized open channels, and one is related to roadway ponding due to improper grading of the roadway pavement. In addition to replacing the under-sized portions of the existing drainage system, the existing Chase Lake detention facility would be expanded to offset flow increases caused by the conveyance upgrades.

Habitat

The fish-bearing streams within the unincorporated areas of the Swamp Creek UGA have a combined length of 13.7 miles. The coho, chinook, and sockeye salmon; steelhead, sea-run, and resident cutthroat trout utilize Swamp Creek and its tributaries. Currently, resident cutthroat trout are the predominant salmonid species spawning in the Swamp Creek UGA, inhabiting almost the entire accessible habitat in the drainage. Chinook salmon spawners were observed in Swamp Creek (from river miles [RM] 0 to 8) and Scriber Creek in the mid- to late 1980s. Coho salmon are found throughout much of the drainage. Sockeye salmon have been reported in the main stem of Swamp Creek, below Lake Stickney and steelhead trout as far south as I-405. There are no recent validated reports of bull trout in the Swamp Creek UGA. The Chase Lake study area has no fish-bearing streams.

For the habitat assessment, sites were selected for examination and data collection that were considered to be representative of the variety of habitat conditions present. Areas outside the unincorporated UGA were examined if they had the potential to significantly affect areas within the unincorporated UGA. Since no streams are located within the Chase Lake area, the habitat assessments were primarily conducted within the Swamp Creek Basin. A total of 5.3 miles of fish-bearing streams within the Swamp Creek Basin were surveyed for this project. The habitat assessment at these sites primarily focused on instream habitat, biotic condition, and fish passage issues. In addition, riparian areas along fish-bearing streams and wetlands within the unincorporated areas of the Swamp Creek Basin were evaluated using recent aerial photographs. Analysis was then performed to examine interrelations between habitat components and factors that could affect habitat quality.

Based on the habitat assessment, a total of 46 habitat problems were identified in the Swamp Creek Basin. The majority were fish passage problems (23 total) resulting from undersized, perched, or degrading culverts. Four problems identified were unknown fish barriers recommended for further study. The stream also has an overall lack of large woody debris (LWD) with 11 specific problem areas that have very low or no LWD. The Swamp Creek Basin has several large wetlands that are important to the health of the biota and stability of the stream's habitat. Four problem areas relating to wetland protection were identified. The four remaining problem areas relate to stream bank stability and general habitat degradation.

Solutions were developed for the higher priority problems, though some of the problems were not addressed since they were located outside of the study area. Recommended habitat CIP projects in the Swamp Creek Basin include removing fish passage barriers, installing LWD along stream corridors, planting various types of native riparian vegetation, removing invasive vegetation, stabilizing stream banks, and acquiring/preserving wetlands. A total of 14 CIP projects are included in the recommended plan that primarily address habitat problems within the Swamp Creek basin. Fish passage problems were also addressed by culvert replacement projects that addressed identified flooding problems.

Water Quality

Existing water quality conditions and associated problems within the Swamp Creek basin were also assessed. The assessment considered characterization of existing water quality conditions in surface waters of the basin, as well as a discussion of general and specific water quality problems in the DNR study area.

The water quality analysis for this DNR is primarily based on review of available data and reports with limited field observation. Although the characterization of existing water quality conditions is based on information covering the entire Swamp Creek Basin, the identification of specific water quality problems and potential improvements focused on the DNR study area.

The data evaluation indicates that the overall water quality of Swamp Creek is degraded throughout the length of the stream system. Swamp Creek is designated as a Class AA fresh water stream according to the Washington State Surface Water Quality Standards (WAC 173-201A), indicating that the stream would be an "extraordinary" quality resource were it not for its degraded water quality and that the expectations for its water quality are high. Sampling at several locations has repeatedly shown that the stream is not meeting Washington State Class AA criteria for fecal coliform bacteria, dissolved oxygen, and toxic metals including copper, lead, and zinc. Segments of the stream are on the Washington Department of Ecology's 1998 Clean Water Act Section 303(d) list

for both fecal coliform bacteria and dissolved oxygen problems. Moderately elevated levels of nutrients (nitrate- and nitrite-nitrogen and total phosphorus) are regularly detected in the surface waters, and may contribute to the stream's low dissolved oxygen concentrations. Degraded water quality in Swamp Creek has impaired its use for wildlife habitat; swimming, wading, and other primary contact recreational activities; and salmon and other fish spawning, migration, rearing, and harvesting.

The primary sources of these contaminants are widespread and span the full range of land uses in the basin. Thirteen specific water quality problems were identified within several subbasins of the Swamp Creek DNR study area. These problems are associated with untreated runoff from much of the development in the Paine Field area and from numerous storm drain outfalls along arterial roadways, unprotected stream reaches within auto wrecking yards, severely eroding stream banks, livestock access to the streams on small farms, and manicured residential lawns extending to the banks of the streams. Many other general, nonpoint sources of water quality problems are evident.

A limited number of water quality CIP projects were developed because flooding and habitat projects will or can include water quality benefits, and because the cost-effectiveness of many potential water quality CIP projects (such as retrofitting of runoff treatment for a small portion of an established residential neighborhood) would be quite low. Five CIP projects specific to water quality were chosen for the Swamp Creek DNR Recommended Plan primarily consisting of retrofitting or expanding existing detention ponds or creating new treatment facilities. Additional programmatic recommendations for water quality improvements (i.e., actions that are not specific CIP projects) were also developed. Actions such as street and parking lot sweeping and increased catch basin cleaning for pollutant removal are particularly important for this DNR study area due to the high density of heavily used roadways and other urban land uses that generate pollutant loadings, and the extremely high cost of installing stormwater treatment systems to combat those pollutant loadings.

To achieve significant improvements in water quality in Swamp Creek, the quality of stormwater runoff from urban areas within the cities of Everett, Lynnwood, Brier, and Bothell (outside Snohomish County jurisdiction) would also need to be improved.

Recommended Plan

As indicated in Table ES-1, the recommended projects were grouped into five different categories, based on the types of problems that were addressed by each project. The first three categories include projects that primarily address only one type of problem: flooding, habitat, or water quality. The other two categories represent projects that address more than one type of problem. The lists of recommended projects for each of these categories are included in Tables 10-2 through 10-6 in Section 10 of this report. Appendix F contains additional details for each project in project summary sheets, which include a summary, a sketch of the proposed improvements, and a cost estimate.

It should be noted that none of the projects included in the recommended plan are actually required to be implemented under current County code. Furthermore, the recommended projects include some that would primarily benefit private property owners, for which the County would not be responsible. To implement the recommended plan, a number of issues will need to be resolved, such as available funding, project responsibility, prioritization of projects, detailed design, construction sequencing, and permitting.

Though a funding analysis was not conducted for this project, it is apparent that the total cost of the recommended CIP projects for the entire DNR project exceeds the County's ability to fund these projects using current revenue sources. Even though the County is

not obligated to implement the recommended projects, it was useful to prioritize the projects. The County will need to consider the relative importance of the recommended projects in the Swamp Creek DNR with the rest of the DNR study areas, in order to use the available funds most effectively.

Successful implementation of all 69 CIP projects within the Swamp Creek DNR area will result in a reduction of flooding at 94 identified problem sites, enhancement of existing habitat conditions, and modest improvements to water quality.

It is further recommended that the following actions be implemented:

- Continued programmatic maintenance of the drainage infrastructure. This applies basinwide, although specific maintenance of the culverts below the outlet from Martha Lake (problem IDs SW-MA-F-Ex-13, 14, and 15) is recommended.
- Conduct additional investigations at nine flooding sites, eight sites with potential habitat problems, and one site having flooding and habitat problems. Additional investigation at these sites is necessary to evaluate the problems and the need for corrective actions. Most of these are areas with historic problems that were not addressed as a part of this study.
- Promote BMPs for small farms in the Swamp Creek Basin in an effort to improve water quality.
- Conduct routine sweeping of public parking lots and high-use roadways to reduce pollutant loadings from these areas.
- Conduct additional analyses to consider erosion problems in the Scriber Creek Subbasin that were reported in previous studies but not studied for this DNR.
- Perform additional habitat investigations, including B-IBI sampling, to confirm some of the data found during this study.
- Continue a detention pond retrofit program, which will provide additional water quantity and quality control. Three pond retrofit projects within the study area are already designed and permit applications are being reviewed.
- Additional analysis to evaluate the need to retrofit existing ditches to improve water quality. Coordinate with the cities of Everett, Brier, Lynnwood, and Bothell to implement water quality improvements.
- Evaluate need for erosion control measures to stabilize stream banks and minimize future erosion potential for three areas along Golde Creek.