3.4 MILL CREEK AND MULLEN SLOUGH SUBBASIN

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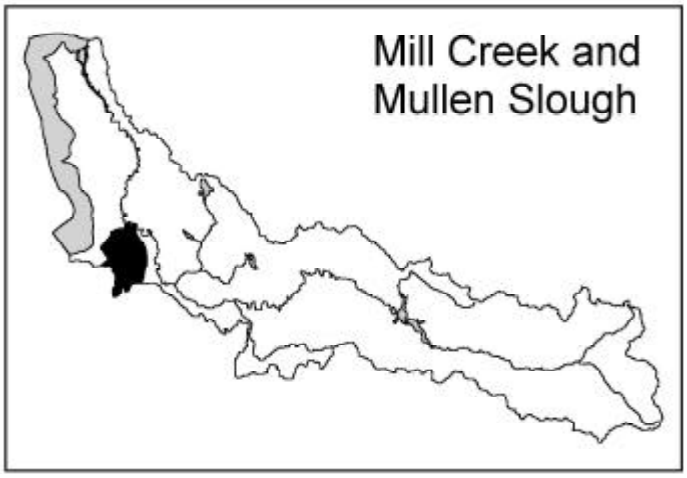
3.4 MILL CREEK AND MULLEN SLOUGH SUBBASIN



PHYSICAL DESCRIPTION

SUBBASIN

For the purposes of this report, the Mill Creek (09.0051; sometimes referred to as Hill Creek in literature sources) and Mullen Slough (09.0045) subbasin is defined as an area bordered by Kent to the north, Algona to the south, the valley wall to the west, and the Green River channel to the east. It includes all areas and tributaries that drain into:

- Mill Creek and tributaries (09.0052, 09.0054, and 09.0055);
- Mullen Slough and tributaries (09.0046, 09.0047, 09.0048, and 09.0049);
- Midway Creek (09.0041) and tributary (09.0043); and
- The northeast Auburn Drainage Systems (09.0056, 09.0058, 09.0059, 09.0060, and 09.0065) that flow independently into the Green River.

All of these drainages are included in this chapter because they share a similar geographic location and a sizeable floodplain immediately adjacent to the mainstem Green River. Together, these tributaries constitute the second-largest subbasin to the Lower Green River.

STREAM COURSE AND MORPHOLOGY

Mill Creek is a left-bank tributary that joins the Green River at approximately RM 23.9. Its stream length is approximately 8.35 miles (Williams 1975). The basin is comprised of two distinct physical settings.

In the western half of the Mill Creek subbasin, rolling hills rise to elevations of 300 – 400 feet above the valley floor. In this area, the origins of stream courses are often not well defined. Four significant lakes (Dolloff, Fenwick, Geneva and Star) are present, along with several smaller ponds (such as Bingaman Pond (09.0049)), and wetlands. These lakes and seeps are the headwater sources for Mill Creek, Midway Creek, Mullen Slough and their respective tributaries. Creeks originating from these upland sources drop abruptly through sharply defined steep canyons to the valley floor, where stream gradients flatten quickly. Typically, these canyons are short and have high gradients. The notable exception is Mill Creek, which drops through a sizeable ravine (Peasley Canyon) before entering the valley floor.

The eastern half of the subbasin lies on the valley floor and stream gradients are virtually flat. Mill Creek and Mullen Slough are the primary drainage courses of this section. Historically, both Mill Creek and Mullen Slough conveyed water received from nearby wetlands to the mainstem Green River, served as important flood storage areas, and provided refugia to anadromous salmonids from winter high flows.

Several studies have examined the Mill Creek subbasin in recent years. The most pertinent of these studies are outlined in the table Mill-1 below. The objective of most of these studies has been flood control (some even refer to Mill Creek as a "conveyance channel" (King County, undated) It is only recently that restoration initiatives have been examined. There have been at least eight other studies (table Mill-1) that also examined hydraulic issues in the Mill Creek subbasin.

Table Mill-1. Summary of Some Pertinent Mill Creek Subbasin Studies.

Study Title	Sponsor/Author	Study Objectives
West Side Green River Watershed Workplan (1965)	Soil Conservation Service, King County, Auburn, Kent, Tukwila, Renton	Flood protection
Urban Drainage Study for the Green River Valley (1974)	Seattle District Corps of Engineers	Flood control
Mill Creek Basin Profile (1980)	Basin Technical Committee	Flood control
Mill Creek Water Quality Management Plan (1993)	King County and Washington Department of Ecology	Flood and water quality issues.
Reconnaissance Report No. 4, Mill Creek Basin (1987)	King County	Compilation of flooding, erosion, water quality and habitat problems
Mill Creek Basin Study (~ 1988)	King County	Flood control
Mill Creek Flood Control Plan (Phase II)	King County, Auburn and Kent	Flood control
Mill Creek Basin, Aquatic Resources Restoration Plan (1997)	Auburn, Kent, King County, Environmental Protection Agency, Corps of Engineers	Guidance for aquatic resource restoration and enhancement

SALMONID USE

MILL CREEK

The known freshwater distribution of anadromous salmonids is depicted in the report Appendix. Coho, chum, and winter steelhead adults have been observed spawning in Mill Creek (Washington Department of Fish and Wildlife *Spawning Ground Survey Database* 1998;

Malcom 1999). Because of the low stream gradients and the anthropogenic barriers to anadromous fish in Mullen Slough and its tributaries, spawning ground surveys are not routinely conducted in this system. Juvenile coho, chum, winter steelhead, cutthroat and chinook have been captured in Mill Creek (Williams 1975; Malcom 1999; Schneider 1999).

MULLEN SLOUGH

Juvenile coho salmon and cutthroat and rainbow trout are documented as using Mullen Slough and portions of its tributary system (Malcom 1999; Shannon and Wilson 2000). Harza (1999) notes chinook and chum salmon juveniles present near the confluence with the Green River (from pers. comm. with R. Malcolm June 9, 1998).

FACTORS OF DECLINE

FISH PASSAGE

MILL CREEK

Historically, anadromous fish migrated up Mill Creek at least as far as approximately RM 6.7. Portions of the short, high-gradient canyons of this subbasin may have been accessible to anadromous salmonids.

However, numerous road culverts block access. For example, tributary 09.0049 (which flows into and out of Bingaman Pond) is blocked by three road culverts (45th Avenue South, 46th Avenue South, and 55th Avenue South). Coho salmon and cutthroat trout habitat suitable for spawning and rearing has been reported upstream of Bingaman Pond (Finney pers. comm.). Currently, an impassable culvert at approximately RM 5.0 blocks anadromous fish passage. The stream reaches of Mill Creek upstream of Peasley Canyon Way South are not currently accessible to anadromous salmonids due to a road culvert and King County paving of the streambed immediately upstream of the culvert. The concrete trapezoidal channel has been identified as a complete barrier to all upstream fish passage (D. Finney pers. comm.).

Stream channel constrictions as a result of debris left by illegal dumping has been implicated in some reaches as a serious problem (Auburn et al. 1997).

MULLEN SLOUGH

Barriers to resident and anadromous fish populations are significant throughout Mullen Slough and its tributaries. A potential low-flow barrier occurs at the confluence of Mullen Slough with the Green River. The cause of this potential barrier is not fully understood but is believed to be from a combination of wetland filling, water withdrawal, and the hydrologic maturity of the watershed.

Other flow barriers (channel encroachment by reed canary grass, and beaver dams) occur throughout the valley floor above and downstream of 277th Avenue bridge.

Anthropogenic barriers in the form of hanging culverts occur at the base of the valley floor for tributaries 09.0046 and 09.0049. Several culverts may be partial or complete barriers to anadromous fish during some flows occur in the agricultural lands of the valley floor. In addition, the wetland above 277th Avenue may impede fish access to the upper reaches of streams 09.0045, 09.0047, and 09.0048.

RIPARIAN CONDITION

A comprehensive riparian assessment has not been completed in this subbasin. The riparian habitat conditions that have been examined, of Mill Creek vary from fair to poor, with some reaches rated as high possibility of recovery while others as unrecoverable (Auburn 1997). However, the 1979 report, *River of Green* (King County 1979) provides an important insight to the habitat losses of the previous 18 years from its publication date.

The riparian areas in these streams do not meet any criteria of properly functioning riparian habitat. Development has greatly eliminated functioning riparian habitat along the stream courses. Once it enters the valley floor, Mill Creek riparian habitat generally consists of small stands of early-growth deciduous trees and borders of non-native shrubs and grasses. Remnant stands of native vegetation are rare. This fragmentation effectively limits where interconnections between formerly functioning elements of the larger ecosystem can be restored. The lack of a functioning riparian habitat is a major limiting factor to natural salmonid production in these streams.

LARGE WOODY DEBRIS

Comprehensive surveys for the presence of LWD were not located during the development of this report for this subbasin. However, it was the professional judgement of fisheries biologist and ecologists involved in the development of this document (Green River Technical Advisory and Factors of Decline Group, 2000) that LWD is extremely limited within the anadromous zone of this subbasin.

Additionally, the current status of riparian habitats within the anadromous zone generally precludes any recruitment of LWD within the next 80 to 100 years. There is more potential for recruitment of LWD from the ravines of the valley wall, as they contain relatively mature stands of a mixed coniferous/deciduous forest.

HYDROLOGY

MULLEN SLOUGH

Mullen Slough has its headwaters from several small streams originating from the uplands along the west side of the Green River valley wall. Three such small streams originate from the outflow of Bingaman Pond, Star, and Fenwick lakes. The later stream flows intermittently while the former flow throughout the year.

The remainder of the system is contained within the valley floor, where it maintains its historic low gradient in the valley floor. Historically it is believed to have functioned as important over-wintering refugia for anadromous salmonids from flood flows.

SEDIMENT CONDITION

MILL CREEK

Erosion in the upper reaches, especially in the ravines along the valley wall has been identified as an adverse impact (King County, undated; King County 1993; King County 1996).

Sedimentation problems in the lower reaches were identified in a former report. Since the last major rain events (1990, 1996), extensive amounts of stream-associated sediments have been transported downstream and areas of the Mill Creek floodplain, and wetlands in Auburn and Kent have been filled and/or eliminated as part of development in the lower valley. This filling of wetlands may cause low-lying and unfilled areas to flood during the next major storm event. The effect on fish could include stranding out of the channel and pollutant collection by the floodwaters.

Some contributory factors include sediments from borrow pit and construction sites, erosion along the streambank in Peasley Canyon, and runoff from urban and agricultural sources.

MULLEN SLOUGH

Because of its low gradient, only limited areas of suitable spawning gravels were believed to have been historically present. These gravels would have been in areas of upwelling groundwater and above existing anadromous barriers that have long since disappeared.

Today, sedimentation problems believed to originate from nearby agricultural lands and their conversion to light industry continues to plague this stream. The slough suffers from extensive ditching in its lower reaches and can best be characterized as a drainage ditch in this area. Exposed banks are common in both the ravines and valley floor and most likely are a source of turbidity and sedimentation. Sediments in the lower reaches of Mullen Slough have high biological oxygen demand and nutrient concentrations.

WATER QUALITY

MILL CREEK

Mill Creek is designated as a Class A stream by the Washington State Department of Ecology (WDOE). However, water quality has become so degraded throughout the Mill Creek system that it appears on the federal Environmental Protection Agency (EPA) 303(d) list in 1996 and the 1998 (see table Mill-2) candidate list for numerous water quality excursions beyond acceptable limits.

Table Mill-2. EPA Clean Water Act 303(d) 1998 Candidate List Parameters and Locations for Mainstem Green River Tributaries (WRIA 9).		
Stream	**Sampling Location (RM)**	**Parameter**
Springbrook	1.5	Dissolved oxygen
	1.5	Temperature
	0.1	Temperature
	0.1	Dissolved oxygen
Mill Creek	1.4	Temperature
	0.3	Dissolved oxygen
	0.2	Temperature
	0.2	Dissolved oxygen
	1.0	Dissolved oxygen
	2.2	Dissolved oxygen
	2.2	Temperature
Mullen Slough	0.5	Dissolved oxygen
	0.5	Temperature
	1.6	Dissolved oxygen
	1.6	Temperature
Newaukum Creek	5.2	Dissolved oxygen
	10.1	Dissolved oxygen
Soos Creek	1.0	Dissolved oxygen
Little Soosette Creek	3.1	Dissolved oxygen
	3.9	Dissolved oxygen
Little Soos Creek	3.2	Temperature
	4.7	Dissolved oxygen
	10.5	Dissolved oxygen
Gale Creek	0.3	Temperature

Water quality was also cited as a degraded by several studies including the Municipality of Metropolitan Seattle (Metro) Draft Priorities for Water Quality (Metro 1989), and the Mill Creek Water Management Plan (Metro 1993). The sampling station at the mouth of Mill Creek maintained by Metro showed the lowest overall water quality of the 44 sites monitored in the Green River valley (Metro 1989). The stream exhibits water quality degradation through:

- Low dissolved oxygen levels;
- Seasonal high water temperatures;
- Streambank erosion and associated water turbidity; and
- High nutrient concentrations (i.e., phosphorus, nitrate, and ammonia).

WDOE and EPA standards for dissolved oxygen, water temperature, turbidity and fecal coliform bacteria are commonly not met. While fecal coliforms are typically of greater concern as a human health threat, they are an indicator of overall water quality and biological oxygen demand (BOD) (King County 1993).

Additionally, especially associated with storm events, the stream water has elevated levels of heavy metals which exceed state and federal water quality standards (King County 1993).

Seasonal high stream water temperatures are linked to low flows, low water velocity and lack of riparian canopy.

An extreme dissolved oxygen sag has been detected between West Main Street in Auburn and 29th Street NW. Dissolved oxygen levels in this reach drop to as low as 3 mg/l. The minimum dissolved oxygen level for salmonids is considered to be 5 mg/l and the state water quality standard is 8 mg/l. Factors believed to be contributing to these low dissolved oxygen levels include;

- Demand from accumulated organics trapped in the reed canarygrass;
- High BOD from pollutants;
- High benthic demand;
- Low gradient of the stream that results in low reaeration rates; and
- Increased seasonal stream temperatures due to lack of suitable canopy (which has also been identified as the primary factor affecting stream temperatures (King County 1996)).

Water quality degradation from point and non-point pollution sources as well as turbidity caused by land clearing and development has also been identified as requiring corrective action (Auburn et al. 1997).

MULLEN SLOUGH

Mullen Slough exhibits much of the same water quality degradation as Mill Creek. Several water quality studies (Shapiro 1989; King County and Ecology 1993) point to exceedance of state and federal standards for temperature, dissolved oxygen, fecal coliform, turbidity, un-ionized ammonia, and total phosphorous and nitrate. Water quality studies (Shapiro 1989)suggest that heavy metals are in lower concentrations than Mill Creek.

The slough appears on EPA's 1996 303(d) list and the 1998 candidate list for excursions beyond allowable criteria for both dissolved oxygen and water temperature. These temperature and low dissolved oxygen violations occur during seasonal low flows in the late summer in Mullen Slough because:

- It is a low-gradient stream;
- Much of its channel is choked with thick concentrations of reed-canary grass;
- It lacks riparian canopy; and
- Its historical wetlands have been removed.

LAND USE

MILL CREEK

Throughout the western area of this subbasin, increased residential development has removed large tracts of forested areas. Impervious surfaces in the Mill Creek subbasin were estimated at 20 percent in 1986, with total build out predictions of 45 percent in upland areas and 70 percent in lowland areas (Author Unknown 1988). These figures were for total impervious areas and are not reflective of effective impervious areas.

MULLEN SLOUGH

Impervious surfaces are significant in the upper reaches of Mullen Slough.

NON-NATIVE SPECIES

FISH

A single large channel catfish (*Ictalurus spp)* has been captured in Mill Creek (Malcom pers. comm.). Other warmwater fish species, including yellow perch (*Perca fluviatilus*), pumpkinseed sunfish (*Lepomis gibbosus*), goldfish (*Carassius auratus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*) and smallmouth bass (*M. dolomieui*) are found in many of the headwater lakes of this subbasin (Cropp pers. comm.). The lakes that these fish typically inhabit do not have any structures (screens) that would prevent them from migrating out of the lake or being washed out during a period of high flow. Thus, it is assumed that these fish are present in Mill Creek, but their numbers are significantly small enough to not turn up in previous electroshocking surveys, and as such they are not believed to be a limiting factor.

PLANTS

Reed canarygrass (*Phalaris arundinacea*) and Himalayan blackberry (*Rubus procerus*) are abundant throughout this subbasin. King County conducted a mapping project to assess the existing and potential threats of invasive, non-native aquatic plants in King County Lakes during 1994 and 1995. That report, published in 1996 (Walton 1996) examined lakes Dolloff, Geneva and Star in this subbasin, and found Eurasian watermilfoil (*Myriophyllum spicatum*) in Dolloff and Star lakes. However, these are currently outside the geographic distribution of naturally producing salmonid populations and therefore do not have an immediate adverse impact to salmonids. A 1999 survey of Lake Geneva found Purple loosestrife (*Lythrum salicaria*) and reed canarygrass (King County 2000).

HYDROMODIFICATION

MILL CREEK

The historic stream channel of Mill Creek and its tributaries have been significantly altered and constrained in a variety of ways. In some places, they are diverted from the natural channel and placed into straight channels or ditches. Often this was done to meet the needs of landowners so

that the creek would be the defining property boundary line. At other times, channels were altered during road construction to facilitate drainage.

The construction of State Route 167 and the expansion of the associated road network further constricted the ability of Mill Creek to migrate laterally. In the mid 1980s, the reach of Mill Creek from 29th Street N.W. to 37th Street N.W. was relocated parallel to SR 167 to allow construction of the Puget Power Christopher Substation as part of the Mill Creek Restoration (relocation) Plan. The new 100-year flood capacity channel was slightly meandered, and revegetated with shrubs and trees. More recently, the stream reach from 37th Street NW to the north was relocated in a similar fashion to allow a warehouse construction (Finney, pers. comm.).

Mill Creek has at a minimum 21 road crossings that are comprised of a mixture of culvert and bridge types. The construction of State Route 167 resulted in the movement of Mill Creek from its historic channel into its current location.

MULLEN SLOUGH

The entire Mullen Slough has undergone a systematic change from historic uses. Historically these channels and streams are thought to have been important flood storage uses. Today, the upper tributary reaches, ravines, and hillsides have been culverted and channelized by suburban development. Reaches along the valley floor are also heavily channelized, although few road crossings and culverts exist in lower Mullen Slough. The stream channel has three bridge crossings; two at the mouth and one on 277th Avenue.

OFF CHANNEL HABITAT

MILL CREEK

Wetlands temper peak flows by slowly releasing storm waters, protecting vital fish habitat from damages due to erosion and sedimentation.

However, much of Mill Creek's historical wetland complexes have been divided up and drained/ditched to improve agricultural lands or development. As noted in Land Use (above), this subbasin's high level of impervious surfaces causes adverse impacts to streams (Booth 1997).

Approximately 2,400 acres of remaining wetlands were inventoried in 1996/97, and the type and acreage are shown in table Mill-3.

Table Mill-3. Existing Wetland Types and Acreage in Mill Creek Subbasin.	
Wetland Type	**Acreage**
Emergent	1,870
Scrub-shrub	108
Forested	236
Open water	213
Total	2,427
Source: Auburn et al 1997.	

The majority of the forested and open water wetlands are in headwater and hillside areas of the basin. Approximately half of the open water acreage (101 acres) is contained in the four major lakes in this subbasin.

Of the 1,870 acres of emergent wetlands, the majority was in some type of agricultural use in 1996-97. The King County Farmland Preservation Program (KCFPP) preserves approximately 900 of those acres for agricultural purposes only. Approximately 650 of the KCFPP acres contain wetlands. These 650 wetland acres represent the last remaining large tract of land in the entire subbasin that is free of impervious surfaces. It is therefore an important potential area for salmonid stream ecosystem restoration.

MULLEN SLOUGH

For anadromous salmonids, the low-gradient lower river streams such as Mullen Slough were historically more important as over-wintering refugia from flood flows than as suitable spawning habitats. In the larger ecosystem, these streams provided an important tool for anadromous salmonids survival. In addition, palustrine streams like Mullen Slough most likely offered good rearing habitat for anadromous and resident salmonids during all but the driest summer months.

Currently, because of extensive ditching and water diversions, much of the habitat complexity of Mullen Slough is lost and the system can no longer properly function at its historic level of productivity.

FLOODPLAIN CONNECTIVITY

MILL CREEK

Within the Mill Creek subbasin, Auburn et al. (1997) identified 14 corridor wetland sites that were suitable for restoration.

Under current conditions, flooding of this subbasin is strongly influenced by backwater effects of the mainstem Green River, and as a result of locally generated runoff. High flows in the Green River can result in the inundation of up to 900 acres of primarily agricultural land in the Mill Creek and Mullen Slough subbasins (Army Corps of Engineers 1997).

MULLEN SLOUGH

Auburn et al. (1997) identified an additional eight off-corridor wetland sites that were suitable for restoration in the Mill Creek and Mullen Slough subbasins. Flooding in Mullen Slough is caused by either high water levels in the mainstem Green River that cause water to back up the

tributary or as a result of increased surface flows due to increases in impervious surfaces in the subbasin. King County (1996) found that flooding in the backwater sections of Mullen Slough is exacerbated by the increasing volumes and rates of runoff from new development in the subbasin, in both the valley floor and upland slopes.

KEY FINDINGS AND IDENTIFIED HABITAT-LIMITING FACTORS

- Mill Creek continue to support spawning of adult coho salmon and juvenile rearing of coho, cutthroat, steelhead, and to a limited extent chinook. Chinook adults were reported to have been observed in Mill Creek in 1999.

- Mullen Slough most likely supports rearing of coho, cutthroat and steelhead along with some cutthroat trout spawning.

- The remaining riparian habitats are fragmented.

- Some of poorest water quality conditions sampled in the Green/Duwamish River occur in Hill Creek and Mullen Slough.

- Water quality is a significant adverse issue impacting anadromous fish productivity and survival.

- Much of the floodplain area is agricultural and within the Farmland Preservation Program.

- Numerous fish blockages are present from degraded water quality, low-flow barriers, and culverts. Unlike many lower Green tributaries, no flap gates or pumping stations are present at the confluence of Mill Creek or Mullen Slough and the Green River.

- Channel relocations have resulted in a simplification of stream channel configuration that limits diversity.

- Impervious surfaces that exceed 20 percent in Mill Creek contribute significantly to storm-associated flood flows.

- Road-associated culverts block anadromous fish access to significant upstream portions of streams in this chapter.

- There is a significant lack of LWD and associated stream habitat complexity throughout the streams in this subbasin.

- Although no quantifiable information was available, it was the professional judgement of the TAG that flood flows due to increased impervious surfaces limit successful salmonid incubation.

- Degraded water quality, streambed condition, invasive and non-native plant species, lack of a properly functioning riparian buffer, channel complexity, floodplain connectivity, and suitable pool quality and quantity all limit natural salmonid production.

DATA GAPS

- Comprehensive barrier surveys need to be initiated in this subbasin.
- Comprehensive base line riparian habitat and bank condition surveys should be initiated.
- An inventory of LWD should be initiated.
- Very little data was found on Midway Creek.
- Historic channel location information needed.
- Comprehensive review of the effects of non-native plant species (reed canarygrass and Himalayan blackberry) on aquatic biota should be documented.

LIST OF TABLES

Table Mill-1. Summary of Some Pertinent Mill Creek Subbasin Studies.

Table Mill-2. EPA Clean Water Act 303(d) 1998 Candidate List Parameters and Locations for Mainstem Green River Tributaries (WRIA 9).

Table Mill-3. Existing Wetland Types and Acreage in Mill Creek Subbasin.