3.3 SPRINGBROOK CREEK SUBBASIN

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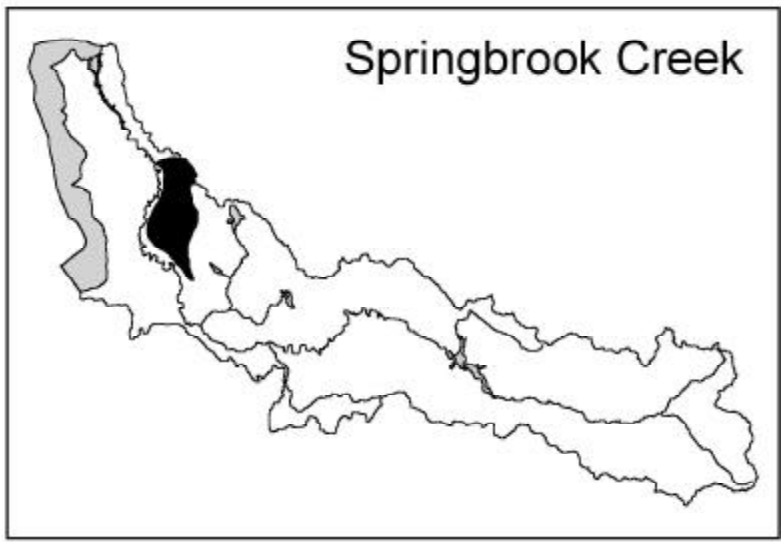

PHYSICAL DESCRIPTION

SUBBASIN

Springbrook Creek (09.0005) Subbasin is located east of the mainstem Green River, in and around the cities of Kent and Renton. The Springbrook Creek subbasin enters the mainstem Green River via the Black River at RM 11.0. With an estimated mainstem stream length of 12.0 miles, and approximately 19.1 miles of tributary streams and 3.8 miles of drainage ditches (Williams 1975), it is the largest subbasin in the lower Green River Basin. Springbrook Creek subbasin drains an area of about 15,763 acres

The basin is comprised of two distinct physical settings. In the eastern half of the subbasin, rolling hills rise to elevations of about 525 feet above the valley floor. In this area, the origins of stream courses are often not well defined. Slopes in the subbasin range from near 0 to 70 percent. One significant lake is present (Panther Lake) along with several smaller ponds and wetlands. 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, with high gradients and generally not accessible to anadromous salmonids

A unique feature to this subbasin in the Black River Pump Station, the details of which will be covered in the Hydromodification section of this chapter. Except where indicated by specific citations, the following descriptions of the Springbrook Subbasin comes from a comprehensive fisheries assessment of the Mill, Garrison and Springbrook Creek system conducted by Harza (1995).

STREAM COURSE AND MORPHOLOGY

Instream potential fish habitats include approximately 5.8 miles within Springbrook Creek, 6.65 miles in Mill Creek, and 5.2 miles in Garrison Creek. The specific habitat types are summarized in table Springbrook-1.

TABLE SPRINGBROOK-1: SUMMARY OF VARIOUS HABITAT TYPES IN THE SPRINGBROOK CREEK SUBBASIN

Habitat Type	Springbrook Creek		Mill Creek		Garrison Creek	
	Length (ft)	Percent	Length (ft)	Percent	Length (ft)	Percent
All Potential Fish Habitat	30,645	100	35,096	100.0	27,456	100.0
Steps	40	< 1	0.5	<1	0	0
Pools	54	<1	627	2	40	<1
Riffles	4,174	13	7,555	22	1,420	5
Glides	0	0	886	3	225	1
Low Gradient Glides	25,304	83	26,023	74	14,488	53
Habitats Not Delineated	1,073	4	0	0	11,283	41

Source: Harza 1995

The western half of the subbasin lies on the valley floor and stream gradients are virtually flat. Mill and Garrison Creeks are the primary tributaries. Both have their origins in the eastern foothills before dropping quickly through the respective steep ravines. The stream labeled by Harza (1995) as the Valley Floor Fork Garrison Creek was depicted by Williams (1975) as Springbrook Creek. In this report we will use the Williams (1975) descriptor and numbering system (09.xxxx). The Garrison Creek subbasin consists of the three forks: North Fork (09.0023), Middle Fork (09.0022) and South Fork (09.0025), and an unnamed tributary to the South Fork (09.0024).

SALMONID USE

The known freshwater distribution of anadromous salmonids is depicted in the report Appendix. Coho salmon, cutthroat trout, and winter steelhead adults have been observed spawning in Springbrook Creek and its tributaries (WDFW Spawning Ground Survey Database., R. Malcom pers. comm.). Juvenile hatchery origin coho salmon have also been released routinely in upper reaches of several tributary streams. Adult chinook have been observed entering the Black River (R. Malcom pers. comm.) and attempting to spawn near the SW 27th Street culvert during the fall of 1997 (P. Schnieder pers. comm.). It is hypothesized that they are exploring this system, but once they enter the Black River via the fish ladder at the Black River pump station there is no mechanism for them to exit.

Juvenile coho, winter steelhead, and cutthroat have been captured at numerous locations throughout the subbasin. (Williams 1975, Harza 1995, R. Malcom pers. comm., P. Schneider pers. comm.). Approximately 17.9 stream miles of potential fish habitat exist within the Springbrook Creek subbasin. Of this amount, approximately 17.2 miles is believed to be accessible to anadromous salmonids (Harza 1995).

FACTORS OF DECLINE

FISH PASSAGE

The most significant fish passage barrier in this system is the presence of the Black River Pump Station. In 1958, the Black River Dam (an earth-filled dam) was completed on the Black River approximately 1,000 feet upstream of its confluence with the Green River. The purpose of this structure was to control outflows from the Black River and prevent flows on the Green River from backing up into the Black River/Springbrook Creek floodplain during floods. Six 48-inch diameter culverts extended through the dam and were fitted with flapgates. In 1972, the U.S. Soil Conservation Service (SCS) (renamed the Natural Resources Conservation Service) replaced the dam with the current Black River Pumping Station (BRPS), to provide a means of releasing flood flows from the Black River/Springbrook Creek system when the Green River is at high stage. The BRPS is currently operated and maintained by King County Surface Water Management.

During flood periods on the Green River, the pumping station acts as a dam, preventing floods from backwatering into the Black River and the wide valley floor of the lower Springbrook Creek subbasin. Water levels downstream of the pumping station range from –4.0 to +21.5 feet MSL, depending on tidal conditions and the water level of the Green River. Water surface elevations upstream of the pumping station are normally held in the range of 0.0 to 2.0 feet, but can reach as high as 13.0 feet. The pumping station consists of a series of eight pumps, and can pass flows of up to 2,945 cfs. Two large pumps with a capacity of approximately 1,028 cfs are also present, but have not yet been used.

The BRPS represents a barrier to upstream passage of salmonids. In addition, the ability to control the water surface elevations upstream of the BRPS often results in situation where the downstream water surface is higher than the upstream water surface. In order to pass upstream and downstream migrating salmonids around the structure, a unique fish passage system has been constructed and is in operation. A combination of a fish ladder and fishway chute is used for upstream passage. Fish migrating downstream are diverted around the pumps using an air-lift pump to raise the fish to the downstream water levels. The general layout of the BRPS and fish passage facilities is illustrated by Figure Pass-11.

UPSTREAM PASSAGE

Upstream passage facilities are located on the south side (left bank) of the pumping station, and consist of a combination fish ladder and fishway chute (Figure Pass-12). The main components of the upstream fish passage facility are a water supply pump, denil fish ladder, a false attraction weir, and a fish way chute. Fish enter the denil fish ladder, swim up and over the false weir and are then returned to the river upstream of the project via the fishway chute.

The denil ladder extends from the downstream pool on the south side of the BRPS approximately 60 feet horizontally and 14 feet vertically to a resting pool below the false weir. From the resting pool, fish enter the second portion of the ladder that extends 25 feet horizontally and seven feet vertically to the top resting pool. The velocity of the 5 cfs flow directed through the ladder is approximately 2.5 to 3.0 feet per second. This velocity is well within the normal range for this

type of ladder and is suitable for adult salmon (Bell 1986). However, these velocities are at the upper limit of sustained swimming speeds for juvenile fish (Bell 1986), and thus likely prevent upstream migration of juvenile fish.

From the top resting pool, fish pass over the false weir and down the fishway chute. The fishway chute drops from approximate elevation 16.0 feet to 2.0 feet, creating a potential vertical drop of 2.0 feet at the end of the chute when the upstream water surface is held at 0.0. The 60 foot long chute is an open channel for the first 10 feet, a closed pipe for 25 feet and ends in an open channel for the final 25 feet. The inside of the chute is coated with vinyl to protect fish from abrasion. Two 30-degree angles in the closed section are used to align the chute parallel to the forebay south (left bank) wingwall.

The upstream passage facility is normally operated from mid-September through 31 January of each year. Before 1993, the upstream passage facility was usually operated 24 hours per day, Monday through Friday. Since 1993, the upstream passage facility has been operated about 24 hours per day, seven days per week, during the seasonal window. The operational window likely precludes the upstream migration of some adult resident and anadromous cutthroat trout and anadromous steelhead.

The species composition of fish migrating upstream was assessed in 1994 by trapping adult fish in a net pen installed in the forebay of the BRPS, immediately below the outflow of the fishway chute (Harza 1995). A total of 229 coho salmon and 14 chinook were trapped between 17 September and 9 December (Harza 1995). Fair coho spawning habitat was noted in some reaches, although the streambed appeared to be unstable and flow levels may have been insufficient for successful spawning (Harza 1995). The facility is not equipped to handle downstream migrating adult steelhead (kelts) or chinook. Adult steelhead and chinook that move upstream past the BRPS cannot exit the Springbrook Creek subbasin, and once there are believed to experience high levels of stress or be killed outright prior to successful spawning (Harza 1995).

DOWNSTREAM PASSAGE

The downstream passage facilities provide a means of transporting juvenile salmonids migrating towards the ocean around the BRPS. The downstream fish passage facility consists of entrance fish ports and associated piping, an air lift system, deaeration tank and transport pipe (Figure Pass-13). Fish travelling through the system enter the downstream passage facility through the fish ports on the upstream side of the dam. The fish are then transported to the air lift system and into the deaeration tank. Fish exit the deaeration tank via a bypass pipe that delivers them to the pool downstream of the dam.

The entrance ports to the system are located at elevation +2.0 and –2.0 on the south wingwall (left bank) and are adjacent to the fish screens for the pumps on the south half of the structure on the south side of the BRPS (Figure Pass-13). The airlift pumps draw flow into the transport pipes, attracting fish to the entrance ports. Fish travelling downstream move across the screens and into the ports. Except for the two large pumps, fish are prevented from entering the pumps by galvanized 0.25-inch mesh screens. To date the large, unscreened pumps have not been used during the late winter or spring (April to June). A visual inspection of the screens in March 2000

provided some concerns that the screens may not meet current screening criteria. The facility was not designed to meet salmonid swimming approach velocities that are now required of facilities under construction.

After entering the fish ports, the fish descend a vertical fiberglass pipe to elevation –17.0 feet, and are then directed towards the airlift through a horizontal collection pipe. As the horizontal pipe passes into the airlift chamber, it turns vertically 90 degrees and descends to elevation –39.0 feet. At this point, the fish go through two more 90 degree elbows, then enter the airlift pump. Air added at –39.0 feet displaces water at the base of the vertical column, lifting the fish to +13.0 feet and into the deaeration tank.

The dimensions of the five-foot deep deaeration tank are 9.5 feet x 9.5 feet. The entrance to the 18-inch diameter fiberglass downstream transport pipe is located at the west end of the tank. This pipe transports fish approximately 108 feet horizontally to the fishway exit. The exit invert pipe is at 10.0 feet elevation, which can vary in height above the receiving water; normally, the drop is approximately 6 feet from the pipe to the receiving water. There is the potential for drops to reach 14 feet under low flow circumstances.

The downstream passage facility is operated from early April to mid-June each year, for approximately eight hours per day, Monday through Friday. Fish attempting to move downstream outside of that operational window are either prevented from exiting the Springbrook Creek subbasin, or must pass through the unscreened large pumps (if operational). Juvenile chinook emerge and begin moving downstream in the middle Green River system and Soos Creek as early as February (J. Kerwin pers obs., Jeanes and Hilgert 2000; Hilgert and Jeanes 1999), thus early downstream migrants may be prevented from exiting the Springbrook Creek subbasin.

The known anadromous fish barriers are summarized in table Springbrook-2. This table likely underestimates the number and types of barriers to anadromous and resident fish because a comprehensive fish barrier assessment has not been initiated for this subbasin.

Table Springbrook-2: Springbrook Creek Subbasin Fish Passage Barriers

Creek Name/Number	**Barrier Type**	**Location**
Springbrook/09.0005	Water quality	Lower reaches
Mill Creek/09.0015	Water quality	Lower reaches
Mill Creek/09.0015	Culvert (unverified concern)	Earthworks Park Detention Pond
Springbrook/09.0005	Culvert	At Talbot Road
S.F. Springbrook/09.0024	Concrete pad & weir	At Talbot Road
Springbrook/09.0005	Diversion	Springbrook trout farm
Springbrook/09.0005	Culverts choked with brush & aquatic vegetation	Throughout creek
M.F. Garrison/09.0022	Braided channel/wetland	Between 212th & 218th
N.F. Garrison/09.0023	Culvert	212th Way

There exists a barrier in the North Fork Garrison Creek at the South 212th Street road crossing. This culvert has a wide concrete chute which is thought to have been designed to distribute flow energy. There is at least a 3.5 foot drop immediately below this chute with no plunge pool present.

The Unnamed tributary (09.0020) Harza (1995) refers to this tributary as Springbrook Creek) has a 2-½-foot step with no plunge pool immediately east of the SR 167 crossing. While not believed to be a blockage to adult salmonids it could prevent instream movement of juvenile salmonids. Between the SR 167 crossing and Talbot Road the creek flows through a private trout farm. These ponds present a migrating barrier for anadromous salmonids for both 09.0020 and a tributary 09.0021.

Several sections of Springbrook Creek are so choked with invasive reed canarygrass and vegetation that they serve as partial barriers. The Springbrook Trout Farm serves as a barrier, under most streamflow situations, to anadromous fish upstream migration. If the bypass reach is dewatered then it would also serve as a barrier to downstream migration. Upstream of the trout farm, Springbrook Creek flows through a 30-foot culvert that is sloped at approximately 100 percent in the vicinity of Talbot Road. On the South Fork Springbrook Creek there is a concrete pad and notched weir that likely is a barrier to upstream and downstream migrating anadromous and resident fish.

Water quality may serve to act as a barrier to anadromous migrating fish in the lower reaches of Mill and Springbrook Creeks.

A culvert in the North Fork Garrison Creek was believed to be impassable in 1993 (Harza 1995). Additionally, those same investigators thought the highly braided channel in the middle Fork Garrison Creek that traversed the wetlands between 212th Way and South 218th Streets may be impassable.

RIPARIAN CONDITION

The riparian habitats in this subbasin range from bare banks to remnant coniferous forest fragments.

In Springbrook Creek, the Black River Pump Station creates a slackwater pond of approximately 3 surface acres. The actual surface acreage is dependent on specific water surface elevations. Riparian vegetation around this pond consists of willow species (*Salix sp.*), Pacific dogwood (*Cornus nuttallii*), cattails (*Typha latifolia*), reed canarygrass (*Phalaris arundinacea*) and red alder (*Alnus rubra*).

As the creek moves upstream out of the inundation reach, the riparian habitat changes slightly to a mixture of red alder, willow species, Himalayan blackberry and sedges (*Carex spp.*) along with some ornamental trees. Conifers are almost exclusively absent and in those areas where shade was absent reed canary grass is abundant. From the 16th Street crossing upstream to the confluence with Mill Creek, Springbrook Creek resembles a drainage ditch with reed canary grass the dominant vegetation with only token numbers of black cottonwood, willow and alder present. Ribbonleaf pondweed (*Potamogeton epihydrous*) was also identified in this reach.

Construction practices observed in the basin in the 1990s indicated vegetation removal to the water's edge.

From the confluence of Mill Creek upstream to the State Route 167 highway crossing the stream more closely resembles a drainage ditch. Reed canarygrass is the dominant riparian vegetation.

Sloughing of the streambank was common in places. From the State Route 167 highway crossing upstream to Talbot Road the stream lost its drainage ditch appearance but still did not have a function riparian zone. A right bank tributary stream at RM 5.2 (09.0020) upstream of the Talbot Road crossing enters an area protected by the City of Renton for municipal water supply. An unnamed tributary (09.0020) flows from a gabion water control structure while the south fork (09.0021) flows from a small reservoir. Harza (1995) labeled these tributaries as north and south forks of Springbrook Creek.

Springbrook Creek continues mostly parallel and adjacent to State Route 167 with reed canarygrass and Himalayan blackberry bushes the dominant riparian habitat. Again, the creek more resembles a drainage ditch used for water conveyance. Red alder was found sporadically throughout this reach with very little instream structure. During the 1993 Harza survey, there were instances of vehicles parked adjacent to the waters edge preventing the establishment of any vegetation.

In summary, riparian habitat within this creek meets the NMFS criteria of not properly functioning and is a limiting factor to natural salmonid production.

In Mill Creek, from its confluence with Springbrook upstream past the West Valley Highway to the East Novac Valley Road, the dominant riparian vegetation was reed-canary grass with minor amounts of red alder and black cottonwood (*Populus trichocarpa*). At some places in this reach, dredging of the creek has created vertical banks and other areas have contoured banks with approximately 4:1 slopes. In many segments, this reach resembles a drainage ditch. Very few riparian trees or shrubs were observed during a habitat survey in 1993.

Mill Creek flows within 5 feet of an apartment complex in the Kent City limits. The primary riparian vegetation consisted of reed canarygrass and a few black cottonwoods. Considerable instream garbage is a problem in the reach near Memorial Park in Kent. It is approximately this point (RM 8.5) that the historic Springbrook Creek as shown in Williams (1975) was diverted into Mill Creek. Because of that diversion we will continue to label this stream as Mill Creek.

Mill Creek flows through the Earthworks Parks Detention Pond (EPDP), a water detention structure that lacks trees, and shrubs. Additional trees were planted in 1994 in an effort to provide riparian habitat. Upstream of the EPDP the character of the stream changes as it enters a forested ravine dominated with red alder and bigleaf maples. Black cottonwood, Douglas fir and western red cedar are also present.

Upstream of the EPDP, the character of the creek changes dramatically as it enters a forested ravine with predominantly red alder and bigleaf maples. There are also black cottonwood, Douglas fir and western red cedar present along with an understory of salmonberry and vine maple. This creek has its origins at an ornamental pond before moving downstream through an open swale upstream of 274th Street.

Garrison Creek is a right bank tributary that enters Springbrook Creek at RM 6.25 and is comprised of three forks (North (09.0023), Middle (09.0022) and South (09.0024)). The South Fork Garrison Creek has one tributary (09.0025) that is accessible to anadromous salmonids.

The lower reaches of Garrison Creek are typical of a drainage ditch with riparian vegetation comprised predominantly of reed canarygrass and Himalayan blackberry plants. Sporadic red alder trees were present during the 1993 Harza survey. Woody vegetation is generally absent in the riparian zone throughout the lower reaches downstream of 88th Avenue South. Upstream of State Route (SR) 167, the Middle Fork Garrison Creek (09.0022) riparian habitat changes slightly as more red alders and Himalayan blackberries are present. The habitat survey conducted by Harza (1995) indicates the presence of a wetland upstream of SR 167. This wetland has a riparian habitat consisting of black cottonwood, red alder, bigleaf maple, pacific willow (*Salix lasiandra*), pacific dogwood (*Cornus nuttallii*), Himalayan blackberry and willow species. An understory of sedge, rush and bulrush species is also present.

Upstream in the reach from SE 218th Street to the confluence of the South Fork there have been several attempts at streambank restoration, including planting of non-native deciduous trees. Investigators involved in the Harza (1995) survey thought most of the attempts to be ineffective at that time.

The creek flows from the foothills through a relatively short steep gradient ravine vegetated with older bigleaf maple, red alder, black cottonwood, Douglas fir and western hemlock. Streamside canopy cover was estimated at 90 percent in 1993.

The North Fork Garrison Creek (09.0023) has a riparian vegetation zone consisting of red alder and bigleaf maple with an understory of salmonberry and blue elderberry (*Sambucus cerulea*). Streamside shade was estimated at 80 percent.

The South Fork Garrison Creek (09.0024) and an unnamed tributary (09.0025) share a high gradient shot ravine with a riparian zone vegetated by older bigleaf maple, red alder, black cottonwood, Douglas fir and western hemlock. Streamside shade in these tributaries was estimated at near 100 percent.

LARGE WOODY DEBRIS

In Springbrook Creek, the area parallel and adjacent to State Route 167 the instream substrate consists exclusively of silts and contains no LWD.

Once Mill Creek enters the forested ravine upstream of the EPDP, LWD is present in this upper reach but has not been inventoried or measured. This LWD is believed to have been deciduous tree in origin and less than 50 years old. However, it is responsible for adding channel complexity, creating pools and sorting of sands and gravels. LWD is absent from the area near EPD as well as the lower reaches of the creek.

LWD is present in Garrison Creek, upstream of the confluence with the South Fork Garrison Creek and is thought to help sort sediments. In the South Fork Garrison Creek, upstream in the reach from SE 218th Street to the confluence of the South Fork, LWD (conifer logs) and boulder clusters is present due to streambank restoration projects. LWD is present in the North Fork Garrison Creek upstream from its mouth but has not been inventoried or measured.

HYDROLOGY

Springbrook Creek flow has an annual yield of about 40 cfs.

Bortz (1981) concluded that the most serious condition existing in these streams was the extreme volumes of water associated with storm events. Harza (1995) reported that water quantity responded quickly after each storm event. Hydrographs indicated that the creek stage decreased after the conclusion of each storm event. This is typical of streams in urban areas that have relatively high impervious surface areas. In stream systems that have greater permeable surface areas, flow stage decreases more slowly thus allowing for a more efficient utilization by fish and other aquatic organisms of the increased instream flows (Lucchetti and Furstenberg 1992).

There currently are two US Geological Survey (USGS) stream gages in this subbasin. USGS gage number 12113346 is located in Garrison Creek and 12113349 is in Mill Creek. Together, Mill and Hill creeks drain approximately 14.5 square miles (~60 percent of the subbasin). Based on the most recent 5 years for water years 1995 through 1999 the combined annual yields for these two tributaries is approximately 29 cfs. The one-day average annual minima/maxima for the same time period and combined gage records is approximately 3.1 cfs with the individual tributaries average annual minima between 1 and 1.5 cfs. The Garrison Creek system, which is smaller than the Hill Creek system produces more annual yield (Burkey pers comm). Because of stream gage location, these analyses do not include the lower 40 percent of Springbrook Creek subbasin.

SEDIMENT CONDITION

As previously stated in the hydrology section, Bortz (1981) observed that extreme volumes of water associated with storm events caused streambank erosion, scouring and siltation in the three creeks. Harza (1995) found evidence of severe downcutting in Mill and Garrison Creeks and low to moderate downcutting in Springbrook Creek.

It is likely that construction practices observed in the basin in the 1990s which removed vegetation to the water's edge was a significant contributor to sediment entering Springbrook Creek. [Location is ambiguous. See Draft original page 2 Riparian Habitats, Springbrook Creek, paragraph 4.] The lower reaches of Springbrook Creek are in the slack water pond behind the BRPS and upstream as far as the SR 167 crossing the instream substrate consists exclusively of silts.

The upper reaches of Mill Creek have been extensively modified. According to anecdotal information, the historic upper reaches of Mill Creek used to flow through a gravel bedded channel. The headwaters are now a poorly channelized swale as the result of excavation and backfilling in an historic riparian wetland. Once Mill Creek enters the forested ravine upstream of the Earthworks Parks Detention Pond, there are patches of gravel suitable for spawning present. The first evidence of sands is seen in the vicinity of the EPDP. The lower reaches of Mill Creek are typical of low-gradient streams and are composed primarily of silt. Also in this reach, instream garbage increases. Bank erosion is present where Mill Creek flows within 5 feet of an apartment complex in the Kent City limits.

The North Fork Garrison Creek upstream from its mouth has numerous small and large boulders present, apparently recruited from streambanks. Gravel patches, while not plentiful were present.Those streambanks without large boulders present showed numerous signs of erosion in the 1993 habitat survey.

On Garrison Creek, as the stream gradient increased upstream in the vicinity of SE 218th Street, the streambed substrate was comprised of primarily gravel with some silt, sand and cobbles. upstream of the confluence with the South Fork Garrison Creek had increasing amounts of gravel with some cobble and boulders. The streambanks are comprised of highly erodible alluvial soils consisting of sand and gravel. Once Garrison Creek enters the ravine, the instream substrate was predominantly gravel, cobble and boulders. There were signs of erosion in this ravine during a 1993 habitat survey. The lower reaches of Garrison Creek are comprised of silts and fine sands typical of low-gradient streams and the drainage ditch that it resembles.

The South Fork Garrison Creek instream substrate is very different from the other forks of Garrison Creek. The stream substrate is a mixture of cobble, boulder and bedrock and significant portions of the streambank were observed to have eroded in the 1993 habitat survey. Investigators from Harza (1995) observed several rock gabions in the canyon. A pipe from the top of the ravine led into these gabions and they were possibly being used as erosion protection.

WATER QUALITY

Water quality within the Springbrook subbasin has been the subject of several intensive studies. Those studies and their focus area are shown in table Springbrook-3.

Table Springbrook-3: Water Quality Studies of the Springbrook Subbasin

Investigator (Date)	Study Title	Focus Subject
Renton (1993)	Black River basin water quality management plan	Water quality, erosion and sedimentation
Parametrix (1992)	Mill Creek erosion control project	Water quality in upper Mill Ck. And literature review
Herrara (1990)	City of Kent Water Quality Assessment	Water quality
Parametrix (1990)	Mill Creek water quality monitoring report	Water quality
Wilsey and Ham (1972)	Mill Creek answer book	Water quality
Entranco (1992)	Garrison Creek wetland/erosion control facilities	Water quality and erosion
Resource Planning Associates and Herrara (1991)	City of Kent water quality program 1992-1996	Water quality
Bortz (1981)	Streambed, habitat, beneficial use and recommendations towards enhancement of Kent stream ecosystems	Water quality

These studies are important in that many report similar water quality parameter concerns (table Springbrook-4). Concentrations of metals that acutely affect salmonids differ according to site specific water chemistry parameters. Copper has been demonstrated to have adverse impacts on rainbow trout and chinook fry at 20 and 18 ug/liter respectively. Lead has been demonstrated

to have adverse impacts to salmonids at levels <20 ug/liter while zinc levels at 10, 9 and 103 ug/liter adversely impact 7 gram rainbow trout, cutthroat trout and chinook fry respectively.

Table Springbrook-4: Reported Concentrations of Metals of Concern in the Springbrook Creek Subbasin

Metal	Water Body	Concentration (ug/liter)	Flow Conditions	Reference
Copper	Springbrook Ck.	2.7 – 3.9	base flow	Renton 1993
Copper	Springbrook Ck.	10.8 – 11.3	Storm flow	Renton 1993
Copper	Springbrook	5.0	NA	Harza 1995
Copper	Mill Creek	4.0 – 12.0	Storm flow	Parametrix 1990
Copper	Mill Creek	(1)	NA	Bortz 1981
Lead	Springbrook Ck.	0.5 – 0.7	Base flow	Renton 1993
Lead	Springbrook Ck.	8.1 – 11.7	Storm flow	Renton 1993
Lead	Mill Creek	2.0 – 14.0	Storm flow	Parametrix 1990
Lead	Springbrook Ck.	2.7	NA	Harza 1995
Lead	Mill Creek	(1)	NA	Bortz 1981
Zinc	Springbrook Ck.	117.0 – 154.0	Base flow	Renton 1993
Zinc	Mill Creek	19.0 – 88.0	Storm flow	Parametrix 1990
Zinc	Mill Creek	1560.0	Base flow	Bortz 1981
Zinc	Springbrook Ck.	32	NA	Harza 1995
Cadmium	Mill Creek	< detection limit	NA	Parametrix 1990
Cadmium	Mill Creek	(1)	NA	Bortz 1981
Chromium	Mill Creek	(1)	NA	Bortz 1981

(1) State water quality parameters were exceeded but no values provided.

One of the single most important environmental variables influencing the reproductive success of salmonids is water quality. Poor water quality may be responsible for direct mortality or indirectly impact adult salmonids through increasing metabolic demands.

The Springbrook Creek subbasin appears on the EPA Clean Water Act 1996 and 1998 303(d) lists for water quality violations (Table xxx NOTE: This table will be included at a later date) for high temperature and low dissolved oxygen levels at multiple locations low in the subbasin. Low dissolved oxygen levels have been reported by numerous sources at sampling locations throughout the subbasin and appear to be a chronic seasonal occurrence. These water quality violations are believed to be the result of low water flows, lack of adequate riparian vegetation and shade, point and non-point pollution sources (Harza 1995). Low dissolved oxygen levels in water decreases the swimming stamina and respiratory efficiency in fall chinook salmon when levels are below 5 mg/l (Smith et. al 1971).

The presence of heavy toxic metals is thought to work synergistically with other water quality environmental stresses to further compromise fish health. A low pH in water results in an increase in the amount of metal ions in solution. This in turn increases the potential for juvenile and adult salmonids to be adversely affected by the toxic effects of these heavy metals.

During 1994, adult chinook salmon entered the BRPS between September 17 and October 22. Water temperatures during this same time period were as high as 19.5 C at the Mill Creek USGS gage and 20.2 C at the BRPS location. At the same time, the dissolved oxygen levels at the Mill Creek gage averaged 4.5 mg/l with a range from 0.9 mg/l to 10.1 mg/l. Temperature, dissolved

oxygen and percent saturation levels at the lower levels of this rangeare lethal to adult chinook salmon, juvenile coho, cutthroat and steelhead (Piper et al 1982).

In 1994, coho salmon that entered the Springbrook Creek subbasin before October 26 would have faced similar lethal water quality issues as chinook. It was only after the first large storm of the season that year that most water quality parameters began to improve. However, Parametrix (1990) suggested that concentrations of heavy metals in Mill Creek increase during the first storm event after a dry period. The rapid influx of heavy metals at this time would almost certainly have placed these adult coho under additional stress and compromised their reproductive success.

Investigators in the 1993 Harza habitat survey noted dead trees and shrubs on both sides of Mill Creek in the vicinity of the West Valley Highway and South 204th Street. A culvert with a reddish discharge was observed entering Mill Creek immediately upstream of the area of dead trees. Subterranean iron was also observed upwelling in Mill Creek immediately downstream of 76th Avenue South.

LAND USE

No information.

NON-NATIVE SPECIES

ANIMALS

Eight species of fish were captured during the 1993 Harza habitat surveys. Pumpkinseed sunfish (*Lepomis gibbosus*) were the only non-native species identified. A total of 26 pumpkinseed sunfish were captured, of which 25 were captured in Mill Creek and 1 in Springbrook (downstream of the confluence with Mill Creek). Pumpkinseed sunfish are also reported to be present in the detention pond in upper Mill Creek in the vicinity of 104th Avenue SE.

PLANTS

Reed canarygrass (*Phalaris arundinacea*) is abundant throughout this subbasin and was historically removed by dredging. Although it can provide some streambank erosion protection functions, it generally affords minimal fish habitat and prevents native shrubs and trees from becoming established in the riparian habitat zone.

Private property owners have planted riparian areas in non-native species of maple, willow and cherry trees in limited sections of the Middle Fork Garrison Creek.

Japanese knotweed (*Polygonum cuspidatum*), an aggressive non-native weed that spreads rapidly in moist environments, was found in a wetland associated with Springbrook Creek between Highway 167 and Talbot Road.

HYDROMODIFICATION

The entire Springbrook Creek subbasin has been adversely impacted by floodplain modifications. The most significant of which is the Black River Pump Station. BRPS initially

consisted of an earthen dam constructed in 1958. The dam was located on the Black River approximately 1,000 feet upstream of the confluence with the Green River and designed to control outflows from the Black River and prevent flows on the Green River from backing up into the Black River/Springbrook Creek floodplain during periods of high water. In 1972, the U.S. Soil Conservation Service (SCS) replaced the dam with the BRPS, to provide a means of releasing flood flows from the Black River/Springbrook Creek system when the Green River is at high flows. Currently, the BRPS is operated and maintained by King County Surface Water Management.

During flood periods on the Green River, the pumping station acts as a dam, preventing water from backing upstream into the Black River and the wide valley floor of the lower Springbrook Creek subbasin. Water levels downstream of the pumping station range from –4.0 to +21.5 feet MSL, depending on tidal conditions and the water level of the Green River. Water surface elevations upstream of the pumping station are normally held in the range of 0.0 to 2.0 feet, but can reach as high as 13.0 feet. The pumping station consists of a series of eight pumps, and are designed to pass flows of up to 2,945 cfs. Two large pumps with a capacity of approximately 1,028 cfs are also present, but have not yet been brought on line.

The BRPS represents a barrier to the upstream passage of salmonids. In addition, the ability to control the water surface elevations upstream of the BRPS often results in situation where the downstream water surface is higher than the upstream water surface. In order to pass upstream and downstream migrating salmonids around the structure, a unique fish passage system has been constructed and is in operation. A combination of a fish ladder and fishway chute are used for upstream passage. Fish migrating downstream are diverted around the pumps using an air lift pump to raise the fish to the downstream water levels. The general layout of the BRPS and fish passage facilities are illustrated by Figure Pass-11.

The upper reaches of Springbrook Creek shown in Williams (1975) have been diverted into Mill Creek (09.0015). The date and reason for this diversion are not clear to individuals involved in this report.

OFF CHANNEL HABITAT

Information describing the current or historic extent of the floodplain in the Springbrook Creek subbasin is scarce, and it is unknown whether channelization, bank armoring or disconnection of off-channel habitats have influenced off-channel habitat connectivity.

No information was made available during the course of this report to assess either the historic or existing extent or condition of off-channel habitat in the Springbrook Creek subbasin.

FLOODPLAIN CONNECTIVITY

The Springbrook Creek subbasin is isolated from the Green River floodplain by the Black River Pump Station discussed previously in this chapter. While there was no direct information provided during this report, it is evident that the creeks in this subbasin have undergone extensive alterations to their historic stream channels by their drainage ditch appearance, right angle turns along property lines and straight channel lines.

KEY FINDINGS AND IDENTIFIED HABITAT-LIMITING FACTORS

- Historically, it is believed that these creeks were important areas of refugia to anadromous salmonids that reared year round in the Green River basin.

- Water quality is degraded throughout much of this subbasin.

- There is no functioning riparian habitat throughout the lower reaches of Mill and Springbrook Creeks. This absence of this habitat contributes to the lack stream channel diversity, complexity and ultimately successful salmonid rearing capabilities.

- The Black River Pump Station is a partial fish passage barrier and does not meet current fish screening criteria. Adult salmonids that migrate upstream of this structure cannot migrate back into the mainstem Green River because of facility design.

- There are several known barriers to adult salmonid fish passage in Springbrook, Mill and Garrison Creeks. Some of these barriers are seasonal and/or dependent on annual precipitation patterns.

- Degraded water quality throughout the lower reaches of Springbrook and Mill Creeks adversely impact adult chinook and coho reproductive success along with coho, cutthroat and steelhead juvenile survival.

DATA GAPS

- No information was available during the course of this report to assess either the historic or existing extent or condition of off-channel habitat in the Springbrook Creek subbasin.

- The extent to which plant and animal non-native species are impacting salmonid survival is not fully understood. A comprehensive assessment of non-native species needs to be initiated, completed and action plan developed.

- The diversion of the upper reach of Springbrook Creek into Mill Creek appears to occur in the vicinity of downtown Kent. Information was not readily available regarding the diversion method which could be a barrier to upstream access.

- There was no land use information easily accessible for use in this report.

EARLY ACTION RECOMMENSATIONS

- Conduct a comprehensive fish barrier survey to determine the full extent of lost habitats

- A quantitative baseline habitat inventory needs to be undertaken.

LIST OF TABLES