

DUWAMISH BASIN

Water Resource Inventory Area 09

The Duwamish drainage contains a single large river system, the Green-Duwamish River. The lower 10 miles, between Tukwila and the river's confluence with Puget Sound in Elliott Bay, is known as the Duwamish River. In addition to the Green River system, five much smaller drainages offer streams entering Puget Sound independently. These include Longfellow Creek entering Elliott Bay near the mouth of the Duwamish, and Miller, Bow Lake, Joes, and one unnamed creek entering Puget Sound's East Passage between Alki Point and Dash Point. There are 367 identified streams in the Green-Duwamish basin providing over 643 lineal miles of drainages.

The Green River originates in the high Cascade Mountains nearly 30 miles northeast of Mount Rainier. From the vicinity of Blowout Mountain and Snowshoe Butte, this river flows generally west and northwest for some 25 miles through mostly narrow valleyed, steep sloped, densely forested terrain, before encountering more gentle slopes and broader valley conditions. Flowing through this upper, rugged and moderately steep gradient area, the Green receives tributary flow from Sunday, Sawmill, Champion, Smay, and Charlie creeks, as well as from the North Fork

Green River. Immediately below the North Fork confluence, at approximately river mile 53, is Howard Hanson Dam. Approximately 3 miles below the dam, the City of Tacoma maintains municipal water supply diversion facilities. This area represents the upper limit for anadromous fish migration. Below here the gradient is moderately steep as the river winds its way between narrow, steep sloped valley walls of heavily forested mountain terrain. This condition prevails some 25 miles downstream at which point the Green emerges from the Gorge near Flaming Geyser Park. Below here the river meanders over the more gentle gradient of the broad valley floor with this area being characterized by considerable expanses of open farm land with occasional thickets of mixed conifer and deciduous growth. These stream and valley characteristics continue for approximately 10 miles downstream with some of the Green's more important tributaries including Newaukum, Spade (Crisp), Burns, and Soos creeks entering in this section. Below river mile 26 the Green River maintains the meandering character with the surrounding valley experiencing urbanization and industrialization that is rapidly replacing the farm land character. Near Kent the stream gradient diminishes considerably with



PHOTO 09-1. Mouth of Duwamish River (right side) surrounded by industrialization.

the remainder of the Green-Duwamish exhibiting slow flows. Here the stream banks are contained by extensive diking and channelizing. The lower 10 miles of Duwamish River is surrounded by extensive industrialization.



PHOTO 09-2. Lower Green River near Auburn.

The five independent basin drainages are all relatively short in length and each experiences considerable periods of low or intermittent flow. Longfellow Creek, entering Elliott Bay near the mouth of the Duwamish, contains a moderate gradient throughout its length. Miller, Bow Lake, Joes, and one unnamed tributary each flow over moderately steep terrain just prior to their confluence with Puget Sound. Although these independent streams provide only limited spawning and rearing area for anadromous or resident fish, their run-off is quite important, contributing to the specific ecological make-up of estuarine and marine habitats near their mouths.



PHOTO 09-3. The middle reaches of the Green River provide excellent chinook spawning habitat.

Fish Inventory and Distribution

Three Pacific salmon species inhabit the Green-Duwamish basin; chinook, coho, and chum. Anadromous game fish using these waters include steelhead, sea-run cutthroat trout, and dolly varden. These anadromous fish migrate, spawn, and rear in approximately 125 miles of river and streams in this basin. While the Green River receives good runs of these anadromous fishes, the smaller independent streams, because of their size and intermittent flow characteristics, receive only limited numbers of coho or chum salmon and cutthroat trout. Although odd year runs of pink salmon once utilized the Green-Duwamish basin, they have been extinct here since the mid-1930's.

Chinook Salmon — The chinook salmon populating the Green River system are principally of the fall variety, as distinguished from spring or summer chinook races. Although springs and summers do utilize the system, spawning principally in the upper gorge area, their total number is believed to be quite limited.

In the Green River chinook salmon spawning occurs over some 33 miles of river, from the City of Tacoma diversion downstream to the vicinity of Kent. The upper 13 miles is distinguished mainly as canyon area with the stream bed being moderately steep and containing numerous cascade sections. However, between cascade areas exist considerable patch and riffle type gravel plus many deep and slow moving pools. These combine to provide relatively good spawning and rearing character despite the ruggedness of the area. The most intensive chinook spawning occurs below Green River Gorge, beginning near Flaming Geyser Park and continuing downstream some 19 miles to the vicinity of Auburn. This section is characterized by extensive gravel bars, long pools and riffles, and considerable channel splitting, all serving to produce excellent spawning and rearing habitat for the chinook. Below Auburn, due to a flatter gradient and reduced velocities, only occasional spawning riffles exist.

Green River tributaries inhabited by chinook include Newaukum and Soos creeks. Occasionally small numbers of chinook are observed in Burns Creek; however, this is not a typical chinook stream.

Juvenile chinook salmon are known to rear in the entire accessible length of the Green River and in those tributaries utilized by spawning adults. Much early rearing also takes place in the basin's estuarine waters with the lower Duwamish and Elliott Bay being extremely important and critical areas.

Adult chinook have been recorded in the Green River as early as late May (Table 09-1). The early adult migrants undoubtedly constitute the small spring or summer chinook segments destined to utilize the upper river areas. Fall chinook enter beginning in late June or early July, with spawning extending from late September into November. Following egg incubation and subsequent fry emergence from the gravel, the juvenile fall chinook characteristically remain in the river about three months before migrating seaward. The spring chinook juveniles remain in the system for one year prior to their seaward migration which usually occurs between early April and mid-July, corresponding with the normally high spring run-off flows.

Based on extensive spawning ground surveys and associated tagging and recovery programs, the assessed total chinook salmon escapement to this stream has ranged from



PHOTO 09-4. Chinook spawning in the Green River. The lighter areas are individual redds or nests.

10,900 to 20,200 fish for the period 1966 to 1971, averaging about 15,100 fish annually. Chinook plants from the Green River hatchery, located on Soos Creek, have returned as many as 31,729 adults to its rack since 1960; however, the average return for a 6-year period of 1966-1971 amounts to 8,500 fish per year.

Coho Salmon — Virtually all accessible streams and tributaries draining the Green-Duwamish basin are utilized by coho salmon. In addition some coho spawning occurs in the mainstem Green River, particularly in the gorge area. Also, spawning coho have been observed in the mainstem Green near Burn's Creek, utilizing divided channel areas where smaller stream courses create more suitable coho spawning conditions.

Some of the more important Green River tributaries maintaining coho runs include Newaukum, Spade (Crisp), Burns, Soos, Spring Brook, and Hill creeks.

Coho spawning in independent basin drainages is generally restricted by limitations of accessibility and suitability of spawning material. For those streams draining into East Passage some area is available for coho use; however, the present spawning escapement magnitude is unknown.

Juvenile coho rear throughout the accessible length of the Green-Duwamish River system and in each of the basin drainages utilized by spawning adults. Additional rearing occurs in the highly important estuarine and marine waters.

Adult coho have been recorded in the Green River system in early August with the run continuing into January. Spawning commences in some areas early in November and continues into late January in some tributaries.

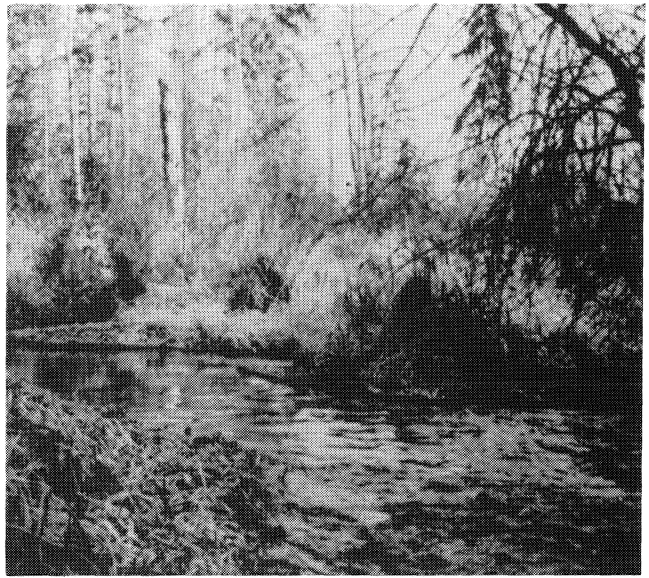


PHOTO 09-5. Lowland tributaries of the Green River are heavily utilized by coho. (Newaukum Creek)

Timing of salmon fresh-water life phases in Green-Duwamish Basin WRIA 09

Species	Fresh-water Life Phase	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
Summer-Fall Chinook	Upstream migration												
	Spawning												
	Intragravel develop.												
	Juvenile rearing												
	Juv. out migration												
Coho	Upstream migration												
	Spawning												
	Intragravel develop.												
	Juvenile rearing												
	Juv. out migration												
Chum	Upstream migration												
	Spawning												
	Intragravel develop.												
	Juvenile rearing												
	Juv. out migration												

Following egg incubation and subsequent fry emergence the juvenile coho characteristically remain in the system for one year prior to their seaward migration. This migration generally occurs between mid-April and mid-July, coinciding with the normal high flows of the spring run-off. The same general timing pattern is expected for the coho utilizing the independent basin drainages.

Based on spawning ground observations, and on extensive fish marking programs, it is estimated that total coho spawning escapements (natural plus artificial) to the Green-Duwamish River system have ranged from 15,900 to 64,000 for the period 1966 to 1971, averaging about 43,500 fish per year. In addition to natural spawning, the Washington State Department of Fisheries hatchery on Soos Creek has received as many as 55,868 coho during a single season of that time period. Only limited survey data is available for the independent basin drainages; however, it is expected that their combined annual coho escapement averages about 200 fish per year.

Chum Salmon — Nearly all basin drainages receive chum salmon. In the mainstem Green River spawning chum have been observed at various points along the stretch from Green River Gorge downstream to the vicinity of Kent. These fish utilize principally the channel split areas and the slower velocity riffle sections. Green River tributaries receiving chum salmon include Newaukum, Spade (Crisp), Burns, Soos, Spring Brook, and Hill Creeks. The independent basin drainages entering East Passage are suspected to receive small chum escapements annually.

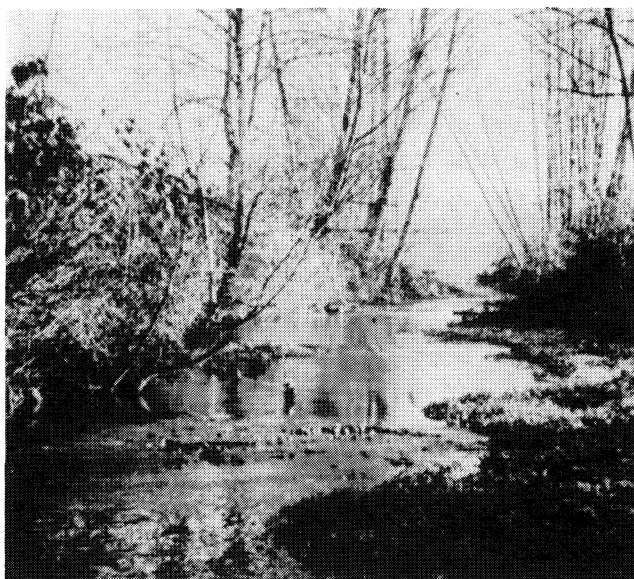


PHOTO 09-6. Seemingly inconsequential streams often support good runs of chum salmon. (Crisp Creek)

The juvenile chum salmon begin their seaward migration soon after emerging from the gravel, making the mainstem portion of the Green-Duwamish River exceedingly important to the fish's early fresh-water rearing period. The lower 6 to 8 miles of Duwamish River serves as the transition zone where the chum fry must acclimate themselves to salt water. Also extremely important to the early rearing are the brackish estuarine waters of the Duwamish waterway and the marine environment of Elliott Bay.

Adult chum salmon begin entering the Green-Duwamish River in mid-September and continue into January. Spawning commences about mid-November and continues in some areas until late January. Soon after emerging from the gravel the juveniles begin their seaward migration, completing this fresh-water phase by mid-July. In this system seaward migration of young chum extends over a relatively long period of time beginning in early to mid-February and continuing for approximately 5 months.

Based principally on spawning ground survey information, it is estimated that chum salmon spawning escapements to the basin have ranged from about 4,400 to 22,100 fish for the period 1966 to 1971, averaging about 11,300 per year for that time period. Within this period the general trend has been for reduced chum escapements throughout the entire eastern Pacific Ocean rim. It is expected that chum salmon escapements to this basin may have exceeded 25,000 adults in past escapement years, and hopefully future runs may again attain this abundance. In addition to natural spawning escapement, the Washington Department of Fisheries hatchery on Soos Creek occasionally propagates this species. The basin drainages entering Puget Sound independent of the Duwamish River are believed to receive a combined spawning escapement of about 300 chum annually.

Salmon Production

A six-year base period, 1966 through 1971, has been selected for the presentation of all salmon production figures. This span of years is used for both naturally and artificially produced fish, as well as escapement and harvest figures.

TABLE 09-2. Salmon Escapement Level for the Green River Basin WRIA 09.

Species	1966-1971 Escapements ¹	
	Range	Average
Chinook	10,900—20,200	15,200
Coho	15,900—64,000	43,500
Chum	4,400—22,100	11,300

Natural Escapement Potential

Chinook	8,000
Coho	7,500
Chum	25,000

¹ Includes natural plus artificial combined escapements.

The total production from all species of salmon in the Green River basin provides over 220,000 salmon annually (1966-1971) to the various sport and commercial fisheries in Washington. In an average year approximately 70,000 adult salmon return to spawn in the Green River drainage, of which over 24,200 spawn naturally and 8,500 chinook and 37,300 coho provide the artificial stock (Table 09-2).

The Washington Department of Fisheries maintains and operates the Green River Salmon Hatchery near Auburn.

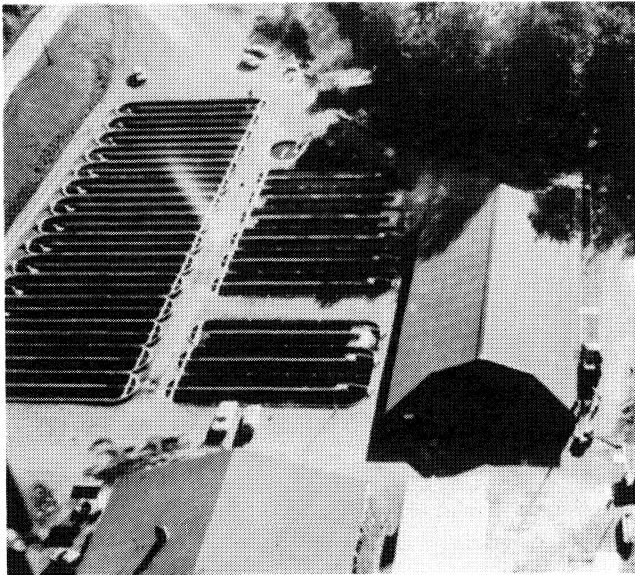


PHOTO 09-7. Sooes Creek Hatchery built in 1901 is one of the more successful artificial production stations.

This 37.5 standard pond equivalent¹ station, served by the waters of Soos Creek, has a capacity of about 81,000 lbs.² Hatching capacity is approximately 16,600,000 salmon fry. The present rearing capacity is about 3,600,000 yearling and 10,800,000 fingerling salmon. Pond construction and modification will raise the capacity to 130,000 lbs. by 1976. The principal species handled at this station are fall chinook and coho salmon, although occasionally some chum are taken for propagation.

For the period 1966 to 1971, chinook returns to the Soos Creek rack ranged from 5,038 to 12,021 adults, averaging 8,487 annually. Coho rack counts ranged from 12,736 to 55,868, averaging 37,326 spawners annually.

The majority of fish produced at the Green River Station are released directly to the Green-Duwamish basin waters; however, large numbers of juvenile fish are often transported to other basins where they are released to supplement existing runs or to introduce new populations to a particular stretch of river (Table 09-3).

For the period 1966 to 1971 a total of 24,918,000 chinook and 8,302,000 coho were planted in the Green River watershed. Average annual plants over the six-year time period for the major species are 4,044,000 chinook and 1,383,000 coho. In 1971 there were 4,864,700 juvenile chinook (36,300 lbs.) and 2,823,500 juvenile coho (77,800 lbs.) released from this station. The majority of chinook fingerlings were planted in the Stillaguamish, Snohomish, Green, Lake Washington, and Nisqually watersheds. Coho were planted in the Snohomish and Green river watersheds.

Preliminary information from commercial and sport catch statistics indicate that the present planting program in the Green River system contributes approximately 215,000 chinook and 347,000 coho to these fisheries annually.

¹ One standard pond is equivalent to 2400 cu. ft.

² The average weight of juvenile salmon when released from hatcheries is 20 coho/lb. and 125 chinook/lb.

Harvest

The question of Indian fishing rights has been contested for many years, and adjudication now in progress may cause significant alterations in both fishing patterns and distribution of catch.

Salmon produced or reared in the Green-Duwamish basin contribute to U.S. and Canadian, Pacific Ocean sport and commercial fisheries, to various Indian fisheries, and to sport and commercial fisheries existing through the Strait of Juan de Fuca and down into Puget Sound. Some sport harvest also occurs within the Green River proper. The estimated total contribution (all species) to these fisheries has, in recent years, ranged from 109,700 to 321,000 salmon.

The basin's marine waters support a very light commercial fishery for salmon. The operation of such a fishery is difficult in this area because of the heavy concentration of shipping traffic, especially in Elliott Bay.

Sport angling for salmon in salt water is very popular in the basin, with Elliott Bay being the favorite area for most fishermen. The proximity to metropolitan Seattle, the numerous access areas close by, and the excellent return of salmon to the Green-Duwamish River all serve to promote an intense sport fishery from late summer well into winter months. Records indicate that in excess of 60,000 angler trips have occurred annually in Elliott Bay alone in recent years.

Fresh water salmon angling in the basin is permitted in the Duwamish and Green rivers. The Duwamish is open the entire year below the First Avenue South bridge in Seattle, and catches in this area are not separated from salt-water catches in Puget Sound. In addition to the normal daytime fishing effort, the Duwamish has a unique night sport fishery for chinook salmon. This fishery employs unique angling techniques and appears to be gaining more enthusiasts each year. The remainder of the river is open for jack salmon³ angling during July through mid-November. Catches made in this area are combined with those of the Green River. The Green is open downstream from the East Valley Highway bridge for jack salmon only during July through mid-November. Totally, 30 miles of the Green-Duwamish system are open to salmon angling. The reported average annual catch from 1964 to 1966 was 270 salmon, with more than 4,074 reported in 1968. The 1966-1971 average was 1,988 salmon.

Limiting Factors

Limiting factors refer to conditions that lead to a complete loss or reduction of the environment's fish producing potential, excluding harvest. Industrial and urban development of the lower Green-Duwamish River area are the most significant factors affecting the fishery resources of the basin. Water quality and suitability of the environment for fish production have been and are continuing to be degraded. Pollution, removal of natural cover, and changes in the streams' natural pool-riffle character are the principal factors associated with these developments.

Stream flow — Seasonal flooding is a problem in the Green basin with the areas of heaviest impact lying between Auburn and the Green River Canyon upstream. These floods often shift streambed materials and destroy spawning areas.

³ Not less than 10 inches nor more than 24 inches in length.

Another very significant development affecting fish populations is control of Green River flows through the operation of Howard Hanson Dam, plus the control associated with the City of Tacoma diversion dam. Flow releases to the river below are quite often too little to alleviate poor water quality conditions existing in the lower Duwamish and sometimes are too low to provide adequate adult salmon transportation water and sufficient juvenile rearing area. Most tributary streams in the Kent and Auburn areas also exhibit low summer flows especially during August and September when some may go dry.



PHOTO 09-8. Anadromous fish are blocked at R.M. 61.0 on the Green River by the City of Tacoma diversion dam.

Physical barriers — A water storage and diversion complex on the upper Green River serves as a total block to anadromous fish migration. The City of Tacoma operates a diversion dam at river mile 61.0 near Kanasket, while the Corps of Engineers maintains and operates Howard Hanson Dam for water storage purposes approximately 3.5 miles further upstream. A total of 16 miles of moderately good river exists above the reservoir with an additional 15 miles of tributary streams.

Natural barriers such as debris jams and beaver activity occasionally block some of the smaller tributary streams. Such blockages are most critical during low flow periods.

Water quality — Poor water quality conditions exist in the lower stretches of the Duwamish River, particularly near the river mouth. This portion of the river, in the area of tidal influences, is affected by high summer temperatures and reduced oxygen during summer low flow periods. This condition is compounded by the introduction of deleterious materials upstream. Spilling of industrial and domestic wastes occurs intermittently along the lower 17 miles of stream which lie in the rapidly expanding industrial zone of the lower Green River Valley. Water quality becomes increasingly poor moving downstream with polluted conditions existing out into the estuary and marine waters. Water quality in the smaller tributaries located in the lower valley are also affected by the dumping of domestic and industrial wastes as well as agricultural materials.

At times, excessively high temperatures occur in the lower stretches of the Duwamish River and in the flatter gradient, low valley tributaries. Although these conditions occur naturally during the summer low flow period, the magnitude of high temperatures has been increased through the removal of bank cover and through dredging and channelizing activities which generally slow water movement. These high temperatures seldom reach lethal levels, but they do contribute greatly to poor water quality.

Limited spawning and rearing — Unstable flow conditions, siltation, and poor water quality are the factors most limiting to spawning and rearing. Low water and high temperatures reduce juvenile rearing potential throughout the Green River basin during summer and early fall. Adult spawners also face these same conditions which can block or delay migration to suitable spawning areas. Seasonal flooding can heavily impact spawning areas by shifting bottom material and destroying redds.

Watershed development — Many of the Green River's smaller fish producing tributaries, as well as the basin's independent streams, are undergoing alterations extremely detrimental to natural fish production. These changes are generally associated with suburban developments throughout the watershed. In some areas these drainages are virtually being paved over, destroying some of the natural qualities necessary to sustain fish life. These include adequate cover, good water quality, and natural run-off patterns.

Considerable logging has taken place over the headwaters of the Green River. Detrimental effects on fish life generally associated with poor logging practices are, for the most part, checked by the existence of Howard Hanson Dam. A potential for further limiting fish production in the lower river does exist, depending on the extent and rate of future logging and on the practices used in logging to control pests and unwanted foliage.



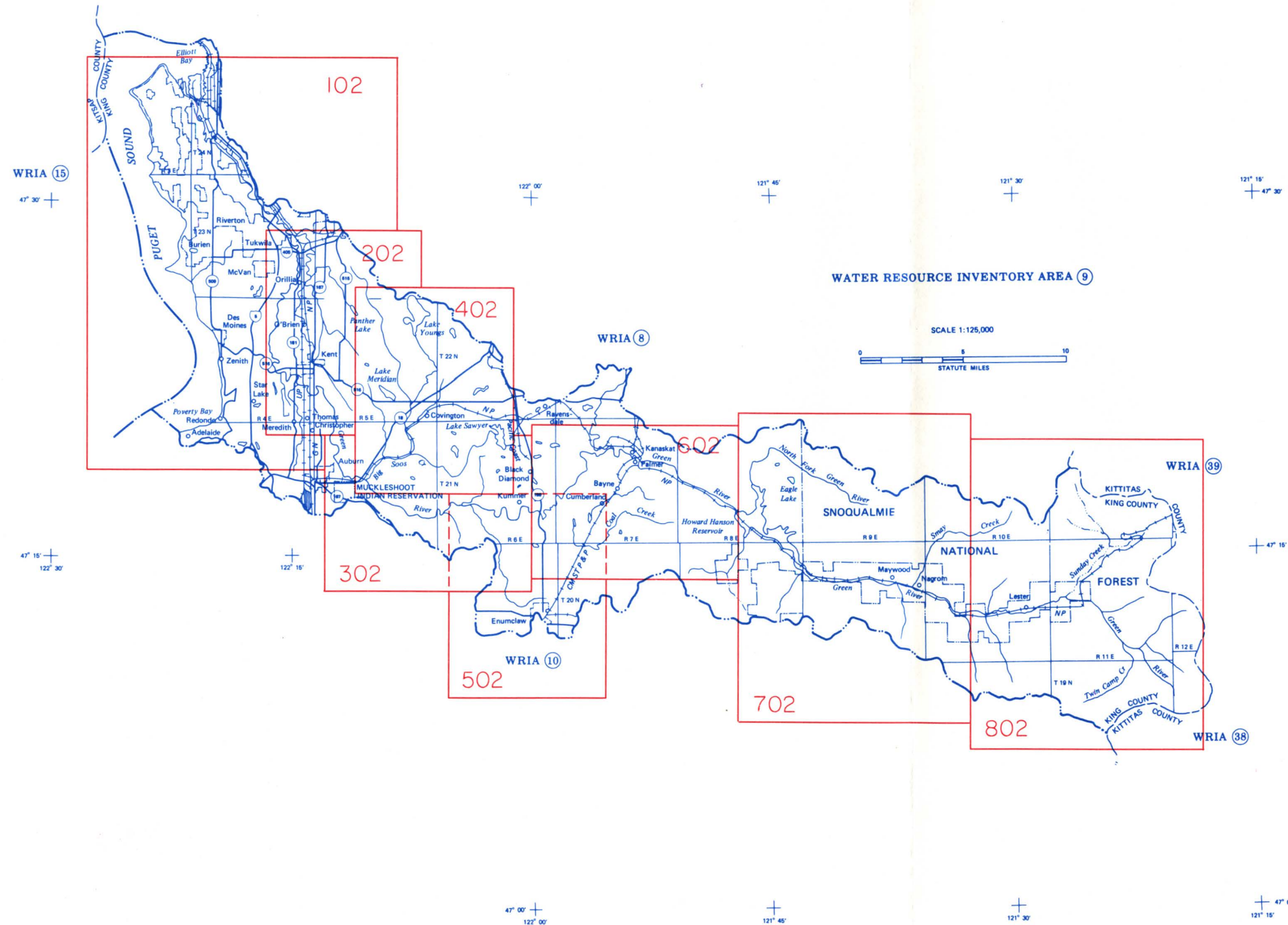
PHOTO 09-9. The operation of Howard Hanson Dam influences the stream flows on the Green River.

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DUWAMISH - GREEN BASIN

WRIA - 09



LOWER DUWAMISH RIVER

This drainage section includes the Duwamish River from its mouth below the Spokane Street Bridge at Elliott Bay (R.M. 0.00) in Seattle upstream to R.M. 11.0 where the Black River enters near Tukwila. In addition, it covers all independent streams entering Puget Sound from the Duwamish westerly to Alki Point at West Seattle, then southerly through Fauntleroy, Burien, Des Moines, and Redondo beaches to Dash Point, north of Tacoma.

Stream Description

The Duwamish River Waterway lies in the industrial southern portion of Seattle. The lower 5.2 miles of the river are dredged, affording navigation for ships upstream to the First Avenue South Bridge (R.M. 2.5) at high tide. Barge traffic extends to the turning basin at the head of navigation (R.M. 5.2). Water dependent activities utilize lands bordering the lower 8 miles of waterway. The mile-wide valley floor and hillsides have heavy residential development.

The width of the Duwamish varies from 500 to 1,000 feet in the lower 5.2 miles and from 150 to 200 feet upstream to R.M. 11.0. The river in this area is under tidal influence and contains definite stratified layering of salt and fresh water below the turning basin. Velocities are dissipated as the stream enters the wider section of river and currents converge with tidal pressures. Stream banks are sloped and diked to contain flows up to 11,000 cfs. Stream bank sloughing and erosion present continuous maintenance problems, and the lower navigational channel must be dredged every third year. Small areas of sparse natural brush and deciduous trees line the bank. The bottom is primarily silt and mud in the navigation channel with compacted gravel in the upper section.

Fifteen small independent streams enter Puget Sound within this section. These typical lowland drainages receive most of their flow from springs, lake outlets, rain and groundwater runoff. Miller, Bow Lake, and Des Moines creeks are the largest, each flowing down moderately steep hillside ravines before passing across gentle plateaus into Puget Sound. Miller Creek originates in Tub and Burien lakes. An impassable culvert occurs at R.M. 1.8; an impassable falls at mile 2.7. This creek has undergone extensive alteration and total deterioration from the heavy residential and commercial growth in the Burien-Riverton Heights districts. Bow Lake Creek flows from the outlet of Bow Lake (R.M. 3.45) and enters salt water at Des Moines. A sewage treatment plant is located at approximately R.M. 1.0 with a partial block to fish migration from a cement weir with a 30-inch drop, and an impassable cascade occurs at R.M. 1.5. The bottom composition is generally good in one-half of the lower mile of stream and provides suitable spawning area. Des Moines Creek is a short-run stream originating from spring and groundwater sources. It flows west 1.9 miles through a fairly steep ravine to a series of cascades at R.M. 0.75, then crosses a shallow valley and enters Puget Sound between Des Moines and Zenith. Concentrated residential development has altered habitat through diversions, channelization and encroachments. The stream is intermittent in nature and is generally dry during late summer and early fall.

Salmon Utilization

The Duwamish River Waterway is a transportation and rearing area. The lower river estuarial zone is vital to salmon as a transition area for adaptation of migrants to salinity changes. Fall chinook, coho, and chum are the principal salmon species utilizing this watershed. Coho and chum salmon are the only species that ascend Miller, Bow Lake and Des Moines creeks. Coho utilize Longfellow Creek, and coho and chum use the two unnamed tributaries in the southern portion of Poverty Bay near Redondo. Chum spawn in the lower portions of these short-run streams, while coho spawn and rear in their accessible lengths.

Limiting Factors

Water quality is the most serious limiting factor for salmon in the Duwamish waterway. The borderline dissolved oxygen level below R.M. 5.2 is very crucial in August and September, particularly for adult chinook. The salt-water wedge, created by dredging the navigation channel, varies with tidal cycles and contributes to the critical oxygen condition. Industrial wastes, domestic sewage, leachate from landfills, and storm runoff have all contributed to the water quality problems.

Low flows and limited spawning gravel are the major limiting factors in the small independent streams. Siltation and water quality are also serious problems.

Beneficial Developments

The METRO studies and waste disposal systems have benefitted the area's water quality. The Green River Hatchery produces excellent artificial runs of both chinook and coho. The Howard Hanson Dam provides flood control for the lower Green River Valley and Duwamish area.

Habitat Needs

A Shorelines Management Plan that considers protection of aquatic resources and habitat is needed to provide coordinated long-range development of this area. Rehabilitation of the small independent streams would provide excellent opportunities to local sports groups and community clubs for environmental improvement.

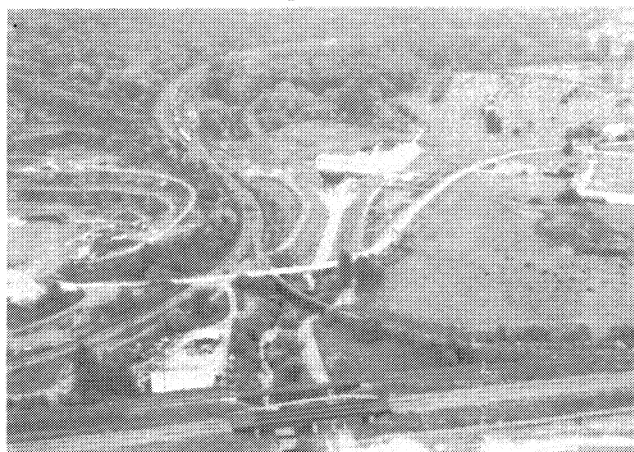
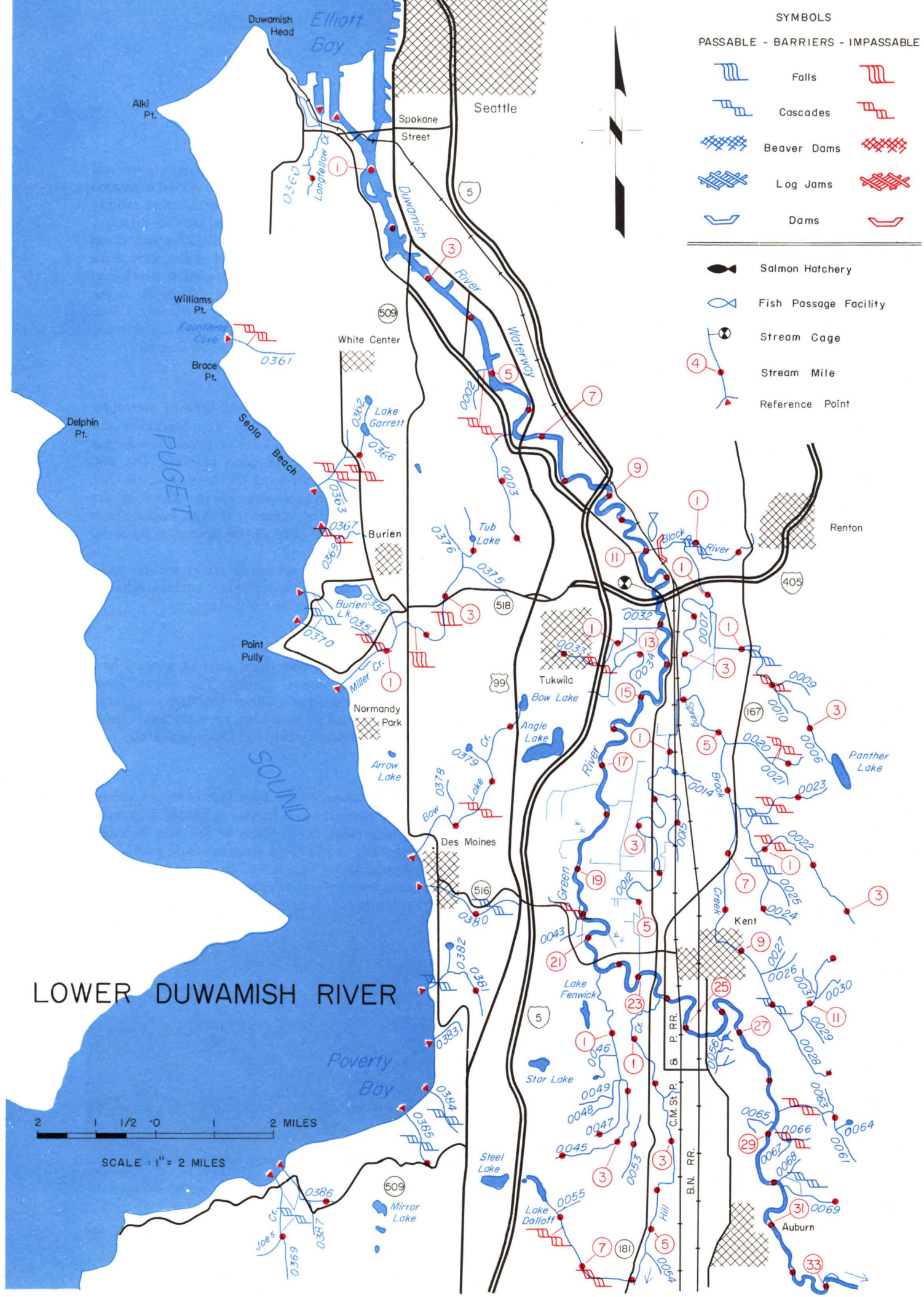


PHOTO 09-10. Black River flood control dam and fish passage facilities.



LOWER DUWAMISH RIVER
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River ¹	Sec13,T24N,R3E	93.6	—	Chin., Coho, Chum
0003	Unnamed	LB-6.5	2.0	—	Unknown
0004	Black River	RB-11.0	2.65	—	Coho
	(See Duwamish 203)				
	Duwamish R. cont. as Green River	@ mi. 11.01	—	—	
0033	Unnamed	LB-13.2	2.2	—	Unknown
	(See Duwamish 203)				
0038	Drainage Ditch	LB-17.35	~ 1.5	—	None
	(See Duwamish 203)				
0045	Unnamed	LB-21.7	4.2	—	Unknown
	(See Duwamish 203)				
0050	Drainage Ditch	RB-23.05	~ 1.15	—	Unknown
	(See Duwamish 203)				
0051	Hill Creek	LB-23.9	8.35	—	Coho
	(See Duwamish 203)				
0061	Unnamed	RB-28.6	1.95	—	Unknown
	(See Duwamish 203)				
0069	Unnamed	RB-30.15	1.0	—	Unknown
	(See Duwamish 203)				
	(Continued Duwamish 303)				
0359	Longfellow Creek	Sec13,T24N,R3E	1.45	—	(Coho)
0362	Unnamed	Sec12,T23N,R3E	1.9	—	Unknown
	Lake Garrett	Outlet-1.4	—	—	
	Unnamed Lake	Outlet-1.9	—	—	
0371	Miller Creek	Sec36,T23N,R3E	4.8	8.21	Coho, (Chum)
	Tub Lake	Outlet-4.2	—	—	
0377	Bow Lake Creek (Des Moines Creek)	Sec8,T22N,R4E	3.45	6.41	Coho, (Chum)
	Bow Lake	Outlet-3.45	—	—	
0380	Unnamed	Sec17,T22N,R4E	1.9	—	Coho, (Chum)
0381	Unnamed	Sec20,T22N,R4E	1.4	—	Coho, (Chum)
0385	Unnamed	Sec5,T21N,R4E	1.1	—	(Coho), (Chum)
0386	Unnamed	Sec1,T21N,R3E	1.25	—	Coho, (Chum)

¹ The eleven mile lower stretch of the Green River is called the Duwamish River.

DUWAMISH RIVER

Kent Area

The Green River flows near the towns of Tukwila, Renton, Kent, and Auburn to join the Duwamish River at the junction of the Black River. The hills that extend from Renton to Auburn on the east side of the valley separate the Green River drainage from the Cedar River. Several major highways and numerous country roads provide transportation access. There are 19.0 miles of mainstem river in this section plus 84.0 miles of tributaries including 12.0 miles of drainage ditches.

Stream Description

The Duwamish River continues as the Green River upstream of R.M. 11.0 where the Black River enters the system, and extends upstream 19.0 miles to R.M. 30.15 near Auburn. The major tributaries are Spring Brook Creek, which drains 12.0 miles along the east valley hillside before entering the Black River, and Hill Creek that drains over 8.0 miles from the west valley before entering at R.M. 23.9. There are 17 other small unnamed tributaries and 8 drainage ditches within this section.

The Green River Valley is about 2 miles wide and contains rich agricultural bottomland. Major flood control measures have made the flood plain valuable for industrial use due to proximity of Sea-Tac Airport, metropolitan Seattle, and the Duwamish industrial area. The towns of Renton, Kent, and Auburn have mushroomed with residential developments, large shopping centers, and small business complexes.

The Green River has a meandering deep channel that is confined at 100 to 200 feet in width. The river banks have been diked and armoured with riprap along many bends. Willows, blackberries, and brush grow sporadically along the banks. The bottom composition below Kent at R.M. 14.0 is heavy silt and mud compacted in large rubble and boulders. Between Auburn and Kent there are many good spawning riffles with a slight increase in gradient. The river bed is stable with compacted gravel. In summer months aquatic vegetation and filamentous algae grow along the shorelines and shallows in this lower river.

Black River, a tributary of the Duwamish-Green receives its major flow from Spring Brook Creek. The Black River originates from storm drainage and ground water in the center of Renton and flows westerly 2.65 miles to its confluence with Duwamish at Tukwila. The Soil Conservation Service channelized and widened the lower 0.5 mile of Black River and constructed a dam and pumping station at the mouth in 1971. Both upstream and downstream salmon migrant collection and passage systems were incorporated into this facility. Spring Brook Creek is formed by four east valley tributaries near Kent and flows north, intercepting Black River at R.M. 0.65. Tributaries are Mill Creek, Canyon Creek, Spring Brook, and the outlet of Panther Lake (all local names). Mill Creek is actually the continuation and headwaters of Spring Brook Creek, and is formed by several branch tributaries. These four tributaries are similar in their physical descriptions, all having brushy, steep cascade and rapids areas in the upper hillside ravines. Intermittent patch

gravel occurs in all but Mill Creek which contains good quality spawning material between R.M. 9.0 and 10.0 with large intermittent gravel sections between R.M. 6.5 and 8.0.

Hill Creek is the second largest tributary and flows from Lake Dolloff near the I-5 freeway on the west valley hill. This stream drains over 8.0 miles down Pearsley Canyon toward Auburn and then north to its confluence with the Green River at R.M. 23.9.

Salmon Utilization

The river below R.M. 24.0 at Kent is transportation and rearing waters. Patch type spawning occurs on the riffles and shorelines between R.M. 24.0 and 29.0 with some concentrated spawning taking place between R.M. 29.0 and 30.5. Fall chinook are the main species utilizing this section, with coho and chum using areas upstream. Coho enter Black River beginning in October and early November. Mill Creek east of Kent contains the largest number of spawners. Coho also spawn in Hill Creek, and possibly in some of the other unnamed tributaries.

Limiting Factors

Flooding conditions above the capacity of Howard Hanson Dam, low summer flows, and water quality are the principal limiting factors for salmon. Removal of stream cover in the lower valley, construction of dikes, and bank stabilization projects have changed the river profile and altered the channels. Other contributing factors are flood control measures, silt deposits, pollution, and the SCS east and west valley pumping stations.

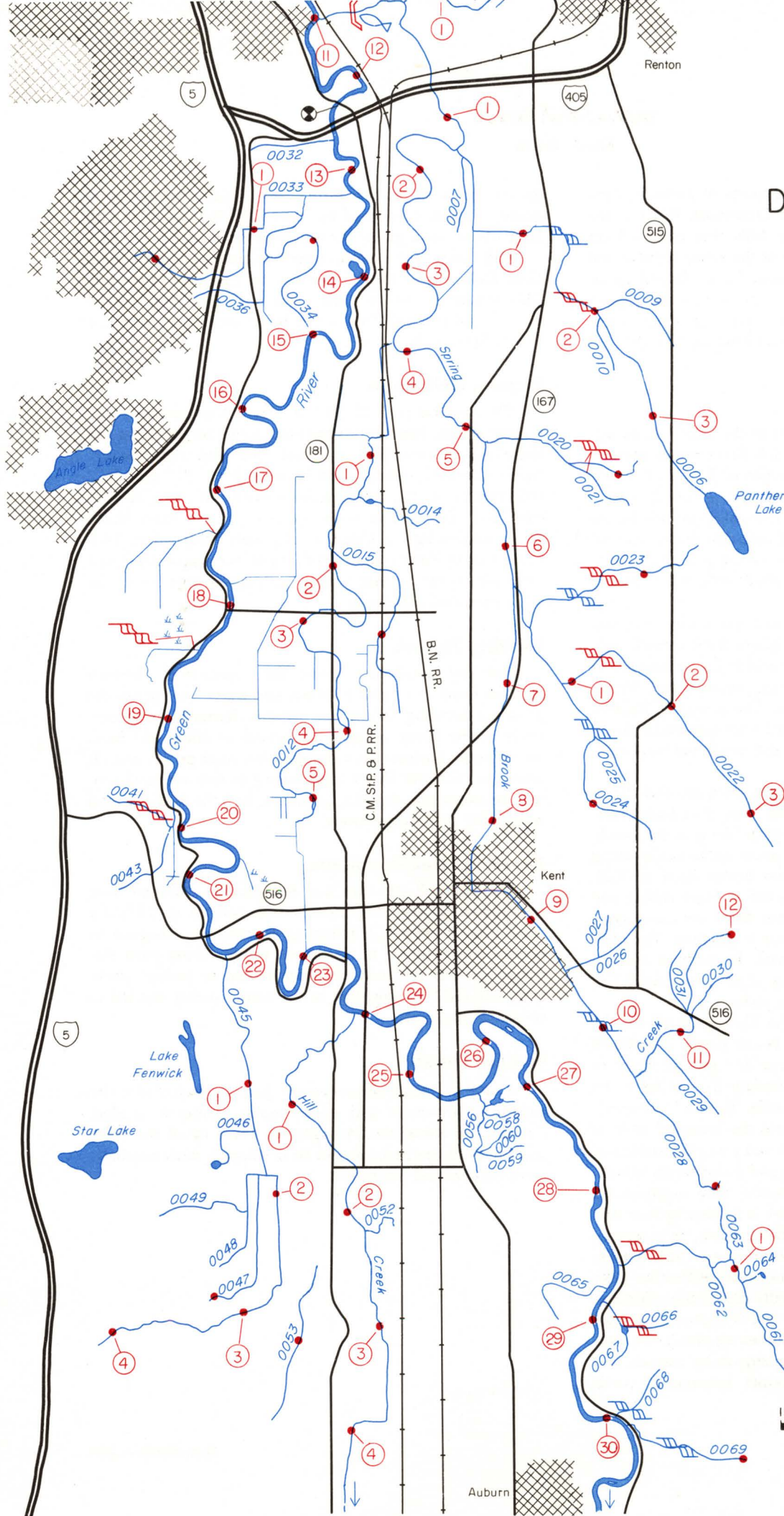
Beneficial Developments

The Black River dam and fish passage facilities were constructed by the Soil Conservation Service in 1971 for flood control. The SCS pumping stations are designed to control storm runoff in the lower valley during peak discharge periods but have also contributed to passage problems. METRO's monitoring of the water quality has led to corrective measures.

Habitat Needs

A well formed comprehensive plan that considers the aquatic environment and stream water quality is needed. Coordinated Shorelines Management Plans by all the cities and towns of the basin should be developed, with emphasis on environmental protection.

DUWAMISH RIVER Kent Area



SYMBOLS

PASSABLE - BARRIERS - IMPASSABLE

	Falls	
	Cascades	
	Beaver Dams	
	Log Jams	
	Dams	

Salmon Hatchery

Fish Passage Facility

Stream Gage

Stream Mile

Reference Point

1 1/2 0 1 MILE

SCALE: 1" = 1 MILE

DUWAMISH AREA — KENT AREA
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				Chin., Coho, Chum
0004	Black River	RB-11.0	2.65	—	Coho
0005	Spring Brook Cr. ¹	LB-0.65	12.0	—	Coho
0006	Unnamed	RB-1.3	3.75	—	Coho
	Panther Lake	Outlet-3.75	—	—	
0012	Unnamed	LB-3.9	5.25	—	(Coho)
0015	Unnamed	RB-1.9	1.5	—	(Coho)
0018	Drain. Ditch	LB-3.91	~ 3.8	—	
0020	Unnamed	RB-5.2	1.2	—	Coho
0022	Unnamed	RB-6.25	3.3	—	Coho
0023	Unnamed	RB-0.4	1.5	—	Coho
0024	Unnamed	LB-0.9	1.5	—	(Coho)
0028	Unnamed	LB-10.45	1.1	—	(Coho)
	Duwamish R. cont. as Green River	@ mi. 11.01	—	—	
0033	Unnamed	LB-13.2	2.2	—	Unknown
0034	Unnamed	RB-0.35	1.8	—	Unknown
0038	Drainage Ditch	LB-17.35	~ 1.5	—	None
0045	Unnamed	LB-21.7	4.2	—	Unknown
0047	Unnamed	LB-1.8	1.2	—	Unknown
0050	Drainage Ditch	RB-23.05	~ 1.15	—	Unknown
0051	Hill Creek ²	LB-23.9	8.35	—	Coho
0053	Unnamed	LB-2.45	1.65	—	(Coho)
	Lake Dolloff	Outlet-8.35	—	—	
0061	Unnamed	RB-28.6	1.95	—	Unknown
0069	Unnamed	RB-30.15	1.0	—	Unknown
	(See Duwamish 303)				
	(Continued Duwamish 303)				

¹ Name is uncertain. Much of the drainage area is Green River flood plain.

² Formerly published as "Dolloff Lake Outlet".

GREEN RIVER

Auburn Area

The mainstem Green River within this section meanders through the upper Green Valley from the lower end of the gorge near Black Diamond (R.M. 46.5) downstream 16 miles to the town of Auburn (R.M. 30.5). This valley section lies within King County. Two major tributaries and ten small tributaries feed into the main river in this upper valley totalling over 47 miles of additional stream. The Muckle-shoot Indian Reservation extends south of the Auburn city limits along the ridge separating the Green River from the White River.

Stream Description

The Green River lies in a valley of varying width, broadening as it proceeds downstream. The valley walls are only about 200 feet apart where it leaves the gorge, but it broadens to 0.75 mile at R.M. 39.0. Gradient is shallow, as it drops only 100 feet over this 16 miles. The valley hillsides are quite steep, rising 200 to 500 feet on both sides along the entire length. The hillsides are densely covered with deciduous trees and brush interspersed with conifers. Heavy clay soils comprise these hillsides, unlike the solid rock walls of the long gorge upstream. Rich alluvial soil covers the valley floor where farming of row crops share the lands with dairy farming.

Good tree and brush cover has been maintained along the river banks upstream of Burns Creek at R.M. 38.0. Downstream of this point the King County Flood Control Agency has dredged and widened the river channel and built formal dikes. Excellent gravel composition still prevails throughout this area, and large trees behind the dikes afford some shade. The channel contains ideal pool-riffle and glide areas with several split channel sections. Gravel composition is excellent in the upper river, but with some short sections of gravel compaction. Silt deposits are also evident in the deeper pools. Stream width varies from 50 to 200 feet, averaging 150 feet.

Big Soos Creek is the major tributary extending 14.0 miles in length to the east and converging with the Green River at R.M. 33.65 (Duwamish 401). Newaukum Creek is the next largest tributary containing 13.7 stream miles and entering the Green River at R.M. 40.7 (Duwamish 501). In addition, there are ten smaller tributaries providing over 19.0 miles of stream drainage in this section. Burns Creek and Crisp Creek are the most important of these small streams.

Burns Creek originates from a spring and drains the east valley floor through pastures and enters the main river at R.M. 30.0. Over the past 15 years Burns Creek has deteriorated due to heavy silting, extensive aquatic weed growths, and reduced flows. There is shade where the creek follows the hillside but none through the pasturelands and along the road. Only small patch gravel spots among the weeds and silt can be found. This creek averages about 12 feet in width. Crisp Creek is similar to Burns Creek in that the lower portion is heavily silted and badly altered where it passes through open pastureland. A small dam and two fish ponds are constructed at R.M. 1.1.

Salmon Utilization

Fall chinook, coho, and chum salmon spawn and rear throughout this section of the mainstem Green River. A few pair of sockeye are annually observed here. Only coho and chum utilize the accessible stretches of the smaller tributaries.

Limiting Factors

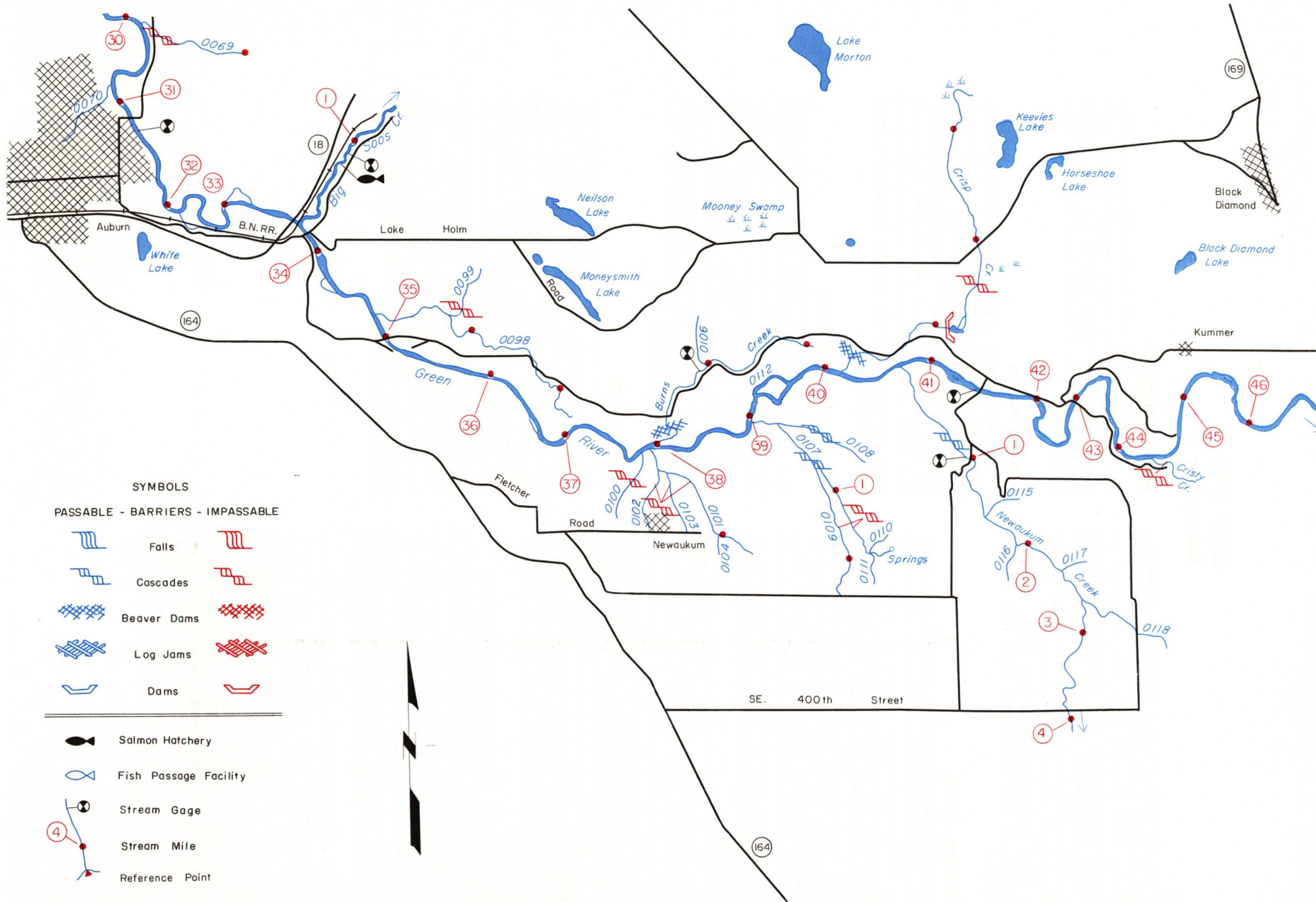
Low summer flows in the small tributary streams seriously curtail coho rearing. The heavy siltation on Burns and Crisp creeks are due to farming activity and illegal hydraulic projects. The main Green River has suffered from flood control measures below Burns Creek and from flooding and bank erosion in some sections of the upper area. Compacted gravel in long glide and riffle areas has reduced the quantity of spawning area.

Beneficial Developments

In 1962 Howard Hanson Dam was completed to provide flood protection to the lower Green River Valley as well as remove most of the flood hazard in the upper Green River Valley. Some flooding still occurs here on heavy storm run-offs and affects the river habitat. Plants from the state salmon hatchery on Soos Creek are released into the system to supplement runs. A stream flow gage is maintained at Auburn which provides daily recordings of this system with records back to September, 1936.

Habitat Needs

Minimum flow releases from Howard Hanson Dam have been requested from the Department of Ecology, to be increased to 500 cfs from October 15, through April 30th, with a linear decrease to 300 cfs during May. During June, July, and August a minimum discharge of 300 cfs is requested followed by a linear increase to 500 cfs on October 15th. The existing minimum flow of 110 cfs is not sufficient to provide adequate spawning, transportation and rearing area for salmon species utilizing the Green River. Long-range plans by King County and the City of Auburn under the Shorelines Management Act are needed for maintaining and protecting the upper Green Valley and the aquatic environment in its natural state.



GREEN RIVER
Auburn Area

GREEN RIVER — AUBURN AREA
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				Chin., Coho, Chum
	Duwamish River cont. as Green River	@ mi. 11.01	—	—	
0069	Unnamed	RB-30.15	1.0	—	Unknown
0072	Big Soos Creek	RB-33.65	14.15	—	Chin., Coho, Chum
	(See Duwamish 403)				
0098	Unnamed	RB-35.2	2.3	—	(Coho)
0101	Unnamed	LB-37.95	1.3	—	Coho, (Chum)
0105	Burns Creek	RB-38.0	2.1	—	Coho, Chum
0107	Unnamed	LB-39.0	1.85	—	Coho, Chum
0109	Unnamed	LB-0.7	1.3	—	Unknown
0113	Crisp Creek	RB-40.1	3.55	—	Coho, Chum
	Unnamed Lake	Outlet-1.12	—	—	None
0114	Newaukum Creek	LB-40.7	13.7	—	Chin., Coho, Chum
	(See Duwamish 503)				
	(Continued Duwamish 603)				

SOOS CREEK DRAINAGE

The Soos Creek system is composed of over 60 miles of stream extending out in a fan shape from the hills east of Auburn and south of Renton between the Cedar River and Green River valleys. This drainage lies within King County and includes Lake Youngs which is part of the City of Seattle domestic water storage system. There are 25 tributaries feeding into Big Soos Creek which converges with the Green River on the right bank at R.M. 33.6 immediately upstream of the Burlington Northern Railroad bridge.

Stream Description

Big Soos Creek is over 14.0 miles in length, originating from springs and groundwater drainage in the hills 1.5 miles south of Renton. The creek drains southward to where Covington Creek joins the system (R.M. 2.8) then it flows westerly to its confluence with the main Green River. Five major tributaries feed Big Soos Creek. Soosette Creek originates from springs and drainage runoff on the plateau between Lake Meridian and the town of Kent, and flows some five miles generally southward, dropping rapidly for the last mile through a steep gulch and ravine before entering at R.M. 1.35. Covington Creek originates on the plateau 2.5 miles east of Lake Sawyer. It drains 9.5 miles generally southwest to where it joins Big Soos Creek at R.M. 2.85. Jenkins Creek is formed from the outlets of Lake Wilderness, Lake Lucerne and Shadow Lake and flows 6.5 miles southwest to its confluence at R.M. 4.2. Little Soos Creek flows from Lake Youngs generally south for 4.75 miles and converges with Big Soos Creek at R.M. 5.6. An unnamed tributary over 4.0 miles in length drains through Clark Lake and through Lake Meridian, flowing southeasterly before joining the mainstem at R.M. 5.15.

Urban developments have expanded over most of this plateau between Renton and Auburn as far east as Little Soos Creek, but much of the land is still heavily covered with second and third growth conifers and heavy stands of deciduous trees and brush. These upland soils are not conducive to good farming.

All tributaries forming the Soos Creek drainage are similar in physical description and size. They all drain from similar flat, rolling terrain until they converge below mile 5.0 of Big Soos Creek. The gradient increases sharply as the streams flow through long ravines with steep hillside slopes until they meet the valley floor below R.M. 3.0. The stream sections located on the upper plateau are of shallow gradient with sparse gravel and limited riffle areas. They vary in width from 2 to 5 yards from headwaters to mouths while Big Soos Creek varies from 2 to 9 yards.

Big Soos also contains some long riffles and rapids below R.M. 5.0 where the tributaries converge and provide additional flows. Good pool-riffle-glide sections are found in the lower section of the stream in the valley. Heavy deciduous growths overhang Big Soos Creek with some open pasturage in the upper six miles. It also contains sections of good gravel bottom and sections of swampy channel splits with mud bottoms and heavy growths of aquatic vegetation. Little Soos Creek is very similar to Big Soos Creek, with good stream bank cover and long pool-glide areas interspaced with shallow riffles. Both Jenkins Creek and Covington Creek are excellent coho-type streams with heavy bank

cover and overhanging cut banks. The bottom composition is very good with an even distribution of gravel on the riffle sections and long glide areas. Heavy aquatic vegetation occurs in these streams along with thick stands of willow saplings in the swampy sections.

Salmon Utilization

Fall chinook, chum and coho utilize Big Soos Creek with the chinook and chum largely confined to the lower six miles where the flows are larger. Coho utilize all accessible sections of the drainage and particularly the tributaries. Total production is dominated by the state salmon hatchery, but it has been recommended that a minimum of 1,000 chinook and 3,500 coho salmon spawners be released above the hatchery rack each year to make full use of the potential of the system. Stream flow gages are operative on all the major tributaries and the lower mainstem.

Limiting Factors

Low summer flow is the most restrictive factor to salmon production, particularly in the upper watersheds. Since lakes are the main source of flow to all these tributaries, there is relatively minor flooding. Treatments of copper sulfate are applied to Lake Youngs periodically for control of aquatic organisms which are toxic to fish. During the past ten years the effects of encroachment have shown up through signs of deterioration in stream habitat. One example is gravel mining operations in the lower valley that have deteriorated the water quality and contributed heavy silt loads in the lower watershed. Diversion of water for irrigation and domestic use is a significant limiting factor in this watershed.

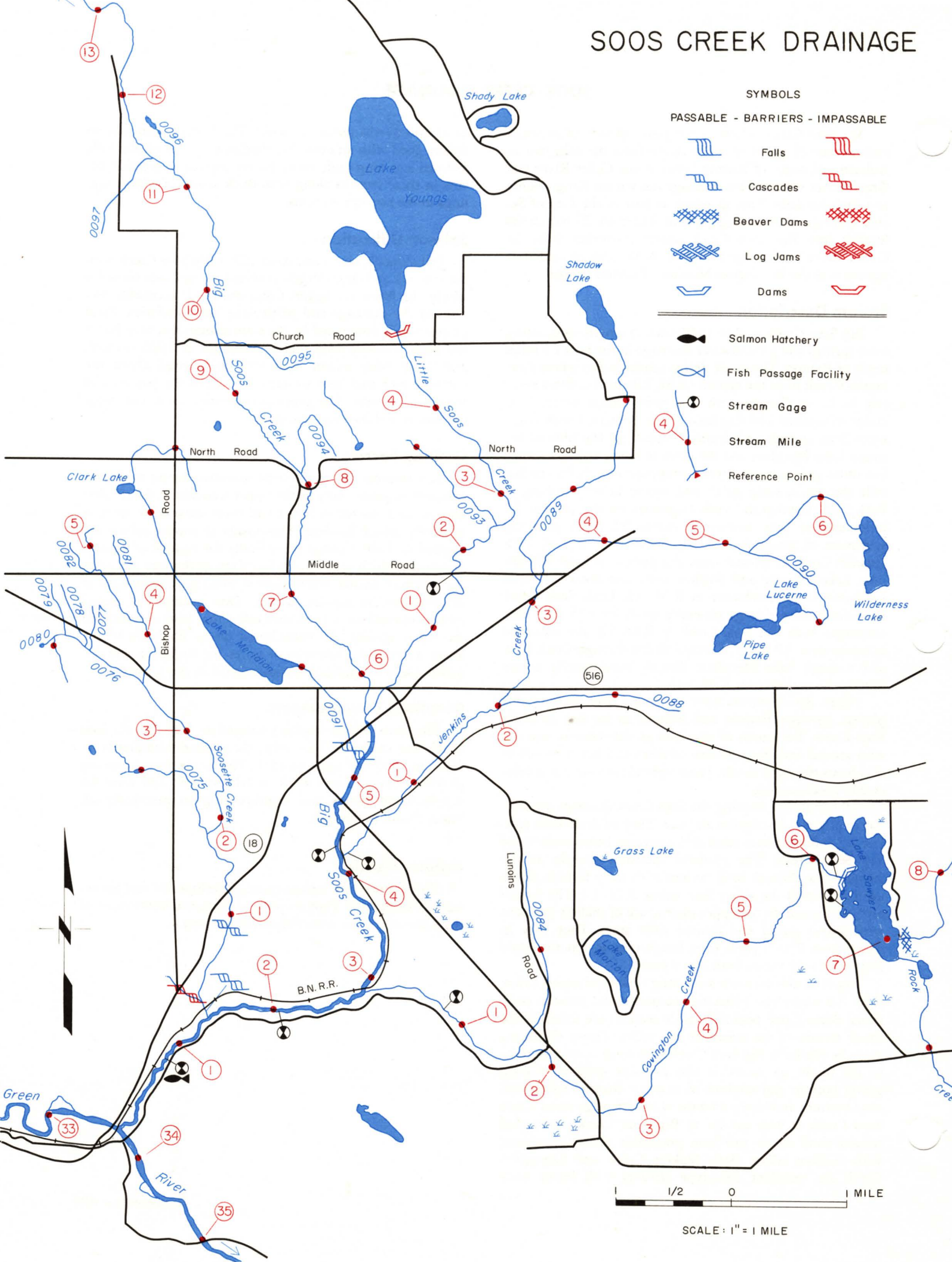
Beneficial Developments

The state salmon hatchery located at R.M. 0.7 on Soos Creek was constructed in 1901, then rebuilt completely in 1907, in 1926, and again in 1948. The hatchery program has provided Green River stock of fall chinook and coho for supplemental plants and crossbreeding in practically all Puget Sound watersheds.

Habitat Needs

There is need for a good county development and Shorelines Management Plan to prevent further deterioration of the watershed from non-compatible industry.

SOOS CREEK DRAINAGE



SOOS CREEK DRAINAGE
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				Chin., Coho, Chum
	Duwamish R. cont. as Green R.	@ mi. 11.01			
0072	Big Soos Creek	RB-33.65	14.15	—	Chin., Coho, Chum
0073	Soosette Creek	RB-1.35	5.15	—	Coho
0075	Unnamed	RB-1.8	1.4	—	Unknown
0076	Unnamed	RB-3.55	1.4	—	(Coho)
0083	Covington Creek	LB-2.85	9.55	—	Chin., Coho
0084	Unnamed	RB-1.6	1.8	—	Coho
	Lake Sawyer	Outlet-6.35	—	—	
0085	Rock Creek	LB-7.1	1.7	—	Unknown
	Unnamed Lake	Outlet-0.2	—	—	
0087	Jenkins Creek	LB-4.2	6.5	—	Coho
0088	Unnamed	LB-2.0	1.6	—	Coho
0089	Unnamed	RB-3.2	2.6	—	Coho
	Shadow Lake	Outlet-2.6	—	—	
0090	Unnamed	LB-5.2	1.2	—	(Coho)
	Pipe Lake	Outlet-1.2	—	0.63	
	Wilderness Lake	Outlet-6.5	—	—	
0091	Unnamed	RB-5.15	4.4	—	Coho
	Lake Meridian	Outlet-1.1	—	—	
	Clark Lake	Outlet-3.25	—	—	
0092	Little Soos Creek	LB-5.6	4.75	—	Coho
0093	Unnamed	RB-2.5	1.1	—	(Coho)
	Lake Youngs	Outlet-4.75	—	—	None

NEWAUKUM CREEK

Newaukum Creek is a major tributary of Green River and flows from the mountains east of the town of Enumclaw through the Enumclaw valley and into the Green River downstream of Flaming Geyser Park for a total distance of over 14.0 miles. This creek lies totally within the boundary of King County. Eight small tributaries provide an additional 13.5 miles of stream length to this watershed. Many roads throughout the outskirts of Enumclaw cross and parallel this creek, providing easy access, even to its headwaters.

Stream Description

Springs, snowmelt and ground water runoff form the headwaters of Newaukum Creek, where it originates between 2,000 and 2,500-foot elevation of Boise Ridge on the western edge of Grass Mountain near Enumclaw. The creek drops rapidly down broad gulleys to the plateau at the 700-foot elevation near the town of Enumclaw, and flows on through open farmlands from R.M. 9.0 to R.M. 3.0 where it enters a steep walled ravine. At this point the stream descends from the 600-foot elevation at the rate of 150 feet per mile to its confluence with the Green River at R.M. 40.7, about 0.5 mile downstream of the Whitney Bridge. North Fork Newaukum Creek and Stonequarry Creek are the principal tributaries, both flowing from Boise Ridge. Spring Creek at R.M. 6.31 and the unnamed tributary at R.M. 2.75 are also important tributaries for fish production.

The broad plateau formed between the Green River and the White River is about six miles wide and extends from the base of the Grass Mountain Range northwest to an apex near the Muckleshoot Indian Reservation. This plateau is a heavily developed farming community and most of the land is cleared. The gradient of Newaukum Creek, as it courses across the plateau, is very gentle with a drop of only 25 feet per mile. The picture book stream is confined within definite channels eroded down to a stable streambed. There are long riffle sections with short pool areas. The general depth of the stream is about 12 inches during the winter spawning season. Gravel composition is ideal through the plateau farm area with larger boulders in the lower 3 miles of the stream, where riffles and rapids prevail in the ravine. Mixed deciduous growth occurs along the stream banks in the lower 5 miles and on the mountains above R.M. 10.0. Other than the deep cut stream banks through the pasture and flat farmlands, very little natural growth is available to provide shade and protection to the creek. Stream gage recordings since 1944 have been made in this watershed.

Salmon Utilization

The three salmon species utilizing the main Green River also inhabit the Newaukum Creek watershed. Fall chinook and chum salmon ascend onto the plateau and spawn and rear in the main creek up to R.M. 10.0. Low flow conditions occasionally prevent large chinook salmon from swimming upstream farther than Spring Creek on years of dry summer conditions. Coho ascend into all accessible areas of the stream and its tributaries to spawn and rear. Coho spawners have been observed up to about R.M. 11.5 where rapids and cascades are encountered at the base of the mountain.

Limiting Factors

Summer low flows and flooding from heavy snowmelts and rainfalls are major limiting factors to fish production in this watershed. Diversion of water for stock watering and irrigation is a competition with fish use. Waste water from the City of Enumclaw water-supply and sewer systems enters above the gage station 2 miles north of Enumclaw. Water quality problems derived from waste discharges into the stream contributes to heavy algae growths. Active logging operations in the Grass Mountains, within the margins of the watershed, are influencing the runoff conditions to the stream.

Beneficial Developments

A program has been initiated by the Farmans Pickle food processing plant in Enumclaw to rectify their methods of waste discharge to prevent further stream water quality problems. Coho have been released in the headwaters of Newaukum Creek on years when poor spawning escapements were recorded.

Habitat Needs

A comprehensive plan for the development and growth of the community by the town of Enumclaw and a coordinated King County zoning plan and Shorelines Management plan that address aquatic habitat requirements, are needed to improve the water quality and stream environment for fish use. More shade is desirable through the pasturelands. Buffer strips bordering the stream are encouraged in areas of pastureland.



PHOTO 09-11. Spring Creek flows through pasturelands.

NEWAUKUM CREEK DRAINAGE
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				
	Duwamish R. cont. as Green River	@ mi. 11.01			
0014	Newaukum Creek	LB-40.7	14.35	—	Chin., Coho, Chum
0118	Unnamed	RB-2.75	2.2	—	Coho
0119	Spring Creek	RB-6.31	1.1	1.49	Coho
0121	Watercress Creek	LB-9.65	2.6	—	Coho
0122	N. Fk. Newaukum Cr.	RB-10.05	3.95	—	Coho
0123	Stonequarry Cr.	RB-0.3	2.7	—	Coho

GREEN RIVER

Black Diamond Area

There are 18 miles of mainstem Green River flowing through this section from the Howard Hanson Dam to the termination of the Green River Gorge. There are 38 tributaries adding more than 31 linear stream miles. Two independent streams, Coal Creek and Deep Creek, that do not flow directly into the main river are located south of the river on the Grass Mountain range.

Stream Description

The main Green River in this section covers several distinct topographical and geological areas. Below Howard Hanson Dam (R.M. 64.5) the river maintains natural mountain stream characteristics and descends 3.5 miles to the Tacoma Water Diversion Dam (R.M. 61.0), then continues 3.5 miles to the town of Kanaskat (R.M. 57.5). The Green River Gorge commences and continues downstream approximately 12 miles terminating near Flaming Geyser Park (R.M. 46.5). The upper river basin between Howard Hanson Dam and Palmer Junction near Kanaskat is a part of the "Boulder Zone" which typifies the steep gradient wild mountain river. This stretch of river has deteriorated from lack of gravel recruitment. The river banks are well defined with brush and timber growing down to the high water mark. The mountains on both sides of the river ascend gradually to above the 3,000-foot elevation. Prime stands of second growth timber cover these mountains; however, extensive logging has been conducted along the upper ridges.

The twelve miles of Green River Gorge below Palmer Junction, where the river has cut its channel through soft sandstone to a depth of over 300 feet deep, varies from only 100 to 200 feet wide. Only State Highway 169 and one county road cross the gorge. The Palmer Junction Road provides access to the two dams and the reservoir. Otherwise this upper watershed is closed to public access.

Lands bordering the gorge, on the fairly flat plateaus on both banks, are inaccessible and sparsely settled. These are heavily forested lands of second growth conifer mixed with deciduous trees.

The stream bottom throughout the gorge is composed of boulders and large rubble interspersed with patch gravel areas suitable for spawning. The river gradient in the gorge averages 80 feet/mile. No shade or cover is found here except for brush patches along the high waterline fringe. Only the deepness of the canyon walls affords shade.

Tributaries are found largely in the upper watershed above the gorge. These are steep streams ascending from the Grass Mountain slopes. Two large, independent streams, Coal Creek and Deep Creek, occur in the lower gorge area. Although these streams drain into small lakes away from the river, it is believed they seep underground and create springs near the river flood plain that provide considerable flow input to the Green River drainage between R.M. 48.0 and 50.0.

Salmon Utilization

This section of Green River is the upper limits of anadromous fish utilization and the Tacoma Diversion Dam is a total barrier to fish passage. This upper 18 miles of river

provide transportation and spawning for spring and fall chinook and coho salmon. A few chum salmon ascend into the lower gorge; however, the habitat here is typical of that selected by chum. Chinook salmon spawn in the mainstem while coho spawn in the tributaries and fringes of the mainstem.

Limiting Factors

The steep gradient in the gorge creates a continuous rapids except for eddies created by boulders and large rubble. The availability of spawning gravel is a definite limiting factor as little recruitment is possible below the dam. The steep gradients of the tributaries precludes fish use above the cascade areas or falls which occur within a few hundred feet of the river valley. No fish passage facilities are incorporated into either dam, thus creating barren areas for fish use above the reservoir.

Beneficial Developments

In cooperation with the Northwest Steelheaders Club, the old Shangrila Trout Hatchery facilities on Icy Creek were modified to rear chinook salmon. Since 1972, chinook fingerlings have been reared in the creek. These fish were reared from June to October and released into Icy Creek and the main Green River. No other facilities or programs have been undertaken within this section to specifically benefit salmon production.

Habitat Needs

To realize the production potential for this section, the reservoir area should be opened for fry and fingerling plants and an artificial spawning and rearing channel located in the area above Kanaskat. Fish screens and bypass on the City of Tacoma water diversion would allow the stretch between the two dams to be utilized for rearing area.



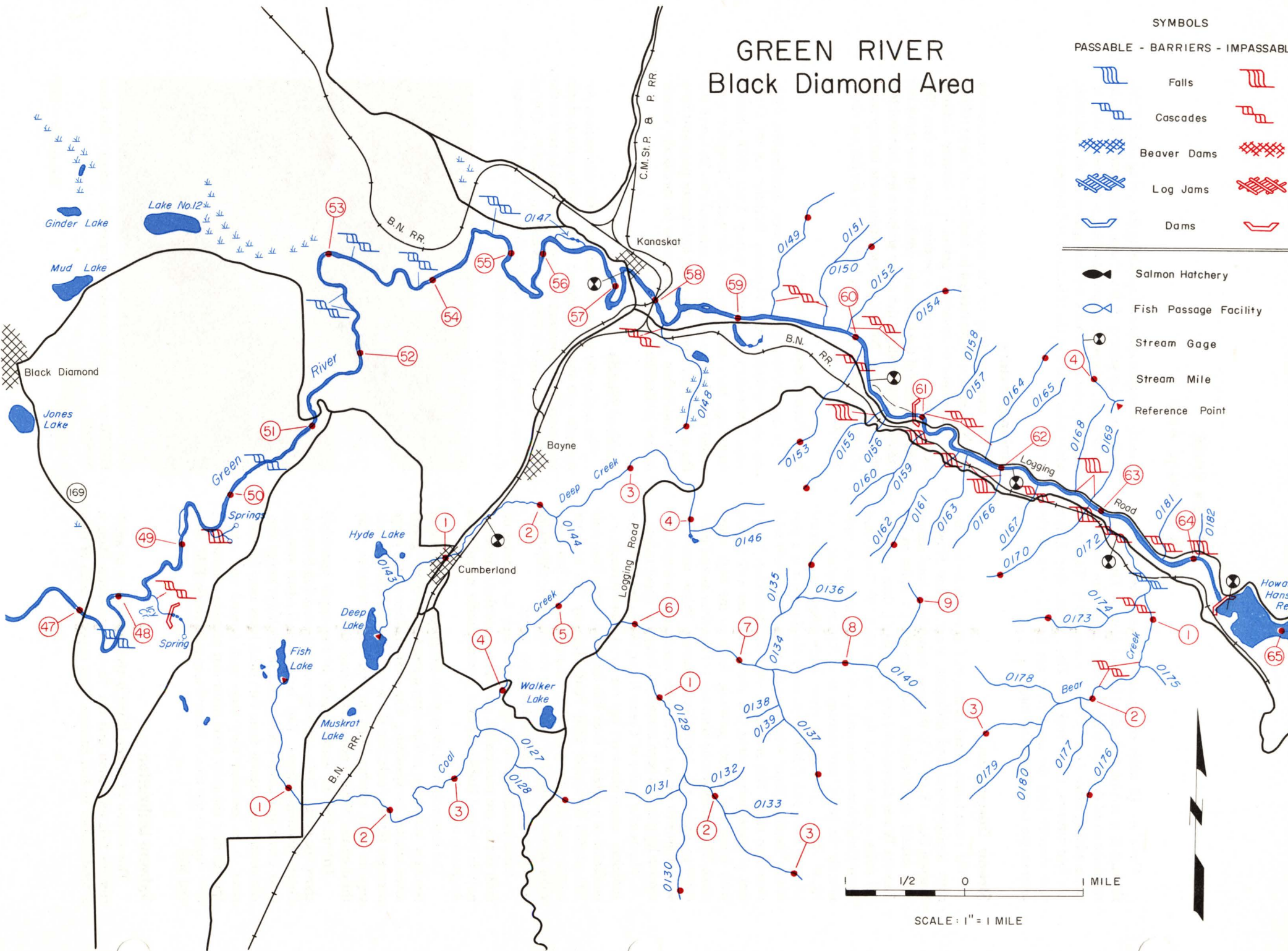
PHOTO 09-12. Aerial surveys reveal spawning chinook redds above Kanaskat.

GREEN RIVER Black Diamond Area

SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE

	Falls	
	Cascades	
	Beaver Dams	
	Log Jams	
	Dams	

- Salmon Hatchery
- Fish Passage Facility
- Stream Gage
- Stream Mile
- Reference Point



GREEN RIVER — BLACK DIAMOND AREA
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				
	Duwamish R. cont. as Green River	@ mi. 11.01	—	—	
0126	Coal Creek	LB-48.4	9.2	—	?
0127	Unnamed	LB-3.5	1.4	—	
0129	Unnamed	LB-5.8	3.1	—	
0130	Unnamed	LB-1.7	1.05	—	
0134	Unnamed	RB-7.2	1.25	—	
0137	Unnamed	LB-7.4	1.3	—	
0142	Deep Creek	LB-49.9	4.8	—	?
0148	Unnamed	LB-58.25	1.1	—	None
0149	Unnamed	RB-59.3	1.3	—	Unknown
0150	Unnamed	RB-59.75	1.1	—	Unknown
0153	Unnamed	LB-60.1	1.3	—	Unknown
0154	Unnamed	RB-60.25	1.1	—	Unknown
0155	Unnamed	LB-60.7	1.0	—	Unknown
0161	Unnamed	LB-61.65	1.2	—	None
0164	Unnamed	RB-61.85	1.15	—	None
0170	Unnamed	LB-62.86	1.1	—	None
0171	Bear Creek	LB-63.1	3.9	—	None
0173	Unnamed	LB-0.75	1.3	—	None
0176	Unnamed	RB-2.05	1.4	—	None
	(Continued Duwamish 703)				

GREEN RIVER

Howard Hanson Reservoir

This section encompasses nearly 14 miles of mainstem Green River from the Corps of Engineers' Howard Hanson Dam, upstream to the vicinity of Champion Creek, about 3 miles west of Lester. In this section there are 27 tributaries adding more than 128 stream miles. The area is located approximately six miles east of Kanaskat in southeast King County, and is accessible via county road leading to Lester and Stampede Pass. The major length of most tributaries are within Snoqualmie National Forest.

Stream Description

From the vicinity of Champion Creek (R.M. 78.1) the Green River flows generally west some eight miles, then northwest six miles to Howard Hanson Dam at Eagle Gorge (R.M. 64.5). The reservoir takes in approximately the lower 3.5 miles of this section. The major tributary is the North Fork Green River, with other larger streams including Charlie, Gale, Green Canyon, and Smay creeks.

In this section the Green winds over a relatively narrow valley floor about 10.5 miles to the upper end of Howard Hanson Reservoir. Valley walls are mostly steep and densely forested with conifer timber, while the bottomland presents moderate to dense growth of mixed deciduous and conifers. The valley floor broadens slightly about one mile above the reservoir. The reservoir fluctuates considerably, reflecting seasonal water supply, and at maximum is approximately four miles in total length. There is relatively little development along this stretch, the principal land use being a watershed supplying the City of Tacoma. Some clear-cut section logging does take place; however, there are relatively few logging roads extending into adjacent mountain areas. Reforestation is evident over some slopes. Presently, recreational use is restricted by limited access and existing land use practices.

Throughout this section the gradient is mostly moderate with only a few slightly steeper stretches. The stream ranges from 8 to 20 yards in width, and is relatively confined within stable banks, with only a few channel split sections. It presents a good pool-riffle balance for this size stream, offering a number of very large, deep pools and long, slow-moving glides. The bottom appears quite stable, consisting mainly of clean rubble and gravel material, with some sections showing moderate to heavy algae growth during the late summer months. The banks are relatively low, natural earth or rock cut, with numerous gently sloping, relatively broad gravel-rubble side beaches. Stream side cover is mainly of quite dense deciduous trees and underbrush, and only a few scattered stretches of cleared land. Relatively good cover and shading conditions exist throughout this stretch. Most of the tributaries entering within this section present mountain-type characteristics, falling swiftly and sharply toward the valley floor, exhibiting narrow stream channels with principally boulder and rubble bottoms. Where these streams meet the valley floor, and move across more gently sloped terrain toward the Green, they do offer some accessibility, with a fairly good pool-riffle balance and smaller sized bottom materials.

Salmon Utilization

There is presently no salmon utilization in the upper Green River watershed above the City of Tacoma diversion (R.M. 61). The river and a number of its tributaries in this section offer considerable potential for salmon spawning and rearing; however, present reservoir and water supply operations prohibit this. Production characteristics in this area would be most suited for spring chinook or coho salmon.

Limiting Factors

To a degree, a limitation on salmon production in the lower Green River is created by water release patterns involving the reservoir operation and water supply diversion located downstream from the reservoir. Occasionally, sustained low flows during the early fall months, or severe river flow reductions have impacted salmon utilizing the Green River downstream. Also, future logging and road building practices could affect the existing fish production potential of the upper Green.

Beneficial Developments

No facilities or programs have been undertaken in this area to specifically benefit salmon production. Preliminary investigations into the suitability of the upper stream areas for producing certain salmon stocks have been made. Plans to implement such a program have not been firmed up as of this time.

Habitat Needs

The major habitat requirement for this stream section is to preserve existing stream side cover and to maintain, in as near a natural state as possible, the existing stream and streambed characteristics. Also, flow release patterns to downstream areas should be coordinated with fish and habitat needs.

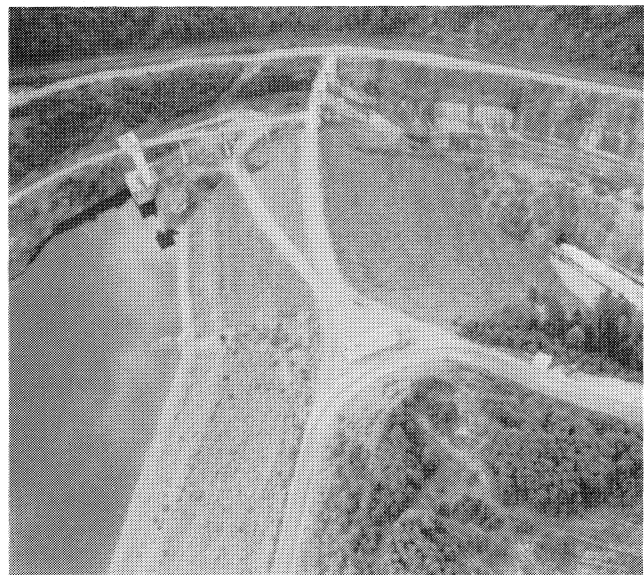
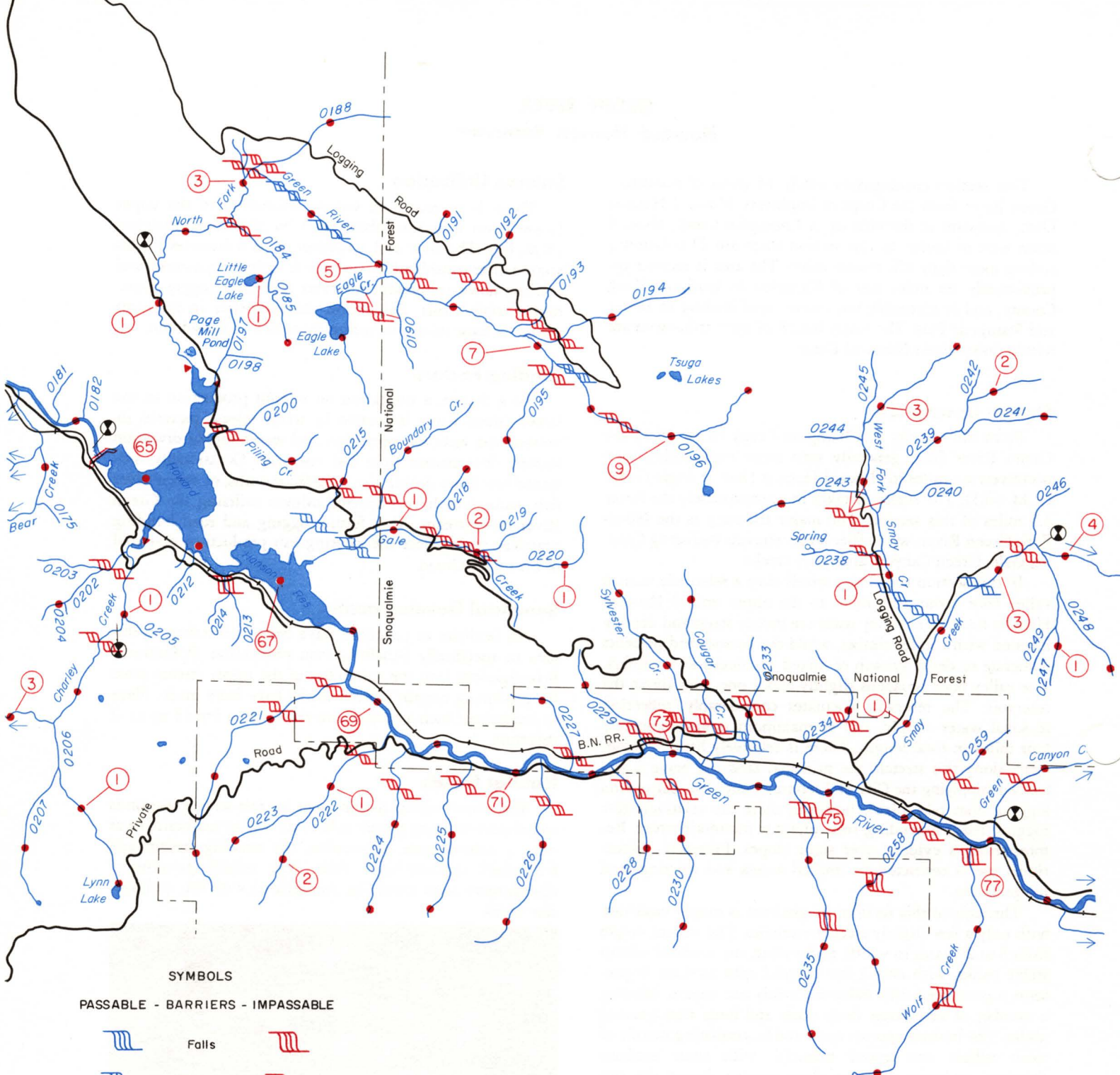


PHOTO 09-13. Green River flows are regulated by releases from Howard Hanson Dam.



SYMBOLS

PASSABLE - BARRIERS - IMPASSABLE

	Falls	
	Cascades	
	Beaver Dams	
	Log Jams	
	Dams	

Salmon Hatchery

Fish Passage Facility

Stream Gage

Stream Mile

Reference Point

GREEN RIVER Howard Hanson Reservoir

2 1 1/2 0 1 2 MILES

SCALE : 1" = 1.5 MILES



GREEN RIVER — HOWARD HANSON RESERVOIR
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				Chin., Coho, Chum
	Duwamish River cont. As Green River	@ mi. 11.01	—	—	
0183	N. Fork Green R.	RS-65.2	10.0	—	None
0184	Unnamed	LB-2.5	1.0	—	None
0185	Unnamed	RB-0.8	1.0	—	None
	Little Eagle Lk.	Outlet-1.0	—	—	
0188	Unnamed	RB-3.3	1.7	—	None
0189	Eagle Creek	LB-5.2	1.8	—	None
	Eagle Lake	Outlet-0.65	—	—	
0191	Unnamed	RB-5.5	1.0	—	None
0192	Unnamed	RB-5.95	1.35	—	None
0194	Unnamed	RB-6.9	1.9	—	None
0195	Unnamed	LB-7.3	1.4	—	None
0199	Piling Creek	RS-65.3	1.4	—	None
0201	Charley Creek	LS-65.4	5.1	—	None
0202	Unnamed	LB-0.25	1.3		None
0206	Unnamed	RB-2.4	2.0	—	None
0207	Unnamed	LB-0.5	1.6	—	None
	Lynn Lake	Outlet-2.0	—	—	
0208	Unnamed	RB-3.3	1.3	—	None
0209	Unnamed	RB-4.1	1.0	—	None
0215	Unnamed	RS-67.1	1.5	—	None
0216	Gale Creek	RS-67.2	2.9	—	None
0217	Boundary Creek	RB-0.8	1.9	—	None
0218	Unnamed	RB-1.45	1.0	—	None
0220	Unnamed	RB-2.05	1.6	—	None
0221	Unnamed	LB-68.6	3.4	—	None
0222	Unnamed	LB-69.3	2.5	—	None
0223	Unnamed	LB-1.3	1.1	—	None
0224	Unnamed	LB-69.6	2.0	—	None
0225	Unnamed	LB-70.4	2.0	—	None
0226	Unnamed	LB-71.4	2.5	—	None
0227	Unnamed	RB-71.75	1.3	—	None
0228	Unnamed	LB-72.25	1.9	—	None
0229	Unnamed	RB-72.66	1.45	—	None
0230	Unnamed	LB-72.9	2.25	—	None
0231	Sylvester Creek	RB-73.05	2.1	—	None

GREEN RIVER — HOWARD HANSON RESERVOIR
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0232	Cougar Creek	RB-73.35	2.3	—	None
0233	Unnamed	RB-73.45	1.9	—	None
0234	Unnamed	RB-74.59	1.9	—	None
0235	Unnamed	LB-74.6	3.25	—	None
0236	Smay Creek	RB-75.3	8.1	22.3	None
0237	W. Fk. Smay Creek	RB-1.7	4.0	—	None
0239	Unnamed	LB-1.7	2.55	—	None
0241	Unnamed	LB-1.35	1.1	—	None
0243	Unnamed	RB-1.9	1.4	—	None
0247	Unnamed	LB-3.65	1.45	—	None
0248	Unnamed	RB-0.4	1.0	—	None
0250	Unnamed	LB-4.85	1.1	—	None
0251	Unnamed	RB-4.95	1.4	—	None
0254	Unnamed	LB-6.4	1.0	—	None
0256	Unnamed	LB-6.7	1.0	—	None
0258	Unnamed	LB-76.25	2.3	—	None
0259	Unnamed	RB-76.4	1.4	—	None
0260	Wolf Creek	LB-76.8	3.3	—	None
0261	Green Canyon Creek	RB-77.05	2.75	—	None
(Continued Duwamish 803)					

GREEN RIVER

Headwaters

This section includes the upper Green River drainage from Champion Creek to its headwaters, a total of nearly 16 stream miles. There are 21 tributaries adding more than 137 linear miles. The area is located 20 miles east of Kanaskat in southeast King County, and is accessible via the Stampede Pass road. Most of the upper Green, plus major lengths of its tributaries are within Snoqualmie National Forest.

Stream Description

From headwaters on Blowout Mountain, the Green flows northwest ten miles to its confluence with Sunday Creek (R.M. 84.2), then west six miles to Champion Creek (R.M. 78.1). The major tributary is Sunday Creek, with other larger streams, including Twin Camp, Tacoma, Friday, Sawmill, Rock, and Champion creeks.

The Green's upper seven miles falls over mostly steep mountainous terrain. The streambed is restricted by narrow, steep-sloped valley walls with adjacent slopes holding dense conifer forest. The valley floor slowly widens below Intake Creek, becoming quite broad and flat near Sunday Creek. From here downstream, bottomland intermittently broadens and narrows, presenting moderate to dense stands of mixed deciduous and conifer timber. Side valley slopes remain moderately steep and densely forested. Land use is principally as a watershed supplying the City of Tacoma. Some clear-cut section logging occurs on adjacent side hills, with reforestation evident in a number of areas. Recreation use is limited due mainly to inaccessibility and land use management practices. Development has been minimal with the community of Lester, the largest populated area.

From its headwaters the Green cuts a narrow course for 6 to 7 miles, exhibiting typical mountain stream character with a few falls, numerous cascades and rapids, and few pools. The channel is quite restricted, generally ranging from 2 to 5 yards in width. The bottom is comprised mainly of boulders and rubble, with only a few scattered patch gravel stretches. Approaching Intake Creek the gradient decreases somewhat and the channel broadens slightly. There are fast flowing riffles, a few small pools, and mostly rubble-gravel bottom composition. Stream widths range 3-8 yards. Stream banks are stable, natural earth or rock cuts, with a few narrow beaches near Sunday Creek. Stream-side cover is dense, consisting of mixed conifer and deciduous growth.

Below Sunday Creek the gradient tends to moderate with only a few slightly steeper areas. A relatively good pool riffle balance exists within a confined stream channel and only occasional channel splits. Stream widths range from 5-18 yards, averaging 12 yards. The bottom is predominately gravel and rubble, generally free of silt, but with areas of considerable algae growth during the summer. Stream banks are generally low, natural earth or rock cuts, with numerous relatively broad gravel-rubble side beaches. Cover is mainly deciduous timber and brush thickets separated by occasional cleared areas. Generally, these conditions prevail downstream to Champion Creek.

Sunday Creek offers considerable moderate gradient stream conditions over its lower reaches, presenting good

pool-riffle balance and gravel-rubble bottom material. Most of the other tributaries exhibit predominantly mountain-type character, with very steep gradients, narrowly confined channels, and boulder-rubble stream bottoms. Most larger streams offer some accessibility and generally smaller-sized bottom materials. All tributaries have moderate to dense cover over most of the stream lengths.

Salmon Utilization

There is no salmon utilization within the upper Green River watershed. Salmon do not ascend above the City of Tacoma water diversion (R.M. 61) located about 3.5 miles below Howard Hanson Dam. Also, since there are no facilities to transport juvenile salmon safely downstream past the dam and diversion, no planting of hatchery produced salmon has been undertaken. The river and a number of its tributaries in this section offer considerable potential for spawning and rearing by spring chinook and/or coho salmon.

Limiting Factors

The principal limitation on salmon production is the barrier imposed by the water supply diversion and storage reservoir complex located downstream from this section. For potential future production, only the natural gradient increase of the Green River and its tributaries present any significant limitation.

Beneficial Developments

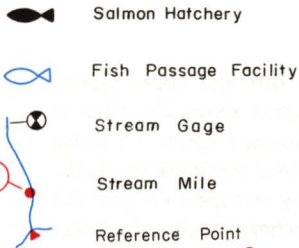
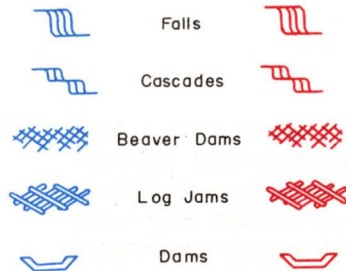
No facilities or programs have been undertaken to benefit salmon production in this section. Suitability for producing certain salmon stocks has been investigated; however, there are no firm plans to implement such a program.

Habitat Needs

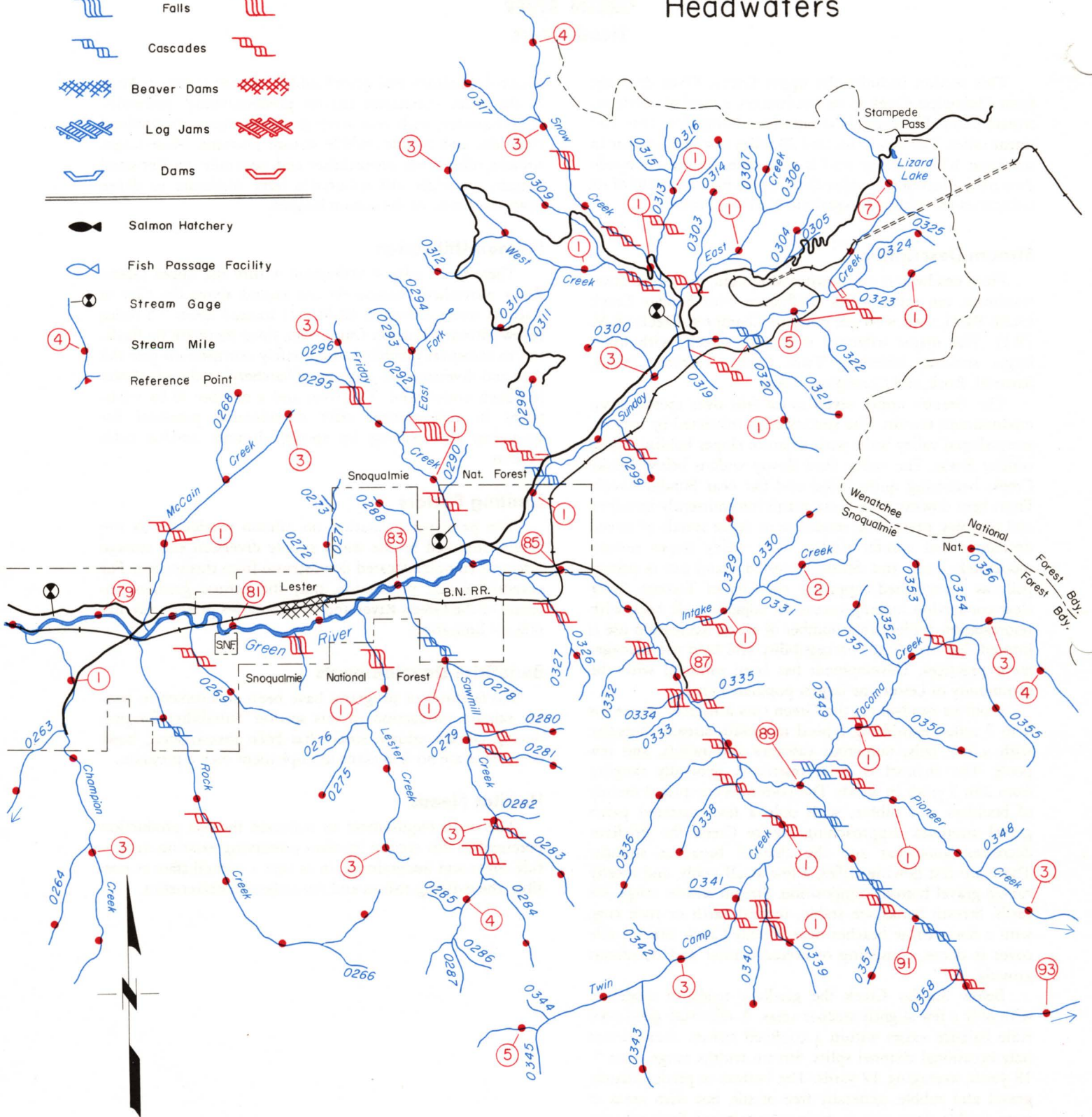
The main requirement to maintain the fish production potential in this section involves preserving existing stream-side cover and maintaining, in as near a natural state as possible, the existing stream and streambed characteristics.

SYMBOLS

PASSABLE - BARRIERS - IMPASSABLE



GREEN RIVER Headwaters



SCALE : 1" = 1.5 MILES

GREEN RIVER — HEADWATERS
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Duwamish River				Chin., Coho, Chum
	Duwamish River cont. as Green River	@ mi. 11.01	—	—	
0262	Champion Creek	LB-78.1	4.6	6.61	None
0263	Unnamed	LB-1.55	2.0	—	None
0264	Unnamed	LB-2.9	1.2	—	None
0265	Rock Creek	LB-79.55	5.3	—	None
0267	Mc Cain Creek	RB-79.7	3.1	—	None
0268	Unnamed	RB-2.0	1.0	—	None
0269	Unnamed	LB-80.3	1.8	—	None
0271	Unnamed	RB-82.0	1.8	—	None
0274	Lester Creek	LB-82.4	3.3	—	None
0275	Unnamed	LB-1.45	1.05	—	None
0277	Sawmill Creek	LB-83.05	4.95	7.9	None
0280	Unnamed	RB-1.9	1.15	—	None
0281	Unnamed	RB-2.1	1.1	—	None
0283	Unnamed	RB-3.05	1.35	—	None
0284	Unnamed	RB-3.65	1.2	—	None
0288	Unnamed	RB-83.25	1.15	—	None
0289	Friday Creek	RB-83.9	3.2	—	None
0291	E. Fk. Friday Cr.	LB-1.65	1.65	—	None
	Unnamed Lake	Outlet-1.65	—	—	
0297	Sunday Creek	RB-84.15	7.9	24.3	None
0298	Unnamed	RB-1.4	1.0	—	None
0299	Unnamed	LB-2.15	1.0	—	None
0300	Unnamed	RB-3.0	1.0	—	None
0301	Snow Creek	RB-3.5	4.45	—	None
0302	East Creek	LB-0.4	2.4	—	None
0303	Unnamed	RB-0.4	1.05	—	None
0304	Unnamed	LB-0.85	1.4	—	None
0308	West Creek	RB-0.65	3.3	—	None
0309	Unnamed	LB-0.75	1.25	—	None
0310	Unnamed	RB-1.25	1.2	—	None
0311	→ Unnamed	RB-0.3	0.6	—	None
0312	Unnamed	RB-2.0	1.2	—	None
0313	Unnamed	LB-0.8	1.8	—	None
0314	Unnamed	LB-0.85	1.0	—	None
0317	Unnamed	RB-3.1	1.3	—	None

GREEN RIVER — HEADWATERS
Duwamish River Basin — WRIA 09

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0320	Unnamed	LB-4.3	1.6	—	None
0321	Unnamed	RB-0.4	1.0	—	None
0323	Unnamed	LB-5.5	1.3	—	None
0324	Unnamed	RB-0.3	1.1	—	None
0326	Unnamed	LB-84.6	1.6	—	None
0328	Intake Creek	RB-86.35	2.8	—	None
0329	Unnamed	RB-1.1	1.2	—	None
0330	Unnamed	RB-1.45	1.1	—	None
0336	Unnamed	LB-87.9	2.1	—	None
0337	Twin Camp Creek	LB-88.2	5.5	9.6	None
0338	Unnamed	LB-0.2	1.05	—	None
0339	Unnamed	RB-1.45	1.6	—	None
0340	Unnamed	LB-0.6	1.0	—	None
0343	Unnamed	RB-3.5	1.2	—	None
0346	Tacoma Creek	RB-89.0	4.6	10.9	None
0347	Pioneer Creek	LB-0.4	4.05	—	None
0350	Unnamed	LB-1.3	1.2	—	None
0351	Unnamed	RB-1.85	1.25	—	None
0353	Unnamed	RB-2.25	1.3	—	None
0355	Unnamed	LB-2.56	1.85	—	None
0356	Unnamed	RB-3.15	1.0	—	None
0357	Unnamed	LB-90.45	1.1	—	None