Edgewater Creek Basin (Figure 3.4-21)

Edgewater Creek. Edgewater Creek drains a small and heavily developed basin of only 200 acres, a portion of which is located in the northwest corner of the SW Everett/Paine Field Subarea. The existing land uses in the Edgewater basin are primarily single family residential and open space. In the 1860's, one of the earliest county roads was constructed in the basin along portions of the stream.

The stream channel is approximately 0.5 mile long, and the stream gradient is approximately 11 percent, the steepest stream gradient in southwest Everett.

Edgewater Creek has inadequate flows to support salmonids The riparian corridor in the inner gorge below Sound Road, however, provides wildlife habitat. Upstream of Sound Avenue (within the SW Everett/Paine Field Subarea), Edgewater Creek comprises several intermittent, relatively low gradient stream channels. These intermittent channels join at a detention pond adjacent to Sound Avenue. Two culverts have been installed within the channels to accommodate an industrial development a few hundred feet upstream of Sound Avenue. Downstream of Sound Avenue, the stream corridor is in a largely undisturbed, natural condition. The stream flows through a large, vegetated corridor approximately 400 feet wide. Little intrusion into the stream corridor has occurred as a result of past urbanization, although one recent landslide and an illegal removal of trees within the stream corridor suggest that Edgewater Creek may soon be facing more frequent intrusions from adjacent land uses. Field visits in the spring of 1995 found that Edgewater Creek actively transported a large volume of sand and apparently experiences significant channel erosion during high flows.

Because Edgewater Creek may be a year-round stream downstream of Sound Avenue, it has been identified as a Category II stream downstream of Sound Avenue and a Category III stream upstream of Sound Avenue. Erosion hazard areas have been identified along the stream bed downstream of Sound Avenue.

In April 1992, City Council adopted the Port Gardner Bay Drainage Plan Update Report No. 5 as the revised Drainage Basin Plan for Edgewater Creek. The plan recommendations included upgrading of two undersized storm drains on Mukilteo Boulevard (outside of the SW Everett/Paine Field Subarea).

Edgewater Creek Basin Wetlands. See Figure 3.4-22 for the average wetland assessment scores for Edgewater Creek drainage basin.

Flood/Storm Water Control and Base Flow Support Functions. Only two wetlands, EC1 and 3, are present in this basin. EC1, a small forested depressional wetland in the upper basin, ranked as a Group 2 wetland. EC3, a riverine wetland at the mouth of Edgewater Creek, ranked as a Group 3 wetland.

The Edgewater Basin had one of the lower overall scores (63) for the flood and stormwater control function because of the lack of wetlands in the upper basin. The upper basin, therefore, would be an appropriate area to improve the storm/flood water control and baseflow function through the creation of depressional wetlands with constrained or bermed outlets.

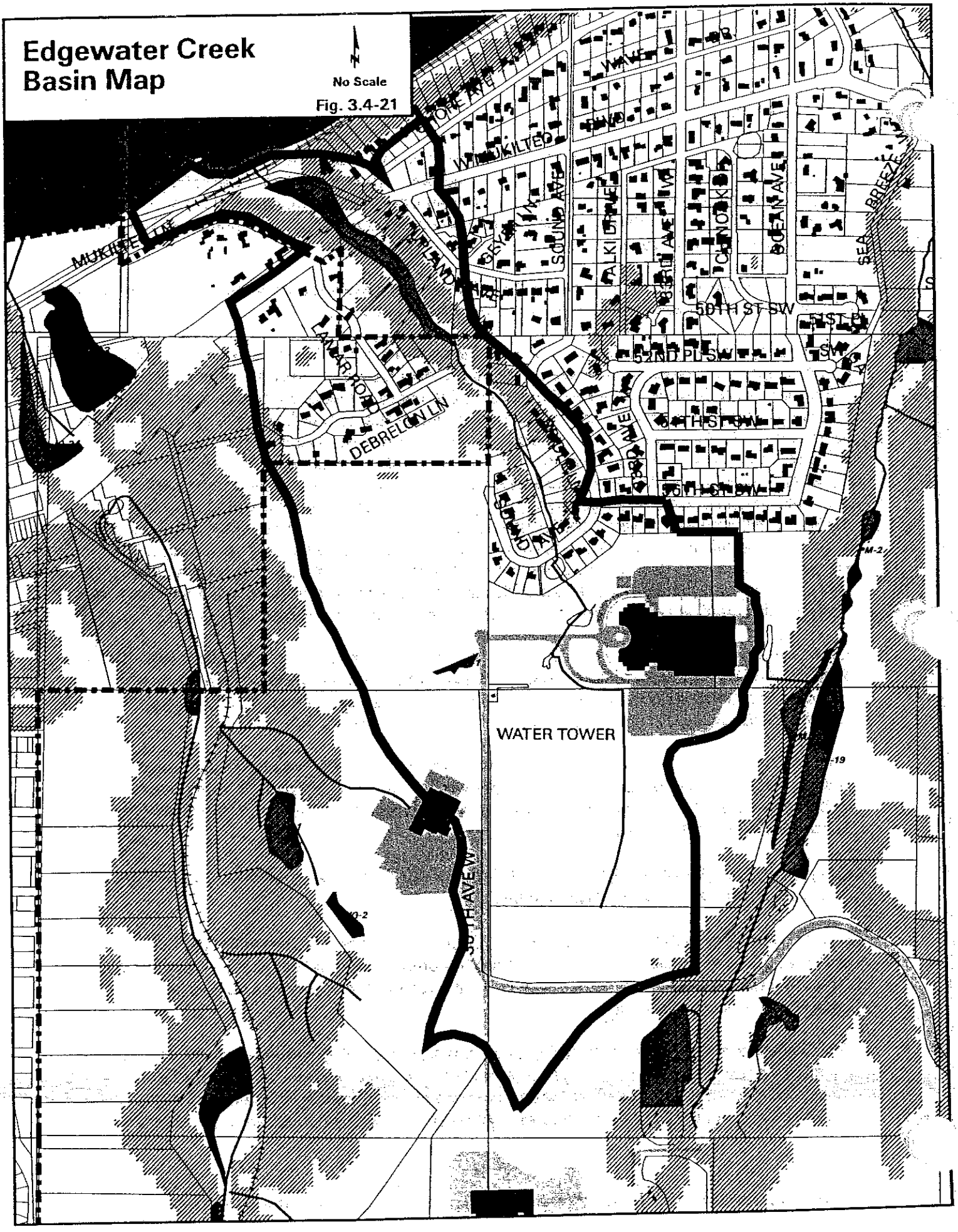
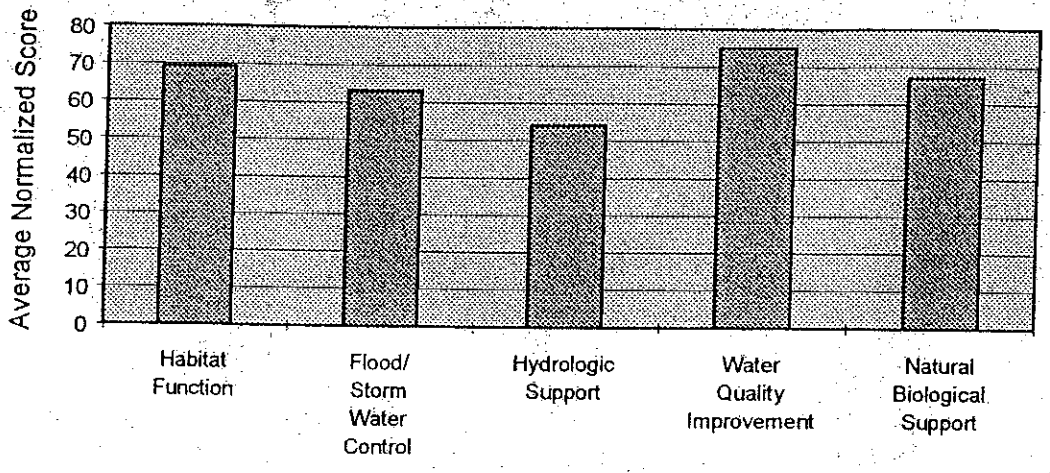

Edgewater Creek
Basin Map
No Scale
Fig. 3.4-21
WATER TOWER
50TH ST SW
52ND PL SW
DEBRELON LN
MUKILTEO BLVD
WATER TOWER

Figure 3.4-22
Edgewater Drainage Basin
Average Wetland Assessment Scores



Water Quality Improvement Function. The Edgewater Basin was the lowest ranking basin for the water quality improvement function (score of 75) due to lack of development in the upper portion of the basin (limited benefit for the function) and unconstrained outlet on the riverine wetland located in the lower portion of the basin.

Only two wetlands, EC1 and 3, are present in this basin. EC1, a small forested depressional wetland in the upper basin, ranked as a Group 2 wetland. EC3, a riverine wetland at the mouth of Edgewater Creek, also ranked as a Group 2 wetland.

The water quality improvement function for the basin could be improved by restricting the outlet of EC3 and ponding water in the lower portion of the wetland. This would have to been done in a manner that would not affect the integrity of the Burlington Northern railbed and culvert downstream of this wetland.

Habitat Functions. Of the two wetlands within this basin, the largest ranked as a Group 1 wetland for both the Natural Biological Support and Habitat Function. The habitat structure within this wetland could be enhanced through additional flooding if fish passage was not hindered and the integrity of the Burlington Northern railroad berm was not harmed.

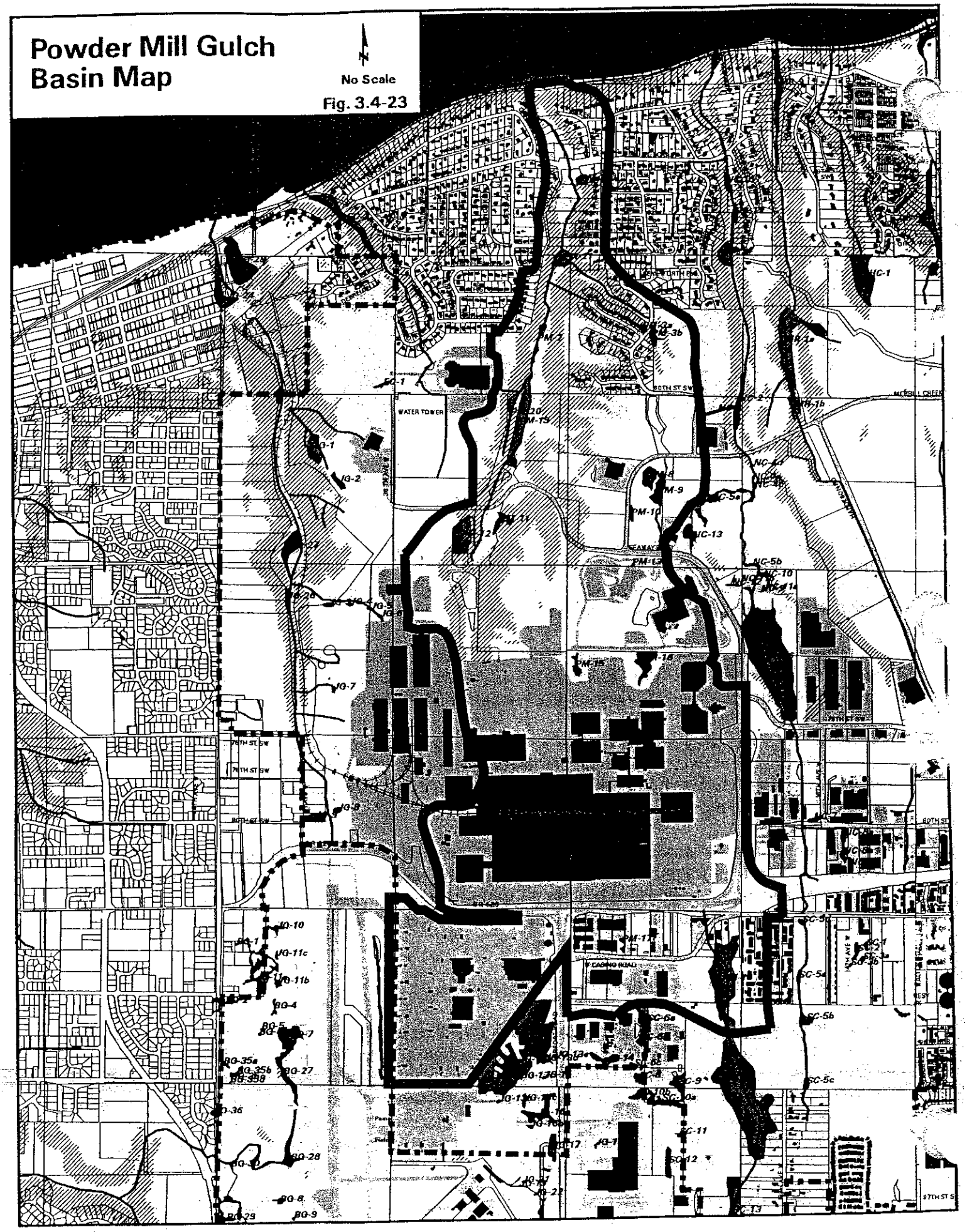
Powder Mill Gulch Basin (Figure 3.4-23)

Powder Mill Gulch Creek. Powder Mill Gulch Creek drains a 1,300-acre basin originating in the north central area of the SW Everett/Paine Field Subarea and flowing north to Port Gardner Bay in Puget Sound. This is one of the larger basins in the study area. Existing land uses vary from a predominance of open space and residential land uses in the lower drainage basin to a predominance of industrial and commercial land uses in the upper drainage basin (within the SW Everett/Paine Field Subarea). The stream corridor and inner gorge are forested and relatively undisturbed, except for the southern end, with no landslides evident on aerial

Powder Mill Gulch Basin Map

No Scale

Fig. 3.4-23



photographs. The stream's headwaters are covered by the Boeing complex, but much of the land on the ridges remains undeveloped. Past disturbances include construction of a powder mill in the gulch between Mukilteo Blvd. and Possession Sound in the early 1900s. The buildings were constructed on high pilings on the slopes in order to fit in the steep sloped ravine. There was a major office building located close to Mukilteo Blvd. on the east side of the ravine. The mill exploded in September of 1930, and many of the concrete footings still remain. (Dilgard, 1995)

The stream corridor downstream of Seaway Boulevard in the lower drainage basin is largely in a natural condition with a wide vegetative buffer along both sides of the stream. Traveling upstream of Seaway Boulevard a large created wetland and detention/water quality treatment facilities are present on the Boeing property, with the balance of the upstream area paved and the stream flow conveyed in storm drains. The detention and water quality treatment systems treat and pass collected stormwater from the Boeing and Fluke manufacturing facilities into the Powder Mill Gulch drainage basin.

The slope of the stream channel varies from approximately 3 percent upstream in the upper drainage area to approximately 9 percent downstream of Mukilteo Boulevard (lower drainage basin). The land slope along the stream corridor varies from approximately 25 percent to 50 percent upstream of Mukilteo Boulevard to 50 to 100 percent downstream of Mukilteo Boulevard.

As of 1988, nearly 50 percent of the land within the Powder Mill Gulch drainage basin was estimated by the City of Everett to be covered with impervious surfaces. The rate and volume of stormwater runoff in the drainage basin has increased dramatically over conditions that existed before the watershed was urbanized. Significant stream cutting and channel erosion have occurred in the lower reaches of the stream. Information obtained from the City of Everett's Drainage Basin Plan Update for Powder Mill Gulch (1988) describes the portion of Powder Mill Gulch that flows between Route 526 and Puget Sound as a steep, relatively straight channel, consisting of riffles and pools with channel slopes at approximately 9 percent. The channel cuts through various stratigraphic units, ranging from glacial till material consisting of silts, sands, gravels, and cobbles to dense sand and hard silt and clay deposits. Because of the presence of cobbles within the till deposits, much of the stream has developed a cobble bed. Several locations within the lower reach of the gulch appear to have unstable side slopes, as indicated by slides or cracks in the bank material or absence of significant vegetation. Most of the slopes within the reach are heavily vegetated with brush and small trees. Large woody debris, consisting of fallen trees, brush, and remains from the old Powder Mill, exists all along the channel.

Peak flow rates from the Boeing complex are partly mitigated by a series of detention ponds and biofiltration systems above Seaway Boulevard. Nevertheless, high flow rates have accelerated channel and bank erosion in this stream.

In the 1970s and 1980s, there were several reports of pollution incidents in Powder Mill Gulch. The most common report was of a strong smell of "jet fuel" emanating from the stream. Water quality had essentially been effected to the point that no life was present in Powder Mill Creek. Residents within the drainage basin expressed their concern about the channel erosion and water quality problems and potential aggravation of these problems from impending land use actions on several occasions. In response to these concerns, the Planning Commission and

City Council directed the Public Works Department to update the comprehensive drainage plan for Powder Mill Gulch and reevaluate potential solutions to the erosion and water quality problems in the drainage basin. The City's recommendation was to develop spill containment plans for the Boeing site and enhance an existing detention pond/wetland at Seaway Boulevard to improve and protect the water quality of Powder Mill Gulch. The enhancement of the detention pond and wetland was performed by Boeing in the early 1990s, and now all stormwater runoff from the facility is collected and sent through sedimentation, and detention/wetland ponds before discharge into the Powder Mill Drainage Basin. Water quality of the stormwater is monitored frequently by Boeing and compared to water quality standards stipulated in the Decision Document for the 1991 Boeing Expansion. Water quality in Powder Mill Creek has improved since Boeing's implementation of spill control plans and construction of the new facilities on the Boeing property, and benthic invertebrates are returning to the creek.

Due to past water quality problems, low summer flows, siltation, and channel erosion caused by industrial and residential development, salmonids are no longer permanent residents of Powder Mill Gulch. Though the lower reaches of Powder Mill Gulch are too steep to provide significant coho habitat, the middle reaches could provide trout habitat. This middle reach, downstream of Seaway Boulevard and upstream of Mukilteo Boulevard, contains 3,000 to 4,000 ft. of habitat physically suitable for salmonids, especially resident cutthroat trout. This section of stream has an average gradient of 3 percent, but it has qualities of a lower gradient stream due to a relative abundance of effective woody debris. If the water quality of this stream was shown to be stable, and if an adequate population of aquatic insects develops, this section of stream would be appropriate for the introduction of resident cutthroat trout.

The lower reach of this creek was surveyed and electroshocked by KCM in March 1993. KCM's report to the City of Everett (Daley, 1993) states:

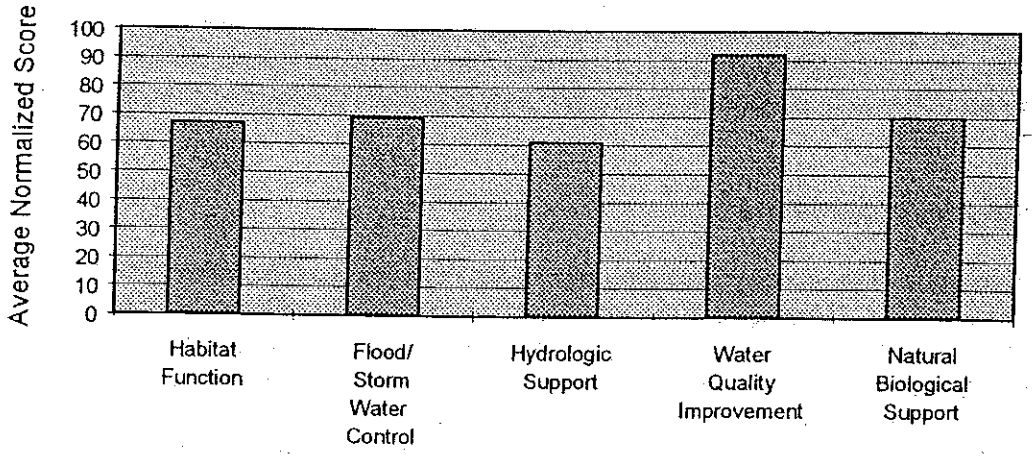
> The creek is very fast flowing at this point with a slope of approximately 6 percent. In addition there are long reaches where the stream bottom is basically clay and velocities are a potential problem for adult migration. Salmonid utilization of this system is further complicated by the release of stormwater from a large storage reservoir on the Boeing plant. There were no salmonids captured in the short reach upstream of the railroad tracks which was fished (approximately 200 feet).

During reconnaissance on June 6, 1995, a large amount of foam was present in the water.

In October of 1988, the City of Everett's City Council adopted the recommended plan from the Port Gardner Bay Drainage Basin Plan Update Report No. 1 as the Revised Powder Mill Gulch Drainage Basin Plan. The main goals of the update were to address citizen concerns about pollution and excessive channel erosion. The objective of the adopted plan was to minimize impacts of future development by creating regional detention ponds and enhancing an existing detention pond/wetland at the Boeing facility.

Powder Mill Gulch Basin Wetlands. Figure 3.4-24 shows the average wetland assessment scores for Powder Mill Gulch drainage basin.

Figure 3.4-24
Powder Mill Gulch Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control and Base Flow Support Functions. For the Powder Mill basin only one wetland, Kasch Swamp (PM18) ranked as a Group 1 wetland. It is located in the uppermost portion of the basin on the Mukilteo terrace, immediately south of the Boeing complex. Because the level upper portion of the basin has been essentially paved and built over, remaining wetlands are located in the ravines and riparian corridors draining northward into Port Gardner Bay. These wetlands ranked primarily as Group 2 and 3 wetlands for the flood and stormwater control function. This is an expected level of functioning for riverine wetlands because they have limited capacity to detain large volumes of water, have unconstrained outlets and do not contribute significantly to baseflows. The flood/storm water control and baseflow support function can be enhanced for PM18 by raising the elevation of the outlet culvert.

Water Quality Improvement Function. With so much of the critical upper portion of this basin developed, little opportunity exists for the creation of additional wetland areas for the purpose of improving the flood and stormwater control function. The City and Boeing should continue efforts; however, to determine if the timing of releases from Boeing's Powder Mill detention facility could be altered in order to further desynchronize downstream flows.

Powder Mill Basin ranked third for the water quality improvement function relative to the other basins in the study area. In general, the riverine wetlands ranked as Group 2 wetlands (59% of total wetlands) with the depressional wetlands ranking as Group 1 wetlands.

Because the Group 2 wetlands are riverine, enhancement of the water quality improvement function through restriction of the outlet, by berming, is limited. Opportunity for improvement of this function does exist with Kasch Swamp (PM18). The outlet for Kasch Swamp is presently below the average elevation of the swamp, resulting in a reduced ponding of water. There is sufficient depth in the swamp to allow for substantially more ponding of water in this swamp if the outlet culvert was raised in elevation.

Habitat Functions. Group 1 wetlands accounted for 35% of the total wetlands for both the Natural Biological Support and Habitat Function. This constituted wetlands within the stream corridor (PM19-22) and Kasch Swamp (PM18) in the very upper fringe of the basin. Wetlands within the middle portion of the basin (PM11,12,15 and 16) ranked in Group 2 and 3 due to impacted buffers, lack of diversity in community types and plant species. One of these wetlands (PM12) is a mitigation wetland and cannot be considered an enhancement opportunity. The remaining three wetlands can be enhanced through improved buffer plantings and creation of more extensive and diverse emergent and scrub-shrub communities.

Narbeck Creek Basin (Figure 3.4-25)

Narbeck Creek. Narbeck Creek is an approximately 450-acre drainage basin located in the north central portion of the SW Everett/Paine Field Subarea, starting at Highway 526 just east of 20th Avenue West and draining north to Port Gardner Bay. A large part of the drainage basin is contained within the SW Everett/Paine Field Subarea. In the southern, upper portion of the watershed, Narbeck Creek flows through Narbeck Swamp, an open-water wetland of about 15 acres that is home to a beaver population and a feeding area for blue heron. Downstream of Narbeck Swamp, the creek has been channelized for several hundred feet. (There is a current proposal to restore this channel.) The headwaters above Narbeck Swamp are heavily developed.

The stream corridor upstream of 75th Street SW has been substantially altered by urbanization. Approximately 25 percent of the land within the Narbeck Creek Drainage Basin is covered with impervious surface. The stream has been piped from SR 526 to an in-stream detention pond at Snohomish County PUD's operation center north of 80th Street SW. From the detention pond the stream is again piped to the 15-acre Narbeck Swamp wetland north of 75th Street SW. Downstream of Narbeck Swamp the stream corridor is largely in a natural condition with a wide vegetative buffer along both sides of the stream, with two exceptions where the stream is piped under roads (Mukilteo Boulevard and Merrill Creek Parkway).

The slope of the stream channel is approximately 3 percent for 200 feet downstream of Narbeck Swamp. The stream channel then steepens to a slope of 7 percent to the stream outlet at Port Gardner Bay (outside physical boundaries of SW Everett/Paine Field Subarea). The slope of the land adjacent to the stream corridor varies from flat (0 to 10 percent) in the upper drainage basin to 75 percent in the lower drainage basin.

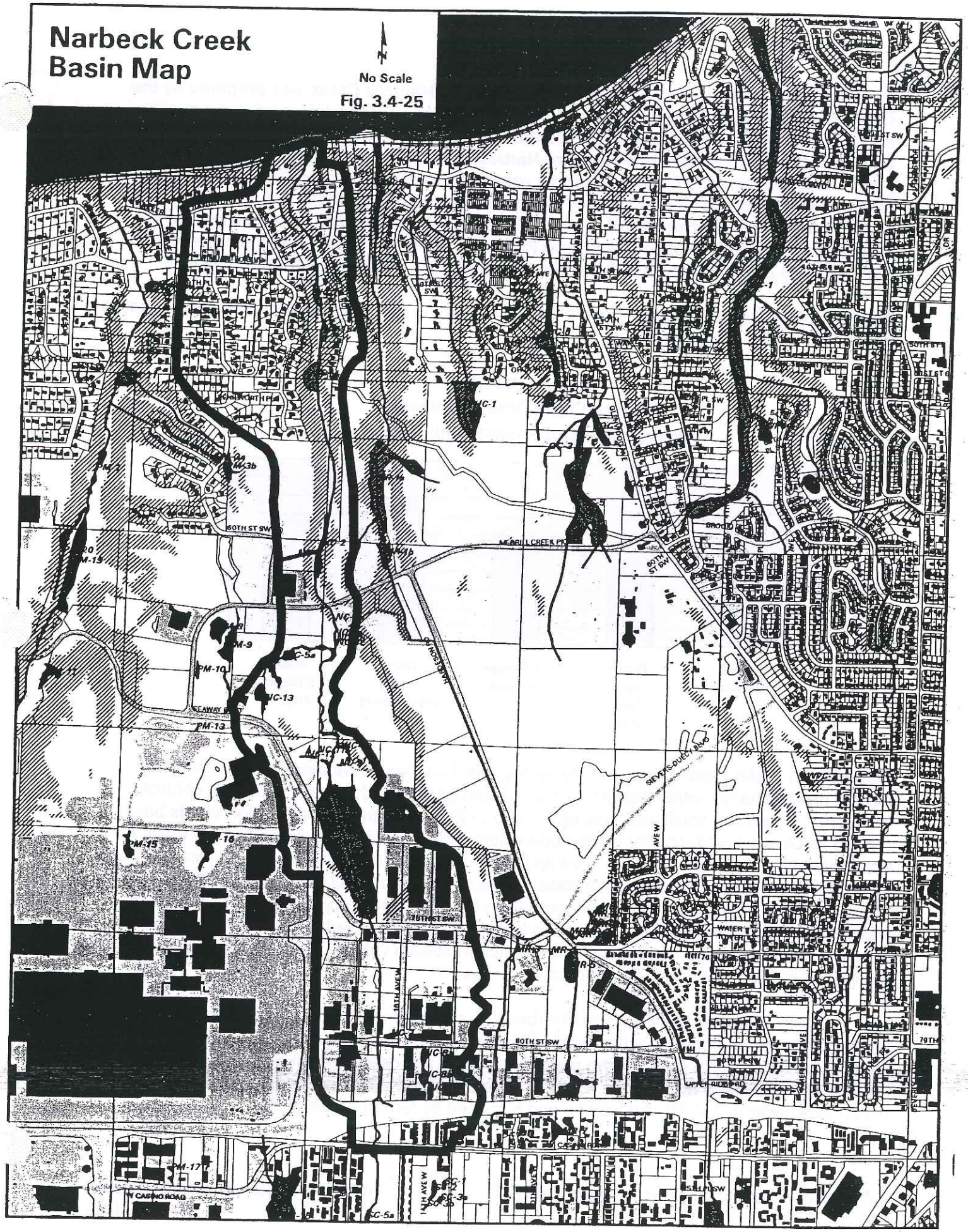
The lower third of the basin is experiencing significant problems with landslides resulting from a combination of cutting of trees for views, discharging residential runoff onto steep slopes, and the presence of a clay lens (Whidbey formation) at the base of steep slopes near the stream.

Narbeck Creek currently has no salmonids. Much of the creek goes dry in the summer, and it is unlikely that this system could support a salmonid population.

Narbeck Creek Basin Map

No Scale

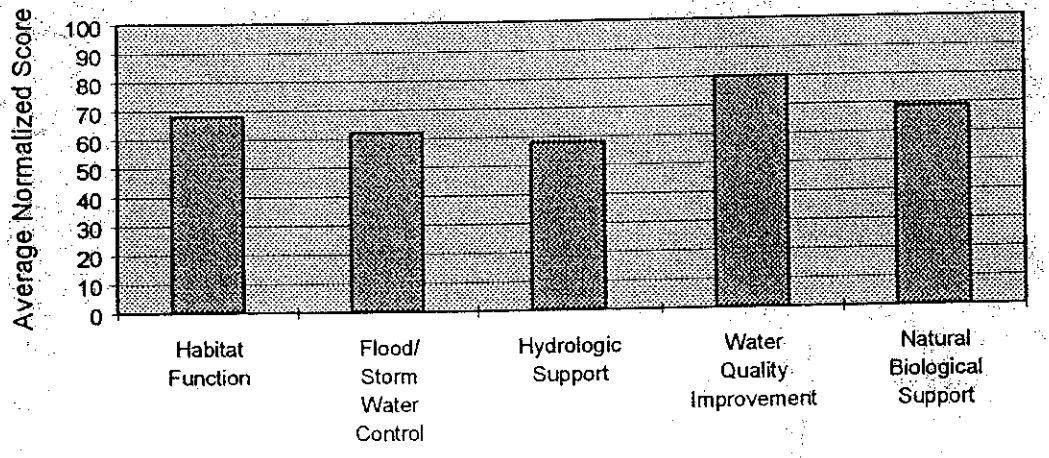
Fig. 3.4-25



The Port Gardner Bay Drainage Basin Plan Update for Narbeck Creek was prepared by the City of Everett Utilities Division in May of 1988. Goals were set to implement water quality controls, establish a stream buffer, and control the quantity of stormwater runoff in the area of the wetland. The Plan recommended that Narbeck Swamp be purchased or encumbered by a public surfacewater easement and used for regional detention. Properties upstream of Narbeck Swamp would rely on Narbeck for detention and would contribute to a fund for regional detention. Downstream of Narbeck Swamp, on-site detention would be required. This is no longer likely to occur, and Paine Field and Fluke Corporation have now developed plans (not yet approved) for expanding Narbeck Swamp as mitigation for other projects.

Narbeck Creek Basin Wetlands. Figure 3.4-26 shows the average wetland assessment scores for Narbeck Creek Drainage Basin.

Figure 3.4-26
Narbeck Creek Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control and Base Flow Support Functions. Wetlands within this basin ranked predominantly within the Group 2 and 3 categories for the storm and flood control functions. Only three small wetlands (8a, b and c) in the extreme upper portion of this basin ranked as Group 1 wetlands for storm/flood water control. The upper portion of the basin is dominated by the 20 acre Narbeck Swamp (NC6) which ranked as a Group 1 wetland for both the flood/storm water control and the baseflow function. Additional wetland could be created adjacent and northward of Narbeck Swamp thereby significantly improving the flood/storm water control and baseflow function for this basin. Because of the high potential for slope failure in the lower portion of this basin, reduction in stream velocity will also assist in reducing the rate of erosion along the toe of unstable slopes.

Water Quality Improvement Function. Narbeck Basin wetlands ranked sixth overall for the water quality improvement function relative to other basins in the study area. There are six Group 1 wetlands (26% of total), the majority of which are depressional wetlands. The most notable of these is the twenty acre Narbeck Swamp (NC6). Three wetlands immediately north of Narbeck Swamp, NC 10 and NC11a and b ranked as Group 3 wetlands.

The most significant potential for enhancement of the water quality improvement function exists immediately north of Narbeck Swamp. Approximately 6 acres of degraded upland and wetland is proposed for wetland creation and enhancement by Snohomish County Airport (Paine Field). Opportunities also exist with NC8a,b, and c and NC13 where restriction of the outlet would enhance the water quality improvement function.

Habitat Function. Approximately 47% of the wetlands ranked as Group 1 wetlands for both the Natural Biological Support and Habitat Function. This included Narbeck Swamp (NC6) and riverine wetlands NC5a and 13 for the Natural Biological Support function and NC14 to 17 (lower reach of Narbeck Creek) for the Habitat Functions.

Opportunity for enhancement in this basin includes: restoration and enhancement of degraded wetlands immediately north of Narbeck Swamp (e.g. from emergent to scrub-shrub and forested habitat); and elimination of the cutting of forested vegetation on slopes surrounding wetlands NC14 to 17 and replanting with native forest and scrub-shrub species.

Merrill and Ring Creek Basin (Figure 3.4-27)

Merrill and Ring Creek. Merrill and Ring Creek drains an approximately 800-acre linear basin. The upper basin, above Merrill Creek Parkway, has been heavily developed and modified. The lower basin is relatively undisturbed and undeveloped. The middle and lower basins, below Merrill Creek Parkway, feature a continuously forested inner gorge and stream corridor. Past disturbances of the stream include construction of a narrow guage railroad that extended from the bay to south of the current Everett Mall Way. A logging camp, including buildings and a cookhouse were constructed in the ravine. Much of the metal was hauled out in W.W.II. In the late 1960's a cofferdam broke on the Associated Sand and Gravel site. This flooded and changed the stream and destroyed what remained of the logging camp/railroad. (Dilgard, 1995)

The drainage basin extends from approximately Casino Road north to Port Gardner Bay. The area of the drainage basin located between Casino Road and Merrill Creek Parkway is contained within the SW Everett/Paine Field Subarea. Upstream of SR 526, the predominant land use is multi-family residential. Downstream of Merrill Creek Parkway, the predominant land uses are single family residential manufactured homes and open space. Industrial, mining, and single family land uses exist in the portion of the basin between Merrill Creek Parkway and SR 526.

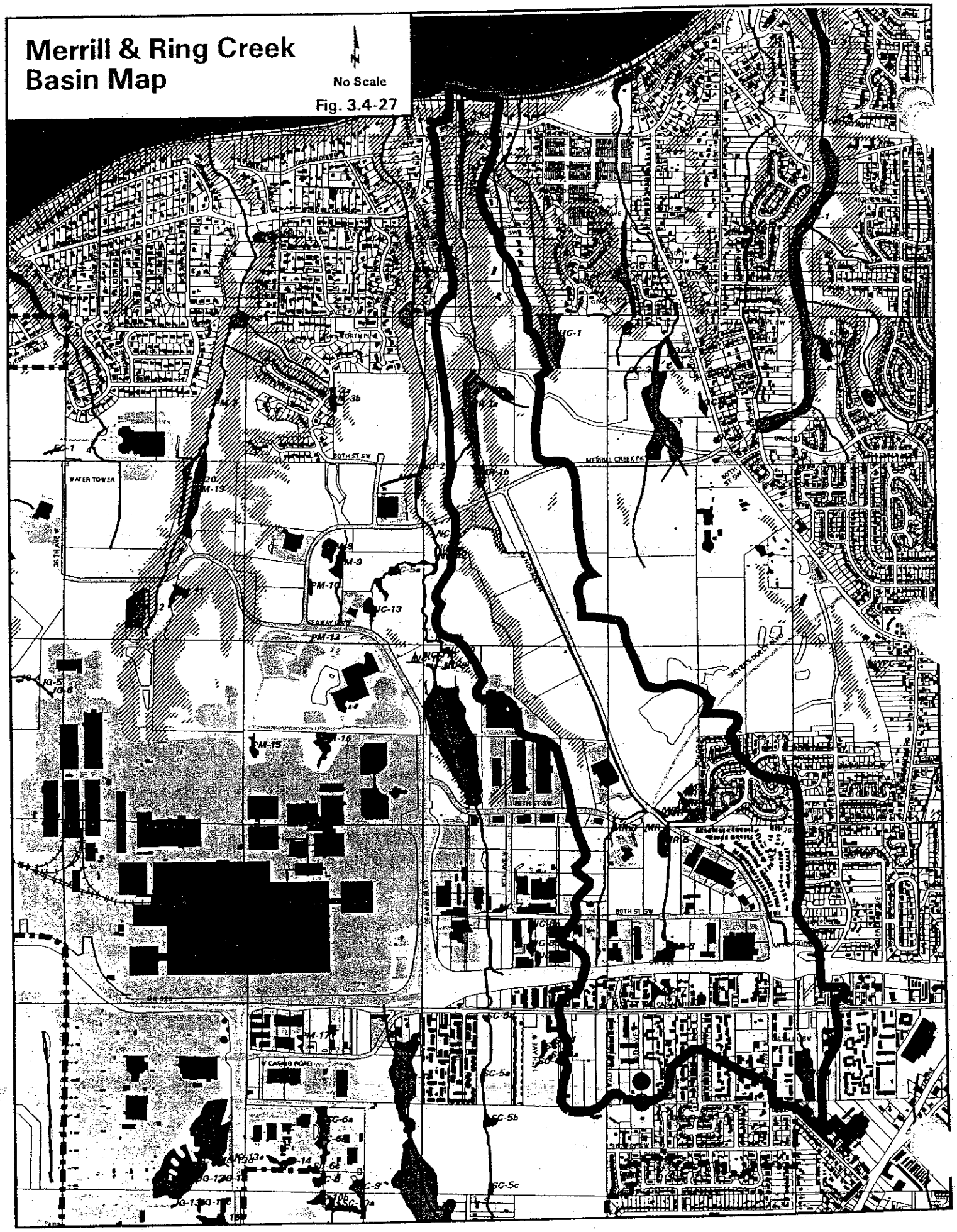
The Merrill and Ring Creek stream corridor is separated into two distinct reaches. The stream corridor downstream of Merrill Creek Parkway is densely vegetated with steep side slopes. The stream corridor is largely undisturbed, although a washwater pond blowout on the Associated Sand and Gravel site in the late 1960s still impacts the stream. The washwater pond blowout eroded the less competent surface soil and created a series of small waterfalls approximately 1,000 feet upstream of Mukilteo Boulevard.

Upstream of Merrill Creek Parkway the stream corridor has been highly disturbed. The stream has been relocated and confined into a narrow riprapped channel adjacent to Hardeson Road, and culverts have been installed at numerous stream/road crossings. The stream channel along Hardeson Road between Merrill Creek Parkway and 75th Street SW is essentially unvegetated due in large part to past mining activity adjacent to the stream.

Merrill & Ring Creek Basin Map

No Scale

Fig. 3.4-27



The stream channel is nearly three miles long. The stream gradient is an average of 4 percent; however, downstream of Merrill Creek Parkway the stream channel steepens to nearly 6 percent.

The fish habitat quality of Merrill and Ring Creek has been significantly degraded by past gravel mining in the bed and banks of the former stream channel above Merrill Creek Parkway. However, the low gradient section at the mouth of the creek does support salmonids. On June 12, 1995, Pentec personnel observed eight salmonids of unknown species in the lower 200 m of channel. Electroshocking conducted in 1981 as part of the South Everett basin planning process found coho fry in this section of Merrill and Ring Creek.

While Merrill and Ring Creek features about 600 ft. of low gradient channel below Merrill Creek Parkway that could provide habitat for small coho and chum populations, this stream will probably not support significant fish populations until sediment inputs are stabilized. Fine sediment inputs from the gravel operations and channel erosion due to increased storm flow rates has degraded the habitat in the lower sections of the stream. Salmonid use of the lower system is limited by the lack of quality spawning gravels. There is a high percentage of sand in the substrate, so flow through the gravel is sub-optimal for egg incubation.

The City's Drainage Basin Plan for Merrill and Ring Creek states that re-establishing a fishery in Merrill and Ring Creek is not a goal. However, it could become a high priority in the future if water quality efforts are successful and if fisheries enhancement efforts in other higher priority drainage basins are successful, which could free additional funds for Merrill and Ring Creek.

Merrill and Ring Creek is identified as a Category II stream downstream of Merrill Creek Parkway and a Category III stream upstream of that point. Because of salmonid usage downstream of Merrill Creek Parkway, this segment should be reclassified as a Category I stream.

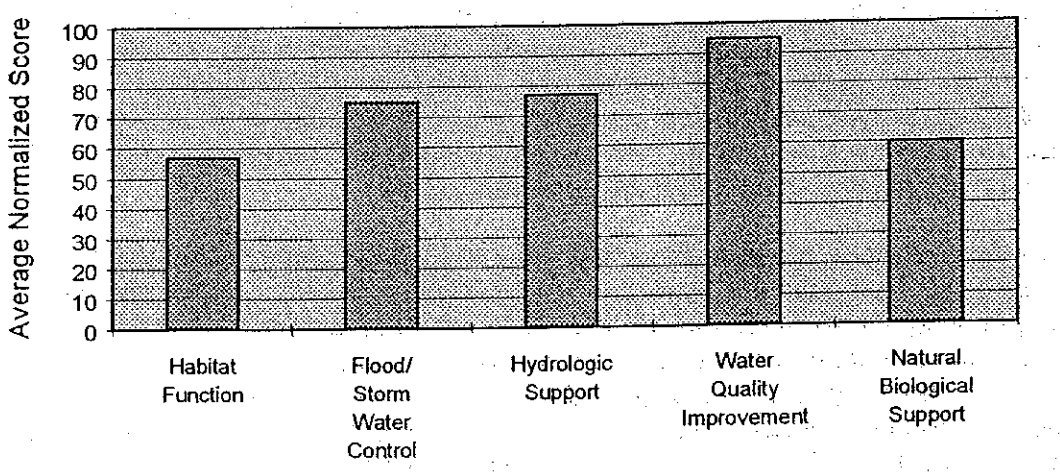
In 1992, the Everett City Council adopted the updated Merrill and Ring Creek Drainage Plan. The goals of the plan were to not only control peak stream flow but to improve the existing water quality conditions and to mitigate the impacts of future urbanization on the water quality. The adopted plan includes a combination of regional and on-site detention systems:

- The existing regional pond at Merrill Creek Parkway was to be expanded.
- A regional detention pond was to be constructed immediately south of the Westridge Mobile Home Park.
- On-site detention requirements downstream of Merrill Creek Parkway were to be based on a 5-year pre-development design storm rather than the previous 10-year criteria.
- Installation of parallel culverts at Veralene Way to decrease flooding.

The regional pond at Merrill Creek Parkway has been expanded, but the regional detention pond proposed south of Westridge Mobile Home Park and the parallel culverts have not.

Merrill and Ring Creek Basin Wetlands. Figure 3.4-28 shows the average wetland assessment scores for Merrill and Ring Creek drainage basin.

Figure 3.4-28
Merrill and Ring Creek Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control Function. Though this basin had one of higher overall scores for the flood and stormwater control function, all wetlands except one, ranked in the Group 2 and 3 categories. For the baseflow support function 5 wetlands (MR 1a, MR 2a, MR 6,7 and 8) ranked as Group 1. Due to past sand mining operations, the middle portion of this basin has no wetlands present with no future opportunity for the creation of additional wetlands. The upper portion of the basin has several wetlands (MR5 to 8) where the flood and stormwater control function could be improved by restricting or berming the outlets. The hydrological support function could also be improved for MR5 by restricting or berming its outlet. Wetland can also be created within a ravine north of Upper Ridge Road and adjacent to Hardeson Road by restricting its outlet into the mobile home park to the north.

Water Quality Improvement Function. The Merrill and Ring Basin Wetlands ranked first for the water quality improvement function. Group 1 wetlands (53%) were primarily small depressional wetlands in the upper watershed and the Group 2 wetlands were slope and riverine wetlands in the lower portion of the watershed.

Limited opportunity for enhancement of the water quality control function exists for the slope and riverine wetlands due to the physical difficulty in restricting water flow on slopes and in stream beds. The outlet to MR9 at the mouth of Merrill and Ring Creek could be restricted if it did not restrict fish passage or affect the integrity of the Burlington Northern railroad berm. Some enhancement opportunity does exist in the upper watershed in wetland MR8 where raising of the outlet elevation would increase ponding; there is sufficient depth in this wetland given the road berm (+6 feet) and sloping sides to allow for a water depth of 1 foot in portions of the wetland. Because the Group 1 wetlands MR5 has been ditched, there is opportunity to increase flooding by restricting the outlet and filling in the ditch running through the wetland. Further, because the Group 1 wetland MR6 is within a relatively well defined ravine, potential also exists for further restricting the outlet and ponding more water within this wetland.

Wetland can also be created within a ravine north of Upper Ridge Road and adjacent to Hardeson Road by restricting its outlet into the mobile home park to the north. This would further improve the water quality improvement function for this basin.

Habitat Functions. Group 1 wetlands for both the Natural Biological Support and Habitat functions were almost exclusively limited to the lower portion of the basin within the stream corridor (exception is MR2i and j). The upper portion of the basin, south of Merrill and Ring Way, consists of degraded Group 2 and 3 wetlands. Within the study area, this Basin was one of the lower scoring basins for these functions.

Opportunities for the improvement of the Natural Biological Support and Habitat functions include the creation of more diverse emergent, scrub-shrub and forested habitat within wetland MR5 through increased flooding. Additional wetland habitat could be created within a moderate sized area of stream habitat immediately south of Upper Ridge Road (no wetland number was assigned to this area). Enhancement opportunities also exist for the severely degraded "Dariotis" wetlands (MR7) which consist of a poor quality emergent wetland on top of compacted glacial till. This wetland could be enhanced with the importation of hydric soils (30% organics), planting of a diverse emergent, scrub-shrub and forested wetland and improved hydrology. However, this enhancement is of a low priority due to the isolation of this wetland.

Phillips Creek Basin (Figure 3.4-29)

Phillips Creek. Phillips Creek drains only about 100 acres, and it goes dry in the summer. Flows are inadequate to support salmonids. The riparian corridor is broken by houses and landscaping adjacent to the stream. Some houses appear to be built on high erosion and landslide hazard areas.

Phillips Creek Basin Wetland. Figure 3.4-30 shows the wetland assessment scores for the wetland evaluated in Phillips Creek drainage basin.

Flood/Storm Water Control Functions. This small basin has one wetland present which ranked in Group 3. Restriction on the outlet of this wetland could improve the storm and flood water control function for this wetland.

Quality Improvement Function. This small basin has one wetland present which ranked in Group 2. Restriction on the outlet of this wetland could enhance the water quality improvement function.

Habitat Functions. The one wetland for this basin ranked as a Group 2 wetland for the Natural Biological Support function and Group 1 for the Habitat function. No enhancement opportunities have been identified at this time.

Phillips Creek Basin Map

No Scale

Fig. 3.4-29

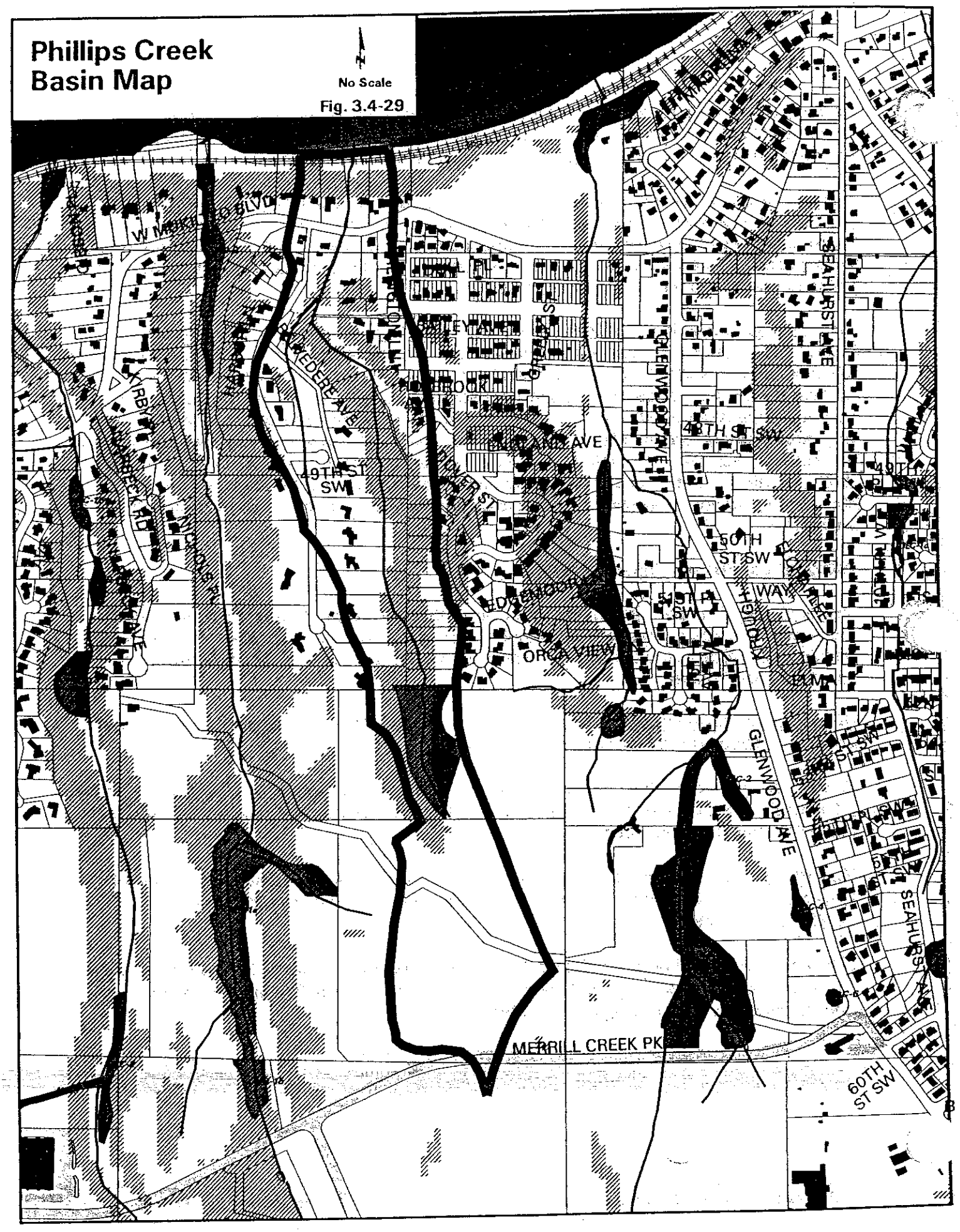
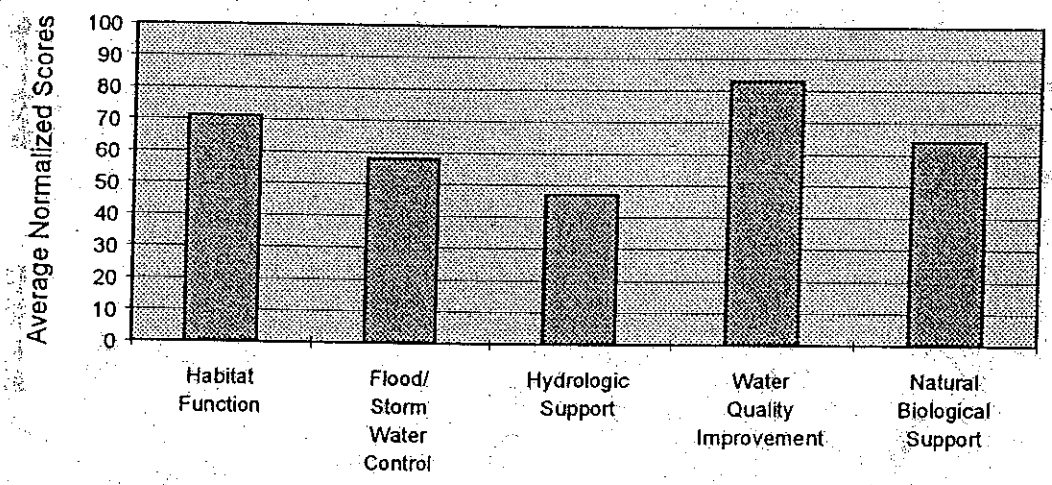


Figure 3.4-30
Phillips Creek Drainage Basin
Average Wetland Assessment Scores



Glenwood Creek Basin (Figure 3.4-31)

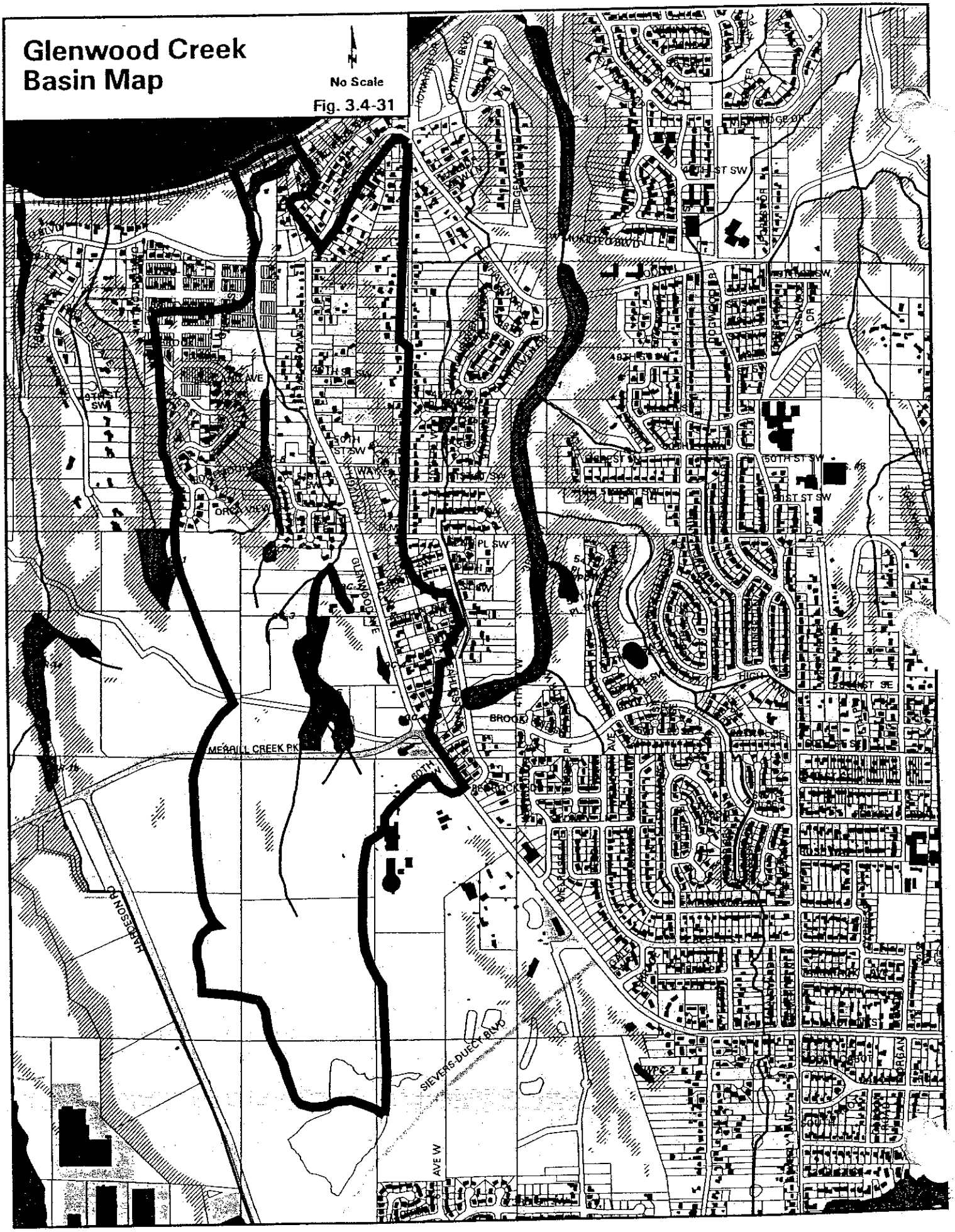
Glenwood Creek Basin. Glenwood Creek drains a 380-acre basin, a portion of which is located within the northeast corner of the SW Everett/Paine Field Subarea. Glenwood Creek consists of a main branch and an east and west fork. The west fork is approximately 0.5 mile long; it originates just downstream of Merrill Creek Parkway and flows north to join the east fork west of Glenwood at approximately 49th Street SW (just north of the physical boundaries of the SW Everett/Paine Field Subarea). Single family residential is nearly the exclusive land use in this drainage basin, with the exception of a PUD substation towards Port Gardner Bay. As of 1989, approximately 6 percent of the land within the drainage basin was covered with impervious surfaces. Past disturbances to the stream include impacts from mining and production of cement on the Associated Sand and Gravel site. In addition, Glenwood Creek was used for the first steam sawmill in the area, which was built in the 1860's. When the area was platted, Glenwood Creek was platted as a street. Fuel was stored in tanks in the area north of Harborview Park, and evidence of fuel spills is still visible. The beach at the mouth of the stream was used as a City beach, but it was eventually closed due to contamination from sewage. (Dilgard, 1996)

The Glenwood Creek basin is small but seems to provide sufficient flow to maintain fish populations. Glenwood Creek supports a trout population and features good spawning gravel and an intact riparian corridor. The stream corridors of the main branch and west fork are largely in natural, undisturbed conditions with wide vegetative buffers along both sides of the stream channels. Past urbanization has significantly altered the middle reach of the east fork stream corridor. There is a relative abundance of in-channel woody debris throughout the system. The channel is highly incised in places and seems to be reacting to the effects of storm drainage from Glenwood Avenue. Because the headwaters are relatively undeveloped, base flow losses are minimal, but development in the upper watershed could significantly affect the stream's base flows, hydrology, and geomorphology because of the small size of the basin.

Glenwood Creek Basin Map

No Scale

Fig. 3.4-31



Unlike many of the streams in this area, the riparian corridor above Mukilteo Boulevard is dominated by conifers rather than alders. However, the canopy cover is thin, and large amounts of sunlight reach the understory. Brush, including salmonberry and Himalayan blackberry, is heavy along the stream.

Glenwood Creek was surveyed and electroshocked from the railroad tracks upstream for approximately 500 ft. by KCM in March 1993. KCM's report to the City of Everett states:

> Because the stream is small, fishing was conducted in miscellaneous pools and riffles through the reach that was evaluated. The creek has excellent riparian habitat and the streambed supports the best combination of spawning gravels of all the streams entering directly into Puget Sound in this immediate vicinity. There were 9 cutthroat trout captured in the reach which was fished. This stream should be considered for fry planted coho by the Salmon in the Classroom program. The abundance of aquatic insects indicates this system will support a significant population of salmonids.

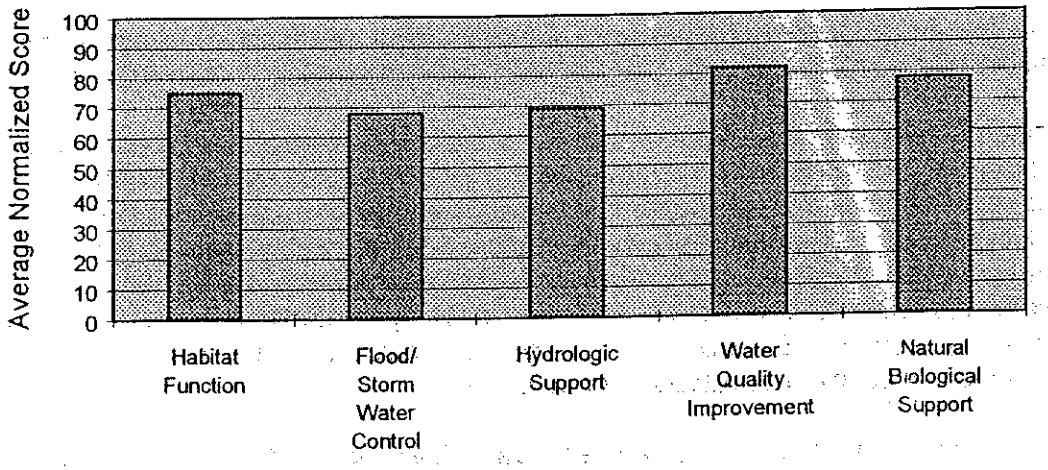
In January 1990 the Port Gardner Bay Drainage Basin Plan Update for Glenwood Creek was adopted by the Everett City Council as the revised Drainage Basin Plan. The Plan included the following goal: Ensure that urbanization in the basin does not adversely affect the existing fisheries resource or the recreational value of Glenwood Creek. This will also benefit the water quality of Puget Sound, the receiving water for the creek. Recommendations in the plan included construction of an expanded bypass drain system and an in-line underground detention system on Glenwood Avenue and on both sides of the Maple Heights Bridge. The expanded bypass drain system has been constructed, but the in-line underground detention systems have not. It is unlikely that the remaining improvements will be constructed due to cost and impacts to Harbor View Park.

Glenwood Creek Basin Wetlands. Figure 3.4-32 shows the average wetland assessment scores for the Glenwood Creek drainage basin.

Flood/Stormwater Control Function. Wetlands within this basin all ranked in the Groups 2 and 3 category for the flood/storm water control and hydrological support functions and are concentrated within the middle and lower portions of the basin. Relative to the flood/storm water control score for the other 11 study area basins, the Glenwood Basin score was ranked number 6. The upper portion of the basin is presently an active sand and gravel operation. When this mining operation is closed there will be significant opportunities to protect and improve the flood/storm water control and hydrological functions for this basin.

Water Quality Improvement Function. Wetlands within this basin ranked 5th overall for the water quality improvement function relative to the other 11 study area basins. All wetlands fell within the Group 2 category and are concentrated within the middle and lower portions of the basin. The upper portion of the basin is presently an active sand and gravel operation. When this mining operation ceases and converts to other uses it is important that the water quality improvement of downstream wetlands is protected by requiring adequate water quality treatment facilities. Because most of the wetlands in the downstream portion of the basin are slope wetlands there is little opportunity to improve their water quality improvement function through the restriction of outlet flows.

Figure 3.4-32
Glenwood Creek Drainage Basin
Average Wetland Assessment Scores



Habitat Functions. For the Natural Biological Support function, wetland GC8 within the middle stretch of Glenwood Creek ranked as a Group 1 wetland. Wetland GC8 was unique in that it was the only stream assessed that contained a relatively extensive cover of conifers. All other wetlands for this function ranked as Group 2 and 3 wetlands. For the Habitat function, essentially all wetlands ranked within the Group 1 category.

Enhancement opportunities include scrub-shrub and forested wetland and buffer plantings within wetlands GC2, 4, 5 and 7; and restoration of the stream corridor for wetland GC7. A more diverse wetland community could be created in wetland GC9 by removing fill, creating more flooded areas by raising the culvert outlet (integrity of Burlington Northern railbed has to be insured and fish passage not affected) and protect trees from cutting (all trees are presently topped).

Glenhaven Creek Basin (Figure 3.4-33)

Glenhaven Creek. Glenhaven Creek drains only about 160 acres, much of which is developed. The riparian corridor has been eliminated in places. This system cannot support a salmonid population and has limited habitat value. It primarily provides for the removal of nutrients and other pollutants input to the system by the adjoining residential development, and limited habitat for small mammals and birds. Eagles have been observed perching in trees near the wetland and ducks and Pileated woodpeckers have been observed in the area.

Glenhaven Creek Basin Wetlands. Figure 3.4-34 shows the average wetland assessment scores for wetlands in the Seahurst-Glenhaven drainage basin.

Seahurst-Glenhaven Basin Map

No Scale

Fig. 3.4-33

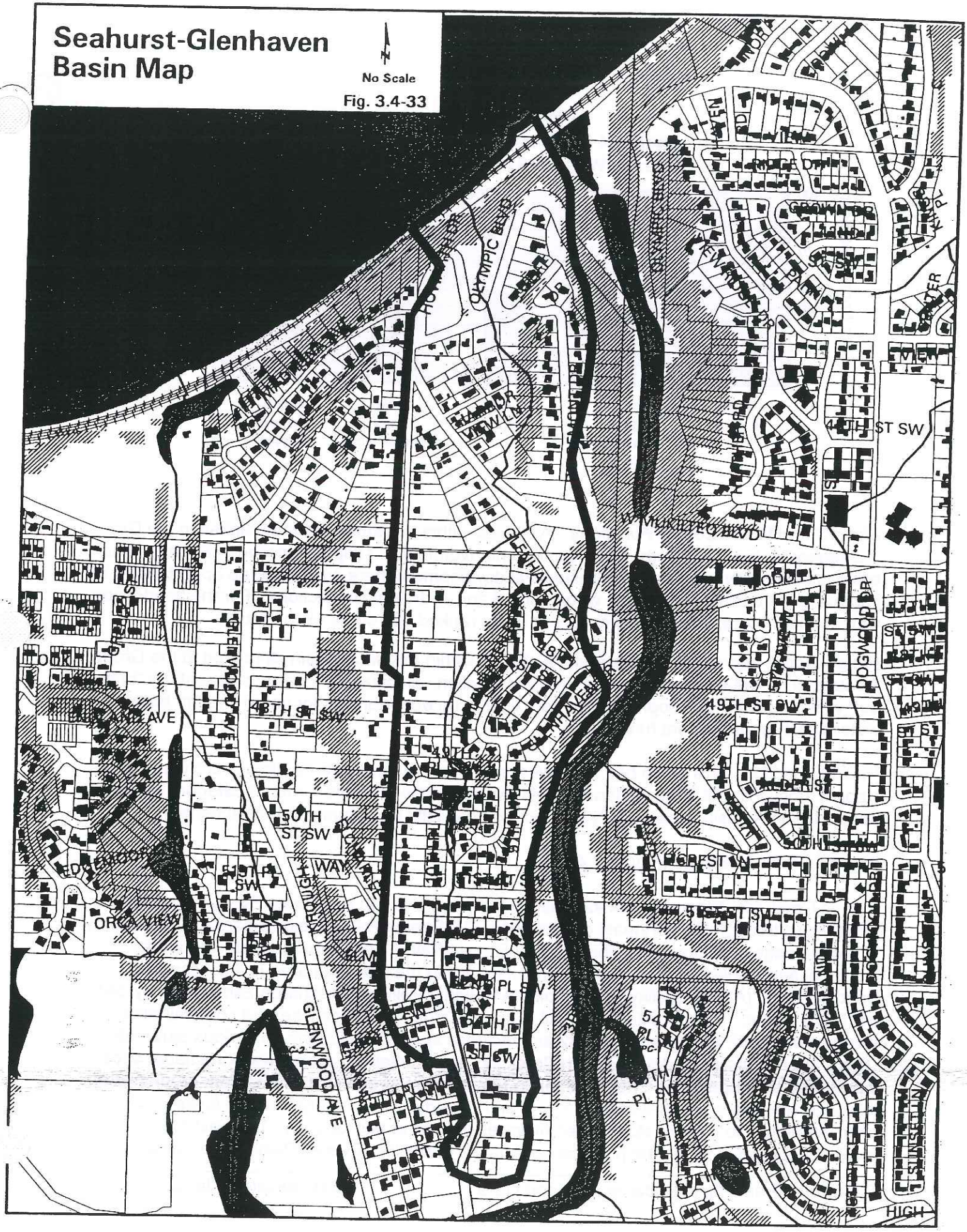
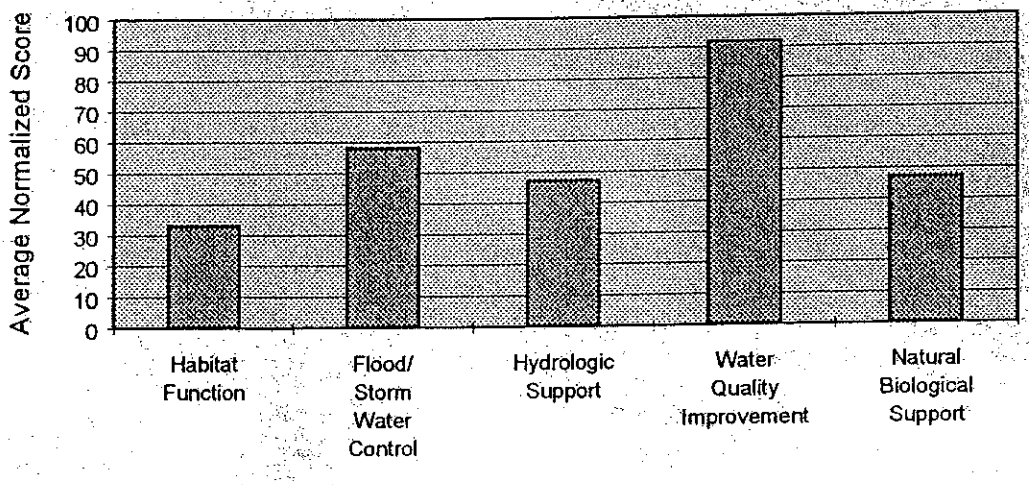


Figure 3.4-34
Seahurst-Glenhaven Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control Functions. Wetlands within this small basin all ranked in the Group 3 category for the flood/storm water control and hydrological support functions. Because this basin is essentially "built-out" with residential development there are little to no opportunities for improving the basin's flood/storm water control and hydrological functions. For the flood/storm water control score, the Glenhaven Creek Basin ranked last out of all the basins.

Water Quality Improvement Function. Wetlands within this small basin all ranked in the Group 1 category for the water quality improvement function. Because this basin is essentially "built-out" with residential development there are little to no opportunities for improving the basin's water quality improvement function.

Habitat Function. This basin had the lowest score for both the Natural Biological Support and Habitat functions. All three wetlands within the basin ranked in the Group 3 category for these functions. This basin is essentially built out and has little opportunity for enhancement.

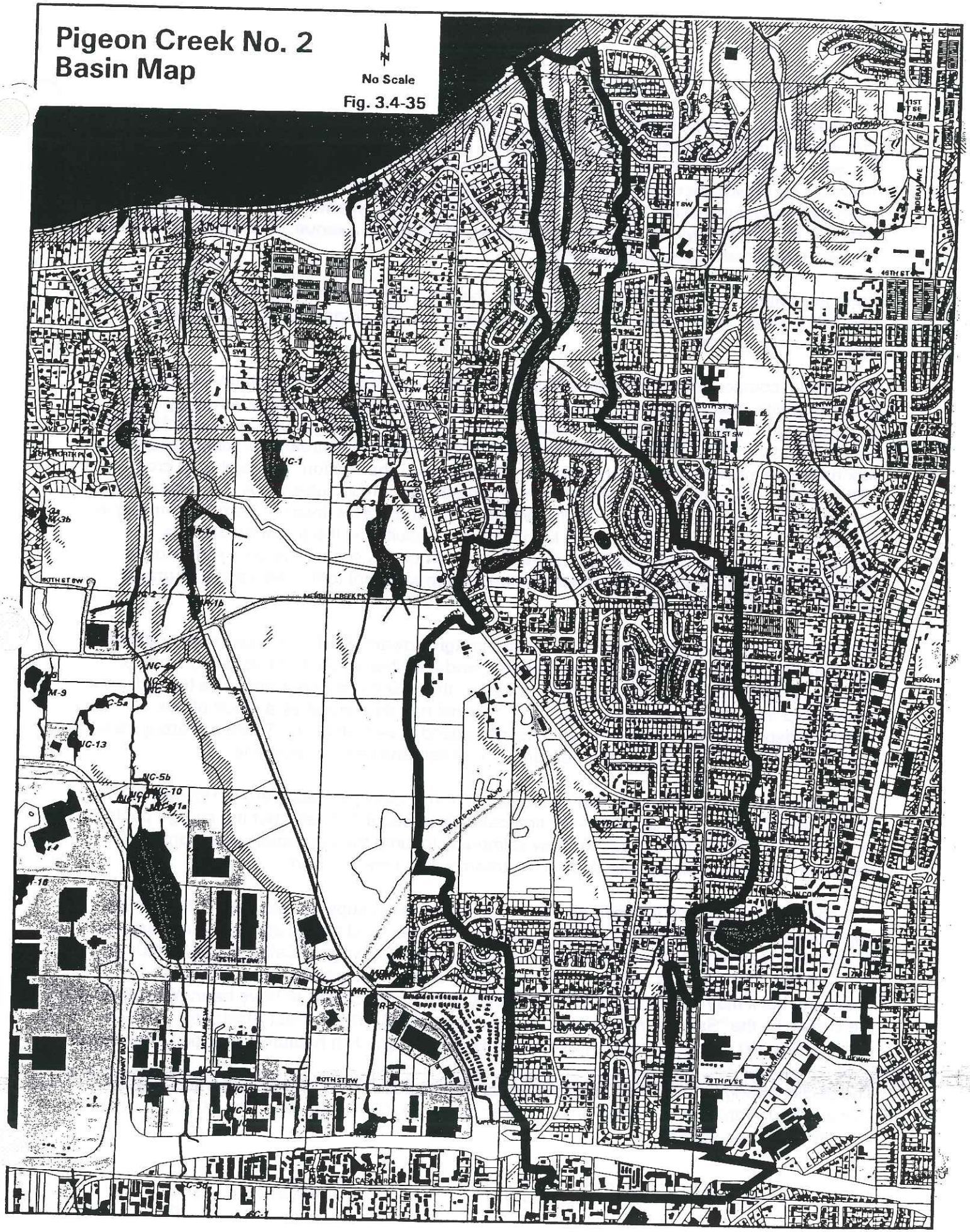
Pigeon Creek #2 Basin (Figure 3.4-35)

Pigeon Creek #2. Pigeon Creek #2 drains a 900-acre basin in southwest Everett, a portion of which flows through the northeast corner of the SW Everett/Paine Field Subarea. The majority of the drainage basin located within the SW Everett/Paine Field Subarea is developed as industrial and single family residential. Included within the industrial area is the Associated Sand & Gravel (AS&G) facility, which holds a National Pollution Discharge Elimination System (NPDES) permit. This permit allows AS&G to discharge "adequately treated contaminated stormwater runoff" to Pigeon Creek #2 and includes specific limitations on various parameters. There are two distinct forks of Pigeon Creek #2, both containing groundwater recharge sites, a preferred drainage feature not common in Everett area streams. The east fork groundwater recharge site is located west of 60th Street and Beverly Lane. All dry weather flows and approximately 1 to 2 cfs of stormwater infiltrates the soil at this location. The east fork of the creek is not located within the physical boundaries of the SW Everett/Paine Field Subarea.

Pigeon Creek No. 2 Basin Map

No Scale

Fig. 3.4-35



The west fork of Pigeon Creek #2 originates at 76th and Lower Ridge Road and flows to a groundwater recharge site at approximately 74th Street SW. A normally dry swale slopes from the groundwater recharge site and continues to a road fill at Upper Ridge Road and Glenwood Avenue. No provisions were made at the road fill to drain the normally dry swale in the event of an extreme rainfall event. The west fork "resurfaces" near Seahurst Avenue and joins the east fork approximately one half mile downstream of Seahurst Avenue. The average slope of the west fork stream channel is 3 percent.

From the confluence of the east and west fork, the main branch drains northerly approximately one mile to Port Gardner Bay. The average slope of the main branch stream channel is approximately 4 percent.

The stream corridors of the main branch and west fork are largely in natural, undisturbed conditions with wide vegetative buffers on both sides of the stream. Little urbanization has occurred in the stream corridor of the main branch and west fork probably due primarily to the very steep slope of the land adjacent to the stream channel. The stream corridor of the east fork has been modified from past land use practices and urbanization. Several road crossings of the stream channel have necessitated enclosing the stream in culverts. A combination of construction on unstable slopes, unconsolidated sand and gravel deposits from past mining in the stream bed, and downcutting from high flows has resulted in the transport of large quantities of sediment from the East Fork to the mouth of this stream system. Additionally, limited hydrocarbon deposits are present in the stream adjacent to the old sand and gravel operation at the Hannabrook site.

The lower stretch of Pigeon Creek #2 passes through Howarth Park. This segment features a low channel gradient, an intact riparian corridor, and a limited amount of habitat suitable for salmonids. Because of the low gradient, however, this reach is a deposition area for sediment transported from the upper basin. A braided channel has developed as a result of this sediment deposit and the stream and adjacent wetland is very shallow. There are many trails adjacent to the channel, and human disturbance of fish and redds is possible.

Two cascades act as barriers to fish passage just above Olympic Boulevard in Howarth Park. These cascades are not very high—the first cascade is about 3 ft. tall—but the plunge pools below them are not large enough to allow salmonids to jump the cascades. Anadromous fish habitat is therefore limited to the section of stream within Howarth Park.

The section of stream within Howarth Park should be able to support salmonids. The stream has small patches of spawning gravels, a few pools, cover, and a food supply. Cutthroat trout inhabit the creek (Dan Mathias, personal communication; Brown and Caldwell 1982; WDFW; KCM 1994). The status of salmon in this system is unclear. A single coho smolt was observed, but it may have moved into the stream from Puget Sound or have been planted in the stream by the "Salmon in the Classroom" program (KCM 1994). Past residential construction and industrial activity have severely affected the fish habitat of Pigeon Creek #2.

The section of Pigeon Creek #2 from the wetland just upstream of the railroad tracks to Olympic Boulevard was surveyed and electroshocked by KCM in March 1993. KCM's report to the City of Everett states:

The creek is suffering from major siltation problems. The wetland area prevents any adult migration (except at very high flows) due to the shallow braided condition where the silts have settled out and heavy vegetation has developed. A single coho smolt was captured in the large plunge pool at the culvert crossing under Olympic Boulevard. Because no other salmonids were captured, it is possible that the coho may have moved into the stream from Puget Sound rather than being the result of spawning activity. Although not documented, it is also possible that fry from a "Salmon in the Classroom" program may have been placed in the stream.

The City's adopted Drainage Basin Plan for Pigeon Creek #2 includes the following goals: Preserve existing fishery resource, reduce the sedimentation occurring in the lower reaches of the stream, and ensure that future urbanization does not adversely impact the fish rearing potential or passive recreational value of Pigeon Creek #2. This will also benefit the water quality of Puget Sound, the receiving water for the creek.

In January 1990, the Port Gardner Bay Drainage Basin Plan Update for Pigeon Creek #2 (Report No. 4) was adopted by the Everett City Council as the revised Drainage Basin Plan for that system. In 1992, a City report concluded that active channel incision and erosion is occurring in the east branch of Pigeon Creek #2 and downstream of the confluence of the east and west branches. As a result of this, the City is requiring a 2-year predeveloped release rate for the entire Pigeon Creek basin. A combination of regional and on-site stormwater control elements composed the adopted drainage plan:

- Three future regional detention ponds were proposed near Highland Road, Seahurst Avenue, and on Associated Sand and Gravel property.
- On-site water quality controls and non-structural solutions such as water quality monitoring were also recommended.

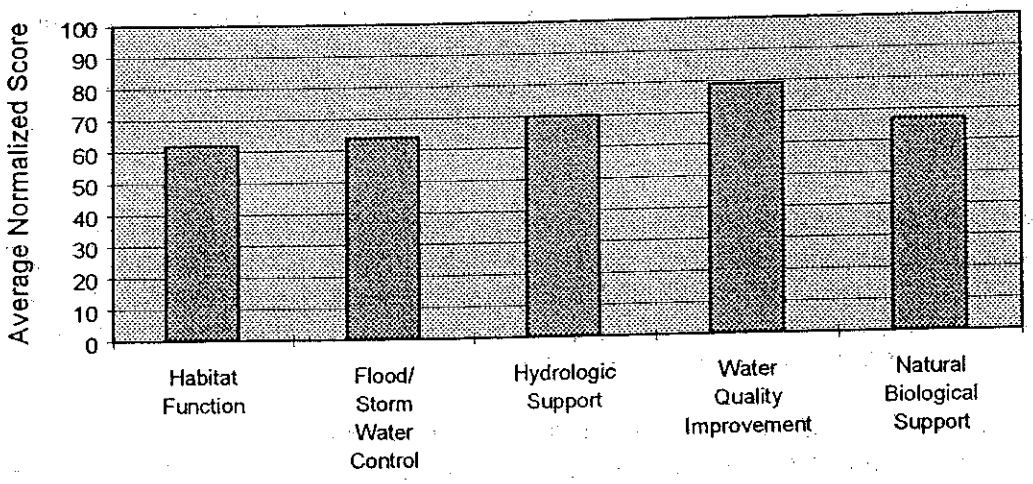
Two of the regional ponds are no longer proposed due to contamination on one site (near Highland Avenue, near Hannabrook) and impacts to wetlands on the other site (Seahurst Ave.). The remaining site on the Associated Sand and Gravel property is still feasible and could be constructed as a joint venture between the City and property owner when the property develops.

Pigeon Creek #2 Basin Wetlands. Figure 3.4-36 shows the average wetland assessment scores for the Pigeon Creek drainage basin.

Flood/Storm Water Control Functions. Wetlands within this basin ranked as Group 1 wetlands for the hydrologic support function in the upper portion of the basin and Group 2 in the lower portion of the basin. For the stormwater control function, the wetlands ranked in Group 2 for the upper basin and Group 3 for the lower portion of the basin.

Because of the excellent hydrologic support provided by upstream wetlands there is a high potential for the restoration of the degraded wetland at the mouth of Pigeon Creek 2 (due to sedimentation) and the enhancement of the fishery function. Like the Glenwood Creek Basin, the very upper portion of the Pigeon Creek basin is presently an active sand and gravel operation. When this mining operation is closed there will be significant opportunities to protect and improve the flood/storm water control and hydrological functions for this basin.

Figure 3.4-36
Pigeon Creek #2 Drainage Basin
Average Wetland Assessment Scores



Water Quality Improvement Function. Because the majority of wetlands were slope and riverine wetlands, this basin ranked 7th for the water quality control function relative to the other basins. The slope wetlands all fell within the Group 2 category for this function. For the entire basin only one wetland in the mid portion of the watershed ranked as a Group 1 wetland (EPC1).

There is limited opportunity to improve the water quality improvement function for the slope wetlands in the lower watershed due to the difficulty in controlling outlet flow. However, restoration of wetland PC2 at the mouth of Pigeon Creek #2, by removal of excess sediment, could provide for additional ponding and enhancement of the water quality improvement function.

The water quality improvement function of mitigation wetlands WPC1 and EPC1 could be substantially enhanced through the installation of better outlet structures that would result in more ponding. Both of these wetlands have suitable topography for such a modification.

Habitat Functions. For the Natural Biological Support function, only wetland PC3 located within the lower reach Pigeon Creek ranked as a Group 1 wetland. The other 5 wetlands in the basin ranked as Group 2 wetlands except for EPC1 which ranked as a Group 3 wetland. For the Habitat function, wetlands within the stream corridor of the lower reach of the basin all ranked as Group 1 wetlands. The three remaining wetlands ranked as Group 2 and 3 wetlands.

Restoration opportunities include removal of sediment from wetland PC2 located at the mouth of Pigeon Creek and creation of a diverse emergent and scrub-shrub wetland with an open water component and installation of a culvert suitable for fish passage between PC2 and PC3. Mitigation wetlands WPC1 and EPC1 require correction of outlet structures in order to improve hydrology and replanting with emergent, scrub-shrub and forested species necessary to meet

the original requirements of their mitigation plans. No enhancement measures have been identified for PC1.

Swamp Creek Basin (Figure 3.4-37)

Swamp Creek. Swamp Creek drains a basin nearly 11 miles long and 2 miles wide, encompassing an area of about 15,500 acres. Swamp Creek originates in the West Casino Road/Paine Field/Highway 99 area of south Everett and flows south for 14.7 miles before discharging to the Sammamish River in Kenmore. Swamp Creek begins in a large scrub-shrub wetland in Kasch Park south of Casino Road and east of Airport Road. Several small branches flow south from this area, and these branches come together south of 119th Street Southwest. Swamp Creek is the only creek in the SW Everett/Paine Field Subarea system that flows south and does not flow directly to Puget Sound. The SW Everett/Paine Field Subarea is located on the north and northwest boundaries of this watershed, at the convergence of West Casino Road, Paine Field, and Highway 99.

Land uses in the Swamp Creek basin have changed dramatically during the past 20 years from small farms, pasture land, and forested land to large residential developments, mobile home communities, shopping centers, and light industrial and business parks. Consequently, water is diverted directly to the drainage system rather than being intercepted by vegetation and soils. As urbanization occurs, more stormwater reaches Swamp Creek and flows through the system faster. The hydrologic regime is very "flashy," meaning that flows rise rapidly during rainstorms and fall rapidly when rain ceases. Results of Hydrological Simulation Program-Fortran (HSPF) modeling indicate that Swamp Creek has a serious potential stormwater flooding problem, particularly in lower reaches of Swamp Creek in the Kenmore area of incorporated King County. Impervious surfaces are estimated to have increased from 20 percent to 29 percent between 1985 and 1990, and in 1995 were 33%. Analysis of the HSPF modeling of Swamp Creek indicate that the hydrology of the watershed is changing as the watershed is developed. The same factors that contribute to high stormwater flow during wet periods or storm events contribute to low flow during the summer (i.e., less soil surface area available for rainwater to soak in to recharge the underlying groundwater). Swamp Creek's upper branches are all very small, low-gradient, silty streams that go dry in the summer.

Swamp Creek is typical of Puget Sound lowland watersheds. In the gently sloping upper basin, Swamp Creek flows through a narrow valley, which gradually broadens to a flood plain almost 0.75 mile wide in the lower basin. Elevation in the headwaters is approximately 520 feet, while the elevation is about 20 feet at the confluence with the Sammamish River. The stream gradient is flat, decreasing from about 50 feet per mile in the upper basin to less than 20 feet per mile near the mouth. Scriber Creek, Little Swamp Creek, and Martha Creek are the major tributaries to Swamp Creek. Major lakes in the Swamp Creek watershed are Scriber Lake, Martha Lake, and Lake Stickney.

Between 199th Street Southwest and Airport Road, Swamp Creek flows through a several-acre open-water wetland. About 0.5 mile downstream from this wetland, Swamp Creek enters Lake Stickney. The stream segment connecting Lake Stickney with the open-water wetland upstream may flow year-round and allow year-round fish passage between these bodies of water. Water quality is a concern in this system because of the sensitivity of these small lakes

Swamp Creek Basin Map

No Scale

Fig. 3.4-37