

## **X. SQUALICUM CREEK SMA**

**Summary:** The Squalicum Creek basin is approximately 15,800 acres. The majority of the creek is within the City of Bellingham. The upper extent of the creek and headwaters are in Whatcom County. SMA jurisdiction associated with this creek is approximately 423 acres. Land use is dominated by urban residential and industrial development as well as large segments of undeveloped parcels. Public access is available via Cornwall Park (Reach 4) and Sunset Pond (Reach 6). All reaches, except the segment between James Street and Hannegan Road, indicated some level of pollution for dissolved oxygen, temperature, fecal coliform, zinc and/or pentachlorophenol. Habitat is generally impaired throughout creek. Due to the amount of undeveloped property in the creek valley and floodplain, good habitat, or habitat potential through restoration, remains along most of the creek. The potential for habitat connectivity along the entire length of the creek still exists to a high degree despite transportation corridor barriers. Undeveloped floodplain also provides opportunities to improve stream habitat (meanders and in-stream structures).

### **X.1 Watershed Analysis**

#### **X.1.1 Landscape Setting**

Squalicum Creek is a glacially formed stream that flows through a shallow valley with widths of less than one-quarter mile in most places. The valley walls in the lower reaches rise approximately 60 feet from the valley floor with the south wall being much steeper than the north wall. The basin is approximately 15,800 acres. The creek valley is dominated by glacial outwash in the upper reaches and glacial drift in the lower reaches. The uplands surrounding the stream valley are also characterized by unstratified glacial drift. The headwaters of the creek are located in a broad area characterized by rural residential development and agriculture. There is not one identifiable source of water for the creek, rather, precipitation, natural springs and wetlands and small lakes feed the creek and minor tributaries in the upper watershed. Squalicum Lake, Toad Lake and Baker Creek all drain into Squalicum Creek.

The creek flows through glacial drift and outwash. Soils in the watershed are dominated by Group D hydrologic soils which tend to have very slow infiltration rates and high runoff potential. Group B and C soils are also mapped in the valley (portions of Reaches 2, 3, 4 & 5). These soils tend to have moderate to slow infiltration and moderate runoff potential. The mouth of Squalicum Creek is confined by artificial fill and industrial uses.

#### **X.1.2 Land Use**

**Land Use:** Squalicum Creek flows through many land uses before flowing into Bellingham Bay in an area dominated by industrial development. Residential development and industrial zoning are prevalent through the entire length of the creek, with scattered pockets of commercial, service and industrial uses. Although land use is fairly dense in Reaches 1 through 6, significant vegetated buffers still remain along

nearly the entire stream length despite the urban character of the landscape. Buffer widths are generally 50 feet or greater. A large percentage of Reaches 6 through 11 is undeveloped land. Most of the undeveloped properties in this area are zoned industrial and hospital. Several large parcels are also in public ownership. Current zoning could allow industrial development that would have severe impacts on existing ecology or the potential for ecological improvement. Publicly owned parcels are scattered throughout the lower reaches of the creek. Cornwall Park is located in Reach 4 and a large portion of industrial property in Reach 2 has recently been acquired and will be developed as a public park, however, the vast majority of this property is outside the SMA.

**Transportation and Utilities:** Transportation corridors and utilities parallel the creek in the lower reaches of the segment (Reaches 1, 2, 3 & 5). Several major arterials and Interstate-5 cross Squalicum Creek, however, crossings and arterials within the SMA decreases measurably in the upper portion of the segment.

**Public Access:** Although large tracts of land are publicly owned along the entire length of the creek, public access is relatively limited. Cornwall Park is located in Reach 4. A park has also been established at Sunset Pond in Reach 6. Cornwall Park offers many recreational opportunities. Sunset Pond is geared toward more passive recreation, such as walking and fishing. A large park is going to be developed in Reach 2 on old industrial property, but the majority of the property is located just outside the SMA.

**Shoreline Modifications:** Data is not available regarding in-stream and shoreline modifications, such as bulkheads and rip-rap, along Squalicum Creek. However, with the aid of aerial photographs, general conclusions about modifications within the SMA jurisdiction can be made. Generally speaking, in-water structures and dense development directly adjacent to the shoreline is relatively sparse over the entire length of the creek. Major structural modifications include the artificial fill and industrial development at the mouth of the creek, creek channel modification (including berms and culverts) due to Interstate-5 construction, and two long channel culverts in Reach 2. Outside of these exceptions, the creek meanders through the valley in a relatively undisturbed channel with buffers averaging 50 feet or greater. Impervious surfaces and structures are generally set back from the creek shoreline, except for Squalicum Parkway in Reaches 1, 2 and 3.

### **X.1.3 Critical Areas**

**Wetlands/ Regulated Streams:** A significant wetland/upland complex still remains in Reaches 5 through 9. Nearly all of this system is directly associated with Squalicum Creek. Scattered riparian wetlands are also located along the creek in Reaches 1, 2 and 3. The wetland complex in the upper reaches is significant based on the large size of the system and connectivity within the system despite surrounding urban development and transportation corridors. The system provides good, diverse habitat and good

connectivity to upland habitat in the upper reaches of the watershed. One City regulated stream system flows into Squalicum Creek: Baker Creek.

**FEMA:** Significant FEMA 100 year floodplain is associated with the creek in Reaches 5 through 11. The floodplain in these reaches is generally mapped for the entire valley floor, from valley wall to valley wall. Floodplain is also mapped in Reaches 1 through 3, but the area of flooding is more immediate to the creek channel and not to the entire valley.

**Slopes:** Steep slopes are present on both the north and south valley walls in Reaches 1 through 3; the south valley wall of Reaches 6 through 8; and, the north valley wall in Reach 11. The Whatcom County Planning Department has mapped the upper portion of Reach 2, Reach 3, and the extreme southern extent of Reaches 5 through 8 as seismic hazard areas based upon geologic units. Reach 1 is mapped as a seismic hazard area based on artificial fill. The majority of Reach 2 is mapped as a mine hazard area.

**Potential PHS/TSE Species:** Tidal influence at the mouth of Squalicum Creek does provide some estuary/marsh type habitat, but the area is very small and the tidal influence is greatly inhibited due to an in-water structure. This structure is a barrier at low tide. Documented fish use in Squalicum Creek includes: sea-run cutthroat, Chinook, coho and steelhead salmon. Bull trout are documented up to the first long culvert in Reach 2 and presumed to be present in the remainder of the reaches. Chum are documented in Reaches 1 through 5 and presumed in the remainder of the reaches. Chinook salmon and bull trout are listed as Federal threatened species and by the State as a species of concern. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

Areas of diverse wildlife habitat are available in Reaches 6 through 9 due to large tracts of undeveloped land, wider buffers and diverse native vegetation that provide canopy and structure. Habitat corridors are present in the lower reaches of the creek but are more limited due to the closer proximity of development. Development has reduced upland and wetland habitats in the lower reaches causing an increase in urban wildlife. Even though habitat is greatly reduced, the buffers that remain tend to be of higher quality and include native vegetation and canopy cover. Moderate industrial development and agricultural use in Reaches 10 and 11 has affected the quality of available habitat.

The best wildlife habitat along the entire length of the creek is between James Street (Reach 6) and Reach 9. Connectivity between habitats over this length of creek is very high and large areas of native vegetation are present. Wildlife usage tends to be more diverse and abundant, including a variety of non-urban animals and birds. Habitat specific species are present for mammals and birds. Movement is easy for medium to large animals.

#### **X.1.4 Ecological Functions**

Ecological functions of the creek and adjacent buffers are reduced down stream from Interstate-5. Development has resulted in the loss of habitat and reduced buffers. Moderate to high functions remain up stream of Interstate-5. Buffer widths are greater and native vegetation still remains in many areas. A large wetland complex with a wide range of quality native vegetation remains in Reaches 6 through 9. The quality of ecological function in this area is reduced by transportation barriers that bisect the reaches and by degradation of native vegetation which has allowed non-native and invasive species to populate portions of these reaches. Buffer widths tend to be 50 feet or greater along the entire creek and 200 feet or great in several areas.

Portions of the entire length of Squalicum Creek have been listed by the Washington Department of Ecology as Category 5 "Polluted Water" for dissolved oxygen, fecal coliform, temperature, zinc and/or pentachlorophenol, except for the stream length between James Street and Hannegan Road (Reaches 6 & 7). Many of these same Reaches are waters of concern for pH and/or temperature. The upper portion of Reach 3 is impaired for degradation of aquatic life.

### **X.2 Reach Analysis: Segment A (Reach 1)**

#### **X.2.1 Landscape Setting**

This reach is approximately nine acres in size. Artificial fill and glacial outwash dominates the geology. Soils in this segment are Group D hydrologic soils and tend to be very slow infiltration rates and high runoff potential. Approximately half of the soils are susceptible to severe sheet flow and rill erosion. The remaining soils have a slight erosion risk. Steep slopes are present on both side of the valley through which the creek flows, except for the area of artificial fill located at the mouth of the creek. Creek substrate data is unavailable for this reach. Marine tides influence the substrate and vegetation at the mouth of the creek.

#### **X.2.2 Land Use**

**Land Use:** Industrial use and zoning dominates this segment. Residential zoning is also present in a small amount, with only one house currently located within the SMA. Ten buildings are located within the SMA jurisdiction covering approximately 0.26 acres (this data may not be correct). Mount Baker Plywood and Bellingham Cold Storage are located along the marine waterfront at the mouth of Squalicum Creek.

**Transportation and Utilities:** Two major arterials cross the segment, Roeder Avenue and Eldridge Drive; and an active railway line bisects the segment. The railway and Eldridge Drive are elevated above the creek on bridges. Cement culverts and road/railway bridges have been built over the creek. Some or all of these structures are located within the creek.

**Public Access:**

**Shoreline Modifications:** Some rip-rap armoring has occurred along the creel shoreline in this reach. On average, impervious surfaces constitute 57% of the reach, semi-pervious surfaces 22% and pervious surfaces 21%.

### **X.2.3 Critical Areas**

**Wetlands/ Regulated Streams:** Some estuarine vegetation is present in the tidally flooded area of this reach. There are no associated streams or wetlands.

**FEMA:** Some tidal flooding occurs at the mouth of the creek twice a day, the extent of which is limited by a narrow cement culvert. FEMA 100 year floodplain is mapped for the entire segment except for a small elevated portion in the northeast corner of the segment.

**Slopes:** Steep slopes are present along the northern and southern valley walls in the upper half of the segment. Whatcom County Planning Department has identified the lower half of the segment as being a seismic hazard area due to artificial fill.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

### **X.2.4 Ecological Functions**

**Water Quality:** This segment has been listed by the Washington Department of Ecology as Category 5 “Polluted Water” for dissolved oxygen, fecal coliform and temperature. The segment is also listed as an impaired water for in-stream flow and fish habitat (at the lower most extent of the segment). Fish limiting factors include: floodplain conditions, gravel quality, channel stability, large woody debris and riparian condition. Low in-stream flows limit salmonid use. The water is also listed as a concern for pH. There are no stormwater discharges in this segment. Mt. Baker Plywood is the only documented toxic site in SMA jurisdiction. Ground water pollutants include: EPA priority pollutants and metals. Soil pollutants include: EPA priority pollutants, halogenated organic compounds, metals, petroleum products and PAH.

**Vegetation:** Built environment (impervious surfaces) dominates the lower half of the segment. The upper half of the segment is dominated by vegetation that includes deciduous trees, and shrub and herbaceous cover. Vegetation is a mix of native and naturalized non-native plants. Some areas in the upper segment are characterized by a medium quality native plant community. The buffer along the creek up-stream of the

railroad grade is a mix of native and non-native shrub and tree species. Canopy cover in the lower half of the segment is non-existent.

**Wildlife:** Documented fish use includes: bull trout, sea-run cutthroat, Chinook, coho, chum and steelhead salmon. The majority of the reach provides no viable habitat. Approximately 13% of the reach supports some non-urban mammals and birds, as well as garter snakes and native amphibians, and offers easy movement for birds, fish and medium to large animals.

**Habitat:** The creek buffer in this reach is ranges from none to 100 feet. Most of the buffer is developed or only a few feet wide below the railroad grade. The buffer north of the railroad grade is substantially wider and of better quality, ranging between 25 to 100 feet of native or naturalized vegetation. Some native habitat exists in this segment and continues into the adjacent reaches providing connectivity to up-stream wetland and upland habitats. This connectivity of habitat allows for animal and bird movement along the stream corridor. PHS and SC species use approximately 13% of the reach as habitat for breeding and/or rearing.

Tidal influence at the mouth of Squalicum Creek does provide some marsh type habitat. One small area of marsh vegetation is present in the tidal zone. The tidal zone offers some opportunity for breeding and rearing for some fish populations. The cement culvert at the mouth of the creek is a barrier to fish passage at low tide.

## **X.2.5 Opportunities**

### **Preservation**

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### **Enhancement and Restoration Opportunities**

- At a minimum, replacement of the blocking structures at the mouth of the creek should be considered. Improving these structures will increase natural tidal flow and fish passage.
- Canopy cover for the creek could be improved greatly by planting coniferous and deciduous trees along the shoreline.
- Enhancement and expansion of the existing marsh habitat may be possible.
- Where practicable, invasive species control and elimination measures should be implemented along the creek channel and in the buffer. Native shrubs and trees should be planted where possible.
- Squalicum Creek delta restoration was studied by Anchor Environmental in September 2001. See draft report for alternatives.

## **X.3 Reach Analysis: Segment B (Reaches 2 & 3)**

### **X.3.1 Landscape Setting**

This reach is approximately 91 acres in size. Glacial drift and outwash dominate the geology. Soil groups represented in this segment vary. Group D soils are generally associated with the creek channel and the lower half of the segment. An area of Group B soils dominates Reach 3 and is also located outside the creek channel in the upper half of Reach 2. A small area of Group A soils is mapped in Reach 2. Group D hydrologic soils and tend to be very slow infiltration rates and high runoff potential. Group B soils have moderate infiltration rates and Group A soils have high infiltration rates. Only seven acres in the segment have soils that are at high risk for erosion, with the remainder of the segment only at slight risk. Steep slopes are present on both side of the valley through which the creek flows. The valley is relatively narrow through this segment, averaging one-quarter mile wide, except for the middle portion of Reach 2. Creek substrate data is unavailable for this reach.

### **X.3.2 Land Use**

**Land Use:** Residential uses and zoning dominates this segment. Commercial zoning is located in the Northwest Drive/Birchwood area. Industrial zoning in Reach 2 has been acquired by the city and will be re-developed into a public park. One hundred two (102) buildings are located within the SMA jurisdiction in Reach 2 covering approximately 3.12 acres, and 21 buildings in reach 3 covering approximately 0.54 acres.

**Transportation and Utilities:** Squalicum Parkway, an arterial between Interstate-5 and the Bellingham Bay waterfront, parallels the creek through the entire segment. Northwest Drive crosses the creek via a high bridge.

**Public Access:** Scattered parcels throughout the segment are publicly owned but have not been developed to provide access.

**Shoreline Modifications:** The creek flows through two long culverts in Reach 2, one under Squalicum Parkway and one at Northwest Drive. On average, impervious surfaces constitute 33% of segment, semi-pervious surfaces 25% and pervious surfaces 42%.

### **X.3.3 Critical Areas**

**Wetlands/ Regulated Streams:** Only one wetland in mapped in the segment at the southern most extent of Reach 2 on the north side of Squalicum Parkway. The wetland does not appear to have a surface water connection to the creek. There may be some riparian wetlands associated with the creek, but this has not been confirmed. Baker Creek, a city regulated stream, flows into this segment at the confluence of Reaches 2 and 3.

**FEMA:** FEMA 100 year floodplain is mapped between the steep valley walls of Reach 2, which constitutes approximately 45% of the Reach. There appears to be no structural development in the floodplain. The creek channel in Reach 3 is confined by natural topography and Squalicum Parkway thus limiting the FEMA floodplain to the existing creek channel.

**Slopes:** Steep slopes are present along both sides of the creek valley throughout the entire segment. Whatcom County Planning Department has identified Reach 2 as being a mine hazard area and the upper most extent of Reach 2 and all of Reach 3 on the south side of Squalicum Parkway as a seismic hazard area due to geologic units.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Presence of bull trout is presumed above the long culvert under Squalicum Parkway in Reach 2. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

#### **X.3.4 Ecological Functions**

**Water Quality:** The segment below the long culvert under Squalicum Parkway in Reach 2 has been listed by the Washington Department of Ecology as Category 5 “Polluted Water” for dissolved oxygen, fecal coliform and temperature. The water is also listed as a concern for pH. There are no stormwater discharges indicated, however, based on the location of storm drain lines and topography, it appears that there are six possible discharges in SMA jurisdiction. A sewer main is located in the Squalicum Parkway. There are no documented toxic sites in this segment.

**Vegetation:** A mix of native and non-native vegetation dominates this segment. The vegetation in Reach 2 tends to be more native in composition and characterized by a mature canopy. Built environment includes Squalicum Parkway and residential homes in the outer limits of the buffer on the south side of the creek. In the areas where the native canopy has been removed, invasive species tend to dominate, particularly Himalayan blackberry and old man’s beard. Non-native and invasive species tend to be problematic along Squalicum Parkway through the entire segment. In the upper portions of Reach 2 and through Reach 3, the quality of the vegetation community decreases due to pressures from commercial and residential development. Vegetation areas are narrower and tend to be dominated by deciduous trees and shrubs, as well as non-native and invasive species that thrive in disturbed areas. Approximately 40% of the segment is an equal mix of native and naturalized non-native plants with a medium quality native plant community with a young forest overstory. Approximately 25% of the segment is ranges from predominately non-native to no native plants with sparse overstory.

**Wildlife:** Documented fish use includes: bull trout, sea-run cutthroat, Chinook, coho, chum and steelhead salmon. The segment offers a mix of habitat that supports mainly urban mammals. Half of Reach 2 supports no mammals. Fifty percent of Reach 3 and 10% of Reach 2 supports both urban and non-urban mammals. Approximately 40% of the segment supports an equal mix of urban and non-urban birds. Approximately half of the segment supports native amphibians with as much as 70% of the segment supporting garter snakes. Large to medium sized animal movement is possible in 40% of the segment. Fish and bird movement is easy in 20% of the segment.

**Habitat:** The creek buffer in this reach ranges from 25 to 200 feet. Most of the immediate buffer is vegetated (20 to 50 feet). Most impervious surfaces are set back from the creek, except for Squalicum Parkway, which parallels the creek through this entire segment. The buffer in Reach 2 tends to be native or naturalized and dominated by a forest canopy, except near the built environment where the canopy has been removed allowing non-native and invasive species to populate. The buffer in the upper portion of Reach 2 and through Reach 3 is a mix of deciduous trees, shrubs and invasive species. Some native plant habitat exists in this segment but it is generally isolated from other habitats by development. Residential development that dominates the southern creek buffer also has a negative impact on habitat and animal use. The overall quality of habitat is reduced due to these two factors. Isolation of habitat limits usage to those species that can take advantage of narrow habitat corridors. Habitat use is also limited to those species that can adapt to habitat disturbance from adjacent development uses. PHS and SC species use approximately 35% of Reach 2 has habitat for breeding and/or rearing and an additional 15% of the reach has habitat that is used regularly for foraging or other non-breeding activity. PHS and SC species use approximately 37% of the habitat in Reach 3 for foraging and non-breeding, and 18% of the reach is used sporadically by PHS and SC.

The two long culverts (under Squalicum Parkway and Northwest Drive) in this segment may limit use of the upper watershed by some fish species.

### **X.3.5 Opportunities**

#### **Preservation**

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#### **Enhancement or Restoration Opportunities**

- Canopy cover for the creek could be improved greatly by planting coniferous and deciduous trees along the shoreline.
- Where practicable, invasive species control and elimination measures should be implemented along the creek channel and in the buffer. Native shrubs and trees should be planted where possible.
- **Culvert under Squalicum parkway?**

## **X.4 Reach Analysis: Segment C (Reach 4)**

### **X.4.1 Landscape Setting**

This reach is approximately 16 acres in size. Glacial outwash dominates the geology. A small area of continental sedimentary rock is also present in the southeastern portion of the reach. Hydrologic soil group B is located in the glacial outwash areas. Group C soils area mapped in the sedimentary rock area. Group B soils have moderate infiltration rates and Group C soils have a slow infiltration rate. All soils in the reach have only a slight risk of erosion. Steep slopes in the reach are minimal and only located immediately adjacent the creek in the lower portion of the reach. The valley through which the creek flows broadens considerably through this reach. The valley walls are well outside SMA jurisdiction. Creek substrate data is generally unavailable for this reach. However, data for one sampling point was available. The sample was taken in Cornwall Park: 3% sand, 10% fine gravel, 20% coarse gravel and 68% cobble.

### **X.4.2 Land Use**

**Land Use:** Public uses and zoning dominates this segment. The majority of this segment is located within a city park. One building is located within the SMA jurisdiction covering approximately 0.07 acres.

**Transportation and Utilities:** Guide Meridian Street, a major arterial, crosses the creek at the lower extent of the reach. Birchwood Ave is located just north of the creek, the majority of which is located outside of the SMA.

**Public Access:** All but 0.2 acres of the SMA is located within a city park. Cornwall Park offers active and passive recreational opportunities.

**Shoreline Modifications:** The extent of shoreline modifications is unknown, however, one foot path bridge is located within the park and there are no culverts in this reach. On average, impervious surfaces constitute 7% of segment, semi-pervious surfaces 40% and pervious surfaces 53%.

### **X.4.3 Critical Areas**

**Wetlands/ Regulated Streams:** There are no wetlands or tributary streams mapped in this reach.

**FEMA:** FEMA 100 year floodplain is associated with the creek through the entire reach. Approximately half of the reach is located with the floodplain.

**Slopes:** Steep slopes in the reach are minimal and only located immediately adjacent the creek in the lower portion of the reach. These minimal slopes pose no real geohazard.

The valley through which the creek flows broadens considerably through this reach. There are no other identified geohazards in the reach.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Presence of bull trout is presumed in this reach. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

#### **X.4.4 Ecological Functions**

**Water Quality:** The reach has been listed by the Washington Department of Ecology as Category 5 “Polluted Water” for dissolved oxygen, fecal coliform, temperature, zinc and pentachlorophenol. The water is also listed as a concern for pH and temperature. There are no stormwater discharges indicated, however, based on the location of storm drain lines and topography, it appears that there is one possible discharge in SMA jurisdiction. Sewer mains are located along Guide Meridian and Birchwood Ave. There are no documented toxic sites in this segment.

**Vegetation:** A large portion of this reach is undeveloped due to public park designation. The portions of the reach that are not developed with park buildings and open space (grass lawn) remain vegetated with mature coniferous forest. In the grass areas of the park a narrow band of shrubs and deciduous trees remain along side of the creek. A small portion of the upper reach is dominated by weedy grasses and herbaceous species. Creek canopy cover is moderate to good in most of the park, except for the northern most extent of the reach where herbaceous species are dominant.

**Wildlife:** Documented fish use includes: sea-run cutthroat, Chinook, coho, chum and steelhead salmon. All of the reach supports garter snakes and lizards, urban and some non-urban mammals, an equal mix of urban and non-urban birds and native amphibians. Large to medium sized animal movement is easy in this reach. Wildlife use is generally higher in this area due to the quality of native vegetation and connectivity to large areas of undeveloped upland habitat in other areas of Cornwall Park.

**Habitat:** Average creek buffer in this reach is nearly 200 feet. Trees or shrubs constitute the immediate creek buffer through all but the northern most portion of the reach. In the lower extent of the reach the majority of the buffer is mowed grass. The buffer in the upper half of the reach is dominated by coniferous forest. Some park services (parking) are located in buffer as well. Outside of the grass areas and park services, the vegetation is predominately native forest with emergent trees and is of medium quality. The native forest habitat extends well beyond the SMA into the remainder of Cornwall Park. Habitat quality is moderate to high for an urban setting due to connectivity to other habitat areas and the quality of the native vegetation. PHS and SC species use

approximately 100% of the reach as habitat for breeding and/or rearing. There are no known fish barriers in this reach.

#### **X.4.5 Opportunities**

##### **Preservation**

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##### **Enhancement or Restoration Opportunities**

- Canopy cover for the creek could be improved by planting coniferous trees in the adjacent buffer in the lower portion of the reach.
- Habitat and canopy cover in the northern most portion of the reach could be improved by replacing the herbaceous plant community with a native shrub and tree community.

#### **X.5 Reach Analysis: Segment D (Reach 5)**

##### **X.5.1 Landscape Setting**

This reach is approximately 22 acres in size. Glacial outwash dominates the geology. Hydrologic soil group B is mapped in the lower half of the reach; the upper half of the reach is mapped as Group D soils. Group B soils have moderate infiltration rates and Group D soils have very slow infiltration rates and high erosion potential. There are no soils in this reach with high risk of erosion. There are no steep slopes in the reach except for a very small area in the south eastern most corner of the reach. The valley through which the creek flows broadens considerably through this reach. The valley walls are well outside SMA jurisdiction. An old creek channel is located in the south eastern portion of the reach. The hydrology of Squalicum Creek was changed dramatically with the construction of Interstate-5. The stream location was changed and segments were channelized and/or culverted. Gravel was removed from the valley floor substrate to mix concrete for the road bed. Additionally, a berm roadbed was constructed across the valley for the interstate, which acts as a barrier or dam for water flow except for the elevated bridge over the railway and culverts. All these activities amounted to dramatic changes in the hydrology of the valley upstream of Reach 5, thus affecting stream flow and stream location in the reach. Creek substrate data is unavailable for this reach.

##### **X.5.2 Land Use**

**Land Use:** Residential multi-family/institutional zoning dominates this reach. A small portion of the reach is zoned industrial (4 acres). Current uses include pasture, and animal and plant agriculture. Zoning potential in this reach poses significant risk potential to the creek and habitat potential of the area. Sixteen buildings are located within the SMA jurisdiction covering approximately 1.17 acres.

**Transportation and Utilities:** One arterial, Birchwood Ave/Squalicum Way, is located in the reach. The road parallels the creek through the valley and then crosses the creek at the upper extent of the reach.

**Public Access:**

**Shoreline Modifications:** The extent of in-water shoreline modifications is unknown. The creek passes under the roadway at the corner of Birchwood Ave and Squalicum Way via three culverts. On average, impervious surfaces constitute 22% of segment, semi-pervious surfaces 60% and pervious surfaces 18%.

### **X.5.3 Critical Areas**

**Wetlands/ Regulated Streams:** The upper most extent of the reach is mapped as wetland. This wetland complex is directed associated with Squalicum Creek and the old creek channel in the south eastern portion of the reach. There are two creek/drainage channels in this reach in addition to the mainstem of Squalicum Creek. The middle channel appears to be a remnant channel of Squalicum Creek and possibly was the mainstem before construction of Interstate-5. The southern most feature appears to be a drainage channel and it corresponds to a city mapped storm drain line. The source of hydrology for this drainage is a 12 inch pipe on the south side of the valley and appears to be conveying surface and groundwater from the south valley wall.

**FEMA:** FEMA 100 year floodplain is associated with the creek through the entire reach. Nearly the entire reach is located with the floodplain.

**Slopes:** There are no steep slopes in the reach. The valley through which the creek flows broadens considerably through this reach. The only identified geohazard in the area is the valley walls, which have been mapped by Whatcom County Planning as seismic hazard areas based on geologic units. The valley wall is located at the outer extent of the SMA jurisdiction on the south side of the creek.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Presence of bull trout is presumed in this reach. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

### **X.5.4 Ecological Functions**

**Water Quality:** The reach has been listed by the Washington Department of Ecology as Category 5 "Polluted Water" for dissolved oxygen, fecal coliform, temperature, zinc and pentachlorophenol. The water is also listed as a concern for pH and temperature. There are no stormwater discharges indicated, however, based on the location of storm drain lines and topography, it appears that there are two possible discharges in SMA

jurisdiction. A sewer main is located along Squalicum Way. There are no documented toxic sites in this segment.

**Vegetation:** The majority of the reach is currently used for agricultural purposes. The remainder, area north of Birchwood Ave, is developed with institutional buildings. The agricultural portion of the reach is dominated by herbaceous grasses and weedy species. Scattered native trees and shrubs are located along the mainstem and secondary channel. A small area of deciduous trees and shrubs is located in the south eastern corner of the reach. Creek canopy cover and overall quality of the vegetation is poor.

**Wildlife:** Documented fish use includes: sea-run cutthroat, Chinook, coho, chum and steelhead salmon. Approximately 65% of the reach supports garter snakes and lizards, urban and some non-urban mammals, an equal mix of urban and non-urban birds and native amphibians. Large to medium sized animal movement is easy in this reach. The potential for wildlife use in this area is higher due to its proximity to quality native vegetation and habitat in Cornwall Park which is adjacent to the reach.

**Habitat:** Average creek buffer in this reach is approximately 50 feet with a width of 200 feet in about 30% of the reach. Scattered trees and shrubs with a ground cover of herbaceous grasses and weedy species constitute the immediate creek buffer through the entire reach. Beyond this area, the buffer is dominated by herbaceous species, both mowed and un-mowed. The buffer in the upper most extent of the reach is reduced on the northern side of the creek due to proximity to Birchwood Ave. Habitat quality is low, however, the reach does have good connectivity to higher quality habitat in Cornwall Park which is adjacent to the reach. PHS and SC species use approximately 65% of the reach as habitat for breeding and/or rearing.

There are no fish barriers mapped in this reach. However, the culverts located under Birchwood Ave/Squalicum Way are impassible during low flows.

### **X.5.5 Opportunities**

#### **Preservation**

- The best available opportunity for fish habitat improvement, together with significant wildlife habitat corridor preservation and restoration, in the City of Bellingham, is in the Squalicum Creek watershed. The potential still exists in this watershed to preserve undeveloped property and improve habitat through the entire length of the watershed.

#### **Enhancement or Restoration Opportunities**

The potential to improve the habitat in Reach 5 is high. The importance of this area is also high due to location of the reach. Improving habitat would significantly increase the connectivity of habitat along the Squalicum Creek corridor through the city. The entire

reach south of Birchwood Ave should be considered for preservation and restoration of both fish and wildlife habitat, including:

- Preservation of creek and buffer (acquisition).
- Discontinuation of current use.
- Habitat restoration – establish native tree and shrub species, with a long term goal of coniferous forest canopy with a native shrub component and ground cover.
- Improve fish passage under Birchwood Ave/Squalicum Way.
- Invasive plant species control and eventual elimination when tree canopy has been established.

Decisions on fish habitat improvements, including passage barriers, should be considered in conjunction with restoration and preservation goals for the Squalicum valley between and including Reach 5 to Reach 8.

## **X.6 Reach Analysis: Segment E (Reach 6)**

### **X.6.1 Landscape Setting**

This reach is approximately 115 acres in size. Glacial outwash dominates the geology of the valley floor; glacial marine drift dominates the outer edges of the valley and the valley walls. Hydrologic soil group D dominates the valley floor. Some Group C soils are mapped along the southern valley wall. Group D soils have very slow infiltration rates and high erosion potential. Group C soils have a slow infiltration rate and generally have a layer that impedes the downward movement of water, or soils of moderately fine to fine texture. Approximately 17% of the reach has soils with a severe risk of erosion by water. Steep slopes are present at the valley walls.

The hydrology of Squalicum Creek was changed dramatically with the construction of Interstate-5. Most of the intense changes occurred in this reach. The original stream location was changed to accommodate excavation of gravel in the valley and the location of the new highway, which was elevation above the valley floor on a man-made berm. The Interstate now acts as a barrier or dam for water flow through the valley, except for the elevated bridge over the railway and culverts. Two borrow pits were excavated for gravel in order to make concrete for the new roadbed. These pits became Sunset Pond and Bug Lake. Squalicum Creek now flows through Sunset Pond, under James Street, through a modified channel to Interstate-5 where it flows through two 225 foot corrugated metal pipes approximately eight feet in diameter, through a meandering channel, into Bug Lake and then flows out of Bug Lake at the corner of Squalicum Way and Birchwood Ave through three culverts. The exact location of the creek channel prior to construction of Interstate-5 is unknown. All these activities amounted to dramatic changes in the hydrology of the valley, thus affecting stream flow, hydroperiod and in-stream habitat. Creek substrate data is unavailable for this reach.

### **X.6.2 Land Use**

**Land Use:** Industrial and institutional zoning dominates this reach. The institutional zoning is located south of Bug Lake, adjacent to the hospital. The remainder of the reach, except Bug Lake and Sunset Pond which are publicly owned, is zoned industrial. The valley wall south of Sunset Pond is zoned residential. Current uses include residential multi-family south of Sunset Pond. The remainder of the reach is undeveloped and at significant risk for development under the current zoning. Said development would greatly impact the creek and habitat in the area. Nineteen buildings are located within the SMA jurisdiction covering approximately 0.96 acres.

**Transportation and Utilities:** Two arterials, Squalicum Way and James Street are located in the reach. Both streets cross the creek. Interstate-5 bisects the reach. The creek passes under each of these roadways via culverts.

**Public Access:** The majority of this segment is publicly owned.

**Shoreline Modifications:** The extent of in-water shoreline modifications is unknown. On average, impervious surfaces constitute 11% of segment, semi-pervious surfaces 13% and pervious surfaces 75%.

### **X.6.3 Critical Areas**

**Wetlands/ Regulated Streams:** Nearly the entire valley floor is mapped as wetland. The southern portion of the valley between Interstate-5 and James Street is not mapped as wetland. The extent of wetland presence has not been confirmed. Some areas may have less wetland or may be a complex system of wetlands and uplands. The wetlands in this portion of the valley have also been affected by the hydrology changes and creek modifications. Generally, the wetlands are associated with the creek and its floodplain. The mainstem of Squalicum Creek flows through Sunset Pond and Bug Lake. It is possible that old mainstem channels also exist in this area, particularly south of Bug Lake.

**FEMA:** FEMA 100 year floodplain is associated with the creek through the entire reach. Approximately 60% of the reach is in floodplain. Floodplain tends to exist throughout the entire valley floor in Reaches 6 and 7 except in areas where the elevation is just above flood. Two areas outside of floodplain in this reach are: the area north of Bug Lake and the southern portion of the reach between Interstate-5 and James Street.

**Slopes:** Steep slopes are present along the southern edge of the SMA jurisdiction throughout the majority of this reach. These slopes are associated with the south valley wall. Whatcom County Planning has identified the valley walls as seismic geohazards based upon geologic units.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Presence of chum and bull trout is presumed

in this reach. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

#### **X.6.4 Ecological Functions**

**Water Quality:** The portion of the reach up to Sunset Pond has been listed by the Washington Department of Ecology as Category 5 “Polluted Water” for dissolved oxygen, fecal coliform, temperature, zinc and pentachlorophenol. The water is also listed as a concern for pH and temperature. There are no listings above Sunset Pond, nor any listings for Bug Lake. There are no stormwater discharges indicated, however, based on the location of storm drain lines and topography, it appears that there are six possible discharges in SMA jurisdiction. Sewer mains and storm drains are located south of Sunset Pond, along James Street and in the old railroad grade north of Sunset Pond. There are no documented toxic sites in this segment.

**Vegetation:** A mix deciduous forest and wetland forest/shrub/emergent vegetation dominates the reach. These plant communities also dominate the riparian vegetation. A small area of industrial development and housing is also located in the reach. Approximately 83% of the reach has diverse multi-structured native habitat of high quality and is forested with a mature component and emerging young trees. Canopy cover is generally good along the length of the creek channel and poor for Bug Lake and Sunset Pond. Invasive species in this reach include: tansy ragwort, meadow knapweed, yellow flag iris, reed canary grass, Himalayan blackberry, hairy willow herb and knotweed.

**Wildlife:** Documented fish use includes: sea-run cutthroat, Chinook, coho and steelhead salmon. Warm water fish use in Sunset Pond includes: largemouth bass, yellow perch, bluegill, brown bullhead and yellow bullhead. Approximately 83% of the reach supports an abundance of garter snakes and lizards including denning habitat, a variety of non-urban mammals including habitat specific species, a variety of non-urban birds including habitat specific species, and salamanders, newts and frogs. Large to medium sized animal movement is easy in 54% of the reach and movement of all sizes of animals is possible in 32% of the reach. Generally, the composition of wildlife tends to be more non-urban due to the higher quality of habitat, the larger size of uninterrupted habitat and the connectivity to other habitat types.

**Habitat:** Creek buffer width tends to be high in this reach. The buffer in many areas is 200 feet and vegetated with native plant species and forested. The majority of the undeveloped area of the reach, which constitutes more than 75% of the reach, is characterized by mature native habitat, both upland forest and wetland communities including forested, shrub and emergent wetland. Habitat quality tends to be of medium to high quality. One of the largest impacts to habitat quality through this reach are the transportation corridors that are barriers to animal movement. Connectivity to other

habitat types, particularly up stream, is good. PHS and SC species use approximately 30% of the reach as habitat for breeding and/or rearing, and 54% of the reach is used by multiple PHS and SC species for breeding, rearing and/or wintering.

There are no mapped fish barriers in this reach. However, culverts under Squalicum Way are impassible during low flows – flow becomes subsurface, culverts under I-5 impassible during mid to higher flows due to high velocity, and the outlet of Sunset Pond is impassible during low flows – flow becomes subsurface.

### **X.6.5 Opportunities**

#### **Preservation**

- To the greatest extent possible, undeveloped property in the floodplain should be protected from development – particularly those area through which the creek flows, or will flow, and the adjacent riparian area (buffers of at least 150 feet).

#### **Enhancement or Restoration Opportunities**

In order to restore creek ecology and shoreline function, fish passage barriers should be improved and Squalicum Creek should not flow through Bug Lake or Sunset Pond. Improving culvert passages, or routing the creek under Interstate-5 through the bridge opening, are straight forward improvements. At the very least, the three blockages (Squalicum Way culverts, Interstate-5 culverts, and Sunset Pond outlet) should be improved. Further restoration within this reach, deciding how to bypass the two artificial ponds, is more complicated. The following offer a brief outline of some of the possible alternatives:

- *Removal of Bug Lake and Sunset Pond.* From an ecological standpoint, the best alternative is to remove the artificial ponds entirely. Each pond could be filled and the areas restored into a wetland/stream complex. Maintaining an undeveloped valley with wetlands in the floodplain would help aid in flood attenuation. Floodplain wetlands would also provide salmonid rearing habitat. Replacing the ponds with a natural creek channel would also remove predation from warm water fish in the ponds and would improve water temperature.
- *Bypass Bug Lake.* This alternative was proposed in 2002 by GeoEngineers in their draft re-rout feasibility study. See study for details.
- *Bypass Bug Lake and Sunset Pond.* This alternative was proposed in 2002 by GeoEngineers in their draft re-rout feasibility study. See study for details
- Where practicable, invasive species control and elimination measures should be implemented.
- Native coniferous tree species should be planted in the upland and wetland forest areas.

### **X.7 Reach Analysis: Segment F (Reaches 7 & 8)**

### **X.7.1 Landscape Setting**

This reach is approximately 102 acres in size. Glacial outwash dominates the geology of the valley floor; glacial marine drift dominates the southern edge of the segment which corresponds to the south valley wall. Hydrologic soil group D dominates the valley floor. Some Group C soils are mapped along the southern valley wall. Group D soils have very slow infiltration rates and high erosion potential. Group C soils have a slow infiltration rate and generally have a layer that impedes the downward movement of water, or soils of moderately fine to fine texture. There are no soils with severe risk of erosion by water in the segment. Steep slopes, valley wall, are present along the southern portion of the segment.

The segment is just up stream of the physical changes that occurred in the valley due to construction of Interstate-5. Structural changes in this segment that have affected stream channel location and flow is the railroad grade in the northern and central portion of the valley. The railroad grade was constructed in the early 1900s. The railroad is not actively used today, however, the raised grade remains and affects the creek through Reach 9. The creek currently flows through or under the railroad grade once each in Reaches 7 and 8. In Reach 7, the creek flows through a former bridge site in the railroad grade. The grade confines the creek but the crossing is not maintained so migration of the creek is a possibility. The condition of the creek crossing in Reach 8 is unknown. The creek channel flows along the railroad grade in the lower half of Reach 7. The grade is preventing the creek from migrating to the north. The creek also flows under Hannegan Road at the junction of Reaches 7 and 8. It is presumed that the location of portions the creek through this segment have been changed over the last 100 years. The exact location of the natural creek channel is unknown. The hydroperiod through this segment has been affected by development and increased flashy stormwater events. Creek substrate data is unavailable for this reach.

### **X.7.2 Land Use**

Land Use: Industrial zoning dominates Reach 7 and publicly owned land dominates Reach 8. A large portion of land north of the railroad grade in Reach 7 is owned by the City of Bellingham. A small portion of residential zoning is located along the southern most portion of the segment, along the valley wall. Nearly the entire segment is undeveloped. The majority of Reach 7 (52 acres) is undeveloped industrial zoned land and is at significant risk for development. Reach 8, above the railroad grade, is also at risk due to industrial zoning. Said development would greatly impact the creek, the hydrology of the valley and habitat, both existing and potential. Increasing impervious surfaces in the valley would intensify flooding downstream. Six buildings are located within the SMA jurisdiction covering approximately 0.12 acres.

**Transportation and Utilities:** One major arterial, Hannegan Road, bisects the segment. The creek passes under Hannegan Road and through or under the railroad grade twice in the segment.

**Public Access:**

**Shoreline Modifications:** The extent of in-water shoreline modifications is unknown. On average, impervious surfaces constitute 5% of segment, semi-pervious surfaces 23% and pervious surfaces 72%.

### **X.7.3 Critical Areas**

**Wetlands/ Regulated Streams:** The entire valley floor is mapped as wetland. The wetlands in this portion of the valley have been affected by the hydrology changes and creek modifications. There are no tributaries to Squalicum Creek in this segment.

**FEMA:** FEMA 100 year floodplain is associated with the creek through the entire reach. The entire valley floor is in floodplain. This constitutes the entire segment, except for the south valley wall and the elevated railroad grade.

**Slopes:** Steep slopes are present along the southern edge of the SMA jurisdiction throughout the entire segment. These slopes are associated with the south valley wall. Whatcom County Planning has identified the valley walls as seismic geohazards based upon geologic units.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Presence of chum and bull trout is presumed in this reach. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

### **X.7.4 Ecological Functions**

**Water Quality:** Reach 8 has been listed by the Washington Department of Ecology as Category 5 "Polluted Water" for dissolved oxygen and fecal coliform. The water is also listed as a concern for temperature. There are no listings for Reach 7. There are no stormwater discharges indicated, however, based on the location of storm drain lines and topography, it appears that there are four possible discharges in SMA jurisdiction in Reach 7 and 2 possible in Reach 8. Sewer mains and storm drains are located along the north valley wall and in the old railroad grade. There are no documented toxic sites in this segment.

**Vegetation:** *Reach 7.* The entire reach is located within the floodplain of Squalicum Creek. The lower half of reach is mixed deciduous/coniferous forest with a shrub understory. The upper half of the reach is dominated by pasture grasses, predominately reed canary grass. The southern buffer of the creek is dominated by shrubs and regenerating young trees. The majority of the vegetation in this reach is characterized by wetland plant species. Creek canopy cover is good in the lower half of the reach and

moderate to low in the upper half where the vegetation becomes more herbaceous. Invasive reed canary grass is well established in this reach.

*Reach 8.* The entire reach is located within the floodplain of Squalicum Creek. Pasture grasses, reed canary grass, dominate the vegetation on the western side of the creek. The eastern side of the creek is a mix of shrubs and deciduous trees, with trees (deciduous and coniferous) becoming more prevalent further from the creek. Invasive reed canary grass is well established in this reach.

**Wildlife:** Documented fish use includes: sea-run cutthroat, Chinook, coho and steelhead salmon. Approximately 96% of the segment supports an abundance of garter snakes and lizards including denning habitat, a variety of non-urban mammals including habitat specific species, a variety of non-urban birds including habitat specific species, and salamanders, newts and frogs. Large to medium sized animal movement is easy in nearly the entire reach. Generally, the composition of wildlife tends to be more non-urban due to the moderate to higher quality of habitat, the larger size of uninterrupted habitat and the connectivity to other habitat types. Wildlife usage and diversity could be higher if the habitat in the herbaceous areas that is dominated by reed canary grass was more diversified for both plant species and structurally.

**Habitat:** Creek buffer width tends to be high in this segment. The buffer in the majority of the segment is 200 feet. Vegetation varies from native forest/shrub to non-native herbaceous. About half of the segment is characterized by diverse multi-structured native habitat of medium to high quality. The remainder of the segment is characterized by monotypic herbaceous vegetation (grasses and weedy species) typical of disturbed sites. Monotypic vegetation provides far fewer habitat opportunities than diverse mature systems. Habitat values in these areas are low. Connectivity to other habitat types, particularly in Reach 8, is good. Connectivity is lower in Reach 7 due to the Hannegan Road barrier and the lack of quality habitat to the north. Multiple PHS and SC species use approximately 96% of the Reach 7 as habitat for breeding, rearing and/or wintering. PHS and SC species use approximately 90% of Reach 8 for breeding and/or rearing. Fish accessible wetlands are associated with Squalicum Creek in Reach 7.

There are no mapped fish barriers in this reach. However the creek does pass through a culvert or tunnel under Hannegan Road. The condition of the structure is unknown.

### **X.7.5 Opportunities**

#### **Preservation**

- *Reach 7.* Preserve floodplain valley and associated uplands along the south valley wall. The undeveloped floodplain and wetlands in the valley provide flood water storage during storm events, which is critical to maintaining habitat and protecting downstream development.

- *Reach 8.* The majority of this reach is publicly owned (Dept. of Natural Resources). Preservation of the floodplain and wetlands (see remarks for Reach 7). Preservation of exiting habitat, including forested upland habitat outside of SMA jurisdiction should be considered.

### **Enhancement or Restoration Opportunities**

- *Reach 7.* Habitat improvement. Emergent wetland vegetation in the upper reach could be enhanced by planting native trees and shrubs. Canopy cover could be improved in the upper half of the reach. Habitat north of the creek in the lower half of the reach could be enhanced with native vegetation.
- *Reach 8.* Low quality emergent wetland vegetation could be improved by planting native trees and shrubs.
- Stream habitat could be improved by adding in-stream structures.

## **X.8 Reach Analysis: Segment G (Reaches 9, 10 & 11)**

### **X.8.1 Landscape Setting**

This reach is approximately 67 acres in size. Glacial outwash dominates the geology of the valley floor; glacial marine drift dominates the northern most portion of Reach 11 which corresponds to the north valley wall. The creek valley begins to widen in this area of the watershed, tending toward one-half mile wide. Hydrologic soil group D dominates the valley floor. Some Group C soils are mapped along the northern valley wall. Group D soils have very slow infiltration rates and high erosion potential. Group C soils have a slow infiltration rate and generally have a layer that impedes the downward movement of water, or soils of moderately fine to fine texture. About nine acres of soils with severe risk of erosion by water are mapped in Reach 9. Steep slopes, valley wall, are present along the northern portion of Reach 11.

These upper reaches of Squalicum Creek are located at the outer limits of the city where development is not as dense. The glacial creek valley becomes broader. Disturbances to the natural hydrology of the valley are less structural (creek channel manipulation and control) and more a function of vegetation changes (agriculture and imperious surfaces versus forest) and transportation corridors. The exception to this is in Reach 9 where the creek has probably been modified by the current industrial development and railroad grade that parallels the creek through the entire reach. The creek is confined between the industrial development and the railroad. The railroad grade is a barrier between the creek and wetland system to the east. The railroad grade is not a factor in Reaches 10 and 11. The creek currently flows under an access road in Reach 9 and under Bakerview Road between Reaches 10 and 11. The Bakerview Road crossing is a bridge; condition of the crossing in Reach 9 is unknown. The hydroperiod through this segment has been affected by development and increased flashy stormwater events. Creek substrate data is unavailable for this reach.

### **X.8.2 Land Use**

**Land Use:** Industrial zoning dominates the segment, except for the upper half of Reach 11 which is zoned residential. Current uses include industrial development in Reaches 9 and 10, and rural residential/agriculture in Reach 11. About half of Reach 10 and all of Reach 11 is under-developed based upon current zoning and is at significant risk for development. Dense industrial development would greatly impact the creek, the hydrology of the valley and habitat, both existing and potential. Increasing impervious surfaces in the valley would intensify flooding downstream. Six buildings are located within the SMA jurisdiction in Reach 9 covering approximately 0.62 acres, one building in Reach 10 covering 0.49 acres, and ten buildings in Reach 11 covering 0.37 acres.

**Transportation and Utilities:** One arterial, Bakerview Road, bisects the segment. The creek passes under Bakerview Road via a bridge.

**Public Access:**

**Shoreline Modifications:** The extent of in-water shoreline modifications is unknown. On average, impervious surfaces in Reach 9 constitute 49%, semi-pervious surfaces 19% and pervious surfaces 32%; impervious surfaces in Reach 10 constitute 35%, semi-pervious surfaces 46% and pervious surfaces 20%; and impervious surfaces in Reach 11 constitute 6%, semi-pervious surfaces 70% and pervious surfaces 24%.

### **X.8.3 Critical Areas**

**Wetlands/ Regulated Streams:** The eastern portion of Reach 9 is mapped as wetland. Surface water interaction between the wetland system and Squalicum Creek is confined by the railroad grade. There are no tributaries to Squalicum Creek in this segment.

**FEMA:** FEMA 100 year floodplain is associated with the creek through the entire reach. Approximately 80% of Reach 9 is in floodplain and 60% of Reaches 10 and 11 is in floodplain.

**Slopes:** Steep slopes are present along the northern most edge of the SMA jurisdiction in Reach 11. These slopes are associated with the north valley wall. Whatcom County Planning has identified the valley walls as seismic geohazards based upon geologic units.

**Potential PHS/TSE Species:** Documented PHS usage includes: Chinook, coho, chum, bull trout and sea-run cutthroat salmonids. Presence of chum and bull trout is presumed in this reach. Chinook salmon and bull trout are listed as a Federal threatened species and by the State as a candidate species. Sea-run cutthroat and coho salmon are listed as a Federal species of concern and have no State status.

### **X.8.4 Ecological Functions**

**Water Quality:** Reaches 9 and 10 have been listed by the Washington Department of Ecology as Category 5 “Polluted Water” for dissolved oxygen and fecal coliform. The reaches are also listed as a water of concern for temperature. Reach 11 is listed as a Category 5 water for fecal coliform, temperature and dissolved oxygen, and a Category 2 water of concern for pH. There are no stormwater discharges indicated, however, based on the location of storm drain lines and topography, it appears there may be discharges in SMA jurisdiction along Bakerview Road at the juncture of Reach 10 and 11. Sewer mains and storm drains are located along Bakerview Road. There are no documented toxic sites in this segment.

**Vegetation:** Very limited areas of native vegetation remain in this segment. The vegetation has been cleared in nearly the entire segment for industrial development and agriculture. Reach 9 is dominated by industrial use. A narrow corridor of native and non-native naturalized vegetation exists along the creek. Native wetland vegetation, including herbaceous, shrub and deciduous tree species, remains in the eastern most portion of Reach 9 (east of the railroad grade and outside current industrial development). Reach 10 has been cleared of vegetation and is now characterized by industrial development and mowed herbaceous species. Sparse shrubs and deciduous trees are growing in a narrow buffer area along the creek. Reach 11 is dominated by agricultural pasture. The northern most portion of the reach, where the slopes increase, is characterized by shrub and deciduous trees. Vegetation along the creek is mixed, with some scattered shrubs and trees. Some diverse multi-structured native habitat exists in Reaches 9 and 11. Creek canopy cover is poor throughout the entire segment. Invasive reed canary grass is well established in this reach.

**Wildlife:** Documented fish use includes: sea-run cutthroat, Chinook, coho and steelhead salmon. For Reaches 9 and 10, approximately 57% supports an abundance of garter snakes and lizards including denning habitat, a variety of non-urban mammals including habitat specific species, a variety of non-urban birds including habitat specific species, and a variety of native only amphibians. For Reach 11, approximately 80% supports garter snakes and lizards with denning habitat, a variety of non-urban mammal, a variety of non-urban birds, including habitat specific species, and salamanders or newts and frogs. Movement is possible for all sizes of animals, including amphibians throughout portions of the segment. In general, wildlife usage tends to be limited by the lack of quality habitat in this segment and the industrial/agriculture development. However, there are areas of good native habitat and there is some connectivity to other habitat types.

**Habitat:** Creek buffer widths tend to be narrow and highly disturbed through this segment. The vegetation tends to be non-native and herbaceous in areas where the buffer width is 200 feet or greater. In Reaches 9 and 10, where industrial development exists, the buffer tends to be more narrow with sparse to moderate shrub and tree coverage. The best quality habitat in the segment is in eastern half of Reach 9 and the

northern portion of Reach 11, where vegetation tends to be more diverse and multi-structured. Cleared areas tend to be characterized by monotypic herbaceous vegetation (grasses and weedy species) typical of disturbed sites. Monotypic vegetation provides far fewer habitat opportunities than diverse mature systems. Habitat values in these areas are low. Connectivity to other habitat types in Reaches 9 and 11 is good. Connectivity in Reach 10 is low due to Bakerview Road and development barriers. Multiple PHS and SC species use approximately 50% of Reach 9, 65% of Reach 10 and 81% of Reach 11 as habitat for breeding and/or rearing. Wetlands do not appear to be accessible from the creek due to the railroad grade barrier between the two features.

There are no mapped fish barriers in this reach. However the creek does pass through an unknown structure under an access road in the industrial development in Reach 9.

### **X.8.5 Opportunities**

#### **Preservation**

- Maintain maximum buffer widths.
- Preserve existing wetland complex east of Reach 9 (beyond SMA jurisdiction as necessary to maintain current system). Explore feasibility of reconnecting wetland complex to creek.
- Protect and preserve headwater wetlands in the upper watershed to the greatest extent possible. Headwater wetlands help maintain base flow and attenuate flood potential.

#### **Enhancement and Restoration Opportunities**

- Enhance existing buffer vegetation and canopy cover by planting native trees, shrubs and ground cover species.
- Maintain or improve, as needed, stormwater treatment from industrial development.
- Stream habitat could be improved by adding in-stream structures.
- Improve access road crossing in industrial development.