

## Appendix 2

### *"Brooklyn Creek Mapping and Inventory Project"*

#### Sensitive Habitat Inventory and Mapping (SHIM) Survey

**Reports Prepared by:**

**Gord Bainbridge and Christine Kuta**

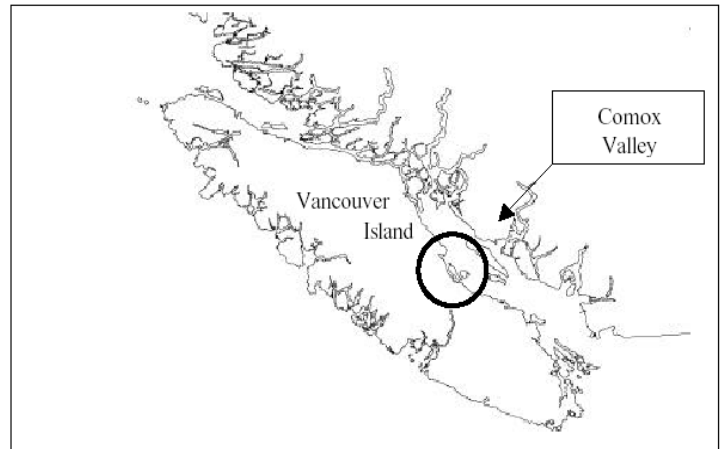
For:

Comox Valley Project Watershed Society  
Box 3007  
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V9N 5N3

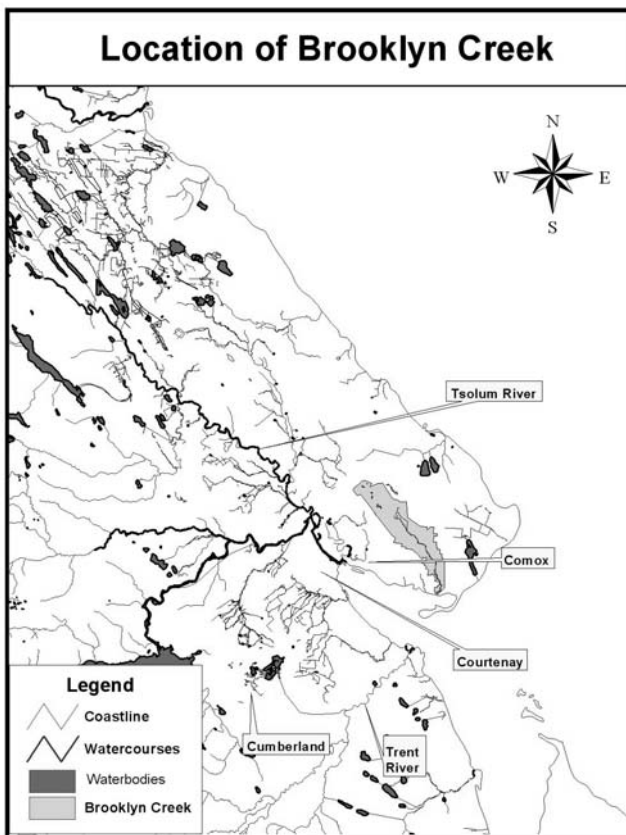
January, 2000

### **Executive Summary**

Brooklyn Creek & Tributaries extends for 10.2 km flowing through the City of Courtenay, the Regional District of Comox Strathcona and the Town of Comox before issuing into Comox Bay about 900 meters east of the Comox Marina. The headwaters of Brooklyn Creek are located in Crown Isle Golf Course and associated development and Longlands Golf Course. A 1.2 meter culvert extending for 337 meters from a large retention pond on Crown Isle property issues into Brooklyn Creek. Historically ephemeral, low summer flow continues to be the main limiting factor to salmonid production in Brooklyn Creek.



Vancouver Island Map showing location of Comox Valley



Storm drain discharge into the creek has created higher peak flows during storm events, contributing to seasonal flow variance throughout Brooklyn Creek. The mid-reaches flood periodically. Brooklyn Creek has been impacted by agricultural & urban development in the mid and upper reaches. The lowest reaches flow through parkland, owned by the Town of Comox. Healthy riparian areas, natural channel characteristics and complexity have been maintained in these areas. A fish ladder has been constructed at Balmoral Avenue. Though spawning habitat is limited, remnant populations of trout and salmon continue to utilize Brooklyn Creek.

During 1998 Comox Valley Project Watershed Society conducted a Sensitive Habitat & Inventory Mapping (SHIM) survey on Brooklyn Creek. The SHIM method used for the survey combined Trimble Pro XR GPS, compass & chain mapping techniques with stream inventory data collection, resulting in geo-referenced lines and points with data for viewing in ArcView GIS. This report is the outcome of

this survey and should be read in conjunction with the accompanying map of Brooklyn Creek.

Restoration opportunities identified by this report include mitigation of erosion, riparian planting, the need for increased complexity and the potential for enhancement/creation of side channels as rearing/over-wintering habitat. To address low summer flow, flow in Brooklyn Creek could be supplemented by spring water originating from Crown Isle Golf Course. Water quality is a potential concern, due to storm drain discharge throughout the Creek. Brooklyn Creek is the focus of a storm water drainage plan produced by Associated Engineering (BC) Ltd for the Town of Comox and The Regional District of Comox Strathcona (1999).

**Report Prepared by:** G. Bainbridge, C. Kuta

**Date of Report:** Jan 21, 2000

### **Background**

The information presented in this report was gathered during the 1999/ 2000 field season of Project Watershed's Watershed Mapping and Inventory Project sponsored by Fisheries Renewal BC, and the Real Estate Foundation of BC.

### **Survey Summary**

**Stream Gazette Name:** Brooklyn Creek

**Alias:**

**Watershed Code:** 920-558600-00000

**Map locations:** 92F066-3-2, 92F066 3-4, 92F076 1-2

**Start Date of Survey:** December 9, 1999      **End Date of Survey:** Jan 13, 2000

**Stream Length Surveyed:** 10.2km including Crown Isle Golf Course

### **List of Research Documents:**

- Associated Engineering (B.C.) Ltd, Brooklyn Creek Storm Drain Study Report,
- Orthophoto maps for filed use,
- Photographs taken during SHIM survey,
- Storm drain maps from Town of Comox,
- Fisheries Resource, and Development Impact Assessment by J.C. Lee and Associates.

### **Purpose of Survey**

The streams inventoried were chosen because of a need to collect information for the following purposes:

- updating to the Regional District of Comox Strathcona's Sensitive Habitat Atlas
- initiating, or adding to, a set of "Streamkeepers Data" for the watershed
- determining rehabilitation, restoration or protection opportunities for the watershed

## **Methods**

The methodology used for this mapping/inventory project was "*Stream Mapping Procedures for Land Use Planning in Coastal Urban Watersheds*" version 3.1, developed in December 1998 by Department of Fisheries and Oceans, Ministry of Environment, Lands and Parks, Langley Environmental Partners Society, and Community Fisheries Development Center.

## **Overview**

Brooklyn Creek is the main watercourse in the Town of Comox. The mouth of the creek is located approximately 900m east of the Comox Marina, and extends for 5.54 km up to Longlands Golf Course. Another major source of water originates from Crown Isle Golf course and adjacent urban development. On Crown Isle property, an underground pipe is connected to a large retention pond which deposits water into Brooklyn Creek at the Parry Place culvert.

Brooklyn Creek has been the focus of a storm water drainage plan, produced by Associated Engineering (B.C.) Ltd, for the Town of Comox and The Regional District of Comox – Strathcona (1999). The report includes a Preliminary Fisheries Resource, and Development Impact Assessment by J.C. Lee and Associates.

## **Acknowledgement**

Project Watershed would like to acknowledge the efforts of Barry Thornton who has been a major advocate for Brooklyn Creek over the last 30 years. Barry has been involved with many projects including the fish ladder at Balmoral Avenue and the dedicated green spaces along Brooklyn Creek. He is also a co-founder of the Salmonids in the Classroom program. When working as Principal at Brooklyn Elementary, Mr Thornton initiated fish habitat improvements along Brooklyn Creek adjacent to the school.

## **Brooklyn Creek Segment Descriptions**

### **Lower Reaches**

The lower reaches of the creek are contained within a park system, and are in a relatively natural state. This area benefits from periodic inputs of fallen trees and has a complex channel with frequent pools and a diverse mixture of salmonid habitats.

### **Mid Reaches**

The mid reaches of the creek have been subjected to urban development. The storm water inputs have contributed to gravel movement, bank erosion, sedimentation and the periodic building of instream sediment wedges and related landowner flooding.

### Upper Reaches

The upper reaches of Brooklyn have been converted to golf course use, and channelized during urbanization. Crown Isle Golf Course augments summer flow into Brooklyn Creek with spring water, for which it retains a water license. Long time landowners claim that Brooklyn Creek was historically ephemeral (in the upper watershed at least) and originated from the vicinity of the lower edge of Crown Isle Golf Course. Remnants of an old dry channel are visible along the western edge of Longlands Golf Course.

### **Features of Interest and Rehabilitation/Protection Opportunities for Brooklyn Creek**

#### **Feature #11 – Spawning gravel**

A section of poor quality spawning gravel begins here and extends for almost 300m.

#### **Location #20- Lack of Complexity**

This is a section of the stream with poor complexity as well as poor spawning and rearing habitat.

#### ***Restoration Opportunity***

There is good access and could be an area of instream wood placement.

#### **Feature #21 – Side Channel**

Short side channel. It will, in time, become the main channel as it breaks through an oxbow.

#### **Feature #23 – Bank Erosion**

Slight erosion occurring in close proximity of the trail.

#### ***Restoration Opportunity***

The bank could be stabilized.

#### **Location #31- Lack of Complexity**

#### ***Restoration Opportunity***

Good site for future complexing with large woody debris (LWD): straight section of the stream with poor spawning and rearing habitat.

#### **Feature # 32.1- Water Quality Monitoring Site**

The Brooklyn Creek Streamkeepers gather water quality data periodically at this location. This also corresponds to a JC Lee and Associates water quality monitoring site.

#### **Feature #34 – Bank Erosion**

Mild erosion is occurring at the upstream end, on the left bank, of the bridge, near the concrete footings (wing walls).

#### ***Restoration Opportunity***

Could use rip-rap, rock gabion or vegetation to stabilize this site and remediate downstream siltation

**Feature #41 – Side Channel**

This is a high water overflow channel, which extend for 66 m before reconnecting with the channel.

***Restoration Opportunity***

This side channel may have attributes, which could be expanded to create rearing habitat. The channel could be dug out at the lower end to create off-channel-rearing habitat. Machine access is poor.

**Feature #46 – Bank Erosion**

There is natural erosion occurring on the right bank. This is presently impacting the streamside trail.

***Restoration Opportunity***

This section could be armoured with rock and / or benefit from deflection structure made out of logs.

**Feature #55 – Off Channel Pond Potential**

A tile drain exits a wet depression on the east side of the trail. There is a concrete cistern of unknown use also associated with this depression.

***Restoration Opportunity***

This right bank depression could be dug out and connected to the main channel to increase off-channel juvenile salmonid rearing habitat.

**X Section #56 - Lack of Complexity**

Poor complexity for 51m. Stable LWD placement could improve potential fish habitat in this section. Substrate is mostly cobble at this location.

**Feature #62 – Fishway**

Concrete fishway at the culvert under Balmoral Ave. It is divided into four sections with 1m plunge pools. Excellent design and construction.

**Feature # 68 – Spawning Gravel**

Moderate quality, anadromous sized, spawning gravel. Extends for 79 m.

**Feature #70 – Extra Information**

There is a staff gauge located upstream of the culvert. On Dec 9 it read 1.23 m.

**Location #75 - Lack Of Complexity**

***Restoration Opportunity***

Begin cobble-gravel substrate with poor channel complexity. It is a good location for stable LWD placement within the park.

**Feature #78 – Storm Drain**

Water cascades from this storm drain, which is located at the top of the bank (5 m high). Over time the flow has moderately eroded the clay bank. The bank is stable

and there are no significant issues. Storm drain was flowing at approximately 1 l/s during survey.

**Location #80 - Tree Removal**

There is evidence of windthrow trees continuously being removed.

***Stewardship Opportunity***

There is an opportunity to educate maintenance crews and local landowners that logs that fall instream are a valuable natural process in creating and maintaining fish habitat. The logs should be cabled in place to maintain stability and minimize the chance of scouring spawning gravel and plugging culverts.

**Feature #89 – Bank Erosion**

Erosion is natural. The lower half is stable; the upper half consists of loose sandy clay with exposed conifer roots. An opportunity exists to cable trees so that when they come down they will be stable and promote channel complexity and pool development.

**Feature #103 – Bank Erosion**

Clay bank is breaking off in chunks and undermining the conifers. It would require hard engineering to stabilize this site if it were affecting property ownership.

***Restoration Opportunity***

Cable the undermined trees so that when they do fall instream they can contribute to channel complexity.

**Feature #107 – Lack of Complexity**

This is an area of generally poor quality gravel and poor channel complexity.

***Restoration Opportunity***

This area may be suitable for LWD complexing.

**Feature #114 – Lack of Riparian Vegetation**

There is grass to edge of the right bank.

***Restoration Opportunity***

Stream could benefit from planting trees on this south facing bank.

**Feature #121 – Off Channel Pond Potential**

There is some seasonal off channel habitat on the left bank. This 25 m shallow depression fills with water during floods.

***Restoration Opportunity***

The habitat characteristics could be improved by digging (adding depth).

**Feature # 126 – Log Jam**

The debris jam is presently not an obstruction at high flows but it could potentially become one if it tends to capture more debris.

***Stewardship Opportunity***

Should be monitored in the future for its potential to become a barrier.

**Feature # 129 – Water Quality Issues?**

The storm drain at this location has a brown algae associated with its outflow of unknown significance.

*Stewardship Opportunity*

Consider this location as a water quality-monitoring site.

**Feature # 133 – Fundamental Change in Channel Characteristics**

This location marks the point of a major substrate change from a variable substrate of gravel, cobble and clay to 100% clay (hard pan).

Pool occurrence has decreased upstream to this point where they become practically nonexistent. These fundamental changes in channel structure extend, for the most part, to Guthrie Rd.

**Feature #149 – Channelization**

Channelization extends upstream for 450 m. In this area the substrate is 100% clay.

**Feature #153 – Fish Friendly Culvert**

Concrete box culvert under Dogwood Ave. It has low flow notch and is complexed with rocks.

**Feature #155 – Fishway**

At the upstream end of the culvert under Dogwood Ave. there is a unique, well designed and constructed fishway.

**Feature #161 – Water Quality Issues**

There may be water quality issues relating to the storm water outlet just above the footbridge at Brooklyn Elementary. There is minimum flow from the outlet and brown algae of unknown origin.

*Stewardship Opportunity*

Consider this location as a water quality monitoring site

**Feature #162 – Ditch**

The ditch extends east along the backside of the Brooklyn School fields, along the residential fencing. This ditch is fish accessible and may provide juvenile winter rearing habitat of marginal quality.

***Enhancement Opportunity***

Digging an off channel pond in the lower portion of the ditch could provide high quality rearing habitat in a reach of Brooklyn Creek which is lacking in channel complexity and rearing habitat. It would also provide an educational opportunity for students of Brooklyn School.

**Feature #168 & #170 – LWD Placement**

These are cross logs that were possibly placed by Brooklyn School participants many years ago.



**Feature #176 – Water Quality Issues**

This right bank storm drain is emitting brown foam of suspect water quality.

*Stewardship Opportunity*

Consider this location as a water quality monitoring site

**Feature #177 – Culvert Blockages**

It should be noted that the culverts are prone to filling with debris and were 50% plugged at the time of the survey.

*Enhancement Opportunity*

It would be useful to have debris catchers upstream of the culverts.

**Feature #179 – Bank Erosion**

Both banks are being undercut in this steeply channelized section. Clay banks are relatively stable but hard engineering (rip-rap) would be required for long-term protection of landowner property.

**Feature #187 - Spawning Gravel**

Twenty metres of good quality spawning gravel downstream of Pritchard Rd culvert.

**Feature # 196 - Sediment Wedge**

There is a large sediment wedge in the floodplain on left bank, vegetated with salmonberry, alder and snowberry. This sediment wedge at the upstream end of the culvert may contribute to road and adjacent property flooding in the future.

*Enhancement Opportunity*

When the sediment wedge is removed by machine, a pool could be dug to offer juvenile rearing and summer refuge.

**Feature # 206 - Summer Salmonid Refuge**

Landowner reports that cutthroat trout use this Salish Rd. culvert pool as summer refuge, when stream flows diminish. The culvert outlet is overgrown with ornamental shrubs and ivy.

**Feature #207 - Bank Erosion/ Lack of Riparian**

Lawn extends to the edge of the creek. Clayish banks are undercutting and sloughing.

*Restoration opportunity*

Native planting could offer root structure to stabilize the bank, and provide summer shading for stream temperature regulation.

**Feature # 210 - Bank Erosion**

This bank erosion is significant. This hairpin change in stream direction is eroding into the Dwulit property. Bank is 70% clay and 30% fines in the upper stratum.

Remediation will require hard engineering (rip-rap).

### **Feature #215 - Property Flooding**

Landowner showed pictures of backyard flooding when the Salish Road culvert becomes plugged.

### **Feature #229 - Log and Boulder Placement**

During the summer of 1999 EBA consulting undertook log and boulder placement work in Salish Park. There are various placements upstream of this location, which have been geo-referenced as part of this survey. LWD placement at F 250 has almost been completely covered with silt since last summer.

### **Feature # 231 - Bank Erosion**

Unstable and erodable clay banks extend from this location to the Guthrie Road culvert.

#### ***Restoration Opportunity***

Although there is extensive shrubby vegetation present, perhaps there needs to be densely rooted native grass species introduced to stabilize the banks. Birkdale Farms has similar banks, but they are relatively stable due to the dense matting of grasses. A retention / fish habitat pond upstream of the Guthrie Rd culvert would also help buffer flooding conditions downstream of Guthrie Rd.

### **Feature #248 - Silty Substrate**

Silty substrate extends from this location to Guthrie Rd. Instream vegetation and silt bars, which have previously disrupted channel flow (L256), were removed in the summer of 1999. Banks are still unstable and erodable despite dense willow and ninebark vegetation.

### **Feature # 257 - Culvert Pool**

This culvert pool has minimal summer rearing/ refuge potential due to its lack of depth. It may have been useful add depth and other rearing characteristics during the instream sediment removal of 1999.

### **Feature #259 - Water Quality Issues**

The black plastic storm drain on the left bank has gray silty water emission.

### **Feature # 260.1- Water Quality Monitoring Site**

The Brooklyn Creek Streamkeepers gather water quality data periodically at this location. This also corresponds to a JC Lee and Associates water quality monitoring site.

### **Feature #264 - Birkdale Farms**

Although the portion of Brooklyn Creek that flows through Birkdale Farms was probably historically channelized, it has outgrown any seriously deficient values and looks quite fish friendly compared with Salish Park downstream. It has stable well-vegetated banks (shrubs and grasses), frequent cutbanks, overstream and instream vegetation cover. It also has more complex channel characteristics and a higher incidence of pools than the previous 1.5 km of stream. Barbed wire fencing parallels the creek on

the right bank through most of Birkdale Farm. Some instream vegetation suggests low summer flow. The upstream end of the culvert at Guthrie Rd is subject to plugging with debris.

**Feature # 268 - Pond**

This steel culvert is suspected to drain a low portion of the field on the left bank, which is utilized by waterfowl.

***Enhancement Opportunity***

This area could be configured into a retention / fish habitat pond connected to Brooklyn Creek and used to buffer flooding and erosion downstream of Guthrie Rd.

**Feature # 275 - Bank Erosion**

Right bank erosion is intermittent for 25 m along fenceline. The banks are undercut and slumping.

**Feature # 290 - Channel Complexity**

Undulating substrate since last set of culverts with increased channel complexity. Cutbanks are present both banks. Banks are stable and well vegetated with grasses. Looks fishy. Series of pools extend upstream from this location.

**Feature # 303 - Spawning Gravel**

Resident and anadromous sized spawning gravel. Highly compacted and embedded but looks stirred up in places as if coho may have spawned here.

***Enhancement Opportunity***

Improve this stretch of spawning habitat by adding native gravels and log placements to retain gravels.

**Feature # 310 - Pools**

A series of pools extend upstream from this location.

**Feature # 322 - Spawning Gravel**

Resident sized spawning gravel extends for 5 m.

**Feature # 327 - Tributary**

Ditchline at Anderton Rd culvert, heading north and paralleling the east side of Anderton Rd. There was significant flow during the time of the survey. Perhaps 20 % of the total stream flow. Fish accessible for a short distance to the first driveway access culvert. The flow from the upper catchment area of this tributary is associated with a diversion structure on Tributary 402 (see feature 402). This tributary was mapped using the SHIM methodology along Anderton Rd. and on Longlands Golf Course only. The mid reach of the tributary is in legal contention and one landowner would not presently allow access. This mid reach is photo interpreted only. There are several culverts, which may be barriers to the upstream migration of juvenile salmonids. This tributary is expected to be ephemeral. No quality rearing or spawning habitat was identified.

### **Feature #334 - Bank Erosion - Lack of Riparian**

Lawn periodically to the edge of the stream with occasional slumping banks.

### **Feature # 335 - Sediment Wedge**

This instream sediment wedge has been the product of sediment movement from the upper watershed and deposition at this location. Vegetated with willow.

This wedge may be contributing to landowner flooding.

#### ***Enhancement Opportunity***

When the sediment wedge is removed by machine, a pool could be dug to offer juvenile rearing and summer refuge.

### **Feature #337 - Channel Complexity**

Begin more complex channel morphology. Banks are stable and well vegetated. A series of pools extend upstream to Idiens Way. These pools were geo-referenced. Pools tend to have resident and anadromous sized spawning gravels in their tail-outs. Looks like trout habitat. No wood is present instream.

### **X Section # 346 - Historic Flow and Adult Spawning**

Landowner reports that he has not seen any adult salmon spawning in this reach of the creek for at least 5 years.

He states that summer flows have tended to be much more dependable now that Crown Isle is connected to the system. Historically this section would dry up in the summer months (20 year landowner).

### **Location # 353 - Historic Flow and Juvenile Sightings**

Landowner reports that salmonids are regularly seen in this pool. Apparently flow tends to be disrupted for approximately 5 days during the driest portion of the summer.

### **Feature # 356 - Sediment Wedge**

A sediment wedge is situated downstream of the Idiens Way culvert. It is vegetated with willow species. A streamside resident reported serious flooding during peak events.

#### ***Enhancement Opportunity***

The channel could be dug out to contain water within banks during flood events. The digging work could include:

- Scour structures to keep silts moving in suspension
- LWD complexing to expand rearing habitat
- Expansion and wood complexing of the culvert pool

### **Feature # 362 - Channelization**

Channelization extends for 40 m, parallel to Idiens Way.

### **Feature # 381 - Channelization**

Channelization extends through this highway "Ditchline right of way"

#### ***Restoration Opportunity***

There are poor fish habitat characteristics along this right of way. The lower end of the right of way is a natural deposition area for spawning gravel (Feature 382). Installing cross logs to build up gravel depth and create spawning platforms could enhance this attribute.

The culvert pool downstream of the access road culverts (Feature # 387) could also be expanded, deepened and complexed to create juvenile rearing and summer refuge habitat. A landowner suggests that this pool is presently a fish trap during extreme low flow conditions in Brooklyn.

### **Feature # 382 - Spawning gravel**

Marginal quality resident sized spawning gravel extends for 40 m in the highway right of way. Gravel tends to scour out from upstream and settle out here (See restoration opportunity listed above).

### **X Section # 392 - Hard Pan Substrate**

Gravel is scoured out to hard pan substrate, though clay banks appear stable.

### **Feature # 399 - Crown Isle Retention Pond Culvert**

This 1.2 m culvert extends for 337 m and is suspected to be a barrier to salmonids. It is connected to a very large retention pond that is fed by a series of interconnected ponds. The ponds in turn are fed by tile drains and storm water drains associated with the Crown Isle housing development. The storm water drains are also expected to accept water originating from the proximity of North Island College. The watercourses on Crown Isle were mapped to reflect updates to the Comox Strathcona Sensitive Habitat Atlas.

#### ***Enhancement Opportunities***

As the biggest limiting factor to the production of salmonids in Brooklyn Creek is dependable summer flow.

- Crown Isle retention water should be managed to maximize flow to Brooklyn in the late summer. Water could be stored in the spring to augment low summer flows.
- Consider the use of Crown Isle ponds as an outplanting site for coho juveniles.

### **Feature # 400.1 - Water Quality Monitoring Site**

The Brooklyn Creek Streamkeepers gather water quality data periodically at this location.

### **Feature # 402 – Tributary**

Tributary 402 begins as a ditchline on the South side of Parry Place and extends through Longlands Golf Course. This tributary is channelized for its full length. Landowners suggest that it is ephemeral. Flow was approximately 0.5 l/s during the time of the survey. Much of Longlands Golf Course fields are tile drained into this tributary. There is lawn to the edge of the waterbody for all of its length through

Longlands, and as such it suffers from small periodic sections of bank slumping. Although juvenile salmonids have access to and transit this waterbody, no quality habitat was identified. Juveniles may use this tributary as winter refuge to retreat from the peak flows of Brooklyn Creek.

This tributary originates from a wet low gradient forested area bordering the northern end of Brooklyn Enterprises land and the Crown Land Block. This wet forest has small pockets with seasonal wetland characteristics and vegetation such as sedges. This property would be difficult to develop due to its soggy characteristics.

### **Feature #2 – Channelization**

This tributary is channelized for its full length

#### **X-Section #10 - Lack of Riparian Vegetation**

This cross section identifies there is very little riparian vegetation for the full length through this golf course.

#### ***Restoration Opportunity***

Innovative techniques would be required to provide fish cover and thermal regulation (shade) to this tributary, without detracting from golf course values.

- Cutbanks could be engineered using concrete troughs.
- There may be enough gradient in sections to create spawning habitat and gravel retention structures

### **Feature # 25 – Bank Erosion**

Banks are undercut and topsoil is sloughing at sporadic locations along this stretch. This feature is not highly significant.

### **Feature # 31- Flow Diversion Structure**

This flow control/ diversion device is presently closed to direct all flow into Tributary 402. Opening this gate valve would allow flow into Tributary 327, which ultimately feeds the Anderton Road ditchline.

#### ***Protective Opportunity***

Leaving this gate permanently closed would reduce the possibility of juvenile salmonids entering the ditchline at Anderton where they would be subject to questionable water quality and lack of summer flow. Permanently closing the diversion may also help supplement upper Brooklyn Creek summer flow.

### **Feature #50 – Seasonal Wetland**

Approaching the upper limits of Tp 402. This land is very low gradient, very wet, forested area. There is small depressions containing vegetation such as sedges with hillocks of conifers surrounding them. These shallow, seasonal wetland like characteristics do not offer enough depth to represent active fish habitat.

### **Location #409 - Arbitrary Brooklyn Continuation**

This abrupt change of direction from the "Highways Right of Way" to the north west could be called a new tributary or an extension of Brooklyn Creek main. It has arbitrarily been called an extension of the Brooklyn Creek mainstem.

### **Feature # 411 - Possible Juvenile Upstream Barrier**

This short cobble cascade may be a juvenile upstream barrier during most flows. There is no plunge pool associated with this cascade.

### **Feature # 429 - Tile Drain: End of Brooklyn Survey**

This tile drain is the upstream limit to the migration of salmonids. The tile drain transmits water for several hundred metres, across the edge of Longlands Golf Course and connects with what looks to be the historic Brooklyn channel. This historic channel only transmits seepage.

## **Conclusions**

### ***Mapping:***

Current (1998) representation of Brooklyn Creek in the Comox Strathcona Sensitive Habitat Atlas is inaccurate.

### ***Habitat:***

The lower reaches of the creek, to Balmoral Avenue are contained within a park system, and are in a relatively natural state. This reach benefits from periodic inputs of fallen trees and has a complex channel with frequent pools and a diverse mixture of salmonid habitats.

The reach extending from Balmoral Avenue to Dogwood Avenue contains viable fish habitat but it is much less diverse than the lower reach. Stretches of spawning gravel are present but there is a lack of rearing and off-channel pool habitat. This reach would benefit from inputs of log placements to encourage pool scour in sub-reaches, which would not affect private landowners.

Much of the reach extending from Dogwood to Guthrie Rd has been channelized. It suffers from the most severe urban impacts. The substrate is mostly scoured out to a clay hardpan base. Bank erosion features are common. Pool habitat and spawning habitat is non-existent. Areas of low gradient within this reach have become deposition zones creating occasional sediment wedges, which disrupt flow, cause flooding and heavy equipment is required to remove these.

The reach from Guthrie Rd to Anderton Rd traverses agricultural property. Although this section appears historically channelized it may have outgrown many of the detrimental qualities, which are associated with channelization. Moderate quality habitats are present in this reach. The lower portion could be modified to improve the

frequency of pools and instream fish cover. The spawning potential in the upper portion could be improved.

Instream vegetation suggests questionable summer flow upstream of Guthrie Rd.

The reach from Anderton Rd to Idiens Way, is relatively undisturbed and complex. Wide ranges of viable fish habitats are represented within this reach. Long time landowners have witnessed adult salmon utilizing the spawning habitat within this reach, though not in recent years.

The reach from Idiens Way to Parry Place is channelized for much of its length and has questionable fish habitat values.

### **Recommendations/Priority Issues For Brooklyn Creek**

1. The greatest limiting factor to the production of salmonids in Brooklyn Creek is dependable summer flow. It would be of great benefit to Brooklyn Creek if Crown Isle retention water could be managed to supplement flow to Brooklyn in the late summer. This could be accomplished by maximizing the storage of water in the spring and regulating its output throughout the summer. This responsibility should be officially mandated to some organization or agency.
2. Permanently close the gate valve between the Parry Place Tributary and the Longlands / Anderton Rd tributary to maximize available of summer flow into upper Brooklyn Creek and deny access of any salmonid juveniles into the Anderton Rd ditchline.
3. Consider the use of Crown Isle Ponds as an outplanting site for coho juveniles, if juveniles have the ability to migrate downstream through the culvert to Parry Place. Perhaps the Little River Enhancement Society would consider collecting broodstock from Brooklyn Creek and incubating them and rearing them separately to bolster Brooklyn stocks.
4. There is need to educate maintenance crews and local landowners that logs, which fall instream, are a valuable natural process in creating and maintaining fish habitat. The logs should be cabled in place to maintain stability and minimize the chance of scouring spawning gravel and plugging culverts.
5. A retention / fish habitat pond upstream of the Guthrie Rd culvert, which has access for juveniles from the mainstream of Brooklyn, would provide summer / winter rearing for juveniles and help buffer flooding conditions. This would reduce bank erosion and sedimentation in and below Salish Park.
6. The reach from Balmoral Avenue to Dogwood Avenue has viable but degraded habitat and would benefit from log placements to encourage pool scour in sub-reaches, which would not affect private landowners.