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From  
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Subject  
Object

**RYDER CREEK WATERSHED - JUVENILE COHO POPULATION ASSESSMENT**

Security Classification - Classification de sécurité

**UNCLASSIFIED**

Our file - Notre référence

Your File - Votre référence

Date

**January 11, 2006**

**Introduction**

The single census Petersen Mark-Recapture method was used to generate juvenile coho population estimates for three study sites in the Ryder Creek watershed during December of 2005. Two of the study sites were habitat restoration projects sponsored by the Chilliwack River Action Committee and the third was an untreated section of the watershed. Attached is a project location map as well as survey drawings of the sites.

The first restoration project (treated site) is located just upstream of the Chilliwack River flood-plain on a Ryder Creek tributary known locally as Wingfield Creek. The project was constructed during the summers of 2004 and 2005 and involved the excavation of a total of five off-channel ponds on two adjacent private properties. The lower four ponds average ~1.5 m in depth. Large woody debris (lwd) was added extensively throughout these ponds for juvenile rearing cover. The uppermost pond, while suitable as rearing habitat, was designed primarily to intercept gravel during flood events. It was excavated deeper (~2.5 m) and had less lwd placed in it.

The second treated site is located within Thompson Park (Fraser Valley Regional District) on a low gradient groundwater-based, relic side channel of the Chilliwack River. The project was constructed in the summer of 2005 and involved the excavation of a section of rearing channel (~1 m deep) and a deeper rearing pond (~2-3 m deep). Lwd was added extensively throughout both these areas. A containment berm was constructed downstream back-watering the entire area by an additional 30 cm. This included a section of un-excavated old river side channel. A new access channel was excavated adjacent to the berm (~1 m deep) and lwd was placed sparsely throughout this area.

Downstream of the Thompson Park project the old river side channel continues through a wetland area known locally as Lovely Pond before joining the lower reach of Ryder Creek on the Chilliwack River flood-plain. This area was enumerated as the untreated or control study site. This included approximately 80m of un-excavated old river side channel (~15 cm deep) extending downstream from the Thompson Park project to the Chilliwack Lake Road and also Lovely Pond (~1-2 m deep) downstream from Chilliwack Lake Road to the confluence with Ryder Creek. Substrate throughout this area is primarily fine silt/mud (~1 m deep) overlaying gravel.

## Materials and Methods

The method of capture in all cases was Gee minnow traps baited with salmon roe and set overnight. This included both the first catch (marking) followed approximately one week later by the second catch (mark recapture). The target species was coho and only they were marked. The mark used was a small (~1 mm) clip of the upper caudal fin using fin-clipping scissors. Incidental captures were recorded from the first catch but not the second.

The first capture/markings of coho fry occurred December 7<sup>th</sup> and 8<sup>th</sup> at both the Thompson Park project and the untreated downstream habitat. A total of 26 traps were set in the restoration project and 22 in the untreated habitat. The second capture occurred December 13<sup>th</sup> and 14<sup>th</sup> at both locations. The number of traps was slightly reduced to 22 for the restoration project and 12 for the untreated habitat. This number was deemed sufficient to adequately collect representative samples from each habitat type. The Wingfield Creek first capture/markings of fry occurred December 15<sup>th</sup> and 16<sup>th</sup> and the recapture occurred on December 21<sup>st</sup> and 22<sup>nd</sup>. A total of 25 traps (5 per pond) were set in each case.

Results were recorded separately for each distinct habitat type or section in the Thompson Park project starting from the top as follows; (S1) excavated rearing channel, (S2) excavated rearing pond, (S3) back-watered rearing channel and (S4) excavated access channel. The untreated habitat below the park was separated into (S5) rearing channel (above Chilliwack Lake Road) and (S6) rearing pond (below Chilliwack Lake Road). Likewise, results were recorded separately for each pond at Wingfield Creek with the pond furthest downstream designated as P1 and the uppermost settling pond as P5.

Population estimates using the adjusted Petersen formula<sup>1</sup>, population variance<sup>2</sup> and 95% confidence intervals<sup>3</sup> were calculated for each type of habitat or pond using the following standard formulae:

$$1) \text{ Population Estimate (N)} \quad N = \frac{(M+1)(C+1)}{(R+1)} \quad \text{where} \quad \begin{array}{l} M = \text{first capture (\# marked)} \\ C = \text{second capture (marked + unmarked)} \\ R = \text{marked recaptures} \end{array}$$

$$2) \text{ Population Variance (V)} \quad V = \frac{N^2(C-R)}{(C+1)(R+2)}$$

$$3) \text{ 95\% Confidence Interval (CI)} \quad CI = N \pm 1.96\sqrt{V}$$

The individual estimates for each distinct habitat type or pond were summed to determine overall population estimates for each restoration project and the untreated habitat. As a final comparison, the area of each different habitat type or pond was surveyed and the density of rearing coho (fry/m<sup>2</sup>) was calculated for each. Overall areas were summed for each study site and average coho rearing densities calculated for each.

## Results

Coho - The following three tables summarize the coho population assessment results for each of the three study sites within the Ryder Creek watershed.

**Table 1.** Wingfield Creek Habitat Restoration Project - Juvenile Coho Population Assessment

<b>Pond</b>	<b>catch 1</b>	<b>catch 2</b>	<b>recaptures</b>	<b>population</b>	<b>95% CI ±</b>	<b>area(m<sup>2</sup>)</b>	<b>coho/m<sup>2</sup></b>
P1	141	165	51	453	101	245	1.85
P2	53	97	34	151	40	212	0.71
P3	228	227	67	768	152	454	1.69
P4	241	253	135	452	52	200	2.26
P5	225	234	65	805	163	186	4.33
<b>Overall</b>	<b>888</b>	<b>976</b>	<b>352</b>	<b>2629</b>	<b>508</b>	<b>1297</b>	<b>2.03</b>

P1. Lowermost rearing pond

P5. Uppermost settling pond

**Table 2.** Thompson Park Habitat Restoration Project - Juvenile Coho Population Assessment

<b>Section</b>	<b>catch 1</b>	<b>catch 2</b>	<b>recaptures</b>	<b>population</b>	<b>95% CI ±</b>	<b>area(m2)</b>	<b>coho/m2</b>
S1	353	600	202	1045	116	560	1.87
S2	671	821	285	1931	180	462	4.18
S3	116	130	47	319	71	257	1.24
S4	228	151	93	370	45	130	2.85
<b>Overall</b>	<b>1368</b>	<b>1702</b>	<b>627</b>	<b>3665</b>	<b>412</b>	<b>1409</b>	<b>2.60</b>

S1. Excavated rearing channel with densely placed lwd

S2. Excavated rearing pond with densely placed lwd

S3. Back-watered rearing channel (not excavated)

S4. Excavated access channel with sparsely placed lwd

**Table 3.** Ryder Creek Watershed Untreated Habitat - Juvenile Coho Population Assessment

<b>Section</b>	<b>catch 1</b>	<b>catch 2</b>	<b>recaptures</b>	<b>population</b>	<b>95% CI ±</b>	<b>area(m2)</b>	<b>coho/m2</b>
S5	177	62	29	374	95	158	2.37
S6	391	315	93	1318	222	995	1.32
<b>Overall</b>	<b>568</b>	<b>377</b>	<b>122</b>	<b>1692</b>	<b>317</b>	<b>1153</b>	<b>1.47</b>

S5. Un-excavated old river channel upstream of Chilliwack Lake Road

S6. Un-excavated wetland area downstream of Chilliwack Lake Road (Lovely Pond)

### Incidental Catches

The incidental catches in the Wingfield Creek project were almost exclusively trout, (9% of the total catch). It was impossible to determine species for the majority of sub-yearling trout so they were recorded as unknown trout. It was also impossible to determine species for the larger non-cutthroat trout, so they were recorded as rainbow/steelhead. For the larger trout, the ratio of cutthroat to rainbow/steelhead was approximately five to one. The only other incidental catch was one prickly sculpin.

The incidental catches in both the Thompson Park project and the untreated side channel habitat were primarily three spine stickleback (35% of the total catch). Trout made up <1% of the total catch in these habitats. The only other incidental catches were two crayfish from the excavated access channel.

### Discussion and Conclusions

The most comprehensive data set for estimates of overwinter survival of coho fry from off-channel habitat come from the Carnation Creek studies<sup>1</sup>. The off-channel overwinter survival rates (both pre- and post-logging) from September to downstream smolt migration the next spring, averaged 70%. I could not find any comparable studies in the literature where juvenile coho were enumerated in December and then again as smolts. Using the average off-channel overwinter survival rate from Carnation Creek as a minimum estimate for the overwinter survival of the December coho populations found at Ryder Creek, the coho smolt production estimates for each study site would be as follows:

**Table 4. Coho Smolt Production Estimates For the Ryder Creek Watershed Study Sites**

	December Coho Fry	Coho Smolt Estimate	Coho Smolt/m <sup>2</sup>
Wingfield Creek Project	2,629	1,840	1.42
Thompson Park Project	3,665	2,566	1.82
Ryder Cr Untreated Habitat	1,692	1,184	1.03

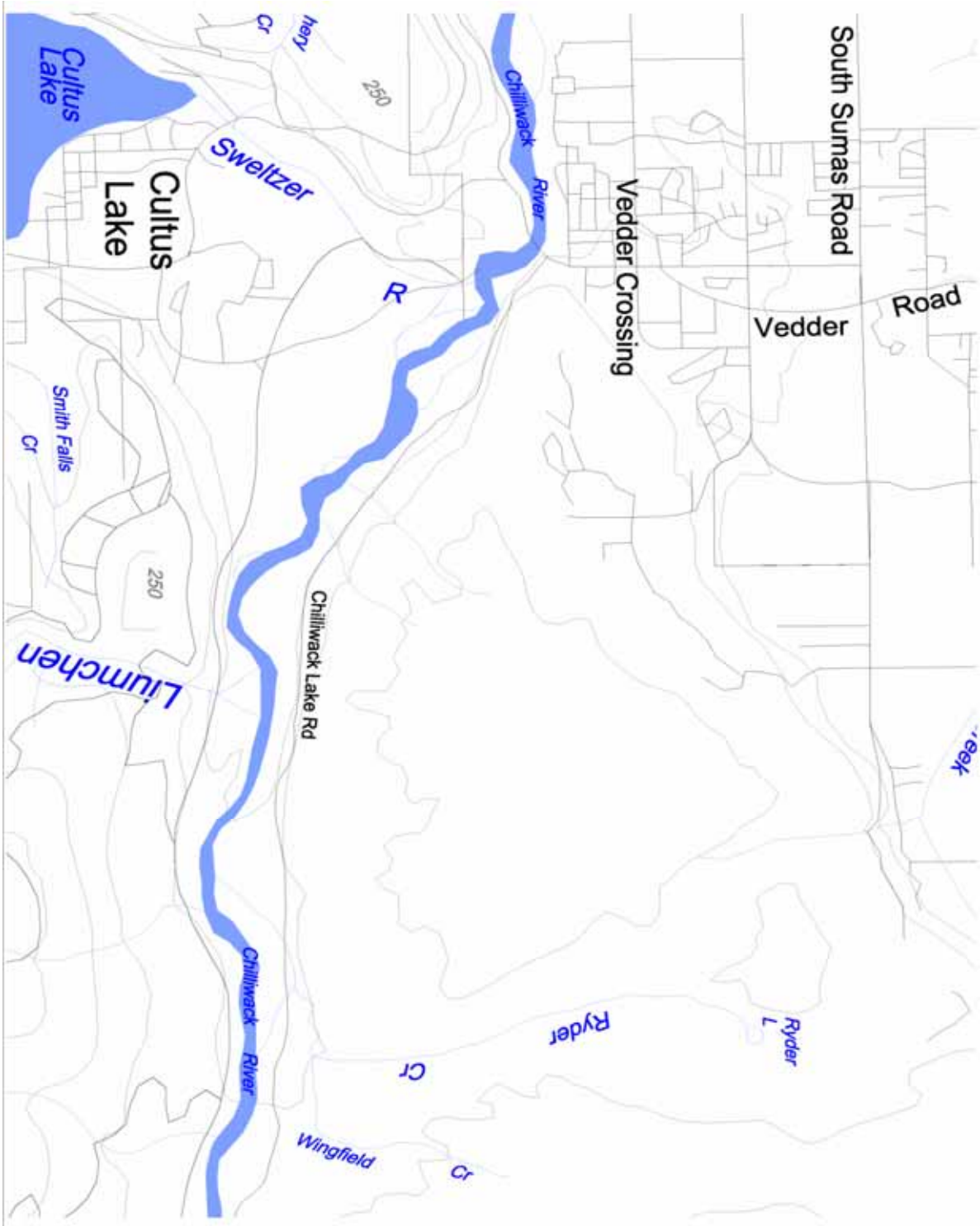
All three estimates for smolt production exceed accepted bio-standards<sup>2</sup> for coho smolt production from side-channels and ponds (0.67 and 0.69 smolts/m<sup>2</sup> respectively).

### References

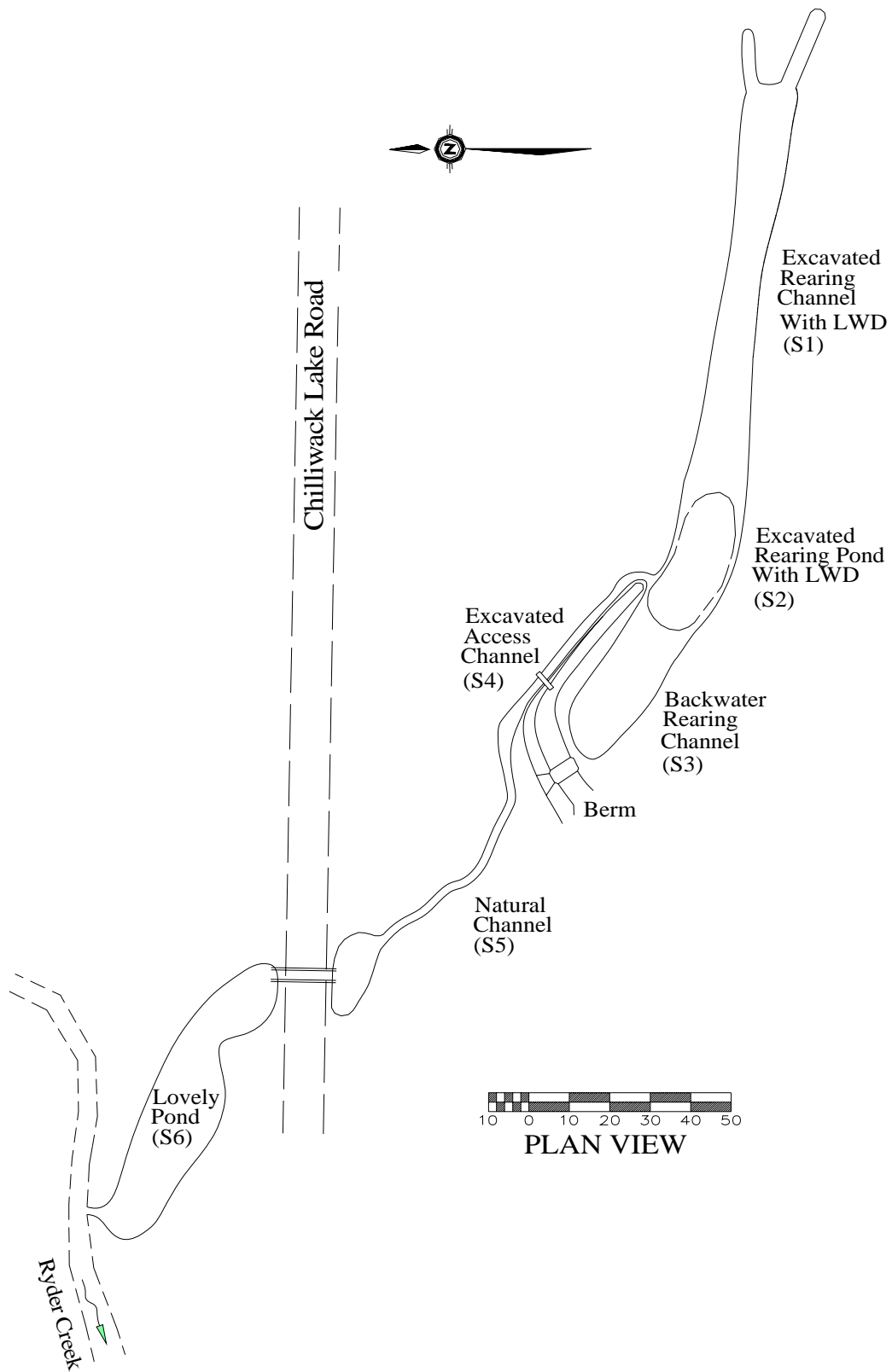
1. Tschaplinski, P.J. and G..F. Hartman. 1983. Winter distribution of juvenile coho salmon (*Oncorhynchus kisutch*) before and after logging in Carnation Creek, British Columbia, and some implications for overwinter survival. *Can. J. Fish. Aquat. Sci.* 40:452-461
2. Keely, E.R., P.A. Slaney and D. Zaldokas. 1996. Estimates of production benefits for salmonid fishes from stream restoration initiatives. *Watershed Restoration Management Report No. 4.*

### Acknowledgements

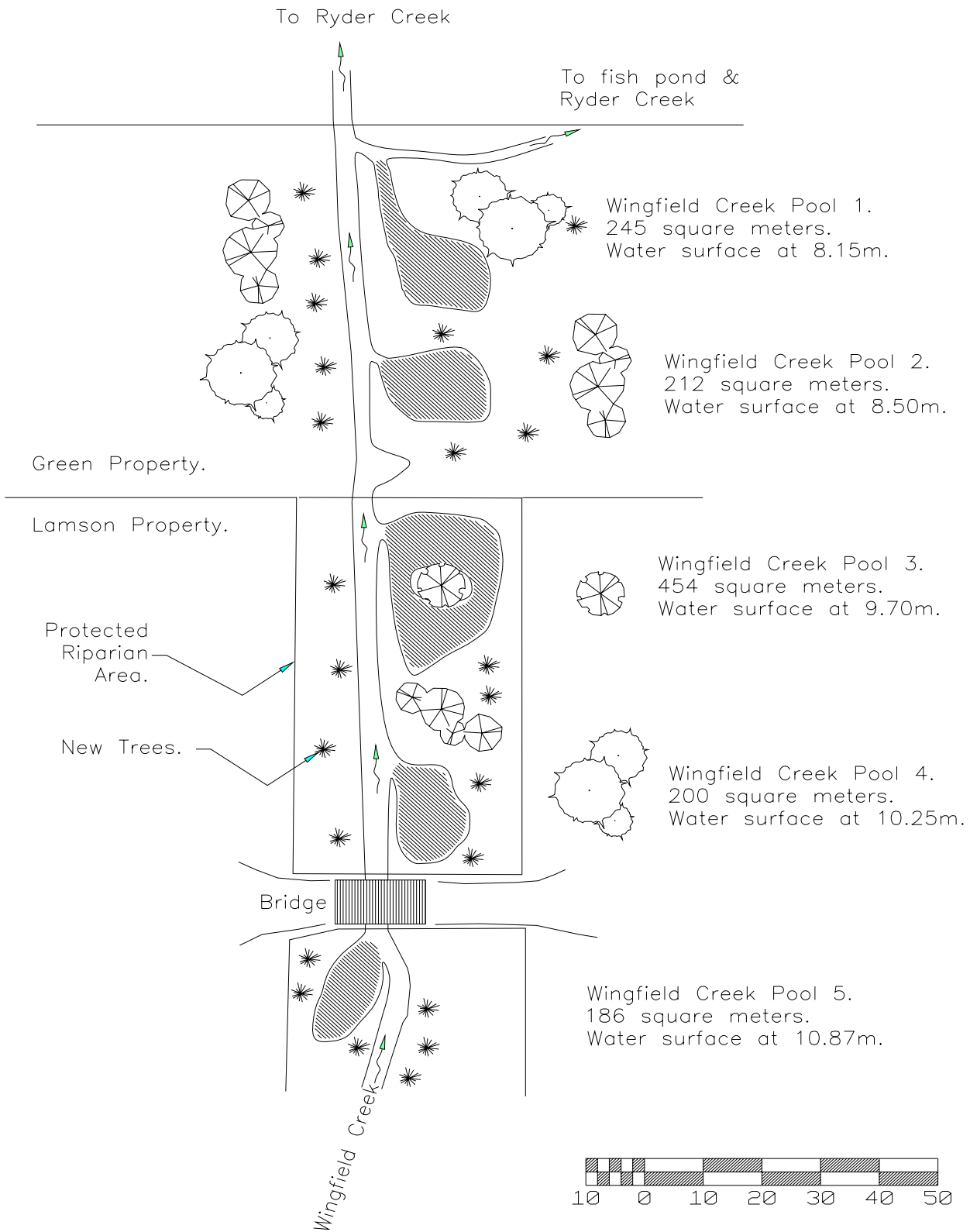
Assistance with the field activities was provided at various times by Jonathon Bulcock, Mike Landiak, Cathy McClean, Mark Johnson and Dave Lamson. Gord Gadsden of FVRD Parks prepared the site location map and J. Bulcock produced the project drawings.



Appendix 1. Study Site Location Map



Appendix 2. Thompson Park and Lovely Pond Study Sites



Appendix 3. Wingfield Creek Study Site

Appendix 4. Wingfield Creek Treated Habitat  
Raw Catch Data Including Incidentals, December 16, 2005

Pond	Trap	coho	cut tr	Rb/sh tr	unk tr	comments
1	1	32	3			
	2	18	1			141 total coho in this pond
	3	34				28.2 coho/trap in this pond
	4	38	2	1	3	
	5	19		1		
2	6	13	1		4	
	7	10			4	53 total coho in this pond
	8	7	4		1	10.6 coho/trap in this pond
	9	12	1	1	7	1 sculpin
	10	11			2	
3	11	59	1			
	12	34			1	228 total coho in this pond
	13	49	1	1		45.6 coho/trap in this pond
	14	47				
	15	39	4			
4	16	64				
	17	54			3	
	18	33	1		2	241 total coho in this pond
	19	46	2		4	48.2 coho/trap in this pond
5	20	44	4		1	
	21	15	4		1	
	22	52				
	23	56		2	5	225 total coho in this pond
	24	42	3	1	2	45 coho/trap in this pond
25	60	2		6		
<b>Totals</b>		<b>888</b>	<b>34</b>	<b>7</b>	<b>46</b>	



Appendix 5. Thompson Park Treated and Lovely Pond Untreated Habitat  
Raw Catch Data Including Incidentals, December 8, 2005.

Trap	coho	stickle	rb/sh tr	cut tr	unk tr	comment
1	77	6	1			upper excavated rearing channel with dense lwd
2	16	2		1		
3	54	2				352 total coho in this section
4	63	5				50.3 coho/trap in this section
5	67	6		1		
6	44	0				
7	31	0				
8	116	1				excavated pond with dense lwd
9	101	1				
10	78	0				671 total coho in this section
11	70	26				95.9 coho/trap in this section
12	92	14				
13	101	2				
14	113	4				
15	21	1				back-watered natural rearing channel
16	7	1				
17	25	0				116 total coho in this section
18	45	2				19.3 coho/trap in this section
19	8	0				
20	10	1				2 crayfish
21	50	104				narrow access channel with sparsely placed lwd
22	85	79				
23	59	115				228 total coho in this section
24	24	92				38 coho/trap in this section
25	9	120				
26	1	12				
27	2	17				upstream of road culvert above Lovely Pond
28	1	22				
29	12	28				177 total coho in this section
30	16	86				19.7 coho/trap in this section
31	16	70				
32	26	30				
33	41	10				
34	63	15				
35	0	86				
36	71	0				downstream of road culvert in Lovely Pond
37	3	3				
38	9	1				
39	59	0				
40	82	1				
41	34	13				391 total coho in this section
42	3	21				30.1 coho/trap in this section
43	0	20				
44	53	10				
45	1	3				
46	3	4				
47	36	3	1	1	1	furthest downstream traps, closest to Ryder Creek
48	37	0			2	"
<b>Totals</b>	<b>1935</b>	<b>1039</b>	<b>2</b>	<b>3</b>	<b>3</b>	

