MONITORING SALMON HABITAT ENHANCEMENT PROJECTS

A REPORT SUMMARIZING MONITORING ACTIVITIES AND RESULTS FOR SKAGIT FISHERIES ENHANCEMENT GROUP

1998 – 2006

Prepared By:

W. Perry Welch, Kevik Rensink and Danny Cain
Skagit Fisheries Enhancement Group
P.O. Box 2497 - 407 Main Street Suite 212
Mount Vernon, WA 98273
www.skagitfisheries.org
360-336-0172

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Preparers

The Skagit Fisheries Enhancement Group (SFEG) strives to develop monitoring programs that utilize trained volunteers in order to maximize community involvement and reduce program costs. We depend on and are grateful to willing landowners that allow access to project sites.

The Skagit Fisheries Enhancement Group collected the data using crew, interns, board members, landowners, and many other trained volunteers. The development of the monitoring program has been overseen by Kevik Rensink, SFEG's field restoration coordinator. Perry Welch, Kevik Rensink, and Danny Cain prepared and edited the report.

Portions of the monitoring contained herein were funded by Jobs for the Environment Program (projects monitored prior to November 2001). Washington Conservation Corps workers contributed, as did many volunteers. Other funding was provided by the Regional Fisheries Enhancement Group Program, National Fish and Wildlife Foundation, Skagit County and the Salmon Recovery Funding Board.

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Introduction

The Skagit Fisheries Enhancement Group (SFEG) is a nonprofit organization dedicated to the enhancement of salmon resources through education, restoration and public involvement. Established in 1990 as one of 14 Regional Fisheries Enhancement Groups in Washington State, SFEG is part of a coordinated effort to educate and involve the public in salmon enhancement activities across the state at the community level. SFEG's region includes the entire Skagit River and Samish Bay watersheds in addition to the watersheds of the San Juan Islands and northern Whidbey Island. The Skagit Fisheries Enhancement Group has been implementing salmon habitat restoration projects since 1991. The mission of the Skagit Fisheries Enhancement Group is to build partnerships that educate and engage the community in habitat restoration and watershed stewardship in order to enhance salmonid populations.

Since 1991, SFEG has implemented 127 habitat enhancement and related projects on 46 miles of stream channels. Removal of salmon migration barriers has improved access to 54 miles of habitat. All of these restoration projects to date are located within the Skagit and Samish watersheds, since the San Juan Islands and Northern Whidbey Island were only added to SFEG's region in 2001.

In 1998, SFEG received monitoring funding to evaluate the results of SFEG's habitat enhancement projects and to learn from and improve our restoration design and implementation. Since then our funding for monitoring has drastically declined and while some staff time is applied to monitoring, we are heavily dependent on volunteers. This report updates the 2003 annual progress report and documents data collected over the last 7 years. SFEG has is establishing post project conditions, and future data collection and analysis is anticipated to be beneficial. SFEG is evaluating our monitoring program based on the reduced funding and making necessary modifications in cooperation with the Skagit Watershed Council implementation and effectiveness monitoring. SFEG has also reached a point of having a large project roster and decisions are being made relative to future monitoring frequency given existing funding, personnel and community resources. Of course, ultimately the goal is for volunteers and landowners to take responsibility for the stewardship of projects.

The SFEG monitoring program has historically had six elements. These included:

1) monitoring instream structures,
2) establishing reference points,
3) quantifying spawning habitat availability,
4) performing salmonid counts (spawning surveys),
5) evaluating riparian revegetation projects, and
6) conducting macroinvertebrate sampling.

The new SFEG monitoring program will combine three of the original elements and add two more. These include:

1) in-stream monitoring (combining structures, reference points, and spawning habitat),
2) habitat Unit Surveys (to be conducted on all SFEG large woody debris sites), and
3) juvenile Presence (determining juvenile fish use on selected sites).

SFEG has collected data from its original monitoring elements over the past seven years. Structure monitoring is conducted in June. Reference point and spawning habitat availability monitoring which were typically done in September are being moved to June, and will be done in conjunction with structure monitoring. The combination of these different monitoring elements will result in the data being collected all together in what is now called the "In-stream monitoring" program. Habitat unit surveys will be conducted in July, or at the conclusion of the in-stream monitoring season. Spawning surveys start in October and run through January, or when no more fish are present. Vegetation monitoring has been moved to May, macroinvertebrate monitoring is done in August and September, and juvenile presence surveys will be conducted in the spring on at least one SFEG site per year.

Goals and Objectives

Monitoring elements include 1) In-stream Monitoring, 2) Juvenile Presence Surveys, 3) Habitat Unit Surveys, 4) Spawning Surveys, 5) Vegetation Monitoring, and 6) Macroinvertebrate Monitoring . The goal of SFEG's monitoring programs is to document the effectiveness of the projects to restore salmon habitat as well as to learn from our projects and improve future restoration design. Each monitoring element has specific objectives listed below.

1. Monitoring in-stream conditions documents:
   - stability of in-stream structures,
   - function of in-stream structures,
   - in-channel habitat improvement for target species,
   - stream processes affected by various structures,
   - pool development,
   - modifications to the channel's cross section,
   - change in canopy closure,
   - points for annual photos,
   - the amount of spawnable gravel available to salmonids, and
   - changes in quantity and quality of spawnable habitat.

2. Juvenile Presence Surveys determine:
   - the presence of juvenile salmonids within a project site,
   - the presence of juvenile salmonids upstream of a fish barrier, and
   - species abundance, diversity, and size of juvenile salmonids.

3. Habitat Unit Surveys determine:
   - the quantity and quality of habitat in wadable streams,
   - the frequency and distribution of riffle and pool habitat units,
   - the channel location, and
   - total surface area.

4. Spawning surveys document:
   - the quantity of fish returning to project streams,

- fish access above fish barrier corrections,
- the number of redds made within project reaches, and
- the size of returning fish by measuring carcasses.

5. Vegetation monitoring determines:
   - plant survival and mortality,
   - probable cause of mortality,
   - presence of invasive species,
   - methods of maintenance, and
   - vegetation cover.

6. Macroinvertebrate monitoring:
   - collects information to develop a biomonitoring index for the Skagit watershed,
   - tracks water quality, and
   - compares the overall health of similar streams in the Skagit watershed.

Methods

Protocols are contained in Appendix A and include: SFEG Structure Monitoring Forms; Timber Fish Wildlife (TFW) Reference Point Survey Forms, 2D, 2H; TFW Spawning Habitat Availability Forms 9H, 9.1D and Criteria & Code Sheet; SFEG Spawning Survey Data Sheets; and SFEG Vegetation Monitoring data sheets. Data collection methods for each monitoring element are described.

SFEG primarily deals with performing effectiveness monitoring at project sites. As project funding sources become more focused and as projects are designed and implemented according to plans, the need for implementation monitoring has also developed. It is our goal to tailor SFEG's monitoring programs to address implementation monitoring and effectiveness monitoring. At present there is no attempt to conduct validation monitoring.

Implementation monitoring will contain a level of detail sufficient to be accountable to funders, while also providing an adaptive management link in order to aggregate watershed scale information for effectiveness monitoring. The goal is to allow the protocol to tier to state and federal strategies and be stored in a retrievable format.

Implementation Monitoring

Implementation monitoring documents the as-built conditions and conditions in which the project was built. Implementation monitoring assesses whether restoration actions and activities were carried out as planned.

Implementation monitoring protocols are still being developed at this date. As a result, reporting on project implementation activities was not concluded at the time of completion of this document. Information is presented on projects that were recently installed.

In-stream Monitoring

Structure Monitoring:

In-stream structure monitoring is conducted annually in June. All structures are tagged and numbered from upstream to downstream. Structures consist of full spanning weirs, deflector logs, rock barbs, rootwads, toe logs, cover logs, log jams, etc. Structure monitoring parameters include bankfull width taken at the structure and structure location (right bank, left bank, or full spanning). Observations and measurements are taken immediately at the upstream and downstream end of the structure. Data is collected on dominant substrate, particle packing, and the depth to streambed. Pool development is determined by using Timber Fish and Wildlife protocol SFEG records the condition of the structure and its function. This includes noting any bank erosion or scouring.

Based upon qualitative field observations the structure is classified as *excellent*, *good*, *fair*, or *poor* (Table 1). If the structure is present, secured, and serving its original purpose along with other positive functions, it is classified as excellent, or above expectation. If the structure is present, and for the most part is serving its original purpose it is classified as good, or according to expectation. Fair, means that the structure neither hinders nor helps the creek. If the structure is present but there have been considerable disturbances it is classified as fair, or below expectation. If the structure is gone or serving a negative purpose, and is causing more damage to the stream than good, it is classified as poor or failing. Structure monitoring is performed the first three years, fifth, seventh and tenth years after installment.

Table 1. Structure Ratings on SFEG Project Sites

Excellent (Above Expectation)
Structure secured, serving original purpose.
Provides additional positive functions.
Good (According to Expectation)
Structure serves original purpose (bank-stabilization, pool development, gravel retention, etc.).
Fair (Below Expectation)
Structure has considerable disturbances,
but neither hindering nor helping the creek.
Poor (Failing)
Structure gone or serving negative purpose.
Causing more damage to stream than good.

Reference Point Survey:

Using the Timber Fish and Wildlife (TFW) criteria, reference point surveys are conducted once a year in September in conjunction with the Spawning Habitat Availability Surveys. Reference points are established at 100-meter intervals on all streams where SFEG has completed instream restoration. At each reference point, photographs are taken every other year, one facing directly upstream and the other directly downstream. Bankfull width and bankfull depth are measured at each reference point. Canopy closure is calculated in the middle of the reference point using a densiometer. Reference Point surveys are conducted every year after project implementation.

Spawning Habitat Availability Survey:

Timber Fish and Wildlife protocol is also used in conducting SHA surveys. Transects are established every 25, 50, or 100 meters depending on the length of the project area. A tape is stretched and secured at bankfull width. Using the TFW substrate size class chart, as reformatted on Table 2, the substrate under the tape is divided into separate classifications.

Table 2. Substrate Classification

No.	Substrate	Size
1	sand/silt	<8mm
2	small spawning gravel	8 to 64mm
3	large spawning gravel	65 to 128mm
4	boulders	>128mm
5	bedrock	>1 meter squared exposed
6	other	LWD, clay, peat, etc.

Each size class must be 0.5 meters wide to be its own size class. This cannot be divided by the wetted edge. The bankfull width and wetted width are also measured, and a stream average for both is calculated at the end of each survey. SHA monitoring is performed yearly.

Juvenile Presence Surveys

Several methods are used to determine juvenile presence. Snorkeling, seining, electro-fishing, netting, and surface counts are all used during the spring and summer months to determine juvenile abundance on project sites. SFEG uses Skagit Watershed Council protocol in all of the above areas. Survey type is determined by site accessibility and visibility.

Snorkel surveys are conducted when there is high visibility, and the stream consists of a high pool to riffle ratio. Seining is done in large open waters. Electro-fishing takes place in streams that have a high turbidity, and/or difficult places to observe juveniles, i.e. undercut banks, roots, or other hiding places. Netting usually takes place in isolated pools away from the main flow of the stream. And, surface counts are conducted in shallow streams, consisting mostly of riffle type habitat, and high visibility. Snorkel surveys can be combined with surface count surveys depending upon the depth of the stream and the pool to riffle ratio.

Habitat Unit Surveys

Number the units from the downstream end of the segment to upstream end starting with number one, and then began the numbering sequence over again for each segment surveyed. The downstream reference point association refers to where a reference point survey has been conducted. Record the number of the nearest downstream reference point. Core habitat unit identification type is determined by riffle; pool; sub-surface flow; wetland; or obscured. The sub-unit type of identification is optional and is only used if the surveyor wishes to collect more detailed information. The process basically splits up the core habitat units to be more accurate. Channel location is recorded as primary, secondary, side-channel, or tributary channel. Surface area is measured by multiplying the total length and the average width of each segment.

Spawning Surveys

SFEG utilizes Washington Department of Fish and Wildlife's (WDFW) methodology for conducting spawning surveys. All data is shared with WDFW to aid them in calculating fish returns for the entire watershed. The stream survey length ranges from a few hundred feet to several thousand depending on restoration project length. The surveys begin below the project site and continue upstream until well above the project site. Project creeks are walked once a week from October to January, or when no more salmon are observed.

Each week the total number of live adult salmonids, salmonid carcasses, and redds are recorded by species. All live adults are counted. Only carcasses with at least three-quarters of the fish remaining are counted as a carcass. If carcasses are overly abundant, length is measured using a subsample. Each carcass is measured from nose to fork tip. Tails are clipped to avoid counting the same carcass in subsequent surveys.

Every redd is counted, measured, and flagged. A flag is tied directly above the redd with the date the redd was recorded written on the flag. This prevents redd disturbance during future surveys and double counting. Flags are removed at the end of the survey season. Spawning surveys are completed each year.

In 2001, the streams were walked by SFEG staff with GPS equipment in order to map redds, large woody debris, pools, and other features. This information was then downloaded into a computer so the data can be easily retrieved and GIS results analyzed.

Vegetation Monitoring

Between 1998 and 2001, a methodology was developed by SFEG for vegetation monitoring involving the creation of circular plots to monitor the vegetation at planted restoration sites. In 2001, this vegetation monitoring protocol was revised. The revised vegetation monitoring protocol is a compilation of methodologies derived from Timber Fish and Wildlife (TFW)-Riparian Stand Survey document (Pleus, et. al), Skagit Conservation District (SCD) protocol, wetland delineation manuals, and past SFEG protocols. Data is collected using SFEG forms, entered into a Microsoft Access database, analyzed using Microsoft Access and Excel, and ultimately provides information to assist with project planning and management.

Sampling methods used by SFEG to collect data are General Observation, Total Count, and Circular Plot. Protocols are outlined for implementing each sampling method. General Observation is aimed at older, more developed sites. After plants have become established and the site has developed, considerations such as survival and growth rate are not as much of a concern. This method provides a means of identifying potential threats and maintenance needs while providing a foundation for more in-depth research. Such research could consist of shade/weed relationships, species/habitat type relationships, large woody debris recruitment potential, general inferences about ecological function and development, and more. Vegetation is monitored the first three years and the fifth, seventh and tenth years after planting.

The protocol for implementing General Observation monitoring is to thoroughly walk the site, fill out SFEG Form, and to write extensive comments pertaining to a broad range of plant, site, and ecological characteristics.

Total count is a sampling approach that counts all plants of interest within a project area. This method can provide very accurate population estimates and good baseline data if done thoroughly. A total count approach may not be practical if the project area is very large.

The protocol for conducting total count is to string a rope along the width of the project area. From one end of the project walk the rope down the length of the project with it spanning the width; it is helpful to have several people. As the rope touches a plant, record that plants data then flop the rope over the plant and continue on. The rope serves as a placeholder, helping to keep track of the plants that have been counted.

SFEG also uses circular plots to sample vegetation. The two plot sizes used are twelve-foot radius (1/100th acre) and thirty-seven foot radius (1/10th acre). Plots are placed at certain intervals along a transect according to NRCS specifications. Using plots enables one to sample only a portion of the sampling area and estimate total populations based on sampling results. The goal is that plots be placed in an unbiased manner and be capable of providing a representative sample of the entire site. In order to achieve this goal sampling design must provide for adequate coverage and thorough plot placement. Refer to Appendix B for further information about the vegetation monitoring protocol.

Macroinvertebrate Monitoring

The macroinvertebrate monitoring element collects macroinvertebrate samples from selected restoration sites. Volunteers are trained through the Skagit River Stewards program, which utilizes the expertise of the U.S. Forest Service (USFS) and North Cascades Institute to train volunteers to collect samples. Three samples are taken from 3 riffles in each of the monitored creeks. The sample area is 2 square feet. Samples are then sent to a lab for professional identification of the macroinvertebrates. At least 500 organisms are identified to the lowest taxonomic level possible (usually genus or species). Physical parameters are also taken in order to compare results with those of other like streams. Physical parameters include: substrate size, flow, cross sectional area, adjacent land use and riparian cover. Macroinvertebrate samples are taken in August and September.

Findings

Since 1991, SFEG has implemented 127 habitat enhancement and related projects on 46 miles of stream in five sub-watersheds of the Skagit and Samish watersheds. 54 miles of habitat has been opened by removing salmon passage barriers.

Table 3 lists the project sites by watershed where effectiveness monitoring has been conducted since 1998. Not all sites are monitored for all monitoring elements and no monitoring began until 1998, so some sites were not monitored immediately after implementation. Specific results for each monitoring element by project are presented in the following section. For this table the landowner name is given following the creek name.

Table 3. Project Sites Monitored by SFEG

	Creek Name, Property Owner	*Project Type*	*Year Completed*
SAMISH BAY WATERSHED			
Samish River Watershed			
1	Barnes Creek- Feemster	fish passage	1999
2	Bob Smith Creek- Ovenell	habitat complexity	1993
3	Cronin Creek- Engstrand	fish passage	1999
4	Finnegan Creek- Thompson	fish passage	1999
5	Larrison Creek- Larrison	fish passage	1997
6	Mud Creek- Camp Lutherwood	habitat complexity	1999
7	N.P. Creek- Helt	fish passage	1998
8	Prairie Lane Creek- Shea	re-channel & habitat complexity	1996
9	Thunder Creek- DeLong, Johansen	riparian	2004
Colony Watershed			
10	Colony Creek-Thelen, McMurchie	re-channel & habitat complexity	1999
11	Colony Creek- Coplen	bank stabilization	1997
12	Harrison Creek-Macken, Thelen, Wrucha, McMurchie	re-channel & habitat complexity	1997
13	West Fork of Colony Creek- Trillium	fish passage	2001
14	Wood Creek- Wood	fish passage	1999
SKAGIT RIVER WATERSHED			
Hansen Watershed			
15	Brickyard Creek- Sauk Mountain View Golf Course	re-channel and habitat complexity	1999
16	Childs Creek-Hamerski	habitat complexity	1996
17	Hansen Creek-Skagit County	bank stabilization / riparian	1996/2001
18	Jones Creek- Goodpastor, Trueman, Levy, Price	habitat complexity	1996
19	Red Creek- Alpine Way Landowner's Assoc.	fish passage	2000
20	Shoeshel Creek- Sloniker	fish passage	2003
21	Alder Creek- Trillium	fish passage	2001
Nookachamps Watershed			
22	G.C. Creek- Gribble	livestock exclusion	1998
23	Kennedy Creek- Kennedy	fish passage	1999

	Creek Name, Property Owner	*Project Type*	*Year Completed*
24	Klahowya Creek- Boy Scouts of America	fish passage, habitat complexity/ 2 fish passage, riparian	1998/2001
25	tributaries to Lake Creek- King	fish passage/ fish passage	2001/2003
26	Mundt Creek- Flaig, Mundt	livestock exclusion	1999
27	Murray Creek- Murray	riparian	2001
28	Pringle Creek-Beaver Lake Estates	fish passage	1998
29	Turner Creek- Beaver Lake Estates/ Tewalt	bank stabilization/ riparian	1998/2002
30	West Fork of Trumpeter Creek- City of Mount Vernon, Bakerview Park	re-channel, habitat complexity, riparian	1997
31	East Fork of Nookachamps Creek- Verdoes	habitat complexity	2002
Sauk Watershed			
32	Gravel Creek- Green	fish passage	1998
33	Lewis Creek- Lewis	fish passage	1998
34	Mouse Creek- Lewis	fish passage	1998
35	Powderhouse Creek- USFS, Lewis	habitat complexity	1998
36	Lyle Creek- Dashiell	livestock crossing	2001
37	Suiattle Slough- Washington Department of Natural Resources	fish passage, habitat complexity	2005
South Skagit Watershed			
38	Winters Creek- Carnes	habitat complexity	1997
39	Aldon Creek- Falconer	riparian	2002
40	Morgan Creek- Israel, Matson	habitat complexity	in progress
Upper Skagit Watershed			
41	Lorenzen Creek- MacMahan	fish passage	2001
42	Marblegate Slough- Marblegate Community	fish passage	2003

Findings by Project by Watershed

SAMISH BAY WATERSHED

Samish River Watershed

BARNES CREEK - Feemster Property

Barnes Creek drains into Lake Samish on its east bank. Lake Samish provides the headwaters to Friday Creek. The site is located in Section 26, Township 37N, and Range 3E. The project was completed in 1999 and involved correcting a fish passage problem by building a series of 11 rock weirs and three large woody debris (LWD) structures along 200 ft (61 m) of stream channel. Mature mixed forest characterized the existing riparian area, and understory trees and shrubs (47) were planted along 100 ft (31 m) of both stream banks. Historically, no fish were thought to utilize this system, however, since project completion, coho salmon have been recorded.

Structure Monitoring - Of the instream structures placed in 1999, 87% had created a total of 12 pools by the summer of 2000. In 2001 and again in 2002, 87% of the structures maintained the same 12 pools as the previous year. In 2004, the total number of pools decreased to 11 with 79% of the structures maintaining pools. The average surface area of the pools has decreased from 2000 to 2002 by 3.77 square meters (from 15.11 in 2000, to 12.43 in 2001, and to 11.34 in 2002). However, the average surface area increased to 14.74 square meters in 2004. The average depth remained the same at 0.55 meters during the first two years after the project, but increased 0.15 meters in the following three years (from 0.55 in 2000 and 2001, to 0.60 in 2002, and to 0.70 in 2004). There have been no structure failures in Barnes Creek. Structure ratings for Barnes Creek are provided in Table 4.

Table 4. Barnes Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	57%	36%	7%	0%
2001	79%	14%	7%	0%
2002	57%	36%	7%	0%
2004	79%	14%	7%	0%

Reference Point and Spawning Habitat Availability Survey:

Table 5. SHA and Reference Point Survey data for Barnes Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		58	60	59	55	56	72	
Bankfull Depth (m)		0.63	0.45	0.34	0.62	0.43	0.46	
Bankfull Width (m)		4.55	6.6	6.75	5.47	4.6	4.4	
Canopy Closure (%)		68	71	27*	80	83	79	
Wetted Width (m)		2.42	1.33	1.81	1.64	1.7	3	

* Decrease in canopy closure due to removal of large cedar branches by road crew.

Spawning Surveys - During the winter after the project was completed (1999-00), nine live coho, one coho carcass, and seven coho redds were recorded. The next year (2000-01) 15 live coho, 3 coho carcasses, and 8 coho redds were counted within the project site. Three years after the completion of the project (2001-02) 130 live coho, 11 coho carcasses, and eight coho redds were recorded. One live kokanee and two live steelhead were also observed on the project site in 2001-02. During the winters of 2002-03 and 2003-04 only five live coho were recorded each year in Barnes Creek. In 2004-05 a total of 26 live coho, five coho carcasses, and six coho redds were recorded. In 2005-06 spawning surveys were conducted by WDFW.

BOB SMITH CREEK - Ovenell Property

Bob Smith Creek drains into the Samish River at river mile 9.9. The restoration project was one of SFEG's first projects and was completed in 1993. It is located in Section 6, Township 35N, and Range 4E. SFEG volunteers placed fixed LWD and planted native trees and shrubs along 1,500 ft (457 m) of stream bank. There was no existing canopy coverage. Bob Smith Creek has been a WDFW Index stream for many years and supports large returns of chum and coho salmon.

Structure Monitoring - none

Reference Point and Spawning Habitat Availability Surveys:

Table 6. SHA and reference point survey data for Bob Smith Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		30	44	48	53	54	53	
Bankfull Depth (m)		0.65	0.51	0.51	0.35	0.37	0.42	
Bankfull Width (m)		3.91	3.36	3.37	2.41	2.4	2.6	
Canopy Closure (%)		96	95	95	95	95	93	
Wetted Width (m)		1.76	1.9	2.16	1.99	1.8	1.9	

Spawning Surveys - conducted by WDFW.

CRONIN CREEK -

Cronin Creek flows into the Samish River at river mile 15.6 near Parson's Road. The restoration project was completed in 1999 and is located in Section 27, Township 36N, and Range 4E. The project included installation of three hand-made plank weirs to allow fish passage from the creek to a large rearing pond, which had previously been bermed. Volunteers also added spawning gravel. Sixty feet (18 m)of Cronin Creek was enhanced for salmon habitat. The project site supports both coho salmon and cutthroat trout. This area of Cronin Creek is used primarily as summer and winter rearing habitat.

Structure Monitoring - none

Reference Point and Spawning Habitat Availability Surveys:

Table 7. SHA and reference point survey data for Cronin Creek.

	1998	1999*	2000	2001	2002	2003	2004	2005

Spawnable Gravel (%)	70
Bankfull Depth (m)	0.39
Bankfull Width (m)	2.58
Canopy Closure (%)	42
Wetted Width (m)	0

* Measurements were only taken in 1999.

Spawning Surveys - SFEG does not conduct spawning surveys on Cronin Creek.

FINNEGAN CREEK - Thompson Property

Finnegan Creek enters Lake Samish on its east bank near the headwaters of Friday Creek. The restoration project is located in Section 23, Township 37N, and Range 3E. Three rock weirs were placed along 60 feet (18 m) of stream channel in 1999 to improve a fish passage problem. The rock weirs opened up 3,000 ft (914 m) of spawning habitat. There have been no plantings at this site. Coho salmon almost exclusively use this stream, although kokanee (landlocked sockeye salmon) have been observed.

Structure Monitoring - In 2000, following project completion in 1999, all three rock weirs had created pools. In 2001, these three rock weirs were still creating pools, and again in 2002. The average pool size decreased by 7.88 square meters (from 33.03 square meters to 25.25 square meters) from 2000 to 2001, but increased by 1.83 square meters (from 25.25 square meters to 27.08 square meters) between 2001 and 2002. While the average pool depth has remained constant (0.67 meters, 0.68 meters, and 0.66 meters) from 2000, 2001, and 2002 respectively. In 2004, the average surface area and depth increased to 36.06 square meters and 0.73 meters, respectively. There have been no structure failures on Finnegan Creek. Structure ratings are listed in Table 8.

Table 8. Finnegan Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	67%	33%	0%	0%
2001	100%	0%	0%	0%
2002	100%	0%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 9. SHA and reference point survey data for Finnegan Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		100	60	42	28	76**	30	
Bankfull Depth (m)		0.42	0.45	0.63	0.49	0.43	0.66	
Bankfull Width (m)		5.08	5.95	6.11	6	5.22	6.6	
Canopy Closure (%)		86	92	92	95	96	79*	
Wetted Width (m)		2.88	4.35	3.91	3.69	3.08	5.2	

* Decrease in canopy closure due to removal of tree limbs by road crew.

** The increase of spawnable gravel was a result of the rock weirs influencing the sorting and settling of fine particles downstream.

Spawning Surveys - During the winter following project completion (1999-00), six live coho, two coho carcasses, and three coho redds were observed. During the winter of 2000-01, three coho carcasses, and one live kokanee were observed. The next winter 31 live coho, five coho carcasses, and three coho redds were recorded. One live steelhead was also observed in 2001-02. In the winter of 2002-03 five live coho, and seven coho carcasses were recorded. During the winter of 2003-04 five live coho, and one coho carcass were observed. In 2004-05 SFEG recorded more fish than ever before with a total of 47 live coho, six coho carcasses, and six coho redds. No spawning surveys were conducted for the 2005-06 season.

LARRISON CREEK - Larrison Property

Larrison Creek drains into the Samish River at river mile 21.6. The project is located just off Cruise Road near State Route 9 in Section 18, Township 36N, and Range 5E. This project was completed in 1997 and involved replacing a perched culvert, installation of one rock weir, one LWD structure, and six log weirs downstream of the new culvert in order to provide fish access through a previous barrier. Overall, a total of eight instream structures were installed, and 250 feet (76 m) of stream was fenced off. Riparian plantings consisted of 675 native trees and shrubs. A total of 400 feet (122 m) of stream habitat was restored, and 7,000 feet (2130 m) of stream channel became accessible to fish upstream of the culvert. Larrison Creek is used almost exclusively by coho salmon, with the occasional siting of steelhead.

Structure Monitoring - In 1998, one year after project completion, there was a 0% structure failure rate with every structure creating a pool. The average pool size was 5.39 meters long and 0.41 meters deep. Following 1998 surveys, some structures were determined to be functioning improperly according to WDFW protocol. The SFEG restoration crew completed structure repair in order to meet WDFW standards. By 1999, structures rated at 100% excellent, although only 64% of the structures were creating pools. These pools became much smaller and deeper, with an average length of 1.99 meters and average depth of 0.52 meters. In 2000, 82% of the structures were creating pools, but the pools continued to get smaller with an average length of 1.55 meters, a width of 2.32 meters, and a depth of 0.32 meters. In 2002, five years after project completion, only 67% of the structures are still maintaining a total of six pools, which have become stable with a surface area of 3.69 meters, and a depth of 0.33 meters. In 2004, an increased bed load completely filled in all but one of the pools, with 11% of the structures maintaining this pool. The remaining pool had a surface area of 3.00 square meters and a depth of 0.30 meters. The structure ratings are shown in Table 10.

Table 10. Larrison Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1998	63%	13%	25%	0%
1999	100%	0%	0%	0%
2000	67%	33%	0%	0%
2002	67%	33%	0%	0%
2004	78%	22%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 11. SHA and reference point survey data for Larrison Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		67	58	39	55	46	48	
Bankfull Depth (m)		0.43	0.36	0.27	0.53	0.58	0.31	
Bankfull Width (m)		3.2	3.92	3.52	4.43	3	3.3	
Canopy Closure (%)		72	36*	38	39	48	98	
Wetted Width (m)		0	1.06	0.18	0	0	1.7	

* Decrease in canopy closure due to tree limb removal

Spawning Surveys - Two years after project completion, in the winter of 1998-99, 49 live coho, 20 coho carcasses, and 27 coho redds were observed. In 1999-00 only three coho carcasses and 6 coho redds were counted, and in 2000-01 there were neither live, dead, or fish redds of any kind found in the creek. However, one year later (2001-02) 81 live coho, 38 coho carcasses, and 9 coho redds were observed in the same stretch of stream. One steelhead was also recorded in 2001-02. The next three years (2002-03/2003-04/2004-05) there were again no live, dead, or fish redds found. No spawning surveys were conducted during the 2005-06 season.

MUD CREEK - Camp Lutherwood

Mud Creek drains into Lake Samish at its northwest end. The project is located on the Camp Lutherwood property in Section 28, Township 37N, Range 3E and was completed in the summer of 1999. The project involved installing 27 instream structures and planting 66 native conifer trees along 400 feet (122 m) of stream bank that was previously dominated by salmonberry. In all, 1,220 feet (371 m) of stream was restored in an effort to increase the numbers of native coho, kokanee, and cutthroat using this system.

Structure Monitoring - By 2000, 61% of all instream structures placed in 1999 had created a total of 13 pools. The average pool size was 4.07 meters long, 2.72 meters wide, and 0.29 meters deep. In 2001, 58% of all instream structures were maintaining 11 separate pools. These pools averaged 4.88 meters in length, 2.1 meters in width, and 0.28 meters in depth, with close to the same surface area (11.07 square meters to 10.25) and depth as the year before. In 2002 the total number of pools created increased to 14, and the size of the pools increased as well. The average surface area increased to 13.1 square meters, and the average depth increased to 0.43 meters. In 2004, 43% of the structures maintained a total of 13 pools. The average surface of the pools decreased to 10.26 square meters and the average depth remained the same at 0.43 meters. Mud Creek structure ratings are provided in Table 12.

Table 12. Mud Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	48%	37%	11%	4%
2001	53%	43%	4%	0%
2002	53%	40%	4%	3%
2004	40%	57%	0%	3%

Reference Point and Spawning Habitat Availability Surveys:

Table 13. SHA and reference point survey data for Mud Creek.

	1998	1999	2000	2001	2002	2003	2004	2005

Spawnable Gravel (%)	58	62	57	68	71	79
Bankfull Depth (m)	0.58	0.56	0.54	0.56	0.49	0.62
Bankfull Width (m)	5.39	5.52	5.5	4.89	4.6	4.7
Canopy Closure (%)	96	95	97	96	96	94
Wetted Width (m)	1.84	2.01	1.93	1.48	1.6	2.8

Spawning Surveys - SFEG has no spawning data from Mud Creek before our records beginning in 1999-2000, the year after project completion. In 1999-00, 68 live kokanee, one kokanee carcass, and 32 kokanee redds were observed, contrasting markedly with 4 live kokanee counted in 2000-01, 2001-02, and 2002-03 (three kokanee carcasses were also recorded in 2001-02). Local residents, based on unofficial monitoring observations, stated that the 2000-01 through 2002-03 seasons were more typical of the overall historical trend. In 2004-05 the kokanee run was stronger than normal with a total count of 13 live, and six redds. In 1999-00, 35 live coho, 4 coho carcasses, and 14 coho redds were observed compared to 14 live coho, 4 coho carcasses, and 6 coho redds in 2000-01. But, in 2001-02 the number of coho increased again with a total of 137 live adults, six carcasses, and 14 redds were recorded. During the winter of 2002-03 the coho run was down again to 13 live coho and two coho carcasses. Four live steelhead were also observed in 2001-02. In 2000-01, the first chinook in a Lake Samish tributary was recorded with one chinook "jack" and one chinook redd. In the winter of 2003-04 a total of 12 live coho were recorded. The coho numbers jumped a little in 2004-05 to 27 live coho, three coho carcasses, and six coho redds. Spawning surveys were conducted by WDFW for the 2005-06 season.

N. P. CREEK - Helt Property

N.P. Creek drains into the upper Samish River at river mile 25 near Wickersham in Section 31, Township 37N, Range 5E. This project was completed in 1998. The objective was to improve salmonid passage for coho, cutthroat, and steelhead through 160 feet (49 m) of stream channel by replacing a perched box culvert with a bridge and installing 8 rock weirs. No plantings took place at the well vegetated site. N.P. Creek is considered one of the most productive fish streams within the Samish Watershed.

During September of 2005, SFEG completed a project upstream of the earlier project on N.P. Creek. This project involved removing an old driveway bridge and concrete sill that formed a fish barrier with a new 40-foot beam bridge. Seven rock weirs were installed for grade control. The project provided access to 1.5 miles of habitat above the old barrier.

Structure Monitoring - In 1999, one year after project completion, 100% of all structures were creating pools. These pools averaged 3.14 meters in length and 0.50 meters in depth. In 2000, 67% of the structures were maintaining pools with an average pool size of 3.43 meters long, 3.68 meters wide, and 0.41 meters deep. This represents an increase in surface area and a decrease in depth from the previous year. In 2001, 63% of the rock weirs were forming pools with an average length of 3.25 meters, width of 3.85 meters, and depth of 0.33 meters. In 2003, 50% of the weirs were still maintaining pools with an average length of 3.6 meters, width of 3.23 meters, and depth of 0.35 meters. A lot has changed within the last couple of years on N.P. Creek with the average pool size at 8.3 cubic meters (14.79 square meters of surface area and an average 0.56 meters in depth). In 2005, 88% of the structures had

developed seven substantial pools. Over the first five years, the average surface area of the pools had remained relatively constant while the average depth became shallower. Over the last two years the average surface area has increased by over three square meters, and the average pool depth has increased by more than 0.20 meters. N.P. Creek structure ratings are contained in Table 14.

Table 14. N.P. Creek Structure Ratings.

Year	Excellent	Good	Fair	Poor
1999	82%	18%	0%	0%
2000	50%	33%	17%	0%
2001	50%	25%	25%	0%
2003	50%	50%	0%	0%
2005	88%	12%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 15. SHA and reference point survey data for N.P. Creek:

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		59	42	18**	43	41	34	46
Bankfull Depth (m)		1	0.58*	0.67	1.1	0.84	0.66	0.42
Bankfull Width (m)		4.74	4.4	4.3	4.92	4	3.8	3.5
Canopy Closure (%)		46	50	54	59	62	84	77
Wetted Width (m)		0	2.32	0.74	0.47	0	2.7	0

* Bankfull depth decrease due to culvert removal.

** Spawnable gravel decrease result of multiple debris jams causing sediment deposition.

Spawning Surveys - In 1998-99, the winter after project completion, 504 live coho, 23 coho carcasses, and 64 coho redds were recorded. In 1999-00 observations decreased to 331 live coho and 20 coho carcasses, though a slight increase of 69 coho redds were recorded. In 2000-01 the live number dropped again to 111 live coho, but the carcass count was up to 64 coho and the redd count was up to 87 coho redds. The steady decrease in coho was ended in 2001-02 when 2,933 live adults, 402 carcasses, and 461 redds were observed in the same length of stream as previous years. One steelhead carcass was also recorded in 2001-02. The 2002-03 season showed another decline when 316 live coho, 135 coho carcasses, and 74 coho redds were recorded. The number of returning coho dipped again in 2003 when 192 live coho returned. A total of 21 coho carcasses and 55 coho redds were also recorded. SFEG recorded an all time low in the coho numbers in 2004 with 61 live, 35 carcasses, and 37 redds. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

PRAIRIE LANE CREEK - Shea Property

Prairie Lane Creek (Richmond Creek) drains into the Samish River at river mile 16.5 near Prairie Road. This restoration project was completed in 1996 and is located in Sections 26 and 27, Township 36N, Range 4E. The purpose for restoration was to create off channel habitat for salmon fry. Spawning gravel was dispersed in the upper 800 foot section of the stream, and 52 large woody debris structures were placed throughout a 2,000 foot stretch of stream. In addition, new fencing was installed to exclude livestock along 750 feet (228 m)of the stream. Approximately 1,670 native trees and shrubs were planted along 4,000 feet (1218

m) of both banks. This revegetation work will provide canopy shade along the stream where no cover had previously existed. Richmond Creek is used predominately by coho adults and fry, although some cutthroat are present. The stream typically maintains cool temperatures as it is fed by underground springs and aquifers. Temperature fluctuates very little during the year.

Structure Monitoring - In 1998, two years after project completion, 100% of all instream structures created or provided cover for pools. The average length for the first 24 pools was 2.56 meters, and the depth was 0.42 meters. The average depth of the large pool in the last 456.4 meters of project was 1.46 meters (over a meter deeper than the upper section). In the upper 320 meters of the project site, 24 individual pools were present with one continuous pool in the remaining 456.4 meters. Prairie Lane (Richmond Creek) structure ratings are contained in Table 16.

Table 16. Prairie Lane (Richmond Creek) Structure Ratings.

Years	Excellent	Good	Fair	Poor
1998	65%	25%	10%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 17. SHA and reference point survey data for Prairie Lane (Richmond Creek).

	1998*	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)	23							
Bankfull Depth (m)								
Bankfull Width (m)	4.88							
Canopy Closure (%)	0							
Wetted Width (m)	3.38							

* This site has not been revisited due to an unwilling landowner.

Spawning Surveys - No official surveys were conducted by SFEG, though 8 to 12 coho were observed spawning in the upper section one year after project completion.

Vegetation - Approximately 1,670 native trees and shrubs were planted along 4,000 feet of both banks. This revegetation work was installed to provide canopy shade along the stream where no cover had previously existed. In fact, in 1998 there was 0% canopy closure over the stream. Reed canary grass was in abundance, and all plant species were struggling to survive with the exception of the willows planted along the stream. Cattle had been let inside the fence on a couple of occasions destroying hundreds of plants. This site has not been replanted, maintained, or revisited since 1998 due to an unwilling landowner. The current status of the vegetation is unknown.

THUNDER CREEK - Delong and Johansen properties

Thunder Creek drains into the Samish River and is located at Section 24, Township 36N, Range 4E. SFEG recently completed a project removing invasive species of Japanese knotweed and Himalayan blackberry. After the invasive species were removed, native species were planted.

Spawning Surveys - During the winter of 2004-2005 chinook, coho, and chum were observed in Thunder Creek. SFEG observed 32 live Chinook, 28 chinook carcasses, and 23 chinook redds. A strong run of chum (100 live, 40 carcasses, 24 redds) and coho (293 live, 47 carcasses, 99 redds) were also observed in Thunder Creek. No surveys were conducted during the 2005-2006 spawning season.

Colony Creek Watershed

COLONY CREEK - Thelen and McMurchie Properties

Colony Creek drains into Samish Bay through McElroy Slough. This project is located in Sections 22 and 27, Township 36N, Range 3E. In the summer of 1999, Colony Creek was diverted from a straightened ditch into its historical 2,555-foot (778 m) meandering channel through floodplain wetland habitat. Seventy large woody debris structures were placed instream and along the banks to help provide cover and habitat in this slow, low gradient section of stream. Plantings were installed along 5,110 linear feet (1557 m) and consisted of 3,310 native trees and shrubs that help to create a buffer width of over a hundred feet on each side of the stream. Colony Creek is a WDFW Index stream and provides critical habitat for chum, coho, steelhead, cutthroat trout, and historically chinook salmon.

Structure Monitoring - In 2000, one year after project completion, 88% of the LWD and other material placed in the channel had developed pools. Twelve individual pools were formed at the upstream end of the project averaging 11.57 meters long, 2.66 meters wide (a surface area of 30.78 square meters), and 0.41 meters deep. Below the last individual pool the stream formed one continuous pool to the end of the project site. The average depth of this large continuous pool was 0.84 meters. In 2001, 99% of the structures were either helping create or providing cover for pools. This is due in large part to a set of beaver dams (each dam was 0.5 to 0.6 meters in height) directly downstream of the project site. This has resulted in only four individual pools in the upper section, before the beaver dams influence the remaining length of the stream. The average pool size above the continuous pool in 2001 was 13.75 meters long, 3.3 meters wide (a surface area of 44.55 square meters), and 0.49 meters deep. The average depth of the continuous pool was 1.13 meters. In 2002 there is a total of seven individual pools with an average surface area of 78.82 square meters, and an average depth of 0.81 meters, before the continuous pool begins. The beaver dams, which continue to back up the continuous pool are now 1.0 to 1.2 meters in height, leading to the increased average depth of 1.21 meters in the one continuous pool to the beaver dams. Colony Creek structure ratings are provided in Table 18.

Table 18. Colony Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	63%	24%	13%	0%
2001	74%	10%	13%	3%
2002	78%	9%	12%	0%
2004	0%	99%	0%	1%

Reference Point and Spawning Habitat Availability Surveys:

Table 19. SHA and reference point survey data for Colony Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)			10	1*	2	0		
Bankfull Depth (m)			0.8	0.82	0.9	0.68		
Bankfull Width (m)			7.38	7.15	6.55	4.72		
Canopy Closure (%)			3	4	11	18		
Wetted Width (m)			4.13	5.85	5.1	3.06		

* Decrease in spawnable gravel result of sediment deposition associated with several beaver dams.

Spawning Surveys - In 1998-99 48 live chum, 53 chum carcasses, and one chum redd were recorded with 2 live coho, 4 coho carcasses, and one coho redd. In 1999-2000, two years after the Coplen project and the winter after the lower Colony project 24 live chum, 17 chum carcasses, and 7 chum redds were counted with 6 live coho, 3 coho carcasses, and 2 coho redds. 1n 2000-01, the chum population dropped to 9 live chum, 4 chum carcasses, and no chum redds, though the coho population increased to 44 live coho, 7 coho carcasses, and 3 coho carcasses. In 2001-02 40 live chum, 26 chum carcasses, and 10 chum redds were observed with three live coho. During the winter of 2002-03 the number of chum remained relatively the same with 16 live chum and 42 chum carcasses observed. The coho population decreased to four live coho and 15 coho carcasses. Also, for the first time since SFEG has conducted spawning surveys, two chinook carcasses were recorded on Colony Creek, which is historically a chinook stream. The winter of 2003-04 closely resembled the return of the previous year with a total of 24 live chum, 19 chum carcasses, and 11 chum redds being recorded. 15 live coho, 16 coho carcasses, and 3 coho redds were also observed. Similar chum counts came in 2004-05 with 31 live, 13 carcasses, and six redds, however, the coho numbers were down to three live, and eight coho redds. No spawning surveys were conducted during the 2005-06 season.

Vegetation - This project site was brand new and completely bare in the summer of 1999 when Colony Creek was diverted from a straightened ditch into its historical 2,555-foot meandering channel through floodplain wetland habitat. Plantings were installed along 5,110 linear feet of low gradient stream and consisted of 3,310 native trees and shrubs that help to create a buffer width of over a hundred feet on each side of the stream. From the data collected and field observations it has been concluded that the site is dominated by reed canary grass. Because of this there has been some vole damage to the native stock. Most of the trees and shrubs planted on this site have been struggling to survive, with the exception of the willow and red osier dogwood cuttings, which are very healthy and doing well. Also, at the upper end of the project site there has been a large recruitment of alders where the soil was pulled back and exposed during construction. The alders, along with the willows and dogwoods, will be providing the most immediate shade on the stream. In 2000, one year after project completion, canopy closure over Colony Creek was 3%. In 2001, closure increased to 4%.

COLONY CREEK - Coplen property

This portion of the project (Section 27, Township 36N, Range 3E) is located 0.5 miles upstream of the re-channel project. In 1997, Colony Creek threatened Colony Road with a

big scour hole where the creek was forced to take a 90-degree turn. Several structures were placed within this turn to help stabilize the bank and six deflector logs were placed downstream to create a meandering pattern within the stream channel. Overall, 285 feet (87 m) of stream channel was restored and planted. Fish utilization remains the same as mentioned above concerning Colony Creek, except that chum salmon do not usually spawn upstream of the 90 degree turn.

Structure Monitoring - From 1998 through 2001, instream structures have maintained a 0% failure rate with 73% of all LWD material creating pools. Although there is still a 0% failure rate, the structures in 2002 were creating pools 50% of the time. In 1998, the average sized pool was 4.84 meters long and 0.37 meters deep, decreasing in 1999 to 3.20 meters long and 0.28 meters deep. In 2000, average pool size increased to a length of 5.38 meters, a width of 3.98 meters, and an average depth to 0.40 meters. The pool size continued to increase in 2002 with an average surface area of 21.06 meters, and an average pool depth of 0.45 meters. In 2004, 25% of the structures maintained a total of 2 pools with an average surface area of 14.58 square meters and an average depth of 0.65 meters. Colony Creek (Copeland's) structure ratings are listed in Table 20.

Table 20. Colony Creek (Coplen's) Structure Ratings

Year	Excellent	Good	Fair	Poor
1998	71%	29%	0%	0%
1999	71%	29%	0%	0%
2000	42%	42%	14%	0%
2002	50%	50%	0%	0%
2004	25%	50%	25%	0%

Reference Point and Spawning Habitat Availability

Table 21. SHA and reference point survey data for Colony Creek (Coplen's).

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)	78	62	66	82	57	49	50	
Bankfull Depth (m)		0.81	0.81	0.82	0.67	0.8	0.63	
Bankfull Width (m)	4	3.77	3.78	2.68	3.58	3.4	3.2	
Canopy Closure (%)		66	80	87	85	92	99	
Wetted Width (m)	3.13	3.16	2.38	2.15	2.6	1.8	2.6	

Spawning Surveys- see Colony Creek.

HARRISON CREEK - Macken, Thelen, Wrucha, and McMurchie Properties

Harrison Creek drains into Colony Creek at river mile 0.9. The restoration project is located in Sections 22 and 27, Township 36N, Range 3E. This project involved rechanneling and restoring 7,300 feet (2223 m) of Harrison Creek during the 1997 and 1998 summer seasons. Project work included the following: placement of spawning gravel in the upper portion of the project within suitable gradient; installation of 71 LWD structures throughout the project area to establish cover, shade, and protection for salmonids; and revegetation of 9,600 feet (2923 m) along the stream with 1,177 trees and shrubs ranging from 25 to 100 feet (8 m –30 m)

back from both banks. Chum and coho salmon are the main users of Harrison Creek, although steelhead and cutthroat are both known to inhabit the system in the spring.

Structure Monitoring - In 1998, one year after project completion, 97% of all LWD structures had developed a total of 56 pools. The average pool size was 3.87 meters long and 0.76 meters deep, except for a stretch on Wrucha's property where the pool measured 42.4 meters long and 0.62 meters deep. In 1999, 71% of the LWD structures maintained 48 pools. The average pool length was 3.96 meters with depth decreasing to 0.48 meters. The large pool on Wrucha's property remained exactly the same as in 1998. In 2000, three years after the project, 90% of the structures had developed pools, though the form and pattern of these pools changed. Instead of many pools, there were 12 individual pools and three large continuous pools. Average pool size increased in surface area (5.31 meters long and 1.98 meters wide) with a concurrent decrease in average depth to 0.26 meters. Pool formation changes appear to result from silt entering the project site. The large pool on Wrucha's property also became shallower with an average depth of 0.42 meters (a decrease of 0.20 meters). Large continuous pools were also found on both Thelen's and McMurchie's property. The large pool on Thelen's property was 108.64 meters long, 2.69 meters wide and 0.53 meters deep. The large pool on McMurchie's property was 75.56 meters long, 5.38 meters wide and 0.74 meters deep. In 2002, five years after the project, 86% of the structures continue to aid in pool development. However, only eight individual pools remain before the continuous pools began, and only two of the continuous pools remain. Thelen's pool has remained the same, while the Wrucha and McMurchie pools have combined due in large part to the beaver dams downstream on Colony Creek. The average surface area of the eight individual pools is 14.87 square meters, with the average pool depth being 0.44 meters. The average depth of the Thelen pool has increased to 0.70 meters, and the average depth of the Wrucha-McMurchie pool has increased to 1.01 meters. In 2004, SFEG was not able to conduct structure monitoring on Harrison Creek due to insufficient flow. Table 22 provides structure ratings for Harrison Creek.

Table 22. Harrison Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1998	86%	12%	2%	0%
1999	87%	17%	1%	1%
2000	80%	11%	6%	3%
2002	54%	30%	9%	7%

Reference Point and Spawning Habitat Availability:

Table 23. SHA and reference point survey data for Harrison Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		13	5	14	8	10	8	
Bankfull Depth (m)		0.8	0.68	0.76	0.72	0.52	0.75	
Bankfull Width (m)		3.15	4.27	4.65	5.66	3.61	4.8	
Canopy Closure (%)		53	58	69	78	82	76	
Wetted Width (m)		0.79	3.01	3.35	3.68	1.12	4.2	

Spawning Surveys - In 1998-99, the year after project completion, 90 live chum, 197 chum carcasses, and 3 chum redds were counted in Harrison Creek, as well as 14 coho carcasses. The numbers changed in both 1999-00 with 7 live chum, 5 live coho, 5 coho carcasses, and 4 coho redds recorded, and in 2000-01 with only 10 live coho recorded. The numbers continued to decrease in 2001-02 with only five live coho and three coho redds being recorded, and have eventually been depleted in 2002-03 when nothing was observed. During the winters of 2003-04 and 2004-05 only one chum carcasses was recorded in each season. The number of chum utilizing the Harrison Creek system has greatly declined over the last seven years. No spawning surveys were conducted during the 2005-06 season.

Vegetation - Revegetation occurred along 9,600 feet of stream. Trees and shrubs totaling 1,177 were established from 25 to 100 feet back from both banks with the help of volunteers. During construction 136 planting mounds were created to provide an upland area for the trees and shrubs to be planted. Materials planted on the mounds are having great success, and most of the trees and shrubs (with the exception of willows) that were planted off of the mounds are struggling. They have to compete with the thick reed canary grass and extremely wet conditions. Because of this there has been a high mortality, especially with the western red cedar where over 50% of them have died. Reed canary grass may continue to be a problem, but that is quickly changing due to the planting mounds and the success those plants have had. Among the most persistent and most healthy of these are willows, alder, cottonwood, Nootka rose, and Sitka spruce. Salmonberry has also done well with naturally recruited starts coming up in abundance. In 1999, there was 53% canopy closure over Harrison Creek, increasing to 58% in 2000 and to 69% in 2001. In three years, there has been a 16% increase in canopy closure shading the stream. This site is still in need of maintenance and monitoring.

WOOD CREEK - Wood Property

Wood Creek drains into Colony Creek at river mile 4.3. The project site is located in Section 24, Township 36N, Range 3E and was completed in 1999. Before 1999 a man-made earthen dam formed a pond and prevented fish access to 5,000 feet (1523 m) of upstream spawning habitat. Project work involved creating 230 feet (70 m) of new channel and placement of 17 instream structures including three rock weirs (which were replaced a year later with four log weirs) and four log weirs to provide fish access to the pond. Fencing was also installed along 3,300 feet (1005 m) to exclude livestock from both Wood Creek and Colony Creek. In 2000, 480 feet (146 m) of the surrounding riparian zone was planted with 447 native shrubs, as mature mixed forest already existed around the project site. Wood Creek is inhabited by coho, steelhead, and both resident and sea-run cutthroat trout.

Structure Monitoring - During the first year of project completion (1999), 74% of all instream structures created 11 pools. The average pool size was 3.6 meters long, 2.9 meters wide, and 0.41 meters deep. During the 2000 surveys, SFEG found one log weir and three rock weirs had failed and were causing channel scouring, bank erosion, sediment input, and partial fish blockages. In the summer of 2000, SFEG replaced the three rock weirs with four log weirs. After monitoring the structures throughout 2001, the log weirs that were used to replace the failing rock weirs were determined to be secure. During the 2001 survey, 80% of all instream structures had developed the same 11 pools noted in 1999. A large beaver dam at the outlet of the pond was also discovered and limited water flow through the project site. Water was still

present in the pools, but there was no water flowing over the weirs. The average pool size was 3.46 meters long, 2.64 meters wide, and 0.35 meters deep. In 2002, the large beaver dam at the outlet of the pond was 0.85 meters tall, and was blocking water flow almost completely. In 2002, one of the log weirs had failed and was completely washed out underneath, therefore, the total number of pools decreased to 10. Nine of these pools were maintained by instream structures and the beaver dam maintained one large continuous pool. The average surface area of the individual pools decreased to 6.33 square meters, but the average depth increased to 0.47 meters. The large continuous pool had a surface area of 70.20 square meters and an average depth of 0.64 meters. In 2004, the total number of pools remained at 10. The average surface area increased to 10.23 square meters and the depth also increased to 0.70 meters. The surface area of the large continuous pool decreased in surface area to 63.75 square meters, but increased average depth to 0.83 meters. Structures ratings are provided in Table 24.

Table 24. Wood Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	47%	18%	12%	24%
2001	67%	33%	0%	0%
2002	67%	22%	6%	6%
2004	56%	22%	11%	11%

Reference Point and Spawning Habitat Availability Surveys:

Table 25. SHA and reference point survey data for Wood Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		69	44	41	23	6*	22	
Bankfull Depth (m)		0.5	0.57	0.52	0.24	0.38	0.35	
Bankfull Width (m)		3.58	4.14	3.36	2.88	3.23	3.7	
Canopy Closure (%)		37	38	37	38	44	49	
Wetted Width (m)		0.4	2.77	1.24	1.62	1.23	2.6	

* Decrease in spawnable gravel due to high flows which downcut and scour the streambed.

Spawning Surveys - Two live coho were observed the winter following project completion (1999-00). During the winter of 2000-01 no fish were recorded. The next winter (2001-02) 25 live coho and three coho redds were recorded on the project site. However, in 2002-03 no fish were observed at the site. The winter of 2003-04 saw five live coho and 2 coho redds in Wood Creek. However, again, no fish were observed in 2004-05 or in 2005-06.

Vegetation - In 2000, 480 feet of the surrounding riparian zone was planted with 447 native shrubs, as mature mixed forest already existed around the project site. No trees were planted at this site. Instead native shrubs were dispersed around the site to provide ground cover and understory. These plants are small, but they are extremely healthy and have done a great job of blending into the existing vegetation. Mock orange and crab apple are the best performing species at this site, which requires no maintenance. Between 1999 and 2001, canopy closure over Wood Creek was similar. In 1999, canopy cover was 37%, increasing slightly to 38% in 2000 and to 37% in 2001. This site is not crucial to continue monitoring, but it might be interesting to analyze considering it was planted predominately by shrubs.

WEST FORK OF COLONY CREEK – Trillium Corporation Property

The West Fork of Colony Creek is one of three tributaries to Colony Creek. The project site is located in Section 14, Township 36N, and Range 3E, and was completed in 2001 in conjunction with the Trillium Corporation. A three-foot diameter fish barrier culvert was replaced with a fish-passable six-foot diameter culvert. The culvert opened up 3000 feet (914 m) of spawning habitat. Native shrubs were also planted around the disturbed area.

In March of 2003, there was a debris torrent that came cascading down upper West Fork Colony Creek as a result of a broken beaver dam. The ensuing rush of water, rocks and trees has re-scoured the entire channel and filled the old channel with massive amounts of rocks, boulders and cobbles.

The culvert at the project site has been severely damaged as the entire road has washed out.

Structure Monitoring - Structure data could not be collected due to the stream being dry in 2003. In 2004, with stream flow, measurements were taken. No pools existed, there was headwall cutting along the damaged culvert, and the structure was making it difficult for fish to move upstream. The stream was dry again in 2005, so no data was collected. Structure Ratings are provided in Table 26.

Table 26. West Fork Colony Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2004	0%	0%	0%	100%

Reference Point and Spawning Habitat Availability Surveys:

Table 27. SHA and reference point survey data for Wood Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)					83	60	57	
Bankfull Depth (m)					0.38	0.6	0.51	
Bankfull Width (m)					2.65	11.7	12.2	
Canopy Closure (%)					100	78	78	
Wetted Width (m)					0.71	0	0.35	

Spawning Surveys - During the winter of 2001-02 five live coho, 17 coho carcasses, and 12 coho redds were all observed downstream of the new culvert. This is due to a large beaver dam downstream of the culvert. SFEG has not observed any fish activity above this particular beaver dam. Another man-made dam exist further downstream, and is passable at high flows. However, the winter of 2002-03 was void of those required high flows, which resulted in not observing any fish of any kind above the man-made dam. The blow out of 2003 resulted in this man-made dam being completely eliminated. However, only three live coho were observed in 2003-04, and no fish of any kind were recorded in 2004-05. No spawning surveys were conducted during the 2005-06 season.

SKAGIT RIVER WATERSHED

Hansen Watershed

SHOESHEL CREEK – Sloniker Property

Shoeshel Creek is a tributary to Brickyard Creek, and enters Brickyard Creek at river mile 2.7. An existing culvert acting as a fish barrier under Shoeshel Drive was replaced with a 12 foot aluminum round pipe. This project opened up 2000 ft (609 m) of upstream salmon spawning habitat. Approximately 250 native trees and shrubs were planted. The project site is located in Section 13, Township 35N, and Range 04E. Shoeshel Creek contains coho salmon, and cutthroat trout.

Structure Monitoring - In 2003 a 70 foot wide, 12 foot diameter aluminum round pipe was put in to replace the 80 foot wide, 2 foot diameter concrete smokestack. In 2004 and again in 2005, the culvert remained in good condition. Structure Ratings are provided in Table 28.

Table 28. Shoeshel Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2004	0%	100%	0%	0%
2005	0%	100%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 29. SHA and reference point survey data for Shoeshel Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)					57	63	58	73
Bankfull Depth (m)					0.52	0.37	0.44	0.43
Bankfull Width (m)					4.57	3.9	3.8	4
Canopy Closure (%)					97	99	97	97
Wetted Width (m)					1.51	1.4	2.5	0.9

Spawning Surveys - During the winter of 2001-02, 59 live coho, 42 coho carcasses, and 41 coho redds were recorded (all below the Shoeshel Drive culvert). The next winter (2002-03), no fish or redds were observed in Shoeshel Creek. In 2003-04 three live coho, nine coho carcasses, five coho redds, and one cutthroat redd were recorded. During the winter of 2004-05 fish were observed above the new culvert for the first time with a total of 25 live coho, 13 coho carcasses, and five coho redds. One live cutthroat was also observed above the pipe. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

BRICKYARD CREEK - Sauk Mountain View Golf Course

Brickyard Creek flows into the Skagit River just southwest of Sedro-Woolley near river mile 19.6. The Brickyard Creek drainage has been significantly modified. Currently, Brickyard Creek flows into Hart Slough and into the Skagit River. Historically it flowed west into Thomas Creek and into the Samish River. The project site occurs along the south side of the Sauk Mountain View Golf Course along McGargile Road (Section 18, Township 35N, and Range 5E). Before 1999, Brickyard Creek flowed along a McGargile Road ditch.

Implementation

The project was completed in the summer of 1999 and involved rechanneling the creek into 1,636 feet (498 m) of meandering stream. Nineteen pieces of LWD and 30 cubic yards of spawning gravel were placed in the channel to provide habitat for salmon fry and returning adults. Native trees and shrubs (628) were also planted along 3,000 feet (91 m) of stream bank. Brickyard Creek contains coho salmon and cutthroat trout.

Structure Monitoring – In year 2000, one year after project completion, 25% of fixed structures created five pools, including the in-channel pond excavated at the time of construction. By 2001, only 17% of the structures were aiding in the formation of two pools (one other pool besides the pond). Some of the previous pools from 1999 had filled in with enough sediment to not be classified as pools any longer. In 2002, 21% of the fixed structures were now creating three pools (two others besides the pond). The average surface area of the two smaller pools was 4.11 square meters, and 0.52 meters deep. The in-channel pond measured 88.04 square meters in surface area, and was 1.25 meters deep. There have been no structure failures in Brickyard Creek. In 2004, 5% of the structures maintained one large pool with a surface area of 126.0 square meters and an average depth of 1.0 meters. Structure ratings are shown in Table 30.

Table 30. Brickyard Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	37%	58%	5%	0%
2001	21%	79%	0%	0%
2002	21%	79%	0%	0%
2004	0%	100%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 31. SHA and reference point survey data for Brickyard Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		24	11**	15	9	12	8	
Bankfull Depth (m)		0.45	0.48	0.54	0.46	0.49	0.63	
Bankfull Width (m)		3.49	3.25	3.51	2.53	3.37	4	
Canopy Closure (%)		0.2	6	3*	7	25	36	
Wetted Width (m)		1.79	2.1	2.55	2.18	1.88	3.4	

* Decrease in canopy closure due to high mortality of new plants.

** Decrease in spawnable gravel due to the deposition of fine sediments downstream into the project area.

Spawning Surveys - Salmon utilization of Brickyard Creek has improved. The winter before the instream project was initiated (1998-99), two coho carcasses were found upstream of the project site. The winter after project completion (1999-00), there were no adults observed, though coho fry were present in the spring. In 2000-01, two years after project completion, 4 live coho, 9 coho carcasses, and 14 coho redds were recorded. All of the redds in 2000-01 were mapped with a GPS unit, with 29% being located within three meters of a fixed structure. Every redd found in Brickyard Creek was within the project site. Three years after project completion (2001-02) 15 live coho, six coho carcasses, and 34 coho redds were

recorded. In 2002-03, only seven coho redds were recorded. Coho numbers increased again in 2003-04 when six live, 17 carcasses, and five redds were observed. During the winter of 2004-05 only two live coho, one coho carcass, and four coho redds were recorded. For a system with virtually no accessible spawning grounds and void of any natural LWD, this project shows signs of success. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

Vegetation-
Notes taken from the 1999 Access data base provided the following impressions.

Native trees and shrubs (628) were planted along 3,000 feet of stream bank. There have been supplemental plantings since 1999 by volunteers. This site seems to be doing well, but because of the lack of steady maintenance there has been some vole damage. Vandalism and garbage are a problem.

Willow and red-osier dogwood cuttings inserted along the stream have sprouted with multiple stems. The Sitka spruce has shown the greatest signs of life, health, and persistence.

In 1999, at project completion, there was less than one percent canopy closure over the stream (one large willow tree). By 2000, canopy closure increased to 6%, but decreased to 3% in 2001. This is due to plant mortality from some of the newer stock that was planted in spring 2001.

Plant maintenance and monitoring should continue on this site. There is some natural recruitment of cottonwood, and they will more than likely provide the fastest shade for the stream.

Vegetation monitoring was also conducted in 2003 using revised protocol. Sampling plots were layed out along transects oriented along the stream (Appendix B: Vegetation Plot Selection). Data is stored in a new Access database. Brickyard Creek is Site 2. Project Form indicates 28.3 % of site was sampled using 20 12' diameter plots. Total site area is estimated at 3, 2000 square. Site Maintenance Form indicates invasives include reed canary grass and Himalayan blackberry

Plant data table indicates a percent survival of 85.5 % (not including stressed plants). Total number of plants inventoried was 1,960. Of those, 1677 were healthy, 141 stressed, and 142 dead. Overall health is good.

CHILDS CREEK - Hamerski and Garver Properties

Childs Creek is located in the eastern portion of the Hansen Creek WAU (Section 7, Township 35N, Range 6E) just west of the town of Lyman. It flows through Minkler Lake before discharging into the Skagit River at river mile 32 near the east end of Utopia Road.

Childs Creek experienced a debris flow in 1983 that affected the channel. Large amounts of logs and fill slid into that channel and completely blocked off a tributary to Childs Creek for a short period of time. This flow sent a cascading wall of logs, boulders, gravel, and water into

the flats below. The stream channel was no longer defined, and the landowner (who had lost his house under the debris flow) rerouted the stream into an excavated channel.

Historically, the stream contained coho, pink, chum, and some steelhead. Between the time of the slide in 1983 and the project in 1996 only two steelhead were observed in the stream, and no salmon were seen. Before the 1996 project, the stream lacked habitat complexity and was characterized by a continuous riffle. The existing riparian zone consisted mostly of mature alder.

The project involved installation of 43 instream structures in a 1,058-foot (322 m) stream section north of Highway 20. The riparian zone along the stream was planted with native trees (mostly conifers) along 2,116 feet (645 m) of both banks. In 2001, an additional 2,200-foot (670 m) CREP riparian restoration project was initiated downstream of the 1996 project. The 2001 project included planting 1,030 native trees and shrubs by volunteers.

The stream restoration site is now characterized by pool/riffle habitat. Instream structures (LWD) provide habitat and bank protection and create much-needed spawning habitat through the sorting of gravel from fine sediment.

In the summer of 2005, SFEG completed a similar project downstream of Highway 20 on the Garver's property. Approximately 30 logs were installed and anchored in the stream to promote development of pool habitat for juvenile rearing and to sort gravel for enhancement of spawning grounds.

Structure Monitoring - In 1998, two years after project completion, 76% of the installed LWD functioned to create 30 pools. Pool size averaged 4.18 meters long and 0.34 meters deep. In 2000, 72% of the structures maintained pools, and the total number of pools increased to 35. The average pool size remained similar with a length of 4.14 meters and depth of 0.39 meters. Within five years (1997-2002), no instream structures failed, yet there were far fewer pools than in 1998 due to infilling of structures with stream substrate. Only 12 pools remained in 2000 and only 28% of the LWD material placed in 1996 was still creating pools. The average pool became larger in surface area (5.6 meters long by 2.85 meters wide), but shallower in depth (0.30 meters). By 2002, the total number of pools had decreased to 10, and only 21% of the LWD material was maintaining those pools. However, the average pool size has increased to 16.05 square meters in surface area, and 0.48 meters deep. In 2004, the total number of pools increased to 11 with 25% of the structures maintaining pools. The average surface area and depth remained nearly the same at 15.93 square meters and 0.45 meters, respectively. Structure ratings for Childs Creek are shown in Table 32.

Table 32. Childs Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1998	76%	12%	12%	0%
1999	58%	30%	12%	0%
2000	26%	42%	33%	0%
2002	21%	67%	12%	0%
2004	26%	54%	21%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 33. SHA and reference point survey data for Childs Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)	69	51	70	61	49	80	71	69
Bankfull Depth (m)	0.84	0.73	0.56	0.44	0.47	0.45	0.51	0.36
Bankfull Width (m)	5.18	5.3	5.27	4.35	4.04	4	4.7	4.5
Canopy Closure (%)		66	78	85	88	93	96	93
Wetted Width (m)	2.91	2.67	3.33	2.27	2.26	2	2.7	3.3

Spawning Surveys - In 1997 the landowner observed no salmon, which was the year following project completion. The 1998 SFEG survey recorded seven live coho, two coho carcasses, and three coho redds on the project site. These were the first coho salmon that had been observed in Childs Creek since 1983. In 1999-00, no fish were observed again. However, four years after the completion of the instream work, in 2000-01, 153 live coho, 15 coho carcasses, and 69 coho redds were recorded. Four live steelhead, 16 steelhead redds, eight live rainbow trout, 5 sea-run cutthroat, and 4 cutthroat redds were also observed in 2000-01. Fish numbers continued to increase during the winter of 2001-02 with 288 live coho, seven coho carcasses, and 71 coho redds being recorded. Two live cutthroat and two live rainbow trout were also observed in 2001-02. In 2002-03 only eight live coho were recorded. That changed again in 2003-04 when 308 live coho, 21 coho carcasses, and 57 coho redds were recorded. And, the coho return continued to be up in 2004-05 with a return of 270 live coho, 37 carcasses, and 92 coho redds. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

Childs Creek was mapped using GPS in 2001. This mapping was used to analyze the location of redds and their placement of in relation to structures. In Childs Creek, 13 redds were recorded downstream of the project site along Highway 20, over a length of 400 feet. None were associated with LWD, and most of these redds were created along the edge of the stream under overhanging blackberries. Throughout the 1,100 foot restoration site, 24 redds were directly related (within three meters) to the fixed LWD structures placed in the stream channel. Four redds were related to natural LWD, and 10 redds were not related to any structures. Eighteen redds were also recorded above the project site (700 feet); ten were directly related to LWD. In summary, of the combined 1,100 feet surveyed above and below the project site, SFEG found 31 redds (45% of the total), with ten of those redds or 32% (all above the restoration site) directly related to LWD. Of the 38 redds (55% of the total) observed on the 1,100 foot project site, 28 or 74% were directly related to LWD.

Vegetation - An existing riparian zone consisted primarily of mature alder. This thin riparian zone along the stream was planted with native trees (mostly conifers) along 2,116 feet of both banks. In 1999, three years after project completion, there was 66% canopy closure over the stream, increasing to 78% in 2000, and 85% in 2001. From 1999 to 2001 there was a canopy closure increase of 19%. In 2001, an additional 2,200-foot CREP riparian restoration project was initiated downstream of the 1996 project. The 2001 project included planting 1,030 native trees and shrubs by volunteers. According to our records many of the conifers did not do so well. Many were reported as dried out, stressed, or dead, and the trees that did survive

have been slow growing. However, the willow and dogwood cuttings that were heavily planted are doing well.

HANSEN CREEK - Skagit County Parks and Recreation

Draining from the steep foothills of Lyman Hill, Hansen Creek flows into the Skagit River east of Sedro Woolley at river mile 24. Hansen Creek is noted for its sediment load, erosive flows, and alluvial fan characteristics.

Completed in the summer of 1996, the restoration project implemented bank stabilization projects on two sections of Hansen Creek on Skagit County property at the Northern State Recreation Area (Section 7, Township 35N, and Range 5E). A total of 30 complex structures were placed within the two segments of the project site. The upper project involved stabilizing 420 feet (128 m) of stream bank, planting 2,500 feet (762 m) of riparian zone, and building 6,000 feet (1827 m) of fence to keep livestock out of the stream. The lower restoration site involved stabilizing 450 feet (137 m) of stream bank, planting 1,000 feet (304 m) of riparian zone, and building 2,000 feet (610 m) of fence.

Historically, Hansen Creek had runs of coho, pink, chinook, chum, cutthroat and steelhead. All of these species are still seen today. Hansen Creek is a WDFW Index Stream for steelhead.

Structure Monitoring - Bank stabilizing LWD structures were installed in 1996. Structure monitoring began in 1998. In 1998, 66% of LWD structures functioned to create 14 individual pools. Pools averaged 8 meters long, 3.06 meters wide, and 0.45 meters deep. In 1999, 12 pools formed at 62% of the structures. Average pool size increased to 10.77 meters long by 3.04 meters wide, and 0.48 meters deep. After four years (2000), 3% of structures rated poor due to more material moving into the project site, and a rock barb collapsing. Due to the large transport of gravel into the project site, the amount of pools developed by LWD decreased to 48%. In 2000, instream structures maintained 11 pools, which are staying consistent in size (10.5 meters long, 3.38 meters wide, and 0.45 meters deep). In 2002, six years after the project, only 39% of the LWD structures are maintaining seven pools. These pools average 28.67 square meters in surface area, and have increased in average pool depth averaging 0.60 meters. However, the primary purpose of the 1996 project was to stabilize banks, which is still being fulfilled. In 2004, the total number of pools increased to 10 with 32% of the LWD structures maintaining pools. The average surface of these pools decreased in to 19.04 square meters and the average depth decreased to 0.51 meters. Structure ratings for Hansen Creek are contained in Table 34.

Table 34. Hansen Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1998	53%	37%	10%	0%
1999	73%	23%	3%	0%
2000	43%	40%	13%	3%
2002	35%	39%	23%	3%
2004	0%	80%	20%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 35. SHA and reference point survey data for Hansen Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)	77	53	80	71	72	77	74	46
Bankfull Depth (m)	1.13	0.95	0.94	0.97	0.76	0.92	1.57*	0.67
Bankfull Width (m)	9.35	11.6	7.99	8.1	7.68	8.1	7.8	8.1
Canopy Closure (%)		37	26*	52	52	71	74	86
Wetted Width (m)	4.36	4.34	4.68	4.6	4.95	4.8	4.5	5.5

* Decrease of canopy closure due removal of blackberry patch.

* The average bankfull depth increased because a portion of Hansen Creek was dredged prior to data collection in 2004.

Spawning Surveys - In 1998-99 surveys; two live chum and one chum redd were recorded, along with 46 live coho, 37 coho carcasses and 48 coho redds. 1999-00 surveys counted; 46 live coho, only 21 coho carcasses and 25 redds, possibly affected by the 468 live pink salmon, 137 pink carcasses, and 238 pink redds also present. In 2000-01, four years after instream project completion, surveys recorded; 29 live chinook, 13 chinook carcasses, and 19 chinook redds (recorded for the first time), along with 195 live coho, 118 coho carcasses, and 166 coho redds. One live steelhead, 14 steelhead redds, and four sea-run cutthroat redds were also observed in the spring of 2001. In 2001-02 Hansen Creek had 1,831 live pink, 265 pink carcasses, and 407 pink redds observed, along with 118 live coho, 93 coho carcasses, and 73 coho redds. Three live chum, 8 chum carcasses, and 1 chum redd, along with 4 chinook carcasses were also recorded in 2001-02. During the winter of 2002-03 the highest number of coho and chum returning to Hansen Creek were recorded by SFEG, while there was no sign of chinook. A total of 309 live coho, 120 coho carcasses, and 139 coho redds were observed, along with 24 live chum, 16 chum carcasses, and 27 chum redds. Also in 2002-03, 14 live cutthroat trout, and one cutthroat carcass were recorded. In 2003-04 surveys recorded; one live chinook. During the winter of 2004-05 Hansen Creek had a good chinook return (11 live, two carcasses, and nine redds), coho return (170 live, 96 coho carcasses, and 105 redds), but no chum return. Three live cutthroat, two cutthroat carcasses, and one live rainbow trout were also observed in 2004-05. During the winter of 2005-06, Hansen Creek had a relatively low return for all species: Chinook (2 live, 0 Carcasses, 1 redd), Chum (5 live, 2 carcasses, 0 redds), Coho (28 live, 22 carcasses, 28 redds), and Pink (243 live, 39 carcasses, and 114 redds).

Hansen Creek and the location of the redds in the creek were mapped in 2001 using GPS. The total length of Hansen Creek surveyed for adult salmonids is 2,134 meters. The two project sites combine for a total of 265 meters, which is only 12% of the total length of stream surveyed. In Hansen Creek 134 coho redds were mapped by GPS, 45 of these being within three meters of a structure. Nine chinook redds were also mapped, only one within three meters of a LWD structure. Overall, 132 (90%) of the redds recorded were found off the project sites. Of those redds only 24% were related to natural LWD. A total of 15 redds (10% of the total) were counted on our project sites, and 14 (93%) of those were directly related to our fixed LWD structures. The chinook habitat was generally located between the cattle crossing and the sediment retention pond. The steelhead redds were generally located between the cattle crossing and the Lower Hansen Creek instream project.

Vegetation - The upper project included planting 2,500 feet of riparian zone, and the lower project included planting 1,000 feet of riparian zone. Both sites have had surprising success despite adverse conditions. On numerous occasions livestock broke through fences or wandered from adjoining properties to eat, trample, and defecate on the trees and shrubs. We have had about a 50% survival on these two sites, but the vegetation that has survived has thrived and is doing extremely well. The riparian area is filling up quickly, and there is a good conifer/deciduous mixture. The alders seem to be doing the best, and growing the fastest, along with the hundreds of willows that were planted along the stream bank for stabilization and immediate shade. There has been some blackberry intrusion, but the maintenance has kept them down. In 1999, three years after project completion, canopy closure over the stream was 37%, decreasing to 25% in 2000. This decrease resulted from the removal of a large blackberry patch from along the stream bank. Due to optimum growing conditions, canopy closure subsequently increased dramatically to 52% in 2001. Both sites are well established and doing well.

JONES CREEK - Price, Levy, Trueman and Goodpastor Properties

Jones Creek drains into the Skagit River at river mile 35 just east of Lyman. The restoration project is located in Sections 8, 9 and 17, Township 35N, Range 6E. Jones Creek originates from a large drainage and is generally characterized by a large sediment load and alluvial fan characteristics. The stream channel is constantly meandering and changing direction, especially where it enters the Skagit River. Jones Creek contains chinook, chum, pink, coho, steelhead, sea-run cutthroat, and residential cutthroat. It is a very productive stream, and has been a WDFW Index stream for 30 years.

In 1996, 2,818 feet (859 m) of stream was enhanced by strategically placing 37 large and complex structures to prevent bank erosion, bank undercutting, and to help channel development and stability in a very unstable system. Stream banks were planted with native trees and shrubs along 3,890 feet (1186 m)within an existing riparian zone of patchy mature growth and open eroded banks caused by flooding.

Structure Monitoring - Jones Creek had a structure failure rate of 3% in 1998, with one bank stabilization structure failing as a result of the stream eroding the bank directly behind it. In 1998, 73% of the LWD functioned to create 21 pools. The average pool dimension was 12.1 meters long by 0.60 meters deep. In 1999, 84% of the LWD structures maintained 29 pools. The average pool became slightly bigger with a length of 12.5 meters and depth of 0.70 meters. In the year 2000, only 64% of the structures were still forming 15 pools. Although larger in surface area (20.2 meters long by 5.24 meters wide), the pools stayed relatively the same depth (0.71 meters). In 2002, only 46% of the structures were still developing pools, but the total number of pools increased to 17. However, the size of the pools decreased with an average surface area of 72.3 square meters, and an average pool depth of 0.55 meters. In 2004, the total number of pools decreased to 15 pools with 40% of the structures maintaining pools. The average surface area decreased to 46.00 square meters but the average depth increased to 0.63 meters. Two structures relocated downstream. Jones Creek structure ratings are listed in Table 36.

Table 36. Jones Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1998	62%	30%	5%	3%
1999	68%	27%	0%	5%
2000	38%	22%	35%	5%
2002	43%	35%	19%	3%
2004	14%	56%	19%	11%

Reference Point and Spawning Habitat Availability Surveys:

Table 37. SHA and reference point survey data for Jones Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)	74	63	64	66	64		80	
Bankfull Depth (m)	1.3	0.85	1.17	1.05	0.88		1.1	
Bankfull Width (m)	10.91	11	11.81	12.45	11.56		10.3	
Canopy Closure (%)		61	57	64	68		62	
Wetted Width (m)	5.2	4.69	5.09	5.6	4.63		6.4	

Spawning Surveys - Jones Creek has a wide variety of salmonid use. No chinook were observed in 1998-99, perhaps because we started our surveys too late (mid-October). Surveys now begin early October. In 1999-00, five live chinook were recorded along with 12 chinook carcasses and two chinook redds. In 2000-01, no live chinook were observed, but 15 chinook carcasses and 7 chinook redds were recorded. In 2001-02, 10 live chinook, 13 chinook carcasses, and 2 chinook redds were observed. No chinook were observed during the winter of 2002-03. In 2003-04 only two chinook carcasses were recorded. More chinook were again recorded in 2004-05 with six live, three carcasses, and six redds. In 2005-06 SFEG observed nine live Chinook, 0 chinook carcasses, and 3 chinook redds.

In 1998-99, surveys reported 29 live chum, 13 chum carcasses, and six chum redds. In 1999-00 the run increased to 164 live chum, 58 chum carcasses, and 56 chum redds and then decreased in 2000-01 when only 3 chum carcasses and 11 chum redds were observed. In 2001-02, 351 live chum, 151 chum carcasses, and 60 chum redds were recorded. The chum run of 2002-03 was down from last year, but closely resembles the run of 1999-00. In 2002-03 a total of 125 live chum, 195 chum carcasses, and 55 chum redds were recorded. The chum run of 2003-04 saw 655 live, 273 carcasses, and 220 redds in Jones Creek. Another large return of chum came in 2004-05 when SFEG observed 516 live, 240 carcasses, and 173 redds. In 2005-06 SFEG observed 65 live chum, 47 chum carcasses, and 37 chum redds.

Coho salmon observed in 1998-99 include 118 live, 22 carcasses, and 35 redds The following year (1999-00) the survey reported 113 live, 17 carcasses, and 31 redds. In 2000-01 there was a dramatic increase in coho with 856 live, 238 carcasses, and 370 redds observed. The number of coho continued to increase in 2001-02 when 975 live, 108 carcasses, and 203 redds were recorded. The number of coho decreased slightly in 2002-03 when 621 live coho, 194 coho carcasses, and 280 coho redds were recorded. There was a huge return of coho in Jones Creek this year with 1,617 live, 187 carcasses, and 372 redds. Coho numbers also continue to be strong with 1,168 live coho returning in 2004-05 (also 117 carcasses and 389 redds). Coho numbers were down in 2005-06 with 268 live, 8 carcasses, and 105 redds.

As pink salmon return every other year they have only been observed twice in the past four years. In 1999-00 surveys reported 1,671 live, 1,571 carcasses, and 464 redds. Similar numbers were anticipated for 2001-02, and 2,775 live pink, 1088 pink carcasses, and 654 pink redds were counted and recorded. In 2003-04 a total of 1629 live pink, 807 pink carcasses, and 455 pink redds were observed. In 2005-06 pink returns were down with 647 live, 162 carcasses, and 238 redds.

In the spring of 2001, 16 steelhead redds, seven cutthroat redds, and four live cutthroat were also recorded. During the spring of 2002 one live steelhead, seven steelhead redds, eight live cutthroat, and one live rainbow trout were observed. In the winter of 2002-03 a record number of 54 live cutthroat and 5 cutthroat redds were recorded in Jones Creek. Two cutthroat and two cutthroat redds were counted in 2003-04, along with the first ever Atlantic salmon carcass (found near the mouth of Jones Creek). Steelhead were recorded again in 2004-05 with two live steelhead and steelhead redd observed. Five cutthroat , one cutthroat redd, one live rainbow trout, and for the second straight year an Atlantic salmon carcass were observed.

The lower section of Jones Creek was mapped in 2001 and due to poor satellite reception, the upper section of Jones Creek could not be mapped by the GPS. However, the entire restoration site and all major pools were mapped. Of all eleven chum redds mapped, observed below the Lyman Hamilton Road, only one related to a natural LWD structure. Two of the chum redds were destroyed in a high water event causing some channel migration at the mouth of Jones Creek. All seven chinook redds were located between Lyman Hamilton Road and Hwy 20. More chinook redds have been observed above our restoration site up in the canyon in years past, though none were recorded in 2001. One chinook redd was found within three meters of a fixed LWD structure. For coho, 224 of the 370 redds were mapped, with 92 redds found within three meters of a LWD structure and 87 redds located with three meters of pool. Due to time constraints, satellite reception, and undetermined goals some minor pools that were not mapped could be influential in redd distribution possibly relating to the instream structures.

RED CREEK - Alpine Way Landowner's Association

Red Creek is a tributary to Hansen Creek, entering at river mile 2.8. The project site is located in Section 8, Township 35N, Range 5E. This fish passage project was completed in the summer of 2000 and involved replacing a perched four-foot diameter culvert with a 30-foot (9 m) bridge to provide fish passage. The bridge opened up 3500 feet (1067 m) of spawning habitat. Coho are the dominant salmonid species in Red Creek. Chum salmon have been observed in the lower reach.

Structure Monitoring - none

Reference Point and Spawning Habitat Availability Surveys:

Table 38. SHA and reference point survey data for Red Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)				45	58	88	77	

Bankfull Depth (m)	0.34	0.28	0.24	0.32
Bankfull Width (m)	4.9	4.45	3.6	4.4
Canopy Closure (%)	71	71	72	76
Wetted Width (m)	1.87	1.7	1	2.8

Spawning Survey - Eleven live coho, 4 coho carcasses, and 4 coho redds were recorded during the winter of 2000-01. In 2001-02, 69 live coho, 32 coho carcasses, and 41 coho redds were recorded above and below the project site. By the winter of 2002-03 Red Creek had changed course, and was even further from channelization than it had previously been. This, in combination with the low water flows, resulted in no fish of any kind finding their way of Red Creek. This is the third year SFEG conducted a spawning survey on Red Creek. However, Skagit System Cooperative had surveyed this stream for salmonid use in the late 1980's and the early 1990's. In 1987, 19 coho carcasses and 15 coho redds were recorded. In 1989, 10 live coho, 3 coho carcasses and 10 coho redds were counted. In 1990, five coho redds were observed. No spawning surveys were conducted during the winter of 2003 or 2004 or 2005.

ALDER CREEK – Trillium Corporation Property

Alder Creek flows into the Skagit River at river mile 41.7 east of Hamilton. The restoration project, which included removing a culvert acting as a fish barrier and replacing it with a 90-foot (27 m) flat car bridge to allow fish passage, is located in Section 18, Township 35N, and Range 7E. The fish passage opened up 50,000 ft (15,244 m) or about 10 miles of healthy spawning habitat! This project was completed, in cooperation with the Trillium Corporation, in the fall of 2001. Rip Rap rock was placed, grass seed was planted, and straw was spread to help reinforce the banks. Alder Creek has salmonid returns of chinook, chum, coho, pink, steelhead, and cutthroat trout.

Spawning Surveys - In 2001-02, the winter after completion of the bridge, nine live chinook, three chinook carcasses, one chinook redd; 11 live chum, six chum carcasses, eight chum redds; 142 live coho, 52 coho carcasses, 31 coho redds; 2,915 live pinks, 1335 pink carcasses, 187 pink redds; eight live steelhead, one steelhead carcass, four steelhead redds; two live cutthroat, and one cutthroat carcass were recorded. In 2002-03 the numbers of chum and coho climbed, while the number of chinook fell. A total of 83 live chum, 37 chum carcasses, 21 chum redds; and 195 live coho, 47 coho carcasses, and 71 coho redds were observed. Meanwhile, only one chinook carcass, and one chinook redd were recorded. One live cutthroat and one cutthroat carcass were also observed in Alder Creek in 2002-03. During the winter of 2003-04 had an increase of every type of salmonid species. A total of 18 live chinook, eight chinook carcasses, nine chinook redds; 266 live chum, 66 chum carcasses, 99 chum redds; 525 live coho, 49 coho carcasses, 161 coho redds; 4825 live pink, 1327 pink carcasses, 1057 pink redds; three live cutthroat, one cutthroat redd; and one steelhead carcass were observed and recorded. Although seven live chinook, five chinook carcasses, and 15 chinook carcasses were recorded in 2004-05, the biggest surprise were the 654 live chum, 250 chum carcasses, and 164 chum redds that were observed. The coho numbers were down (60 live, 25 carcasses, and 33 redds) and the cutthroat totals were up (11 live). In 2005-06 SFEG observed 2 live chinook, 1 chinook carcass, 0 chinook redds. 32 live chum were recorded, 10 chum carcasses and 11 chum redds. Coho returns were way down with only 13 live coho

observed, 3 coho carcasses and 5 coho redds. 1861 live pink were observed along with 770 pink carcasses and 613 pink redds. 9 cutthroat were also observed on Alder Creek during the 2005-06 season.

Upper Skagit Watershed

LORENZEN CREEK – MacMahan Property

Lorenzan Creek flows into the Skagit River at river mile 52.8 just west of the town of Concrete. This restoration project is located in Section 9, Township 35N, and Range 8E. Completed in the summer of 2001, the project involved the removal of a human-made fish passage barrier (culvert), and the installation of a 20-foot long by 14-foot (4 m) wide Janicki bridge. The removal of the fish passage barrier opened up 5300 ft (1616 m) of spawning habitat. The disturbed soil was revegetated with native grass seed, and planted with 25 native trees and shrubs. Lorenzan Creek's salmonid use consist of coho, steelhead, and cutthroat trout.

Reference Point and Habitat Availability Surveys:

Table 39. SHA and reference point survey data for Lorenzan Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)					18	0	0	
Bankfull Depth (m)					0.3	0.41	0.8	
Bankfull Width (m)					2.13	1.9	2.2	
Canopy Closure (%)					91	90	77*	
Wetted Width (m)					1.33	0.57	1.5	

* Decrease in canopy closure due to tree limb removal.

Spawning Surveys - In 2000-01 no fish were observed in Lorenzen Creek. During the winter of 2001-02 seven live coho, seven coho carcasses, and 1 coho redd were recorded. One live steelhead was also observed in 2001-02. In 2002-03 two live coho, and one coho carcass was all that was recorded. In the winter of 2003-04 one live coho, three coho carcasses, and five coho redds were recorded. More fish were seen in Lorenzen Creek by SFEG in 2004-05 than any other year. A total of 43 live coho, 21 coho carcasses, and 12 coho redds were recorded. SFEG observed 8 live coho and 2 coho redds in Lorenzen Creek during the 2005-06 season.

MARBLEGATE SLOUGH - Marblegate Community

The Skagit River flows into Marblegate Slough at river mile 76.7 and then enters the Skagit River at river mile 76. The restoration project is located in Section 13, Township 35N, Range 12E. Completed in 2003, the project included removing culverts and road fill from the slough and replacing it with a 48-foot (14.6 m) rail road flat car bridge. This slough has historical native returns of the following salmonids: chinook, chum, coho, pink, and steelhead.

Reference Point and Habitat Availability Surveys:

Table 40. SHA and reference point survey data for Marblegate Slough.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)						86	42	
Bankfull Depth (m)						0.68	0.72	

Bankfull Width (m)	5.85	5.6
Canopy Closure (%)	99	99
Wetted Width (m)	2.3	2.4

Spawning Surveys - During the winter of 2003-04, the first winter after the project, 294 live chum, 225 chum carcasses, 107 chum redds; 127 live coho, 130 coho carcasses, 44 coho redds; 10 live pink, 38 pink carcasses, 21 pink redds; and one steelhead carcass. The fish return dropped in 2004-05 when only 26 live chum, 27 chum carcasses, and 26 chum redds were recorded. Only 30 live coho, 24 coho carcasses, and 31 coho redds were recorded as well. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

Nookachamps Watershed

G. C. CREEK - Gribble Property

G.C. Creek flows into the West Fork Nookachamps Creek at river mile 6.7 from the Eaglemont wetlands in southeast Mount Vernon. This restoration project is located in Sections 23 and 26, Township 34N, Range 4E. Completed in 1998, the project involved fencing 3,000 feet (915 m) of the stream with a 25 foot (8 m) set back to exclude landowner's livestock, and planting 6,000 feet (1829 m) of both banks with native trees and shrubs. Monitoring consists of Spawning Surveys. Coho are the main species of this tributary.

Spawning Surveys - In 1998-99, the winter after project completion, surveys counted 2 live coho, 7 coho carcasses, and 2 coho redds. In 1999-00, 7 live coho, 3 coho carcasses, and 2 coho redds were counted, and in 2000-01, 2 live coho, 3 coho carcasses, and 5 coho redds were recorded. The third winter after the fence was installed showed 59 live coho, 32 coho carcasses, and 21 coho redds. The winter of 2002-03 reclaimed the historical trend with 10 live coho, and eight coho carcasses. However, large numbers of coho showed up again in 2003-04 with 58 live, 24 carcasses, and 34 redds recorded. A huge number of coho (105 live, 96 carcasses, and 53 redds) were recorded in 2004-05. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

KENNEDY CREEK - Kennedy Property

Kennedy Creek flows into the East Fork Nookachamps at river mile 2. The project is located in Section 13, Township 34N, Range 4E. Completed in 1999, the project involved installing 12 log weir structures, providing fish access to a pond and upstream drainage. The pond provides excellent rearing for juveniles that migrate in from main stem Nookachamps Creek and the local juveniles that rear in Kennedy Creek. The weirs downstream of the culvert help provide fish access to 500 ft (152 m) of upstream spawning habitat. The project restored a total of 300 feet (91 m) of the stream, with 250 feet (76 m) being planted in native trees and shrubs around the pond and downstream with a 25-foot buffer zone. Along the buffer zone is an electric fence, running for 1,055 feet (322 m) along Kennedy Creek and the Nookachamps Creek. Kennedy Creek now provides major off-channel rearing habitat for coho salmon. Major utilization of the creek is by coho adults and fry. Cutthroat trout and steelhead are also present.

Structure Monitoring - In 2000, one year after project completion, 75% of instream structures were functioning to create pools. In 2001, 92% of the structures had developed pools. In 2002, 84% of the structures were still maintaining 10 pools. In 2000, the average size of a pool (2.96 meters long, 2.49 meters wide, and 0.42 meters deep), did not contrast markedly to the average size in 2001 (2.64 meters long, 2.86 meters wide, and 0.42 meters deep). The pools have stayed relatively stable through 2002 with an average surface area of 5.46 square meters, and an average depth of 0.39 meters. In 2004, 92% of structures maintained a total of 11 pools. The average surface area and depth increased to 5.97 square meters and 0.73 meters, respectively. Table 41 shows Kennedy Creek Structure Ratings..

Table 41. Kennedy Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2000	67%	33%	0%	0%
2001	92%	8%	0%	0%
2002	50%	33%	17%	0%
2004	92%	8%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 42. SHA and reference point survey data for Kennedy Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		62	57	44	29	35	54	
Bankfull Depth (m)		0.27	0.34	0.3	0.39	0.25	0.28	
Bankfull Width (m)		2.71	2.64	2.51	2.76	2.1	2.5	
Canopy Closure (%)		11	10	14	7	6	6	
Wetted Width (m)		1.34	1.59	1.74	1.97	2	1.7	

Spawning Surveys - In 1999-00, the winter following project completion, 5 live coho, 5 coho carcasses, and 3 coho redds were observed. A year later, in 2000-01, 5 live coho, 3 coho carcasses, and 3 coho redds were recorded. Kennedy Creek has remained fairly consistent, but in the last two years the number of coho has increased slightly when 13 live, 9 carcasses, and 3 redds were recorded in 2001-02, and 17 live, 4 carcasses, and 0 redds were recorded in 2002-03. Three live steelhead were also observed in Kennedy Creek for the first time in the spring of 2002. In the winter of 2003-04 Kennedy Creek saw record numbers of coho with 27 live, 9 carcasses, and 15 redds. These numbers remained strong through 2004-05 with 21 live coho, 8 coho carcasses, and 12 coho redds. During the 2005-06 spawning season no live fish, redds, or carcasses were observed in Kennedy Creek.

KLAHOWYA CREEK - Boy Scouts of America

Klahowya Creek flows into the East Fork of the Nookachamps at river mile 5.7. The project is located in the Fire Mountain Boy Scout Camp in Sections 29, 32, and 33, in Township 34N, Range 5E. This restoration project was completed in two phases (1998 and 2000). In 1998, a fish barrier culvert was replaced, which opened up 10,500 feet (3201 m) of upstream habitat for the first time in 9 years. Further upstream, 2,640 feet (805 m) of shallow riffle habitat stream was enhanced through installation of 66 instream structures that form pools and create habitat complexity. Revegetation occurred along 5,000 feet (1524 m) of riparian habitat. Approximately 1,025 trees and shrubs were planted on both banks. The existing canopy

consisted mostly of hardwoods, but since the existing vegetated riparian zone was narrow (10 to 20 feet wide), SFEG planted out to 66 feet (20 m) on both sides of the stream.

In 2000, another problematic culvert was replaced downstream of the 1998 project. In addition, a series of three fish barrier culverts were replaced immediately upstream of the 1998 project with a new bridge. Another 550 feet (168 m) of spawning habitat became accessible because of this project. Coho, cutthroat, and steelhead predominantly use Klahowya Creek.

Structure Monitoring - In 1999, one year after project completion, 91% of the LWD installed functioned to create a total of 58 pools. The average length and depth of these pools was 3.85 meters long and 0.23 meters deep. In 2000, only 48% of the structures were still maintaining 26 pools. The average size increased to 4.68 meters long, 2.1 meters wide, and 0.28 meters deep. In 2001, 61% of the LWD maintained 32 pools, with the average size (3.96 meters long, 2.1 meters wide, and 0.21 meters deep) closer to 1999 values. In 2003, only 41% of the instream structures were maintaining only 19 pools out of the original 58 pools that were formed due to LWD. The average pool size (4.1 meters long, 1.94 meters wide, and 0.29 meters deep) was closer to the pool measurements of 2000. By 2005 the number of pools had increased to 28 (47% of the structures aiding in development). Although the surface area has decreased approximately four square meters (5.77 square meters) over the last seven years, the average depth has increased to 0.30 meters. Table 43 provides Klahowya Creek Structure Ratings.

Table 43. Klahowya Creek Structure Ratings.

Year	Excellent	Good	Fair	Poor
1999	71%	27%	2%	0%
2000	33%	57%	10%	0%
2001	48%	50%	2%	0%
2003	33%	64%	3%	0%
2005	40%	60%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 44. SHA and reference point survey data for Klahowya Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		69	67	75	70	59	63	75
Bankfull Depth (m)		0.51	0.61	0.48	0.43	0.33	0.41	0.41
Bankfull Width (m)		3.47	3.47	3.24	3.14	2.8	3	3.1
Canopy Closure (%)		87	90	90	90	96	90	92
Wetted Width (m)		1.67	1.51	1.42	1.36	1.8	2.2	1.4

Spawning Surveys - During the winter of 1998-99, 36 live coho, 11 coho redds, and 1 live steelhead were observed. These were the first sightings the landowner had seen in eight years. In 1999-00, 18 live coho, 1 coho carcass, and 14 coho redds were counted. Due to low flow conditions in November and December of 2000, as well as log jams in the lower stream reaches, no coho redds were observed in the project site. However, three steelhead and two cutthroat redds were found in February of 2001. One redd of each species was located

directly downstream of a rock barb and upstream of a LWD structure associated pool. The location of other redds did not correlate to any mapped structures or pools. In 2001-02 there was a huge return of coho as 262 live, and 28 carcasses, and 28 coho redds were observed. No steelhead or cutthroat were recorded in 2001-02. The winters of 2002-03 and 2003-04 were exact replicas of the winter of 2000-01 when there were low flow conditions, log jams, and no sign of fish anywhere. 2004-05 was much of the same until one live coho showed up. During the 2005-06 season one 1 live coho, 1 coho carcass, and 1 cutthroat were observed in Klahowya Creek.

Vegetation - In 1998, revegetation occurred along 5,000 feet of riparian habitat. Approximately 1,025 trees and shrubs were planted on both banks. The existing canopy consisted mostly of hardwoods, but since the existing vegetated riparian zone was narrow (10 to 20 feet wide), SFEG planted out to 66 feet on both sides of the stream. The established alders and salmonberry have continued to do well, and have helped the newly planted understory vegetation, such as cedars, by providing shade. Rugosa rose and Nootka rose along with some patches of willow cuttings also perform well. Western hemlock struggles at this site and mortality is high. The canopy closure in 1999, one year after project completion, was 87%. In 2000, closure increased to 90%, stabilizing through 2001. Klahowya Creek has been well maintained, and is a very healthy site because of the maintenance. This site needs to have continued monitoring to track its success and species health.
There was also a CREP project that occurred on-site, which has resulted in additional plantings. SFEG has not monitored any of the CREP plantings.

Tributary to LAKE CREEK - King Property

This off-channel wetland flows into Lake Creek at river mile 14. This wetland offers off-channel habitat for coho fry and other salmonid species. The project is located in Section 19, Township 33N, Range 5E.

The restoration project was completed in the September of 2001 and involved installing a 20-foot culvert to create fish passage under the existing railroad grade. The project involved removing an 8-inch culvert and replacing it with a 4-foot by 20-foot squashed CMP to create fish passage under the existing railroad grade. This fish passage allowed fish to access 1000 feet (305 m) of habitat that was previously inaccessible.

Structure Monitoring - One year after project completion, the culvert was working well. A deep glide was passing through, but it wasn't quite a pool. The same observations were made in 2003 and 2004. The structure rating is provided in Table 45.

Table 45. Tributary to Lake Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
2002	0%	100%	0%	0%
2003	0%	100%	0%	0%
2004	0%	100%	0%	0%

Reference Point and Spawning Habitat Availability:
Table 46. SHA and reference point survey data for tributary to Lake Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)					12	0	13	0
Bankfull Depth (m)					0.37	0.35	0.46	0.36
Bankfull Width (m)					2.5	2.47	2.8	2.4
Canopy Closure (%)					90	98	97	89
Wetted Width (m)					0.6	0.58	1.5	0.6

Spawning Surveys - No live adults or fry have been observed in or around the culvert during the winters of 2001-02, 2003-03, or 2003-04. Although no adults were observed, coho fry were observed for the first time above the new culvert in 2004-05. 2 live coho were observed during the 2005-06 season.

LAKE CREEK tributary 0264 - King

This tributary flows into Lake Creek at river mile 13.5, and is located in Section 19, Township 33N, Range 5E. A three-foot (1 m) cement pipe was removed from the old rail road grade and replaced with a 20 ft. foot bridge. This project allowed fish (predominantly coho) to move upstream of the prior blockage. Approximately 550 ft. (168 m) of spawning habitat was made available by this project. The stream banks were pulled back, seeded, and the disturbed soil was planted with native trees and shrubs.

Reference Point and Habitat Availability Surveys:

Table 47. SHA and reference point survey data for Lake Creek tributary 0264.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)						0	2.8	0
Bankfull Depth (m)						0.81	1.06	0.9
Bankfull Width (m)						3.57	3.4	3.6
Canopy Closure (%)						99	100	94
Wetted Width (m)						0	2.8	0

Spawning Surveys - During the winter of 2003-04 a total of 183 live coho, 17 coho carcasses, and 29 coho redds were recorded. A similar return occurred in 2004-05 with a total of 176 live coho, 27 carcasses, and 58 coho redds were recorded. One live cutthroat was also recorded. Coho numbers were way down during the winter of 2005-06 with only 5 live coho and 2 coho redds being observed on Lake Creek 0264.

MUNDT CREEK - Flaig and Mundt Properties

Mundt Creek flows into the East Fork Nookachamps at river mile 4. This tributary is large and supports every salmonid species with the exception of sockeye. Mundt Creek is a WDFW index stream. The project is located in Section 19, Township 34N, Range 5E. The restoration project was completed in 1999 and involved installing 815 feet (284 m)of fencing to exclude cattle from the stream. Approximately 816 trees and shrubs were also planted amongst an already established riparian zone to provide a mixed canopy with understory plants.

Spawning Surveys - The 1999-00 survey recorded; 35 live chum, 21 chum carcasses, and 5 chum redds, with 20 live coho, 5 coho carcasses, and 9 coho redds. In 2000-01, there were no

signs of chum salmon, though 27 live coho, 26 coho carcasses, and 25 coho redds and one live chinook salmon were recorded. In 2001-02, the chum salmon returned with 50 live chum, 19 chum carcasses, and 18 chum redds recorded. Eight live chinook, two chinook carcasses, and four chinook redds were observed with 549 live coho, 193 coho carcasses, and 137 coho redds. Pink salmon were also observed for the first time in Mundt Creek with 44 live adults, 1 carcass, and 4 pink redds counted and recorded. During the winter of 2002-03 there was no sign of chinook, and both the chum and coho runs were down from the previous year. A total of 12 live chum, nine chum carcasses, and four chum redds were recorded along with 230 live coho, 98 coho carcasses, and 99 coho redds. Three live cutthroat were also observed in 2002-03. In 2003-04 a total of three chinook carcasses; 121 live chum, 23 chum carcasses, 27 chum redds; 214 live coho, 105 coho carcasses, 76 coho redds; and 51 live pink, 31 pink carcasses, 20 pink redds were recorded. In 2004-05 a total of two live chinook, one chinook carcass, one chinook redd; 24 live chum, seven chum carcasses, nine chum redds; 208 live coho, 33 coho carcasses, 57 coho redds; and eight live steelhead. Spawning surveys for Mundt Creek were conducted by WDFW during the 2005-06 season.

MURRAY CREEK WEST FORK NOOKACHAMPS TRIBUTARY - Murray Property

Murray's Reach of unnamed Nookachamps tributary was enhanced in the spring of 2001 by JFE crew. The project site consists of upper water shed. Approximately (1200) linear feet of riparian area with a stream enhancement zone ranging from 60 to 100 feet was enhanced with invasive species control and native plantings. The area of enhancement is approximately 5 acres. [3.64, (66*2 x 1200) 5.5ac, 200x1200)] .

Up to four qualified JFE workers provided labor. A subcontract was provided for one day of hygrotilling. Site preparation was initiated the week of May 21. The crew mowed reed canarygrass with weed whackers. Plantings holes were dug using a hygrotiller to clear the planting root zone. Planting holes were backfilled by hand to prepare the planting substrate.

Potted nursery stock was installed during the week of June 4. The last of the late spring plantings were installed on June 14. Regular precipitation occurred in June 2001, with the channel reaching bankfull conditions during the planting period. Additional Plantings were watered at the time of installation. An as built planting plan was developed to document plant location. The following plants were installed in October 2001. Additional Plants were installed in April 2003.

Table 48. Murray Creek Plantings

Species	C/D/S/W	Planting
1red-osier dogwood (Cornus stolonifera)	W	113
2black cottonwood (Populus balsamifera)	W	109
3Western red cedar (Thuja plicata)	C	102
4willow (Salix sp.)	W	82
5Douglas spirea (Spiraea douglasii)	S	60
6red-osier dogwood (Cornus stolonifera)	S	52
7red alder (Alnus rubra)	D	50
8Pacific ninebark (Physocarpus capitatus)	S	50
9Sitka spruce (Picea sitchensis)	C	37
10shore pine (Pinus contorta)	C	28

11Douglas fir (Pseudostuga mensiezii)	C	22
12Drummond Willow	S	16
13grand fir (Abies grandis)	C	11
14black twinberry (Lonicera involucrata	S	10
15western hemlock (Tsuga heterophylla)	C	10
16Sitka willow (Salix sitchensis)	S	10
17Scouler's Willow (Salix scouleriana	W	10
18Oregon grape (Berberis sp.)	S	5
19chokecherry (Prunus sp.)	D	5
20Oregon ash (Fraxinus latifolia)	D	2
21bigleaf maple (Acer macrophyllum)	D	2
22mountain maple (Acer	S	2
23pea fruit rose (Rosa piscocarpa)	S	2
24red elderberry (Sambucus racemosa)	S	1
25Nootka rose (Rosa nutkana)	S	0
total		791

Site maintenance continued periodically. Reed canarygrass was sprayed in the late summer. Plants were watered in the summer (July CHECK). Stream flow ceased in August and September. Plant protector wraps were installed in the summer to protect against rodent predation. 12oz wraps were installed on smaller materials. Willow and cottonwood cuttings were installed in lowland riparian areas. In January of 2006 the restoration zone was extend approximately 100 feet to the north and 100 feet to South. 550 additional plants were installed.

Vegetation Monitoring

Murray Creek is labeled as Site 13 in the access data base. The data contains information on survival, cover, invasives and maintenance. Table 49 summarizes survival.

Table 49. Murray Creek Survival

Species Name	Healthy	Bank	Stressed	Dead
willow-cuttings	228	RB	3	22
willow-cuttings	106	LB	6	1
dogwood-cuttings	79	LB	6	16
cottonwood-cuttings	62	LB	1	4
ninebark, pacific	29	LB	2	0
spirea	28	LB	1	0
spruce, Sitka	24	LB	2	2
alder, red	23	LB	1	1
spirea	22	RB	2	0
cottonwood-cuttings	18	RB	0	4
dogwood-cuttings	16	RB	1	9
fir, Douglas	15	RB	0	1
rose, Nootka	13	LB	16	2
cedar, western red	11	LB	12	23
fir, Douglas	10	LB	0	1
hemlock, western	9	LB	0	4
ninebark, pacific	8	RB	3	3
twinberry, black	8	RB	0	0

cedar, western red	7	RB	4	7
spruce, Sitka	6	RB	3	0
willow	6	LB	0	0
pine, shore (lodgepole)	6	RB	1	0
hemlock, western	5	RB	0	1
pine, shore (lodgepole)	4	LB	1	0
twinberry, black	2	LB	0	0
ash, Oregon	2	LB	0	0
fir, grand	2	RB	0	0
ash, Oregon	2	RB	0	0
willow	1	RB	0	0
maple	1	LB	0	0
elderberry, red	1	LB	0	0
serviceberry	1	LB	0	0
maple	1	RB	0	0
elderberry	1	RB	0	0
maple, bigleaf	1	RB	0	0
Oregon-grape	0	LB	0	1
Totals	758		65	102
				925

EAST FORK OF NOOKACHAMPS CREEK – Verdoes Property

The East Fork of the Nookachamps joins with the West Fork of the Nookachamps in Barney Lake at river mile 3.0. The Verdoes site is located just west of Highway 9, south of Babcock Road (Section 11, Township 34N, and Range 04E). The objective of this project, completed in 2002, is to restore habitat in a channelized stream, restore the riparian zone, and improve floodplain processes. The 1,200 foot (366 m) stream channel was enhanced through the installation of six large woody debris structures, used to promote pool scour and gravel sorting, and channel meander. Approximately 33 acres were planted with native trees and shrubs. Every species of salmonid accesses this stretch of stream, with the exception of the sockeye salmon. Data collection on this particular project preceded construction.

Structure Monitoring - In June of 2003, one year after project completion, 71% of the large instream structures were creating five pools. The average surface area was 143.81 square meters and the average depth was 0.98 meters. In 2004, the total number of pools increased to 7 with 100% of the structures maintaining pools. The average surface area increased to 181.57 square meters and the average depth also increased to 1.65 meters. One of the seven structures blew out, and the pool filled in leaving a total of six pools created by 86% of the original structures. The average surface area has decreased to 123.87 square meters, and the average pool depth holds at 1.26 meters. Table 51 displays the structure ratings.

Table 50. East Fork of Nookachamps Structure Ratings

Year	Excellent	Good	Fair	Poor
2003	72%	14%	14%	0%
2004	100%	0%	0%	0%
2005	86%	0%	0%	14%

Reference Point and Habitat Availability Surveys:

Table 51. SHA and reference point survey data for East Fork Nookachamps.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)				28	40	42	47	
Bankfull Depth (m)				1.67	1.67	1.17	1.3	
Bankfull Width (m)				9.6	11.55	9.3	9.6	
Canopy Closure (%)				14	13	16	14	
Wetted Width (m)				6.2	6.08	5.31	7.7	

Spawning Surveys - Random surveys were done throughout the winter of 2001-02, but no final data was recorded. In 2002-03 spawning surveys were conducted weekly with two chinook carcasses, five chum carcasses, two coho carcasses, and three cutthroat carcasses observed. One live chum salmon was also observed under an SFEG large woody debris structure. During the winter of 2003-04 twelve chum carcasses, three live coho, and 81 coho carcasses were recorded. In 2004-05 a scattered total of species was observed including: two chinook carcasses, one chum carcass, three live coho, three coho carcasses, one steelhead carcass, and two cutthroat carcasses. No spawning surveys were conducted during the 2005-06 season.

PRINGLE CREEK - Beaver Lake Estates

Pringle Creek is located in Section 18, Township 34N, Range 5E and flows into Turner Creek at river mile 1.3. The restoration project was completed in 1998 and involved several elements. Firstly, a fish barrier consisting of three iron pipes was removed and replaced with a new 10-foot culvert that allows access to 3,500 feet (1067 m) of desirable spawning habitat for returning salmonids. Secondly, 200 feet (61 m) of riparian habitat was planted with native shrubs. Above the new culvert, 11 LWD instream structures were installed along 100 feet (30 m) of stream to provide bank stabilization. Pringle Creek is utilized by cutthroat trout, steelhead, and coho and chum salmon.

Structure Monitoring - In 1999, 80% of LWD instream structures functioned to create seven individual pools averaging 2.6 meters in length and 0.21 meters in depth. In 2000, only one pool measuring 3.05 meters long, 1.5 meters wide, and 0.34 meters deep was present. By 2001, none of the structures created pools and SFEG noted recent deposition and movement of gravel in both the Turner Creek and Pringle Creek. However, the one pool remaining in 2000 appeared again in 2003. The surface area was the same (3 meters long by 1.5 meters wide), but the depth had decreased by more than half to 0.16 meters. This same pool, along with one other, appeared again in 2005. Although the surface area had diminished to 1.62 square meters, the average depth increased to 0.25 meters. Pringle Creek structure ratings are provided in Table 53.

Table 52. Pringle Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1999	36%	64%	0%	0%
2000	9%	82%	9%	0%
2001	0%	91%	9%	0%
2003	9%	46%	45%	0%
2005	27%	37%	36%	0%

Reference Point and Habitat Availability Surveys:

Table 53. SHA and reference point survey data for Pringle Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		42	48	53	73	43	83	
Bankfull Depth (m)		0.67	0.66	0.64	0.43	0.6	0.35	
Bankfull Width (m)		4.01	3.88	3.61	2.97	4.41	2.1	
Canopy Closure (%)		99	98	99	99	95	98	
Wetted Width (m)		1.13	1.47	1.32	1.52	1.85	1.5	

Spawning Surveys - In the winter of 1998-99, surveys recorded 26 live coho, 18 coho carcasses, 7 coho redds, and 1 live steelhead, decreasing to 2 live coho, 2 coho carcasses, and one chum carcass in 1999-00, and with 2 coho carcasses and 5 coho redds in 2000-01. However, in 2001-02, the number of live coho increased to 96 with 29 coho carcasses, and 64 coho redds. During the winter of 2002-03 a total of 38 live coho, 15 coho carcasses, and 26 coho carcasses were recorded. In 2003-04 two live chum, and two chum carcasses were observed, and 32 live coho, eight coho carcasses, and 49 coho redds were recorded. During the winter of 2004-05 coho was the only species present with a total of 18 live, five carcasses, and 37 coho redds. No spawning surveys were conducted during the 2005-06 season.

TURNER CREEK – Walt Property

Turner Creek (also located in Section 18, Township 34N, Range 5E) drains into the East Fork of the Nookachamps Creek at river mile 2.1. The restoration project involved placement of two complex structures immediately upstream of a culvert along 50 feet (15 m) of stream channel (one on each bank) to direct the water into the culvert. In addition, the riparian understory of mature alder and willow growth was planted with native trees along 2,000 feet (610 m) of stream banks on both banks from the downstream culvert to a pond. Chum and coho salmon inhabit Turner Creek with cutthroat trout and steelhead utilization in spring.

Structure Monitoring - In 1999, one year after placement, both structures created pools (two pools total). The average pool size was 2.5 meters long and 0.26 meters deep. By 2000 the structures no longer formed pools, though their primary purpose of water redirection was still being satisfied. This has remained true through 2005. Turner Creek structure ratings are contained in Table 55.

Table 54. Turner Creek Structure Ratings

Year	Excellent	Good	Fair	Poor
1999	100%	0%	0%	0%
2000	0%	100%	0%	0%
2001	0%	100%	0%	0%
2003	0%	100%	0%	0%
2005	0%	100%	0%	0%

Reference Point and Spawning Habitat Availability Survey:

Table 55. SHA and reference point survey data for Turner Creek.

	1998	1999	2000	2001	2002	2003	2004	2005

Spawnable Gravel (%)	46	58	65	67	78	68
Bankfull Depth (m)	0.79	0.78	0.62	0.53	0.64	0.45
Bankfull Width (m)	5.03	3.78	3.87	3.96	4.02	3.7
Canopy Closure (%)	98	89	99	99	99	97
Wetted Width (m)	1.75	1.77	1.65	1.64	2.86	2.7

Spawning Surveys - In 1998-99, the winter after project completion, 29 live coho, 19 coho carcasses, and 25 coho redds were observed. Surveys recorded 2 live coho, 5 coho carcasses, and 4 coho redds in 1999-00 and 25 live coho, 16 coho carcasses, and 32 coho redds in 2000-01. One live steelhead and 6 steelhead redds were also recorded. In 2001-02, there was also a huge increase in the coho return when 189 live coho, 73 coho carcasses, and 154 coho redds were observed. The winter of 2002-03 brought back more of the historical trend of coho when 36 live, 22 carcasses, and 13 redds were observed. In 2003-04 a total of 65 live coho, 15 coho carcasses, and 91 coho redds were recorded. The coho return remains intact with a return of 84 live coho, 13 coho carcasses, and 100 coho redds in 2004-05. No spawning surveys were conducted during the 2005-06 season.

WEST FORK OF TRUMPETER CREEK – City of Mount Vernon (Bakerview Park)

The West Fork of Trumpeter Creek originates in the City of Mount Vernon, flowing north into the West Fork of the Nookachamps Creek at river mile 4. This restoration project is located at Bakerview Park in Section 16, Township 34N, Range 4E. This habitat restoration project, implemented from 1995 through 1997, involved recreating a stream channel through filled wetlands. Ninety instream structures were placed along 3,000 feet (915 m) of stream channel, including five rock weirs placed at the upper end of the project to provide fish access to 1,260 feet (384 m) of upstream habitat. In order to provide rearing habitat for juvenile salmon, LWD was installed along the stream channel, and an off-channel pond was created. Native trees and shrubs (1,982) were planted along 6,000 feet of the riparian zone on both stream banks with a 25-foot buffer. Until the spawning surveys of 2002-03 (when a chum salmon was observed), coho were the only salmonids known to use this urban stream.

Structure Monitoring - In 1998, three years after the project was completed, 92% of all the LWD material functioned to create 78 pools averaging 3.38 meters long and 0.32 meters deep. In 1999, 92% of the LWD maintained 67 pools averaging 5.52 and 0.30 meters in depth. In 2000, 54% of the LWD maintained 40 pools averaging 5.6 meters in length, 2.19 meters in width, 0.25 meters in depth. In 2000, several leaky log weirs were repaired. In 2002, seven years after the project, 55% of the LWD was still maintaining 47 pools averaging 5.73 square meters in surface area, and 0.24 meters in depth. In 2004, the total number of pools decreased substantially to 15 with only 18% of the structures maintaining pools. The average surface area of the pools decreased slightly to 5.42 square meters and the average depth increased to 0.37 meters. Water leaks under one of the log weirs. West Fork Trumpeter Creek Structure Ratings are contained in Table 56.

Table 56. West Fork Trumpeter Creek Structure Ratings.

Year	Excellent	Good	Fair	Poor
1998	74%	21%	6%	0%
1999	73%	21%	3%	3%

2000	40%	50%	10%	0%
2002	50%	35%	15%	0%
2004	11%	81%	7%	1%

Reference Point and Spawning Habitat Availability Surveys:

Table 57. SHA and reference point survey data for West Fork Trumpeter.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		49	51	51	56	69	50	
Bankfull Depth (m)		0.39	0.43	0.36	0.27	0.32	0.4	
Bankfull Width (m)		2.42	2.27	2.42	1.63	1.68	1.9	
Canopy Closure (%)		70	75	84	86	95	96	
Wetted Width (m)		0.52	0.77	0.32	0.6	0.42	1.3	

Spawning Surveys - Coho salmon utilization of Trumpeter Creek (West Fork) had been relatively consistent within the first four years. Surveys recorded 7 live coho, 11 coho carcasses, and 21 coho redds in 1998-99; 10 live, 5 carcasses and 25 redds in 1999-00; 7 live, 3 carcasses, and 15 redds in 2000-01; and 14 live, 4 carcasses, and 18 redds in 2001-02. However, in 2002-03 there was an increase with 32 live coho, 18 coho carcasses, and 23 coho redds. One chum carcass and one chum redd noted the first sign of chum salmon in the West Fork of Trumpeter Creek since SFEG began surveying in 1998. In 2003-04 a total of 18 live coho, 12 coho carcasses, and seven coho redds were observed. More coho were observed by SFEG than ever before in 2004-05 with 37 live coho, 22 carcasses, and 14 redds were recorded. Chum were once again observed with one live and one dead. No live fish, redds, or carcasses were observed during the 2005-06 spawning season.

Of the 15 coho redds mapped using GPS in 2000-01, all were within three meters of a LWD structure. Redd location in relation to pools was not mapped.

Vegetation Monitoring -

Native trees and shrubs (1,982) were planted along 6,000 feet of the riparian zone on both stream banks with a 25-foot buffer. After collecting and analyzing the vegetation data from the past four years we have concluded that the overall health of the site is excellent. Large amounts of cottonwood, alder, along with some salmonberry have naturally recruited themselves into this site, and have done very well. The bare soils exposed during excavation allowed these species to get a head start, and they are now proving to be much needed shade not only to the stream, but to other vegetation. The western red cedar is having the most benefit from this as it prefers to grow in the shade, and is doing great. The entire stream reach is now partially to fully shaded, where only a few sapling alders existed prior to construction (now from 30 to 45 feet tall). This is also due in large part to the willow and dogwood cuttings that were planted streamside for immediate shade. In 1999, four years after project completion (when there were virtually no trees tall enough to provide any canopy closure) , stream canopy closure was 70%, increasing to 75% in 2000, and to 84% in 2001. This site was heavily planted and well maintained, and there have been minor damages from voles, weed eaters, and vandalism. Future vegetation monitoring should continue to observe health, survival, and canopy closure.

Sauk Watershed

GRAVEL CREEK - Green Property

Four restoration projects were completed in the Sauk River Watershed during the summer of 1998. The first project was Gravel Creek, located in Section 33, Township 33N, Range 6E. Gravel Creek drains into a Sauk River wetland slough at river mile 16.1. This project involved the replacement of a fish barrier culvert with 10 rock weirs and two LWD structures along 152 feet (46 m) of stream in order to allow access to over 10,000 feet (3049 m) of upstream spawning habitat. Native trees and shrubs (75) were planted along 125 feet (38 m) of the riparian zone (both stream banks). Cutthroats utilize Gravel Creek.

Structure Monitoring - In 1999, one year after project completion, 100% of the structures created pools with average size of 4.79 meters long by 0.67 meters deep. In 2000, 85% of the structures maintained 7 pools averaging 3.06 meters long, 3.5 meters wide, and 0.35 meters deep. In 2001, 54% of the structures maintained 4 pools averaging 3.19 meters long, 3.05 meters wide, and 0.33 meters deep. By 2003, only 44% of the structures had developed the same four pools. The surface area of the pools remained constant with an average of 3.13 meters long, and 2.86 meters wide, but the average depth increased to 0.42 meters. Five pools now exist in 2005 and are larger than ever with an average surface area of 7.49 square meters, and an average pool depth of 0.50 meters. Gravel Creek structure ratings are contained in Table 58.

Table 58. Gravel Creek Structure Ratings.

Year	Excellent	Good	Fair	Poor
1999	89%	11%	0%	0%
2000	45%	33%	22%	0%
2001	33%	67%	0%	0%
2003	44%	56%	0%	0%
2005	56%	44%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 59. SHA and reference point survey data for Gravel Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		75	55	45	74	85	46	63
Bankfull Depth (m)		0.9	0.48	0.39	0.45	0.35	0.54	0.4
Bankfull Width (m)		9.53	6.04**	5.22	4.73	4.27	5.2	4.3
Canopy Closure (%)		84	81*	84	85	87	90	89
Wetted Width (m)		1.12	1.05	0.9	0	0	3.5	0.4

* Decrease in canopy closure due to a large cottonwood tree falling down.

** Decrease in bankfull width due to severe downcutting.

Spawning Surveys - Surveys have been conducted every winter since 1998-99 by SFEG. From 1998 to 2006 no salmon have been observed in the creek, though an occasional cutthroat trout is observed.

LEWIS CREEK - Lewis Property

Lewis Creek flows into Mouse Creek, which drains into a slough of the Sauk River at river mile 1.8 (of the slough) and 18.6 of the mainstem river. The restoration project was completed in 1998 and is located in Section 5, Township 32N, Range 10E. This project involved replacing a fish barrier culvert with 5 rock weirs, 4 log weirs, and 4 pieces of large woody debris along 140 feet (43 m) of stream channel to allow access to 1,760 feet (537 m) of habitat above the culvert. Native trees and shrubs (1,030) were planted along 1,400 feet (427 m) of both stream banks with a 25-foot buffer downstream of the culvert. The riparian area already consisted of a thin buffer of mature alder growth in one area, and open field in the other. Lewis Creek is utilized by coho, though an occasional residential cutthroat trout has been observed.

Structure Monitoring - In 1999, one year after project completion 62% of instream structures functioned to create 10 pools averaging 1.63 meters long by 0.32 meters deep. In 2000, 46% of the structures were maintaining 6 pools averaging 1.91 meters in length, 2.56 meters in width, and 0.32 meters in depth. By 2001, 39% of the structures were maintaining 5 pools, which were much smaller (1.32 meters long, 2.56 meters wide, and 0.24 meters deep) than in previous years. Structures that had failed before 2000 corrected themselves by June of 2001. In 2003, 54% of the structures were creating seven pools with an average length of 1.86 meters, an average width of 2.24 meters, and an average depth of 0.27 meters. By 2005, after Lewis Creek blew out Sauk Prairie Road, only two of the original pools remained. The average surface area was 3.13 square meters, and the average depth was 0.28 meters. Lewis Creek Structure rating is provided in Table 60.

Table 60. Lewis Creek Structure Rating.

Year	Excellent	Good	Fair	Poor
1999	92%	0%	8%	0%
2000	39%	39%	15%	8%
2001	39%	23%	39%	0%
2003	54%	15%	31%	0%
2005	24%	38%	38%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 61. SHA and reference point survey data for Lewis Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		56	52	18*	52	53	28*	60
Bankfull Depth (m)		0.79	0.69	0.43	0.39	0.47	0.55	0.6
Bankfull Width (m)		3.57	3.43	3.2	3.27	3.1	3.7	4.6
Canopy Closure (%)		100	100	100	100	100	99	100
Wetted Width (m)		1.72	1.6	1.67	1.79	1.6	1.8	1.7

* Decreases in spawnable gravel due to fine sediment deposition.

Spawning Surveys - One male coho was observed during the winter of 1998-99 above Sauk Prairie Road, and had been the only salmon activity observed until 2002-03. Twelve live coho, one coho carcass, and one coho redd were all recorded above the two-foot culvert under

Sauk Prairie Road. During the winters of 2003-04, 2004-05, and 2005-06 no fish were observed in Lewis Creek.

MOUSE CREEK - Lewis Property

Mouse Creek flows into a Sauk River slough at river mile 1.8 of the slough, and 18.6 of the river. The restoration project is located in Section 5, Township 32N, Range 10E. This project, completed in 1998 and involved lowering a culvert and placing three weirs (one rock and two log) downstream for grade control in order to restore 100 feet (30 m) of stream channel. These improvements opened up about 1400 feet (427 m) of spawning habitat. Three-hundred feet (91 m) of riparian zone including some mixed mature forest was planted with native trees and shrubs (part of the total 617 plants used on Powderhouse Creek). Mouse Creek is a WDFW index stream and is predominately utilized by coho, steelhead, and cutthroat trout.

Structure Monitoring - In 1999, two of the weirs (one rock and one log), functioned to create two pools averaging 1.9 meters in length and 0.31 meters in depth,. By 2000, only the rock weir was maintaining one pool, which remained stable through 2003. The pool decreased in size since weir installation in 1999 to 2001, most notably the depth (0.43 meters in 1999, 0.35 meters in 2000, and 0.28 meters in 2001). However, by 2003 the pool was again much larger with a length of 3.1 meters, a width of 2.8 meters, and a residual depth of 0.39 meters. Due to the large amount of bed load that came through this system in November of 2003 there are no longer any pools on SFEG's restoration site. Table 62 provides Mouse Creek Structure Ratings.

Table 62. Mouse Creek Structure Ratings.

Year	Excellent	Good	Fair	Poor
1999	33%	67%	0%	0%
2000	0%	100%	0%	0%
2001	33%	67%	0%	0%
2003	33%	67%	0%	0%
2005	0%	0%	100%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 63. SHA and reference point survey data for Mouse Creek

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		66	66	65	77	82	59	62
Bankfull Depth (m)		0.58	0.69	0.49	0.36	0.43	0.62	0.39
Bankfull Width (m)		2.96	2.97	2.66	2.19	2.3	4.4	4.2
Canopy Closure (%)		100	100	100	100	100	99	100
Wetted Width (m)		1.09	1.44	1.42	1.22	1.33	2.9	1.6

Spawning Surveys - The coho run in Mouse Creek steadily declined in the first three years, but rebounded in the fourth year. In 1998-99, the winter after project completion, 128 live coho, 56 coho carcasses, and 18 coho redds were recorded. In 1999-00, coho numbers dropped to 86 live and 9 carcasses, though the number of redds increased to 41. In 2000-01, coho numbers dropped again to 30 live, 8 carcasses, and 15 redds. However, in 2001-02, 224

live coho, 65 coho carcasses, and 53 coho redds were recorded. Four steelhead redds, and four live cutthroat trout were also observed in the spring of 2002. Like the winter of 2001-02, 224 live coho, 26 coho carcasses, and 117 coho redds were recorded during the winter of 2002-03. In 2003-04 Mouse Creek had totals with 330 live coho, 55 coho carcasses, and 86 coho redds. Five live cutthroat and one cutthroat carcass were observed. In 2004-05 Mouse Creek had its highest coho totals ever recorded by SFEG with 373 live, 119 carcasses, and 221 redds. During the 2005-06 season 124 live coho, 2 coho carcasses, and 48 coho redds were observed in Mouse Creek.

In 2001 Mouse Creek was mapped using GPS. On Mouse Creek 15 coho redds were mapped and 7 were within three meters of a LWD structure. However, only 1 redd was found on the project site, and it was directly related to a fixed structure placed by SFEG. Eleven redds were mapped within three meters of a pool.

POWDERHOUSE CREEK - Lewis and United States Forest Service Properties

Powderhouse Creek is a tributary of Mouse Creek joining at river mile 0.8. Mouse Creek then flows into an off-channel slough at the location listed above. This restoration project, completed in 1998, is located in Section 5, Township 32N, Range 10E. The project involved redirecting 330 feet (100 m) of stream channel. Instream structures were built into the channel (27 structures including rock weirs and log weirs), and spawning gravel was added to the streambed. In 1999, native trees and shrubs (617) were planted along 330 feet (100 m) of both stream banks, and 1,200 feet (366 m) of fencing was installed to exclude a horse pasture. Powderhouse Creek is a WDFW index stream and is utilized by the same fish species at Mouse Creek though in lesser numbers.

Structure Monitoring - In 1999, one year after project completion, 88% of instream structures functioned to create 25 pools averaging 2.56 meters long and 0.35 meters deep. In 2000, 66% of the structures maintained 13 pools averaging 2.48 meters long, 3.48 meters wide, and 0.34 meters deep. In 2001, 56% of the structures maintained 12 pools with average size decreasing to 1.76 meters long, 3.23 meters wide, and 0.26 meters deep. In 2003, 41% of the instream structures were maintaining 10 pools with an average size increasing again to 2.54 meters long, 3.17 meters wide, and 0.31 meters deep. Considering the extensive work done to the stream channel, Powderhouse Creek had held up quite well until November of 2003. The stream jumped banks for over a year before returning to form in 2005 when only four pools were recorded with an average surface area of 2.56 square meters, and 0.35 meters as the average pool depth. Structure ratings are contained in Table 64.

Table 64. Powderhouse Creek Structure Ratings.

Year	Excellent	Good	Fair	Poor
1999	67%	30%	4%	0%
2000	41%	37%	22%	0%
2001	59%	33%	7%	0%
2003	41%	37%	22%	0%
2005	0%	22%	78%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 65. SHA and reference point survey data for Powderhouse Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		51	57	28	67	67	67	78
Bankfull Depth (m)		0.44	0.49	0.46	0.41	0.25	0.44	0.32
Bankfull Width (m)		4.86	5.2	4.94	4.36	3.88	4.7	4.1
Canopy Closure (%)		97	98	96	98	99	98	98
Wetted Width (m)		1.5	1.45	2.25	2.12	2.58	1	1.7

Spawning Surveys - Within four years, numbers of coho observed during surveys have varied considerably. The first winter after project completion (1998-99), 4 live coho and 1 coho redd were counted. Coho returns increased in 1999-00 to 14 live and 6 redds, but decreased sharply in 2000-01 to no live coho, 1 carcass, and 2 redds. The coho numbers increased again in 2001-02 when 102 live, 30 carcasses, and 13 coho redds were observed. During the winter of 2002-03 there were 60 live coho, one coho carcass, and 27 coho redds recorded on Powderhouse Creek. During the Fall of 2003 Powderhouse Creek filled up entirely with gravel and was forced to change course, making the stream inaccessible to returning salmonids. The surveys of 2003-04 showed no live, no carcasses, and no redds in this reach. However, prior to the 2004-05 spawning season the stream had corrected itself and was once again accessible to 50 live coho, 2 coho carcasses, 26 coho redds, and three live cutthroat trout. During the 2005-06 spawning season 8 live coho, 1 coho carcasses, and 2 coho redds were observed on Powderhouse Creek.

Two coho redds were mapped on the project site in 2000-01, one within three meters of a fixed LWD structure. The majority of pools in Powderhouse Creek were not mapped.

Vegetation - In 1999, 617 native trees and shrubs were planted along 330 feet of both stream banks, and 1,200 feet of fencing was installed to exclude a horse pasture. Most all of the plant species are doing great with the exception of those planted in the low areas along the stream that collect and hold water. The western red cedar and Douglas fir that were planted in these areas are showing signs of stress, and some are dead. All other firs and cedars are extremely healthy, and are very abundant in areas. Vine maple, cascara, and willows are also doing well. There has been some blackberry intrusion, and little maintenance has been done to this site. Maintenance should be performed in the blackberries. Canopy closure over the stream remained relatively stable at 97% in 1999, 98% in 2000, and 96% in 2001. This is due to a large, mature canopy both upstream and downstream of the 330-foot project site.

LYLE CREEK – Dashiell properties

Lyle Creek flows into the Sauk River at river mile 13.7. The restoration project site is located in Section 20, Township 33N, and Range 10E. This project, completed in 2001, included installing a recycled flatcar bridge over Lyle Creek to provide access for livestock to an adjacent pasture. This excluded livestock access to the stream, which contains runs of chum, coho, steelhead, and cutthroat trout.

Reference Point and Habitat Availability Surveys:

Table 66. SHA and reference point survey data for Lyle Creek.

	1998	1999	2000	2001	2002	2003	2004	2005

Spawnable Gravel (%)	71	64	66	84
Bankfull Depth (m)	0.59	0.43	0.52	0.35
Bankfull Width (m)	5.42	4.8	5.2	4.6
Canopy Closure (%)	47	39*	41	52
Wetted Width (m)	0	0	3.5	0

* Decrease in canopy closure due to large alder trees falling down in wind storm.

Spawning Surveys - In 2000-01, one year before the livestock bridge was in place, a total of 19 live coho, five coho carcasses, and 33 coho redds were observed. One live steelhead, four steelhead redds, and one cutthroat redd were also recorded. The next spawning season (2002-03) had a large return with 60 live chum, 10 chum carcasses, 16 chum redds; 68 live coho, 22 coho carcasses, 27 coho redds; 10 live steelhead, four steelhead carcasses, 16 steelhead redds; five live cutthroat, and 1 cutthroat carcass observed and recorded. Surveys were not conducted in 2002-03 due to lack of funds. However, surveys were continued in 2003-04, and recorded 26 live chum, one chum carcass, and 10 chum redds; 194 live coho, 23 coho carcasses, and 90 coho redds. Six live steelhead and three steelhead redds were also observed. More chum were recorded that ever before by SFEG in 2004-05 when 214 live, 142 carcasses, and 103 chum redds were counted. A total of 146 live coho, 14 coho carcasses, 55 coho redds; three live steelhead, two steelhead redds; and three live cutthroat trout were also observed. During 2005-06 4 live chum, 2 chum carcasses, and 8 chum redds were observed in Lyle Creek. 4 live coho, 4 coho redds, and 1 live steelhead were also observed in Lyle Creek.

SUIATTLE SLOUGH – Washington State Department of Natural Resources Property

Suiattle Slough is a side channel complex and off channel wetland 2.5 miles upstream of the mouth of the Suiattle River. The project site is located in Section 22, Township 33N, Range 10E. This project, completed in 2005, involved the removal of a deteriorating wooden fish ladder and dam built in 1988. The fishway was replaced with a series of log weirs to maintain water levels, improve fish passage and increase spawning and rearing habitat. Suiattle Slough is primarily used by coho salmon and cutthroat trout, other species include steelhead trout, chinook and chum salmon.

Spawning Surveys – During the 2005-06 spawning season, 18 live coho and 21 coho redds were observed.

South Skagit Watershed

ALDON CREEK – Falconer Property

The Aldon Creek restoration project builds upon a culvert replacement project done by Skagit County in 2000 to restore fish passage to Aldon Creek. This project will benefit coho salmon, steelhead, and trout by restoring spawning and rearing habitat for all species. Riparian habitat and water quality conditions had been degraded for salmonids by eroding stream banks caused by livestock access and lack of riparian cover. A fence was built to exclude livestock along both sides of the creek for a total of approximately 3,000 linear feet (915 m). Native

plants were planted by community members in 3.5 acres of riparian area to improve riparian and water quality conditions. Since the creek has been fenced, existing riparian vegetation such as understory shrubs and ground layer species have flourished in the absence of cattle trampling.

Spawning Surveys - During the winter of 2000-01, prior to improving the fish barrier, seven live coho, two coho carcasses, and 16 coho redds were recorded. In 2003-04 a total of 127 live coho, 54 coho carcasses, and 56 coho redds were recorded. Two live pink salmon, 19 pink carcasses, and eight pink redds were also observed. Aldon Creek was home to many salmonids in 2004-05. Chinook were present for the first time with one live and one redd being observed. Four chum carcasses were also counted for the first time. There was also a good coho run with 109 live, 28 carcasses, and 68 redds recorded. One steelhead carcass was also observed. SFEG observed 31 live coho and 15 coho redds in Aldon Creek during the 2005-06 season.

WINTERS CREEK - Carnes Property

Winters Creek flows into Morgan Creek at river mile 2. Morgan Creek enters the Skagit River in a side channel slough at river mile 4 (Skagit r.m. 32). The restoration project site is located in Section 30, Township 35N, Range 6E. This project was completed in 1997 and involved the replacement of two failing bridges with new bridges The project was completed in 1999 and involved instream placement of 52 LWD structures. Approximately 3,250 feet (991 m) of stream was planted with native trees and shrubs. Winters Creek is utilized by coho salmon, steelhead, and cutthroat trout.

Structure Monitoring - In 2000, three years after project completion, 75% of all LWD instream structures functioned to form 32 pools. By 2001, 49% of LWD structures maintained 23 pools. The average pool size remained relatively constant from 2000 to 2001, with the exception of pool length decreasing 2.24 meters from 6.22 meters to 3.98 meters within one year. Winters Creek structure ratings are shown in Table 67.

Table 67. Winters Creek Structure Ratings

Years	Excellent	Good	Fair	Poor
2000	65%	27%	8%	0%
2001	50%	50%	0%	0%

Reference Point and Spawning Habitat Availability Surveys:

Table 68. SHA and reference point survey data for Winters Creek.

	1998	1999	2000	2001	2002	2003	2004	2005
Spawnable Gravel (%)		45	35	24*				
Bankfull Depth (m)		0.55	0.7	0.8				
Bankfull Width (m)		3.74	4.17	4.23				
Canopy Closure (%)		93	89	90				
Wetted Width (m)		0.39	0.57	1.02				

* Decrease in spawnable gravel due to fine sediment deposition.

Spawning Surveys - In 1998-99, two winters after project completion, 71 live coho, 41 coho carcasses, and 27 coho redds were observed. In 1999-00 the number of coho dropped to 49 live, 9 carcasses, and 11 redds. In 2000-01 returns increased to 69 live coho and 35 coho carcasses, though only 9 coho redds were observed. One steelhead carcass was counted in 2000-01. In 2001-02, 400 live coho, 36 coho carcasses, and 89 coho redds were counted and recorded. One steelhead carcass was also observed in 2002. Surveys were not conducted in 2002-03, 2003-04, or 2005-06 due to a change in land ownership.

MORGAN CREEK - Israel and Matson properties

Morgan Creek is located in the Day Creek basin off the South Skagit Highway at Section 19, Township 35N, and Range 6E. Morgan Creek enters the Skagit River in a side channel slough. SFEG is currently working with two landowners to design a LWD installation project to reduce flooding, create scour, and increase habitat complexity. Morgan Creek is utilized by Chinook, coho, steelhead, and cutthroat.

Reference Point and Spawning Habitat Availability Survey:

Table 69. SHA and reference point survey data for Morgan Creek.

	1998	1999	2001	2002	2003	2004	2005
Spawnable Gravel (%)						26	29
Bankfull Depth (m)						0.72	0.74
Bankfull Width (m)						4.9	4.7
Canopy Closure (%)						84	90
Wetted Width (m)						2.6	0.9

Spawning Surveys - During the winter of 2004-2005 20 live coho, 38 coho carcasses,6 coho redds, and one steelhead carcass were observed in Morgan Creek. Only one live coho and one coho carcass were observed in Morgan Creek during the winter of 2005-2006.

Findings by Monitoring Type

In-stream Monitoring

Structure Monitoring:

In-stream structures total 973 structures in 38 stream locations. Table 70 indicates the type of structures that SFEG is currently monitoring. Not all 973 structures are monitored due to access constraints. The number of structures monitored is different every year.

Table 70. Types of Structures

Structure	Quantity
Rootwad	328
Cover log	156
Toe log	127
Deflector log	108
Rock barb	80
Log weir	66
Rock weir	57
Bridge	19
Culvert	11
Gravel bar stabilizer	8
Piling debris catch	5
Log jam	5
Total	973

Figure 1. Debris Cluster, E. F Nookachamps

Structure Ratings - SFEG has been able to track up to a nine year history on project sites. While the percentage of structures with excellent ratings steadily decreases over time, the percentage of structures with good ratings increases (Table 71, Figure 2). Nine years after project completion 81% of structures maintain good ratings.

Table 71. Structure Rating Results

Structure Rating	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Excellent	59.70%	52.60%	50%	46.00%	44.30%	33.20%	35.30%	13.20%	11%
Good	34.20%	40.60%	38.20%	34.90%	47.30%	47.10%	38.10%	63.20%	81%
Fair	4.90%	6.10%	6.80%	16.80%	7.20%	17.70%	26.60%	20%	7%
Poor	1.20%	0.70%	5%	2.30%	1.20%	2.00%	0%	3.60%	1%

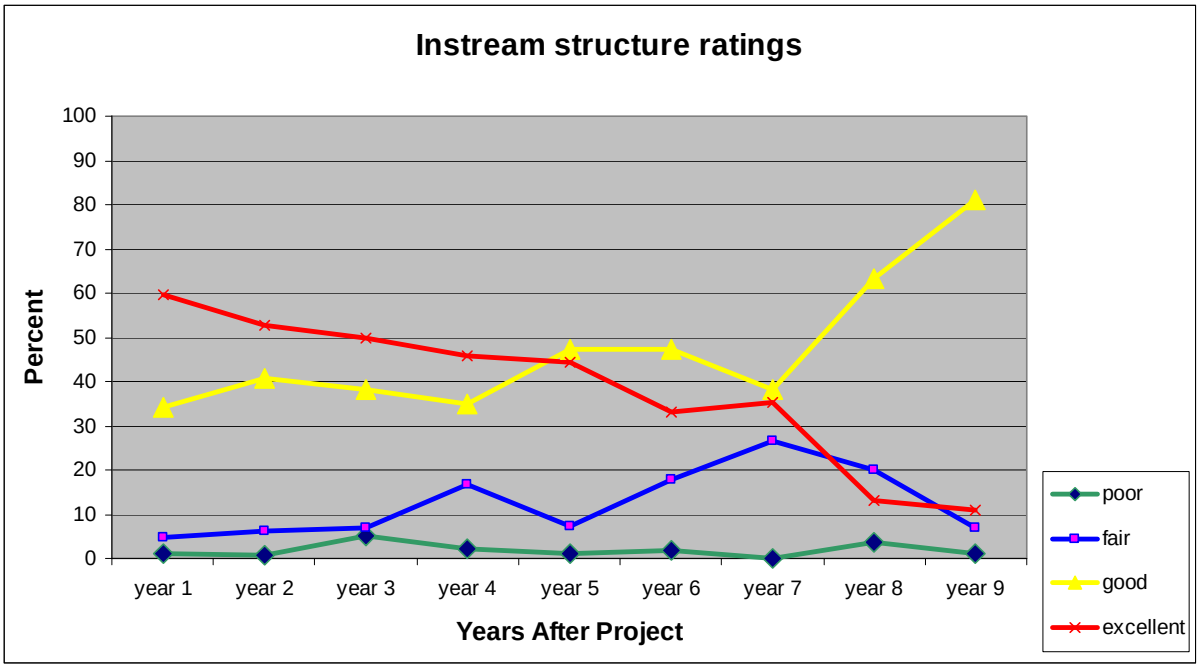

Figure 2. Percentage of structures with excellent, good, fair, and poor ratings.

Structure Failures - In 2001, minor problems at structures were identified at several locations. At Wood Creek a few rock weirs have not sealed well, and water leaks through the rocks. A few rock barbs at Hansen and Jones Creeks experienced adverse scour with a few rocks falling in the stream. At Jones Creek, a detached root wad was noted in the stream. At Mud Creek, the liner on a wood weir became exposed and flipped up above the structure.

In 2002, structures on Colony and Harrison Creeks were noted as buried and could not be located. A structure was missing on Mud Creek, as well as one on Jones Creek. The first rock barb on Upper Hansen Creek is completely washed out now, and there is some bank erosion taking place. One log weir has completely failed on Wood Creek, and there are a few

small leaks on some of the log weirs in the West Fork of Trumpeter Creek and Kennedy Creek.

In 2004, a log weir on Mud Creek received a poor rating because it no longer spanned the length of the channel. A structure in the West Fork of Trumpeter Creek also received a poor rating because two logs were blocking the stream. The culvert on the West Fork of Colony Creek was given a poor rating because it was damaged after a 30 acre beaver pond blew out.

In 2005, a structure on the East Fork of Nookachamps failed. The structure consisting of 2 cover logs, 2 toe logs, and 1 rootwad was blown out and relocated downstream. SFEG staff re-secured the structure.

Pool Development - Pool development often results from structure placement. Monitoring results indicate that most structures have created pools and provide cover and protection from predators for juvenile salmon and trout.

Rock weirs have had the greatest success in creating and maintaining pools. Nine years after the installation of rock weirs 71% of rock weirs still maintain pools (figure 3). Another structure with a high success rate at maintaining pools is the rock barb. Eight yeas after project completion, 69 % of rock barbs maintain pools (figure 3). Culverts are one type of structure that is not intended to create pools. When a new culvert is installed, it is often replacing a perched culvert that has created a large pool directly downstream. After the barrier culvert is replaced with a culvert that allows the stream to flow freely at its natural width, the pool caused by the perched culvert immediately begins filling in to allow smoother passage for returning salmonids. Most of the gravel bar stabilizer logs that have been installed have been buried and filled in, and no longer aid in pool development. However, in a few streams the logs have been rediscovered by the high flows and have since formed substantial pools. The gravel bar stabilizer, which lays perpendicular to the stream in the gravel bar, now aids in pool development (33% of the time) after eight years (figure 3). The deflector log has the lowest rate (5%) of maintaining pools (figure 3).

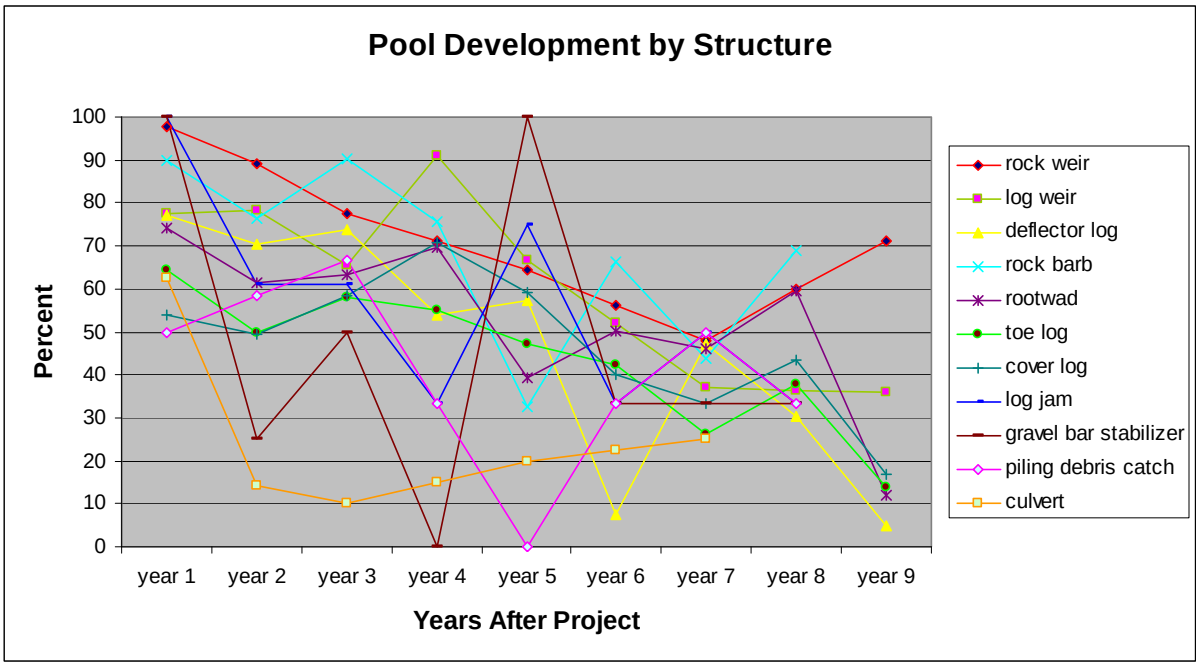

Figure 3. Percentage of structures maintaining pools.

Pool Size – Pool development at SFEG's project sites has steadily decreased over the years since project completion, but the surface area and depth of these remaining pools has increased by 31% in the nine years since project completion (Figure 4).

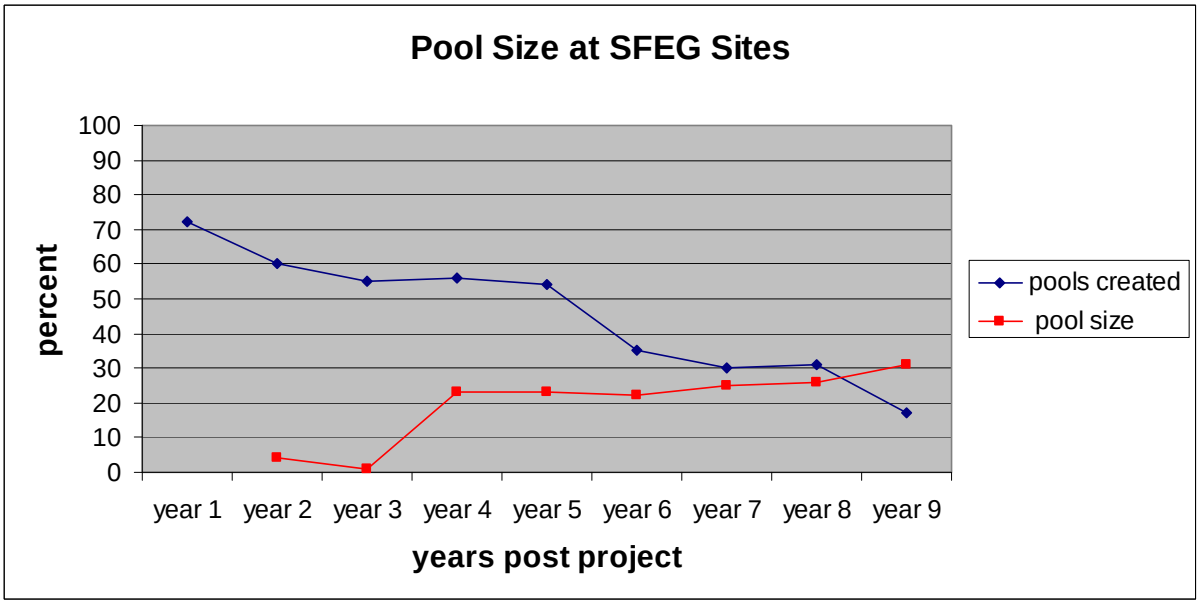

Figure 4. Number of pools created post project versus the average pool size.

Reference Point Survey:
The results for the Reference Point Survey are summarized in the following tables and figures:

Canopy Closure – Table 72, Figures 5A and 5B

Average Bankfull Width – Table 73, Figures 6A and 6B

Average Wetted Width – Table 74, Figures 7A and 7B

Average Bankfull Depth – Table 75, Figures 8A and 8B

Table 72. Percent canopy closure

Stream Name	1999	2000	2001	2002	2003	2004	2005
Powderhouse	97	98	96	98	99	98	98
Lewis	100	100	100	100	100	99	100
Gravel	84	81	84	85	87	90	89
Mouse	100	100	100	100	100	99	100
Marblegate					99	99	
Lyle				47	39	41	52
Lorenzen				91	90	77	
Hansen	37	26	52	52	71		86
Shoeshel				97	99	97	97
Red			71	71	72	76	
Childs	66	78	85	88	93	96	93
Brickyard	0.2	6	3	7	25	36	
Jones	61	57	64	68		62	
Winters	93	89	90				
Harrison	53	58	69	78	82	76	
Colony		3	4	11	18		
Bob Smith	96	95	95	95	95	93	
N.P.	46	50	54	59	62	84	77
Larrison	72	36	38	39	48	98	
Colony (Coplen's)	66	80	87	85	92	99	
Wood	37	38	37	38	44	49	
W.F. Colony				100	78	78	
Barnes	68	71	27	80	83	79	
Mud	96	95	97	96	96	94	
Finnegan	86	92	92	95	96	79	
Cronin	42						
Prairie Lane	0						
W.F. Trumpeter	70	75	84	86	95	96	
Kennedy	11	10	14	7	6	6	
Klahowya	87	90	90	90	96	90	92
Pringle	99	98	99	99	95	98	
Turner	98	89	99	99	99	97	
E.F. Nookachamps			14	13	16	14	
trib. To Lake				90	98	97	89
0264 trib. To Lake					99	100	94
Morgan						84	90

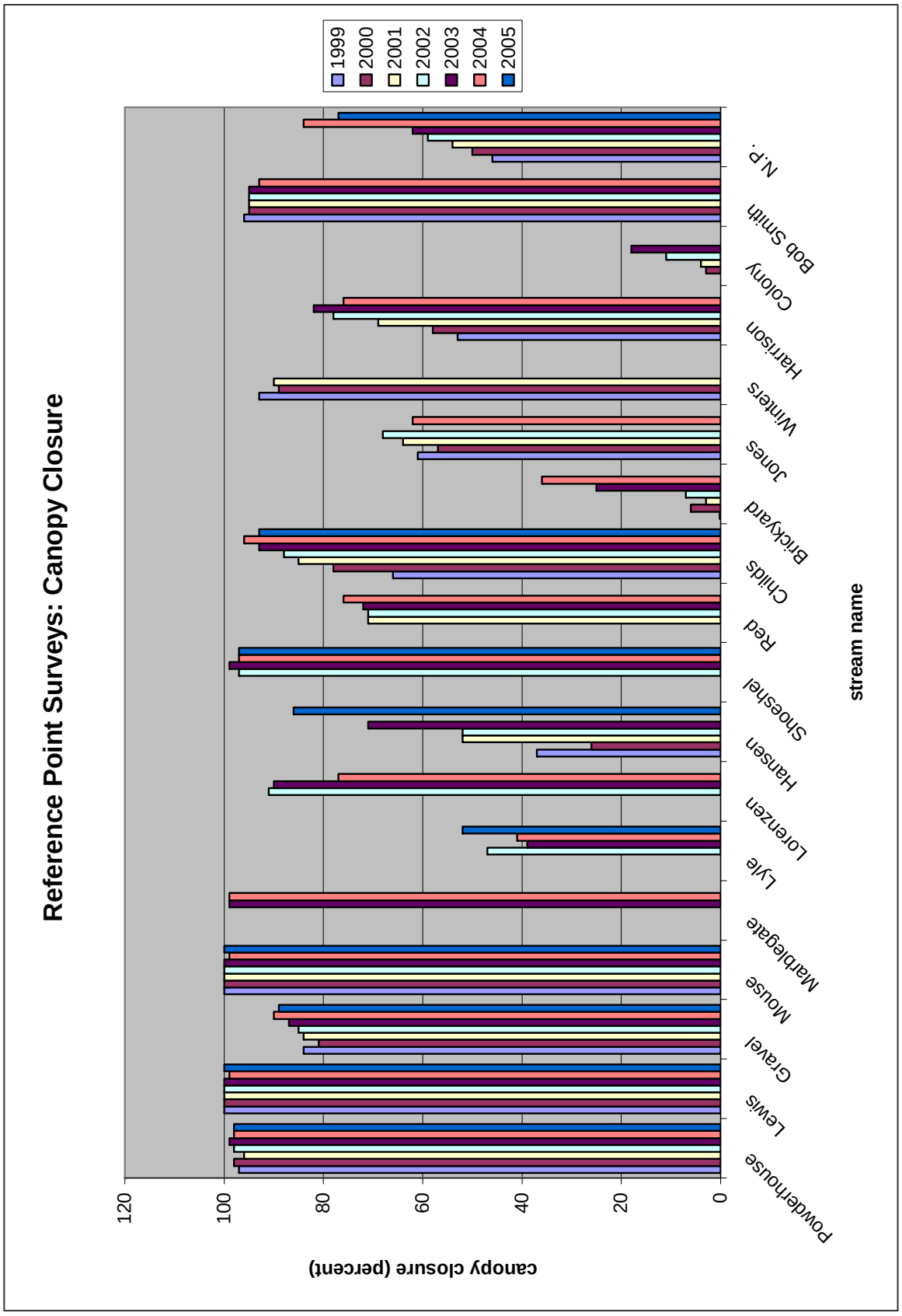

Figure 5A: Percent canopy closure for SFEG streams

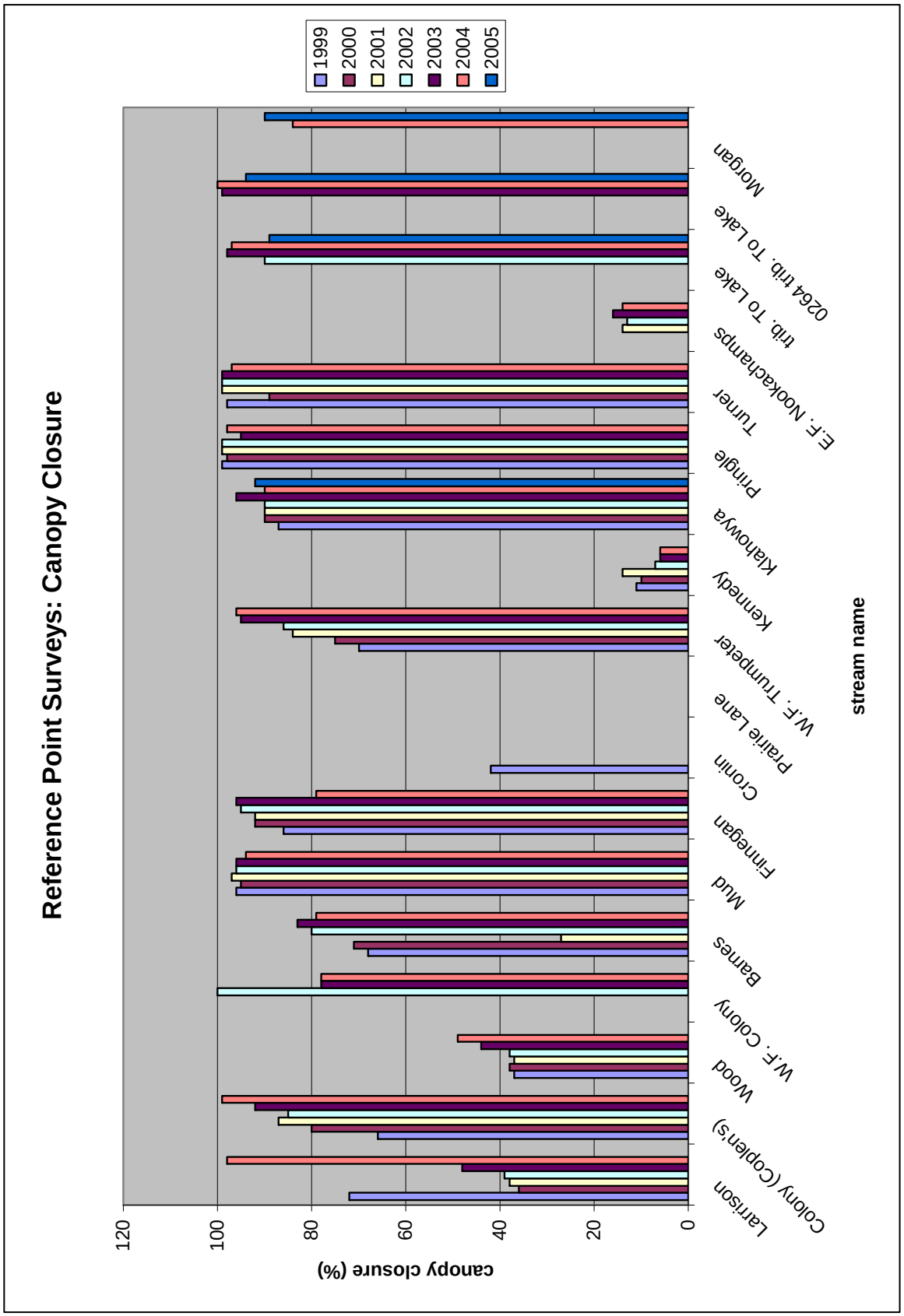

Figure 5B. Percent canopy closure for SFEG streams

Table 73. Average bankfull width in meters

Stream name	1998	1999	2000	2001	2002	2003	2004	2005
Powderhouse		4.86	5.2	4.94	4.36	3.88	4.7	4.1
Lewis		3.57	3.43	3.2	3.27	3.1	3.7	4.6
Gravel		9.53	6.04	5.22	4.73	4.27	5.2	4.3
Mouse		2.96	2.97	2.66	2.19	2.3	4.4	4.2
Marblegate						5.85	5.6	
Lyle					5.42	4.8	5.2	4.6
Lorenzen					2.13	1.9	2.2	
Hansen	9.35	11.6	7.99	8.1	7.68	8.1		8.1
Shoeshel					4.57	3.9	3.8	4
Red				4.9	4.45	3.6	4.4	
Childs	5.18	5.3	5.27	4.35	4.04	4	4.7	4.5
Brickyard		3.49	3.25	3.51	2.53	3.37	4	
Jones	10.91	11	11.81	12.45	11.56		10.3	
Winters		3.74	4.17	4.23				
Harrison		3.15	4.27	4.65	5.66	3.61	4.8	
Colony			7.38	7.15	6.55	4.72		
Bob Smith		3.91	3.36	3.37	2.41	2.4	2.6	
N.P.		4.74	4.4	4.3	4.92	4	3.8	3.5
Larrison		3.2	3.92	3.52	4.43	3	3.3	
Colony (Copeland's)	4	3.77	3.78	2.68	3.58	3.4	3.2	
Wood		3.58	4.14	3.36	2.88	3.23	3.7	
W.F. Colony					2.65	11.7	12.2	
Barnes		4.55	6.6	6.75	5.47	4.6	4.4	
Mud		5.39	5.52	5.5	4.89	4.6	4.7	
Finnegan		5.08	5.95	6.11	6	5.22	6.6	
Cronin		2.58						
Prairie Lane	4.88							
W.F. Trumpeter		2.42	2.27	2.42	1.63	1.68	1.9	
Kennedy		2.71	2.64	2.51	2.76	2.1	2.5	
Klahowya		3.47	3.47	3.24	3.14	2.8	3	3.1
Pringle		4.01	3.88	3.61	2.97	4.41	2.1	
Turner		5.03	3.78	3.87	3.96	4.02	3.7	
E.F. Nookachamps				9.6	11.55	9.3	9.6	
trib. To Lake					2.5	2.47	2.8	2.4
0264 trib. To Lake						3.57	3.4	3.6
Morgan							4.9	4.7

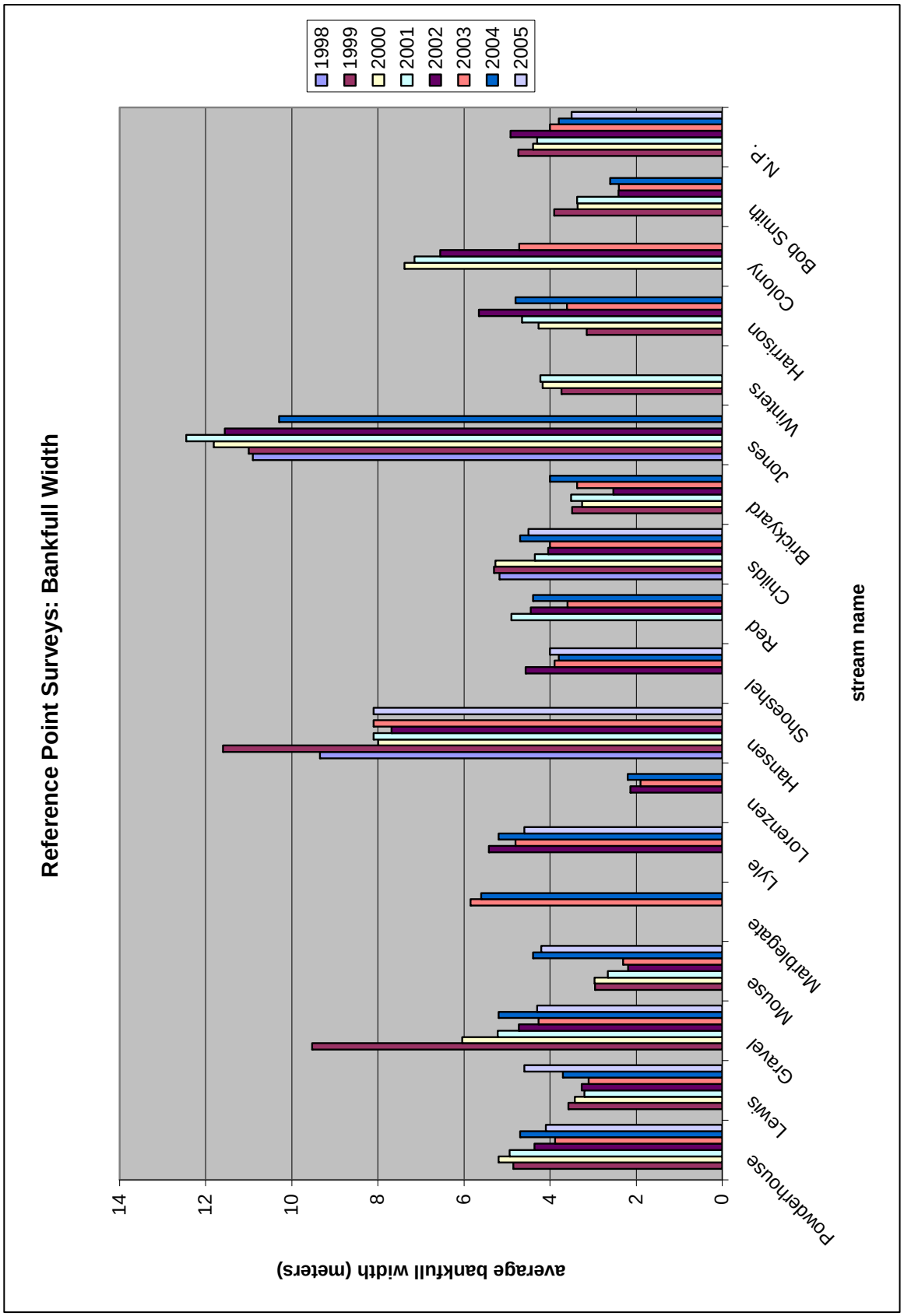

Figure 6A. Average bankfull width for SFEG project streams

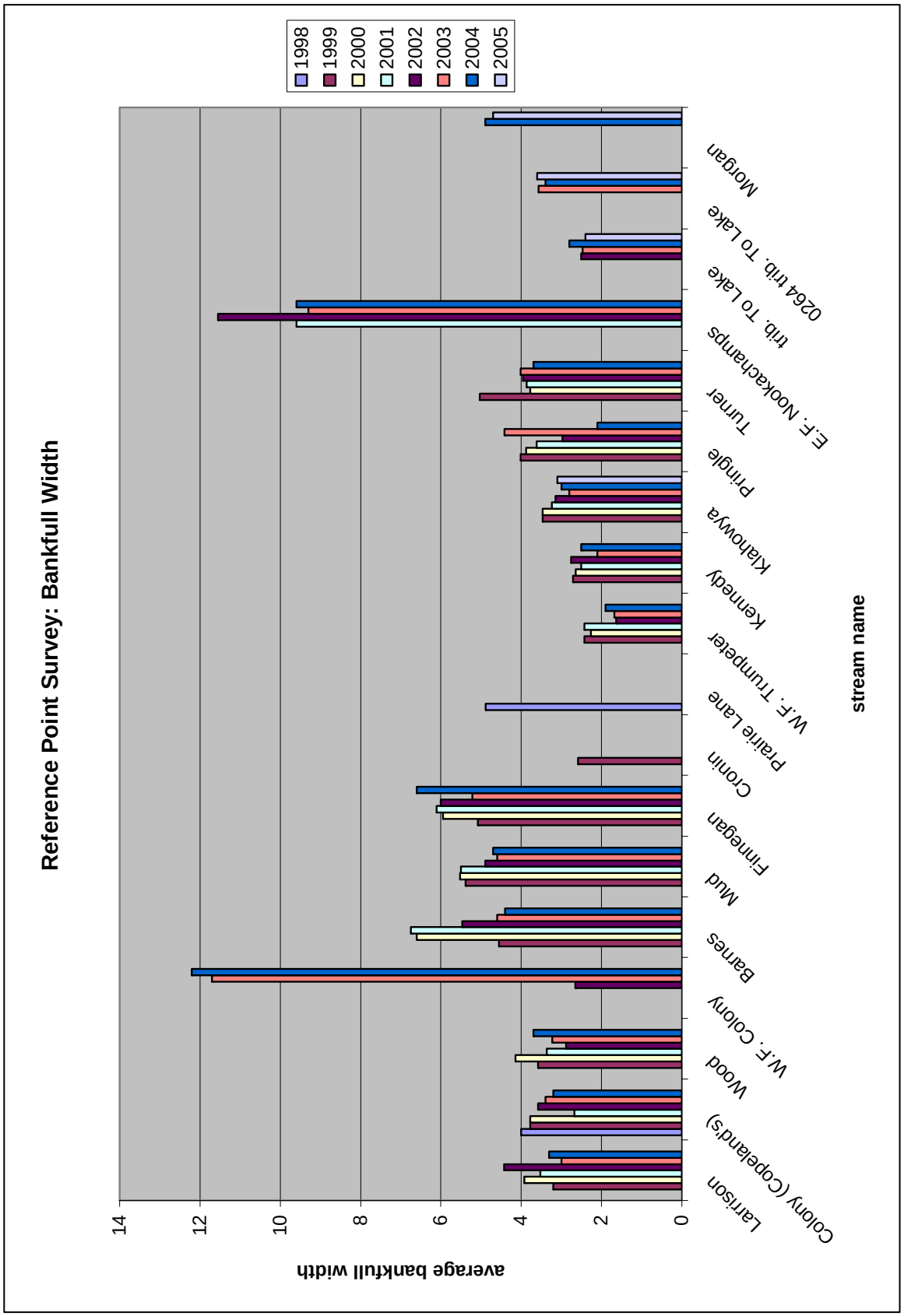

Figure 6B. Average bankfull width for SFEG project streams.

Table 74. Average wetted width in meters

Stream name	1998	1999	2000	2001	2002	2003	2004	2005
Powderhouse		1.5	1.45	2.25	2.12	2.58	1	1.7
Lewis		1.72	1.6	1.67	1.79	1.6	1.8	1.7
Gravel		1.12	1.05	0.9	0	0	3.5	0.4
Mouse		1.09	1.44	1.42	1.22	1.33	2.9	1.6
Marblegate						2.3	2.4	
Lyle					0	0	3.5	0
Lorenzen					1.33	0.57	1.5	
Hansen	4.36	4.34	4.68	4.6	4.95	4.8		5.5
Shoeshel					1.51	1.4	2.5	0.9
Red				1.87	1.7	1	2.8	
Childs	2.91	2.67	3.33	2.27	2.26	2	2.7	3.3
Brickyard		1.79	2.1	2.55	2.18	1.88	3.4	
Jones	5.2	4.69	5.09	5.6	4.63		6.4	
Winters		0.39	0.57	1.02				
Harrison		0.79	3.01	3.35	3.68	1.12	4.2	
Colony			4.13	5.85	5.1	3.06		
Bob Smith		1.76	1.9	2.16	1.99	1.8	1.9	
N.P.		0	2.32	0.74	0.47	0	2.7	0
Larrison		0	1.06	0.18	0	0	1.7	
Colony (Coplen)	3.13	3.16	2.38	2.15	2.6	1.8	2.6	
Wood		0.4	2.77	1.24	1.62	1.23	2.6	
W.F. Colony					0.71	0	0.35	
Barnes		2.42	1.33	1.81	1.64	1.7	3	
Mud		1.84	2.01	1.93	1.48	1.6	2.8	
Finnegan		2.88	4.35	3.91	3.69	3.08	5.2	
Cronin		0						
Prairie Lane	3.38							
W.F. Trumpeter		0.52	0.77	0.32	0.6	0.42	1.3	
Kennedy		1.34	1.59	1.74	1.97	2	1.7	
Klahowya		1.67	1.51	1.42	1.36	1.8	2.2	1.4
Pringle		1.13	1.47	1.32	1.52	1.85	1.5	
Turner		1.75	1.77	1.65	1.64	2.86	2.7	
E.F. Nookachamps				6.2	6.08	5.31	7.7	
trib. To Lake					0.6	0.58	1.5	0.6
0264 trib. To Lake						0	2.8	0
Morgan							2.6	0.9

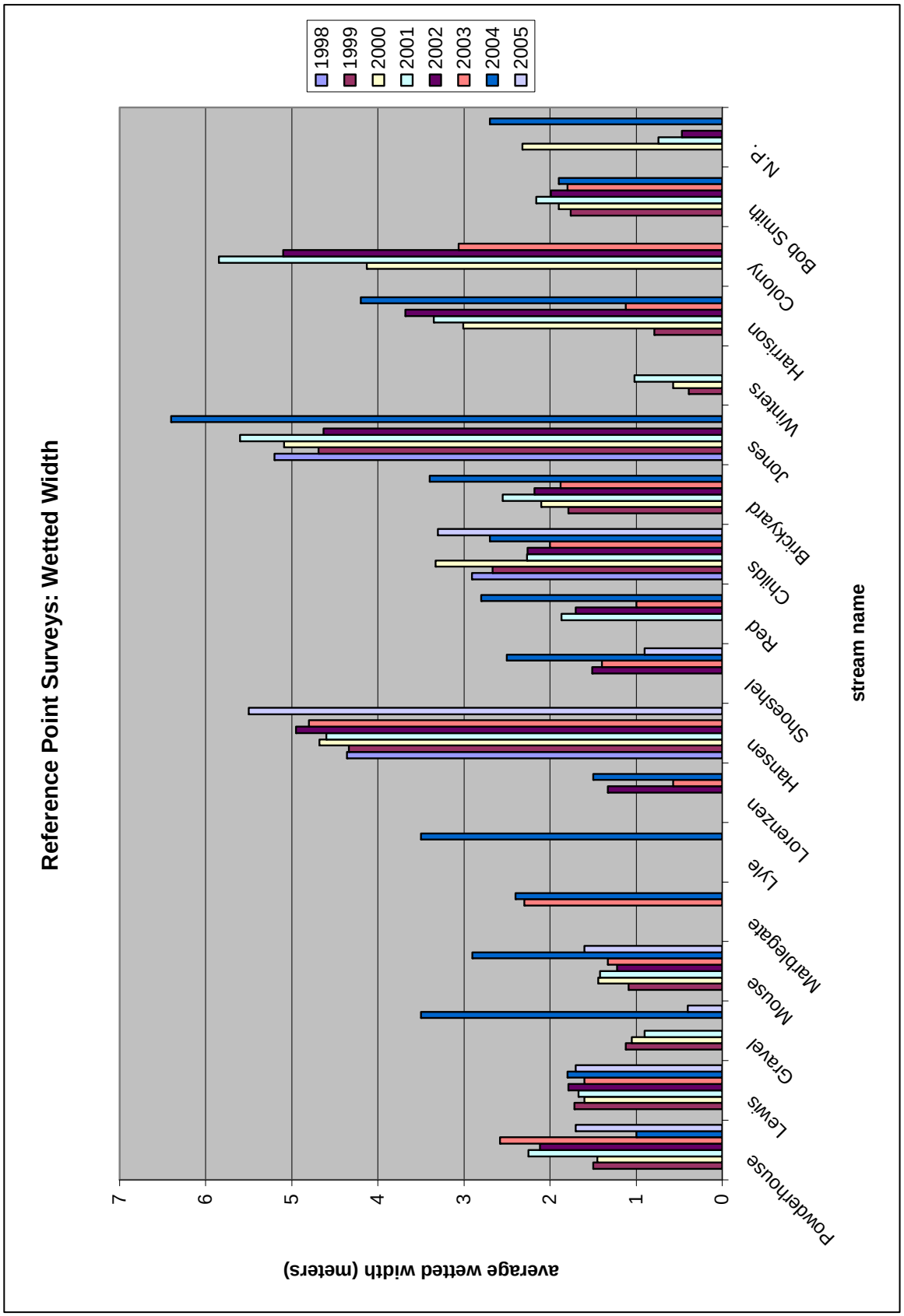

Figure 7A. Average wetted width for SFEG project streams.

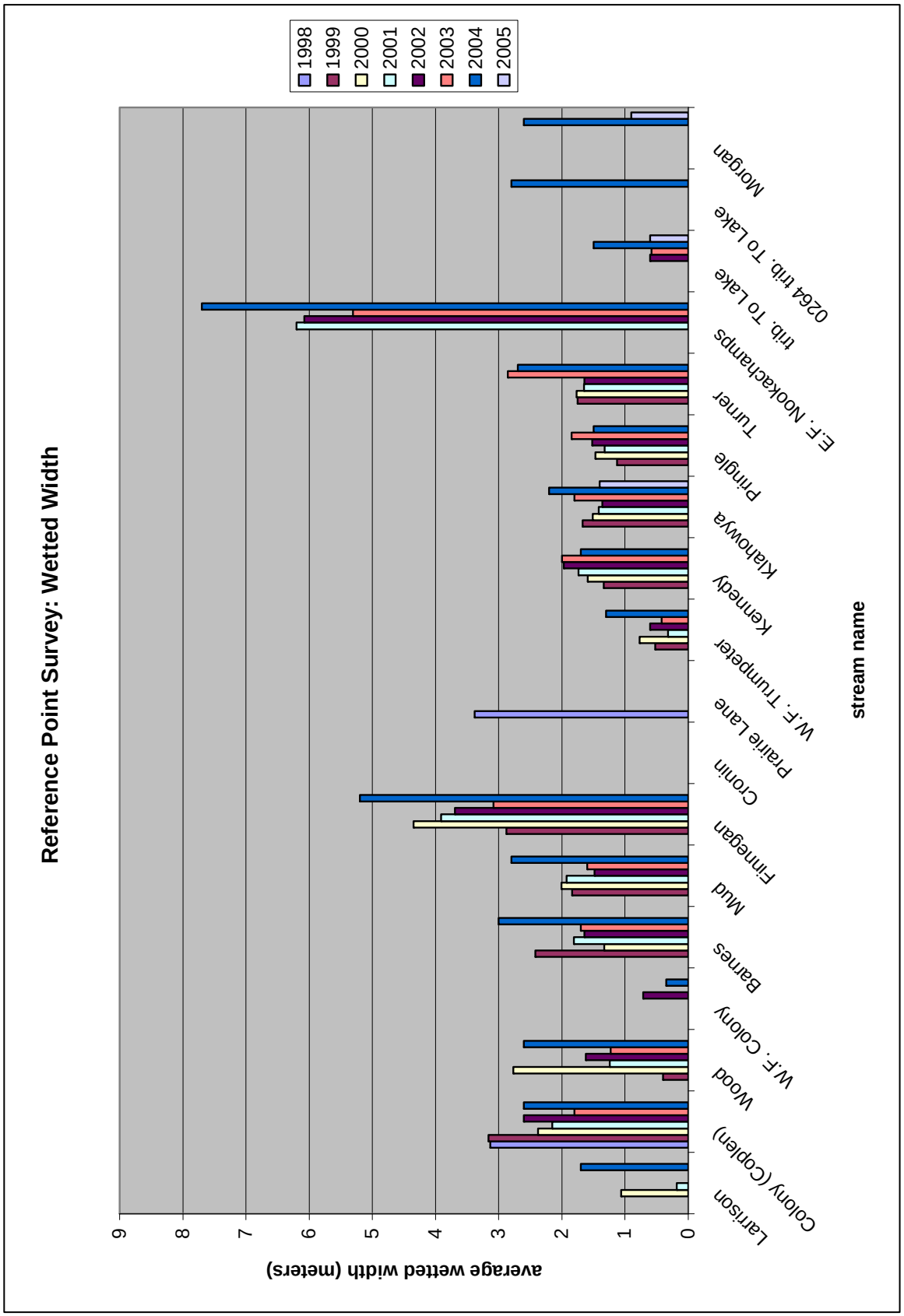

Figure 7B. Average wetted width for SFEG project streams.

Table 75. Average bankfull depth in meters

Stream name	1998	1999	2000	2001	2002	2003	2004	2005
Powderhouse		0.44	0.49	0.46	0.41	0.25	0.44	0.32
Lewis		0.79	0.69	0.43	0.39	0.47	0.55	0.6
Gravel		0.9	0.48	0.39	0.45	0.35	0.54	0.4
Mouse		0.58	0.69	0.49	0.36	0.43	0.62	0.39
Lyle					0.59	0.43	0.52	0.35
Marblegate						0.68	0.72	
Lorenzen					0.3	0.41	0.8	
Hansen	1.13	0.95	0.94	0.97	0.76	0.92		0.67
Shoeshel					0.52	0.37	0.44	0.43
Red				0.34	0.28	0.24	0.32	
Childs	0.84	0.73	0.56	0.44	0.47	0.45	0.51	0.36
Brickyard		0.45	0.48	0.54	0.46	0.49	0.63	
Jones	1.3	0.85	1.17	1.05	0.88		1.1	
Winters		0.55	0.7	0.8				
Harrison		0.8	0.68	0.76	0.72	0.52	0.75	
Colony			0.8	0.82	0.9	0.68		
Bob Smith		0.65	0.51	0.51	0.35	0.37	0.42	
N.P.		1	0.58	0.67	1.1	0.84	0.66	0.42
Larrison		0.43	0.36	0.27	0.53	0.58	0.31	
Colony (Coplen)		0.81	0.81	0.82	0.67	0.8	0.63	
Wood		0.5	0.57	0.52	0.24	0.38	0.35	
W.F. Colony					0.38	0.6	0.51	
Barnes		0.63	0.45	0.34	0.62	0.43	0.46	
Mud		0.58	0.56	0.54	0.56	0.49	0.62	
Finnegan		0.42	0.45	0.63	0.49	0.43	0.66	
Cronin		0.39						
Prairie Lane								
W.F. Trumpeter		0.39	0.43	0.36	0.27	0.32	0.4	
Kennedy		0.27	0.34	0.3	0.39	0.25	0.28	
Klahowya		0.51	0.61	0.48	0.43	0.33	0.41	0.41
Pringle		0.67	0.66	0.64	0.43	0.6	0.35	
Turner		0.79	0.78	0.62	0.53	0.64	0.45	
E.F. Nookachamps				1.67	1.67	1.17	1.3	
trib. To Lake					0.37	0.35	0.46	0.36
0264 trib. To Lake						0.81	1.06	0.9
Morgan							0.72	0.74

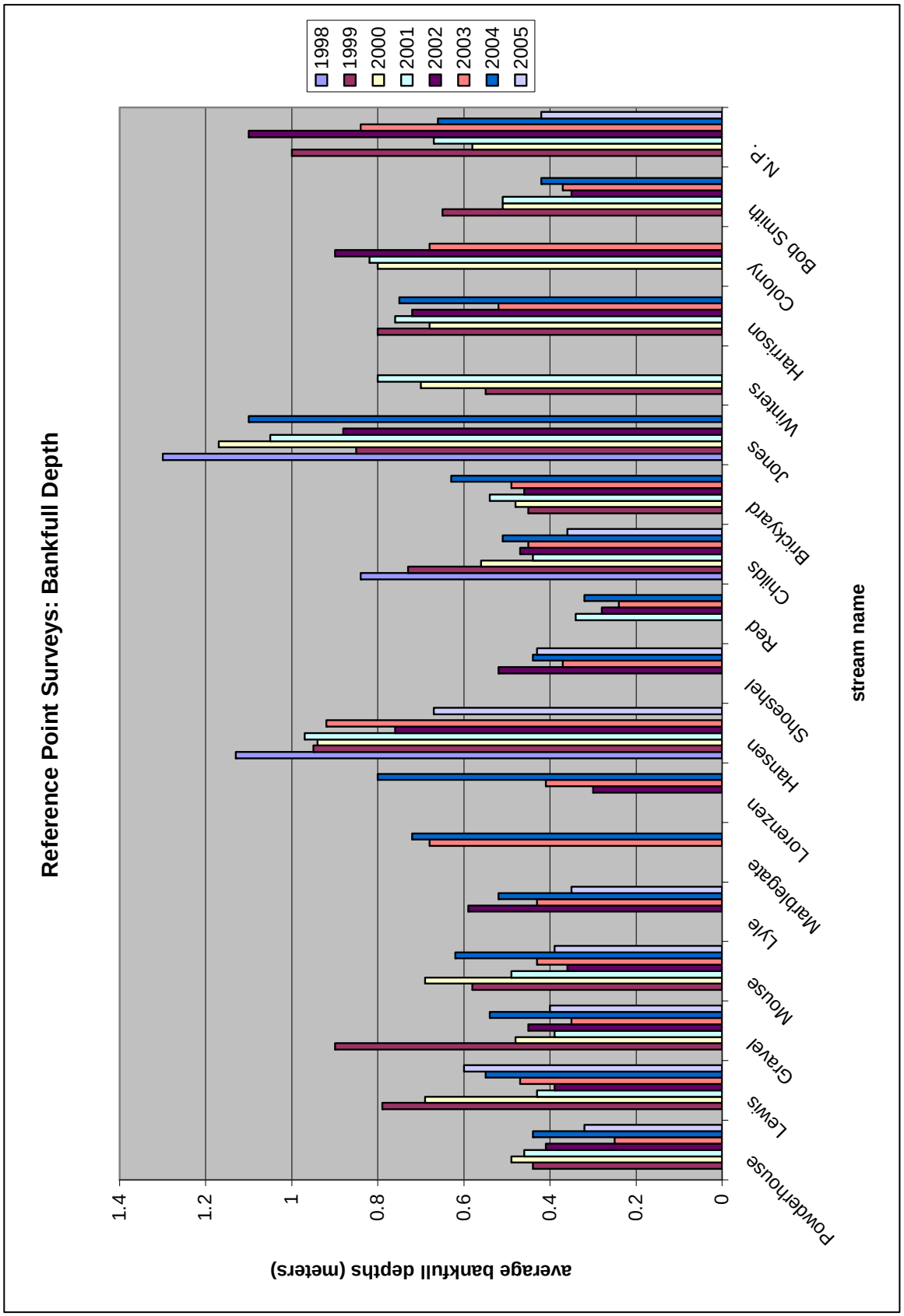

Figure 8A. Average of Maximum Bankfull Depths for SFEG project streams.

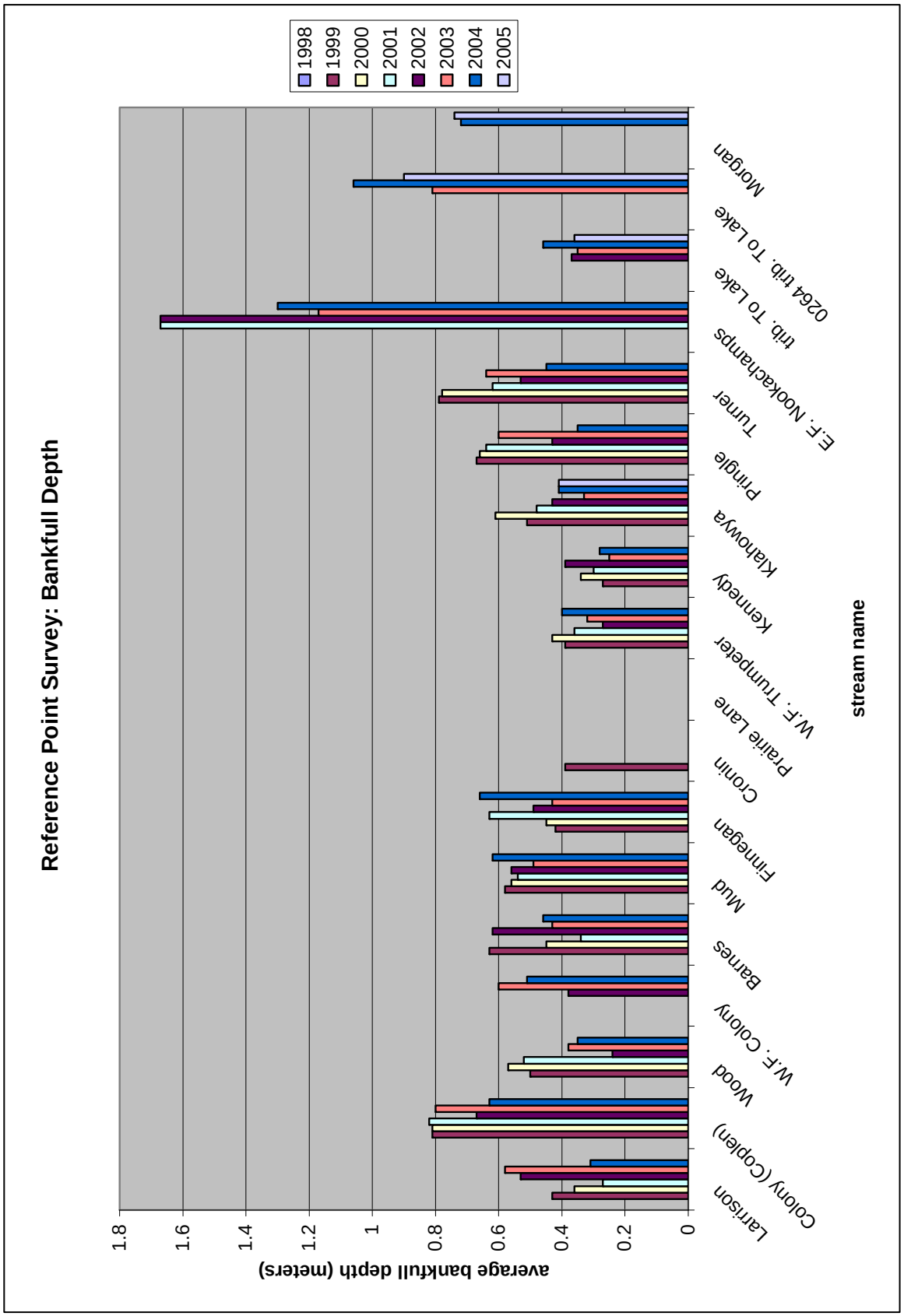

Figure 8B. Average of Maximum Bankfull Depths for SFEG project streams.

Spawning Habitat Availability Survey (SHA):

Most SFEG project sites have suitable amount of spawnable substrate available for returning salmonids, but there are a few cases where SFEG has added spawning gravel to a site that has little to none.

For example, Brickyard Creek had no spawnable habitat within the project site, before the restoration began in 1999. In the summer of 1999, 30 cubic yards of washed rock spawning gravel was placed in three different stretches of the project reach. That same summer 24% of the project reach was classified as spawnable for returning salmon. Unfortunately, no salmon returned the first winter to use the project site. The next winter, 14 coho redds were recorded at the project site. The 24% spawnable gravel that existed a year before had been diminished to 11% spawnable gravel before the 2000-01 return. The 14 redds that were observed occupied most of the 11% gravel that was classified as spawnable. In 2001, 15% of the substrate in Brickyard Creek was considered spawnable, and no spawning habitat was lost over the mild winter. The most current sampling was conducted in 2004 showing 8% spawnable gravel.

If sediment continues to move downstream in Brickyard Creek at the rate it has in the past, the spawnable habitat at this site will continue to become unavailable for the returning adults each year. More spawning gravel could be placed in Brickyard Creek to provide adequate spawning habitat in the future. It might be a band aid approach, but it might last a while too. SFEG thought the gravel we put in originally would quickly "go away", but it continues to provide spawning habitat seven years later.

Other sites where spawning gravel was added include Powderhouse Creek, Gravel Creek, and a small portion of Harrison Creek and upper Colony Creek.

Results for SHA surveys are summarized in table 76 and figures 8A and 8B.

Table 76. Percent spawnable gravel

Stream name	1998	1999	2000	2001	2002	2003	2004	2005
Powderhouse		51	57	28	67	67	67	78
Lewis		56	52	18	52	53	28	60
Gravel		75	55	45	74	85	46	63
Mouse		66	66	65	77	82	59	62
Marblegate						86	42	
Lyle					71	64	66	84
Lorenzen					18	0	0	
Hansen	77	53	80	71	72	77	74	46
Shoeshel					57	63	58	73
Red				45	58	88	77	
Childs	69	51	70	61	49	80	71	69
Brickyard		24	11	15	9	12	8	
Jones	74	63	64	66	64		80	
Winters		45	35	24				
Harrison		13	5	14	8	10	8	
Colony			10	1	2	0		
Bob Smith		30	44	48	53	54	53	
N.P.		59	42	18	43	41	34	46
Larrison		67	58	39	55	46	48	
Colony (Copeland's)	78	62	66	82	57	49	50	
Wood		69	44	41	23	6	22	
W.F. Colony					83	60	57	
Barnes		58	60	59	55	56	72	
Mud		58	62	57	68	71	79	
Finnegan		100	60	42	28	76	30	
Cronin		70						
Prairie Lane	23	23						
W.F. Trumpeter		49	51	51	56	69	50	
Kennedy		62	57	44	29	35	54	
Klahowya		69	67	75	70	59	63	75
Pringle		42	48	53	73	43	83	
Turner		46	58	65	67	78	68	
E.F. Nookachamps				28	40	42	47	
trib. To Lake					12	0	13	0
0264 trib. To Lake						29	45	20
Morgan							26	29

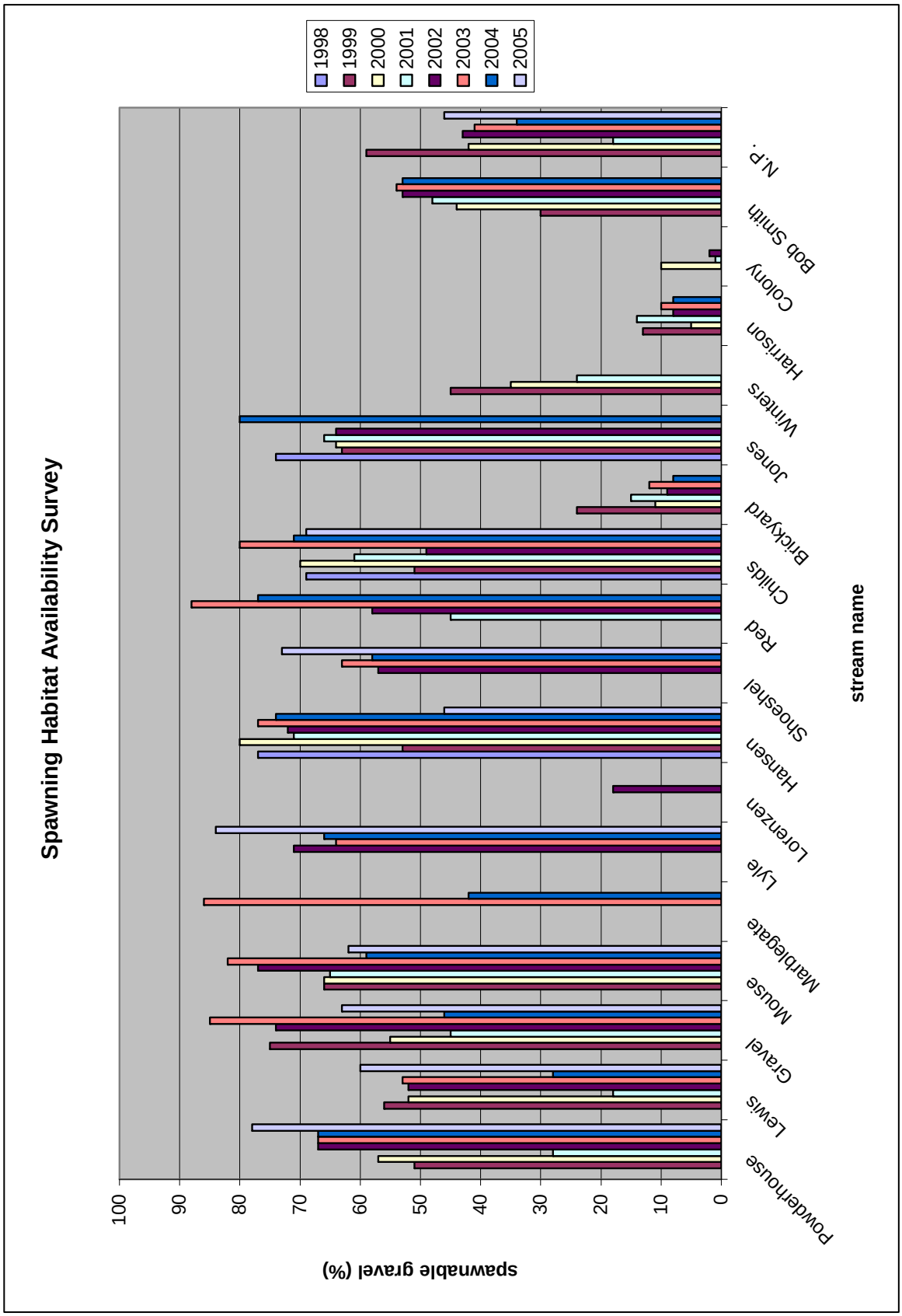

Figure 9A. Percent spawnable gravel for SFEG project streams

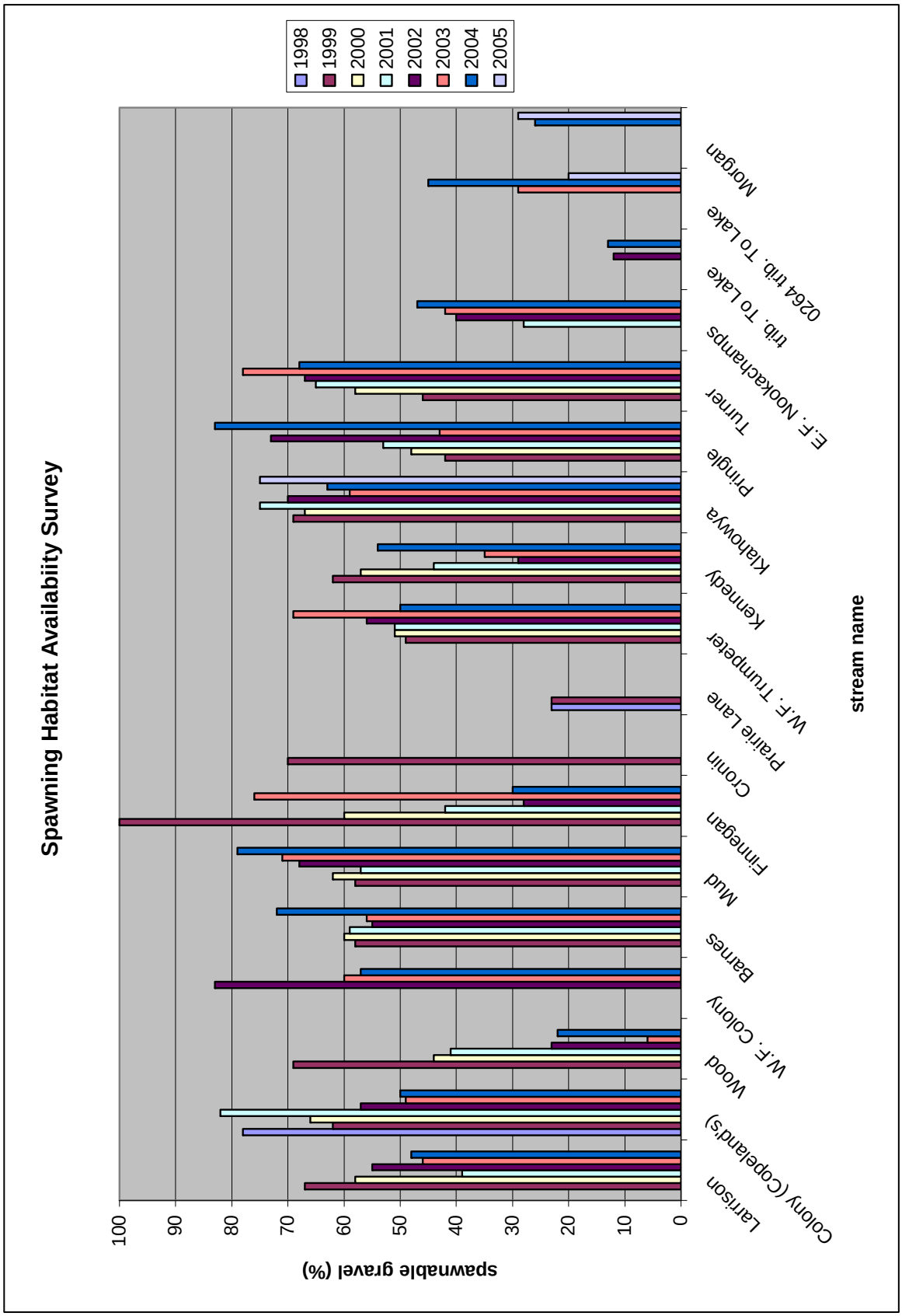

Figure 9B. Percent spawnable gravel for SFEG project streams

Spawning Surveys
Spawning survey totals, including live salmonid counts, carcass counts, and redd counts, are presented in Table 77.

The primary purpose of spawning surveys is to assess salmonid utilization upstream of fish barrier removal projects. The following summarizes spawning survey results for fish passage enhancement projects implemented between 1997 and 2005. Surveys were not conducted for passage projects completed previous to 1997, though SFEG has been removing fish passage barriers since 1991, having restored access to 54 miles of upstream salmon habitat.

During 1998-99 spawning surveys, a total of 616 live coho, and 2 live steelhead were observed in streams that now provided access to habitat above six previous fish barriers.

During 1999-00 spawning surveys, a total of 373 live coho had access to habitat above nine previous fish barriers.

In 2000-01, a total of 142 live coho and were observed in stream that now had access above ten previous fish barriers. Additional funds resulted in an expanded survey season during 2000-01. At that time the following additional species were observed; one live steelhead, two live cutthroat, and one live kokanee.

In 2001-02, a total of 3,767 live coho, 664 coho redds, 15 live steelhead, and 10 live cutthroat had access above 15 previous fish barriers. Nine live chinook, 11 live chum,; 2,915 live pinks had access above the Alder Creek fish passage project.

During 2002-03 spawning surveys, a total of 590 live coho, and three live cutthroat had access to the habitat above the same fifteen previous fish barriers of a year ago. One chinook redd, 83 live chum, and 21 chum carcasses were also recorded in Alder Creek.

In the 2003-04 spawning season, a total of 18 chinook, 562 chum, 1,456 coho, 4,925 pink, and 9 cutthroat were observed in streams that now provide access above 16 previous fish passage barriers.

During the winter of 2004-05, a total of 7 chinook, 681 chum, 918 coho, and 15 cutthroat were observed in streams that now have access above 16 previous fish barriers.

In 2005-06, a total of 2 chinook, 32 chum, 173 coho, 1,861 pink, and 12 cutthroat were observed in streams that now have access to habitat above 17 previous fish barriers.

Spawning surveys are also used to track salmonid use for stream restoration projects which utilize large woody debris (LWD) to enhance instream habitat. In 2000-01, GIS and GPS mapping technology was used to calculate and compare the number of redds directly related to large woody debris structures at these project site (see Findings by Project section). 30% of the total number of redds were mapped outside project site boundaries, 14% of these being located within 3 meters of natural LWD. Seventy percent of the total number of redds were

mapped within project site boundaries, 66% of these being located within 3 meters of installed LWD structures.

Table 77. Spawning Survey Totals for 1998-2006

		1999-1998			1999-2000			2000-2001			2001-2002			2002-2003			2003-2004			2004-2005			2005-06		
Site	**Species**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**
Hansen Creek	Chinook	0	0	0	0	0	0	29	13	19	0	4	0	0	0	0	1	4	0	11	2	9	2	0	1
	Chum	2	0	1	0	0	0	0	0	0	3	8	1	24	16	27	31	11	21	0	0	0	5	2	0
	Coho	46	37	48	46	21	25	195	118	166	118	93	73	309	120	139	402	157	208	170	96	105	28	22	28
	Pink				468	137	238				1831	265	407				1162	335	573				243	39	114
	Steelhead							1	0	14	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0
	Cutthroat							0	0	4	2	1	0	14	1	8	2	0	0	3	2	0	0	0	0
	Rainbow										3	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Brickyard	Coho	0	2	0	0	0	0	4	9	14	15	6	34	0	0	7	6	17	5	2	1	4	0	0	0
Red Creek	Coho							11	4	4	69	32	41	0	0	0									
Childs Creek	Coho	7	2	3	0	0	0	153	15	69	288	7	71	8	0	0	308	21	57	270	37	92	0	0	0
	Steelhead							4	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cutthroat							5	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rainbow							8	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jones Creek	Chinook	0	0	0	5	12	7	0	15	7	10	13	2	0	0	0	0	2	0	6	3	6	9	0	3
	Chum	29	13	6	164	58	56	0	3	11	351	151	60	125	195	55	655	273	220	516	240	173	65	47	37
	Coho	118	22	35	113	17	31	856	238	370	975	108	203	621	194	280	1617	187	372	1168	117	389	268	8	105
	Pink				1671	1571	464				2775	1088	654				1629	807	455				647	162	238
	Steelhead							0	0	16	1	0	7	0	0	0	0	0	2	2	0	1	0	0	0
	Cutthroat							4	0	7	8	0	0	54	0	5	2	0	2	5	0	1	0	0	0
	Rainbow										1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Atlantic																0	1	0	0	1	0	0	0	0
Alder Creek	Chinook										9	3	1	0	1	1	18	8	9	7	5	15	2	1	0
	Chum										11	6	8	83	37	21	266	66	99	654	250	164	32	10	11
	Coho										142	52	31	195	47	71	525	49	161	60	25	33	13	3	5
	Pink										2915	1335	187				4825	1327	1057				1861	770	613
	Steelhead										8	1	4	0	0	0	0	1	0	0	0	0	0	0	0
	Cutthroat										2	1	0	1	1	0	3	0	1	11	0	0	9	0	0
Shoeshel Creek	Coho										59	42	41	0	0	0	3	9	5	25	13	5	0	0	0
	Cutthroat										2	1	0	1	1	0	0	0	1	1	0	0	0	0	0
Lorenzan Creek	Coho							0	0	0	7	7	1	2	1	0	1	3	5	43	21	12	8	0	2
	Steelhead										1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Trumpeter	Coho	7	11	21	10	5	25	7	3	15	14	4	18	32	18	23	18	12	7	37	22	14	0	0	0
	Chum													0	1	1	0	0	0	1	1	0	0	0	0
Kennedy Creek	Coho				5	5	3	5	3	3	13	9	3	17	4	0	27	9	15	21	8	12	0	0	0
	Steelhead										3	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site	Species	1998-1999			1999-2000			2000-2001			2001-2002			2002-2003			2003-2004			2004-2005			2005-06		
		liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red
Mundt Creek	Chinook				0	0	0	1	0	0	8	2	4	0	0	0	0	3	0	2	1	1			
	Chum				35	21	5	0	0	0	50	19	18	12	9	4	121	23	27	24	7	9			
	Coho				20	5	9	27	26	25	549	193	137	230	98	99	214	105	76	208	33	57			
	Pink				0	0	0				44	1	4				51	31	20						
	Steelhead													0	0	0	0	0	0	8	0	0			
	Cutthroat													3	0	3	0	0	0	0	0	0			
Turner Creek	Chum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	2	0	0	0			
	Coho	29	19	25	2	5	4	25	16	32	189	73	154	36	22	13	65	15	91	84	13	100			
	Steelhead							1	0	6	0	0	0	0	0	0	0	0	0	0	0	0			
Pringle Creek	Chum	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0			
	Coho	26	18	7	2	2	0	0	2	5	96	29	64	38	15	26	32	8	49	18	5	37			
	Steelhead	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
G.C. Creek	Coho	2	7	2	7	3	2	2	3	5	59	32	21	10	8	0	58	24	34	105	96	53	0	0	0
	Cutthroat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Klahowya Creek	Coho	36	0	11	18	1	14	0	0	0	262	28	28	0	0	0	0	0	0	1	0	0	1	1	0
	Steelhead	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cutthroat	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0
Lake Creek 0264	Coho																183	17	29	176	27	58	5	0	2
	Cutthroat																0	0	0	1	0	0	2	0	0
Lake Cr. Trib.	Coho										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Fork Nookachamps Creek	Chinook													0	2	0	0	0	0	0	2	0			
	Chum													1	5	0	0	12	0	0	1	0			
	Coho													0	2	0	3	81	0	3	3	0			
	Steelhead																			0	1	0			
	Cutthroat													0	3	0	0	0	0	0	2	0			
Winters Creek	Coho	71	41	27	49	9	11	69	35	9	400	36	89												
	Steelhead							0	1	0	0	1	0												
Gravel Creek	Coho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lewis Creek	Coho	1	0	0	0	0	0	0	0	0	0	0	0	12	1	1	0	0	0	0	0	0	0	0	0
Mouse Creek	Coho	128	56	18	86	9	41	30	8	15	224	65	53	224	26	119	330	55	86	373	119	221	124	2	48
	Steelhead							0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
	Cutthroat							0	0	0	4	0	0	0	0	0	5	1	0	0	0	0	0	0	0
Powderhouse Creek	Coho	4	0	1	14	0	6	0	1	2	102	30	13	60	1	27	0	0	0	50	2	26	0	0	0
	Cutthroat																			3	0	0	0	0	0

Site	Species	1998-1999			1999-2000			2000-2001			2001-2002			2002-2003			2003-2004			2004-2005			2005-06		
		liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red	liv	car	red
Suiattle Slough	Coho																						18	0	21
Lyle Creek	Chum							0	0	0	60	10	16				26	1	10	214	142	103	8	4	2
	Coho							19	5	33	68	22	27				194	23	90	146	14	55	4	4	1
	Steelhead							1	0	4	10	4	16				11	0	6	3	0	2	3	0	0
	Cutthroat							0	0	1	5	1	0				0	0	0	3	0	0	0	0	0
Marblegate Slough	Chum																294	225	107	26	27	26	31	0	0
	Coho																127	130	44	30	24	31	0	0	0
	Pink																10	38	21				0	0	0
	Steelhead																0	1	0	0	0	0	0	0	0
Aldon Creek	Chinook							0	0	0							0	0	0	1	0	1	0	0	0
	Chum							0	0	0							0	0	0	0	4	0	0	0	0
	Coho							14	2	16							127	54	56	109	28	68	31	0	15
	Pink																2	19	8				0	0	0
	Steelhead							0	0	0							0	0	0	0	1	0	0	0	0
Morgan Creek	Coho																			20	38	6	1	1	0
	Steelhead																			0	1	0			
Larrison Creek	Coho	49	20	27	0	3	6	0	0	0	81	38	9	0	0	0	0	0	0	0	0	0			
	Steelhead										1	0	0	0	0	0	0	0	0	0	0	0			
N.P. Creek	Coho	504	23	64	331	20	69	111	64	87	2933	402	461	316	135	74	192	21	55	61	35	37	0	0	0
	Steelhead							1	0	12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cutthroat							2	0	11	8	1	0	1	0	0	1	0	0	0	0	0	0	0	0
Thunder Creek	Chinook																			32	28	23			
	Chum																			100	40	24			
	Coho																			293	47	99			
Mud Creek	Chinook							1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coho				35	4	14	14	4	6	137	6	14	13	2	0	12	0	0	27	3	6	5	0	0
	Kokanee				68	1	32	4	0	0	4	3	0	4	0	0	0	0	0	13	0	6	0	0	0
	Steelhead										4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barnes Creek	Coho				9	1	7	15	3	8	103	11	8	5	0	0	5	0	0	26	5	6	4	0	0
	Kokanee										1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Steelhead										2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cutthroat													1	0	0	0	0	0	0	0	0	0	0	0
Finnegan Creek	Coho				6	2	3	0	3	0	31	5	3	5	7	0	5	1	0	47	6	6			
	Kokanee							1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Steelhead										1	0	0	0	0	0	0	0	0	0	0	0			

		1998-1999			1999-2000			2000-2001			2001-2002			2002-2003			2003-2004			2004-2005			2005-06		
Site	**Species**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**	**liv**	**car**	**red**
Wood Creek	Coho				2	0	0	0	0	0	25	0	3	0	0	0	5	0	2	0	0	0	0	0	0
West Colony	Coho										5	17	12	0	0	0	3	0	0	0	0	0			
Colony Creek	Chinook	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0			
	Chum	48	53	1	24	17	7	9	4	0	40	26	10	16	42	0	24	19	11	31	13	6			
	Coho	2	4	1	6	3	2	44	7	3	3	0	0	4	15	0	15	16	3	3	0	8			
Harrison Creek	Chum	90	197	3	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0			
	Coho	0	14	0	5	5	4	10	0	0	5	0	3	0	0	0	0	0	0	0	0	0			
TOTALS	Chinook	0	0	0	5	12	7	31	28	27	27	22	7	0	5	1	19	17	9	59	41	55	13	1	4
	Chum	169	263	12	230	97	62	9	7	10	475	194	103	261	305	108	1422	639	497	1566	726	505	106	61	56
	Coho	1030	276	280	764	120	240	1611	569	887	6812	1262	1554	2137	716	869	4461	1014	1433	3576	816	1540	517	37	232
	Pink	0	0	0	2139	1708	697	0	0	0	7565	2689	1252	0	0	0	7679	2557	2134	0	0	0	1751	971	965
	Kokanee	0	0	0	68	1	32	5	0	0	5	3	0	4	0	0	0	0	0	13	0	6	0	0	0
	Steelhead	2	0	0	0	0	0	7	1	51	31	7	38	0	0	0	11	2	8	13	3	3	3	0	0
	Cutthroat							6	3	29	31	4	0	74	5	16	12	1	5	29	4	1	12	0	0
	Rainbow										5	0	1	0	0	0	0	0	0	2	0	0	0	0	0
	Atlantic																0	1	0	0	1	0	0	0	0

Vegetation Monitoring

Results from vegetation monitoring data are currently being analyzed. Data was not ready for inclusion in the report at time of printing.

Reports in Access database include: Average Height of Stressed plants, Average height of Healthy Plants,

Macroinvertebrate Monitoring

SFEG continues to work with the U.S. Forest Service to publish the macroinvertebrate monitoring results with the other results from the Skagit River Stewards program. The U.S. Forest Service is working with the National Park Service to develop an index of biological integrity specific to the Skagit Watershed. Several more years of data is needed to complete this index. Once the index is completed, data will be published detailing the health of restoration sites over the years and in comparison to other disturbed and pristine sites. SFEG has worked with the U.S. Forest Service to compare data from sampled streams, however this analysis just strengthens the need for an index specific to the Skagit Watershed.

Discussion

Instream Monitoring

Structure Monitoring

Instream structures consist of large woody debris and/or rock structures. Large woody debris (LWD) consists of large stumps and logs. Instream structures are placed for a variety of purposes such as bank stabilization, gravel retention, interim replacement of LWD, spawning habitat, holding habitat, temperature moderation, channel narrowing, and sometimes to enhance flood plain processes. Oftentimes the objective is to initiate pool formation or to trap sediment for spawning beds.

Log deflectors may be used to create scour pools or promote meander development. V-weirs may be used to promote scour pools, gravel retention, and provide juvenile rearing habitat. Complex woody debris and logjams are used to enhance adult and juvenile cover. Root wads can be used for cover and rearing as well. Installation of structures in the streams helps to provide a place for salmon to spawn (rifflecrest - outlet of pool), and a place for the salmon to rest or take cover (pools and flow deflectors).

When considering how the structures modify the stream channel, SFEG has found that post project average bankfull widths and depths are decreasing on most project sites. The structures have made the banks more defined and created more complexity and meandering to the stream. Structures that develop deeper pools are suspected of helping to cool the stream temperature and create more diversity in the entire aquatic ecosystem. SFEG has no temperature data.

Reference Point Survey

Measurement of the average bankfull width and depth at reference points helps to determine physical changes to the stream. SFEG uses reference point surveys to measure whether the channel is getting wider or narrower, shallower or deeper. The bed load coming down each stream may affect channel width. For example, streams with a higher bed load have developed a wider and shallower channel. After collecting and analyzing the data we have discovered that the bankfull depth at the project sites are still deep enough to maintain spawning conditions and cool water temperature.

Another type of data that is collected during the reference point survey is the percent canopy closure over the stream. Many project sites do not have an existing canopy when projects are implemented. This data helps to measure when and how fast the stream is shaded from the revegetation of the site. Some sites have an existing canopy, but it is still important to monitor the closure of the canopy from year to year. Sometimes the larger trees will fall creating an open space in the canopy where there was not the year before.

Channel configuration may have implications on temperature moderation. A recommendation would be to track temperature, pH, conductivity, and other water quality parameters. If the stream channel continues to become wider and shallower SFEG could then determine if the temperature is increasing as well.

Spawning Habitat Availability (SHA):

The amount of spawning habitat available for returning salmonids is important to their success. The spawning habitat availability survey determines how much of the stream channel is actually spawnable for returning salmonids. By collecting this data SFEG can document what works best to create prime spawning conditions for salmon. SHA surveys have showed that LWD and other instream structures play a significant role in the sorting and placing of streambed materials. These structures help sort the gravel from the fine sediment, and maintain clean spawnable gravel.

SHA surveys help SFEG to understand spawning potential at restoration sites by examining the amount of spawnable habitat in relation to the number of returning salmon. SHA surveys help to determine whether current salmon runs are utilizing available gravel, or whether there is potential for more salmonid use in a particular reach, or for additional gravel.

Juvenile Presence Surveys and Habitat Unit Surveys:

Juvenile Presence surveys and Habitat Unit surveys are new components of SFEG's monitoring program. Snorkel surveys, electrofishing, and beach seining have all been performed by staff on several SFEG project streams. This juvenile survey data has not yet been entered into SFEG's database, therefore, it was not included in this report. Habitat Unit surveys are now part of new SFEG monitoring protocol but have not yet been conducted.

Spawning Surveys

Spawning surveys help to address validation monitoring. If the stream restoration project included fixing a fish barrier (i.e. a perched culvert) to allow fish access, it is important to know how many returning spawners are able to migrate upstream of the new crossing. If the

restoration project included placement of large woody debris to enhance salmon habitat, SFEG wants to document how many returning salmon use the enhanced project site.

Redd counts are an important component and form the base of the typical spawning survey. From information gathered, fish utilization related to placement of structures provides feedback for future planning and design; as well indication whether there is a sufficient fish population to continue restoration.

Spawning surveys cannot be used alone to determine project success or failure, due to extrinsic factors. Observation and understanding of fish utilization helps to direct restoration efforts and provide incentive to conduct and excel at stream restoration. Spawner surveys provide an indirect measure of project success where various restoration activities—fish passage, instream structure placement, sediment control, riparian restoration, etc—culminate to enhance habitat functions for salmon and get us closer to asking the question whether the fish respond directly to enhancement activities.

In 1998 Skagit Fisheries began spawning surveys. Throughout the years there has been moderate variation in the number of returning salmon to the monitored streams. It is hard to conclude what the cause of these variations are, but there is one consistent factor, precipitation. The amount of rain has varying effects on salmon escapement that depends on the size of the stream and the spawning period of the salmon species. In this last year (2002-03) chinook were hard hit by the low stream levels because they run so early in the fall when the rain had not started. In the winter of 2001-02 there were unusually large numbers of all species on most of the streams due to the heavy rainfall during the entirety of the winter. This winter there was also very few or no salmon on the smaller streams (Shoeshell, Klahowya) due to the fact that there was so little water in the streams throughout the winter. On the other hand, more fish spawned in the bigger streams (Hansen, Alder) when the water got high enough for them to be used. Another detrimental effect of the low rainfall, that is not monitored, is the unknown number of eggs that dried up during the low water periods. On the reverse, lower water means less heavy flow events that may scour out redds. Total counts for SFEG streams for 2002-03 were 2137 live coho and 261 live chum which turns out to be comparable with all other monitored years, excluding 2001-02. There was a record number of cutthroat seen this year at 74 compared to a total of 37 in the last four years combined. The low water levels in the early part of the winter had a negative effect on Chinook spawning and for some of the smaller streams, but it's hard to say how much the numbers would have varied with more rain.

Vegetation Monitoring

The goal of vegetation monitoring is to understand the success of revegetation activities relative to species planted, replaced, and otherwise colonizing restoration sites. SFEG's monitoring is typically concerned with survival and establishment practices as well as looking at presence of invasive species.

With the revised vegetation monitoring methods, SFEG will be able to look more specifically at survival, percent cover, and canopy cover. The methodology involves a combination of direct count, indirect count, belt transect plot sampling, permanent plot survival and cover

sampling, and simple growth sampling throughout measurement of height that will depend on the age and establishment of the project. For example, initial plant survival will be assessed at new and younger projects, whereas canopy close would be assessed at older more established project that are no longer being planted.

Macroinvertebrate Monitoring

Macroinvertebrate samples collected at SFEG restoration sites are being used to track the health of streams at restoration sites. The information is also being used to help develop a biomonitoring index for the Skagit basin with the National Park Service. The biomonitoring index project is a unique project the North Cascades National Park is undertaking to establish a community metrics for determining stream health specifically in the Skagit watershed. The current index of biological integrity used for streams in western Washington was developed in less pristine watersheds than exist in the Skagit basin. Due to the Skagit River's unique protected status through the National Park, a biomonitoring index for the Skagit basin must be able to better differentiate high quality streams from pristine conditions. The Park's biomonitoring project intends to refine the current index to specifically meet the needs of the Skagit basin. Development of this index will allow agencies and organizations to better assess the health of streams throughout the Skagit watershed. This improved assessment ability will help determine effectiveness of restoration projects after completion.

Final Note

The Skagit Fisheries Enhancement Group has collected data at restoration sites since 1998. This information has been very useful for both establishing site specific habitat assessments and to inform and improve SFEG's methodologies. We have prioritized projects and improved our restoration techniques for implementation of current projects. Although this information has proven useful, the amount of data is insufficient to draw confident assumptions. More data is needed in order to solidify some of the premature findings included in this report.

REFERENCES

Natural Resources Conservation Service (NRCS). 1991. Soil Survey of Skagit County, Washington. USDA-Soil Conservation Service in cooperation with Washington State Dept. of Natural Resources and Washington State University, Agriculture Research Center.

Pleus, A. Schuett-Hames, D., and Bullchild, L. Timber Fish and Wildlife. Habitat Unit Survey Method Manuel. Northwest Indian Fisheries Commission. June 1999.

Pleus, A, Schuett-Hames, D. Timber Fish and Wildlife. Reference Point Survey Method Manual. Northwest Indian Fisheries Commission. May 1998.

Schuett-Hames, D, Pleus, A, Bullchild, L, and Hall, S. Ambient Monitoring Program Manual. Northwest Indian Fisheries Commission. August 1994.

Schuett-Hames, D, Pleus, A. Timber Fish and Wildlife. Spawning Habitat Availability Level 1 Survey (SHA). Northwest Indian Fisheries Commission. July 1996.

APPENDIX A
Monitoring Protocols

- SFEG Structure Monitoring, Data Forms and Definitions Sheet
- Timber Fish and Wildlife Reference Point Survey Forms, 2D, 2H,
- Timber Fish and Wildlife Spawning Habitat Availability Forms: 9H, 9.1D, and Criteria & Code Sheet
- SFEG Spawning Survey Data Sheets
- Timber Fish and Wildlife Protocols for Pool Development

APPENDIX B

Vegetation Plot Selection

In the office delineate the project boundaries on a map or orthophoto. This will allow you to identify the locations of transects. Establish separate transects for left bank (LB) and right bank (RB); if the project area is segmented then segment transects. Locating transects and plots in the office helps to remove bias.

In order to achieve adequate coverage plots must cover more than 10% of the project area; a coverage of 20-30% would be ideal. In order to achieve thorough coverage, transects should extend through diverse habitat types. If transects don't allow for adequate and thorough plot coverage then consider revising sampling design during initial design phase.

If the distance from the edge of the bank to the outer project boundary is less than 80 feet then establish a single transect parallel to the waterway in the middle of the project area. If the distance from the edge of the bank to the outer project boundary is greater than 80 feet then divide the distance by three and establish transects at 1/3 intervals (i.e. if distance = 115ft. then 115/3 = 38; establish transects at 38ft and 76ft). One may also achieve adequate coverage using 37' radius plots if the distance is greater than 80 feet; this will have to be assessed on a project by project basis during sampling design phase.

If meanders prevent the placement of a straight transect through the project area then delineate the average high water mark and bend transects according to this delineation. Make sure that the distances from the transect to the average high water mark stays consistent. Placing additional transects perpendicular to the main transect may also help to achieve adequate and thorough coverage; again this will be determined during the sampling design phase.

Once transects are laid out you can establish plots along these transects. The start point (SP) will be the point where the transect meets the project boundary. Location and directions to the start point should be provided to sampling technicians. Establish the start point by sticking a pin flag in the ground. Use pin flags at first to mark SP and all plot centers; after they are located and marked, and no modifications need to be made to the plot layout then replace pin flags with rebar. Use 3.5 ft long pieces of rebar and hammer them into the ground. Flag them and write the plot number, transect number, and any other pertinent information on the flagging. Putting a piece of orange painted PVC over the rebar may help to locate this point and may prevent damage to mowers/ maintenance equipment. If using a GPS unit record the reading at the start point location. Also locate a bearing tree or other permanent benchmark. Mark tree/benchmark with flagging and record the distance and compass bearing from it to the start point. Describe the age and appearance of bearing tree/benchmark. Use a bearing tree/ benchmark that will remain where it is for ten years or more. Record all information on SFEG forms: Plot Placement Form.

Once start point is established you are ready to begin plot placement. The specified distance from plot center to plot center for 12' radius plots is 44.46 (45) feet and for 37' radius plots it

is 140.46 (140) feet. If establishing 12' radius plots, the first plot can go anywhere between 12 and 45 feet, for 37' plots anywhere from 37 to 140 feet. In the office determine this location using a random number generator or other method that preserves randomness, or set first plot at 45 feet for 12' plots and 140' for 37' plots. From plot center measure the specified distance along a predetermined transect and install the next plot center. Take a GPS reading at each plot center if possible.
If the plot overlaps another plot, crosses the waterway, lands on a cliff, extends outside the project boundary, etc. move it according to a predetermined method in an effort to preserve randomness and reduce bias.

One method is to move it along the transect 15ft. either towards the start point or away from the start point. Flip a coin: heads towards the start point tails away. If this doesn't solve the problem choose to move the plot 15ft. perpendicular to the transect. Flip a coin to determine which side to move it to. If this doesn't work choose to move the plot thirty feet in one of two opposite directions. Again flip a coin to decide which direction to move it.

If you move a plot do not move the next plot. i.e. if plot 1 is at 45 feet and you have to move plot 2, which would have been at 90 feet, then plot 3 will still be at 135 feet. Begin sampling after plots have been permanently established. Use a 12' or 37' rope tied to the rebar at plot center to determine extent of plot and to identify plants occurring in plot. Record all plantings occurring in plot on the data form- plants that fall on the border should be counted in if their roots are in the plot or if a majority of their basal area occupies the plot. If it is a 50/50 situation, with half in half out, then count every other plant of this type around the plot. Fill Plot/Plant Form out completely, measuring height, estimating % cover, shade, etc.

Once all data has been collected it is ready to be entered into the Microsoft Access Database named Veg Monitoring.mdb. It's file path is C:\\VegMonitoring\VegDatabase. There is a document named Information about veg monitoring db linked to a table in Access and also available at the file path above.

Permanent vs. Temporary Plots
Plots will be permanent. The principal advantage of using permanent instead of temporary plots is that the statistical tests for detecting change from one time period to the next in permanent plots are much more powerful than the tests used on temporary plots.

Measurements of Circular Plots

Radius(ft.)	Feet from plot center to plot center		Acreage	Area(sq ft)
11.78 (12')	44.46 (45')	1/100	435.6	
37.23 (37')	140.46 (140')		1/10	4356.0

APPENDIX C

SFEG Vegetation Monitoring Data Sheets.