Exxon Valdez Oil Spill
Restoration Project Annual Report

Eastern Prince William Sound Wildstock Salmon Habitat Restoration

Restoration Project 97220
Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this annual report.

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Study History: This report covers the second year of the Eastern Prince William Sound Wildstock Salmon Habitat Restoration project. The first year's activities were reported in the 96220 Annual Report under the same title. The 96220 Annual Report covers the stream surveys that led to the selection of Plateau Creek for restoration work in 1997. This report covers the activities in 1997.

Abstract: Habitat surveys and a limiting factors analysis indicated that coho salmon (*Oncorhynchus kisutch*) production in Plateau Creek in the Port Gravina area is most likely limited by the scarcity of suitable winter habitat. We built 12 instream habitat structures, creating approximately 211 sq m of additional winter habitat. Work was halted earlier than planned when an early run of pink salmon (*O. gorbuscha*) entered the system. Additional habitat may be needed to significantly increase production and provide an opportunity for subsistence harvest as intended.

Key Words: *Exxon Valdez*, habitat enhancement, habitat survey, coho salmon, *Oncorhynchus kisutch*, Prince William Sound.

Project Data: Data for 1997 consist of diagrams of the structures and the habitat that was created. The diagrams are included in the appendix of this report. *Custodian*: Ken Hodges, USDA Forest Service, Cordova Ranger District. P.O. Box 280 Cordova, AK 99574. (907) 424-7661.

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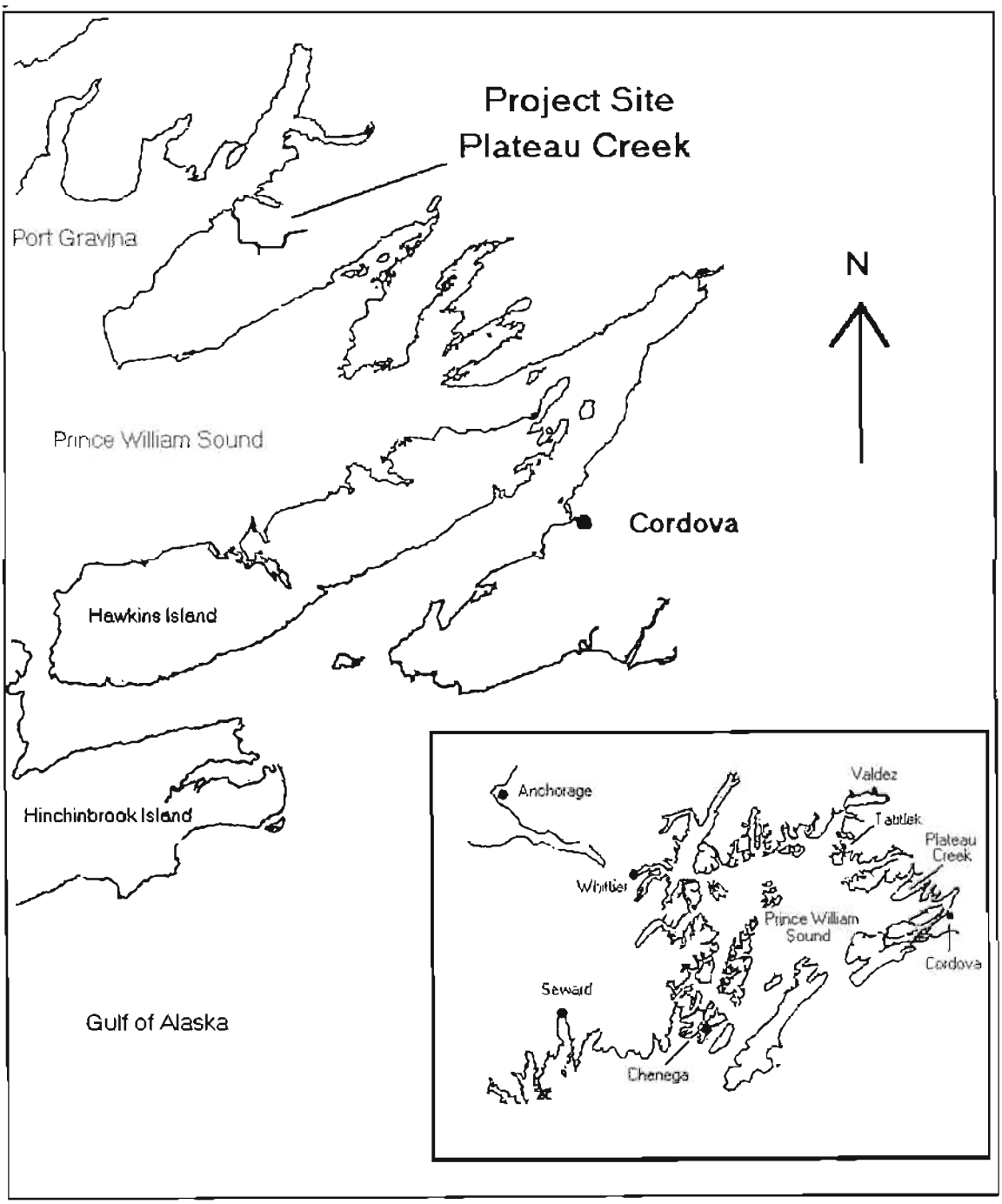
Table of Contents



Project Location: Plateau Creek, approximately 30 km northwest of Cordova.

Executive Summary

Following the *Exxon Valdez* oil spill, there was a substantial decrease in subsistence harvests in the Prince William Sound area. The Village of Eyak, working with the USDA Forest Service, proposed a wildstock salmon habitat restoration or enhancement project in the streams of eastern Prince William Sound. By improving habitat to restore or enhance salmon populations, additional subsistence opportunities would be provided. The project would also provide local youth with an opportunity to learn habitat enhancement techniques and participate in the management of the resources in the area.

In 1996, the results of habitat surveys and a limiting factors analysis indicated that coho salmon *(Oncorhynchus kisutch)* production in Plateau Creek was most likely limited by the scarcity of suitable winter habitat. Plateau Creek also provided the best opportunity for habitat enhancement because it is a fairly small system, making it more suitable for the construction of instream habitat structures. Instream structures have been used successfully in a number of projects to increase juvenile coho salmon habitat.

In 1997, 12 instream structures were built to increase winter habitat. The structures were designed to create low-velocity backwaters and deepen or maintain water levels in areas that may go dry during low-flow periods in winter. Logs, brush, and cobble were added to these areas to create more complex cover. Diagrams were drawn to document the habitat and changes over time. Construction was halted earlier than planned because a large, early run of pink salmon (*O. gorbuscha*) entered the system. Under the terms of our permit, we could not work in the stream when there was a possibility of disturbing spawning fish or their eggs. Spawning surveys were conducted in the beginning and middle of October, but inclement weather prevented later surveys.

The structures created approximately 211 sq m of winter habitat. Although this is fairly substantial for a small system, additional habitat may be required to produce enough fish for a limited subsistence harvest. No adult coho salmon were observed during the spawning surveys. Coho runs were unusually weak and late throughout the area in 1997, and it is possible that there were very few fish, which we simply did not see, or the run occurred after our surveys. Without this information we cannot tell if there are already surplus fish available for subsistence harvest.

In 1998, we intend to conduct population estimates of the number of juvenile fish utilizing the structures. Structure maintenance will be conducted as needed, and additional habitat work may be completed. Spawning surveys will also be conducted.

Introduction

Following the *Exxon Valdez* oil spill, there was a substantial decrease in subsistence harvests in the Prince William Sound area. The Village of Eyak, working with the USDA Forest Service, proposed a wildstock salmon habitat restoration or enhancement project for the streams of eastern Prince William Sound. By improving habitat to restore or enhance salmon populations, additional subsistence opportunities could be provided. The project would also provide local youth with an opportunity to learn habitat enhancement techniques and use their knowledge of the streams and fish for the management of their lands.

In 1996, a crew working through the USDA Forest Service conducted habitat inventories in 11 streams to determine the feasibility of salmon enhancement projects. Using the results of a habitat-based limiting factors analysis (Reeves et al. 1989), we concluded that Plateau Creek in the Port Gravina area offered the best opportunity for the enhancement of coho salmon *Oncorhynchus kisutch*, and that winter habitat was the limiting habitat factor in the system (see previous annual report, Hodges and Schmid 1997). We decided to concentrate our efforts on coho salmon, since this species is more highly valued than the other species of salmon present in the project area (pink salmon *O. gorbuscha* and chum salmon *O. keta*). Another consideration was that a number of successful coho salmon habitat improvement projects have been implemented using simple instream habitat structures (House and Boehne 1985, Nickelson et al. 1992, Crispin et al. 1993, House 1996).

In 1997, we built 12 structures designed to increase winter habitat for juvenile coho salmon. We had hoped to build more structures, but a large, early run of pink salmon prevented further work in the stream. The structures created approximately 211 sq m of winter habitat, but additional area may be needed to substantially increase the number of returning adults. Some modification of the existing structures or additional structure work is suggested for 1998 to increase the potential number of fish available for harvest.

1997 Objectives

1. Increase winter habitat to boost coho salmon production for additional subsistence opportunities.

2. Provide local youth with the opportunity to learn about habitat enhancement techniques and to use their knowledge of local conditions to help manage the resources.

3. Document winter habitat increase for future monitoring.

Methods

In our previous annual report (Hodges and Schmid 1997), we had used a habitat-based limiting factors analysis to determine that winter habitat was limiting coho salmon production in Plateau Creek (Reeves et al. 1989). In 1997, a five-person crew built 12 instream structures to provide winter habitat for juvenile coho salmon. The structures were designed to create complex cover habitat and protected areas with low water velocities. The structure designs were modeled after those in Crispin (1988), with logs, brush, and cobble added for additional cover and resting area, which are particularly important in winter (Bustard and Narver 1975, Taylor 1988, Nickelson et al. 1992). Log barbs pointing downstream created low-velocity backwaters. Log weirs spanning the channel were used to flood shallow inlets and maintain or increase depths in other habitat areas.

At each site, we drew diagrams of the structures and the surrounding area to document the amount of habitat created and enable us to detect any changes over time (Appendix 1).Using the amount of new winter habitat and the production factors in the limiting factors analysis, we calculated the number of smolts this habitat could produce. We then used smolt-to-adult survival rates from Groot and Margolis (1991) and Bradford (1995) to estimate the number of returning adults the habitat might produce. We performed this calculation to get a rough idea of how much more habitat we may need to create in the future, since our work was halted earlier than expected by the arrival of the pink salmon.

We conducted spawning surveys on October 1 and 16, 1997, but no adult coho salmon were seen. We were unable to conduct other surveys due to inclement weather. We monitored the structures on these dates and looked for juvenile coho at the sites. We did not attempt to electroshock the habitat or conduct population estimates.

Methods for work in 1998

In the early spring of 1998, we will electroshock the habitat created by the structures to estimate the number of juvenile fish using the sites for overwintering. The population will be estimated using removal-depletion methods described by Platts et al. (1983). We will have to assume that immigration or emigration since winter is minimal. This may be a large assumption, but access to the site in winter is difficult and unsafe with the variable weather conditions in the area. Estimating the populations in the spring may give a better indication of the number of fish that actually survived the winter at the site.

We plan to make any necessary repairs to the structures and increase the amount of habitat in early summer after fry have emerged and before pink salmon enter the system. Diagrams of the structures and habitat will be redrawn to reflect any changes. Spawning escapement surveys will be conducted in the fall.

Results

We built 12 structures, creating approximately 211 sq m of winter habitat. Using the

production model by Reeves et al. (1989), we estimated that this habitat could produce 338 smolts. Smolt-to-adult survival rates range from 5% to 20% (Groot and Margolis 1991, Bradford 1995), which would produce an estimated 17 to 68 returning adults.

The structure types, the habitat created, and other information are presented in Table 1. Diagrams of the structures are presented in Appendix 1.

Table 1. Structure types, amount of winter habitat created, and comments.

Number	Structure Type	Area sq m	Comments
1	Downstream Barb	7.0	Structure at downstream limit of coho habitat
2	Log Jam	27.4	Several logs, brush, cobble
3	Downstream Barb	15.6	Two logs, cobble
4	Downstream Barb	13.9	Single log, cobble
5	Downstream Barb	28.9	Two logs, cobble
6	Downstream Barb	17.8	Single log, cobble
7	Downstream Barb	14.9	Single log, cobble
8	Full-span Weir	23.6	Numerous backwaters, undercuts flooded
9	Full-span Weir	0	Anchor pulled out, structure failed.
10	Cover Log	15.8	Single log, cobble, brush in backwater area
11	Downstream Barb	19.0	10-20 juvenile coho observed
12	Downstream Barb	26.4	30-40 juvenile coho observed

The structures themselves were generally functioning as intended, although some backwater areas were shallower than before. Smaller substrate had been deposited in the lower velocity areas after high flows in September. An anchor had pulled out at site 9, causing the structure to fail. The structures will be reassessed in 1998 after the high flows associated with the snowmelt.

We conducted two spawning escapement surveys, but did not see adult coho salmon on either occasion. Numerous pink salmon carcasses were observed, but there were no coho carcasses. Approximately 30-40 juvenile coho salmon were using one structure and 10-20 were using another. No juveniles were seen at the other structure sites.

Discussion

The structure work had to be halted earlier than planned because a large run of pink salmon entered the stream system. Under the terms of our project permit, we could not work in the stream when we might disturb spawners or the eggs. As it is, the amount of winter habitat we created, though fairly substantial for a smaller stream system, may need to be increased to provide enough returning coho adults for some limited subsistence use.

The number of returning adults predicted by the limiting factors analysis and the smolt-to-adult survival rates (17 to 68) was calculated only to give us a rough idea of how much additional work may be needed. The limiting factors analysis is intended to identify habitat imbalances rather than actual production, and Reeves et al. (1989) state that it cannot address such influences as geography, climate, geology, and food availability. It is possible, for example, that the nutrients from the thousands of pink salmon carcasses could make Plateau Creek much more productive than the analysis would predict. We do feel, however, that additional habitat work is needed to make an effective contribution to the adult returns.

The number of fish available for subsistence harvest is dependent not only on the amount of fish produced in the newly created habitat, but also on any surplus fish the system is already producing. Unfortunately, we do not have enough escapement information to determine whether there is a harvestable surplus already. In the fall of 1996, we were unable to survey Plateau Creek until early November, when we saw only one fish. Based on surveys at Hartney Creek for this project (Hodges and Schmid 1997) and observations in streams in the Copper River Delta area (USDA Forest Service unpublished data, personal observations), the peak spawning period had already passed. This past fall (1997), we conducted surveys in the beginning and middle of October when spawning should have been peaking, but no spawners were seen.

There are several possible reasons why we have not seen many adult fish in Plateau Creek. In 1996, we were probably too late to catch the peak spawning time. In 1997, coho salmon runs throughout the area were unusually weak and late (Steve Morstad, Alaska Department of Fish and Game Commercial Fisheries Biologist, personal communication), and consequently, the commercial coho fishery was closed after a few early openings. It is possible that very few adults returned to Plateau Creek, and we simply did not see them, or they returned later than usual after our last survey. Another possibility is that the average escapement may not be very large even in normal years. Although we have observed large numbers of juveniles, it does not take many spawners to fully seed a system if spawning conditions are good.

The fall of 1998 will give us our last opportunity to assess the returning adult population without the influence of our habitat work. Hopefully, we will then have a better idea of the natural population and be better able to determine what subsistence opportunities there might be in the future.

Involvement of local youth

In addition to the production of fish for subsistence use, the other main objective of this

project is to involve local youth in the management of the resources in the area. During both years of the project, several Cordova residents have worked on the crews, and in 1998, one member will return for his third season of work. Speaking for the Forest Service, this project has given us a good opportunity to work more closely with outside groups and the young people in the community. The crew members, we believe, have gained a better understanding of fish biology and career opportunities with resource management agencies.

Conclusions

The scarcity of winter rearing area was identified as the habitat factor limiting coho salmon production in Plateau Creek. The additional winter habitat created by the structures should increase the overwinter survival of juvenile coho salmon and result in higher numbers of smolts. This assumes that no other physical or biological factors are more limiting to the juvenile population. The number of returning adults produced by the new habitat cannot be estimated precisely, but it is felt that additional habitat is needed to produce enough adults for a limited subsistence harvest. The current escapement has not been determined, and it is not known whether there are already enough fish for some harvest.

In 1998, we will continue to work with local residents on this project. We will evaluate the structures, make any needed repairs, and expand the amount of habitat if possible. We also hope to obtain better escapement data to determine the current strength of the run, and, in the future, evaluate the effects of the habitat structures on adult production.

Literature Cited

Bradford, M.J. 1995. Comparative review of Pacific salmon survival rates. Canadian Journal of Fisheries and Aquatic Sciences 52:1327-1338.

Bustard, D.R. and D.W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 32:667-680.

Crispin, V. 1988. Main channel structures. In: House, R., J. Anderson, and J. Suther, *eds.* Stream rehabilitation manual, emphasizing project design, construction and evaluation. American Fisheries Society, Oregon Chapter, Corvallis, OR. Section 9.

Crispin, V., R. House, and D. Roberts. 1993. Changes in instream habitat, large woody debris, and salmon habitat after the restructuring of a coastal Oregon stream. North American Journal of Fisheries Management 13:96-102.

Crone, R.A. and C.E. Bond. 1976. Life history of coho salmon (Oncorhynchus kisutch) in Sashin Creek, southeastern Alaska. Fishery Bulletin 74:4:897-922.

Groot, C. and L. Margolis. 1991. Pacific salmon life histories. University of British Columbia Press. Vancouver, BC, Canada.

Hodges, K. and D. E. Schmid. 1997. Eastern Prince William Sound Wildstock Salmon Habitat Restoration, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 97220), USDA Forest Service, Cordova, Alaska.

House, R. 1996. An evaluation of stream restoration structures in a coastal Oregon stream, 1981-1993. North American Journal of Fisheries Management 16:272-281.

House R. and P.L. Boehne. 1985. Evaluation of instream structures for salmonid spawning and rearing in a coastal Oregon stream. North American Journal of Fisheries Management 5:283-295.

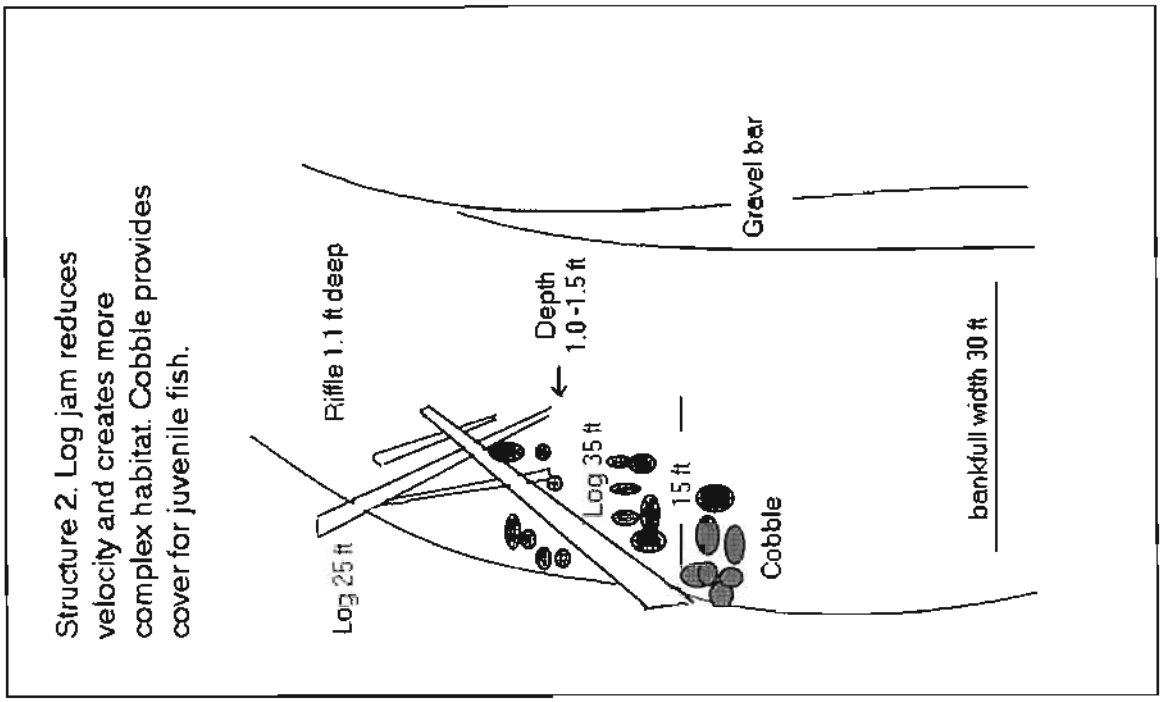
Nickelson, T.E., M.F. Solazzi, S.L. Johnson, and J.D. Rodgers. 1992. Effectiveness of selected stream improvement techniques to create suitable summer and winter rearing habitat for juvenile coho salmon (*Oncorhynchus kisutch*) in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 790-794.

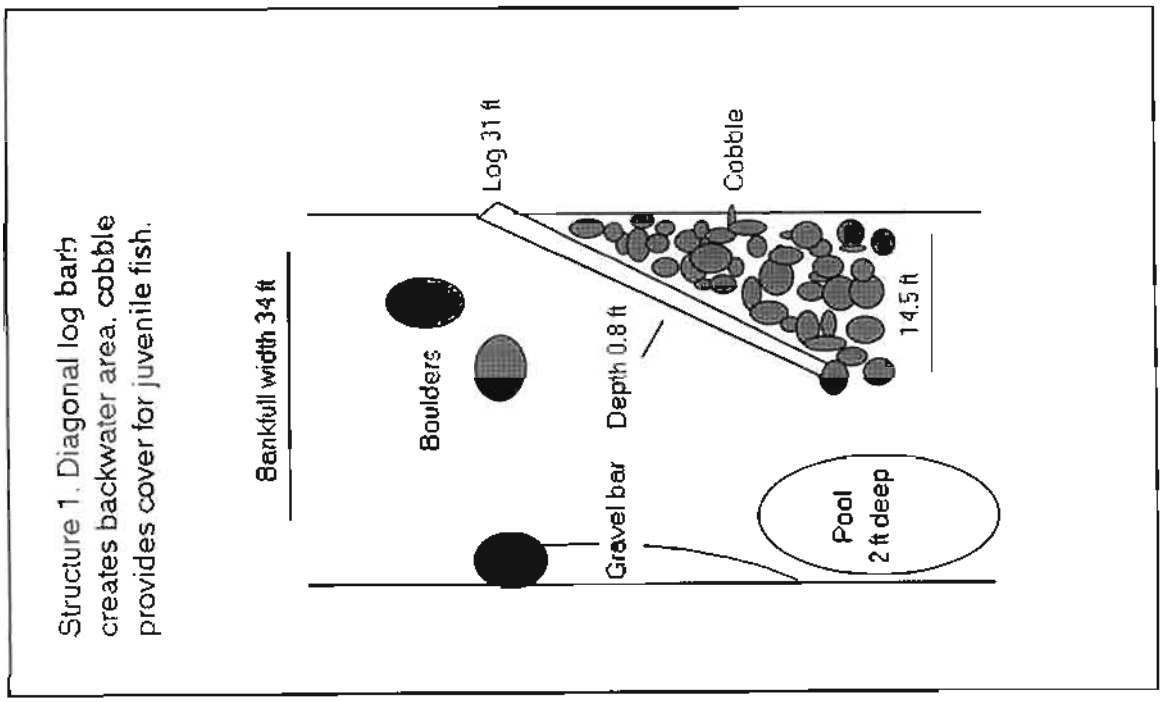
Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. General Technical Report INT-138. USDA Forest Service, Intermountain Forest and Range Experiment Station. Ogden, UT.

Reeves, G.H., F.H. Everest, and T.E. Nickelson. 1989. Identification of physical habitats limiting the production of coho salmon in western Oregon and Washington. General Technical Report PNW-GTR-245. USDA Forest Service, Pacific Northwest Research Station. Corvallis, OR.

Taylor, E.B. 1988. Water temperature and velocity as determinants of microhabitats of juvenile chinook and coho salmon in a laboratory stream channel. Transactions of the American Fisheries Society 117:22-28.

Appendix 1. Diagrams showing the structures built, habitat, and stream features.





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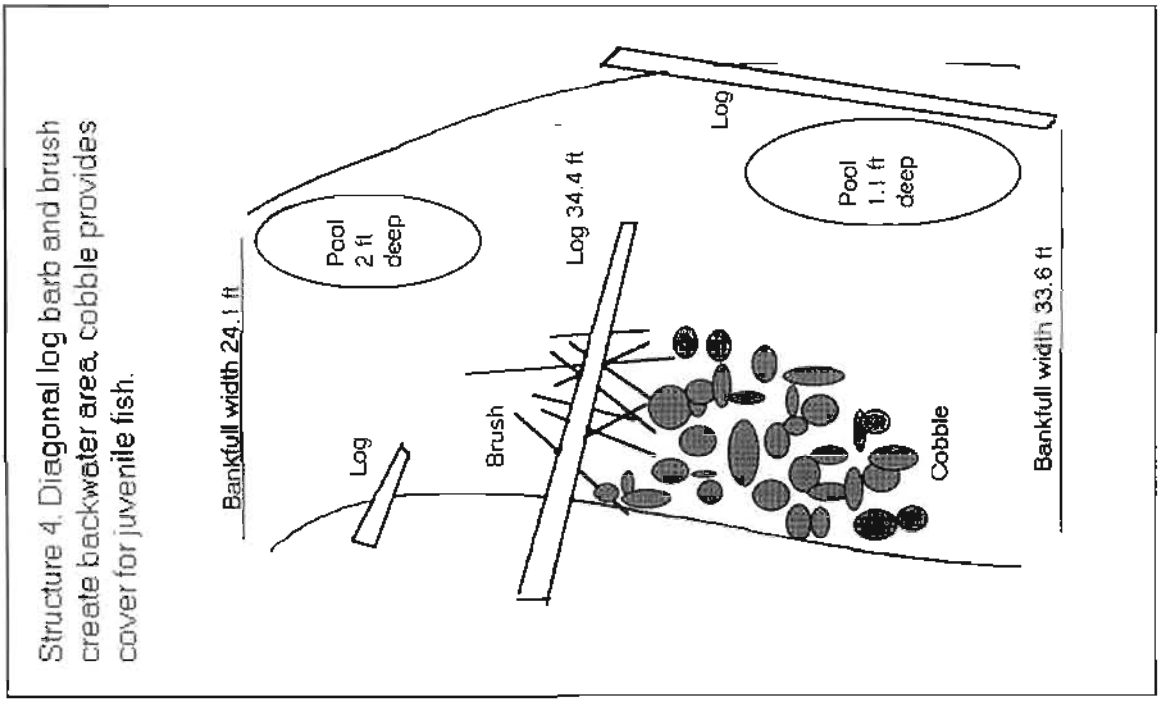

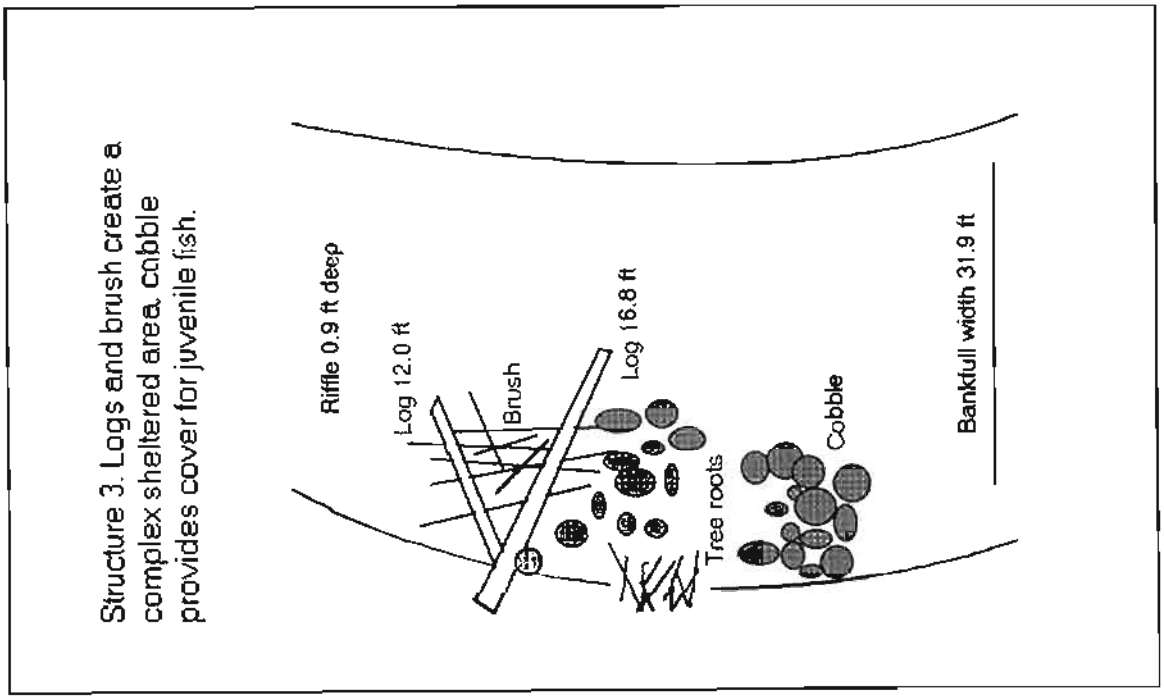

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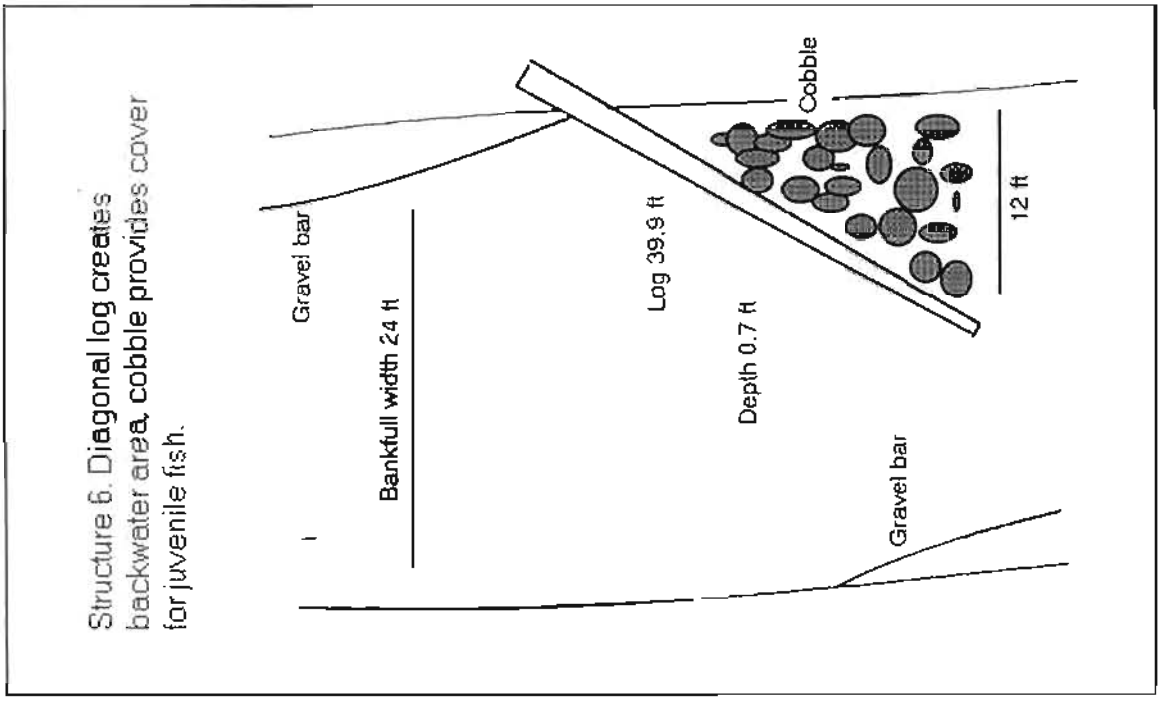

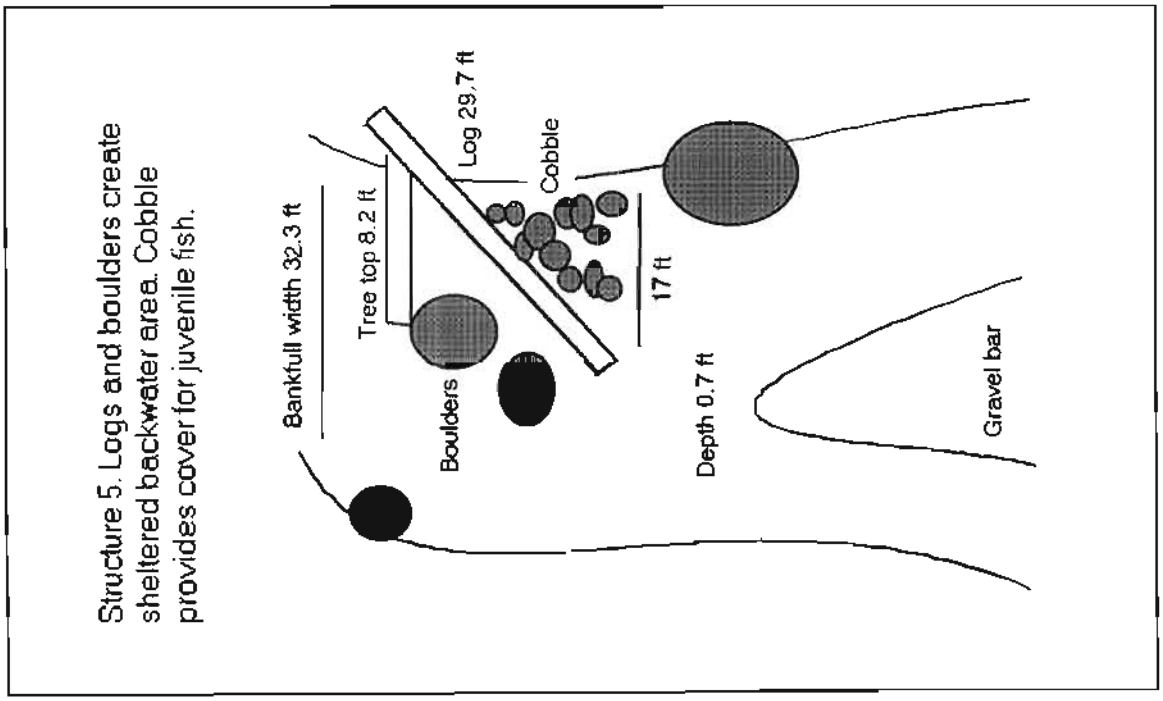

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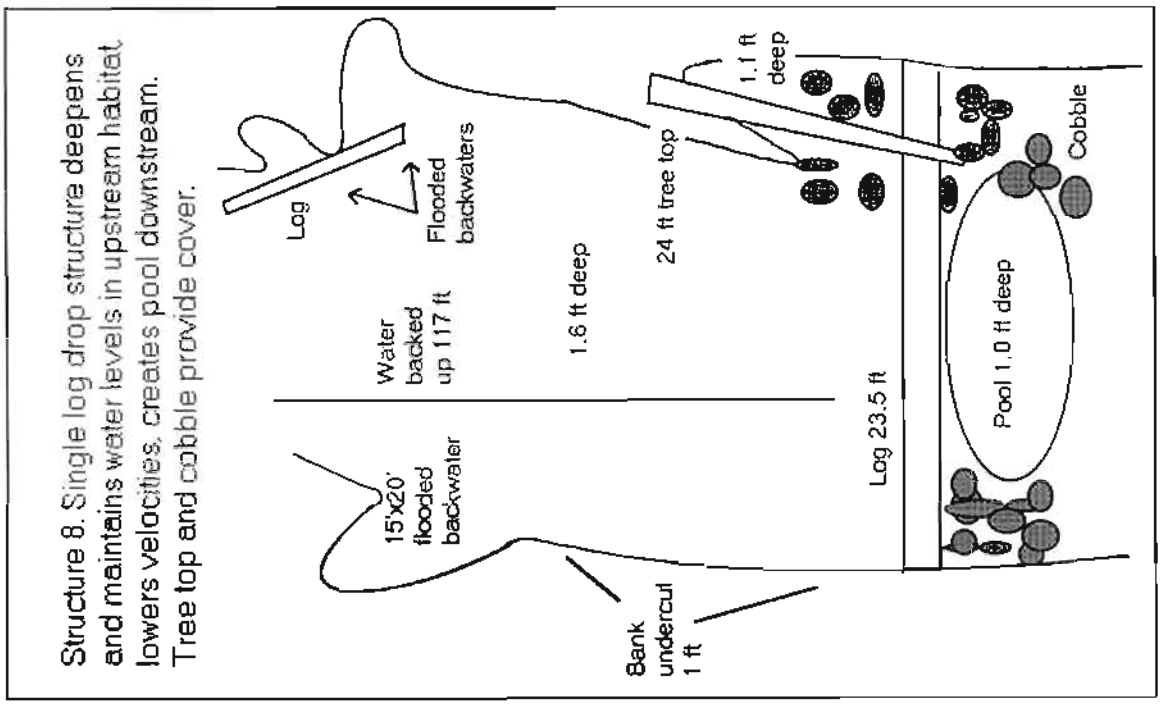

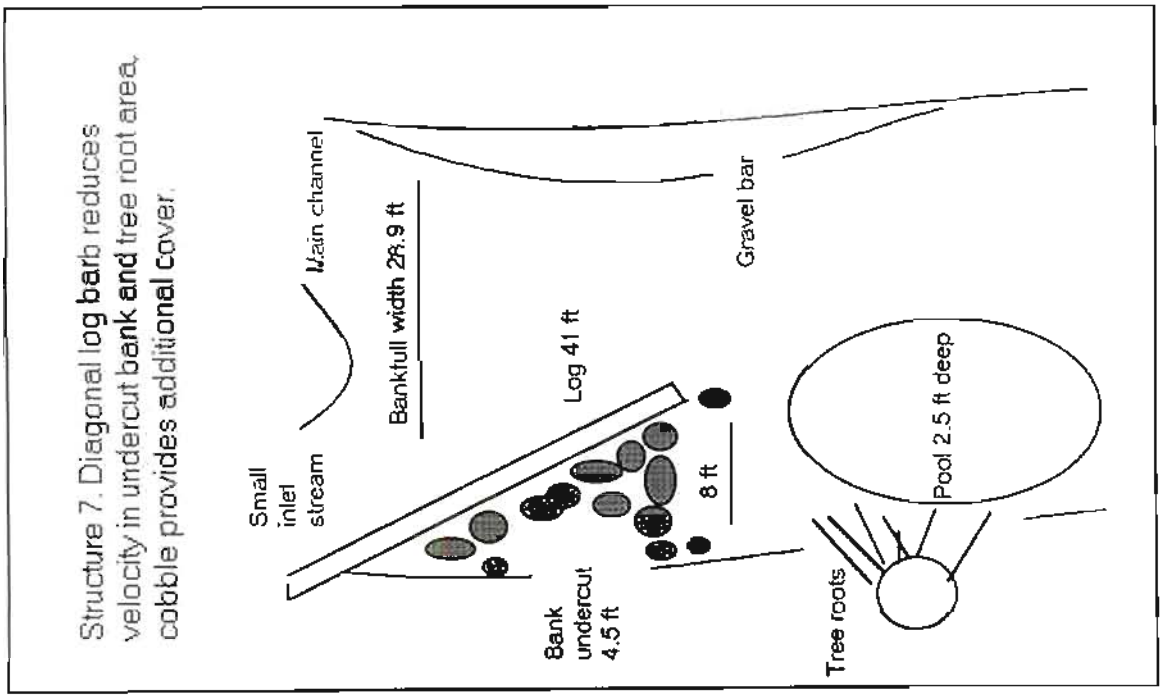

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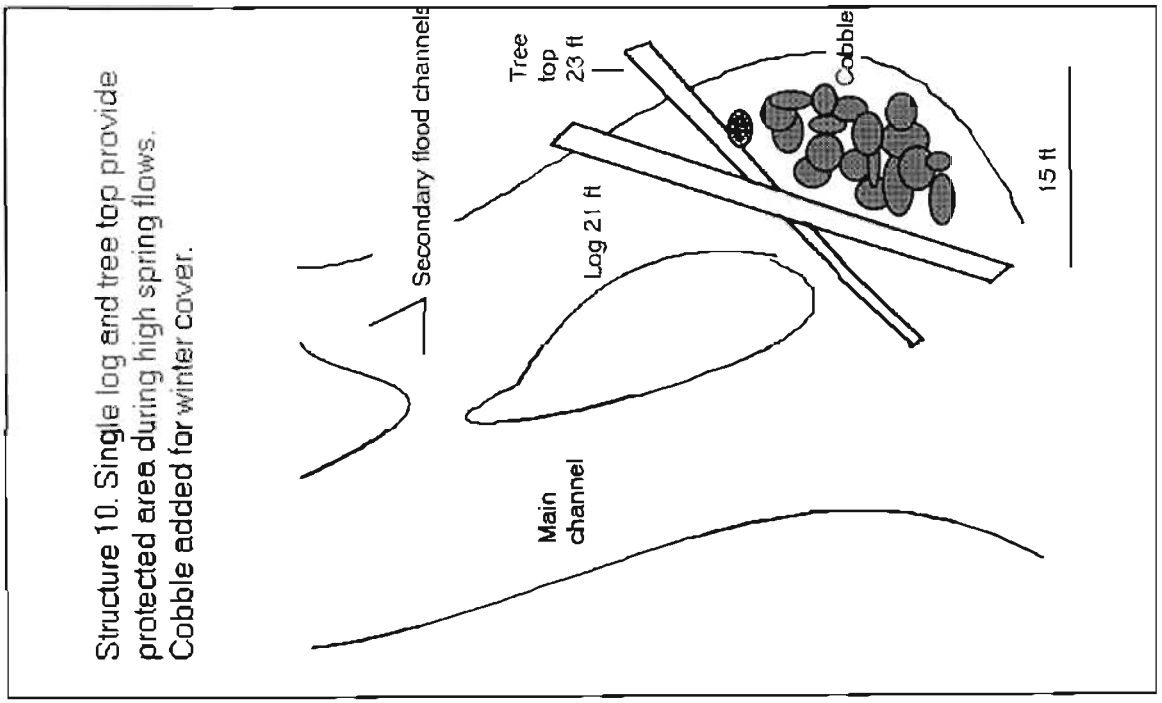

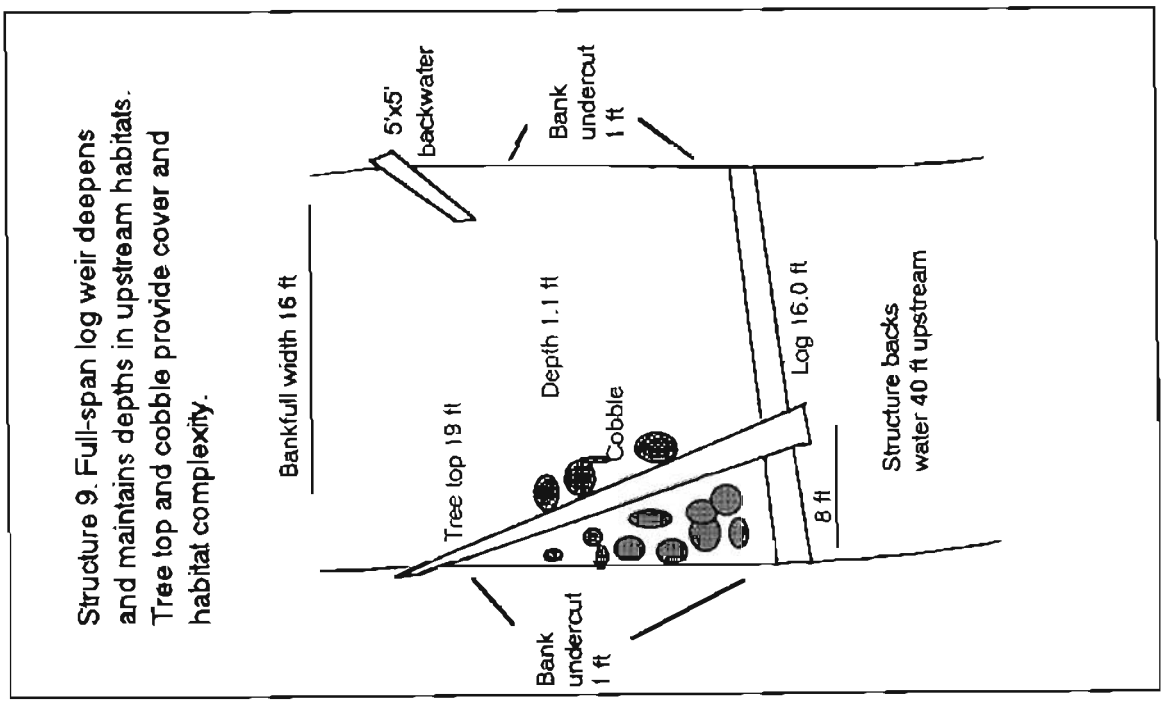

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