BROWN POINT SALMONID STREAM RESTORATION AND ENHANCEMENT PLAN

Prepared by

Code 043, Environmental Division

October 1994

NAVAL UNDERSEA WARFARE CENTER DIVISION
610 Dowell Street
Keyport, Washington 98345-7610

Enclosure (2)

TOANDOS PENINSULA SALMONID STREAM RESTORATION AND ENHANCEMENT

Background:

Recently, the lower drainage of a perennial salmonid stream located on the southeast corner of the Naval Undersea Warfare Center Division (NUWC) Keyport's Brown Point property was buried by slide debris from logging road washouts. This blockage diverted the stream flow from the established channel into a grassy meadow, resulting in an unnatural ponding of water and destructive erosion activity within an adjacent wetland site. In order to prevent further erosion/slide activity and restore the in-stream and riparian habitat to a more natural state, the following measures were developed and implemented.

Stream Restoration Planning and Design:

A stream habitat inventory was conducted to determine the condition of the stream in relation to the natural or desired condition. Through this inventory, the condition of the existing habitat was documented and rated to establish priorities for the design and construction of enhancements in the restoration effort. The habitat inventory consisted of a system of transects spaced at 75-foot intervals along the project reach and mapping. Transects were placed across the stream channel perpendicular to the flow, and were used primarily as reference points and the stream inventory sampling points. Refer to the map in Appendix A. Along each transect, the following stream habitat attributes, based on an Intermountain West Habitat-Rating System developed by William Platt in 1983, were inventoried and measured: riparian vegetation, stream-bank stability, substrate composition and condition, water depth and velocity, in-stream cover, and pool/riffle habitats. Refer to Appendix A.

Riparian Vegetation

Vegetation Type: A description of the dominant and subdominant plant species present and their respective percentage cover within the streamside plant community was documented. Lower ratings were assigned with the assumption that streamside environments composed of fine sand with little or no vegetation have limited value to salmonids. The sapling, shrub, and herbaceous tree and plant species that produce a tangle of roots and vegetation receive the highest rating.

Vegetation Overhang: Measurements of terrestrial vegetation hanging over a streambank provide valuable information on the amount of effective streamside cover available for the rearing and migration of both juvenile and adult salmonids. Measurements of the overhang were made along transects extending from the bank to the end of all vegetation with overhang within 12 inches of the water surface.

Shade: The degree of shade provided by riparian vegetation was measured by visually estimating the amount of shade covering the stream at noon. A stream reach with 40 to 60 percent shade is considered optimal for maintaining cool water temperatures critical for salmonid survival.

Stream-bank Condition

Bank Angle: Measurements were made by positioning the base of a measuring rod on the streambed parallel to the angle of the sloping streambank. Vertical 90-degree bank angles and streams with dished out bank angles that measure greater than 90 degrees provide little or no streambank cover for salmonid and may be unstable. Undercut banks tend to have bank angles less than 90 degrees and provide good cover and valuable rearing habitat.

Bank Height: Bank-height measurements were taken from the stream water surface to the top of the bank. In general, bank heights averaging less than 1 foot meet the best habitat requirements for salmonids. Banks higher than 3 feet are an indication of an unstable, incised channel.

Stream-Bank Undercut: Undercut measurements were made with a rod, in the same manner used to measure vegetation overhang, to measure the extent of the undercut where the transect intercepts the bank. A measurement of greater than 6 inches on 50 percent of the transects indicates ideal cover for salmonids.

Stream Channel Shape

Active Channel Width: Channel width was measured along each transect. A channel extends from bank to bank where the borders are marked by either encroaching vegetation or where the high-water mark is distinguished by a break in the general slope in the land or by the lack of vegetation. Channel widths greater than water widths indicate a laterally unstable channel eroding during high flows.

Water Width: Measurements are made along the transect from bank to bank across the channel's water surface. A wide, shallow stream channel reach does not contain adequate pool habitat or cover. Water widths are a measurement of limited value unless related to channel width and channel depth.

Water Depth: Using a measuring rod, water depths were taken at several points, i.e., at one-fourth, one-half, and three-fourths water-width intervals, along the stream transect.

Substrate

Composition: Substrate composition measurements were based on visual estimates at the same regular one-fourth, one-half, and three-fourths water-width intervals along the same transect line that water-depth measurements were taken. Composition estimates were made by projecting a 1-foot square area on the streambed. Within the square a percentage was estimated of the area that is composed of boulder, rubble, gravel, sand, and coarse and fine sediments. The classification of substrate size is based on Table 1 in Appendix A.

Embeddedness: Visual observations were used to evaluate embeddedness, i.e., extent to which substrate particles are surrounded or covered by fine sediment, at the same locations that composition measurements were taken. Research indicates that a substrate ranking of more than 30 to 40 percent embeddedness is associated with an accompanying loss of spawning and rearing habitat.

Pool-To-Riffle Ratio: The pool-to-riffle ratio was calculated by measuring the percentage of riffle along the transect lines and dividing the measurement into the percentage of pool. A pool-to-riffle ratio of 1 to 1 provides optimal conditions for producing spawning and rearing habitat.

In-stream Cover

Woody Debris: The approximate size and relative position of significant woody debris within the stream was noted and mapped within each transect reach.

Aquatic Vegetation: Aquatic vegetation was noted and mapped during the measurement and rating of the substrate along each transect. Only vegetation larger than cobble and dense enough to provide cover for salmonid fingerlings was noted.

Permit Requirements:

Due to its proximity to the waters of Hood Canal and the in-stream construction requirements of this task, approval from the following regulatory agencies was required:

A Hydraulic Project Approval Permit was obtained from the Washington Department of Fish and Wildlife. Additionally, a Shoreline Management Exemption Permit was obtained from the Jefferson County Permit Center. Refer to Appendix C.

Stream Enhancement/Restoration - Engineered Features:

Based on the results of the habitat inventory, the following measures were developed and implemented to restore and enhance the stream to a more natural state:

Protective Measures

Whenever possible, naturally occurring materials were used to construct in-stream structures. Such materials enhance the aesthetic quality of the structures and provide a readily accessible source of inexpensive material. In the event that an in-stream structure should fail, the native materials used in its construction will eventually be incorporated into the stream's natural organic material load.

All excavation and construction activities were completed through the use of hand tools to avoid damaging and/or destabilizing the streambank and its riparian plant communities. Additionally, all in-stream construction occurred in late spring to early summer, i.e., prior to the fall out migration of juvenile salmonids, in order to minimize any potential impacts to the resident salmonid population.

Cover logs were used primarily to provide overhead cover and resting areas. Refer to Appendix B. Cover logs consisted of half logs elevated by blocks, used to position the logs above the stream substrate, and secured to the stream bottom with rebar. Large benchlike log slabs, cut from trees over 16 inches in diameter, were used to create an irregular surface that causes turbulence along the edge of the log, which keeps the edges scoured free of silt and gravel. All cover log structures were placed in faster flowing, i.e., exceeding 2 cubic feet per second, riffles, glides, and pools, at slight angles to the flow to further enhance scouring action.

Channel Deflectors were installed to create and enhance lateral scour pools and form a more meandering and/or sinuous channel. Refer to Appendix B. Deflectors were placed to direct flow toward naturally occurring cover, i.e., steeper overhanging banks. Deflectors were constructed of logs with diameters ranging from 12 to 18 inches. Logs were placed at angles of 40 degrees or less to the stream flow and were built low in profile, 6 to 8 inches above normal summer flows but well below bank height, to increase the longevity of the structure and allow it to function during high water flows. The deflector logs were laid in trenches that were 3 to 4 inches deep and extend into the streambank 4 to 5 feet. Two-foot-long wooden stakes were driven into the streambed to hold the deflector logs in place.

Log Sills were constructed to slow velocities upstream of the sill to trap sediment and gravel, form spawning riffles, and create plunge pools for fingerling rearing habitat. Refer to Appendix B. Straight sills were selected to mimic natural accumulations of large woody debris. Generally, sills were placed in a series of groups with varying distances between them.

Sills were built at sites where high, but relatively stable banks into which the sills can be anchored were present. Sills were laid in 8 to 10-inch trenches dug into the streambed and extended into the banks 4 to 6 feet. The douglas fir logs used for sill construction were 12 to 16 inches in diameter. Material excavated from the streambed, which contained significant amounts of gravel found beneath the substrate, was deposited on the upstream side of the sills to seal the structure.

Four separate sections of **culvert** which were blocking the stream channel flow, due to sediment accumulations, were excavated and removed by hand. The sections of culvert removed were located beneath the logging roads on the upper reach of the stream. Approximately 90 to 100 cubic yards of soil were excavated and deposited several yards away from the creek channel. Native vegetation transplants were used to stabilize this excavated material. Removed culvert sections of varying lengths were deposited in low gradient areas parallel to the stream channel. Streambanks exposed by the culvert excavation were intentionally tiered and stabilized with riprap and native riparian vegetation, e.g., willow wattling, and grass seeding. Refer to the map in Appendix A.

The following steps were taken to return the stream to its original channel:

- Woody debris blocking the stream channel outlet was removed by hand and deposited along the shoreline above the mean higher high water mark.

- Gravel and sediment accumulations were subsequently excavated to form a more accessible channel outlet into the waters of Hood Canal.

- Approximately 125 feet of new creek channel was excavated to skirt the logging road slide area and reroute the stream flow back into its original established channel.

- Approximately 40 to 50 cubic yards of soil was removed and used to build up the adjacent streambanks. These streambanks were subsequently stabilized with transplants of native riparian vegetation, willow wattlings, and riprap.

- In areas of new channel with significant stream-flow gradient change, i.e., greater than 12 degrees, a series of tiered log sills was installed to create a ladder of plunge pools to facilitate upstream salmonid migrations and prevent the formation of erosive conditions.

- Gravel fill, obtained from the shoreline, was placed within the newly excavated section of rerouted creek channel to form a natural substrate that will serve to stabilize the underlying layers of loose substrate clay and soil.

  Refer to Appendix A for further details.

TOANDOS PENINSULA SALMONID STREAM MONITORING AND MAINTENANCE PLAN

Background:

Enhancement and restoration of salmonid streams is never complete. Human induced disruptions within stream ecosystems require immediate action in order to be restored to their natural state. Once restoration is complete, continuous monitoring and maintenance will facilitate and increase the likelihood of returning the stream back to a normal functioning and evolving ecosystem.

Monitoring should continue biannually for at least 5 years, but preferably for 10 years. The data retrieved from monitoring will help determine the success of the project. Further maintenance will rectify reoccurring problems, i.e., heavy sediment loading caused by nearby logging and further logging road washouts, within this specific stretch of stream.

Post-Treatment Monitoring:

Post-treatment monitoring is conducted with the same methods utilized for the initial stream habitat inventory. In addition to the methods outlined in the Stream Restoration Planning and Design section of this report, specific monitoring objectives to this stream have been included.

Vegetation

Problem: Vegetation abundance and growth should be closely monitored to ensure that natural growth has returned to areas trampled during the restoration project.

Monitoring Solution: Check the re-establishment of transplanted species. Recalculate the percentage of overhang and shade to determine vegetation enhancement success.

Bank Stability and Substrate

Problem: This stream is extremely vulnerable to excessive sediment loads from adjacent slopes clearcut during past logging operations.

Monitoring Solution: Bank stability at crucial areas such as the culvert removal areas, logging road slides, and upper reaches of the log sills must be periodically checked.

In-Stream Habitat

Problem: Initial observations identified a low pool count on the pool-to-riffle ratio.

Monitoring Solution: As a key measure of the stream's condition and ability to support salmonid populations, the pool-to-riffle ratio of the stream requires monitoring to ensure that enhancement measures helped to achieve the more desirable 1 to 1 ratio.

Population Counts

Problem: Population density, species distribution and return of recruitment stock is essential to tracking the condition of the stream's salmonid population.

Monitoring Solution: Electroshocking of fingerlings in spring or early summer and adult carcass counts in the fall/winter will be used to indicate population density, species distribution, and relative health of the returning and recruitment stock.

Shoreline

Problem: Excessive amounts of shoreline tidal debris may adversely effect the stream.

Monitoring Solution: Ensure that blockage does not impede or disrupt salmonid migration patterns.

Post-Treatment Maintenance:

Slide Areas

Problem: Erosion control measures need to be replaced or added to the slide areas if and when the need arises.

Maintenance Solution: Ensure that transplanted species are flourishing and replace contour wattling as necessary.

Culvert Removal Areas

Problem: Contour wattling may need replacing if periods of drought prevent willow cuttings from taking root.

Maintenance Solution: Replace stabilization riprap along streambanks and contour wattling along the terrace levels of the culvert removal areas. Periodically seed areas affected by erosion with grass and sedge.

Deflector Logs

Problem: Deflector angles may need to be changed if an excessive amount of bank erosion occurs.

Maintenance Solution: Riprap and stabilization stakes should be replaced around deflector logs as necessary. Ensure that anchoring points of deflectors and adjacent banks are stable.

Sediment Traps

Problem: Sediment trap accumulation will need to be excavated when full.

Maintenance Solution: Excavate accumulations within each sediment trap. Traps will require more frequent visual inspections during periods of heavy rainfall.

Log Sills

Problem: Riprap should be replaced to seal any leaks between or under logs. Periods of high water may overflow log sills and cause erosion on the downstream side of the sills.

Maintenance Solution: Replace riprap beneath logs and ensure that anchor points are secured. Periodically, constrictor logs may need to be placed along the upper reach pools of log sills if the banks do not hold increased volumes of water.

Cover Logs

Problem: Cover logs can be displaced either by humans or higher flow periods during the rainy season.

Maintenance Solution: Return cover logs to their original position within the stream if displacement has occurred. Remove all debris trapped beneath the structure.

Diversion Dams

Problem: Leaks can affect the integrity of the diversion dams.

Maintenance Solution: Visually inspect and repair all leaks.

Confluence

Problem: Tidal debris can hinder or otherwise impede migrating adult or juvenile salmonid during fall and spring.

Maintenance Solution: Stream mouth should be visually inspected and tidal debris removed.