Limiting Factors Assessment and Restoration Plan

Bummer Creek

A Tributary to South Fork Alsea River in the Alsea Basin

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Introduction

This document provides watershed restoration actions proposed to enhance the Coho Salmon population within the Bummer Creek sub-watershed in Benton County, Oregon. Bummer Creek is a 5th order contributor to South Fork Alsea River within the Alsea River Basin.

The goal of the restoration effort is to identify the dominant processes and habitat characteristics that currently limit the production of Coho salmon smolts in the watershed, and to develop a prioritized list of actions ("prescriptions") for removing the limitations in ways that help normalize landscape and stream channel function.

Central to this goal is the identification of Coho "Core Areas" and "Anchor Sites", which are sections of the stream channel that support the remnant Coho population. By Core Area we mean a contiguous section of stream channel or channel system where juveniles rear on a consistent (year to year) basis. The term Anchor Site is used to specify the portion of the Core Area which provides all essential habitat features necessary to support the complete Coho freshwater life history.

For a more detailed description of these concepts as well as the restoration, assessment, and prioritization protocols used in developing the plan, please refer to "*Midcoast Limiting Factors Analysis, A Method for Assessing 6^{th} field subbasins for Restoration*". This document is available at www.midcoastwatershedscouncil.org/GIS or by contacting the Midcoast Watersheds Council.

The following questions exemplify the types of issues addressed in the assessment process.

- How well and in what mode is the current system functioning for Coho production (what part does each of the habitat subdivisions play)
- What temperature problems are apparent?
- Where are temperature refugia located?
- Where are the barriers?
- What are the sediment issues in the system?
- Where are the spawning areas, and how are they integrated with the summer and winter rearing sites?
- What needs to be done to make the Core habitat function for all life phases, and to function at a higher level?
- What work should be done in each area to facilitate a more completely functional whole?
- What is the best upslope work that supports the instream work?
- How are the fish currently using the system?
- What problems are generated by the current habitat configuration (e.g., temperature dependant movements that expose juveniles to predation)
- How and when are the greatest losses generated to the population?
- Within the Core habitat, what are the dominant limiting factors?
- Within the 6th field, what are the dominant limiting factors?
- Within the 4th field, what are the dominant limiting factors?
- Does the presence or absence of adequate winter habitat outside the spatial boundaries of the 6th field suggest or preclude the need for expanding the quantity or quality of winter habitat?

Resources used in developing the plan

The following resources were used in preparing the restoration plan:

- Management reports: "South Fork Alsea Watershed Analysis", October 1995, Marys Peak Resource Area, Salem District, Bureau of Land Management, Salem, OR 97306.
- Aquatic habitat inventories: Habitat surveys were conducted in Bummer Creek by the Oregon Department of Fisheries and Wildlife in 1995 and 2000.
- Summer snorkel surveys: These "Rapid Bio Assay" fish inventories identify the species, age class, density and distribution of salmonids in pools based on fish counts made in randomly selected pools of a stream reach. Little Lobster Creek was surveyed by Bio-Surveys each consecutive year between 1998 and 2002 except for 1999.

- Field assessment: This identifies the location and functionality of the sub-watershed's Core Area and Anchor Site(s). The field assessment of Little Lobster Creek was conducted on May 11, 2005.
- Oregon Department of Forestry slide assessment mapping: This procedure evaluates failure-prone headwater slopes as potential sources of wood and substrate to the aquatic corridor. The evaluations help identify Critical Recruitment Areas within the sub-watershed.
- Habitat Limiting Factor Model (HLFM): This analytical model, also referred to as the Nickelson Model, evaluates estimates of spawning gravel, egg deposition rates, and abundance of aquatic habitat to identify which seasonal habitat, and thus which Coho life stage, currently limits smolt production within a watershed. The model is described in ODFW Information Report 98-4.

Watershed overview

The Bummer Creek sub-watershed comprises 3,424 hectares within the South Fork Alsea River watershed of the Alsea River Basin. Flow originates at about 2,500 ft elevation in two steep headland branches on the north slopes of Prairie Mountain. These are the origins of both mainstem Bummer Creek and Swamp Creek, the largest tributary with a drainage similar to that of the upper mainstem. Flow direction of these two main branches, and then the combined mainstem, is generally north to the stream's confluence with the South Fork Alsea River at about RM 0.3.

Above their confluence, the mainstem and Swamp Creek valleys may each be broadly described as three geomorphic sections:

- At the upper end are the headwaters with steep, narrow valleys.
- Below this is a transition zone where the gradient decreases below 6%.
- Near Tributary D in the mainstem and near Brown Creek in Swamp Creek, the gradient approaches 2% and the valley is sufficiently broad that hillslope constraint gives way to terrace constraint.

Below the confluence, the mainstem flows through an increasingly widening valley that converges with the combined South Fork Alsea floodplain. This forms a very broad, open valley floor.

The drainage pattern is dendritic, with the large majority of flow entering in the upper half of the mainstem. Wilson Creek at RM 2.6 is the first significant tributary, while Swamp Creek enters at RM 3.8 (Appendices 1 and 2).

Upper drainage tributaries generally flow through steep, narrow valleys, while tributaries entering the lower mainstem tend to have flatter, broader valleys confluent with the mainstem valley. The two principle contributors to Swamp Creek, Record Creek and Brown Creek, enter through broad, flat valleys confluent with the Swamp Creek valley.

Rural residence and livestock grazing are the predominant uses of the lands bordering stream channels flowing through the South Fork Alsea/Bummer Creek/Swamp Creek valley floor complex. These lands have been highly modified by logging, draining, grazing, and similar events. The further downstream, the greater the influence these uses have had on stream channel structure and function. BLM manages lands adjoining approximately 43 of 84 stream miles in the Bummer Creek subwatershed.

The character of lands surrounding upper Bummer and Swamp Creeks in the remote and steep valleys of Prairie Mountain is very different from those of lower sections in the drainage. These higher elevation lands retain stands of late stage old growth timber. Portions of the Bummer Creek headwaters are included in a large block of federally protected lands that include Tobe Creek and Rock Creek.

Limited aquatic habitat information available indicates that the total amount of instream wood is high, but that little of it is large wood that can function as key pieces to trap smaller wood and mobile substrates. Substantial amounts of large substrate (cobble, boulders) were recorded in Bummer Creek above Swamp Creek, but not in Record Creek. Beaver activity appears to be limited to Record Creek and the area of its confluence with Swamp Creek.

Current status of Coho

The status of Oregon Coast Natural (OCN) Coho in the Alsea basin has been well documented for adult spawners by ODFW's Stratified Random Sampling Program, and for the summer standing crop of juveniles by the Midcoast Watershed Councils Rapid Bio-Assessment Inventory. The adult data provide a sense of basin-wide trends in abundance, while the juvenile data indicate trends within specific 5^{th} and 6^{th} fields.

A 15 year review of basin wide trends in the Alsea indicate that adult escapement hovered at a very low level from 1990 to 1998 and only once during that period exceeded 1,700 adult Coho. This depressed status culminated in the 1998 cohort crashing to a total basin estimate of 213. From the period of 1999 to 2003 there has been a very significant and steady incline in spawner abundance in the basin that peaked at 8,957 in 2003. A 33% decline (from the 2003 level) was documented in the most recent adult inventory (2004).

The general improvement in adult escapement during this five year period was likely influenced by two important factors:

- A dramatic increase in ocean survival rate from smolt to spawning adults. This increase was documented by ODFW's Life Cycle Monitoring program, which found that survival rate exceeded 10% at multiple locations.
- A cessation of hatchery Coho releases into the Alsea basin from the Fall Creek Coho production facility. This reduced the influence of adverse genetic interactions between hatchery and wild stocks. (To quote Monitoring and Evaluation of Supplementation Projects, ISRP and ISAB, 2005: "*The primary genetic risk is that matings in the wild involving one or more hatchery origin parents results in the production of offspring with reduced fitness*".)

To focus our review of status more narrowly on the Bummer Cr 6^{th} field, a review of the Rapid Bio-Assessment data (juvenile snorkel surveys) provides some excellent comparative analyses from low and moderate escapement years (1998 / 2002). The 1998 summer abundance of Coho juveniles represents a back calculated estimate of 6-8 adult Coho spawning in the 6^{th} field during the winter of 1997. Coho production was equally divided between Upper Swamp and Upper Bummer (these low abundance rearing data have also helped us identify key spawning locations).

The 2002 summer abundance of Coho juveniles represents a back calculated estimate of 49-55 adult Coho spawning in the 6^{th} field. During this year of moderate adult escapement, Bummer was rearing 43 % of the summer standing crop, Swamp was rearing 51 % and the other combined tributaries provided for 6 % of the available summer parr. The Bummer Cr surveys represent 6 miles of available habitat, the Swamp Cr surveys only 2.7 miles of habitat. The obvious conclusion here is that Swamp Cr is providing a disproportionate amount of the production in both low and moderate abundance years.

Based on the estimated abundance of high quality spawning gravel (135 sq meters) and the observed abundance and rearing densities of summer parr, we believe that the Bummer Cr 6^{th} field has not been seeded to capacity during any of the observed years between 1998 and 2002. With that said, adult escapement continues to be the functional limiting factor for Coho smolt production and until the Alsea Watershed as a whole is receiving approximately double the level of adult escapement observed in 2001 (3,339), the Bummer Cr 6^{th} field will not be capable of producing to even its current habitat capacity (pre-restoration).

Limiting seasonal habitat analysis

Using the Nickelson model

A primary goal of the assessment process is to identify which seasonal habitat most restricts smolt production. Restoration work then focuses on improving those aquatic, riparian, and upslope conditions that contribute to the restriction.

A principle, but not the only, tool used to identify the limiting seasonal habitat is the Nickelson Model. The analysis requires estimates of the amount of Coho spawning gravel in the sub watershed, and the amount of each type of pool, riffle, glide, and rapid habitat present during each season of the year.

The Assessment phase of the current study supplies estimates of spawning gravel, while previously conducted habitat inventories provide habitat data. Most of the habitat inventories have been conducted by ODFW. USFS, BLM and occasionally private landowners and watershed councils also commission inventories.

Model limitations

Several factors can limit the usefulness of this analysis:

- Typically, only summer data are available. Winter, and spring inventories are almost never conducted.
- Habitat inventories may be lacking altogether within a sub watershed, or may miss important Coho-bearing reaches.
- Inventory protocols often vary among agencies (e.g., trench pools may be identified in one survey, but not in another).
- Variable surveyor experience and point of view can generate variable data sets (e.g., one surveyor may see a glide where another sees a pool tail out).
- Habitat conditions can change year to year, sometimes dramatically. High water years can change habitat structures. Beaver can move into or out of a drainage, or be removed for management purposes. Slope failures, natural timber recruitment, logging and similar events can introduce large amounts of soil and wood into a channel.
- The model relies on a highly simplified view of the Coho life cycle and the forces that control season to season survival.
- Model results depend heavily on assumptions made about season to season survival rates, and these rates are both evasive and debatable.

We attempt to address these problems in the following ways:

- To estimate winter rearing capacity, we use an empirical polynomial regression equation provided by ODFW that predicts smolt rearing density based on summer inventory data describing channel gradient, % pools, number of beaver ponds, active channel width, and reach length.
- The spring season is ignored in the analysis.
- Where possible, we approximate missing reach habitat data with information collected in nearby reaches, or with habitat sub samples collected during RBA surveys.
- We run the model using two sets of survival rates. One set is provided in ODFW Information Report 98-4, and the other set is based on the unpublished data of James Hall at Oregon State University. The two sets of rates vary in their assumptions about survival, and thus provide outputs that express alternative views of seasonal rearing potentials. More specifically, the ODFW survival rates are higher than those of the OSU study because they assume that only density independent mortalities occur, while the OSU rates are based on population studies where all forms of mortality occurred.

Combining model results with other resources

Clearly, the model's output should be seen as just one guideline in a decision making process that necessarily relies heavily on the professional judgment of the biologists conducting the assessment as other information is reviewed.

As part of this process, summer habitat conditions and distribution (based on habitat inventories) are compared to the summer distribution of juvenile Coho (RBA surveys). This comparison shows how the fish respond to physical habitat variables, and is generally very informative.

Some very important habitat conditions which are not adequately evaluated during physical habitat surveys must also be considered. These include sediment loading and elevated summer temperature. Information on these topics is generally sparse, and usually must be augmented by observations made during the field assessment. A typical examination of elevated temperature effects would review the few temperature measurements provided by survey crews and possibly some DEQ temperature monitoring records, consider the sources and locations of cold water inputs, and assess the level of shading provided by the riparian canopy.

The assessment process therefore is not a fixed methodology that relies strictly on data tabulation and model outputs. Rather, it is an informed use of diverse and incomplete resources that change from system to system.

Bummer Creek analysis

Recent aquatic habitat surveys of the Bummer Creek subwatershed are limited to Record Creek (ODFW 2000) and to Bummer Creek above Swamp Creek (ODFW 1995). The high gradient channel of Bummer Creek above Tributary D that leads into the headwaters was surveyed in 1995 by ODFW. However, this section is not included in the current assessment because it contains only marginal Coho rearing potential up to and no potential above a currently impassable falls and jam.

Lower Bummer Creek, Banton Creek, Swamp Creek, and Brown Creek, all containing potentially important low-gradient stream channels, have not been recently surveyed. For these reaches, we used RBA pool type and dimension data as a basis for estimating summer physical habitat structure. This approach does did not allow us to distinguish among glide, rapid, riffle, cascade, and other non-pool habitats. All non-pool habitat was classified as "riffle" for the purpose of evaluating Coho rearing capacity.

Field assessment

Migration barriers

There are 5 documented barriers to migration within the entire 6th field that have the potential of impacting the distribution of anadromous salmonids.

1) A natural 5 ft vertical plunge at the confluence of Trib A and mainstem Bummer. This barrier is inundated during moderate to high winter flows and therefore passes migratory Cutthroat that would be targeting this very small 2nd order tributary.

2) A natural 7 ft vertical bedrock falls at RM 6.1 that has been observed to terminate adult Coho migration but that is dependant on flow regimes (some years juvenile Coho have been observed above this falls). The falls is currently the endpoint of the ODFW adult spawning survey reach. During the 2005 inventory conducted by Bio-Surveys, there was an ephemeral full spanning log jam 400 ft above the bedrock falls that is currently acting as a definitive adult barrier. In addition, habitats are minimal because of the steep channel gradient developing in this segment.

3) The concrete dam on Wilson Cr just above the Alsea / Deadwood Hwy crossing. This is a definitive barrier to both adult and juvenile salmonids of all species. The dam is in an advanced state of disrepair and the spillway designed to provide a jump pool for adults is completely dysfunctional. Juvenile Inventories have documented Coho rearing in lower Wilson within the boundaries of the Bummer Cr floodplain. It appeared that spawning could have occurred in this lowest segment. The May 2005 inventory of Wilson inventoried the habitats above the concrete dam to assess their potential for rearing adult Coho. There were no spawning gravel sites located that would be adequate for Coho or Steelhead within the reach. There were however significant segments of low gradient marsh habitat that would provide high quality rearing habitat for potential upstream migrant juveniles.

4) Brown Cr (Trib of Swamp Cr) forks at approximately 1,500 ft into two equal subbasins. The subbasin to the right (west fk) then immediately forks again with both of these forks going under the Prairie Mtn road. At both of these crossings there are barriers to both juvenile and adult migration in the form of rotted and perched culverts. The first culvert is perched 1 ft and the bottom is rotted out of the 3ft dia. corrugated

metal culvert. The subbasin above is a high quality spawning destination for Cutthroat and possibly Coho. Coho juveniles have been observed to the road crossing but not above.

5) The second Brown Cr culvert on the Prairie Mtn road exhibits a 6in perch and the bottom of the 3ft corrugated culvert is rotted out. The subbasin above is a high quality spawning destination for Cutthroat trout and possibly Coho. The pipe is undersized and has impounded water above the pipe during high flow regimes and scoured a large plunge pool below with excessive velocities.

Temperature issues

There is very limited temperature data available for the Bummer Cr 6th field. It is currently not on the DEQ 303(d) list. Most of the available temperature data has been collected as a byproduct of historical habitat or juvenile inventories. A temperature of 60 deg F was recorded by Bio-Surveys just above its confluence with the South Fk Alsea at 10:00 on July 5, 2001.

The BLM South Fork Alsea Watershed Analysis describes Bummer Cr as exhibiting approximately 1/3 of its subbasin stream miles as high risk for temperatures that exceed standard thresholds for aquatic species. This analysis was based on a basin morphology modeling exercise designed to highlight potential areas of concern for elevated temperature. In addition, Bummer Cr was ranked as the most at risk 6th field in the South Fk. Alsea 5th field.

It is likely that lower Bummer Cr (below the confluence of Swamp Cr) is capable of approaching and / or exceeding juvenile salmonid temperature thresholds.

Temperature dependant migrations of juvenile salmonids have been observed within the scope of the Rapid Bio-Assessment Inventories. These occur in Brown, Wilson and Trib B. This migration pattern is a potential indication that mainstem temperatures are not optimal.

Aquatic habitats overview

Core Area

Describe the Core Area and its location.

The Core area describes the current summer distribution of Coho within the 6th field. Coho utilize 6.1 miles of mainstem Bummer Cr to a full spanning debris jam complex that terminates anadromous migration just above the confluence of Trib E. In addition, Coho have been observed as high as 2.7 miles in Swamp Cr, 0.3 miles up Brown Cr, 0.5 miles up Record Cr, 0.6 miles up Banton Cr and short distances in Wilson Cr and Tribs B and E of Bummer Cr. and Trib A of Swamp Cr.

Spawning gravel

Describe the quantity, quality and location of spawning gravel.

Gravel abundance was limited with only 299 sq. meters observed throughout the 6th field. To complicate this low abundance 41% of the total was ranked as poor (25% egg / fry survival) and 48% was ranked as fair (50% egg / fry survival). The effective abundance of spawning gravel utilized for the Limiting Factors Modeling process was 135 sq. meters.

The distribution of spawning gravel is not even throughout the 6th field. All of the gravel classified as high quality was observed in Bummer Cr above the confluence of Swamp Cr. and Trib E of Bummer. In addition, 80 % of the gravel classified as fair was also observed in Bummer Cr.
Swamp Cr, a major producer of summer parr only contained 7 % of the gravel ranked as fair and 29 % of the gravel ranked as poor and no gravel ranked as high quality.

Juvenile distribution patterns suggest that 28% of the spawning gravel observed in mainstem Bummer (those gravels below the confluence of Wilson Cr) are not being utilized by adult Coho even on moderate adult abundance years. This may reduce the estimate of functional spawning gravel from 135 sq. meters to 113 sq. meters. This may be a function of the channel entrenchment that was observed in this section that at winter flows would significantly alter the channel character from the riffle / pool complex observed in the summer to a continuous pasture trench type habitat without the appropriate hydraulics for encouraging and retaining spawning adults.

There is an important geological distinction between Bummer Cr above the confluence of Swamp Cr and Swamp Cr that is significant in the uneven distribution of high quality gravel. The basaltic headwater origins of Bummer are producing durable gravels and significantly less sand when compared to the sandstone dominated headwaters of Swamp that produce highly erodible gravels with a high percentage of sand and fines.

Summer juvenile distribution

Describe the summer distribution of Coho juveniles. Include a description of the resources used.

There have been 4 years of summer juvenile snorkel surveys completed in the Bummer Cr 6th field (1998, 2000, 2001, 2002). Each of these surveys has been conducted to the full extent of juvenile Coho distribution within the mainstem and all of its tributaries. During years of low abundance (1998) there were no Coho observed in Wilson, Banton, Record, or Tribs A, B, C, D or E. Spawning and rearing was occurring only in mainstem Bummer, Swamp and Brown. Peak spawning activity during these low abundance years occurred in the same place that peak spawning was observed in high abundance years (RM 5.5 in Bummer Cr and RM 2.0 in Swamp Cr.). During moderate abundance years spawning peaks were observed just below the confluence of Swamp and Bummer but no spawning was observed in the lower 2.7 miles from the mouth of Bummer to the confluence of Wilson.

During all of the inventoried years there was only one location that exhibited rearing densities near capacity, Swamp Cr from RM 1.0-2.3 (see Coho Density histogram from 2002). Within this reach only 28 % of the pool habitats contained high densities with the remainder averaging 50 % of their potential carrying capacity. This is an indication that habitat selection was occurring with a significant preference toward pool complexity. To support this conclusion a review of juvenile Coho distribution from the 1998 low abundance year also exhibits the same habitat preference even at extremely low rearing densities with many pools containing no rearing Coho. This is an unusual pattern and may be indicative of extensive pressure from predators. It also suggests that the injection of cover and complexity into this segment could benefit survival substantially. A review of Cutthroat abundance in this segment does not appear to exhibit unusual abundance with a range of 1-4 individuals / pool observed.

The abundance of summer rearing Coho below the confluence of Wilson Cr was zero in years of low abundance and negligible even in years of high abundance (<0.1fish/sq.meter). There is no clear evidence that this zone is incapable of rearing higher densities (no definitive evidence of a temperature limitation). Therefore, until adequate temperature data is sequestered we will assume that summer abundance in the lower 2.7 miles of mainstem Bummer has contemporarily been limited by adult escapement.

The expanded 6th field estimates of summer parr abundance from the 20 percent snorkel inventory were as follows;

Bummer Cr	**Coho**	**0+**	**Sthd**	**Cut**
1998	665	315	405	655
2000	2360	460	230	650
2001	4430	455	300	1070
2002	6065	185	170	770

Summer cover

Describe the character and distribution of summer cover. Note that this evaluation generally lacks quantitative measurement, and relies on professional judgment.

The abundance of summer cover for juvenile salmonids is often expressed in quantitative inventories as the abundance of woody debris. Lower Bummer Cr (from the confluence with the South Fk Alsea to the confluence of Swamp Cr at RM 3.8) is rich with wood complexity that is integrally associated with the aquatic corridor. There is a combined total of 90 pieces / mile that are providing cover and edge oriented complexity for the provision of complex rearing habitat. There is however only 3 pieces /mile in this reach that are large enough to qualify as key logs capable of providing a foundation for the development of complex jams.

Upper Bummer Cr from the confluence of Swamp Cr to the confluence of Trib D on the left at RM 5.6 contains a very low pool / riffle ratio (especially above the Alsea / Deadwood Hwy crossing). This is a result of a lack of sinuosity in the channel above the Alsea/ Deadwood Hwy crossing and the lack of wood complexity. The aggregate wood count for the reach was excellent at 146 pieces /mile, however the section above Anchor Site #2 for approximately 1 mile is not a significant contributor to this wood complexity. Consequently summer cover is minor and should be addressed as part of the comprehensive restoration plan.

Swamp Cr contains a total of 120 pieces / mile of combined wood and 4 pieces / mile of wood classified as key pieces. Twenty nine percent of all the significant wood (>12 dia) in Swamp Cr was placed as part of stream enhancement projects on private property to create complexity and trap mobile substrates. There is a significant segment on the Turpin property that lacks wood complexity and exhibits the potential for interactive floodplains that should be considered in a restoration prescription.

Record Cr contains a total of 67 pieces / mile of woody debris. Six pieces /mile were classified as key log pieces. Record has not contained Coho in all of the surveyed years but in 2002 (moderate adult abundance) produced an estimate of 245 Coho or the progeny of possible two spawning pairs. There is a 0.7 mile section of Record that exhibits potential for good floodplain interaction that could be enhanced as part of a restoration strategy that begins at RM 0.4 and extends to the confluence of a major left Trib.

Winter cover

Describe the character and distribution of winter cover. Note that this evaluation generally lacks quantitative measurement, and relies on professional judgment.

Bummer Cr exhibits good levels of interactive woody debris that can function to provide complex cover during winter flows. However, the section from the mouth to 0.2 miles below the confluence of Wilson Cr is deeply entrenched (8 – 10 ft). This 2.5 mile corridor, because of its deep entrenchment and the inability of the active channel to access its floodplain provides very limited potential for winter habitat. This condition improves in the 1.3 mile section below the confluence of Swamp Cr in the zone classified as Anchor Site #1. Within this zone a consistent low terrace is present that alternates from left to right, sinuosity is higher, riffle habitats are more pronounced with a slight increase in gradient. Side channel and backwater habitats are abundant. All of these characteristics improve the potential for the development of floodplain connectivity. There is also another section of Bummer (identified as Anchor Site #2) above the confluence of Swamp Cr that exhibits interactive floodplains. This interaction provides high quality winter cover and complexity for approximately 0.7 miles (see project location map).

Above Anchor Site #2 in mainstem Bummer the potential for winter cover is negligible until the first habitat improvement structures are encountered on private industrial forest ownership (this is approximately 1 mile).

Swamp Cr exhibits a similar channel form to that of lower Bummer for the first 1.0 miles. In this section terrace confinement limits winter habitat potential during mean winter flows. The remainder of the Swamp Cr corridor exhibits an entirely different channel form that provides for a much higher abundance of floodplain connectivity than observed in all of Bummer except for Anchor Site #1. The result of this condition is the increased potential for winter habitat in low velocity habitats associated with backwaters, eddies and natural alcoves. Expect the retention of juveniles through the winter to the smolt stage to be significantly higher in upper Swamp Cr than in most of mainstem Bummer Cr.

Channel form and floodplain interaction

Describe the channel form and degree of floodplain interaction.

We have been alluding to significant differences in channel form in the previous discussion of winter cover and complexity. It is important to not underestimate the dominant effects of channel form in the development of cover and complexity especially during winter flow regimes. The channel in lower Bummer Cr from its mouth to a point 0.2 miles below the confluence of Wilson Cr is deeply incised (8 – 10 vertical ft). The channel has moderate sinuosity which provides some minor level of velocity relief at winter flows. However, this section can be ranked as having almost no floodplain interaction and no potential for improving the current situation through restoration.

The section from RM 2.5 to just below the confluence of Swamp Cr is extremely different and can be considered a morphological transitional zone. The channel here doubles its gradient from 0.3% in the entrenched segment to 0.6%. In addition, there is an increase in channel sinuosity, an increase in the frequency of spawning gravel (although quality is poor from silt loading), exposed gravel bars are now present between pool habitats and point bars, backwaters and side channel habitats are appearing for the first time. There is also a low inner terrace that remains fairly continuous within this segment that suggests that good floodplain connectivity occurs here at moderate winter flows (less than bankfull).

Bummer Cr from the confluence of Swamp Cr to the top end of identified Anchor Site #2 (aprox. 0.8 miles) exhibits high quality interaction between low floodplain terraces and the active channel at both summer and winter flows. The channel is highly sinuous, exhibits braiding and side channels and is classified providing good function. The remainder of the mainstem Bummer Cr corridor from the top end of Anchor Site #2 (behind the Biddell residence) to the end of anadromous distribution exhibits extremely poor function. There is almost no current potential for floodplain interaction. The channel is moderately entrenched and most distinctly, lacks any sinuosity. Indications are that significant historical effort was exerted here to simplify the channel and to maximize the abundance of tillable soils for farming.

The Swamp Cr corridor exhibits excellent sinuosity and maintains a relatively low gradient (0.8%) from its mouth to the Alsea / Deadwood Hwy crossing. The stream is terrace confined to approximately RM 1.0. At this point the channel becomes more interactive with its floodplain and exhibits alternating low terraces and the development of point bars. The lower terrace confined portion of Swamp exhibits much shallower entrenchment than observed in lower Bummer Cr. (4 -5 ft) and begins to interact with the floodplain at mean winter flow events. Terraces become completely inundated during a bankfull flow event. This segment of stream exhibits a legacy of significant beaver occupation that no longer exists.

Channel complexity potential

Assess the potential for the development of meander, braiding, side channel, alcove, backwater channel forms.

The entrenched channel form observed in lower Bummer is locked into a trajectory of entrenchment by historical manipulation of the stream adjacent terraces by agriculture and by a lack of large woody debris in the riparian for recruitment to the channel. Because of the severe entrenchment in the lower 2.5 miles of Bummer Cr, there is very limited potential for the development of channel complexity in the form of off channel habitat types. There are no reasonable prescriptions for changing the state of entrenchment in this lower 2.5 mile segment of Bummer Cr.

The interactive channel observed from RM 2.5 to just below the confluence of Swamp Cr exhibits potential for channel development that trends toward complexity. Larger substrates (gravels) are dropping out in this segment to form bars and accumulate and sort behind structural components (logs). The potential for the development of off channel habitat types is excellent. Many of these conditions currently exist and improving them, maintaining them and expanding their surface areas is simply a matter of improving channel roughness with the injection of large woody debris. Maintaining a healthy riparian here that will continually recruit roughness to the active channel will support complexity and frustrate entrenchment.

The Bummer Cr corridor from the confluence of Swamp Cr to the end of anadromous distribution exhibits two distinct zones of channel morphology and thus two different potentials for channel complexity. The first segment (a 0.8 mile subsection) begins 600ft above the confluence of Swamp Cr and exhibits excellent potential for the development of off channel habitat types. This segment has been classified as Anchor site #2 and will be discussed in detail. The remainder of Bummer Cr to the end of anadromous distribution exhibits limited potential for the development of substantial off channel habitat types.

Swamp Cr Has been the location of at least two historical instream wood placement projects designed to directly effect the development of the active channel. The lower treatment was conducted on the Podmore property and consisted of full spanning structure complexes designed to mimic the historical beaver presence in the zone that originally formed the uniform deposition plains that currently confine the entrenched channel. The intent was to lift the channel back to a more interactive elevation by encouraging deposition behind the full spanning structures. The upper treatment on private industrial forest land was designed to trap mobile gravels, create pool scour, cover and complexity. Both sites have improved the condition of the channel for the production of salmonids and resisted the tendency for channel simplification and entrenchment. Swamp Cr has exceptional potential for the development of off channel habitat characteristics because of its shallower entrenchment and interactive floodplain terraces.

Channel complexity limitations

List and rank the factors currently limiting the development of channel complexity.

1) Deeply entrenched active channels through isolated floodplains
2) Limited riparian potential for the recruitment of large stable woody components
3) Low sinuosity in upper Bummer (above Alsea / Deadwood Hwy) from historic channel manipulation
4) Low density of full spanning debris jam complexes to encourage floodplain connectivity
5) Low abundance of Beaver activity that historically prevented the development of deep entrenchment

Addressing the limitations

Are these limitations addressable through restoration work? Explain for each limitation listed above.

1) The deep entrenchment observed primarily in the lower 2.5 miles of Bummer Cr does not appear addressable through accepted means of restoration.

2) There are definitely significant opportunities to address long term channel function with the treatment of riparian corridors with planting prescriptions to boost the availability of large conifer for future recruitment.

3) The low sinuosity in upper Bummer Cr does not appear to be addressable through accepted methods of restoration.

4) This is a condition that can be easily addressed with restoration prescriptions. In addition, this is the most likely treatment to have a beneficial long term effect on channel condition.

5) There is no contemporary or historical beaver abundance data available to utilize as a foundation for suggesting a decline. However, there is substantial visible evidence that large beaver ponds used to be present in Swamp Cr that are no longer present. Restoring beaver populations to Swamp Cr could be considered a viable restoration alternative if cooperation from a broad range of private landowners was sequestered.

Anchor Site 1

This site is the largest in the 6th field and begins 0.2 miles below the confluence of Wilson Cr at RM 2.5 and extends 1.2 miles upstream to a point 0.1 miles below the confluence of Swamp Cr. The Anchor site exhibits the first transition from an entrenched channel type to low interactive terraces, side channel development and point bar development.

Sinuosity

Sinuosity values are approximately 1.3 and slightly higher than approximate values calculated for the reach from the mouth to the start point of the anchor site. Continuous alterations in meander patterns and sinuosity values can be expected from this Anchor because of the broad interactive floodplain that extends to 300 ft in some locations.

Terrace structure

Within the Anchor Site there is a broad meander belt between confining terraces (up to 270ft). This is note worthy because it is distinctly different than the width of the meander belt in the lower segment of Bummer Cr that averages 75 ft. However, terrace confinement is still the dominating control for any potential shift in channel complexity and floodplain interaction only occurs on lower terraces within the confinement of higher terraces above the level of normal bankfull.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

Spawning gravels have been quantified within the Anchor (approx 142 sq. meters). This represents 61% of the total amount of gravel available in lower Bummer Cr from the mouth to the confluence of Swamp Cr. This 1.1 mile Anchor represents 29 % of the lineal distance in lower Bummer Cr. The observed gravels are classified as 44% poor and 56% fair. All of the gravels are burdened with sand, silt and fines to some extent and there was no high quality, well sorted gravel observed. This is significant because redds within the Anchor will always exhibit lower egg / fry survival rates than observed in Anchor #2 or Swamp Cr. Both of the 2001 and 2002 summer juvenile inventories exhibit spikes in fish density within this Anchor site that may be an indication of spawning activity.

Summer rearing of juvenile Coho is occurring within the Anchor during years of moderate adult abundance. Observed densities are significant but have never been documented over 0.4 fish/sq. meter. This rearing density was probably not a result of ecological capacity but more likely a response to a general state of under seeding during the inventoried years. Habitats below the physical bounds of this Anchor site have not exhibited significant abundances of summer rearing juveniles (this may also be related to under seeding).

Winter habitat within the Anchor is extremely high quality and is the result of both wood complexity and channel form. The broad meander belt facilitates the development of many backwaters, seasonal side channels and low terraces for effective floodplain interaction. Winter habitat inventories do not exist for Bummer Cr and therefore this assessment is based on professional opinion.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

There are some significant unknowns that may be limiting factors within Anchor Site #1. These are summer temperature profiles and sedimentation. Each of these factors could dramatically influence egg/fry survival rates. Without adequate information to evaluate these two critical parameters we are unable to definitively identify a single dominant limiting factor within the Anchor Site. It is likely however, that each of these factors is providing some limitation to the Anchors carrying capacity and production potential. We have attempted to factor lower egg / fry survival rates into the Nickelson Modeling process within this

Anchor site by ranking the quality of the spawning gravel and then attributing a lower incubation success rate to emergent fry.

The abundance of winter habitat does not appear to limit capacity within this Anchor. However, because all of the habitats below the boundaries of this anchor are deeply incised and exhibit no potential for winter function. It may be realistic to assume that this Anchor functions as a last resort for Winter habitat for juveniles summer rearing higher in the basin. This suggests that any effort to expand winter habitat potential in this Anchor could have a disproportionately positive impact on over winter survival for the 6th field.

Addressing the limitations

List and rank the restoration work at the site that would most effectively increase survival within the site and stabilize the core population at a higher base level.

1) Development of any off channel habitat linkage for the provision of winter habitat
2) Improve wood complexity and channel roughness to encourage gravel sorting and provide low velocity winter habitat
3) Plant riparian conifers to provide a long term source of large wood for restoring and maintaining optimum channel function
4) Prioritize any upstream restoration efforts that could reduce the cumulative impacts on stream temperature that may be limiting summer carrying capacity in Anchor Site #1

Anchor Site 2

Location and length

This Anchor site begins 750 ft above the confluence of Swamp Cr and extends 0.56 miles to a point directly behind the Bidell residence. The gradient increases to 1.2 % and this anchor represents the highest functioning portion of stream corridor in the Bummer Cr 6th field.

Sinuosity

Sinuosity within the Anchor is excellent in the lower ½ and begins to diminish above the Alsea / deadwood Hwy crossing. Road construction and agricultural activities have impacted this upper ½. Improvements in sinuosity in this upper ½ are attainable through full spanning log placement that promotes channel meander.

Terrace structure

There are many broad (75 ft) low terraces within the anchor and evidence of old channel braids. There is a significant low terrace just above the Alsea / Deadwood Hwy crossing that is currently maintaining a seasonal division between the active channel and high quality off channel habitats (85ft wide) during winter flow regimes. This provides an excellent restoration opportunity for connecting off channel habitats. The low terraces provide an excellent platform for channel meander and the development of additional off channel winter habitat.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

There was 39 sq. meters of spawning gravel identified within the Anchor that were classified as appropriate for Coho and Steelhead. Twenty three percent of this gravel (9 sq. meters) was classified as high quality. The anchor is also a spawning destination for large numbers of Fall Chinook (gravels not quantified). The highest Coho rearing densities within the Anchor were observed in 2001 (See Appendix 6) and averaged only 0.4 fish/sq. meter. Peak rearing densities in the 6th field during all of the inventoried years were only 1.0 fish / sq. meter (attained in only limited zones directly associated with spawning activity). Adult escapement has likely not been adequate to seed the available summer rearing habitat

The abundance of winter habitat within the anchor is excellent (unquantified) as displayed by the presence of several large back waters (confluence of Banton Cr and just above the Alsea / Deadwood Hwy culvert crossing). There is significant potential for improving this condition through restoration.

Lamprey redds were observed during the May, 2005 inventory conducted by Bio-Surveys.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

The Anchor site can be classified as exhibiting good current function. Riparian conditions are excellent, temperature is probably optimum, gravel is present and well sorted and obvious high quality winter habitat is present. The primary long term limitation to production potential is probably channel morphology and its trend toward simplicity. Channel morphology above this anchor has been so heavily impacted that a heavy burden for the provision of low velocity winter cover is shifted to the Anchor site below. It is unlikely that the current winter habitat capacity is adequate for providing a sink for all of the potential production occurring in the 1.7 stream miles of Bummer Cr above the end point of the Anchor.

Addressing the limitations

List and rank the restoration work at the site that would most effectively increase survival within the site and stabilize the core population at a higher base level.

1) The provision of additional wood complexity within the anchor that takes advantage of existing low terraces for developing interactive floodplain habitats during winter flow regimes.
2) The injection of additional wood complexity on the private property corridor above the Anchor site location to supplement the provision of winter habitat even though channel entrenchment and lack of sinuosity will limit the effectiveness of these installations.

Anchor site rankings

Function

Rank the identified anchor sites in terms of current function (1= best).

1) Anchor Site #2
2) Anchor site #1

Restoration potential

Rank the identified anchor sites in terms of restoration potential.

1) Anchor Site #1
2) Anchor Site #2

Secondary Branch 1 (Swamp Cr)

Location and length

Swamp Cr is the primary secondary branch and includes habitat contributions from Record Cr, Brown Cr and Trib A. The total inventoried habitat for Swamp and its tributaries has been as high as 3.9 miles (habitats observed with Coho parr present). Swamp Cr enters the mainstem of Bummer at RM 3.8. Additionally significant is that Swamp delivers directly into Anchor Site #1 and is a primary contributor of flow (50%).
Swamp 2.8 miles
Record 0.5 miles
Brown 0.3 miles

Trib A 0.3 miles

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

Swamp Cr and its tributaries contributes 22 % of the total available spawning gravel for Coho and Steelhead observed in the Bummer Cr 6th field (66 sq meters). These gravels on moderate years of adult abundance (2002) have produced 43 % of the summer standing crop of juvenile Coho. The 2002 contribution may have been actually higher than observed because of parr rearing in lower Bummer that could have originated from the Swamp Cr branch.

Winter habitat is unquantified and this analysis relies on professional judgment from inventories conducted in the summer. For the first 1.0 miles Swamp Cr is terrace confined. This channel morphology limits winter habitat potential during mean winter flows. The remainder of the Swamp Cr corridor exhibits an entirely different channel form and provides for a much higher abundance of floodplain connectivity than observed in most other segments of the 6th field. The result of this condition is the increased potential for winter habitat in low velocity habitats associated with backwaters, eddies and natural alcoves. Expect the retention of juveniles through the winter to the smolt stage to be significantly higher in upper Swamp Cr (above RM 1.0) than in most of mainstem Bummer Cr.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

There are two primary limitations that appear to impact Swamp Cr.
1) Channel entrenchment in the lower 1 mile that limits the provision of off channel winter habitats during mean winter flows.
2) Low densities of full spanning wood complexes to trap and sort gravel and encourage floodplain connectivity.

Addressing the limitations

1) Half of this lower 1 mile of Swamp Cr has been treated with full spanning log placements to lift the active channel into a more interactive state with its floodplain. The lower 0.5 miles is still untreated and could be incorporated into a log placement project. However, the current property owners (Glades) have expressed concerns over log placements.

2) Log placements in the section from RM 1.0 to the Alsea / Deadwood Hwy crossing would dramatically improve floodplain connectivity and the sorting of high quality spawning gravels. There are 3 small private landowners in this section that would need to be approached.

Secondary Branch 2 (Banton Cr)

Location and length

Banton Cr is a 3rd order tributary from the east of mainstem Bummer Cr. It enters Bummer Cr at RM 4.0, 1,300 ft above the confluence of Swamp Cr. Bio-Surveys quantified spawning gravels to a point 0.7 miles above it's confluence with mainstem Bummer. No AQHI data exist for the tributary.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

The tributary is sand and silt dominated and there is only minor potential for spawning in the subbasin with 10 sq. meters of gravel observed. Ninety percent of the quantified gravel was classified as poor and heavily burdened with silt sand and fines. No Coho have been observed rearing here in any of the 5 inventoried years including 2005. Summer and winter rearing capacity in the tributary is massive because of a manmade lake that provides passage for adults. However, this potential has been unrealized in contemporary surveys and may be a function of the limited abundance of functional gravel. The lake rearing habitat is not accessible to potential upstream temperature dependant migrants because of two separate barriers to juveniles that exist between the lake and the mainstem of Bummer. These are natural sandstone falls and cascades (2ft and 3ft) that collective form a barrier for juveniles.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

1) The primary limiting factor within Banton Cr appears to be the quality of the available gravels for successful incubation.

Addressing the limitations

1) There are no restoration prescriptions that could effectively rectify the current limiting factor issue.

Secondary Branch 3 (Wilson Cr)

Location and length

Wilson Cr is a third order tributary of mainstem Bummer that enters at RM 2.6. Bio-Surveys conducted an inventory in 2005 that extended 0.7 miles upstream to quantify the abundance of accessible spawning gravel. No AQHI data exist for the tributary.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

There was no spawning gravel observed in the tributary. The system was marsh dominated with depositions of silt, sand and fines and no exposed hard rock. There is a man made pond on the tributary with a concrete dam that has been compromised by flows scouring underneath the structure. This structure terminates both adult and juvenile upstream migrations from the mainstem. In addition, there are 3 separate culverts that appear to be passable for adults and juveniles. There have been juvenile Coho observed in lower Wilson Cr within the floodplain of mainstem Bummer. It is likely that these juveniles were the result of a minor upstream temperature dependant migration from the mainstem. For all 5 of the inventoried years Coho juveniles were only present in the tributary in the first few pools.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

1) The primary limitation for Wilson Cr is the quantified absence of spawning gravel for Coho or Steelhead.

Addressing the limitations

1) No restoration prescriptions are available for improving the current limitation of a lack of spawning gravel.

Secondary Branch 4 (Trib A)

Location and length

Trib A is a small 2nd order tributary that enters mainstem Bummer Cr at RM 1.7 on the right from the west. The tributary enters Bummer Cr over a 5ft vertical pour and is inaccessible during summer flow regimes.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

The stream is accessible only during flows that are equal to or above the winter mean. The habitat is appropriate for migratory Cutthroat but not for adult Coho or Steelhead. The stream contains no gravels that are appropriate for large anadromous salmonids and it does not contribute to the rearing potential for these species.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

1) Minor flow profile limits access for large salmonids

Addressing the limitations

1) No prescription

Secondary Branch 5 (Trib B)

Location and length

Tributary B is a small second order stream that joins mainstem Bummer Cr at RM 2.7. It enters on the right from the west. The lower segment of Trib B is dominated by marsh habitats and low gradient.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

The 2005 inventory conducted by Bio-Surveys observed large numbers of Coho fry in this lower marsh habitat. The stream itself does not contain gravels appropriate for large anadromous spawners (Coho, Steelhead). Our conclusion is that this is prime habitat for spring fry and the reduction of summer water tables within the marsh habitats probably impacts summer rearing surface areas. Trib B enters Bummer within the defined boundaries of Anchor Site #1 and probably provides extremely high quality winter rearing potential as well.

Rearing limitations

Which functions limit the site's production potential, and what causes these limitations?

The tributaries production potential is dependant on fry originating in other segments of the 6^{th} field. The carrying capacity of the trib habitats is a function of its ability to retain summer surface area in the low gradient marsh habitats near the mouth.

1) The primary limitation would be the quality and quantity of summer flow

Addressing the limitations

1) Protect the tributary from upslope and riparian impacts (solar exposure) that may impact instream water temperatures.

Secondary Branch 6 (Trib E)

Location and length

Trib E is a 3^{rd} order tributary that enters the mainstem of Bummer Cr at RM 6.0. The tributary enters on the right from the south west. Trib E was surveyed in 2005 by Bio-Surveys to quantify the abundance of spawning gravel. The survey extended approximately 1,500 ft to an 8% bedrock chute that probably limits adult distribution.

Rearing contribution

Describe how the site contributes to spawning, incubation, summer rearing, and winter rearing.

There was 17 sq. meters of gravel observed and most significantly, 33% of the entire 6th fields supply of gravel classified as high quality. Coho have been observed within the tributary but rearing abundances have been minor because of the limited pool surface area in this higher gradient tributary. Winter habitat is not available in Trib E because of the steep gradient and the potential for high velocities at winter flow regimes.

This secondary branch not only provides potential rearing habitat for Coho but has been identified in the ODF landslide risk analysis (see appendix) as exhibiting the highest likelihood of delivering a debris torrent directly into habitats occupied by rearing Coho.

limitations

Which functions limit the site's production potential, and what causes these limitations?

1) Steep gradient
2) Limited pool surface area

Addressing the limitations

1) No prescription
2) No prescription

Secondary branch site rankings

Function

Rank the identified branch sites in terms of current function (1= best).

1) Trib E
2) Trib B
3) Swamp Cr
4) Trib A
5) Banton Cr
6) Wilson Cr

Restoration potential

Rank the identified branch sites in terms of restoration potential.

1) Swamp Cr
2) Trib B
3) Wilson
4) Trib A
5) Banton Cr
6) Trib E

Only the top 3 rankings should be considered for the development of restoration prescriptions and Wilson Cr only if consideration is given to the provision of access for anadromous Cutthroat.

Lower mainstem area

Winter habitat potential

The lower mainstem below Anchor site #1 is homogeneously poor winter habitat because of its current state of deep channel entrenchment. This represents a 2.5 mile corridor from it's confluence with the South Fk Alsea that provides only limited winter function. The winter habitat available would be associated with small wood complexity and inside corner bends within sinuous portions of the channel. Some minor low terrace surface area does exist but variable winter flows would negate their potential for continuous connectivity.

Summer habitat potential

The lower mainstem has exhibited the potential of rearing juvenile salmonids during moderate abundance years at low densities (0.1 fish/sq. meter). The ability of this stream segment to maintain summer abundances at or near carrying capacity has not been tested during contemporary inventories because low adult escapement to the 6^{th} field has resulted in low levels of seeding . Therefore it has not been possible to observe a response in juvenile abundance and distribution to potential elevations in summer temperature that may exceed the threshold for juvenile salmonids in the lower mainstem. The summer distribution data that does exist for the lower mainstem indicates that there is preferential selection of habitat based on wood complexity (this is evident with no Coho observed in low complexity pools).

Lowland habitats

Describe lowland habitats and locations outside the 6th field.

Bummer Cr joins the South Fk Alsea 1,550 ft above the South Forks confluence with the mainstem Alsea River. From this point it is 34 river miles to the head of tide and the potential for estuarine rearing habitat. Mainstem Alsea rearing is known not to be occurring in significant quantities during summer flow regimes because of elevated summer temperatures above the threshold for juvenile salmonids. Mainstem Alsea winter rearing may be occurring at low levels but winter juvenile inventories in mainstem Five Rivers indicate that this mainstem contribution is minor. No other high quality wetland or lowland interface is present until juveniles have arrived in tidally influenced segments of the 4^{th} field.

Riparian corridor

Dimensions and location

Describe the lineal dimensions and location of deciduous, coniferous, and open canopy.

Lower Bummer Cr from the mouth to the confluence of Swamp Cr (3.8 miles) currently exhibits 35% of the riparian corridor in an early seral stage of open canopy resulting in solar exposure on the aquatic corridor. Ninety percent of this open canopy is in the lower 2.7 miles of the mainstem below the confluence of Wilson Cr. 100 percent of this open canopy exhibits at least 50% solar exposure. 54 percent of this open canopy exhibits at least 80 % solar exposure.

This lower riparian (2.7 miles) is dominated by older age class alder that exhibit signs of senescing. Expectations are for this section of the riparian to be trending in the direction of increased solar exposure rates. Reed Canary is a dominant inner riparian species that maintains bank stability but chokes out the natural regeneration of native woody species.

The second reach of Bummer from the confluence of Swamp Cr to the confluence of Trib D maintains a consistent over story of primarily deciduous vegetation (alder) that protects the majority of the active channel from solar exposure. There is an occasional riparian conifer within one site potential of the active channel approximately every 300 ft above the Alsea / Deadwood Hwy crossing. The zone classified as anchor site #2 does not exhibit the livestock grazing impacts to vegetative succession that are observed in the 0.9 miles above the top end of anchor site #2. In this area, rotational grazing is practiced that maintains a very healthy under story of annual grasses. No detrimental impacts to bank stability were observed. However, the annual rotational grazing tends to fix vegetative succession in an early seral stage that will not be capable of replacing the current over story when alders senesce and die. Expect the trend for a large segment of upper Bummer to be toward increases in solar exposure.

Swamp Cr exhibits a deciduous dominated canopy with some conifer component on the Podmore property. There is limited solar exposure for the majority of the corridor except for the section just above the Alsea / Deadwood Hwy crossing where the active channel traverses a cattle paddock for 300 ft with no significant riparian on either bank. This area is not classified as creating a significant impact because of its limited lineal duration.

Recruitment potential

What is the recruitment potential and time frame for delivery to the channel?

There are two areas that exhibit significant conifer recruitment potential to the active channel. The first is 0.5 miles of Swamp Cr on the Podmore property from the confluence of Record Cr upstream. The second is the East side of Bummer Cr between the confluence of Trib D and Trib E. Each of these segments of riparian currently are stocked with large second growth conifers that could play a role in boosting stream complexity.

In addition, it is worth discussing the recruitment potential of the riparian corridor within the confines of Anchor site #1 (RM 2.6 – 3.8). This stream segment is actively recruiting deciduous species (alder and maple) to the stream corridor from the natural deflection in thalweg caused by a sinuous channel. These wood components are short lived and do not offer the long term return in fish production that conifer placements could provide. However, short term aquatic complexity here is currently high.

Thermal problems

Describe the relationship between riparian condition and thermal problems in the aquatic system. Include locations and causes.

The lower 3.8 miles of mainstem Bummer Cr below the confluence of Swamp Cr. is the zone of highest concern for elevated summer stream temperatures. There are several morphological factors that predispose lower Bummer for this condition. The channel is very low gradient (0.3%). This results in slow pool turnover rates during low summer flow profiles. There are no cold water contributions to the lower mainstem to mitigate for elevated summer temperatures. The stream traverses the majority of the historically significant agricultural landscape in the subbasin with an extensive history of channel manipulation, accelerated entrenchment, wetland draining, stream confinement and riparian conversion.

Most of these manipulative activities are legacies on the landscape that are not possible to address in a restoration plan to restore long term function. The greatest limitation to restoration being the lack of information on historical condition. There are however, opportunities to treat the riparian corridor to initiate the vegetative recovery that will address the long term need for shade and large wood recruitment potential.

Solar exposure is not a significant issue for the mainstem of Swamp Cr. However, low gradients and slow pool turnover rates will tend to accelerate and maintain elevated stream temperatures.

Any opportunity to limit the cumulative impacts to lower Bummer Cr stream temperatures during summer flow would directly address probable limiting factors for fish production within the basin. This can be translated into:
1) Upslope management prescription that protect surface flows in Type N streams from direct solar exposure.
2) Prioritize the retirement of water rights to limit summer agricultural withdrawal during critical low flow periods (No survey of current use has been conducted).

Critical Contributing Areas (CCA)

Description and relation to core site

Identify the CCA's and describe the spatial relationship between each CCA and the Core Area and Anchor Site(s). Identify CCA's that contribute directly to specific Anchor Sites.

Trib C

Trib C is a 2nd order stream that enters the mainstem at RM 3.0 on the left from the east. The tributary crosses the Alsea / Deadwood Hwy through a 2ft corrugated culvert that is passable for adults and juveniles. Tributary C is dry at summer flows and no spawning gravel was observed that was appropriate for large anadromous migrants. The tributary is not a contributor to the production of Coho with no summer rearing habitat potential.

The tributary does enter into anchor site #1 and provides some unquantified winter habitat potential. In addition, anadromous Cutthroat are probably utilizing this tributary for spawning and rearing.

The tributary is not a likely source of resource recruitment because of gentle headwater slopes.

Trib D

Trib D is a second order tributary entering the mainstem of Bummer Cr at RM 5.6. The Trib enters on the left from the east. There is a dysfunctional culvert on the road crossing of Trib D that compromises the tributaries ability to deliver upslope resources in the form of torrent flows to the mainstem of Bummer Cr. Upslope resource delivery is uniquely important here because a late successional conifer canopy exists on the right slope of Trib D that offers recruitment potential to the 6th field. In addition, the ODF landslide risk analysis has ranked the Trib D corridor as the 3rd most significant site for the delivery of upslope resources directly to Coho bearing portions of the 6th field.

Ranking

Rank the CCA's in order of importance to the Core/Anchor Site system. This ranking should consider the contribution of substrate, wood, flow, and temperature maintenance to the Anchor Site system.

1) Trib D
2) Trib C

Restoration analysis

Habitat Limiting Factors Model results

Describe the results of the Nickelson Model and compare it to the results of utilizing seasonal survival rates from The Alsea Watershed Study.

The Limiting Habitat Analysis Worksheet (see appendix 4) displays a final comparison of the two modeling efforts in Tables F1 and F2. Both of these tables are working with the same seasonal habitat data and differ only in season to season survival rates. A comparison of the two methods indicates that they are in agreement that the abundance of high quality spawning gravel is the primary seasonal habitat limitation.

This conclusion leads us to a discussion of spawning gravel, its quantity, quality and the methodology utilized to assess it. To clarify, there were 299 sq meters of gravel observed in the May 2005 basin wide inventory conducted by Bio-Surveys. However, much of this gravel was not classified as high quality as is assumed in the Nickelson Model. To compensate for this effect, each gravel location was classified as high, medium or poor quality based on the level of associated sediments and fines. The effective quantity of medium quality gravel was reduced by 50%, while the effective quantity of poor gravel was reduced by 75%. With this adjustment, the total amount of effective high quality gravel was estimated at 135 sq. meters. This is the value utilized in the initial model run.

This is probably an appropriate adjustment for the Nickelson Model that utilizes a density independent 70% egg / fry survival rate. This survival rate assumes that only density independent mortalities occur during this early life stage. This adjustment is probably also appropriate for the Alsea Watershed Study survival rate calculations because the density dependant 43 % egg/fry survival rate in this study was calculated for extremely high quality gravels (unlike Bummer Cr).

Both the Nickelson Model and the Alsea Watershed Study conclude that the carrying capacity of winter habitat far exceeds that of the spawning gravels and the available summer habitats even when the lower 2.6 miles of what we have classified as severely entrenched mainstem corridor is removed from the model as potential winter habitat.

In summary, both gravel quality and abundance are primary limitations. If the trajectory in sedimentation was altered to improve gravel quality, the abundance of summer habitats exhibiting less than 64deg 7 day average temperatures during low summer flows would likely become the most significant seasonal limitation.

Factors influencing the production bottleneck

Does the seasonal bottleneck identified by the Nickelson Model remain the primary limiting habitat when each of the other issues identified in the assessment process are factored in? Explain.

Modeling efforts in Bummer Cr should be reviewed with caution because aquatic habitat inventories have not been conducted in a large percentage of the Bummer Cr 6th field. Therefore, Rapid Bio-Assessment snorkel inventories were utilized to estimate habitat type and abundance. The RBA survey data base represents only a 20 percent sample of the available pool habitat. An expansion of this sub sample was utilized to provide the foundational metrics for 73 % of the basins stream miles. The primary strength of the Limiting Factors Habitat Model is its reliance on comprehensive AQHI data. Without this data, quantitative summaries of seasonally available habitats could vary significantly from the actual abundance of habitats available. There is however, a high likelihood that identification of the seasonal bottleneck would not be influenced by this variation in the case of Bummer Cr because the seasonal limitation was overwhelmingly the abundance of high quality spawning gravel (data that was collected outside the boundaries of the AQHI program).

If all of the 299 sq. meters of observed gravel was high quality and functioning as modeled by the Alsea Watershed study then summer temperature profiles in the lower 3.8 miles of the Bummer Cr mainstem could also be a significant limiting factor in the 6th field. We have discussed in the Temperature section of this analysis the lack of comprehensive temperature data for Bummer Cr but that empirical evidence suggests that lower mainstem temperatures are likely to exceed upper thresholds for optimum salmonid rearing.

Potential for lowlands contribution

If the abundance of winter habitat has been determined as the primary factor limiting Coho production, discuss how lowland habitats existing outside the boundaries of the 6th field might function to provide winter habitat for smolts produced in the 6th field.

Not Applicable

Ownership issues

To what degree would land use and ownership allow restoration work?

There are several private properties that have been identified as including significant anchor habitats and other habitats exhibiting restoration potential. These are primarily the Rhineharts, Glade, Gammon and Biddel properties. Assistance with livestock fencing and riparian planting may be issues of interest with most of these landowners. Log placement projects will likely be met with a higher level of skepticism because of a need for a higher level of assurance that property damage will not be the end result. Field tours to representative log placement sites could be very valuable for some of these landowners.

Channel complexity potential

What is the potential to increase channel complexity in the long term through natural recruitment processes, with and without restoration?

Without restoration the potential for the natural recruitment of coniferous species is almost non existent until you get above the confluence of Trib D on the mainstem of Bummer Cr. At this point you are nearing the top end of anadromous distribution and benefits would be minor and localized for the provision of cover, complexity and roughness. There is excellent deciduous potential throughout most of Anchor Site #1 but the width of the active channel here is great enough to transport most of this deciduous resource out of the system rapidly (this is evident by the lack of full spanning wood complexes).

With riparian restoration, two issues of long term function will be addressed. Provision of a continuous source of wood complexity to maintain high instream wood densities and an addition to summer shade which is a primary limiting factor for especially the lower reach of mainstem Bummer Cr.

Restoration prescriptions

Potential restoration sites

1) Anchor Site #1
2) Anchor Site #2
3) Private land corridor from Top of Anchor Site #2 to Trib D
4) Culvert on Trib D
5) Swamp Cr mainstem
6) 2 culverts on West Fk of Brown Cr
7) Conifer planting on west terrace above Trib A
8) East and west terraces in portions of Anchor site #1 and lower Swamp Cr

Location

1) Anchor Site #1 extends from RM 2.5 (0.2 miles below the confluence of Wilson Cr) to RM 3.7 (0.1 miles below the confluence of Swamp Cr)
2) Anchor Site #2 extends from RM 4.0 (750 ft above the confluence of Swamp Cr) to RM 4.5 (directly adjacent to the Bidell residence).
3) The 1 mile of stream corridor from RM 4.5 (top of anchor site #2) to RM 5.5 (at the confl. of Trib D).
4) The culvert is located in trib D within a 100 ft of the mainstem of Bummer Cr under the east side forest road.
5) The 0.4 mile corridor from the Alsea / Deadwood Hwy crossing downstream to the top edge of the Podmore property (Podmore property has already been treated).
6) These two culverts are at 1,155 ft and 1,355 ft on the Prairie Mtn Rd. (R8W, T14S,Sec.35)
7) This is property owned by Bob Schwarzler. The site is small approximately 300' x 80' and begins just south of the confluence of Trib A at RM 1.7.
8) The primary opportunity exists on historical pasture ground and within the stream channel on the Glade residence. Both banks have potential. Livestock fencing and plantings for 1,500 ft below the confluence of Swamp on Bummer Cr and 2,400 ft on the west side of Swamp Cr above its confluence with Bummer.

Issue

1) Anchor Site #1 has been designated through the course of this analysis as the single most important zone for maintaining and improving ecosystem function. Its juxtaposition below spawning destinations in Swamp and upper Bummer indicate its importance for the provision of winter habitat. Some wood complexity has been noted, as well as the formation of complex off channel habitat within the anchor.

There is however, substantial room for boosting in channel wood complexity and improving the winter floodplain linkage.

2) Anchor Site #2 also currently provides habitats that exhibit excellent function. However, there are multiple opportunities to expand the abundance of interactive floodplain habitat with the placement of log structures designed to deflect and impound.

3) This 0.5 mile private property corridor has been channelized, exhibits no sinuosity, exhibits a narrow senescing band of alder, provides no winter habitat potential and limited summer pool surface areas. In addition, because of the lack of instream wood and lack of sinuosity the substrates are cobble dominated and provide limited opportunity for spawning.

4) This culvert is currently providing access on an abandoned forest road. The Trib D corridor exhibits the potential to be a significant source of resource recruitment to the mainstem and was ranked #3 for potential direct contribution to the mainstem by the ODF landslide risk assessment. The culvert is undersized and with its associated road fill could prevent a debris flow event from reaching the mainstem of Bummer Cr.

5) This section of Swamp Cr exhibits the type of channel morphology (sinuous, low terraces, moderate gradient) where structure log placement could have a significant positive impact on floodplain connectivity and the recruitment and sorting of spawning gravels that are limiting.

6) The two decaying culverts on the West Fk of Brown Cr. are currently definitive juvenile barriers because of there perched status. In addition, both culverts may also terminate adult migration because the bottoms of the pipes have rotted through and most of the flow is exiting through the bottom of the pipe through torn metal. High quality spawning habitats exist above each pipe particularly for Cutthroat. In addition, the ODF landslide risk analysis has identified the Brown Cr subbasin as the second highest priority for tributaries that could potentially contribute resources directly to Coho bearing segments of the mainstem in the form of debris torrent flows.

7) This site at RM 1.7 is a terrace of lower mainstem Bummer Cr. where Reed Canary Grass is not the dominant competitive species. The chance of success for a riparian planting on this location is much higher than other lower mainstem locations because of this feature.

8) The ¾ mile section of contiguous riparian habitat on the Glade property offers some of the best opportunities for establishing conifers for future recruitment to the active channel and for the provision of shade. Trees recruiting from this riparian segment would be entering anchor site #1 where there is excellent potential for channel meander and the development of interactive floodplain habitats. To succeed at establishing conifers in the riparian, livestock exclusion fencing would be required and CREP may be a viable program for the landowners.

Goal

1) Improve aquatic complexity and the development of low velocity habitats that interact with low terraces within the floodplain. In addition, trap and sort mobile gravels to address the primary limiting factor for the 6^{th} field.

2) Optimize the abundance of off channel and side channel habitats with the deflection or impoundment of flows onto low terraces during winter flow regimes. This will result in additional accumulations of well sorted spawning gravels that have been identified as the primary limiting factor for the 6^{th} field.

3) The segment is desperate for the provision of structure that can form scour pools, trap and sort spawning gravel and boost habitat complexity. In addition, permanent livestock exclusion from the riparian would initiate vegetative succession to boost riparian complexity and diversity.

4) To remove any impediment to debris flows originating in the Trib D corridor.

5) Improve floodplain connectivity and boost the abundance of well sorted gravels to address the primary seasonal limitation.

6) Remove the passage barriers formed by these two culverts to obtain access to additional summer rearing and winter spawning habitat.

7) Address the potential secondary 6^{th} field limitation of elevated summer temperatures by initiating a riparian planting project.

8) Address the potential secondary 6^{th} field limitation of elevated summer temperatures by initiating a livestock exclusion and riparian planting project.

Method

1) Structure log placement in Anchor Site #1 could be accomplished by either excavator or helicopter. The helicopter option is more likely to interest the landowner because of his concern of structure mobility. In addition, there is a BLM wood source on the adjacent ridge that has already been marked for aquatic restoration on the SF Alsea Project. These trees were never cut and remain standing on site because a clear flight line could not be established for the SF Alsea project.

2) Log Placement in Anchor site #2 could be accomplished by either excavator or helicopter. Helicopter placement would be more problematic in portions of this anchor because of proximity to the Alsea / deadwood Hwy and because of existing livestock fencing on the Gammon property.

3) Structure log placement in this segment would most efficiently be completed by helicopter. However, excavator placement of structure logs could also be accomplished here. The riparian is thin and visibility from the air is excellent.

4) Access to the road crossing on Trib D is excellent and the culvert could easily be removed with a rubber tired backhoe. This is an excellent site to get cooperation from the private industrial landowner as a match to other restoration components.

5) This section of Swamp Cr exhibits a 20ft wide active channel and the excavator placement of delivered logs for structure placement would meet Aquatic Restoration guidelines. Access is excellent from the west bank throughout the corridor and there are 3 potential cooperating landowners.

6) The two barrier culverts need to be removed and replaced with larger pipes to accommodate bankfull flows. The project can be most effectively completed with a track hoe / excavator. The property is Weyerhauser and the road is part of the BLM network.

7) Planting of seedling conifers would be accomplished in the winter to spring. Douglas Fir would be the most appropriate species for the site. High / dry / exposed.

8) Livestock exclusion fencing would be constructed to protect riparian setback that would be planted to primarily coniferous species (already good mix of deciduous).

Potential complications

1) Landowner has not been completely sold on structure log placement although he is willing to cooperate and appears willing to consider an educational field trip (Glade).

2) Multiple landowners (commitment to restoration unknown).

3) Single landowner (Bidell), commitment to restoration unknown.

4) Private Industrial ownership, no complications expected.

5) Multiple landowners (commitment to restoration unknown).

6) Private Industrial landowners and BLM access road. No complications expected.

7) Single private landowner. New owner has not taken possession of property yet and commitment to restoration is unknown.

8) No complications expected.

Expected results

1) Restoration efforts in Anchor Site #1 are designed to improve the long term function of the aquatic corridor in an attempt to address the primary limitation to salmonid production (abundance / quality of spawning gravel).

2) Expectations for restoration efforts in Anchor Site #2 are identical to those stated above.

3) Expected results include increased channel roughness, increased pool frequency and the capture and sorting of migratory gravels for increasing abundance of the limiting resource.

4) Restoration efforts would result in an unobstructed pathway in a Critical Contributing Area (Trib D) for the delivery of wood and substrate to the mainstem to address the limitation of gravel abundance.

5) Restoration efforts would result in increased aquatic complexity and an increase in the abundance of structure to sort and clean gravels for addressing the primary limitation.

6) These culvert replacements would remove a barrier to both juvenile and adult upstream migration. The primary benefactors of this restoration prescription would be Cutthroat trout.

7) Expected results include future mainstem wood recruitment and the short term benefit of additional riparian shade (secondary limiting factor).

8) Expectations are for establishing a new trajectory for the riparian that improves long term structural wood recruitment to trap and sort gravels spawning gravels and maintain maximum summer shade.

Restoration rankings

From the recommendations listed above, list and rank the restoration work that most effectively stabilizes the population at a higher base level and prioritizes the recovery of ecosystem function.

Short Term (Prioritized)
1- 2 – 3 – 5 – 6 – 4 – 8 – 7

Long Term (Prioritized)
8 - 4 - 7 – 6 – 1 – 2 – 5 – 3

Combined Prioritization
8 – 1 – 2 – 4- 6 – 3 – 5 - 7

APPENDICES

Appendix 1. Habitat features and survey status of sections of the Bummer Creek sub-watershe bearing potential.

Section	Description	River Mile			Survey Resource			Valley Morphology			Aquatic Habitats		
		Beg	End	Len	Type	Year	Surv Rch #	Gradient (%)	Valley Width	Constraint	Pools (%)	Bvr Pnds (#)	Woc (pcs/
1	Bummer (lower)	0.0	3.8	3.8	RBA	2000		0.4	Very broad	Terraces	49	0	90.
2	Bummer (upper)	3.8	5.6	1.8	ODFW	1995	1	2.1	Very broad	Terraces	37	0	146.
3	Swamp	0.0	2.4	2.4	RBA	2000		0.7	Very broad	Terraces	44	5	120.
4	Record (lower)	0.0	0.5	0.5	ODFW	2000	1	1.3	Broad	Terraces	88	7	91.
5	Record (upper)	0.5	1.0	0.5	ODFW	2000	2	2.1	Narrow	Hillslope	59	6	103.
6	Brown	0.0	0.3	0.3	RBA	2000		2.8	Broad	Terraces	37	0	
7	Banton	0.0	0.7	0.7	RBA	2000		1.7	Broad	Terraces	41	0	

1) RBA is "Rapid BioAssay", a fish inventory that also collects physical habitat data for sampled pools.
2) Where both ODFW and RBA surveys exist, ODFW data are used.

3) If no ODFW survey exists, valley morphology and habitat data are obtained from RBA data and topographic mapping.

4) Swamp Creek is listed as having 5 beaver ponds. This number is extrapolated from a single pond sampled in the RBA survey.

Appendix 2. Bummer Creek drainages.

Drainage	River Mile	Enters from	Slope faces	Relative size	Valley description	Comments
Trib A	1.7	Right	E	Very small	Flat, broad	Cutthroat potential
Wilson Creek	2.6	Left	W	Medium	Moderate, moderate	Dam is Passage barrier
Trib B	2.7	Right	E	Small	Flat, narrow	High quality wetland @ mouth
Trib C	3.0	Left	W	Small	Flat, narrow	Limited potential
Swamp Creek	3.8	Right	N	Very large	Broad valley floor near mouth, narrowing and steepening above.	Major habitat and flow contributor, with fish bearing tribs.
Banton Creek	4.0	Left	W	Medium	Flat, moderate	Excellent rearing/limited spawning
Trib D	5.6	Left	W	Very small	Steep, narrow	No potential
Trib E	6.0	Right	N	Medium	Steep, moderate	Excellent spawning destination
Trib F	6.6	Right	N	Medium	Steep, narrow	Above extent of anadromous
Headwaters	6.6	N/A*	NW	Medium	Steep, narrow	Above extent of anadromous

* Mainstem

Appendix 3. Bummer Creek Coho spawning gravel estimates.

Spawning gravel	Poor	Fair	Good	Total
Amount (m2)	123	143	33	
Effectiveness rating	0.25	0.50	1.00	
Effective gravel (m2)	30.8	71.5	33.0	**135**

Appendix 4. Bummer Creek limiting habitat analysis based on the Nickelson model.

WORKSHEET FUNCTION

This sheet evaluates spawning gravel estimates, summer rearing areas, and winter smolt capacity developed in previous sheets to identify which seasonal habitat is the rearing bottleneck.

Ideally, this evaluation would rank Spawning gravel smolt capacity, Spring smolt capacity, Winter smolt capacity, and Summer smolt capacity.

However, Winter surveys are not available. The work-around for this is to use the regression relationship between summer conditions and winter capacity developed in the Winter Smolt Capacity worksheet.

No such work-around exists for estimating Spring capacity, and it is not estimated.

Therefore, the current evaluation aims at determining whether Spawning Gravel, Summer conditions, or Winter conditions are most limiting in the rearing system.

The calculation model used is "Version 5.0. Coho Salmon Carrying Capacity Model", provided by Tom Nickelson of ODFW Research Division.

Two sets of survival rates are available and have been entered into Table B1 and B2. Each set of survival rates generates different seasonal smolt capacities that are output in Tables F1 and F2.

NOTE: Currently non-functioning parts of the worksheet are shaded gray.

SECTION 1. SMOLT CAPACITY AND SURVIVAL RATES

Table A. Coho salmon rearing density for each habitat type in each season.

HABITAT TYPE	SEASON		
	SPRING	SUMMER	WINTER
Cascades	0	0.24	0
Rapids	0.6	0.14	0.01
Riffles	1.2	0.12	0.01
Glides	1.81	0.77	0.12
Trench Pools	0.99	1.79	0.15
Plunge Pools	0.84	1.51	0.28
Lateral Scour Pools	1.29	1.74	0.35
Mid Chan Scour Pools	1.29	1.74	0.35
Dam Pools	2.56	1.84	0.56
Alcoves	5.75	0.92	1.84
Beaver Ponds	2.56	1.84	1.84
Backwaters	5.75	1.18	0.58

Data of Tom Nickelson based on ODFW research.

Tables B1 and B2. Survival rates to smolt

Table B1. ODFW research data.

Life stage	Survival rate
Egg to smolt	0.3200
Spring to smolt	0.4600
Summer to smolt	0.7200
Winter to smolt	0.9000

Rates used by Tom Nickelson (ODFW)

Table B2. Alsea study data.

Life stage	Survival rate
Egg to smolt	0.0270
June to Smolt	0.0644
Fall to smolt	0.1110
Winter to smolt	0.2870

Data provided by Jim Hall, OSU Dept of F & W

Table C. Egg and maximum rearing densities

Life stage	#/m2
Spawning (eggs)	833
Spring	5.75
Summer	1.84
Winter	1.84

Data of Tom Nickelson based on ODFW research.
Egg density is based on 2500 eggs/redd & 3 m2/redd
Spring, Summer, and Winter values are maximums from Table A.
These data currently do not contribute directly to spreadsheet calculations.

SECTION 2. DATA INPUT

Table D. Data entry

1) Enter length of reach or group of reaches analyzed (km).		(currently not used)
2) Effective Spawning Gravel referenced from the Spawning Gravel worksheet)	135.25	

3) Enter summer habitat area totals below from the Summer Hab Areas worksheet.

Habitat Type	Season	
	Summer	Winter
Cascades	40	
Rapids	110	
Riffles	35,432	
Glides	365	
Trench Pools	0	
Plunge Pools	176	
Lateral Scour Pools	22,706	
Mid Chan Scour Pools	5,675	
Dam Pools	1,230	
Alcoves	49	
Beaver Ponds	1,478	
Backwaters	0	
Total	67,261	0
Pool Area	31,314	0
Percent Pools	47%	#DIV/0!

Table E. Calculation of seasonal rearing capacities for each habitat type.

Habitat Type	Season		
	Spring	Summer	Winter
Cascades	0	10	0
Rapids	0	15	0
Riffles	0	4,252	0
Glides	0	281	0
Trench Pools	0	0	0
Plunge Pools	0	266	0
Lateral Scour Pools	0	39,508	0
Mid Chan Scour Pools	0	9,874	0
Dam Pools	0	2,263	0
Alcoves	0	45	0
Beaver Ponds	0	2,720	0
Backwaters	0	0	0
Total	0	59,234	0

No winter data are available. Therefore the spring rearing capacity could not be calculated by this method. Winter rearing capacity was calculated using a separate methodology (see "Winter Smolt Capacity" sheet") and entered by reference below.

Calculation of egg deposition and smolt production depending on which seasonal habitat is limiting.

Table F1. Results using ODFW research survival rates.

Life Stage	Potential Seasonal Capacity	Potential Smolts Produced
Spawning (# eggs)	112,500	36,000
Spring (# fish)	0	0
Summer (# fish)	59,234	42,600
Winter (# fish)	*54,412*	49,000

Table F2. Results using Alsea study survival rates.

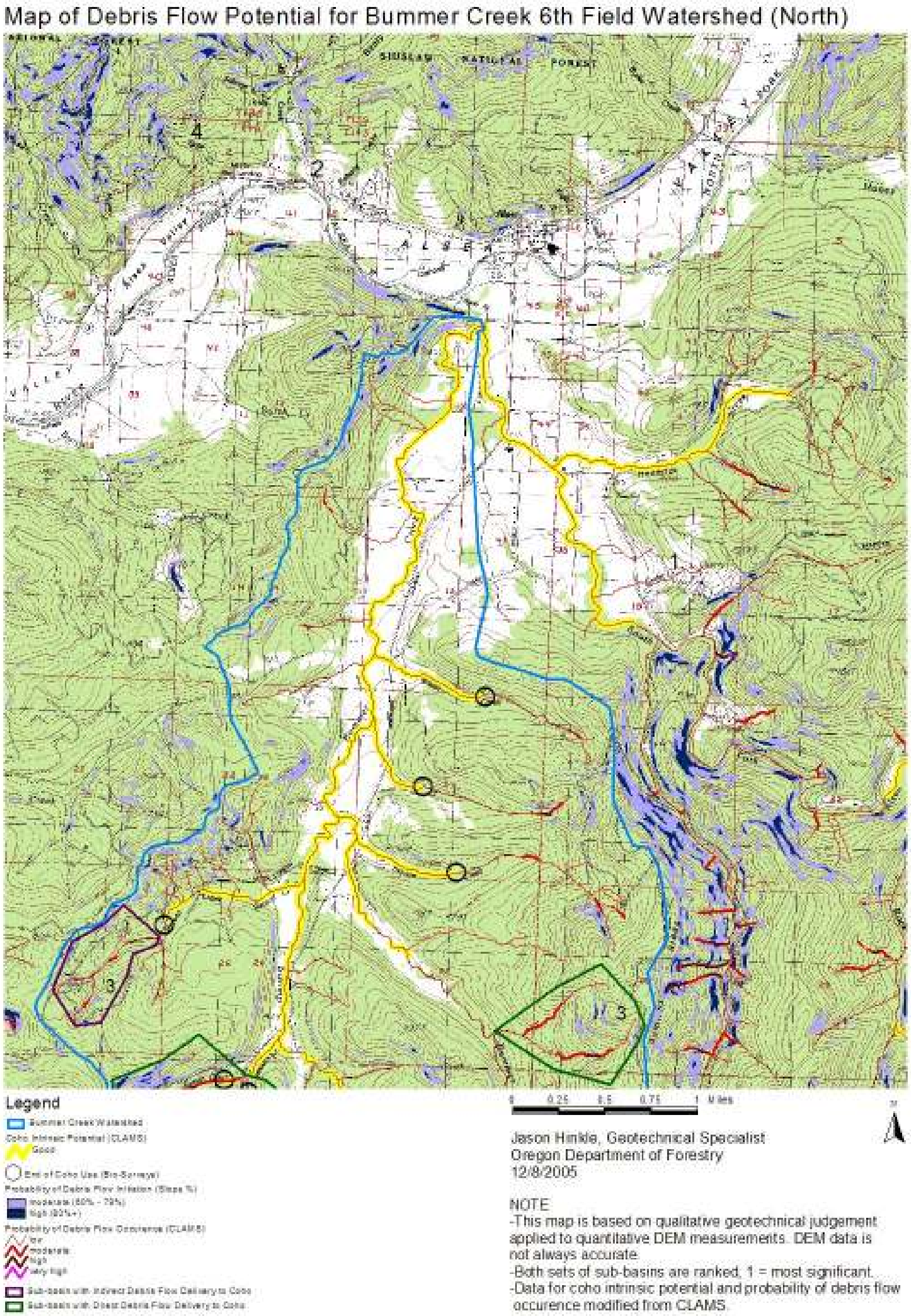
Life Stage	Potential Seasonal Capacity	Potential Smolts Produced
Spawning (# eggs)	112,500	3,038
June (# fish)	0	0
Fall (# fish)	59,234	6,600
Winter (# fish)	*54,412*	15,600

*Winter capacity is entered by **cell reference** to the "Winter Smolt Capacity" worksheet*

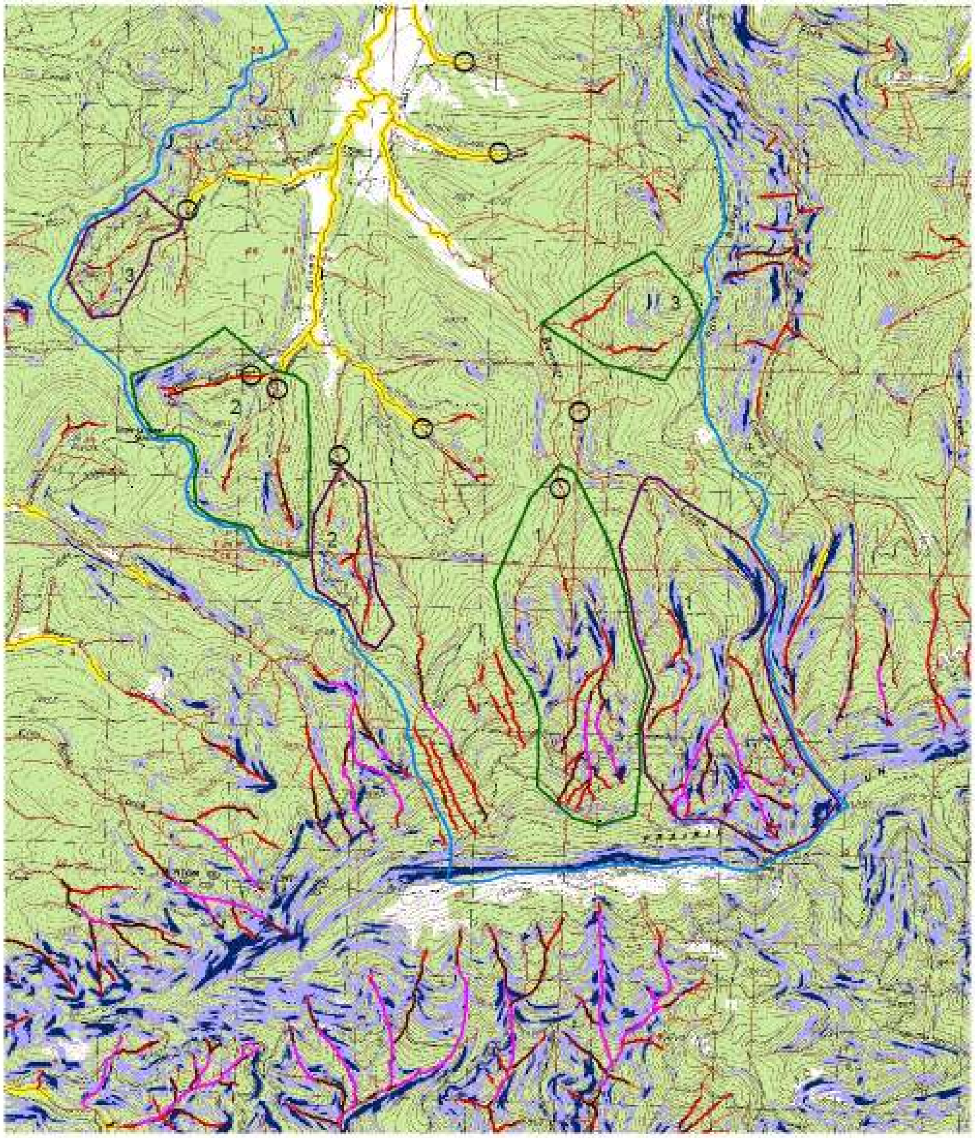
No estimate of spring capacity or potential smolts produced is possible with current data.

Calculation of Spawning (# eggs) is based on the assumptions of 2500 eggs/redd and 3 m2/redd

Appendix 5. Bummer Creek ODF slope risk analysis map.



Map of Debris Flow Potential for Bummer Creek 6th Field Watershed (South)



Legend

- Bummer Creek Watershed
- Coho Intrinsic Potential (CLAMS)
  - Good
- End of Coho Use (Bio-Surveys)
- Probability of Debris Flow Initiation (Slope %)
  - moderate (60% - 79%)
  - high (80%+)
- Probability of Debris Flow Occurrence (CLAMS)
  - low
  - moderate
  - high
  - very high
- Sub-basin with Indirect Debris Flow Delivery to Coho
- Sub-basin with Direct Debris Flow Delivery to Coho

0 0.25 0.5 0.75 1 Miles

N

Jason Hinkle, Geotechnical Specialist
Oregon Department of Forestry
12/8/2005

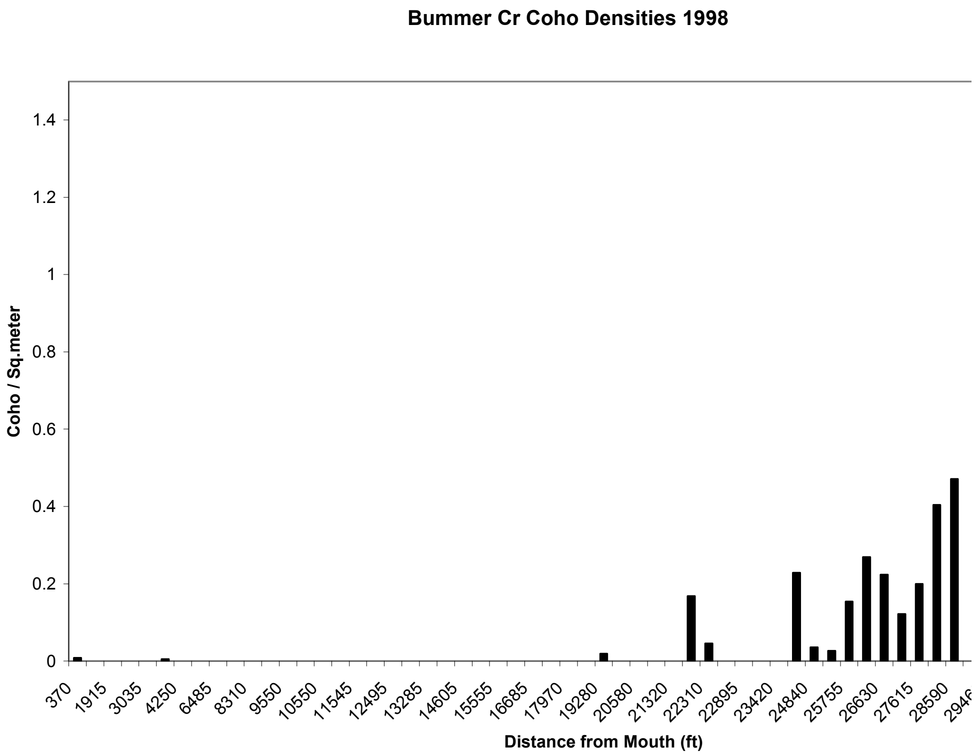
NOTE

-This map is based on qualitative geotechnical judgement applied to quantitative DEM measurements. DEM data is not always accurate.

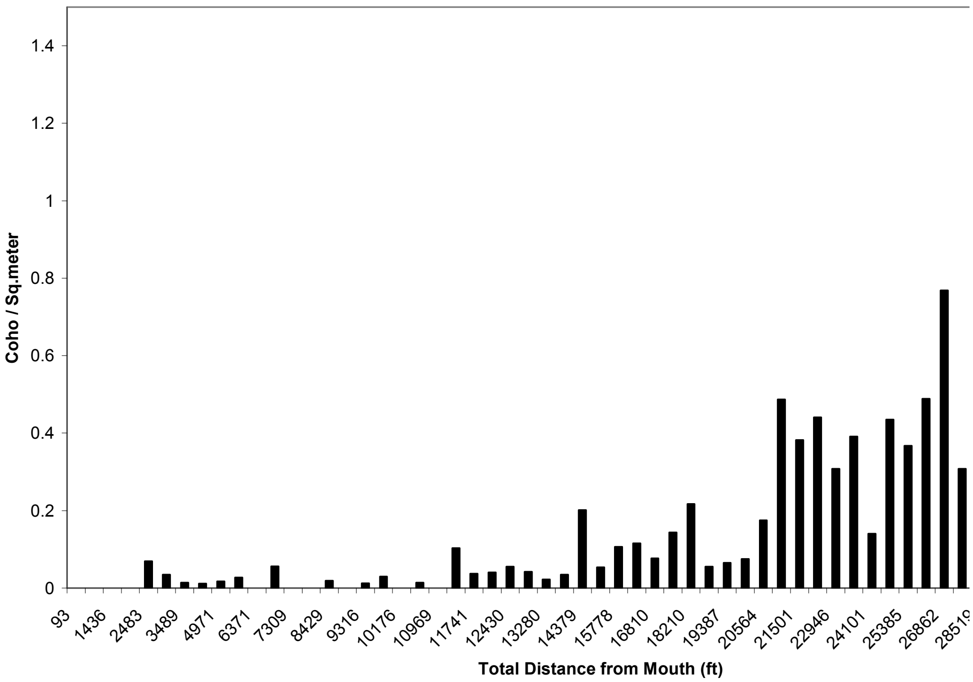
-Both sets of sub-basins are ranked, 1 = most significant.

-Data for coho intrinsic potential and probability of debris flow occurence modified from CLAMS.

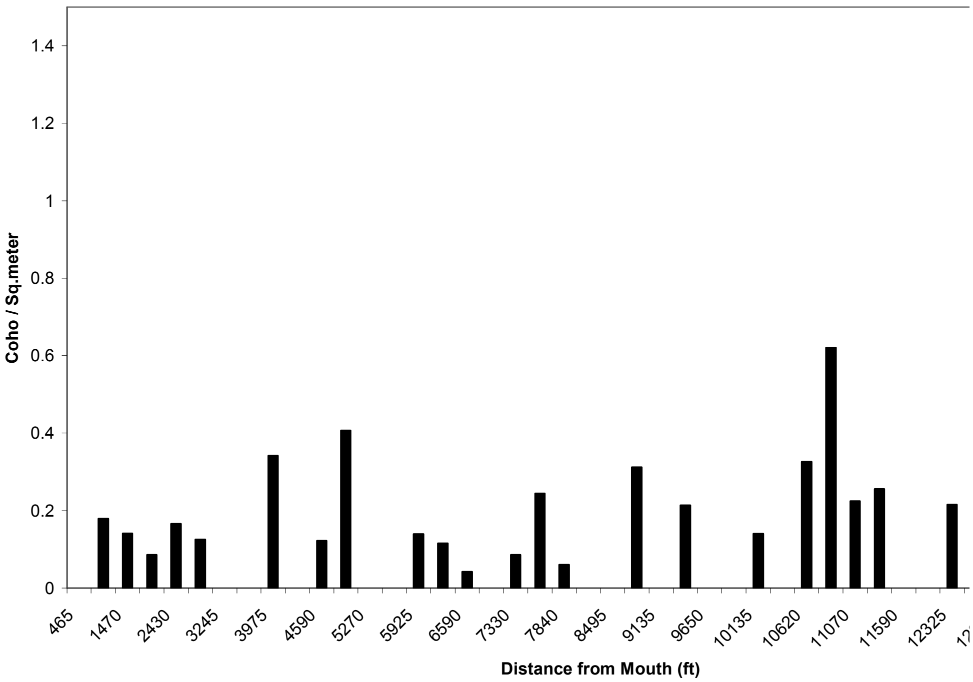
Appendix 6. Bummer Creek summer Coho distribution charts



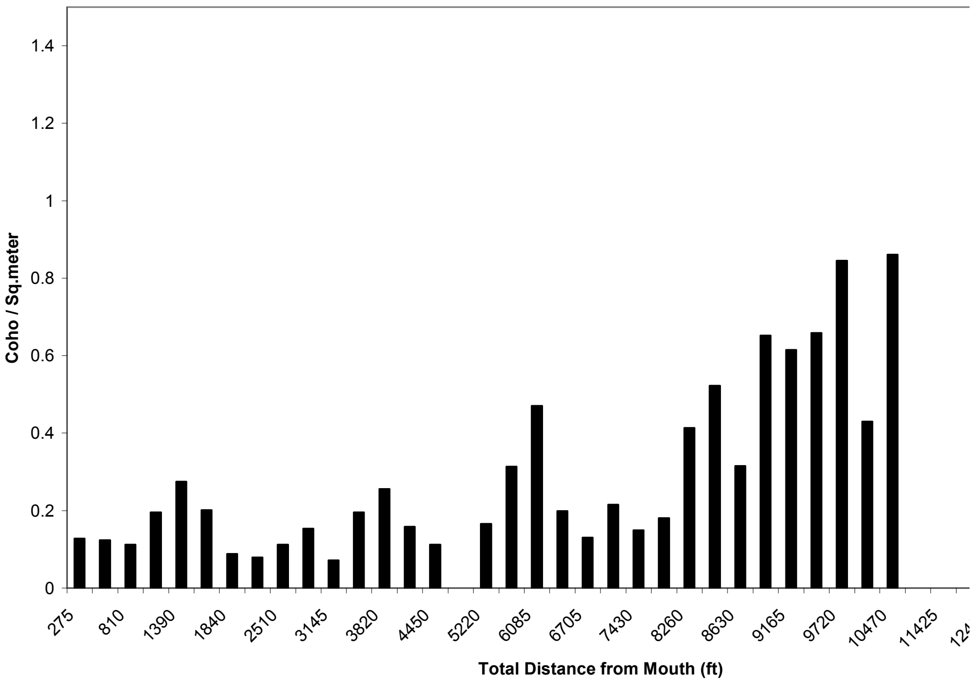
Bummer Coho Densities 2001

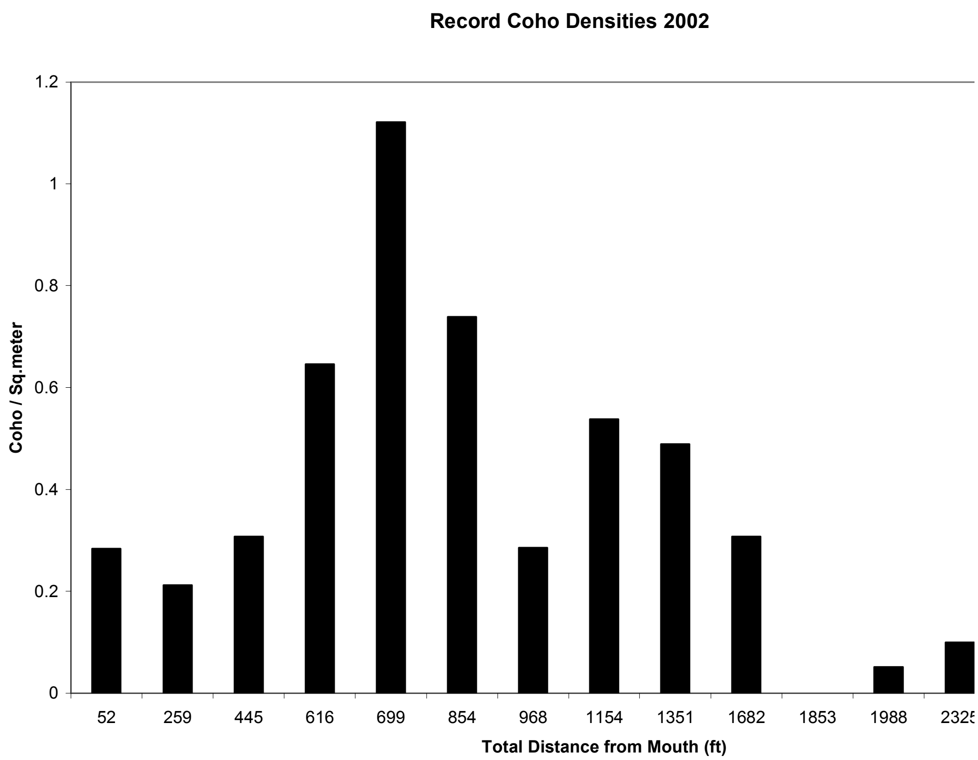


Swamp Cr Coho Densities 1998

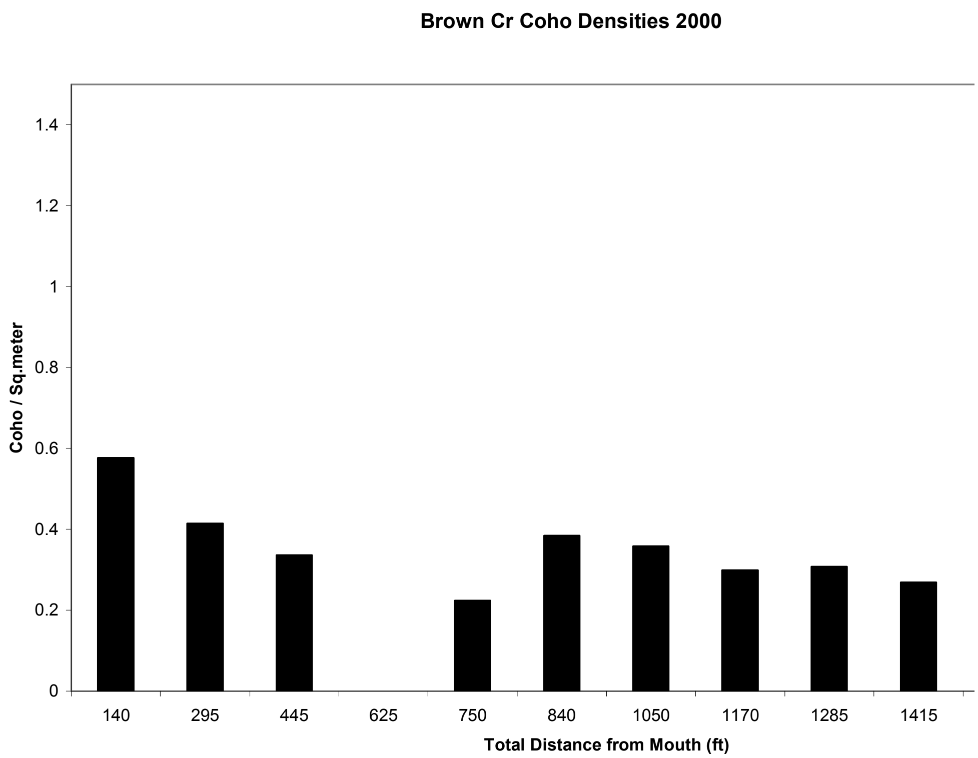


Swamp Coho Densities 2000



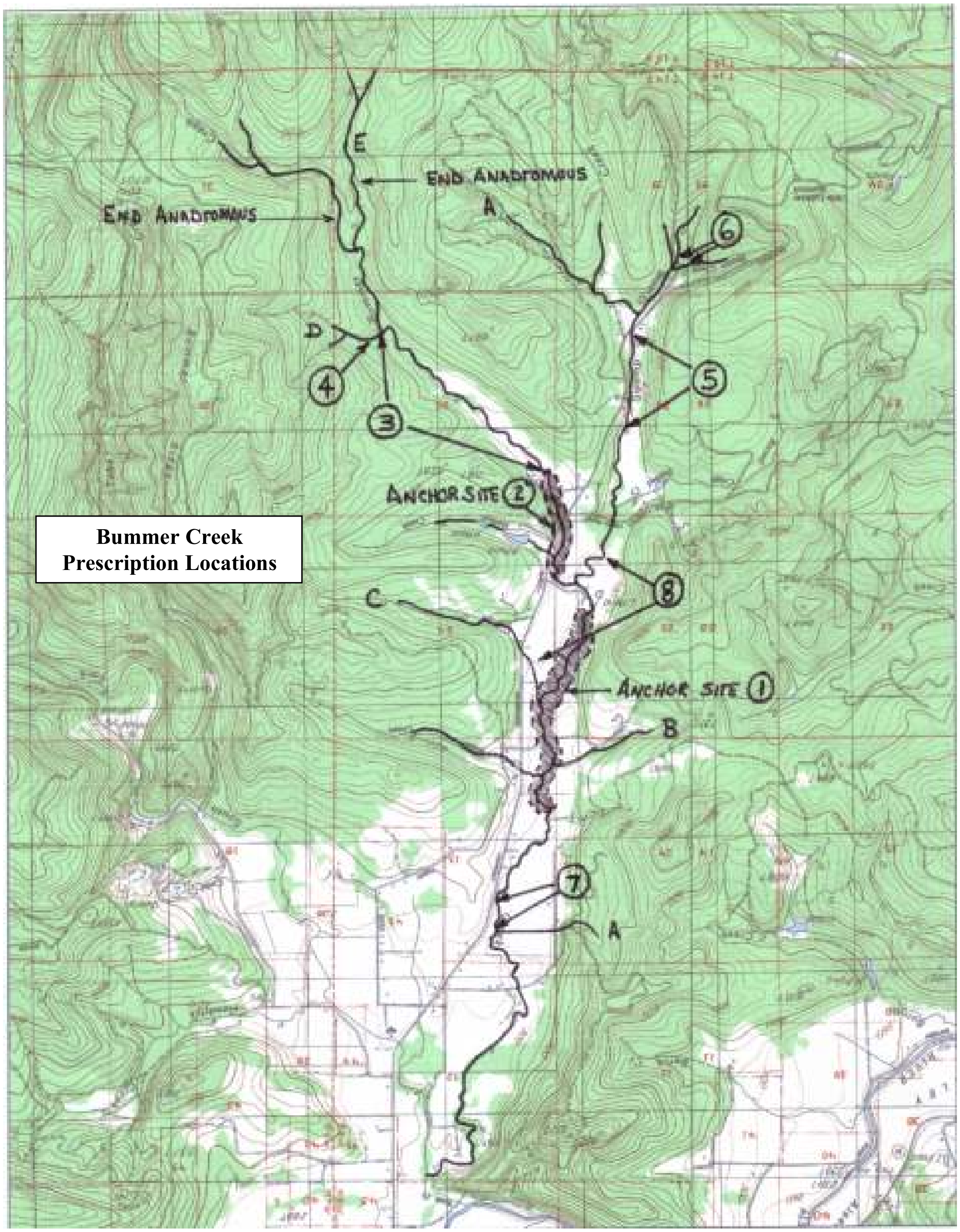


Record Coho Densities 2002
Coho / Sq.meter
1.2
1
0.8
0.6
0.4
0.2
0
52
259
445
616
699
854
968
1154
1351
1682
1853
1988
Total Distance from Mouth (ft)



Brown Cr Coho Densities 2000
Coho / Sq.meter
1.4
1.2
1
0.8
0.6
0.4
0.2
0
140
295
445
625
750
840
1050
1170
1285
1415
Total Distance from Mouth (ft)

Appendix 7. Bummer Creek prescription location map.



Appendix 8. Bummer Creek photos.

Photo 1. Lower Bummer Creek typical: Deeply entrenched, exposed channel bordered by Reed Canary grass.

Photo 2. Lower Bummer Cr typical: Deeply entrenched, narrow riparian

Photo 3. Dam on Wilson Creek.

Photo 4. Impoundment above dam on Wilson Creek.

Photo 5. Upper Bummer Cr: Just above Anchor Site #2.

Photo 6. Upper Bummer Cr: 1/4 mile above Anchor Site #2.

Photo 7. Upper Bummer Cr: Above pasture and grazing influence.

Photo 8. Upper Bummer Cr: Structures on industrial ownership.

Photo 9. Bummer Reach 3: Just above confluence of Trib E.

Photo 10. Enter Trib E.

Photo 11. Gradient increasing rapidly above Trib E.

Photo 12. Seven ft falls terminates Coho distribution in low flow winters.

Photo 13. Current end of anadromous distribution at ephemeral jam.