



CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Cooper Mill Creek

INTRODUCTION

A stream inventory was conducted from May 23 to June 7, 2016 on Cooper Mill Creek. The survey began at the confluence with Yager Creek and extended upstream 2.1 miles.

The Cooper Mill Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Cooper Mill Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Cooper Mill Creek is a tributary to Yager Creek, tributary to Van Duzen River, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Cooper Mill Creek's legal description at the confluence with Yager Creek is T02N R01E S15. Its location is 40.5583° north latitude and -124.0563° west longitude, LLID number 1240563405584. Cooper Mill Creek is a first order stream and has approximately 3 miles of blue line stream according to the USGS Hydesville 7.5 minute quadrangle. Cooper Mill Creek drains a watershed of approximately 3.7 square miles. Elevations range from about 157 feet at the mouth of the creek to 1,200 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 36 just east of the town of Hydesville.

METHODS

The habitat inventory conducted in Cooper Mill Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project (WSP) members and California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by the CDFW. The inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement. Surveyors also take photos

to document general habitat conditions (Appendix II).

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Cooper Mill Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Water and air temperatures are measured and recorded at every tenth habitat unit using a hand-held thermometer. Both temperatures are taken in degrees (°) Fahrenheit and the time of the measurement is also recorded. Air temperatures are recorded within one foot of the water surface, while water temperatures are recorded (where possible) in flowing water within the habitat unit.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Cooper Mill Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Cooper Mill Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Cooper Mill Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then calculated by multiplying the qualitative shelter value by the percent of the unit covered. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Cooper Mill Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Cooper Mill Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests

(velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Cooper Mill Creek. In addition, underwater mask and snorkel observations were made at 18 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Cooper Mill Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED IN APPENDIX I *

The habitat inventory of May 23 to June 7, 2016, was conducted by Nicole Bejar, Amidia Fredericks, Ryan Bernstein, Emily Maloney (WSP), Chantel Moore (CCC), David Lam, and Brian Starks (CDFW). The total length of the stream surveyed was 11,101 feet with an additional 567 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.35 cfs on June 9, 2016.

Cooper Mill Creek is an F4 channel type for 8,949 feet of the stream surveyed (Reach 1), and an A2 channel type for 2,719 feet of the stream surveyed (Reach 2). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with gravel-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 51° to 60° Fahrenheit. Air temperatures ranged from 54° to 70° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% riffle units, 36% pool units, and 25% flatwater units (Graph 1). Based on total length of Level II habitat types there were 40% pool units, 31% flatwater units, 28% riffle units, and 1% dry units (Graph 2).

Nineteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 28%; mid-channel pool units, 24%; and run units, 15% (Graph 3). Based on percent total length, there were mid-channel pool units made up 30%, low gradient riffle units 20%, and step run units 18%.

A total of 156 pools were identified (Table 3). Main channel pools were the most frequently encountered at 70% (Graph 4), and comprised 78% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fifty-two of the 155 pools (34%) had a residual depth of two feet or greater (Graph 5). Of the 155 pools, 8% had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 155 pool tail-outs measured, 33 had a value of 1 (21.3%); 42 had a value of 2 (27.1%); 52 had a value of 3 (33.5%); 7 had a value of 4 (4.5%); 21 had a value of 5 (13.5%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 3, flatwater habitat types had a mean shelter rating of 17, and pool habitats had a mean shelter rating of 45 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 40, scour pools had a mean shelter rating of 54, and backwater pools had a mean shelter rating of 61 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Graph 7 describes the pool cover in Cooper Mill Creek. Large woody debris is the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 64% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 20% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Cooper Mill Creek was 96%. Four percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 58% and 42%, respectively. Graph 9 describes the mean percent canopy in Cooper Mill Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 61% sand/silt/clay, 25% cobble/gravel, 12% boulder, and 3% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 56% of the units surveyed. Additionally, 25% of the units surveyed had coniferous trees as the dominant vegetation type, and 17% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

A survey team conducted a mask and snorkel survey at 18 sites for species composition and distribution in Cooper Mill Creek on October 3 and 4, 2016 (Table A). Water temperature taken at 0942 was 55° Fahrenheit. Air temperature was 52° Fahrenheit. The sites were sampled by Maddelyn Harden (CDFW) and Nicole Bejar (WSP).

In Reach 1, which comprised the first 7,500 feet of stream, 14 sites were sampled. The reach sites yielded 74 young-of-the-year (YOY) steelhead trout (SH), 2 age 1+ SH, 20 YOY coho salmon, 1 age 1+ coho salmon, and 1 unknown YOY species.

In Reach 2, four sites were sampled starting approximately 8,530 feet from the mouth with and continued upstream 112 feet. The reach sites yielded 2 YOY SH.

During the survey, the upstream-most observation of juvenile coho salmon occurred at 40.57006° north latitude, -124.06488° west longitude, approximately 6,225 feet upstream from the confluence with Yager Creek. The upstream-most observation of juvenile steelhead occurred at 40.57535° north latitude, -124.06717° west longitude, approximately 8,530 feet from the confluence with Yager Creek.

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Table A. Summary of results for a fish composition and distribution survey within Cooper Mill Creek, 2016.

| Date | Survey Site # | Habitat Unit # | Habitat Type | Approx. Dist. from mouth (ft.) | Steelhead Trout | | | Coho Salmon | | Additional Aquatic Species Observed |
|--------------------------|---------------|----------------|--------------|--------------------------------|-----------------|----|----|-------------|----------------------------------|-------------------------------------|
| | | | | | YOY | 1+ | 2+ | YOY | 1+ | |
| Reach 1: F4 Channel Type | | | | | | | | | | |
| 10/03/16 | 1 | 20 | 4.2 | 686 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 22 | 4.2 | 715 | 10 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 25 | 4.2 | 901 | 15 | 0 | 0 | 4 | 0 | 0 |
| | 4 | 28 | 4.2 | 1118 | 18 | 0 | 0 | 3 | 0 | 0 |
| | 5 | 36 | 4.2 | 1222 | 0 | 0 | 0 | 6 | 0 | 0 |
| | 6 | 43 | 5.5 | 1484 | 1 | 0 | 0 | 3 | 0 | 0 |
| | 7 | 48 | 4.2 | 1706 | 4 | 1 | 0 | 0 | 0 | 0 |
| | 8 | 104 | 4.2 | 3595 | 18 | 1 | 0 | 1 | 0 | 0 |
| | 9 | 118 | 4.2 | 4222 | 15 | 0 | 0 | 0 | 0 | 0 |
| | 16 | 184 | 4.2 | 6089 | 0 | 0 | 0 | 3 | 0 | 0 |
| 17 | 188 | 4.2 | 6225 | 2 | 0 | 0 | 0 | 1 | 1 YOY of an unidentified species | |
| 10/04/16 | 18 | 190 | 4.2 | 6298 | 1 | 0 | 0 | 0 | 0 | |
| | 15 | 228 | 4.2 | 7192 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 14 | 236 | 4.2 | 7500 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reach 2: A2 Channel Type | | | | | | | | | | |
| 10/03/16 | 10 | 297 | 4.2 | 8642 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 11 | 299 | 4.2 | 8715 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12 | 301 | 4.2 | 8746 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 13 | 290 | 6.4 | 8530 | 1 | 0 | 0 | 0 | 0 | 0 |

DISCUSSION

Cooper Mill Creek is an F4 channel type for the first 8,949 feet of stream surveyed and an A2 channel type for the next 2,719 feet. The suitability of F4 and A2 channel types for fish habitat improvement structures is as follows: F4 channels are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. A-type channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days May 23 to June 7, 2016, ranged from 51 to 60° Fahrenheit. Air temperatures ranged from 54° to 70° Fahrenheit. This is a suitable water temperature range for salmonids. However, 60° Fahrenheit, if sustained, is near the threshold stress level for salmonids.

Flatwater habitat types comprised 31% of the total length of this survey, riffles 28%, and pools 40%. Fifty-two of the 155 (34%) pools had a maximum residual depth greater than two feet. In

general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Seventy-five of the 155 pool tail-outs measured had embeddedness ratings of 1 or 2. Fifty-nine of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-one of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Cooper Mill Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred twenty-nine of the 153 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 45. The shelter rating in the flatwater habitats is 17. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Cooper Mill Creek. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 96%. Reach 1 had a canopy density of 94%, Reach 2 had a canopy density of 97%. The percentages of right and left bank covered with vegetation were 99% and 99%, respectively.

RECOMMENDATIONS

Cooper Mill Creek should be managed as an anadromous, natural production stream. Recommendations for potential habitat improvement activities are based on target habitat values suitable for salmonids in California's north coast streams. Considering the results from this stream habitat inventory, factors that affect salmonid productivity and CDFW's professional judgment, the following list prioritizes habitat improvement activities in Cooper Mill Creek. Keep in mind, watershed and stream ecosystem processes, land use alterations, changes in land ownership, and other factors could potentially change the order of these recommendations or create the need to remove/add recommendations in the future.

- 1) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.
- 2) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
- 3) Consider modifying or removing the small check dam located on lower Cooper Mill

Creek (see Comments – Position: 2,526 feet) to ensure year round passage to all life stages of juvenile salmonids. This seasonal barrier was formerly associated with the PALCO fish rearing facility that is no longer in use.

- 4) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for three to five years.
- 5) There are several log debris accumulations present on Cooper Mill Creek that are retaining large quantities of fine sediment and appear to create significant seasonal barriers. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

| Position (ft): | Habitat unit #: | Comments: |
|-------------------|--------------------|--|
| 0 | 0001.00 | Start of survey began at the confluence of Cooper Mill and Yager Creek. There was visible right bank sediment deposit. Step pool with first plunge of 1.6' over a boulder into a 3.1' pool that then plunged 2.1' over a boulder into a smaller, 0.71' pool that had a 1.3' plunge over a boulder into a 2.1' pool which then had a 1.6' plunge over a final boulder into a 1.9' pool. Channel type is a F4. Channel type cross-section location is at Habitat Unit (HU) 35 and HU 98. |
| 65 | 0003.00 | There is visible, exposed silt on the right bank. |
| 389 | 0014.00 | Bridge #1 is the crossing for an unnamed road, and is 8.1' high x 20' wide x 41' long. It is a metal automobile bridge and is not a barrier to salmonids. One YOY salmonid observed upstream of bridge. |
| 999 | 0028.00 | LDA #1 is 3.3' high x 5' wide x 21' long and contains four pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 6' wide x 4.6' long x 0.8' deep. The sediment is silt. |
| 1149 | 0033.00 | Bridge #2 is the crossing for an unnamed road (that leads to a fish grate gate), and is 23' wide x 4.4' high x 2.1' long. It is a footbridge made of wood and is not a barrier to salmonids. |
| 1402 | 0041.00 | Bridge #3 is the crossing for Fisher Road and is 15.2' wide x 5.9' x high x 30' long. It is an automobile bridge made of wood and cement. It is not a barrier to salmonids |

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| 1862 | 0054.00 | LDA #2 is 3.7' high x 20' wide, consisting of two pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 6.8' wide x 8' long x and 1.5' deep. Fish were observed above the LDA. |
| 2097 | 0059.00 | Approximately 50% of the substrate is exposed in this HU. |
| 2526 | 0071.00 | Many pools in in this unit. Pool one has 1.3' plunge over boulder into 1.9' deep pool. Pool two has a 0.9' plunge over boulder into pool with 1.3' depth. Pool three has 0.7' plunge over wooden weir into pool with 0.5' depth. |
| 2811 | 0079.00 | LDA #3 is 3.7' high x 35' wide x 5' long with 7 pieces of LWD. Water does flow through and there are visible gaps in the LDA. Sediment is retained and stored in the dimensions 11ft wide x 30' long x 2.5' deep. Size ranges from silt to gravel. The LDA is a possible barrier to juvenile salmonids as LDA would block passage, but adults may be able to get through during high flows. Fish were observed above the LDA. |
| 3214 | 0091.02 | Landslide 30' long x 20' high contributing significant silt/LWD. |
| 3214 | 0091.05 | Right bank seep possibly from main channel. |
| 3214 | 0092.00 | LDA #4 is 4' high x 22' wide x 5' long and contains 7 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 4' wide x 12' long x 2' deep. The sediment ranges from silt to gravel. The LDA is a possible barrier for adult salmonids as there is clear passage towards the bottom that is big enough for juveniles but too small for adults to get through. There are minimal gaps throughout for adults to get over LDA. Fish were observed above the LDA. |
| 4060 | 0115.01 | There is an active erosion on the left bank, it measures 8' long x 7' high. |
| 4547 | 0129.00 | There is a 2.1' plunge over wood debris into a 1.9' pool. |
| 4574 | 0130.01 | HU 130.1 splits off from the right bank and HU 130.2 is a channel that splits off from the left bank. |
| 4574 | 0130.01.01 | LDA #5 is 5' high x 7.5' wide x 11' long and contains 3 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 8' wide x 14' long x 3' deep. The sediment is silt. The LDA is not a salmonid barrier as adults can jump over with clear passage on bottom for juveniles. Main channel is redirected due to the LDA. Side channels are formed from low flow beneath LDA. Fish were observed above the LDA. |

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|------|---------|--|
| 4629 | 0134.00 | There is a seep on the right bank. |
| 4832 | 0142.00 | LDA #6 is 5.5' high x 7' wide x 25' long and contains 4 pieces of LWD. Water flows through it and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 14' wide x 18' wide x 3.5' deep. The sediment ranges in size from silt to boulders. The LDA is not a possible barrier to salmonids, as there is clear passage on the bottom for juveniles and adults may be able to jump over 6' of LDA. Fish were observed above LDA. |
| 4832 | 0142.00 | There is a landslide on the left bank measuring 20' high x 30' long x 25' wide. |
| 4967 | 0147.00 | Tributary #1 enters on the right bank. It contributes to approximately 5% of Cooper Mill Creek's flow. The water temperature of the tributary was 56 degrees Fahrenheit, the water temperature downstream of the confluence was 58 degrees Fahrenheit, and the water temperature upstream of the confluence was 59 degrees Fahrenheit. The slope of the tributary is 7%. The tributary is accessible to salmonids until 50' upstream of tributary there is an 8' waterfall and LWD that may inhibit access. Fish were not observed in the tributary. At the top of the 8' plunge over rock cliff with LWD in channel, an anadromous barrier flag is hanging. |
| 5039 | 0148.00 | LDA #7 is 6' high x 28' wide x 14' long and contains 4 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 35.5' wide x 14' long x 7' deep. The sediment ranges in size from gravel to small cobble. The LDA is not a possible barrier to salmonids as it has clear passage through bottom for juveniles and adults can jump over 6' LDA. Fish were observed above the LDA. |
| 5133 | 0152.00 | There is a 1.2' plunge over an LWD into a 1.3' pool. |
| 5433 | 0162.00 | Tributary #2 enters on the right bank. It contributes approximately <5% of Cooper Mill Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit, the water temperature downstream of the confluence was 56 degrees Fahrenheit, and the water temperature upstream of the confluence was 56 degrees Fahrenheit. The slope of the tributary is 11%. The tributary is accessible to salmonids at high flows, at low flows, there is a barrier due to dry patch 42' upstream after a sharp turn that marks increase in slope. Fish were not observed in the tributary. Flag was placed at the mouth of tributary. |
| 5605 | 0165.02 | There is an active erosion on the left bank, it measures 14' long x 13' high. |

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|------|---------|--|
| 5605 | 0166.00 | LDA #8 is 7.5' high x 18' wide x 13' long and contains 5 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 15' wide x 11' long x 2.5' deep. The sediment ranges in size from gravel to boulder. The LDA is a possible barrier to juvenile salmonids as there is no clear passage underneath the LDA for juveniles to swim under, with little light penetration. Fish were observed above the LDA. |
| 5805 | 0172.00 | There appeared to be a landslide on the left bank that caused young trees to fall across the creek. |
| 6002 | 0180.00 | The roots from vegetation dangle over the creek and creates a cavern type structure. |
| 6062 | 0183.00 | LDA# 9 is 11' high x 26' wide x 41' long, and contains 14 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 45' wide x 52' long x 1' deep. The sediment ranges in size from gravel to large cobble. The LDA is a possible barrier to juvenile salmonids as there is a steep incline with no space under the LDA for juveniles to swim under. Fish were observed above the LDA |
| 6103 | 0184.00 | The SCP is within an LDA substrate buildup. |
| 6334 | 0191.00 | There is a 0.8' plunge over a log into 1.5' deep pool followed by a 1.5' plunge over wood debris into a 2.2' pool and a 1' plunge over wood debris into a 1.2' pool. |
| 6551 | 0202.00 | There is a 1.8' plunge over and LWD into a 3' pool. |
| 6640 | 0206.00 | LDA #10 is 11' high x 21' wide x 36' long, and contains 12 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 35' wide x 18' long x 8' deep. The sediment ranges in size from silt to gravel. Fish were observed above the LDA. |
| 6668 | 0207.00 | There is a buildup of sediment on the right bank from LDA. |
| 6861 | 0212.02 | LDA #11 is 8' high x 42' wide x 18' long and contains 8 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 18' wide x 10' long x 3.5' deep. The sediment ranges in size from silt to boulder. The LDA is not a possible barrier to salmonids as the LDA has redirected the main channel so fish can easily access it; however, juveniles can still swim under small openings under LDA and adults can jump over LDA in high flows. Fish were observed above the LDA. |
| 7335 | 0230.00 | LDA #12 is 7' high x 36' wide x 5' long, and contains 5 pieces of LWD. |

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Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 12' wide x 40' long x 2.5' deep. The sediment ranges in size from silt to large cobble. Adults can jump over this plunge. Fish (YOY) were observed above the LDA, even with dry channels on both banks above LDA.

| | | |
|------|---------|--|
| 7384 | 0232.00 | There is a one foot diameter rusting culvert sitting within a pool. |
| 7650 | 0240.00 | LDA #12 is 11' high x 33' wide x 29' long and contains 17 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 28' wide x 36' long x 2.5' deep. The sediment ranges in size from silt to boulder. The LDA is a possible barrier to juvenile salmonids as there is a large plunge from top to the bottom of LDA blocking juvenile's access. YOY were observed upstream of the LDA. Channel type changes to an A2 at HU #242. Channel type cross-section location is at HU #257. |
| 7862 | 0249.00 | In order from top to bottom, there is a 1' plunge over a boulder into a 0.7' pool, there is a 0.8' plunge over a boulder into a 1.2' pool, a 0.4' plunge over a boulder into a 0.6' pool, and lastly, a 1.9' plunge over a boulder into a 0.7' pool. |
| 8122 | 0262.00 | There is a 2' plunge over a boulder into a 2.7' pool. |
| 8270 | 0268.00 | Tributary #3 (unnamed) enters on the right bank. It contributes approximately less than 1% of Cooper Mill Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit, the water temp downstream of the confluence was 55 degrees, and the temp upstream was 55 degrees Fahrenheit. The slope of the tributary is 22%. The tributary is not accessible to salmonids due to a 4' plunge at mouth followed by series of 2-3' plunges which are highly entrenched. Fish were not observed in the tributary. A flag was placed at the mouth of the tributary. The canyon is extremely steep and because of low flow, fish may not have entered tributary. |
| 8307 | 0269.00 | The right bank is made of clay, silt, and bedrock. |
| 8339 | 0272.00 | LDA #14 is 5' high x 4' wide x 10' long x contains 3 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 36' wide x 15' long x 1.5' deep. The sediment ranges in size from silt to boulder. The LDA is a possible barrier to juvenile salmonids as there is a 3' plunge over a LWD into a 2.5' pool. A dry channel goes around the LDA on the left bank. Fish were observed above the LDA. |
| 8595 | 0286.00 | One YOY salmonid was observed. |

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| | | |
|-------|---------|--|
| 8840 | 0299.00 | LDA #15 is 12' x 24' x 27' long, and contains 6 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimension of 14' wide x 30' long x 1' deep. The sediment ranges in size from silt to boulder. The LDA is a possible barrier to juvenile salmonids. Fish were not observed above the LDA. |
| 8893 | 0302.00 | Water currently drops/seeps under a boulder into a pool below. It is not possible to see water dropping as it is out of sight. |
| 9138 | 0315.00 | There is a sediment buildup on the right bank measuring 37' long x 18' wide x 3' deep. |
| 9432 | 0328.00 | LDA #16 is 12' high x 30' wide x 31' long and contains 12 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 33' wide, 39' long x 3' deep. The sediment ranges in size from silt to cobble. The LDA is a possible barrier to salmonids as juveniles cannot swim up the 6' plunge, and the adults may not be able to jump over the plunge and 6' long LWD as well. |
| 9454 | 0329.00 | There is a plunge of 0.9' into a pool of depth 0.8'. |
| 9607 | 0337.00 | Water runs under wood accumulation on right bank. |
| 9661 | 0341.00 | There is a very overgrown SWD with one large mass of roots. |
| 9699 | 0342.00 | There is erosion on the right bank 5' high x 3' long. |
| 9708 | 0343.00 | There is a plunge of height 2.5' into water that is 2.9' deep. There is a large amount of wood accumulated. |
| 9777 | 0346.00 | There is a large mass of roots on the left bank. |
| 9879 | 0350.00 | There is a large root wad on the left bank. |
| 10006 | 0356.00 | LDA #17 is 11' high x 24' wide x 45' long, and contains 24 pieces of LWD. Water does flow through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimension of 21' wide x 28' long x 4' deep. The sediment ranges in size from silt to cobble. The LDA is a possible barrier to salmonids due to minimal flow and room to swim. Water flows underground occasionally. LDA seems to have been here for a long time as there is vegetation growing on the logs. |
| 10118 | 0363.00 | A small landslide was on the left bank measuring approximately 10' x 10'. |

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| | | |
|-------|---------|--|
| 10193 | 0367.00 | There is active erosion on the left bank that measures 22' long x 7' high. |
| 10203 | 0368.00 | Erosion that began at HU 367 ends in HU 368. |
| 10215 | 0369.00 | Tributary #4 enters on the left bank. It contributes approximately less than 5% of Cooper Mill Creek's flow. The water temperature of the tributary was 51 degrees Fahrenheit and the water temperature downstream of the confluence was 52 degrees Fahrenheit and the water temperature upstream of the confluence was 52 degrees Fahrenheit. The slope of the tributary is 14%. The tributary is not accessible to salmonids due to debris and vegetation piled up in the channel as well as a steep incline. A flag was placed at the mouth of the tributary. There is a barrier at low flow because tributary flows onto left bank before entering pool. |
| 10384 | 0377.00 | HUs 385 to 388 contain more than 20 pieces of LWD spanning across channel and there is a 6.5' drop from top of logs to the water's surface. |
| 10574 | 0391.00 | LDA #18 is 6.5' high x 23' wide x 20' long, and contains 8 pieces of LWD. Water does not flow through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 20' wide x 18' long x 1.5' deep. The sediment ranges in size from silt to gravel. The LDA is a possible barrier to salmonids as water skirts around LDA towards left bank then disappears underground and eventually filters into the pool underneath. The LDA is a potential barrier due to subsurface flow. Fish were not observed above the LDA. There is a landslide on the left bank. |
| 10622 | 0394.00 | LDA #19 is 5' high x 21' wide x 15' long, and contains 9 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 14' wide x 12' long x and 3' deep. The sediment ranges in size from silt to cobble. The LDA is a possible barrier to salmonids as water plunges down through the bottom of the LDA. There was a landslide on the right bank. |
| 10868 | 0403.00 | There is a large LWD spanning laterally across deep pools with large root wads forming a 4.7' plunge over wood into 1.6' deep pool. |
| 11017 | 0407.00 | There is an active erosion on the right bank, it measures 26' long x 10' high. |
| 11053 | 0409.00 | The unit is surrounded by more than 20 pieces of LWD. |
| 11078 | 0411.00 | LDA #20 is 10.5' high x 20' wide x 29' long and contains over 20 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 16' wide x 15' long x 4' deep. The sediment ranges in size from silt to gravel. The |

LDA is a possible barrier to salmonids as there are over 20 pieces of LWD spanning channel.

11078 0411.00 There is active erosion on the left bank.

11089 0412.00 End of survey due to multiple LDAs consisting of approximately 60' pieces of lwd greater than 20' in length and unsurveyable conditions. Visual observation of a highly entrenched steep channel, and shallow pools barely connected observed under the LWD.

LDA #21 is 12' high x 20' wide x 17' long and contains 16 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 16' wide x 15' long x 4' deep. The sediment is silt. There is a 12' plunge into a 2.1' deep pool at the end of LDA. The plunge at the top of the LDA was approximately 4' into a 0.7' deep pool, with the LWD being 7.5' high. The LDA is a possible barrier to salmonids. Fish were not observed above the LDA.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

| | | | |
|----------------------|-------|-------|-------|
| Low Gradient Riffle | (LGR) | [1.1] | { 1 } |
| High Gradient Riffle | (HGR) | [1.2] | { 2 } |

CASCADE

| | | | |
|---------------|-------|-------|-------|
| Cascade | (CAS) | [2.1] | { 3 } |
| Bedrock Sheet | (BRS) | [2.2] | {24} |

FLATWATER

| | | | |
|--------------|-------|-------|------|
| Pocket Water | (POW) | [3.1] | {21} |
| Glide | (GLD) | [3.2] | {14} |
| Run | (RUN) | [3.3] | {15} |
| Step Run | (SRN) | [3.4] | {16} |
| Edgewater | (EDW) | [3.5] | {18} |

MAIN CHANNEL POOLS

| | | | |
|-------------------------|-------|-------|-------|
| Trench Pool | (TRP) | [4.1] | { 8 } |
| Mid-Channel Pool | (MCP) | [4.2] | {17} |
| Channel Confluence Pool | (CCP) | [4.3] | {19} |
| Step Pool | (STP) | [4.4] | {23} |

SCOUR POOLS

| | | | |
|--|--------|-------|-------|
| Corner Pool | (CRP) | [5.1] | {22} |
| Lateral Scour Pool - Log Enhanced | (LSL) | [5.2] | {10} |
| Lateral Scour Pool - Root Wad Enhanced | (LSR) | [5.3] | {11} |
| Lateral Scour Pool - Bedrock Formed | (LSBk) | [5.4] | {12} |
| Lateral Scour Pool - Boulder Formed | (LSBo) | [5.5] | {20} |
| Plunge Pool | (PLP) | [5.6] | { 9 } |

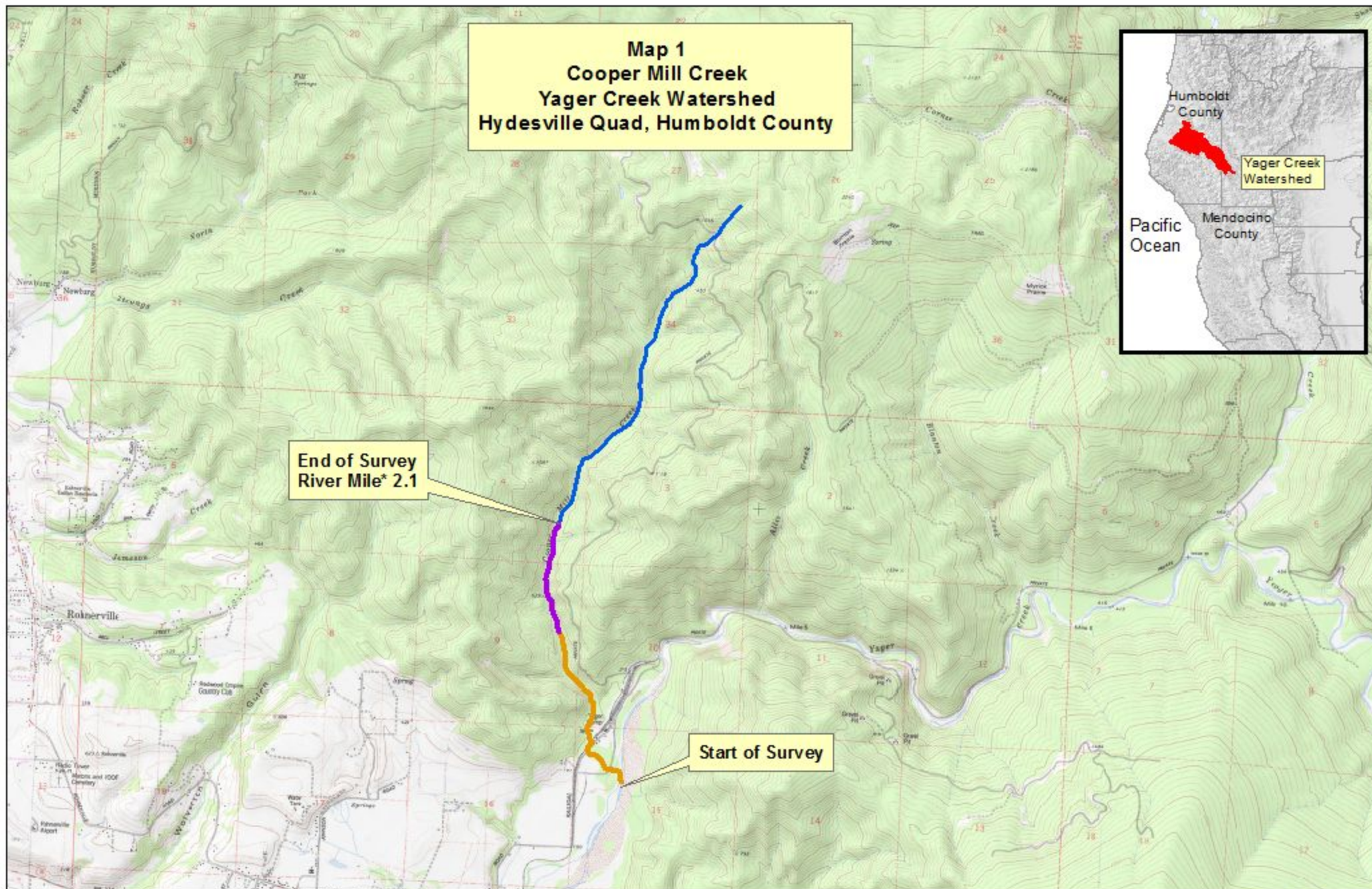
BACKWATER POOLS

| | | | |
|----------------------------------|-------|-------|-------|
| Secondary Channel Pool | (SCP) | [6.1] | { 4 } |
| Backwater Pool - Boulder Formed | (BPB) | [6.2] | { 5 } |
| Backwater Pool - Root Wad Formed | (BPR) | [6.3] | { 6 } |
| Backwater Pool - Log Formed | (BPL) | [6.4] | { 7 } |
| Dammed Pool | (DPL) | [6.5] | {13} |

ADDITIONAL UNIT DESIGNATIONS

| | | | |
|-----------------------------|-------|-------|--|
| Dry | (DRY) | [7.0] | |
| Culvert | (CUL) | [8.0] | |
| Not Surveyed | (NS) | [9.0] | |
| Not Surveyed due to a marsh | (MAR) | [9.1] | |

Map 1
Cooper Mill Creek
Yager Creek Watershed
Hydesville Quad, Humboldt County



End of Survey
River Mile* 2.1

Start of Survey



Cooper Mill Creek ——— Reach 1: F4 Channel Type ———
 Reach 2: A4 Channel Type ———



*River Mile indicates distance from confluence with Yager Creek

APPENDIX I

TABLES AND GRAPHS

Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Confluence Location: Quad: HYDESVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0

| Habitat Units | Units Fully Measured | Habitat Type | Habitat Occurrence (%) | Mean Length (ft.) | Total Length (ft.) | Total Length (%) | Mean Width (ft.) | Mean Depth (ft.) | Mean Max Depth (ft.) | Mean Area (sq.ft.) | Estimated Total Area (sq.ft.) | Mean Volume (cu.ft.) | Estimated Total Volume (cu.ft.) | Mean Residual Pool Vol (cu.ft.) | Mean Shelter Rating |
|---------------|----------------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|------------------|----------------------|---------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|
| 1 | 1 | DRY | 0.2 | 91 | 91 | 0.8 | 12.0 | | | | | | | | 0 |
| 108 | 16 | FLATWATER | 24.9 | 33 | 3607 | 30.9 | 8.5 | 0.5 | 1.0 | 235 | 25328 | 121 | 13024 | | 17 |
| 156 | 156 | POOL | 35.9 | 30 | 4710 | 40.4 | 12.1 | 0.9 | 1.8 | 362 | 56432 | 509 | 78824 | 396 | 45 |
| 169 | 17 | RIFFLE | 38.9 | 19 | 3260 | 27.9 | 8.2 | 0.3 | 0.7 | 176 | 29752 | 56 | 9526 | | 3 |
| Total Units | Total Units Fully Measured | | | | Total Length (ft.) | | | | | Total Area (sq.ft.) | | | Total Volume (cu.ft.) | | |
| 434 | 190 | | | | 11668 | | | | | 111513 | | | 101374 | | |

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Confluence Location: Quad: HYDEVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

| Habitat Units | Units Fully Measured | Habitat Type | Habitat Occurrence (%) | Mean Length (ft.) | Total Length (ft.) | Total Length (%) | Mean Width (ft.) | Mean Depth (ft.) | Max Depth (ft.) | Mean Area (sq.ft.) | Estimated Total Area (sq.ft.) | Mean Volume (cu.ft.) | Estimated Total Volume (cu.ft.) | Mean Residual Pool Vol (cu.ft.) | Mean Shelter Rating | Mean Canopy (%) |
|---------------|----------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|------------------|-----------------|--------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|-----------------|
| 121 | 13 | LGR | 27.9 | 19 | 2286 | 19.6 | 8 | 0.4 | 1.4 | 165 | 19964 | 58 | 7025 | | 2 | 97 |
| 46 | 4 | HGR | 10.6 | 20 | 933 | 8.0 | 8 | 0.3 | 0.8 | 212 | 9752 | 51 | 2340 | | 4 | 75 |
| 2 | 0 | BRS | 0.5 | 20 | 41 | 0.4 | | | | | | | | | | |
| 64 | 9 | RUN | 14.7 | 23 | 1461 | 12.5 | 7 | 0.5 | 1.3 | 165 | 10577 | 84 | 5361 | | 19 | 96 |
| 44 | 7 | SRN | 10.1 | 49 | 2146 | 18.4 | 11 | 0.5 | 1.5 | 324 | 14237 | 168 | 7389 | | 14 | 96 |
| 1 | 1 | TRP | 0.2 | 7 | 7 | 0.1 | 3 | 0.1 | 0.6 | 21 | 21 | 11 | 11 | 2 | 0 | 100 |
| 102 | 102 | MCP | 23.5 | 34 | 3457 | 29.6 | 13 | 1.0 | 4.6 | 418 | 42671 | 619 | 63156 | 494 | 40 | 96 |
| 1 | 1 | CCP | 0.2 | 16 | 16 | 0.1 | 10 | 0.8 | 1.5 | 160 | 160 | 240 | 240 | 128 | 20 | 88 |
| 5 | 5 | STP | 1.2 | 36 | 179 | 1.5 | 11 | 0.9 | 2.6 | 368 | 1840 | 511 | 2555 | 310 | 48 | 88 |
| 3 | 3 | CRP | 0.7 | 33 | 98 | 0.8 | 6 | 0.5 | 1.5 | 188 | 564 | 163 | 488 | 104 | 35 | 98 |
| 21 | 21 | LSL | 4.8 | 21 | 433 | 3.7 | 11 | 0.7 | 2.3 | 217 | 4554 | 229 | 4812 | 170 | 59 | 96 |
| 5 | 5 | LSR | 1.2 | 29 | 146 | 1.3 | 16 | 0.7 | 2.4 | 513 | 2564 | 519 | 2594 | 326 | 32 | 98 |
| 1 | 1 | LSBk | 0.2 | 13 | 13 | 0.1 | 8 | 0.9 | 1.8 | 98 | 98 | 98 | 98 | 88 | 5 | 100 |
| 5 | 5 | LSBo | 1.2 | 25 | 126 | 1.1 | 8 | 0.7 | 1.8 | 208 | 1040 | 221 | 1104 | 152 | 44 | 95 |
| 5 | 5 | PLP | 1.2 | 20 | 102 | 0.9 | 16 | 1.0 | 3.6 | 299 | 1494 | 373 | 1865 | 294 | 90 | 94 |
| 2 | 2 | SCP | 0.5 | 16 | 33 | 0.3 | 8 | 1.1 | 1.9 | 83 | 165 | 164 | 164 | 120 | 43 | 98 |
| 3 | 3 | BPL | 0.7 | 25 | 75 | 0.6 | 14 | 1.2 | 1.7 | 309 | 926 | 490 | 1470 | 435 | 37 | 99 |
| 2 | 2 | DPL | 0.5 | 12 | 25 | 0.2 | 14 | 0.7 | 1.3 | 168 | 336 | 134 | 268 | 112 | 115 | 95 |
| 1 | 1 | DRY | 0.2 | 91 | 91 | 0.8 | 12 | | | 0 | 0 | | | | 0 | 99 |

Total Units
434

Total Units Fully Measured
190

Total Length (ft.)
11668

Total Area (sq.ft.)
110962

Total Volume (cu.ft.)
100940

| | | |
|---------------------------------------|--------------------------------|---|
| Stream Name: Cooper Mill Creek | LLID: 1240563405584 | Drainage: Van Duzen River |
| Survey Dates: 5/23/2016 to 6/7/2020 | | |
| Confluence Location: Quad: HYDESVILLE | Legal Description: T02NR01ES15 | Latitude: 40:33:30.0N Longitude: 124:03:23.0W |

[illegible]

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Confluence Location: Quad: HYDESVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

| Habitat Units | Habitat Type | Habitat Occurrence (%) | < 1 Foot Maximum Residual Depth | < 1 Foot Percent Occurrence | 1 < 2 Feet Maximum Residual Depth | 1 < 2 Feet Percent Occurrence | 2 < 3 Feet Maximum Residual Depth | 2 < 3 Feet Percent Occurrence | 3 < 4 Feet Maximum Residual Depth | 3 < 4 Feet Percent Occurrence | >= 4 Feet Maximum Residual Depth | >= 4 Feet Percent Occurrence |
|---------------|--------------|------------------------|---------------------------------|-----------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|----------------------------------|------------------------------|
| 1 | TRP | 1 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 102 | MCP | 66 | 9 | 9 | 53 | 52 | 29 | 28 | 8 | 8 | 3 | 3 |
| 1 | CCP | 1 | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | STP | 3 | 0 | 0 | 3 | 60 | 2 | 40 | 0 | 0 | 0 | 0 |
| 3 | CRP | 2 | 1 | 33 | 2 | 67 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | LSL | 14 | 3 | 14 | 12 | 57 | 6 | 29 | 0 | 0 | 0 | 0 |
| 5 | LSR | 3 | 0 | 0 | 4 | 80 | 1 | 20 | 0 | 0 | 0 | 0 |
| 1 | LSBk | 1 | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | LSBo | 3 | 1 | 20 | 4 | 80 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | PLP | 3 | 1 | 20 | 1 | 20 | 2 | 40 | 1 | 20 | 0 | 0 |
| Total Units | | | Total < 1 Foot Max Resid. Depth | Total < 1 Foot % Occurrence | Total 1< 2 Foot Max Resid. Depth | Total 1< 2 Foot % Occurrence | Total 2< 3 Foot Max Resid. Depth | Total 2< 3 Foot % Occurrence | Total 3< 4 Foot Max Resid. Depth | Total 3< 4 Foot % Occurrence | Total >= 4 Foot Max Resid. Depth | Total >= 4 Foot % Occurrence |
| 155 | | | 17 | 11 | 86 | 55 | 40 | 26 | 9 | 6 | 3 | 2 |

Mean Maximum Residual Pool Depth (ft.): 1.8

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Confluence Location: Quad: HYDESVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

| Habitat Units | Habitat Type | Habitat Occurrence (%) | < 1 Foot Maximum Residual Depth | < 1 Foot Percent Occurrence | 1 < 2 Feet Maximum Residual Depth | 1 < 2 Feet Percent Occurrence | 2 < 3 Feet Maximum Residual Depth | 2 < 3 Feet Percent Occurrence | 3 < 4 Feet Maximum Residual Depth | 3 < 4 Feet Percent Occurrence | >= 4 Feet Maximum Residual Depth | >= 4 Feet Percent Occurrence |
|---------------|--------------|------------------------|---------------------------------|-----------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|----------------------------------|------------------------------|
| 1 | SCP | 1 | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | BPL | 2 | 1 | 33 | 2 | 67 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | DPL | 1 | 0 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |

| Total Units | Total < 1 Foot Max Resid. Depth | Total < 1 Foot % Occurrence | Total 1< 2 Foot Max Resid. Depth | Total 1< 2 Foot % Occurrence | Total 2< 3 Foot Max Resid. Depth | Total 2< 3 Foot % Occurrence | Total 3< 4 Foot Max Resid. Depth | Total 3< 4 Foot % Occurrence | Total >= 4 Foot Max Resid. Depth | Total >= 4 Foot % Occurrence |
|-------------|---------------------------------|-----------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|
| 155 | 17 | 11 | 86 | 55 | 40 | 26 | 9 | 6 | 3 | 2 |

Mean Maximum Residual Pool Depth (ft.): 1.8

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Dry Units: 1

Confluence Location:

Quad: HYDESVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

| Habitat Units | Units Fully Measured | Habitat Type | Mean % Undercut Banks | Mean % SWD | Mean % LWD | Mean % Root Mass | Mean % Terr. Vegetation | Mean % Aquatic Vegetation | Mean % White Water | Mean % Boulders | Mean % Bedrock Ledges |
|---------------|----------------------|--------------|-----------------------|------------|------------|------------------|-------------------------|---------------------------|--------------------|-----------------|-----------------------|
| 121 | 13 | LGR | 35 | 52 | 9 | 0 | 0 | 0 | 0 | 4 | 0 |
| 46 | 5 | HGR | 0 | 30 | 0 | 0 | 20 | 0 | 50 | 0 | 0 |
| 2 | 0 | BRS | | | | | | | | | |
| 169 | 18 | TOTAL RIFFLE | 21 | 41 | 7 | 0 | 7 | 0 | 21 | 3 | 0 |
| 64 | 9 | RUN | 24 | 35 | 24 | 4 | 0 | 0 | 0 | 15 | 0 |
| 44 | 6 | SRN | 0 | 9 | 45 | 1 | 0 | 0 | 5 | 40 | 0 |
| 108 | 15 | TOTAL FLAT | 14 | 24 | 33 | 2 | 0 | 0 | 2 | 25 | 0 |
| 1 | 1 | TRP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 102 | 99 | MCP | 16 | 26 | 41 | 3 | 4 | 0 | 1 | 8 | 0 |
| 1 | 1 | CCP | 5 | 10 | 70 | 0 | 0 | 0 | 5 | 10 | 0 |
| 5 | 5 | STP | 0 | 28 | 10 | 20 | 0 | 0 | 8 | 33 | 0 |
| 3 | 3 | CRP | 2 | 45 | 0 | 50 | 0 | 0 | 0 | 3 | 0 |
| 21 | 20 | LSL | 2 | 17 | 71 | 3 | 1 | 0 | 1 | 5 | 0 |
| 5 | 5 | LSR | 3 | 19 | 46 | 24 | 0 | 0 | 1 | 7 | 0 |
| 1 | 1 | LSBk | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 5 | 55 |
| 5 | 5 | LSBo | 3 | 6 | 22 | 0 | 0 | 0 | 1 | 68 | 0 |
| 5 | 5 | PLP | 7 | 16 | 54 | 4 | 0 | 0 | 10 | 9 | 0 |
| 2 | 2 | SCP | 43 | 0 | 57 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 3 | BPL | 2 | 18 | 61 | 12 | 0 | 0 | 0 | 7 | 0 |
| 2 | 2 | DPL | 0 | 40 | 45 | 0 | 0 | 0 | 0 | 15 | 0 |
| 156 | 152 | TOTAL POOL | 12 | 23 | 45 | 5 | 2 | 0 | 2 | 11 | 0 |
| 434 | 186 | TOTAL | 12 | 24 | 43 | 5 | 2 | 0 | 3 | 11 | 0 |

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Dry Units: 1

Confluence Location: Quad: HYDESVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

| Habitat Units | Units Fully Measured | Habitat Type | % Total Silt/Clay Dominant | % Total Sand Dominant | % Total Gravel Dominant | % Total Small Cobble Dominant | % Total Large Cobble Dominant | % Total Boulder Dominant | % Total Bedrock Dominant |
|---------------|----------------------|--------------|----------------------------|-----------------------|-------------------------|-------------------------------|-------------------------------|--------------------------|--------------------------|
| 121 | 13 | LGR | 0 | 0 | 62 | 15 | 15 | 8 | 0 |
| 46 | 4 | HGR | 0 | 0 | 25 | 50 | 0 | 25 | 0 |
| 2 | 0 | BRS | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 9 | RUN | 22 | 0 | 67 | 11 | 0 | 0 | 0 |
| 44 | 7 | SRN | 0 | 0 | 29 | 14 | 0 | 57 | 0 |
| 1 | 1 | TRP | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 102 | 102 | MCP | 72 | 7 | 12 | 4 | 1 | 4 | 1 |
| 1 | 1 | CCP | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 5 | 5 | STP | 60 | 0 | 20 | 0 | 0 | 20 | 0 |
| 3 | 3 | CRP | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 21 | 21 | LSL | 67 | 0 | 19 | 5 | 0 | 10 | 0 |
| 5 | 5 | LSR | 40 | 20 | 40 | 0 | 0 | 0 | 0 |
| 1 | 1 | LSBk | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| 5 | 5 | LSBo | 40 | 20 | 0 | 0 | 0 | 40 | 0 |
| 5 | 5 | PLP | 40 | 0 | 20 | 0 | 0 | 40 | 0 |
| 2 | 2 | SCP | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 3 | BPL | 33 | 0 | 67 | 0 | 0 | 0 | 0 |
| 2 | 2 | DPL | 0 | 50 | 50 | 0 | 0 | 0 | 0 |

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Cooper Mill Creek LLID: 1240563405584 Drainage: Van Duzen River
Survey Dates: 5/23/2016 to 6/7/2020
Confluence Location: Quad: HYDESVILLE Legal Description: T02NR01ES15 Latitude: 40:33:30.0N Longitude: 124:03:23.0W

| Mean Percent Canopy | Mean Percent Conifer | Mean Percent Hardwood | Mean Percent Open Units | Mean Right Bank % Cover | Mean Left Bank % Cover |
|---------------------------|----------------------------|-----------------------------|-------------------------------|-------------------------------|------------------------------|
| 96 | 42 | 58 | 0 | 99 | 99 |

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Survey Length (ft.): 11668

Main Channel (ft.): 11101

Side Channel (ft.): 567

Confluence Location: Quad: HYDEVILLE

Legal Description: T02NR01ES15 Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

Summary of Fish Habitat Elements By Stream Reach**STREAM REACH: 1**

Channel Type: A2

Canopy Density (%): 94.8

Pools by Stream Length (%): 38.4

Reach Length (ft.): 8473

Coniferous Component (%): 48.5

Pool Frequency (%): 35.1

Riffle/Flatwater Mean Width (ft.): 9.5

Hardwood Component (%): 51.5

Residual Pool Depth (%):

BFW:

Dominant Bank Vegetation: Hardwood Trees

< 2 Feet Deep: 69

Range (ft.): 9 to 29

Vegetative Cover (%): 98.4

2 to 2.9 Feet Deep: 26

Mean (ft.): 19

Dominant Shelter: Large Woody Debris

3 to 3.9 Feet Deep: 5

Std. Dev.: 5

Dominant Bank Substrate Type: Sand/Silt/Clay

>= 4 Feet Deep: 0

Base Flow (cfs.): 0.4

Occurrence of LWD (%): 31

Mean Max Residual Pool Depth (ft.): 1.7

Water (F): 53 - 60 Air (F): 56 - 70

LWD per 100 ft.:

Mean Pool Shelter Rating: 43

Dry Channel (ft): 0

Riffles: 2

Pools: 7

Flat: 3

Pool Tail Substrate (%): Silt/Clay: 4 Sand: 1 Gravel: 65 Sm Cobble: 27 Lg Cobble: 1 Boulder: 2 Bedrock: 0

Embeddedness Values (%): 1. 21.2 2. 27.9 3. 40.4 4. 4.8 5. 5.8

STREAM REACH: 2

Channel Type: A2

Canopy Density (%): 97.3

Pools by Stream Length (%): 46.9

Reach Length (ft.): 2628

Coniferous Component (%): 27.5

Pool Frequency (%): 37.8

Riffle/Flatwater Mean Width (ft.): 4.1

Hardwood Component (%): 72.5

Residual Pool Depth (%):

BFW:

Dominant Bank Vegetation: Hardwood Trees

< 2 Feet Deep: 61

Range (ft.): 9 to 25

Vegetative Cover (%): 99.5

2 to 2.9 Feet Deep: 25

Mean (ft.): 17

Dominant Shelter: Large Woody Debris

3 to 3.9 Feet Deep: 8

Std. Dev.: 4

Dominant Bank Substrate Type: Sand/Silt/Clay

>= 4 Feet Deep: 6

Base Flow (cfs.): 0.4

Occurrence of LWD (%): 47

Mean Max Residual Pool Depth (ft.): 1.9

Water (F): 51 - 56 Air (F): 54 - 62

LWD per 100 ft.:

Mean Pool Shelter Rating: 47

Dry Channel (ft): 91

Riffles: 8

Pools: 16

Flat: 11

Pool Tail Substrate (%): Silt/Clay: 20 Sand: 2 Gravel: 63 Sm Cobble: 6 Lg Cobble: 0 Boulder: 10 Bedrock: 0

Embeddedness Values (%): 1. 21.6 2. 25.5 3. 19.6 4. 3.9 5. 29.4

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Confluence Location: Quad: HYDEVILLE

Legal Description: T02NR01ES15

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

Mean Percentage of Dominant Stream Bank Substrate

| Dominant Class of Substrate | Number of Units Right Bank | Number of Units Left Bank | Total Mean Percent (%) |
|--------------------------------|-------------------------------|------------------------------|---------------------------|
| Bedrock | 7 | 3 | 2.6 |
| Boulder | 20 | 25 | 11.8 |
| Cobble / Gravel | 46 | 48 | 24.7 |
| Sand / Silt / Clay | 117 | 114 | 60.8 |

Mean Percentage of Dominant Stream Bank Vegetation

| Dominant Class of Vegetation | Number of Units Right Bank | Number of Units Left Bank | Total Mean Percent (%) |
|---------------------------------|-------------------------------|------------------------------|---------------------------|
| Grass | 0 | 2 | 0.5 |
| Brush | 34 | 31 | 17.1 |
| Hardwood Trees | 98 | 115 | 56.1 |
| Coniferous Trees | 57 | 37 | 24.7 |
| No Vegetation | 1 | 5 | 1.6 |

Total Stream Cobble Embeddedness Values: 3

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: Cooper Mill Creek

LLID: 1240563405584

Drainage: Van Duzen River

Survey Dates: 5/23/2016 to 6/7/2020

Confluence Location:

Quad: HYDEVILLE

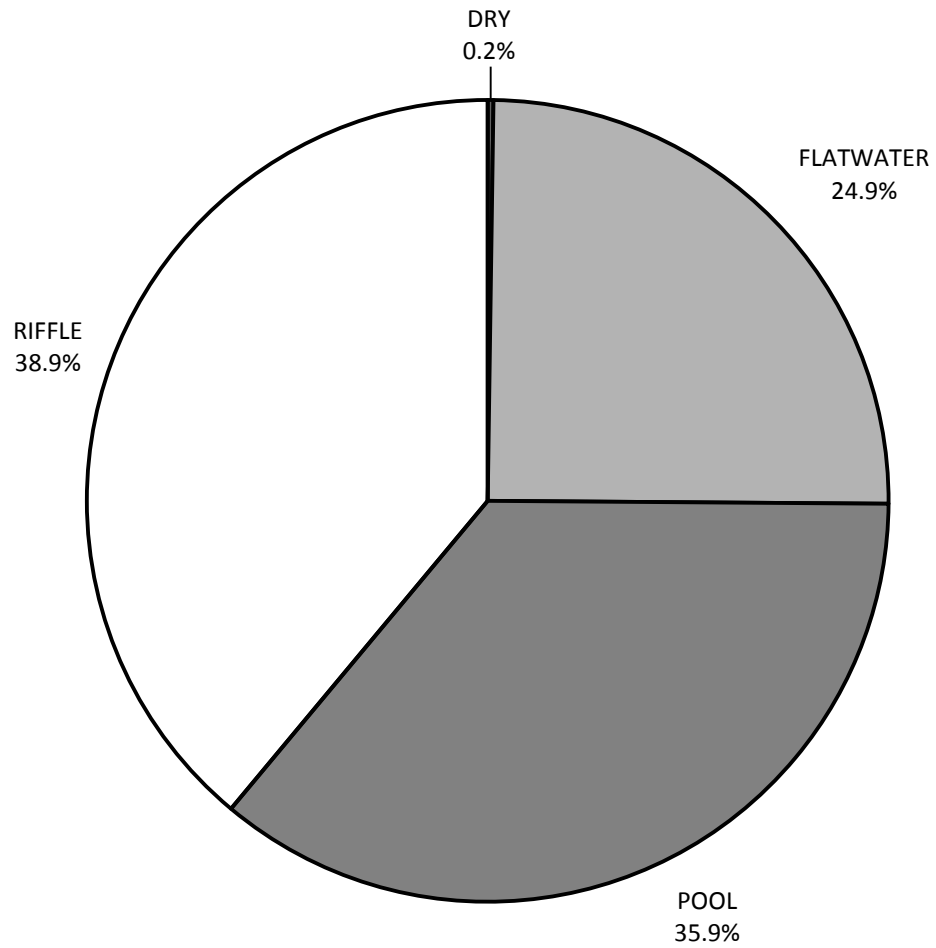
Legal Description: T02NR01E515

Latitude: 40:33:30.0N

Longitude: 124:03:23.0W

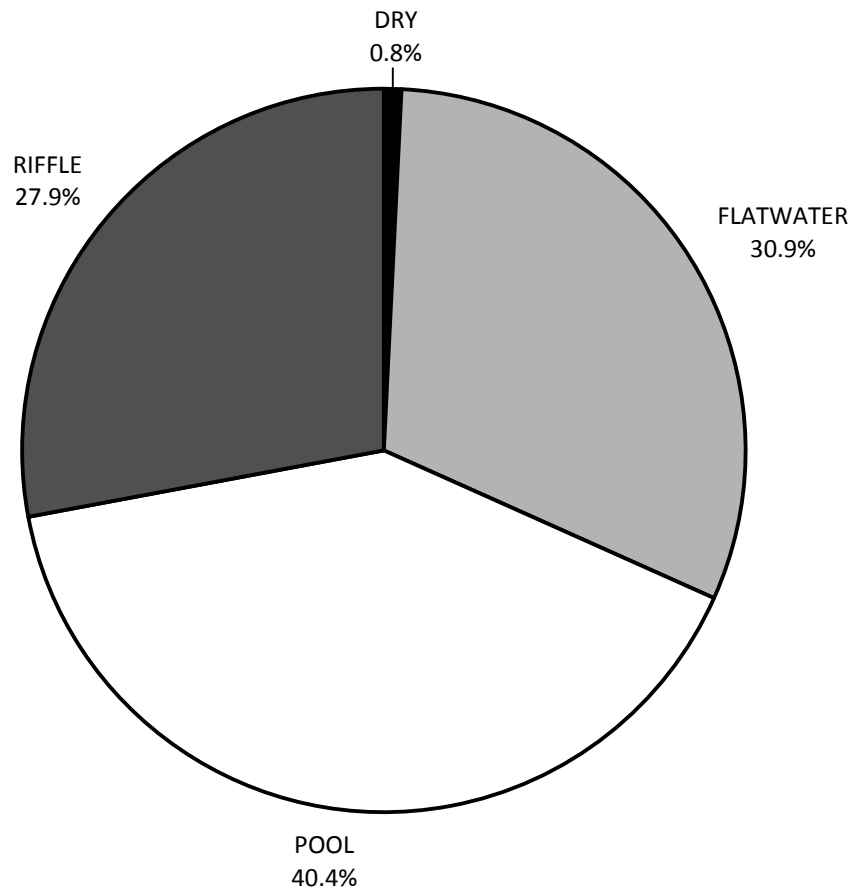
| | Riffles | Flatwater | Pools |
|----------------------------|----------------|------------------|--------------|
| UNDERCUT BANKS (%) | 21 | 14 | 12 |
| SMALL WOODY DEBRIS (%) | 41 | 24 | 23 |
| LARGE WOODY DEBRIS (%) | 7 | 34 | 45 |
| ROOT MASS (%) | 0 | 2 | 5 |
| TERRESTRIAL VEGETATION (%) | 7 | 0 | 2 |
| AQUATIC VEGETATION (%) | 0 | 0 | 0 |
| WHITewater (%) | 21 | 2 | 2 |
| BOULDERS (%) | 3 | 24 | 11 |
| BEDROCK LEDGES (%) | 0 | 0 | 0 |

COOPER MILL CREEK 2016
HABITAT TYPES BY PERCENT OCCURRENCE



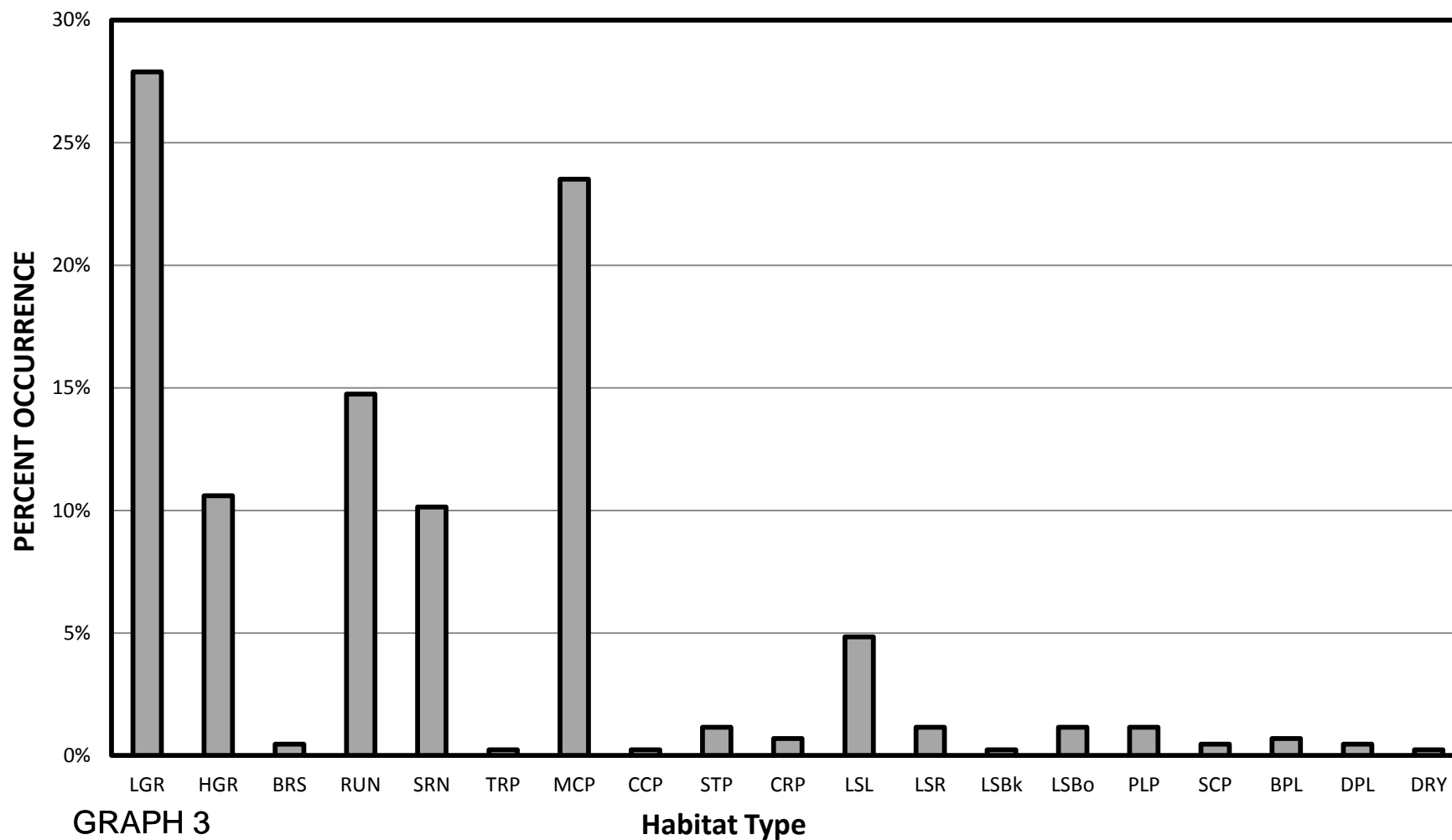
GRAPH 1

COOPER MILL CREEK 2016
HABITAT TYPES BY PERCENT TOTAL LENGTH



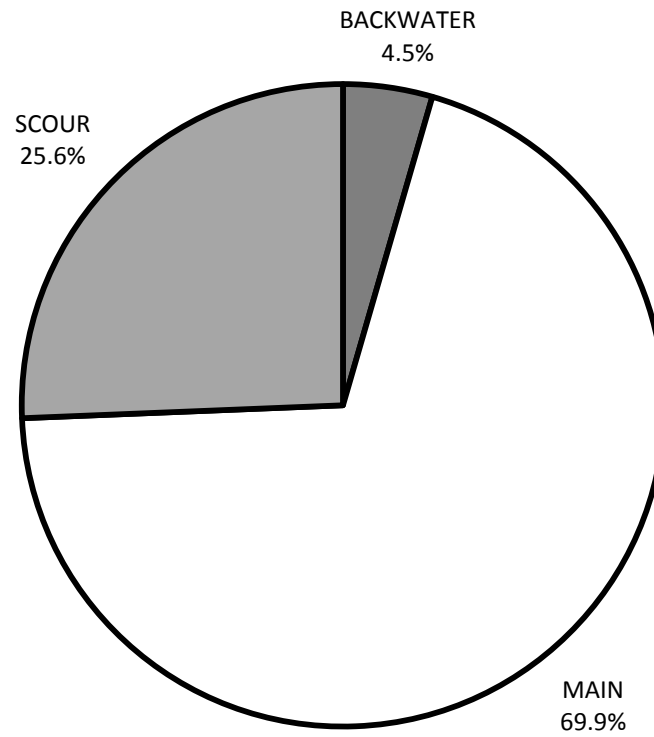
GRAPH 2

COOPER MILL CREEK 2016
HABITAT TYPES BY PERCENT OCCURRENCE



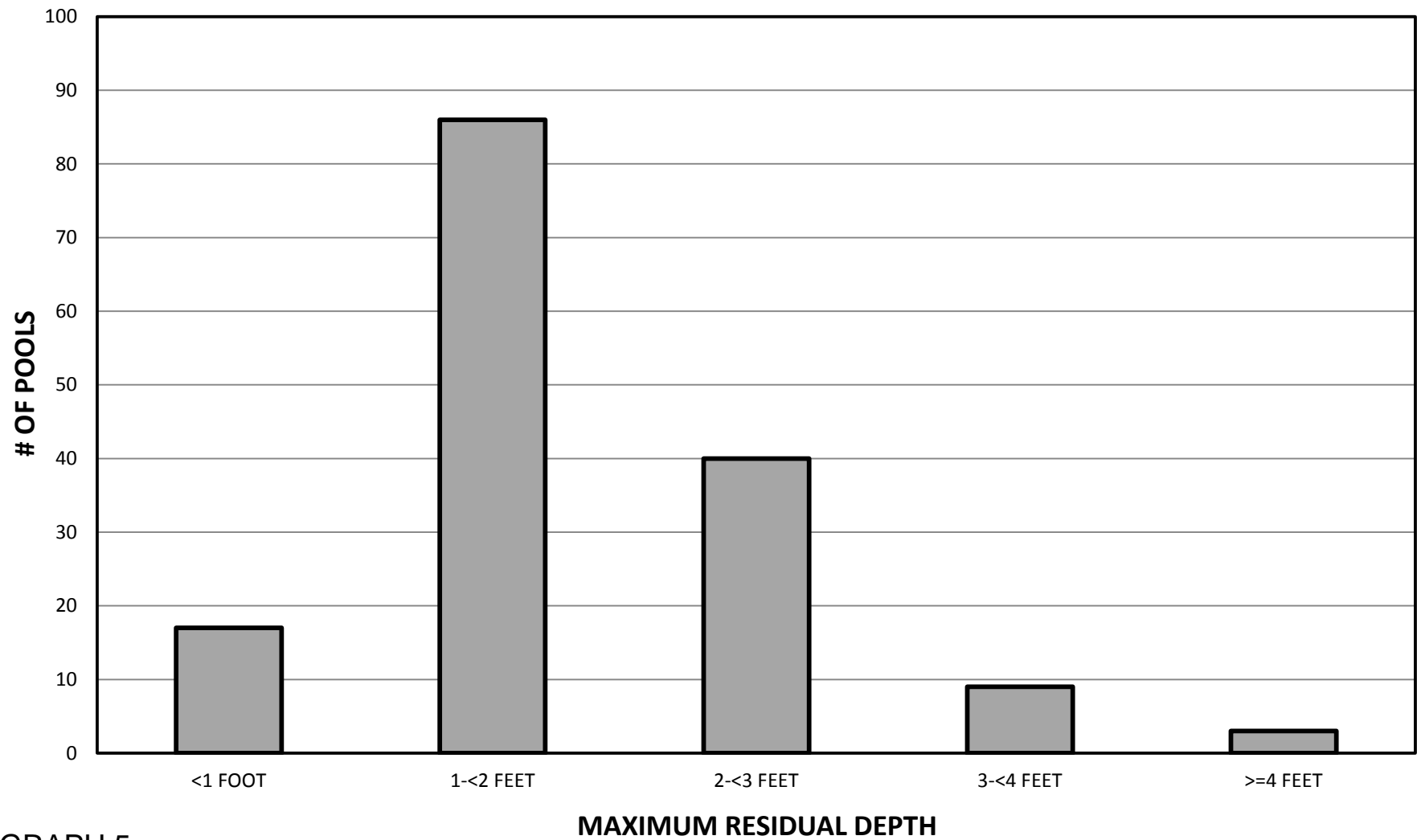
GRAPH 3

**COOPER MILL CREEK 2016
POOL TYPES BY PERCENT OCCURRENCE**



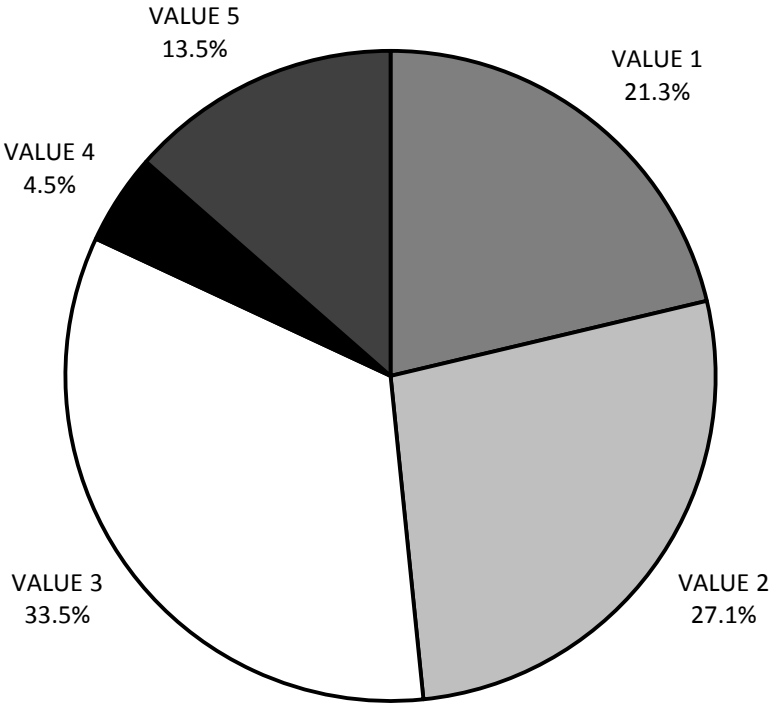
GRAPH 4

**COOPER MILL CREEK 2016
MAXIMUM DEPTH IN POOLS**



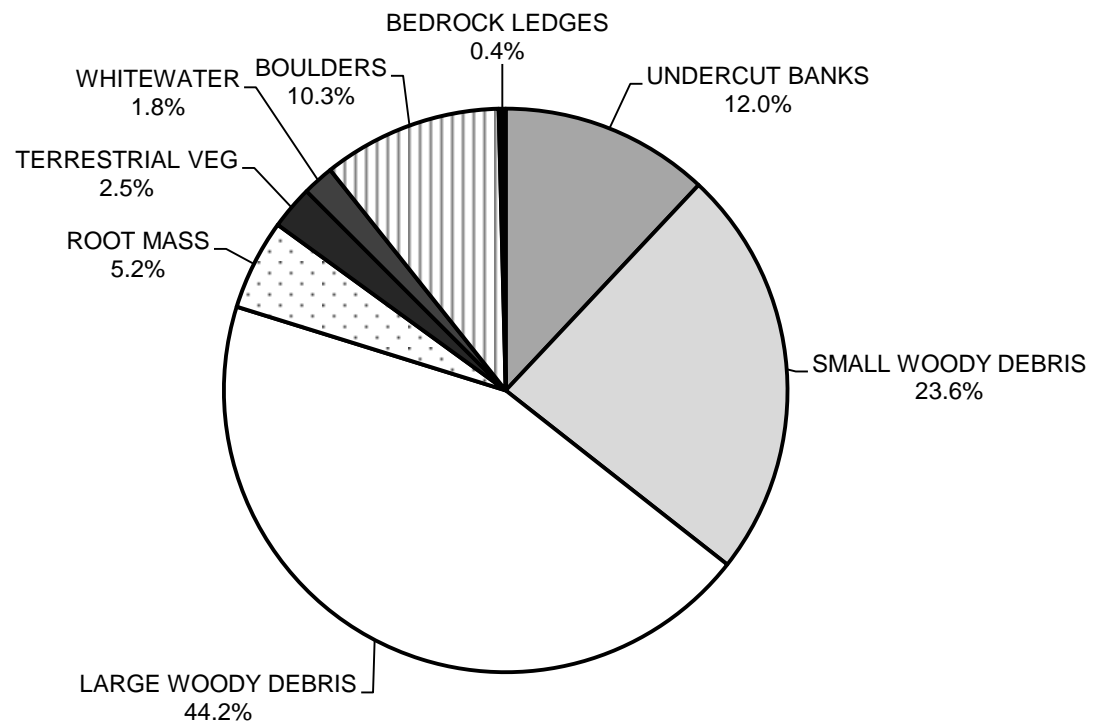
GRAPH 5

**COOPER MILL CREEK 2016
PERCENT EMBEDDEDNESS**



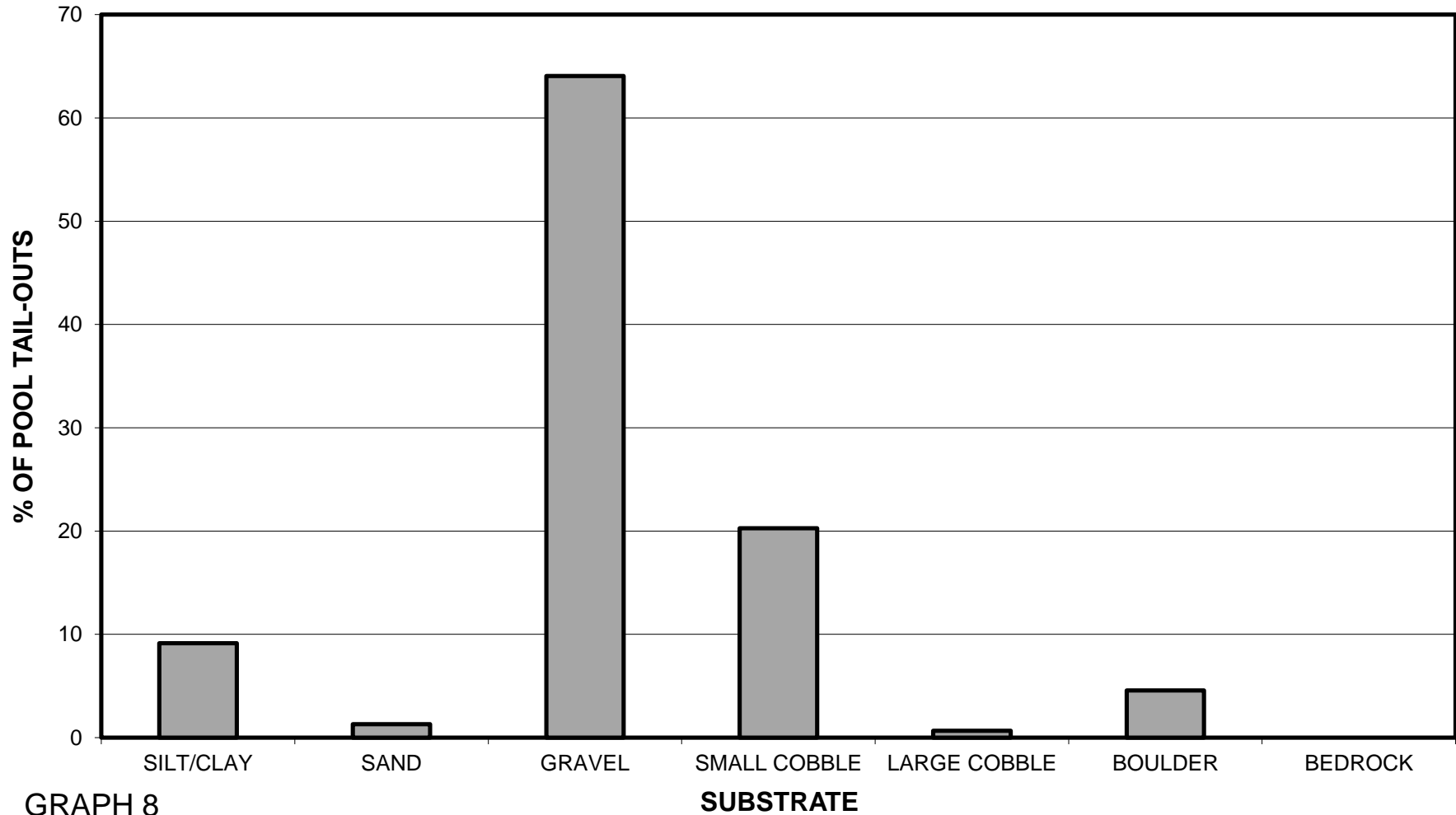
GRAPH 6

COOPER MILL CREEK 2016 MEAN PERCENT COVER TYPES IN POOLS

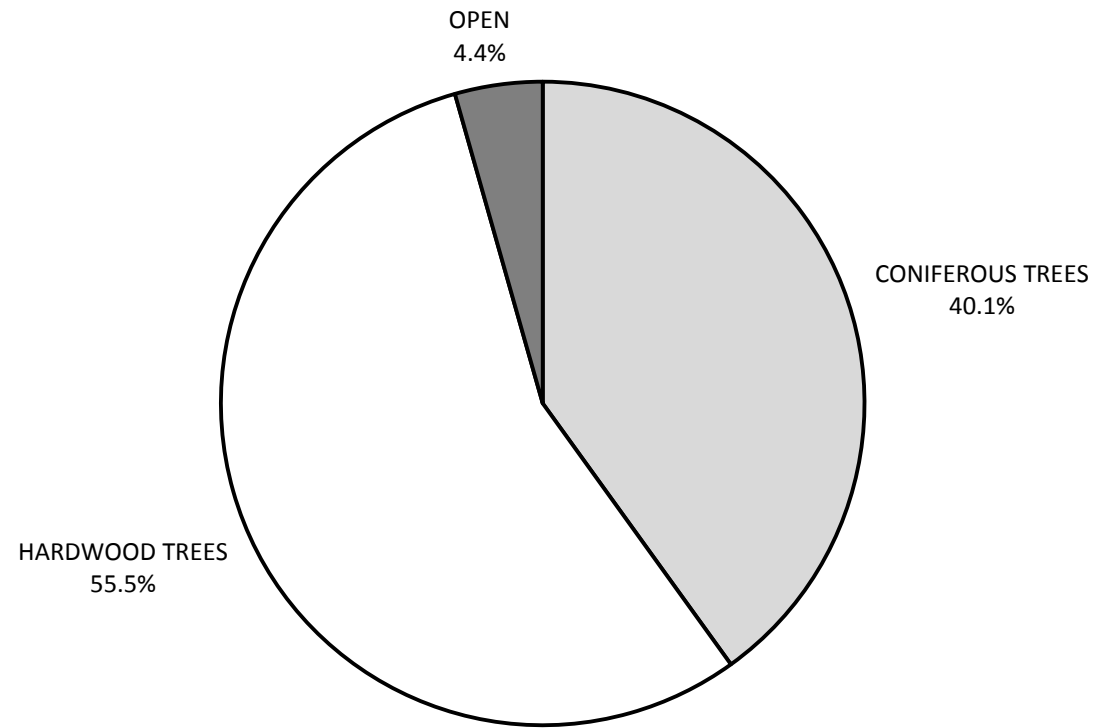


GRAPH 7

**COOPER MILL CREEK 2016
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**

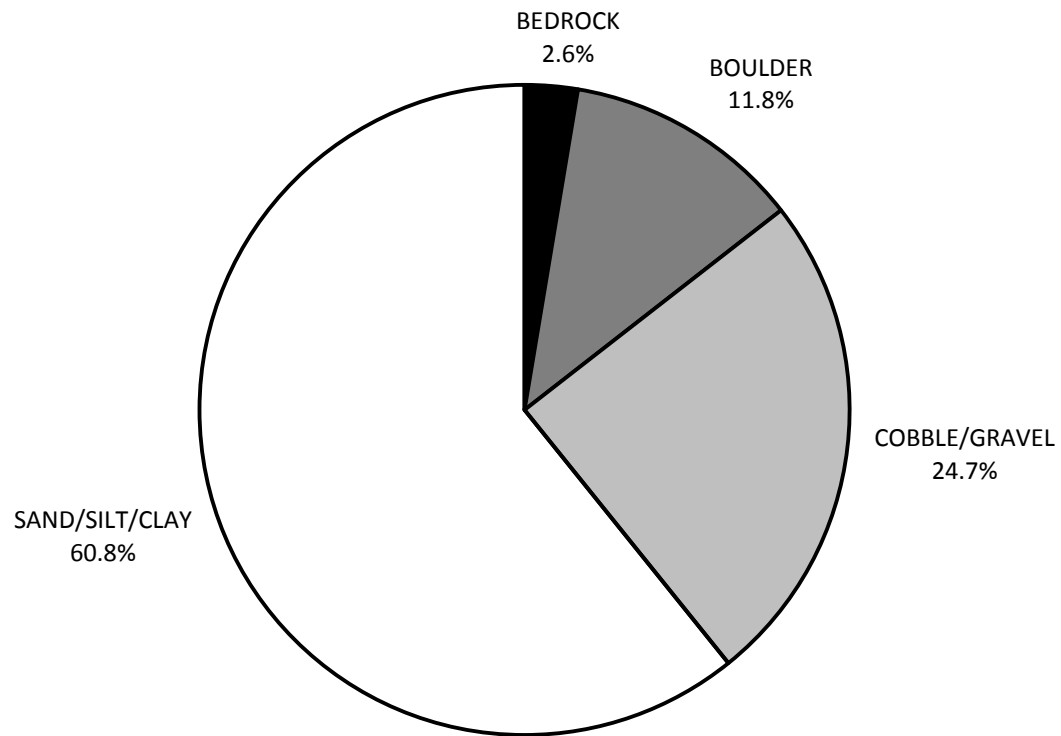


**COOPER MILL CREEK 2016
MEAN PERCENT CANOPY**



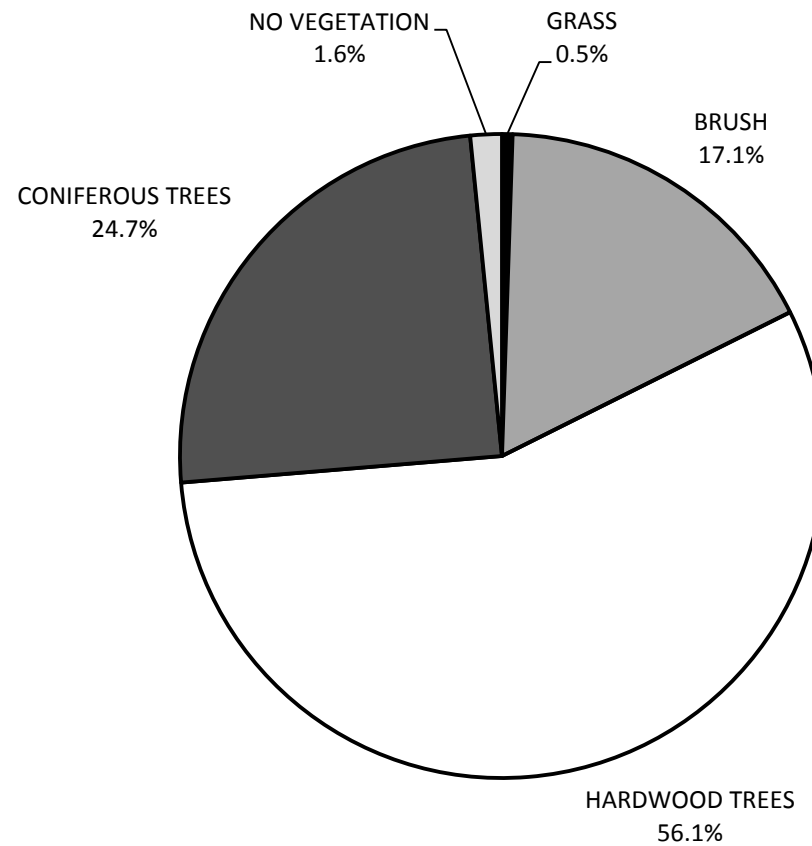
GRAPH 9

COOPER MILL CREEK 2016
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

COOPER MILL CREEK 2016
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

APPENDIX II

STREAM INVENTORY PHOTOS



Photo 1. Wooden weir (Habitat # 0071.00) that forms seasonal barrier. Structure was formerly associated with the PALCO fish rearing facility that is no longer in use. Photo taken 5/25/2016.



Photo 2. Same wooden weir pictured in Photo 1. Photo taken 5/25/2016.