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CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Mark West Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Mark West Creek starting just downstream of Slusser Road. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Mark West Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

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

Mark West Creek is a tributary to the Russian River, located in Sonoma County, California (see Mark West Creek map, page 2). The legal description at the confluence with laguna De Santa Rosa is T8N, R9W, S32. Its location is 38 29'30" N. latitude and 122 53'30" W. longitude.

Mark West Creek and its tributaries drain a basin of approximately 40 square miles. Mark West Creek is a fourth order stream and has approximately 27 miles of blue line stream, according to the USGS Camp Meeker, Healdsburg, Sebastopol, and Mark West Springs 7.5 minute quadrangles. Major tributaries include Porter Creek and Humbug Creek both of which are described in separate stream reports. Elevations range from about 40 feet

at the mouth of the creek to 1800 feet in the headwaters. The topography is mountainous in the headwaters, becoming a flat valley in the middle section and turning to low hills near the mouth. Most of the stream in the middle section is bordered by cultivated fields and housing developments. Vegetation near the mouth is typical Redwood Forest. The vegetation near the headwaters is characterized by oaks, bays, redwoods, Douglas-fir, maples, madrone, and manzanita.

METHODS

The habitat inventory conducted in Mark West Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi, et al. 1998). The Sonoma county Water Agency personnel that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two person team with technical oversight by Bob Coey, Russian River Basin Planner (DFG).

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 Mark West Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1996).

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.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured in fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote Temperature recorders which log temperature every two hours, 24 hours/day.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). 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". Mark West 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 unit lengths were measured, additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (length,mean width, mean depth, maximum depth and pool tail crest depth). All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Mark West 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), 76 - 100% (value 4). Additionally, a rating of "not

suitable" (NS)was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out,or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter isthen classified according to a list of nine shelter types. In Mark West Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent 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 measured habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual, 1994. Canopy density relates to the amount of stream shaded from the sun. In Mark West 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 evergreen or deciduous trees.

9. Bank Composition:

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 Mark West Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE IV data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following tables and appendices:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Shelter by habitat types
- Dominant substrates by habitat types
- Vegetative cover and dominant bank composition
- Fish habitat elements by stream reach

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Mark West Creek include:

- Level II Habitat Types by % Occurrence and % Total Length
- Level IV Habitat Types by % Occurrence

- Pool Habitat Types by % Occurrence
- Maximum Depth in Pools
- Pool Shelter Types by % Area
- Substrate Composition in Low Gradient Riffles
- Percent Cobble Embeddedness by Reach
- Mean Percent Canopy
- Mean Percent Canopy by Reach
- Percent Bank Composition and Bank Vegetation

HISTORICAL STREAM SURVEYS:

The Department of Fish and Game conducted surveys of Mark West Creek in July 1965, September 1969, and August 1970. All surveys extended from the mouth to the headwaters. In the 1965 survey, the gradient was moderate. The width averaged 11' and the depth averaged 1.1'. Flow was estimated at 0.6 cfs. The water temperature averaged 69°F and the air temperature averaged 77°F.

The substrate consisted of 40% small cobble, 20% large gravel, 18% boulders, 17% large cobble, 12% small gravel, 2% silt, and 1% bedrock. Steelhead spawning areas were good to excellent with approximately 3.2 miles of spawning grounds. Fifty percent of the stream was pools averaging 16.7' in length, 7.1' in width, and 1.6' deep. Shelter consisted of boulders, logs, undercut banks, aquatic plants, and overhanging vegetation.

A barrier consisting of a large flashboard dam was located 100 yards upstream of the Trenton-Heladsburg Road. Three diversions were found pumping water for irrigation and domestic purposes. One was 1500 feet downstream of Laughlin Road Bridge, another was 3000 feet below the same bridge, and the last was 1.1 miles downstream of the same bridge.

In the 1969 survey, the streambed dropped an average of approximately 61'/mile and was near zero in the valley section and near the Russian River. The width averaged 14' and the depth averaged 1.4'. A flow taken near the headwaters approximately 200' downstream from the St. Helena Road bridge measured 1.41 cfs. Another flow taken near the mid section approximately 100'

downstream from Slusser Road bridge measured 1.10 cfs. Another flow taken approximately 10' upstream from the confluence with the Russian River measured 4.16 cfs. A pigmy meter was used for all flow measurements. Water temperature averaged 68°F and air temperatures averaged 73°F.

The substrate consisted of 25% gravel, 23% large cobble, 26% silt, 16% bedrock, and 10% boulders. Steelhead spawning areas comprised approximately 2.5 miles of the stream. No spawning gravels were observed downstream from Windsor Creek, due to the turbidity of the water. Pools were numerous throughout the entire stream with shelter consisting of logs, boulders, and undercut banks. Stream shade canopy was approximately 75%.

A complete barrier consisted of a 10' falls located about 2.5 miles upstream from the St. Helena Road bridge. Resident trout were observed for 0.5 miles upstream from this barrier. Numerous log jams and flashboard dams were also observed during the survey. Thirty-two diversions were observed, ranging in size from 1"-6" in diameter.

In the 1970 survey, the gradient was estimated to be 54' per mile. The average width was 2' in riffles and 8' in pools and the average depth was 3" in riffles and 1.5' in pools. The flow was estimated to average approximately 0.75 cfs. The air temperature was 73°F and the water temperature was 62°F at a point 25 miles upstream from the mouth.

The substrate consisted of 40% silt, 40% sand , 10% small gravel, 5% small cobble, 5% large gravel. Pools were estimated at 60% by occurrence and averaged 8' wide, 1.5' deep, and 15' long. Shelter was considered good and consisted mostly of vegetation. Only one irrigation dam barrier was observed.

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of August 8 - October 23, 1996 was conducted by Sean White, Pamela Higgins, and Joyce Ambrosius, Sonoma County Water Agency personnel. The survey began just

downstream of Slusser Road and extended up Mark West Creek to the end of anadromous fish passage at a waterfall. The total length of the stream surveyed was 81,811 feet, with an additional 2,280 feet of side channel. Flow was estimated to be 1-2 cfs at habitat unit 1 during the survey period.

This section of Mark West Creek has 6 channel types: from the mouth to 28,229 feet an F4; next 5,510 feet an F2; next 6,870 feet a B2; next 13,412 feet a B3; next 10,856 feet a C3 and the upper 16,934 feet a B1-2. F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate. F2 channel types are similar, but with a boulder substrate.

B3 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly cobble substrate. B1 and B2 types are similar, but with bedrock and boulder substrates, respectively.

C3 channel types are low gradient (<2%), meandering, point-bar, riffle/pool, alluvial channels with a broad, well defined floodplain and a predominantly cobble substrate.

Water temperatures ranged from 46°F to 73°F. Air temperatures ranged from 48°F to 97°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 47% flatwater units, 37% pool units, 16% riffle units, and 1% dry streambed units. Based on total **length** there were 50% flatwater units, 40% pool units, 8% riffle units, and 1% dry streambed units (Graph 1).

There were 1,115 habitat units measured and 11% were completely sampled. Twenty-two Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were glides at 17%, runs 12%, low gradient riffles 11% and step runs 11% (Graph 2). By percent total **length**, glides made up 23%, step runs 14%, root wad scour pools 12%, and mid-channel pools 11%.

There were 412 pools identified (Table 3). Scour pools were most often encountered at 68%, and comprised 64% of the total length of pools (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Thirty-four percent of the pools had a depth of three feet or greater (Graph 4). These deeper pools comprised 19% of the total length of stream habitat.

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. Pool types in general had a mean shelter rating of 42. Of the pool types, the scour pools had the highest mean shelter rating at 44, main channel pools rated 37, and backwater pools rated 36 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were root masses at 27%, terr. vegetation 23%, boulders 18%, and undercut banks 15%. Graph 5 describes the pool shelter in Mark West Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 4 of the 19 low gradient riffles measured. Small cobble was dominant in 13 of the low gradient riffles (Graph 6).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 395 pool tail-outs measured, 4 had a value of 1 (1%); 77 had a value of 2 (19%); 248 had a value of 3 (63%); and 66 had a value of 4 (17%). On this scale, a value of one is best for fisheries. Graph 7 describes percent embeddedness by reach.

The mean percent canopy density for the stream reach surveyed was 68%. The mean percentages of deciduous and evergreen trees were 63% and 37%, respectively. Graph 8 describes the canopy for the entire survey and graph 9 describes the canopy by reach.

For the entire stream reach surveyed, the mean percent right bank vegetated was 83% and the mean percent left bank vegetated was 82%. For the habitat units measured, the dominant vegetation types for the stream banks were: 56% deciduous trees, 40% evergreen trees, 3% brush, and 1% grass. The dominant substrate for the stream banks were: 58% silt/clay/sand, 17%

cobble/gravel, 14% bedrock and 11% boulder (Graph 10).

During the summer of 1997, summer water temperatures were measured using remote temperature recorders placed in pools (see Temperature Summary graphs at end of report). Seven recorders were placed in various locations in Mark West Creek and logged temperatures every two hours from May 15 to September 9, 1997. The first recorder was placed in Reach 1 and the highest temperature recorded was 74°F in June and the lowest temperature was 62°F in May. The second recorder was placed in Reach 3 and the highest temperature recorded was 69°F in July and the lowest temperature was 59°F in May. The third recorder was placed in Reach 4 and the highest temperature recorded was 76°F in June and the lowest temperature was 58°F in May. The fourth recorder was placed in Reach 5 and the highest temperature recorded was 71°F in May and the lowest temperature was 54°F in May. The fifth recorder was also placed in Reach 5 just upstream of the confluence of Mark West Creek with Humbug Creek and the highest temperature recorded was 71°F in May and the lowest temperature was 55°F in May. The sixth recorder was placed in Reach 6 and the highest temperature recorded was 71°F in July and the lowest temperature was 54°F in May. The seventh recorder was also placed in Reach 6 and the highest temperature recorded was 69°F in August and the lowest temperature was 54°F in May.

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In the 1965 survey, steelhead averaged 175/100 feet of stream. California Roach averaged 237/100 feet of stream and Three-spined Stickleback averaged 100/100 feet.

In the 1969 survey, young of the year, 1+, and 2+ steelhead were observed averaging approximately 60 per 100' of stream and they were observed from the headwaters to the Mark West Slough. Other fish species observed included: Sculpin, California Roach, Green Sunfish, Carp, Sacramento Suckers, and Gambusia.

In the 1970 survey, Coho Salmon, Steelhead, Sculpin, California Roach, and Topminnows were all noted. Salmonids were estimated at 60 per 100' of stream.

Biological surveys were not conducted in Mark West Creek in 1996 or 1997 due to inadequate staffing levels. Biological Sampling is proposed to be conducted in 1998.

A summary of historical data collected appears in the table below.

Table 1. Species Observed in Historical Surveys

Table 1. Species Observed in Historical Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
1965,1969,1970	Steelhead	DFG	N
1970	Coho	DFG	N
1969,1970	Sculpin	DFG	N
1965,1969,1970	Roach	DFG	N
1969	Sacramento Sucker	DFG	N
1969	Three-spine Stickleback	DFG	N
1969	Green Sunfish	DFG	I
1969	Carp	DFG	I

Historical records reflect that steelhead were transferred into Mark West Creek in 1915, 1982, and 1983.

Table 2. Summary of fish hatchery - transfers/rescues into Mark West Creek

YEAR	LOCATION	SOURCE	SPECIES	#	SIZE
1915	Mark West Creek	Dry Creek	SH	???	???
1982	Mark West Creek	Dry Creek	SH	10,240	FING
1983	Mark West Creek	Dry Creek	SH	8,960	FING

SH = steelhead

DISCUSSION

Mark West Creek has 6 channel types: F4, F2, B2, B3, C3 and B1-2. There are 28,229 feet of F4 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

There are 5,510 feet of F2 channel type in Reach 2. F2 channel

types are fair for low-stage weirs, single and opposing wing-deflectors and log cover.

There are 6,870 feet of B2 channel type in Reach 3. B2 channel types are excellent for low and medium-stage plunge weirs, single and opposing wing deflectors and bank cover.

There are 13,412 feet of B3 channel type in Reach 4. B3 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. They are also good for medium-stage plunge weirs.

There are 10,856 feet of C3 channel type in Reach 5. C3 channel types are excellent for bank-placed boulders and good for low-stage weirs, boulder clusters, single and opposing wing deflectors and log cover. They are fair for medium-stage weirs.

There are 16,934 feet of B1-2 channel type in Reach 6. B1 channel types are excellent for bank-placed boulders and bank cover and good for log cover.

The water temperatures recorded on the survey days August 8 - October 23, 1996 ranged from 46-73°F. Air temperatures ranged from 48-97°F. The warmest water temperatures were recorded in Reaches 1-3. These temperatures, if sustained, are above the threshold stress level (65°F) for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Pools comprised 40% of the total length of this survey. In third and fourth order streams a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Mark West Creek, the pools are relatively shallow with 34% having a maximum depth of at least 3 feet. These pools comprised 19% of the total length of stream habitat. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 42. However, a pool shelter rating of approximately 80 is desirable. The pool shelter that now exists is being provided primarily by root masses, terr. vegetation, boulders, and undercut banks. More log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Seventeen of the 19 low gradient riffles measured (89%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Seventy-nine percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 1% had a rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Mark West Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the survey was 68%. This is a slightly low percentage of canopy, since 80 percent is generally considered desirable. In general, canopy levels increased in an upstream direction. Elevated water temperatures could be reduced by increasing stream canopy. Cooler water temperatures are desirable in Mark West Creek. The large trees required for adequate stream canopy would also eventually provide a long term source of large woody debris needed for instream structure and bank stability.

GENERAL RECOMMENDATIONS

Mark West Creek should be managed as an anadromous, natural production stream.

Recent storms brought down many large trees and other woody debris into the stream, which increased the number and quality of pools since the drought years. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Many signs of recent and historic tree and log removal were evident in the active channel during our survey. Efforts to increase flood protection or improve fish access in the short run, have led to long term problems in the system. Landowners should be encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

SPECIFIC FISHERY ENHANCEMENT RECOMMENDATIONS

1) Increase the canopy on Mark West Creek by planting willow, alder, redwood, and douglas fir along the stream where shade canopy is not at acceptable levels. The non-anadromous reach above the survey section should be assesses for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

2) Map sources of upslope and in-channel erosion, and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine-sediments entering the stream. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban run-off. Biotechnical erosion control approaches could be utilized in reach 5 to decrease stream width and improve sediment transport.

3) Mark West creek is being impacted from livestock in the riparian zone in several areas. Livestock in streams generally inhibit the growth of new trees, exasperate erosion, and reduce summertime survival of juvenile fish by defecating in the water. Alternatives to limit cattle access, control erosion and increase canopy, should be explored with the landowner(s), and developed if possible.

4) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations. This must be in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

5) Where feasible, design and engineer pool enhancement structures to increase the number and

quality of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. Many glide and run habitats could be converted to pools with the addition of large woody debris.

6) Landslide mapping should be conducted throughout the watershed.

7) Continue to monitor stream temperatures.

PROBLEM SITES AND LANDMARKS - MARK WEST CREEK SURVEY COMMENTS

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

HABITAT UNIT #	STREAM LEN (FT.)	COMMENTS
1.00	267	BEGIN @ BRIDGE #1 DOWNSTREAM OF SLUSSER RD. (LAMPREY)
9.00	767	TRIB DRY L/B
10.00	939	UPSTREAM OF TRIB ON L/B
19.00	1828	BRIDGE #2 CEMENT W/6'DIA CEMENT COLUMN IN CREEK CHANNEL
20.00	1871	NEXT UNIT UPSTREAM OF SLUSSER RD. BRIDGE
27.00	2606	EROSION L/B
30.00	2792	100' BELOW HOUSE
40.00	3718	1000' UPSTREAM OF HOUSE
49.00	4570	60 % OF CONIFEROUS TREES ARE BAY
51.00	4779	MANY FISH SPECIES 2 1+ SH TULE PERCH;SUCKERS;ROACH;BLUEGILL.
56.00	5121	TULE PERCH
61.00	5755	AROUND R/B
63.00	5818	TULE PERCH, ROACH, SH JUV
72.00	6331	PUMP ON R/B INTO CREEK
90.00	8115	5.2' SUMP POOL L/B @ 281'
114.00	9814	END @ MCMULLEN PROP. BOUNDARY
115.00	9827	BEGIN @ #3 BRIDGE LAUGHLIN RD. (UPSTREAM)
116.00	9898	ARRUNDO PRESENT ON R/B
120.00	10110	LG TULE PERCH (4")
123.00	10415	LAMPREY (2) 5-6" SM. GRAVEL/SAND DOM.
124.00	10493	GRAVEL/SAND/COBBLE DOM 2" HIGH
138.00	11414	2+SH
141.00	11573	TULE PERCH
179.00	13692	L/B DIVERSION PIPE/PUMP

180.00 13777 GREAT COVER COHO?
199.00 15517 3 - 1 OR 2 + (9"X) SH (VERY LIGHT COLORED YELLOW)
200.00 15570 MASSIVE EROSION R/B UNDERCUTTING BAY TREES. GRAYWATERY BANK
203.00 15957 MASSIVE EROSION BETWEEN UNIT # 200-203
204.00 16070 RIPRAP L/B
209.00 16452 END X 75' DOWNSTREAM OF RRX BRIDGE #4
210.00 16524 BRIDGE (RR)
214.00 16772 HOBO CAMP
216.00 17023 TULE PERCH
218.00 17133 SH JUVS.
227.00 17637 MOBILE HOME PARK R/B
231.00 18128 LAMPREY AMMOCETE 1+SH
240.00 19232 TULE PERCH 4-5" BLUEGILL/SUNFISH (DOWNSTREAM SIDE OF 101 HWY BRIDGE)
241.00 19298 BEGIN AGAIN HERE AT DOWNSTREAM BOUNDARY OF MURASKO PROPERTY
246.00 19571 END UPSTREAM OF BRIDGE #6 (FULTON ST) 36" DIA METAL CULVERT R/B
252.00 20008 SM. TULE PERCH
253.00 20048 ARRUNDO STAND RT BANK
272.00 21666 LAMPREY AMNOCETE
281.00 22541 TULE PERCH 3-4"
285.00 23045 BRIDGE #7 (OLD REDWOOD HWY) END OF ACCESS HERE
286.00 23155 BEGIN AGAIN AT LANGLAEN PROP. (GOLF COURSE RT BANK)
289.00 23430 BLUEGILL PRESENT, SH 0+, VERY LARGE POOL
291.00 23977 LAMPREY AMNOCETE
295.00 24315 SH
305.00 25029 2+ SH; LARGE SUCKERS; BLUEGILL
310.00 25522 EROSION RT BANK DOWN TO GRAY WACKY BEDROCK
313.00 25759 5' DIA. CEMENT CULVERT LF BANK
314.00 25861 END PROPERTY ACCESS
315.00 25909 BEGIN AGAIN AT 7TH DAY SCHOOL DOWNSTREAM PROP. BOUNDARY

316.00 26031 MAJOR LF BANK EROSION DOWN TO GRAY WACKY BEDROCK
317.00 26045 0+ SH
319.00 26230 EROSION LF BANK
322.00 26499 SMALL/LARGE COBBLE SUMMER DAM ACROSS CREEK; BLUEGILL & 2+ SH
324.00 26725 END DOWNSTREAM OF 7TH DAY SCHOOL PROP. BOUNDARY
325.00 26935 6 ADULT POND TURTLES AT BRIDGE ON LOG
332.00 27404 SUCKERS/ROACH
351.60 28246 CHANNEL CHANGE BEGIN (BOULDER/BEDROCK)
385.00 30860 CHANNEL SPLIT HERE (SIDE CHANNEL?) UPSTREAM FOR 725 FT. DOES NOT CONNECT WITH MAIN CHANNEL.
399.00 31874 EROSION LFT. BANK
400.00 32076 1+ SH/BLUEGILL/ROACH/SUCKER
401.00 32282 EROSION RT. BANK
407.00 32801 SH/SM. M. BASS/ROACH
408.00 32870 BLUEGILL; BRIDGE #8- UNDERCUTTING CEMENT FOUND. LFT. BANK
416.00 33800 CHANNEL CHANGE
426.00 34482 EROSION RT. & LFT. BANKS
430.00 34893 1+ SH.S
434.00 35292 SEVERAL 1+ SH; 1 JUV. SH YOY; SUCKERS; H20 64 DEGREES.
438.00 35405 SEVERAL 1+ SH; 1 JUV. YOY SH; SUCKERS.
443.00 35905 1+ SH.S PRESENT
450.00 36407 1+ SH PRESENT.
474.00 38873 ENDED @ UPSTREAM EDGE OF WOODEN DECK, MARKWEST MEADOWS PROPERTY.
479.00 39215 1+ SH.
482.00 39559 SM. SUCKERS; 1+ SH; BLUEGILL
484.00 39787 1+ SH
494.00 40370 1+ SH
498.00 40801 CHANNEL CHANGE
508.00 41540 GRAVEL BAR IN CENTER OF UNIT
514.00 42103 ENDED DOWNSTREAM OF BRIDGE
539.00 43551 1+ SH

545.00 43996 1+ SH; SUCKERS
552.00 44740 SEVERE EROSION RT. BANK; YELLOW-LEGGED FROG.
555.00 45131 BRIDGE # 200 FT. (UPSTREAM) UNIT; CEMENT BRIDGE.
559.00 45769 FILM ON WATER SURFACE.
560.00 46158 FILM ON WATER SURFACE.
568.00 47206 FILM ON WATER SURFACE; ROACH? WITH FUNGI/ALGAE (GREEN) ATTACHED TO THEM.
569.00 47240 ORANGE ALGAE PRESENT.
574.00 47919 VERY SPARSE RIPARIAN RT. & LFT. BANKS. 100 PERCENT DECIDUOUS.
577.00 48079 FILM ON WATER SURFACE.
578.00 48260 EVIDENCE OF DOZER IN CREEK CHANNEL ON PREVIOUS WILLOW BAR.
585.00 48859 FILM ON WATER SURFACE.
608.00 50639 TRIB. LFT. BANK (DRY) END OF UNIT
630.00 52438 2 JUV. SH
631.00 52495 SH JUV'S
632.00 52597 DIRT XNG THROUGH CREEK
633.00 52683 (PHOTO #1-3) IRON/WOOD BRIDGE IN CREEK RT. BANK, 75 FT. DOWNSTREAM FROM OLD XNG.
634.00 52733 BRIDGE XNG (NO BRIDGE).
655.00 54194 CHANNEL CHANGE
660.00 54591 1+ SH
661.00 54613 RT. BANK EROSION
683.00 56638 SH
685.00 56822 DIRT ROAD XNG IN CREEK
688.00 57080 BRIDGE #
696.00 57677 1 SM MOUTH BASS
711.00 58739 JUV SH (5)
712.00 58753 BRIDGE (CEMENT/WOOD)
724.00 59385 CONFLUENCE OF HUMBUG CREEK LFT. BANK
740.00 60600 SM BASS?
744.00 60972 2 1+ SH
750.00 61473 CEMENT CULVERT RT. BANK- 3 FT. H X 6 FT. W
751.00 61535 BRIDGE # (END HERE)

761.00 62453 50 FT. BELOW WEEKS CREEK CONFLUENCE.
776.00 63347 UNNAMED TRIB. CONFLUENCE
800.00 65041 @ Rd. CROSSING TO HOUSE
801.00 65097 START @ PRICKETT PROPERTY 5705 MWS RD. *CHANNEL CHANGE?
805.00 65275 VAN BUREN CK. CONFLUENCE
834.00 66408 WATERFALL CASCADES
835.00 66516 BRIDGE CROSSING
839.00 66834 START CHANNEL CHANGE DATA FOR ALL UNITS 100%
856.00 67825 GREENHOUSES ON LEFT BANK
879.00 69722 LWD JAM; POOL; COHO CONDO
906.00 71292 TRIB. CONFLUENCE RD. ON RD/S
915.00 72042 CABIN ELLIS
922.00 72572 RD. ON L/B
938.00 73516 BRIDGE CROSSING
962.00 75060 TRIB CONFL. ON LEFT
971.00 75754 TRIB CONFL ON F/B
972.00 75784 @ BRIDGE CROSSING, TARWATER RD.
978.00 76000 TRIB. CONFL. ON RIGHT
1020.00 78112 AWESOME POOL , LARGE DIGGER
1041.00 79116 HOUSE ON R/B
1042.00 79140 AT TRIB. R/B
1051.00 79590 steven's slide on right. 7905 7915 on opp. side of rd. above slide
1055.00 80079 OLD RD. ON RT. BANK
1058.00 80254 HOUSE ON RT. (LEVINE)
1065.00 80674 TRIB ON RT. @ 2ND CURVE
1069.00 80923 HOUSE ON R/B
1071.00 81223 BEGINNING OF GATES PROP.
1079.00 81870 WATERFALL

LEVEL III and LEVEL IV HABITAT TYPE KEY:

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1

Backwater Pool - Boulder Formed [BPB] 6.2
Backwater Pool - Root Wad Formed [BPR] 6.3
Backwater Pool - Log Formed [BPL] 6.4
Dammed Pool [DPL] 6.5