

**STREAMS OF WESTERN PLACER COUNTY
AQUATIC HABITAT AND BIOLOGICAL RESOURCES
RESOURCE ASSESSMENT**

Prepared for:

PLACER COUNTY PLANNING DEPARTMENT

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INTRODUCTION

The purpose of this report is to provide an assessment of the pertinent aquatic habitat and biological resources data and literature associated with 10 streams in Western Placer County. A separate document entitled “*Streams Of Western Placer County:*

Aquatic Habitat And Biological Resources Literature Review” (Literature Review) has been prepared for the Sierra Business Council serves as the foundational data and analysis source for the overall assessments of conditions and data quality and needs presented in this report. Specific objectives of this assessment are:

- (a) Assess the quality and quantity of data available for several important parameters affecting salmonid use of Antelope Creek, including water temperature, habitat quality; water quality, and other factors;
- (b) Provide an initial overall assessment of the general condition of the stream to support anadromous salmonids;
- (c) Evaluate adequacy of the data to support specific decisions regarding the stream’s potential to support anadromous fish; and
- (d) Identify factors that should be considered in the Habitat Conservation Planning process for Antelope Creek.

The literature review and this assessment focused on the following general areas that are important to understanding the current conditions of the streams and assessing their potential as anadromous fish streams:

- Water Quality
- Water Temperature
- Benthic Macroinvertebrates
- Physical Habitat
- Fishery Resource
- Fish Passage or Screening

METHODS

The data and information used to prepare the data summaries and overall assessment of stream conditions are from a variety of sources, particularly, California Department of Fish and Game files, data and sampling efforts conducted by the various watershed groups, and environmental documents prepared by the various jurisdictions that include information about these watersheds. All environmental documents from Lincoln, Rocklin, Roseville, and Placer County that could contain useful information about any of the watersheds being evaluated were reviewed for pertinent data or information. Limitations on the time available to conduct the literature review precluded an exhaustive search of all possible data sources.

Where the amount of data from a particular source was small, I incorporated all of the relevant information completely in this report. In cases where the volume of data was large, I summarized the data into what I considered meaningful units. This is particularly true for the

water temperature data. Where data is presented, the source has been documented within the presentation. In addition to the data and information presented, I also reviewed the VHS tape from Placer County's stream videography project to provide additional visual assessment of the watersheds for the areas flown.

Although the data were to be submitted in an Excel spreadsheet format to the Sierra Business Council and County of Placer, my review has found very little information that is in electronic format. Also, much of the data consists of fragments of information from a single location, scattered in various files. Where possible, I have included electronic copies of the data to the County under separate cover. This is particularly true of the water temperature data from the continuous monitoring sites (this data has already been transmitted to the County). Some other data sources may be electronic format, but may not be transmitted to the County because of the limited nature and overall usefulness, unless the County decides otherwise (e.g., water quality and benthic macroinvertebrate data).

ANTELOPE CREEK/CLOVER VALLEY CREEK

DATA SUMMARY AND ASSESSMENT

A. Water Quality Data

Summary: The water quality data available is excellent in quality, but is spatially and temporally limited. The limited pH data raises more questions than it answers. Also, the data on copper concentrations indicates a chronic source of copper is available to the water column during certain times of the year. Hardness and alkalinity concentrations are relatively low for a low elevation stream.

Assessment: The situation with respect to high pH values is not clear. In the other streams surveyed, pH values appear to increase in the fall/winter period to high levels. Review of the Antelope Creek water quality data in the Literature Review demonstrates the unusual fluctuation in pH values recorded in this watershed, with a minimum pH of about 6.5 and a maximum of about 8.6. This wide fluctuation is unexplained at this time and the impacts on aquatic system productivity and organisms are unknown. No obvious causal relationship is readily apparent. This situation merits further investigation and evaluation.

The high levels of nitrates and orthophosphates in the stream may result in biostimulation of plant growth in the stream and subsequent dissolved oxygen declines during certain times of the year. The source of these nutrients needs to be identified and their impact should be evaluated.

The Regional Water Quality Control Board and Dry Creek Conservancy data raise a question about the effect of copper concentrations on aquatic life. I suspect that the aquatic life has adapted to local sources, since no external source is readily apparent in the watershed. However, additional spatial and temporal sampling may be warranted to further define the situation. The appearance of barium in the sampling data is surprising and needs further explanation and/or evaluation.

With the exceptions noted above, the water quality of Antelope Creek is capable of supporting anadromous fish on a year around basis in at least most of the watershed. The nutrient balance in the stream should be evaluated and steps should be taken to insure that nutrient levels are stabilized or decreased in the future and that the ratio of nitrates to phosphates is maintained at 10:1, with nitrates not exceeding 1.0 mg/l. In general, this stream shows an increase in nutrients and hardness as it flows down from the foothills. This is a natural occurrence, but this stream has some constituents that are enhanced, most likely because of runoff from suburban and urban development.

B. Water Temperature Data

Summary: Water temperature data from Antelope Creek shows that approximately 25-50% of the channel length is suitable for summer rearing for steelhead, if steelhead occur in the

watershed at all. Water temperatures are suitable for fall-run chinook salmon spawning and rearing as evidenced by their persistence in the stream. Some sites show temperatures in excess of salmonid egg incubation and juvenile rearing tolerances.

Assessment: Although water temperature data are limited to a few samples, the data do show that fall and winter temperatures are sufficient to support adult spawning and rearing of juvenile fall-run chinook salmon. However, there is insufficient data to determine if longer-term conditions for summer rearing of juvenile steelhead are possible. It is possible that if adult steelhead, assuming that they are present, were allowed to migrate further upstream in the watershed, then summer rearing conditions might be suitable. However, the large wetlands complex immediately upstream of the railroad bridge in Loomis and its associated dam may be a barrier to migration and exert an adverse influence on downstream water temperatures during the summer. These probable effects of the wetlands complex may limit the potential for steelhead migration to upstream locations.

C. Benthic Macroinvertebrate Data

Summary: Benthic macroinvertebrate data is relatively comprehensive for this watershed.

Assessment: The benthic macroinvertebrate community in Antelope Creek is dominated by organisms that are moderately to highly tolerant of water quality impairment. This may be a result of a combination of flow fluctuations, water quality, and the amount of sediment in the stream channel. These factors may contribute to the general lack of diversity and tendency towards benthic macroinvertebrate species that are pollution tolerant.

D. Physical Habitat Data

Summary: Detailed physical habitat data is very limited for this watershed. The data that are available are limited in scope and detail. Other than some casual observations by foot surveyors and limited assessment by Dave Vanicek, there is no systematic physical habitat data available for this entire watershed.

Assessment: Based on my walking survey of portions of Antelope Creek and Clover Valley Creek, and on review of the videotape of Antelope Creek, the stream channel has the potential to have relatively good physical habitat parameters, given some restoration. High sediment loads and a lack of pools appear to be the major problems. The riparian vegetation appears to be stable or improving. Creating pool habitats, reducing sediment input to the channel, cleaning stream gravels to promote increased aquatic insect production, and ensuring that riparian vegetation is allowed to reproduce would improve conditions. Improving sediment transport through the system would be an overall benefit to aquatic organisms in general. If fish passage beyond the dam/wetlands complex in Rocklin is feasible, then a physical habitat survey upstream of this location in Antelope Creek may be warranted.

E. Fishery Resource Data

Summary: Data on fish species composition is available from intermittent one-time sampling events over the period 1962 to 2003 and several foot surveys for spawning fall-run chinook salmon. Most of the surveys have focused on salmonids.

Assessment: There is insufficient data to support conclusions about the status of fish populations in Antelope Creek, except that fall-run chinook salmon do use parts of the watershed for spawning and this activity has been documented over the last 40 years. There are no reliable data to determine whether steelhead actually are in the watershed. Given Rob Titus' findings that steelhead are in the headwaters of Secret Ravine and Miners Ravine, further sampling in Clover Valley Creek and throughout the length of Antelope Creek is warranted, particularly upstream of the dam/wetlands complex in Rocklin.

F. Fish Passage or Screening Data

Summary: Insufficient water depth and beaver dams present during the adult migration period are major problems in this stream. A waterfall and dam/wetlands complex in Rocklin could also be a barrier to migration.

Assessment: There are no data available to assess potential migration barriers. We know that beaver dams, which are present in the lower section of Antelope Creek, can be a barrier to salmon migration. Several of the sources reviewed for this report also indicate the presence of diversion dams, culverts, waterfalls, and dams. All or none of these features may be barriers or impediments to anadromous fish migration, depending on the water depth and flow conditions. An assessment of potential fish passage problems is warranted. The greatest concern may be the asphalt-bottomed culverts underneath Sunset Blvd. in Rocklin.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors which could influence the Antelope Creek watershed's potential to support anadromous fish on a continual basis, several factors deserve additional definition and consideration:

1. Genetic data on the origin of chinook salmon and/or possibly steelhead trout using this watershed are needed to determine if the chinook and steelhead (?) populations using the watershed are qualified as listed or candidate species under the provisions of the Endangered Species Act. Determining the genetic origins of the fish using the system is also a key to developing a conservation strategy.
2. Providing adult salmonid access to upstream spawning areas on a consistent year-to year basis is also a key to establishing and maintaining juvenile production at its potential. Unless steelhead and chinook salmon have consistent access to spawning areas, the benefits of investments in stream bank restoration, sediment control, riparian restoration,

and other restoration actions may be only marginal. The critical variable in establishing and maintaining adult salmonid passage is providing sufficient water depth during the right time of year to allow passage to upstream areas. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations, or implementing a program to insure adult fish passage over existing dams during the spawning migration periods for chinook and steelhead (approximately November through February). Addressing the potential problems of small dams, culverts, and a waterfall should also be a priority.

3. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
4. The physical habitat conditions in the channel are a limiting factor for juvenile fish production, particularly the amount of sediment in the channel. A major reduction in the quantity of sediment entering the channel is critical to improving hatching and emergence success and long-term juvenile rearing capability. Fish are currently successfully spawning and some emergence and rearing of juveniles has been documented. However, the potential of this stream to produce anadromous salmonids is certainly greater than the actual production under current conditions.
5. Water quality conditions, particularly the levels of nutrients in the water, are a concern. Eutrophication in the stream channel is a potential problem. Maintaining a balance between nitrates and orthophosphates is important to limiting the potential for eutrophication and a resulting decline in dissolved oxygen during the summer rearing period for juvenile steelhead. Also of concern is the level of copper documented to occur in the watershed. A more extensive assessment of this situation and the impacts of copper on salmonids may be warranted. In addition, the wide swings in pH levels should be investigated. Water temperatures may also be a problem, with temperatures exceeding egg incubation and juvenile rearing tolerances for a substantial portion of the year at one site. Water temperatures for the creek need to be documented systematically over a longer period of time before their potential for limiting salmon and steelhead production can be assessed.
6. Each watershed should be extensively evaluated to determine if additional channel segments could be opened to anadromous fish access. In addition, opportunities to improve the quality of existing habitat should be assessed. Both of these evaluations should be “top down” in the watershed since suitable water temperature conditions and sediment source control potential are greatest in the upper reaches of the drainage.
7. In watersheds where there is potential for adult steelhead spawning and juvenile rearing, the annual water temperature regime should be documented. In addition, if there are juvenile steelhead present, then watershed specific temperature tolerance studies should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles

rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.

8. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.
9. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However, that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the potential to attract runs of chinook salmon (e.g., winter-run and spring-run), which are not native to these watersheds must be evaluated.

AUBURN RAVINE

DATA SUMMARY and ASSESSMENT

A. Water Quality Data

Summary: Data describing the water quality of Auburn Ravine is fairly extensive, primarily because of two wastewater treatment facilities discharging to the stream and the resulting requirements for water quality sampling in order to obtain an NPDES permit. The California Department of Water Resources conducted a monthly sampling program in the lower portion of the watershed during 2001, with an emphasis on pesticides and heavy metals. These data provide some insight into potential problems:

- First, the level of nitrates measured indicates what appears to be a major nutrient enrichment problem in the middle to lower watershed. These measurements do not include any new discharge from the new City of Lincoln Wastewater Treatment and Reclamation Facility.
- Second, the readings for dissolved oxygen, from the Lincoln High School samples, appear to be unrealistically high with some values exceeding 150% of saturation.
- Third, some of the recorded pH values are extremely low for the types of streams found in the Sierra Nevada Foothills.
- Finally, the levels of copper recorded by DWR in their sampling (See Appendix Auburn Ravine 1 in the Literature Review) show levels that exceed the California Toxics Rule standards for the hardness of water in the stream during certain months of the year.

Assessment: The situation with respect to low pH values is unexplained. In the other streams, pH values appear to increase in the fall/winter period to high levels. Auburn Ravine demonstrates a wide range of pH values (5.7 to 7.7) in the recorded data, but the rate of change and total magnitude of change on aquatic species is undocumented. This situation merits further investigation and evaluation.

The anomalous dissolved oxygen readings cannot be fully explained at this time (Bailey Environmental did discuss this situation with Lee Beckman, Lincoln High School, and we determined that sample handling and delay in processing the samples could be contributing to the problem). Given the unrealistic readings, we may conclude that they are the result of sampling error and that dissolved oxygen during the fall-spring period is not an issue; that is, the dissolved oxygen levels are probably near saturation. This conclusion would be consistent with the remainder of the data, which indicates that low dissolved oxygen levels are not a major problem in this stream.

The high levels of nitrates in the stream are a potential problem because of the potential for biostimulation of plant growth in the stream and subsequent declines in dissolved oxygen during certain times of the year. In the upper watershed, the potential for problems is lower, even though there is a nutrient loaded treatment plant discharge, because of the higher gradient and

rapid transport of water to the valley floor, which reduces exposure time to sunlight and heat. The impacts from a new discharge from the new Lincoln facility will probably be minimal because the discharge location is downstream of anadromous fish rearing habitat. Nevertheless, the apparent high levels of nitrates in Auburn Ravine need further evaluation.

The Department of Water Resources data raises a question about the effect of heavy metals concentrations on aquatic life in the watershed. Aquatic life has probably adapted to local sources of heavy metals, since no external source is readily apparent in the watershed. However, additional spatial and temporal sampling may be warranted to further define the situation.

With the exceptions noted above, the water quality of Auburn Ravine is suitable for anadromous fish on a year around basis in at least most of the watershed. The nutrient balance in the stream should be evaluated and steps should be taken to insure that nutrient levels are stabilized or decreased in the future or that the ratio of nitrates to phosphates are maintained at 10:1 with nitrates not exceeding 1.0 mg/l. In general, this stream shows an increase in nutrients and hardness as it flows down from the foothills and on to the valley floor. This is a natural occurrence, but this stream has some constituents that are enhanced because of treatment plant discharges.

B. Water Temperature Data

Summary: Water temperature data on Auburn Ravine is extensive between Fowler Road downstream to Aitken Ranch, with approximately 4 years of hourly readings at 5 stations (minus data lost to vandalism or equipment failure). Two new monitoring stations (Otto property and Davis Ranch Bridge) were established in June 2003 and are recording temperatures hourly.

Assessment: Data associated with the various fish sampling projects indicate that winter and spring temperatures are suitable for successful anadromous fish spawning and juvenile rearing. Data from the NID gaging station and Bitter's, which is just downstream of Moore Road, indicate that temperatures are generally suitable for anadromous fish spawning and rearing in these areas.

C. Benthic Macroinvertebrate Data

Summary: Benthic macroinvertebrate data is relatively comprehensive for this stream in the Lincoln area and locales upstream. Downstream data is lacking, but would add little to our understanding of the aquatic system because the species composition of sand bottomed streams is generally well known, as is the stream's overall productivity in the lower reaches.

Assessment: Data from the citizen monitoring program suffers from two fundamental problems. First, samples are collected with equipment that does not readily collect all taxon present in the stream. Second, during the initial sorting, generally less than 100 individuals are selected for taxonomic identification. This limited sample size raises concerns regarding the representativeness of the data. Data from the two NPDES permitting programs (cities of Auburn and Lincoln) have provided much more detailed information regarding the benthic community. However, while the data from the Auburn area indicate that organisms that are moderate-to-

highly tolerant of water quality impairment are dominant in the system, the high nutrient input to this section of the stream does result in high productivity of some desirable fish species. A reasonable hypothesis is that a combination of flow fluctuations, water quality, and the amount of sediment in the stream channel contributes to the general lack of diversity and tendency towards benthic macroinvertebrate species that are pollution tolerant.

D. Physical Habitat Data

Summary: Detailed physical habitat data is available for the area around Lozanos Road Bridge upstream to Interstate 80. Less systematic habitat information is available for the area from Moore Road to Highway 65. The County videography project provides close up aerial views of the entire stream channel.

Assessment: Auburn Ravine's physical habitat can be divided into two major segments. Beginning about Joiner Parkway Bridge in Lincoln, the stream begins to increase in gradient and the channel becomes a traditional pool and riffle stream. The channel contains fair quantities of sediment and sediment transport and sediment inputs to the channel are probably limiting hatching and emergence success and overall aquatic habitat quality. Upstream of about Goldhill Road, the amount of sediment in the channel decreases and the overall quality of habitat increases. In the area upstream of NID's Auburn Ravine #1 diversion dam, the quality of habitat for anadromous salmonids is excellent, except that there are probably impacts associated with low fall flows. Downstream of Joiner Parkway, the channel is nearly all sand bottomed with little productivity or habitat complexity. The general quality of riparian vegetation diminishes downstream from the City of Lincoln. Downstream from the Placer/Sutter county line, the contribution of the riparian community to the quality of aquatic habitats is generally low. This downstream area should be considered a migration corridor for anadromous fish and not suitable spawning or rearing areas.

Thus, although water quality may be quite suitable for salmonid rearing in some locations, the quality of the physical habitat may be limiting in some areas. For example, the physical habitat in the Moore Road crossing area is not really suitable for anadromous fish rearing although water quality is adequate. Suitable anadromous fish rearing habitat therefore probably terminates in the area between Joiner Parkway Bridge and Nelson Lane. The stream bottom at Nelson Lane is mostly sand-bottomed, with some gravel showing not too far upstream, but is heavily silted and thus low in benthic macroinvertebrate production suitable as food items for juvenile salmonids.

E. Fishery Resource Data

Summary: Data on fish species composition is available from a numerous locations over a long period of time. The data are sufficient to determine the probable fish species composition. With the exception of the Auburn area, data are insufficient to generate biomass estimates of desirable fish species. There are sufficient sources of information to raise the issue of the presence of half-pounder steelhead in this and possibly adjacent streams.

Assessment: There is sufficient data to describe the geographical distribution of fish species in the watershed. The only data suitable for biomass estimates is from the Auburn area. If

estimates of biomass were needed for areas other than Auburn, additional data would be needed. Despite the lack of biomass data for most of the stream, it is obvious that anadromous fish juveniles would occupy all suitable habitats if sufficient adults were allowed into the watershed to spawn. Given the right flow conditions, adults have been documented to ascend the watershed up as far as Auburn. The most glaring lack of data is information on the genetics of the anadromous fish stocks spawning in Auburn Ravine. Although there have been numerous episodes of stocking in the stream, stocking has probably had little influence on the current genetic makeup of anadromous fish stocks, because the major factors controlling the origin of anadromous fish stocks are probably (a) the source of water in Auburn Ravine and (b) recolonization from sources north of Verona. It is also critical to note that the current practice of delivering water from the Yuba, Bear, and/or American rivers during the summer months is the basis for a conclusion that this watershed could support anadromous fish over a long length of stream. At the same time, importing American River water into the watershed during the period October 15th through May 15th only increases the likelihood of causing straying and false attraction for anadromous salmonids from south of Verona. In addition, there are sufficient data to indicate that half-pounder steelhead are a part of this watershed's history and continue to occur sporadically. Maintaining a suitable migratory corridor for half-pounders, given the timing of migration, raises some additional issues. These issues are resolvable.

F. Fish Passage or Screening Data

Summary: Adult fish passage and screening concerns for juveniles emigrating past several man-made structures are considerable. Insufficient water depth and beaver dams pose major problems for the adult migration period in this stream.

Assessment: Most of the flashboard dams in Auburn Ravine are operated during a time period when adult chinook salmon and steelhead are not attempting to ascend the stream to spawn. The diversion structures (even NID Auburn Ravine diversion dam #1) also do not pose a barrier to adult migration at higher flows. At low flows, there are many obstructions to migration including diversion dam configuration, inadequate water depth in the natural channel, in-place beaver dams, and lack of a thalweg in some locations. These issues can all be solved in a variety of ways. During moderate flows many of the diversion structures are not an issue, water depths are suitable for migration, and many of the beaver dams are either washed away or sufficient flow is going over the dam to allow passage. Migration delay may occur at moderate flows at the NID gaging station, Hemphill Diversion Dam, and Auburn Ravine #1 diversion dam. Fish passage, on an annual basis, is possible at all of these locations using existing technology. The key to long-term sustainability of anadromous fish in this watershed is providing consistent annual access to areas upstream of the City of Lincoln all the way to Auburn.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors which could influence Auburn Ravine's potential to support anadromous fish on a continual basis, several factors deserve additional definition and consideration:

1. Genetic data on the origin of chinook salmon and/or steelhead trout using this watershed are not available. Obtaining these data is critical to determining if the chinook salmon and steelhead populations using the watershed are even qualified as listed or candidate species under the provisions of the Endangered Species Act. Recent experience with interbasin water transfers in the Cross Canal watersheds have shown a demonstrated lack of understanding and concern regarding the genetic origins of the populations in the Cross Canal watersheds. Determining the genetic origins of the fish using the system is a key to developing a conservation strategy.
2. Providing adult access to upstream spawning areas on a consistent year-to-year basis is also a key to maintaining juvenile production at its potential. Without consistent access to spawning areas, investments in stream bank restoration, controlling sediment inputs to the channel, and other restoration activity will have marginal benefit. The challenge for adult passage is to provide sufficient water depth during the spawning migration. This is particularly important in areas downstream of Joiner Parkway in Lincoln. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations or implementing a program to ensure adult fish passage over existing dams during the spawning migration periods for chinook salmon and steelhead (approximately November through February). Until such time as adults are consistently allowed into the watershed to spawn, fish exclusion devices on water diversions are problematic at best and should be evaluated in conjunction with downstream water temperatures. Fish passage at the three NID facilities mentioned in the fishery resources assessment section of this report should be a high priority in any conservation strategy.

One approach that might be possible in Auburn Ravine (as well as Doty Ravine and Coon Creek) would be to pay farmers to fallow some land in order to provide sufficient water depth at critical time periods. Such a program could be implemented in cooperation with the cities, Placer County, a regional sewer authority, drinking water supply programs, and the Central Valley Project Improvement Act Anadromous Fish Restoration Program. Water could be purchased or traded to provide benefits to anadromous fish, but later diverted, at downstream locations, to agricultural or municipal and industrial use.

3. The physical habitat conditions in the channel are clearly limiting juvenile fish production, particularly the amount of sediment in the channel. A major reduction in the quantity of sediment entering the channel will be critical to improving hatching and emergence success and long-term juvenile rearing capability. Fish are currently successfully spawning and some emergence and rearing of juveniles has been documented. However, the potential of this stream to produce anadromous salmonids is certainly greater than is currently evident.
4. Water quality conditions are a concern because of the levels of nutrients in the water that could result in eutrophication in the stream channel. Unknown at this time is the impact of Lincoln's discharge on stream water quality and nutrient budget. Maintaining a balance between nitrates and orthophosphates is important to understanding the potential impacts of dissolved oxygen sag during the summer rearing period for juvenile steelhead. Also of

concern is the level of copper documented to occur in the watershed. A more extensive assessment of this situation may be warranted. In addition, the high variation in pH levels should be investigated.

5. The presence of half-pounder steelhead in the watershed presents an opportunity to foster a somewhat unique life history strategy in the Central Valley. Maintaining or fostering their presence in the watershed will create some additional issues that will need resolution. However, these issues are not complicated and have straightforward fixes. A conservation strategy that fosters this unique life history strategy is needed. Also, this strategy may need to be applied to adjacent watersheds if half-pounder steelhead have the potential to inhabit these areas.
6. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
7. Watershed specific temperature tolerance studies for juvenile steelhead and chinook salmon should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.
8. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.
9. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However, that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's

Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the potential to attract runs of chinook salmon (e.g. winter-run and spring-run), which are not native to these watersheds, must be evaluated.

BEAR RIVER

The only data currently available for the Bear River is limited water temperature information collected in the summer of 2003. Additional information from a study conducted by South Sutter Water District is currently under review by the District's legal counsel and should become available in late-December 2003. At that time, some assessment of this stream may be possible. The Department of Fish and Game has lost all files pertaining to the Bear River downstream of Camp Far West Reservoir.

COON CREEK

DATA SUMMARY and ASSESSMENT

A. Water Quality Data

Summary: Data describing the water quality of Coon Creek is limited, consisting of a one-time grab sample from the Teichert Property and two single samples from the Tahti and Fleming properties (Lincoln High School project). The California Department of Water Resources also conducted a monthly sampling program in the lower portion of the watershed during 2001, with an emphasis on pesticides and heavy metals. The available data provide some insight into potential problems. First, the level of nitrates measured indicates what appears to be a major nutrient enrichment problem in the upper to middle watershed. Second, the readings for dissolved oxygen, from the Lincoln High School samples, appear to be unrealistically high with some values exceeding 150% of saturation. Third, some of the recorded pH values are extremely high for the types of streams found in the Foothills. Finally, the levels of copper recorded by DWR in their sampling show levels that exceed the California Toxics Rule standards for the hardness of water in the stream during certain months of the year, while the sampling for the Teichert Aggregate Facility used detection limits which do not permit an adequate evaluation of their findings in relation to aquatic life water quality standards.

Assessment: Because the nitrate data is mostly from the fall/winter period, with the exception of the DWR data at the extreme western edge of the watershed, it is not possible to assess the effects of this level of nutrients on aquatic plant production and possible declines dissolved oxygen levels during the summer months. However, field observations by Bailey Environmental over the past several years indicate (a) that excessive plant growth is occurring and (b) that the primary source of nitrates is probably the County's Wastewater Treatment Plant (SMD #1) located off Joeger Road in North Auburn. In order to prevent excess plant growth, a general rule of thumb is to limit the ratio of nitrate to orthophosphate at least 10:1 with nitrate concentrations not exceeding 1.0 mg/l. Orthophosphate measurements are not being taken by current sampling programs. Generally, orthophosphate is not limiting in streams. Also, Placer County recently approved the Teichert Aggregate Project, which will deliver water to Doty Ravine and eventually to Coon Creek from a dewatering program needed for a gravel strip mining operation. Review of the groundwater monitoring data included in the project EIR shows high (25-50 mg/l) levels of nitrate in the existing groundwater. The impacts of this additional discharge (and any additional discharges should the active pit flood) should be addressed independently. Given the potential for additional biostimulation and resulting declines in dissolved oxygen, the nutrient balance of this stream should be carefully evaluated in the upper watershed and downstream from the confluence with Doty Ravine.

The anomalous dissolved oxygen readings cannot be fully explained at this time (Bailey Environmental did discuss this situation with Lee Beckman, Lincoln High School, and we determined that sample handling and delay in processing the samples could be contributing to the

problem). Given the unreliable readings, it may be appropriate to conclude that dissolved oxygen during the fall-spring period is not an issue and readings are probably near saturation.

The high levels of pH recorded in the data (exceeding 8 units) are rare in mountain streams, particularly those with a granitic geology. However, this same swing of pH readings is present in the data from a number of nearby streams. These readings are taken by a variety of methods by individuals with adequate levels of technical expertise in measuring water quality parameters. The rate of change in some streams (e.g., Dry Creek in the upper Coon Creek drainage) is extreme. In this example, stream pH values changed from 6.4 to 8.5 in two days in January 2001. This is the most extreme fluctuation in pH identified in this study, and there appears to be an unexplained pattern of high fall and early winter pH values. This situation needs further evaluation.

The Department of Water Resources data raises a question about the effect of heavy metals concentrations on aquatic life in the watershed. I suspect that the aquatic life has adapted to local sources, since no external source is readily apparent in the watershed. However, additional spatial and temporal sampling may be warranted to further define the situation.

With the exceptions noted above, the water quality of Coon Creek appears to be capable of supporting anadromous fish on a year around basis. The nutrient balance in the stream should be evaluated and steps should be taken to insure that nutrient levels are stabilized or decreased in the future or that the ratio of nitrates to phosphates are maintained at 10:1 with nitrates not exceeding 1.0 mg/l.

B. Water Temperature Data

Summary: Prior to September 2001, water temperature data are limited to several readings at specific locations associated with fish sampling projects for juvenile chinook salmon and the continuous recordings from the Teichert Property. Since September 2001 nearly continuous (subject to vandalism and equipment problems) hourly readings have been recorded on the Foggy Ranch, just upstream of Garden Bar Road, the Tahti property, just upstream of Gladding Road, and at the Teichert monitoring program (which I believe is recording temperatures every two hours). Three new monitoring stations (Zobel property, Coon Creek Trap Club, and Nicolaus Road crossing) were established in June 2003 and are recording temperatures hourly.

Assessment: Data associated with the various fish sampling projects indicate that winter and spring temperatures are suitable for successful anadromous fish spawning and juvenile rearing. Plots of data from the Tahti and Foggy Ranch properties indicate that conditions are generally suitable for anadromous fish spawning and rearing on an annual basis. Data from stations downstream of Gladding Road indicate that juvenile salmonid rearing is unlikely in this area. Data from the SMD #1 monitoring program and the partial one-year data from Zobel's in the Dry Creek/Coon Creek upper watershed indicate that temperatures may be suitable for steelhead rearing and anadromous fish spawning in general. Temperatures in these upper areas may exceed the recommended levels. However, these recommended levels are not thermal maximums and individual fish may find thermal refugia in/near groundwater seeps or small springs.

Overall, it appears that Coon Creek, upstream of Gladding Road, has water temperatures that are suitable for year-round production of anadromous fish. However, flow levels and resulting elevated water temperatures in some locations may limit the amount of available suitable habitat during some time periods and/or years. It is important to note that existing water management, which provides supplemental flows during the spring/summer/early fall period, may be the most critical component of the suitability of this stream to support steelhead trout and any extended juvenile chinook salmon rearing.

C. Benthic Macroinvertebrate Data

Summary: Benthic macroinvertebrate data were collected from Coon Creek at the Fleming Property, just downstream of Garden Bar Road in December 2000 (additional samples may have been collected, but analysis is not complete).

Assessment: The data are limited and sampling protocols are less than ideal. First, samples are collected with equipment that does not readily collect all taxon present in the stream. Second, during the initial sorting, generally less than 100 individuals are selected for taxonomic identification. This limited sample size raises concerns regarding the representativeness of the data. That said, the data do indicate domination by organisms that are moderately to highly tolerant of water quality impairment. A combination of flow fluctuations, water quality, and the amount of sediment in the stream channel is probably responsible for this general lack of diversity and tendency towards species that are pollution tolerant.

D. Physical Habitat Data

Summary: Physical habitat data has been collected upstream from Highway 65 to a waterfall/cascade complex on the Spear Ranch property upstream from Garden Bar Road located in the canyon portion of the watershed. Sampling between Highway 65 and Gladding Road was completed as part of the Teichert Aggregate Facility EIR process and the data is summarized in the FEIR. However, although the sampling protocols for the Teichert portion of the stream and sampling upstream of Gladding Road conducted by Stacy Li are documented as being identical, no detailed comparison has been completed. The data collected by Li has not been analyzed. Data on the physical habitat conditions downstream of Highway 65 are unavailable.

Assessment: A thorough and integrated analysis of the data from the Teichert property and that upstream of Gladding Road to the Spear Ranch should allow a more detailed and documented assessment of the habitat conditions existing in this portion of the stream. Data from the watershed upstream of the waterfall/cascade complex on the Spear Ranch is unavailable. However, review of the videotape from the County's videography project for this upstream area indicates that this area consists of relatively high quality anadromous fish spawning and rearing habitat (given that water quality and temperatures are suitable). Based on the videotape data, this area and the area upstream from Garden Bar Road may be the best potential habitat in the watershed. The videotape shows a number of waterfall/chute/cascade locations/complexes in this upper area that need further evaluation. Under very high flows, adult fish passage is probable (one local land owner indicates that salmon and steelhead have been observed in Dry

Creek in the upper watershed). With less than very high flows, fish passage into this area is problematic to impossible, depending on the actual flows. An evaluation of the habitat quality in this area is warranted and the potential to provide fish passage into these habitats should also be evaluated.

The channel downstream of Gladding Road is nearly all sand bottomed with a few heavily sedimented riffles of gravel/cobble. This downstream area is probably not suitable for anadromous fish rearing, except during juvenile emigration in the winter/spring period. It has little potential to become quality habitat because of the water temperatures and high sediment levels in the channel. However, restoration of the riparian area and any actions that would reduce the levels of sediment entering the channel from the extensive eroding banks would be beneficial to adult migration and juvenile emigration. Any action which will create pool areas and increase in-channel habitat complexity will also aid adult migration and juvenile emigration.

E. Fishery Resource Data

Summary: Data on fish species composition is only available for a relative small section of stream ranging from Dowd Road to near Gladding Road. No data are available from downstream of Dowd or upstream of Gladding. Most of the data are from one-time or short-term sampling for chinook salmon juveniles.

Assessment: There is insufficient data on the presence and spatial and temporal distribution of steelhead in Coon Creek, although anecdotal evidence from the Foggy Ranch indicates adult steelhead spawned there in the past 3 years. The data suggest that fall-run chinook salmon use the stream for spawning in certain years. Because there is no systematic annual survey, an adequate assessment of the magnitude, duration, timing, or geographic distribution of spawning by fall-run chinook cannot be made. Juvenile chinook salmon were captured in all but two of the projects sampling for fish that could have come from upstream stockings earlier in the sampling year. However, sampling conducted in 1965 and 1983, which did capture juvenile chinook salmon, would not have been influenced by stocking. No surveys are documented for steelhead or, although highly unlikely to have persisted, spring-run chinook salmon. The data support the fact that this stream is suitable for fall-run chinook in all years if sufficient provisions are made for adult migration. The data are insufficient to draw any conclusions regarding steelhead use in the system, but water temperatures, water quality, and anecdotal evidence indicates that steelhead are present in the system, at least periodically and that summer rearing conditions are sufficient in the area of the watershed upstream of Gladding Road.

F. Fish Passage or Screening Data

Summary: Adult fish passage and screening concerns for juveniles emigrating past man-made structures are minimal. Insufficient water depth and beaver dams during the adult migration period are major problems in this stream.

Assessment: Potential adult fish passage problems from man-made structures appear to be minimal and if documented could be easily and inexpensively corrected. The degree to which passage is limited or hindered by the combination of lack of water depth in the channel and

beaver dams blocking the channel is unknown. Understanding the interaction of these factors is necessary for developing a strategy to provide adult passage on a seasonal and year-to-year basis. Juvenile losses through entrainment at diversions or pumping stations are unknown. The impact of any losses on the overall population is unknown. High levels of sediment and extensive bank erosion contribute to the lack of water depth and ability of beavers to maintain dams in place. Restoration of riparian areas, which would reduce sediment input to the channel, increase stream channel shading, and eventually increase in-channel habitat complexity, is warranted. Providing access to currently generally inaccessible habitat upstream of the waterfall/cascade complex on the Spear Ranch could add several miles of what appears to be good quality habitat and an appropriate evaluation of this upstream area is needed.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors which could influence Coon Creek's potential to support anadromous fish on a continual basis, several factors deserve additional definition and consideration:

1. Genetic data on the origin of chinook salmon and/or steelhead trout using this watershed are needed to determine if the chinook salmon and steelhead populations using the watershed are even qualified as listed or candidate species under the provisions of the Endangered Species Act. Recent experience with interbasin water transfers in the Cross Canal watersheds have shown a demonstrated lack of understanding and concern regarding the genetic origins of the populations in the Cross Canal watersheds. Determining the genetic origins of the fish using the system is a key to developing a conservation strategy.
2. Providing adult access to upstream spawning areas on a consistent year-to-year basis is another key to maintaining juvenile production at its potential. Without consistent access to spawning areas, the benefits of extensive investments in stream bank restoration, controlling sediment inputs to the channel, and other restoration actions would be marginal. Sufficient water depth during the right time of year is also critical to adult passage. This is particularly important in areas downstream of Gladding Road. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations, or implementing a program to insure adult fish passage over existing dams during the spawning migration periods for chinook salmon and steelhead (approximately November through February). Until such time as adults are consistently allowed into the watershed to spawn, fish exclusion devices on water diversions are problematic at best and should be evaluated in conjunction with downstream water temperatures. The potential to provide adult access to additional miles of suitable habitat upstream of the waterfall/cascade complex on the Spear Ranch should be evaluated.
3. The physical habitat conditions in the channel are limiting juvenile fish production, even if only the amount of sediment in the channel is considered. A major reduction in the quantity of sediment entering the channel would significantly improve hatching and

emergence success and long-term juvenile rearing capability. Fish are currently successfully spawning and some emergence and rearing of juveniles has been documented. However, the potential of this stream to produce anadromous salmonids is certainly greater than under current conditions.

4. Water quality is a concern, primarily because of the levels of nutrients in the water, which currently result in extensive aquatic plant growth over miles of stream channel. Maintaining a balance between nitrates and orthophosphates is important to the potential for declines in dissolved oxygen during the summer rearing period for juvenile steelhead. The level of copper documented to occur in the watershed also needs to be evaluated. In addition, the wide swings in pH levels should be investigated.
5. The potential for the presence of half-pounder steelhead in the watershed presents an opportunity to foster a somewhat unique life history strategy in the Central Valley. Although the presence of this life history strategy is not documented at the present time, the likelihood of it occurring in Coon Creek is high, particularly given the presence in Auburn Ravine. Maintaining or fostering their presence in the watershed will create some additional issues that will need resolution. However, these issues are not complicated and have straightforward fixes. A conservation strategy that fosters this unique life history strategy is needed. Also, this strategy may need to be applied to adjacent watersheds if half-pounder steelhead have the potential to inhabit these areas.
6. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
7. Watershed specific temperature tolerance studies for juvenile steelhead and chinook salmon should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.
8. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water

transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.

9. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However, that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the potential to attract runs of chinook salmon (e.g. winter-run and spring-run), which are not native to these watersheds, must be evaluated.

CURRY CREEK

The literature review for Curry Creek did not result in any information related to any of the categories listed immediately above. I reviewed all of the pertinent environmental documents produced by the City of Roseville and searched the fisheries files at the California Department of Fish and Game's Region 2 office. Since Curry Creek is currently intermittent, environmental documents focus on wetlands, vernal pools, and riparian issues, but not on water quality, benthic macroinvertebrates, or fishery resources. In fact, CDFG does not even have a file for Curry Creek, let alone any data in that non-existent file. However, I did visit all of the accessible road crossings of the channel and during several flights looking for salmon in other drainages, did fly over the stream channel on several occasions. During the stream videography project in March 2003, we did not fly Curry Creek because of time and priority constraints. Therefore, my assessment of this stream's potential to support anadromous fish is based on my limited road crossing and several over flight observations.

ASSESSMENT

A. Water Quality

Assessment: Observations of water quality left me with one solid observation and one impression. During the fall and early winter the turbidity levels were high, with the water being chocolate brown in color. The impression that I have is that nutrient levels might be unsuitable for anadromous fish, should they ever enter the system. This impression is based on the amount of aquatic vegetation growing in the channel, during the winter period and an overall sense of high botanical productivity in the immediate channel area.

B. Water Temperature

Assessment: Although no data is available, my belief is that water temperatures, if perennial flow were to become the norm, would be unsuitable in summer for juvenile salmonid rearing. I base this conclusion on two factors. First, the volume of flow in the channel would be low, unless an artificial discharge supplemented the natural flow, resulting in rapid heating during the spring and summer months. Second, the gradient of the channel is very low which would result in long residence times for water and thus greater opportunity for temperature increases.

C. Benthic Macroinvertebrates

Assessment: In the event the channel did become perennial at some future date, I speculate that the substrate would be composed of fine particles to coarse sand. This substrate would support a low diversity and numbers of organisms that would be suitable as a food source for salmonids.

D. Physical Habitat

Assessment: This stream channel is very low gradient and the surrounding soils are mostly fine textured. Given these constraints, I do not believe that this stream could ever possess the physical characteristics to support salmonid species. The lack of stream power to scour pools and gravels, if any gravel even exists under the existing channel, would render this stream unsuitable as habitat for anadromous salmonids. Also, the lack of sediment transport ability would further hinder the likelihood that suitable conditions could be created. A lack of riparian vegetation would also limit the potential development of habitat complexity.

E. Fishery Resources

Assessment: Based on the location, gradient, soils, and other factors associated with this channel, I believe that this stream has close to zero potential as an anadromous fish stream. The current conditions, and I believe most likely future conditions in the channel do not meet most, if any, of the requirements necessary to support anadromous fish. I do believe that this channel should be kept intermittent, if possible, to avoid false attraction of anadromous species and to minimize the introduction or expansion of undesirable warmwater fish species into other watersheds.

F. Fish Passage or Screening

Assessment: During the over flights, I believe I did see several beaver dams in the lower portion of the drainage, but cannot confirm that observation as fact. If by some chance stream conditions became suitable for anadromous fish, then the beaver situation would have be dealt with in the manner recommended for other watersheds.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors, which could influence Curry Creek's potential to support anadromous fish on a continual basis, I foresee little potential for this stream. My recommendation is that riparian and wildlife values should be maximized, with only a slight potential for anadromous fish. The County should leave its options open to supporting an anadromous fish population in the long-term future (100 years), but in this planning effort, Curry Creek should be given a low priority from a fish perspective.

DOTY RAVINE

DATA SUMMARY and ASSESSMENT

A. Water Quality Data

Summary: Data describing the water quality of Doty Ravine are limited, with only four grab samples in two years. However, this data does provide some insight into potential problems. First, the level of nitrates measured indicates what appears to be a nutrient enrichment problem. Second, the readings for dissolved oxygen appear to be unrealistically high with some values exceeding 150% of saturation. Third, some of the recorded pH values are extremely high for the types of streams found in the Foothills.

Assessment: Because the nitrate data is mostly from the fall period, it is not possible to assess the effects of this level of nutrients on aquatic plant production and possible declines in dissolved oxygen during the summer months. Also, since there are no measurements of the levels of orthophosphate (Lincoln High School has recently agreed to begin taking orthophosphate measurements) biostimulation may not be a problem. However, field observations by Bailey Environmental over the past several years indicate that excessive aquatic plant growth is occurring in Doty Ravine. In order to prevent excess plant growth, a general rule of thumb is to limit the ratio of nitrate to orthophosphate at least 10:1 with nitrate concentrations not exceeding 1.0 mg/l. Three of the four nitrate measurements are ≥ 1.0 mg/l. Generally, orthophosphate is not limiting in streams. Also, Placer County recently approved the Teichert Aggregate Project, which will deliver water to Doty Ravine from a dewatering program needed for a gravel strip mining operation. Review of the groundwater monitoring data included in the project EIR shows high (25-50 mg/l) levels of nitrate in the existing groundwater. The impacts of this additional discharge (and any additional discharges should the active pit flood) should be independently addressed. Given the potential for additional biostimulation and resultant declines in dissolved oxygen, the nutrient balance of this stream should be carefully evaluated.

The anomalous dissolved oxygen readings cannot be fully explained at this time (Bailey Environmental did discuss this situation with Lee Beckman, Lincoln High School, and we determined that sample handling and delay in processing the samples could be contributing to the problem). Given the unreliable readings, it may be appropriate to conclude that dissolved oxygen during the fall-spring period is not an issue and readings are probably near saturation.

The high levels of pH recorded in the data, sometimes exceeding 8 units, are rare in mountain streams, particularly those with a granitic geology. However, this same swing of pH readings is present in the data from a number of nearby streams. These readings are taken by a variety of methods by individuals with adequate technical expertise in measuring water quality parameters. The rate of pH fluctuation in some streams (e.g., Dry Creek in the upper Coon Creek drainage) is extreme. In Doty Ravine, pH values are consistently over 7 and reach 8.7 in one of the 4 samples taken. High pH may be a problem in this portion of the watershed.

With the exceptions noted above, the water quality of Doty Ravine appears to be capable of supporting anadromous fish on a year around basis. The nutrient balance in the stream should be evaluated and steps should be taken to insure that nutrient levels are stabilized or decreased in the future or that the ratio of nitrates to phosphates are maintained at 10:1 with nitrates not exceeding 1.0 mg/l.

B. Water Temperature Data

Summary: Water temperature data prior to September 2001 are limited to several readings at specific locations associated with fish sampling projects for juvenile chinook salmon. Nearly continuous hourly readings have been recorded on the former Garcia Property, just upstream of Crosby Herold Road, since September 2001. Two new monitoring stations (Wise and Goldhill roads) were established in June 2003 and are recording temperatures hourly.

Assessment: Data associated with the fish sampling projects indicate that winter and spring temperatures in much of Doty Ravine are suitable for successful anadromous fish spawning and juvenile rearing. Plots of data from the Garcia Property indicate that conditions are suitable for anadromous fish spawning and rearing on an annual basis. Data from the Wise Road station for June and July 2003 indicate that juvenile salmonid rearing is also possible in this area. The Goldhill Road location shows temperatures above the recommended maximum levels for juvenile rearing during part of the time period. However, these recommended levels are not thermal maximums and individual fish may find thermal refugia in groundwater seeps or small springs.

Overall, it appears that a good portion of Doty Ravine does have water temperatures that are suitable for year around production of anadromous fish. However, flow levels and resulting elevated water temperatures in some locations may limit the amount of available suitable habitat during some time periods and/or years. Existing water management, which provides supplemental flows during the spring/summer/early fall period, is a critical component of the suitability of this stream to support steelhead trout and any extended juvenile chinook salmon rearing.

C. Benthic Macroinvertebrate Data

Summary: Limited benthic macroinvertebrate data have been collected from Doty Ravine at the Garcia Property, just upstream of Crosby Herold Road. Samples were collected in December 2000, October 2001, and some unknown time in 2002 (the 2002 samples have been collected, but analysis is not complete).

Assessment: The data are of limited value due to methodological problems. First, samples are collected with equipment that does not readily collect all taxon present in the stream. Second, during the initial sorting, generally less than 100 individuals are selected for taxonomic identification. This limited sample size raises concerns regarding the representativeness of the data. However, the data do indicate that organisms that are moderately to highly tolerant of water quality impairment dominate the invertebrate community. Some combination of flow fluctuations, water quality, and the amount of sediment in the stream channel is probably

responsible for the general lack of diversity and tendency towards species that are pollution tolerant.

D. Physical Habitat Data

Summary: Physical habitat data is limited to data from a walking survey conducted nearly 40 years ago by Eric Gerstung and a 2003 steelhead spawning gravel survey conducted by Placer County. No other physical habitat data was found in the data sources reviewed.

Assessment: The 1964 survey identified general areas in the stream where Gerstung found spawning gravels, adult chinook salmon spawning, and made some estimate of spawner capacity, but no methodology or protocols are documented to determine how he reached his conclusions. Given the age of the survey and all of the factors which control the physical habitat parameters, this survey is of limited value in assessing the current potential of Doty Ravine to support anadromous fish.

The more-recent (summer) survey conducted by the County was limited in geographic scope. The sampling protocols employed do not provide reliable quantitative estimates of the extent of spawning sized gravel available in the drainage or the level of sediment in the spawning gravels. These data do not provide a sound basis for evaluation of spawning suitability based on the established relationships between hatching and emergent success and particle size. Also, given the heavy sediment loads in the stream, sampling during the summer period may not represent the conditions which an adult anadromous fish might encounter in late-fall or winter spawning season.

In summary, there is insufficient physical habitat data to adequately characterize the existing conditions in the stream and to estimate or adequately evaluate this stream's potential to support anadromous fish. Visual observations show that there is excessive sediment in the channel. Also, water flows are insufficient in certain years and/or certain times of the year to support large populations of anadromous salmonids.

E. Fishery Resource Data

Summary: Data on fish species composition is limited and 20-40 years old. No recent sampling data were found in the literature review. Fall-run and spring-run chinook salmon were stocked in Doty Ravine three times in the mid-1980s.

Assessment: There is insufficient data on the spatial and temporal distribution of fishes in Doty Ravine. The data do suggest that fall-run chinook salmon do use the stream for spawning in certain years. The lack of a systematic annual survey does not allow an adequate assessment of the magnitude, duration, timing, or geographic distribution of spawning by fall-run chinook salmon. No surveys are documented for steelhead or, although highly unlikely to have persisted, spring-run chinook salmon. The data support the fact that this stream is suitable for fall-run chinook salmon in some years, but the data are insufficient to draw any conclusions regarding steelhead use in the system.

F. Fish Passage or Screening Data

Summary: Preliminary assessments exist for two man-made structures (Garden Bar Road Crossing Culvert and Doty South Diversion Structure). Anecdotal reports and video footage exists to document the problems associated with beaver activities which hinder fish passage.

Assessment: The two man-made structures identified in this stream have the potential to block adult fish passage, but only under certain flow conditions. The degree to which passage is limited or hindered by the combination of water depth in the channel, beaver dams blocking the channel, and the man-made structures is unknown. Understanding the interaction of these three factors is critical for developing a strategy to provide adult passage on a seasonal and year-to-year basis. Juvenile losses through entrainment at diversions or pumping stations are unknown. The impact of any losses on the overall population is unknown.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors which could influence Doty Ravine's potential to support anadromous fish on a continual basis, several factors deserve additional definition and consideration:

1. Genetic data on the origin of chinook salmon and/or steelhead trout using this watershed are needed to determine if the chinook salmon and steelhead populations using the watershed are even qualified as listed or candidate species under the provisions of the Endangered Species Act. Recent experience with interbasin water transfers in the Cross Canal watersheds have shown a lack of understanding and concern regarding the genetic origins of the populations in the Cross Canal watersheds. Determining the genetic origins of the fish using the system is one key to developing a conservation strategy.
2. Providing adult access to upstream spawning areas on a consistent year-to-year basis is also a key to maintaining juvenile production at its potential. Without consistent access to spawning areas, extensive investments in stream bank restoration, controlling sediment inputs to the channel, etc., will be marginalized. Potential problems at the two man-made structures are easily fixed for the appropriate flow conditions using off the shelf technology and known solutions. Providing sufficient water depth during the adult spawning migration is particularly important in areas downstream of Crosby Herold Road. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations, or implementing a program to insure adult fish passage over existing dams during the spawning migration periods for chinook salmon and steelhead (approximately November through February). Until such time as adults are consistently allowed into the watershed to spawn, fish exclusion devices on water diversions are problematic at best and should be evaluated in conjunction with downstream water temperatures.
3. The physical habitat conditions in the channel limit juvenile fish production, just based on the amount of sediment in the channel. A major reduction in the quantity of sediment entering the channel is critical to improving hatching and emergence success and long-

term juvenile rearing capability. Fish are currently successfully spawning and some emergence and rearing of juveniles have been documented. However, the potential of this stream to produce anadromous salmonids is certainly greater than under current conditions.

4. Water quality conditions are a concern because of the unknown levels of nutrients in the water. Maintaining a balance between nitrates and orthophosphates is important to understanding the potential impacts of dissolved oxygen sag during the summer rearing period for juvenile steelhead.
5. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
6. Watershed specific temperature tolerance studies for juvenile steelhead and chinook salmon should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.
7. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.
8. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However, that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The

potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the potential to attract runs of chinook salmon (e.g. winter-run and spring-run), which are not native to these watersheds, must be evaluated.

DRY CREEK

DATA SUMMARY and ASSESSMENT

A. Water Quality Data

Summary: The available water quality data is excellent, but is spatially and temporally limited. Data for some important parameters are not collected simultaneously with other important parameters, making it difficult to assess the impacts of one parameter on the aquatic ecosystem. Data indicate high and fluctuating pH values. One good example is the lack of hardness data to correspond with metals concentrations.

Assessment: High pH values, and wide fluctuations in pH values over short periods of time, cannot at present be explained. In the other adjacent streams values appear to increase in the fall/winter period to high levels. Review of the pH data for the stream demonstrates the abnormal fluctuation in pH values recorded in this watershed. The impacts on aquatic system productivity and organisms are unknown. There is no obvious cause. This situation merits further investigation and evaluation.

The high levels of nitrates and orthophosphates in the stream have the potential for biostimulation of plant growth in the stream and subsequent declines in dissolved oxygen levels during certain times of the year. This situation needs further evaluation.

The Regional Water Quality Control Board and Dry Creek Conservancy data raises a question about the effect of copper and zinc concentrations on aquatic life in the watershed. Because copper levels are high throughout the system, they would appear to be natural and aquatic species may have adapted to this local condition. However, additional spatial and temporal sampling may be warranted to further define the situation. The appearance of barium, chromium, and vanadium in the sampling data is surprising, because these metals are often associated with industrial activity. This needs further explanation and/or evaluation.

Dry Creek in this portion of the overall watershed is heavily influenced by urban development and runoff. The high nutrient concentration and improper ratio of nutrients is of only moderate concern, because this section of Dry Creek is of marginal use as rearing and spawning habitat for anadromous salmonids. The nutrient balance in the stream should be evaluated and steps should be taken to insure that nutrient levels are stabilized or decreased in the future or that the ratio of nitrates to phosphates are maintained at 10:1 with nitrates not exceeding 1.0 mg/l. In general, this stream shows an increase in nutrients and hardness as it flows down from the foothills. This is a natural occurrence, but this stream has some constituents that are likely enhanced because of urbanization. The other major concern is the concentrations of heavy metals revealed by the limited metals sampling. The concentrations reported are about 2-5 times the California Toxic Rule water quality standards. The metals situation should be evaluated much more thoroughly.

B. Water Temperature Data

Summary: The single year of water temperature data available from the Darling Way and Riverside Drive locations show temperatures ranging from near 4°C to about 30°C. This wide fluctuation allows a wide variety of fish species to use this watershed. The single year of data collected by the California Department of Fish and Game, near the confluence of Secret and Miners ravines show that summer rearing temperatures are adequate for juvenile steelhead.

Assessment: Although the data on water temperature is limited to one year, they show that fall and winter temperatures may be sufficient to support adult spawning and rearing of juvenile fall-run chinook salmon. The window of opportunity for chinook salmon is about late-October through about the end of May. Although steelhead do occur upstream of this stream section in Secret and Miners ravines, summer rearing conditions appear to become unsuitable at some point between Eureka Road and Darling Way. Further evaluation of water temperature data is warranted.

C. Benthic Macroinvertebrate Data

Summary: Currently available benthic macroinvertebrate data are limited to two data sets that contain adequate sample sizes to make some reasonable assessments for this watershed. Additional sampling has been completed, but results are not currently available.

Assessment: The data from the watershed indicates that organisms that are moderately to highly tolerant of water quality impairment. I speculate that it is a combination of flow fluctuations, water quality, and the amount of sediment in the stream channel that contributes to the general lack of diversity and tendency towards benthic macroinvertebrate species that are pollution tolerant.

D. Physical Habitat Data

Summary: Quantitative physical habitat data is limited for this segment of watershed, in both scope and detail, but Dry Creek's physical habitat has been well summarized by Vanicek.

Assessment: Based on my own foot surveys of much of the same reaches of Dry Creek and the segment Vanicek labeled Lower Miners Ravine (Antelope Creek Confluence to the confluence of Miners and Secret ravines) and review of stream video footage from the Videography Project, I believe that Vanicek's habitat assessments and conclusions are still valid a decade later. The riparian vegetation situation appears to be stable or improving. Improvement over current conditions may be accomplished by creating pool habitats, reducing sediment input to the channel, cleaning stream gravels to promote increased aquatic insect production and enhance limited chinook salmon spawning areas, and ensuring that riparian vegetation is allowed to reproduce. Improving sediment transport through the system would be a benefit to aquatic organisms in general. More detailed physical habitat survey may not be warranted, unless it is completed at low flows in conjunction with a fish passage assessment.

E. Fishery Resource Data

Summary: Data on fish species composition is available from a limited number of one-time sampling events and several foot surveys for spawning fall-run chinook salmon.

Assessment: There are sufficient data to outline the nature of the fish species composition in this segment of the watershed. Since this portion of the watershed is used primarily as a migratory corridor, the data are sufficient to develop conservation recommendations. Increasing the frequency and number of chinook salmon spawning salmon surveys in this segment of the watershed would help more fully document the extent and magnitude of chinook salmon spawning.

F. Fish Passage or Screening Data

Summary: Beaver dams and man-made obstructions, combined with insufficient water depth during the adult migration period, are major problems in this stream.

Assessment: Detailed data to assess potential migration barriers in this segment of the watershed is unavailable. A project to improve, although not optimally, fish passage conditions at the pipeline crossing at the confluence with Cirby Creek has been recently completed.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

The primary factors which could influence this segment of the Dry Creek watershed's potential to support anadromous fish on a continual basis include:

1. Genetic data on the origin of chinook salmon and/or steelhead trout using this watershed are need to be developed. Obtaining this data is critical to determining if the chinook salmon and steelhead populations using the watershed are even qualified as listed or candidate species under the provisions of the Endangered Species Act. Determining the genetic origins of the fish using the system is a key to developing a conservation strategy.
2. Providing adult access to upstream spawning areas on a consistent year-to year basis is also a key to maintaining juvenile production at its potential. Without consistent access to spawning areas, the benefits of steam bank restoration, controlling sediment inputs to the channel, and other restoration actions will be marginal. Providing sufficient water depth during the adult spawning migration is therefore critical. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations, or implementing a program to ensure adult fish passage over existing dams during the spawning migration periods for chinook salmon and steelhead (approximately November through February). Addressing the overall situation should be a priority.
3. The physical habitat conditions in the channel are limiting juvenile fish production, even if only the amount of sediment in the channel is considered. A significant reduction in

the quantity of sediment entering the channel is critical to improving hatching and emergence success and juvenile rearing capability. Fall-run chinook salmon have been documented in some areas of this segment of stream. However, the potential of this stream to produce anadromous salmonids is certainly greater than it is under current conditions.

4. Water quality conditions are a concern because of the levels of nutrients in the water, which could result in eutrophication in the stream channel. Maintaining a balance between nitrates and orthophosphates is important to managing potential declines in dissolved oxygen sag during the summer rearing period for juvenile steelhead. Also of concern are the levels of copper and zinc documented to occur in the watershed. A more extensive assessment of this situation may be warranted. In addition, the wide swings in pH levels should be investigated.
5. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
6. Watershed specific temperature tolerance studies for juvenile steelhead and chinook salmon should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.
7. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.
8. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However,

that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the potential to attract runs of chinook salmon (e.g. winter-run and spring-run), which are not native to these watersheds, must be evaluated.

MINERS RAVINE

DATA SUMMARY and ASSESSMENT

A. Water Quality Data

Summary: The water quality data available is excellent in quality, but is spatially and temporally limited. The limited pH and dissolved oxygen data raise more questions than they answer. Also, the data on copper concentrations indicates that copper is available to the water column during certain times of the year. Concentrations of nitrate and orthophosphate are at levels of concern.

Assessment: The situation with respect to high pH values is unexplained, with abnormal fluctuation in pH values recorded in this watershed. In the other adjacent streams values appear to increase in the fall/winter period to high levels. There are no data on the potential impacts of pH fluctuations on aquatic system productivity and organisms and no obvious causal relationship is apparent. This situation merits further investigation and evaluation.

The high levels of nitrates and orthophosphates in the stream have the potential for biostimulation of plant growth in the stream and subsequent declines in dissolved oxygen levels during certain times of the year. The low dissolved oxygen concentrations are of concern, particularly since the limited data were taken in the middle of the afternoon when concentrations should be near their daily maximum. This situation needs further evaluation, particularly in light of Rob Titus' (CDFG Biologist) conclusions regarding the potential impacts of low dissolved oxygen concentration on the fish fauna of the stream.

The Regional Water Quality Control Board and Dry Creek Conservancy data raise a question about the effect of copper concentrations on aquatic life in the watershed. Because elevated copper concentrations have been found throughout the watershed, these findings may reflect long-term conditions and the aquatic life may have adapted to these local sources. No external source of this copper is apparent in the watershed. However, additional spatial and temporal sampling may be warranted to further define the situation.

Nutrient balance in the stream should be evaluated and steps should be taken to insure that nutrient levels are stabilized or decreased in the future or that the ratio of nitrates to phosphates are maintained at 10:1 with nitrates not exceeding 1.0 mg/l. In general, this stream shows an increase in nutrients and hardness as it flows down from the foothills. This is a natural occurrence, but this stream has some constituents that are enhanced most likely because of urbanization.

B. Water Temperature Data

Summary: Limited water temperature data from Miners Ravine shows that perhaps only the upper portion of the watershed provides suitable conditions for summer rearing of steelhead.

Water temperatures are suitable for fall-run chinook salmon spawning and rearing, as evidenced by their persistence in the stream.

Assessment: Although the data on water temperature is extremely limited, the data do show that fall and winter temperatures are sufficient to support adult spawning and rearing of juvenile fall-run chinook salmon. Titus' data show that conditions for summer rearing of juvenile steelhead are possible. It is possible that if adult steelhead were allowed to migrate further upstream in the watershed and/or more consistently over Cottonwood Dam, then summer rearing conditions might be suitable and the annual quantity of suitable habitat would increase.

C. Benthic Macroinvertebrate Data

Summary: Benthic macroinvertebrate data is relatively comprehensive for this watershed.

Assessment: The data from the watershed indicates that organisms that are moderately to highly tolerant of water quality impairment dominate the invertebrate community. Some combination of flow fluctuations, water quality, and the amount of sediment in the stream channel probably contributes to the general lack of diversity and tendency towards benthic macroinvertebrate species that are pollution tolerant.

D. Physical Habitat Data

Summary: Detailed physical habitat data are available for this watershed.

Assessment: The summary data presented in Lee's habitat assessment report is of value to assessing overall physical habitat conditions in the watershed. One major concern is that by using the substrate particle size definitions in the CDFG Level II protocol, we do not have any way to assess the quantity of spawning gravel available for anadromous fish. Also, some of the summary data are too gross in scale to make reasonable assessments regarding the overall quality of habitats on a smaller scale. A more comprehensive or different assessment of the field data might yield more detailed and in some cases more relevant information.

E. Fishery Resource Data

Summary: Data on fish species composition is sufficient to characterize the stream's fish fauna, but more detailed examination of Titus' data would be necessary since he has completed the most comprehensive assessment to date.

Assessment: There are sufficient data to support the conclusion that this stream supports chinook salmon and steelhead. Also, it appears that the stream has more potential to support steelhead and potentially more chinook salmon if fish passage were available to upstream areas on an annual basis. The presence of steelhead juveniles and documented reproduction and extended rearing increases the priority for passage improvements in this watershed.

F. Fish Passage or Screening Data

Summary: Insufficient water depth, man-made obstructions, and beaver dams during the adult migration period are major problems in this stream and are well documented in the “Miners Ravine Habitat Assessment” report from the Department of Water Resources.

Assessment: The data available to assess potential migration barriers is excellent and needs no further evaluation. What is now needed is to develop a strategic approach to solving the potential barrier issues one at a time, with highest priority to ensuring that steelhead get upstream of Cottonwood Dam on an annual basis.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors which could influence the Miners Ravine watershed’s potential to support anadromous fish on a continual basis, several factors deserve additional definition and consideration:

1. Genetic data on the origin of chinook salmon and/or steelhead trout using this watershed are critical to determining if the chinook salmon and steelhead populations using the watershed are even qualified as listed or candidate species under the provisions of the Endangered Species Act. Determining the genetic origins of the fish using the system is a key to developing a conservation strategy.
2. Providing adult access to upstream spawning areas on a consistent year-to-year basis is also a key to maintaining juvenile production at its potential. Without consistent access to spawning areas, the benefits of investments in stream bank restoration, controlling sediment inputs to the channel, and other restoration actions will be marginal. Providing sufficient water depth during the right time of year to allow passage to upstream areas is therefore a critical need. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations, or implementing a program to insure adult fish passage over existing dams during the spawning migration periods for chinook salmon and steelhead (approximately November through February). Addressing the situation at Cottonwood Dam, culverts, and a waterfall should be a priority.
3. The physical habitat conditions in the channel are limiting juvenile fish production, even considering only the amount of sediment in the channel. A major reduction in the quantity of sediment entering the channel would improve hatching and emergence success and long-term juvenile rearing capability. Fish are currently successfully spawning and some emergence and rearing of juveniles has been documented. However, the potential of this stream to produce anadromous salmonids is certainly greater than under current conditions.
4. Water quality conditions are a concern because of the levels of nutrients in the water, which could result in eutrophication in the stream channel. Maintaining a balance between nitrates and orthophosphates is important to understanding the potential impacts

of dissolved oxygen sag during the summer rearing period for juvenile steelhead. Also of concern is the level of copper documented to occur in the watershed. A more extensive assessment of this situation may be warranted. In addition, the wide swings in pH levels should be investigated. An overall assessment of the causes of the low concentrations of dissolved oxygen and information on the diel fluctuations in dissolved oxygen concentrations should be a high priority. Water quality conditions may be limiting fish species distribution and composition.

5. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
6. Watershed specific temperature tolerance studies for juvenile steelhead and chinook salmon should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.
7. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.
8. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However, that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the

potential to attract runs of chinook salmon (e.g. winter-run and spring-run), which are not native to these watersheds, must be evaluated.

PLEASANT GROVE CREEK

The literature review for Pleasant Grove Creek did not result in any information related to any of the categories listed immediately above. I reviewed all of the pertinent environmental documents produced by the cities of Rocklin and Roseville, talked with appropriate staff in the two cities, and searched the fisheries files at the California Department of Fish and Game's Region 2 office. Since Pleasant Grove Creek is currently intermittent, environmental documents focus on wetlands, vernal pools, and riparian issues, but not on water quality, benthic macroinvertebrates, or fishery resources. In fact, CDFG only has an empty file folder for Pleasant Grove Creek. However, I did visit all of the accessible road crossings over the various channels. During the stream videography project in March 2003, we did fly the main channel of Pleasant Grove Creek. Therefore, my assessment of this stream's potential to support anadromous fish is based on my limited road crossing observations and my flight observations.

ASSESSMENT

Water Quality

Assessment: Observations of water in the channel during the helicopter flight showed what appeared to be some minor turbidity and color. I suspect that the color is generated from the extensive wetlands in the upper portion of the watershed. At road crossings in the uppermost portion of the watershed, the stream channel is quite small, but water quality appeared good, although no information on metals or pesticide concentrations are available.

Water Temperature

Assessment: Although no data is available, my belief is that water temperatures, if perennial flow were to become the norm, would be unsuitable in summer for juvenile salmonid rearing in the portion of the watershed downstream of a point somewhere between Stanford Ranch Road and Wyckford Drive in Rocklin. The channel becomes shaded in a greenbelt and it is possible that water temperatures could support summer rearing of juvenile steelhead. In areas downstream, water temperatures would be unsuitable for salmonids. However, once the new City of Roseville wastewater treatment facility begins discharging water to the channel near Phillips Road, downstream temperature conditions could change things considerably.

Benthic Macroinvertebrates

Assessment: In the event the channel did become perennial at some future date, I speculate that the substrate would be composed of fine particles to coarse sand. This substrate would support a low diversity and numbers of organisms that would be suitable as a food source for salmonids. In the watershed upstream of Stanford Ranch Road, there is suitable substrate to support a more diverse invertebrate community and the sediment levels are lower than in downstream areas.

Physical Habitat

Assessment: This stream channel, in general, is very low gradient and the surrounding soils are mostly fine textured. Given these constraints, I do not believe that a significant majority of this stream could ever possess the physical characteristics to support salmonid species. However, there is a small percentage of the channel in the upper headwaters that may be able to support a small population of steelhead. I do not believe this stream could support chinook salmon. The size of the stream at the point where suitable physical conditions might develop is just too small to support chinook. In this upper portion of the watershed, stream gradient increases, which results in gravel and cobble beginning to appear as the channel substrate. The nature of the sediment changes from decomposed granite in downstream areas to a much finer soil/organic matter texture. The vast majority of the channel has a riparian zone in very poor condition and miles of eroding banks. Sediment load deposited in the channel is staggering in extent and volume.

Fishery Resources

Assessment: Based on the location, gradient, soils, and other factors associated with this channel, I believe that this stream has very low potential as an anadromous fish stream. The current conditions, and I believe most likely future conditions in the channel do not meet most, if any, of the requirements necessary to support anadromous fish. Although, conditions might change sufficiently in the future, to allow suitable habitat and flow volumes to support a very small population of steelhead in the uppermost portion of the watershed.

Fish Passage or Screening

Assessment: There are numerous diversions, a multitude of beaver dams, and man-made small earthen dams upstream of Highway 65. All of these potential barriers would need to be evaluated in the context of the potential steelhead habitat in the upper watershed. Not much bang for the buck in this stream channel.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors, which could influence Pleasant Grove Creek's potential to support anadromous fish on a continual basis, I foresee little potential for this stream. My recommendation is that riparian and wildlife values should be maximized, with only a slight potential for anadromous fish. The County should leave its options open to supporting an anadromous fish population in the long-term future (20-40 years), but in this planning effort, Pleasant Grove Creek should be given a low priority from a fish perspective. The one factor that should be monitored is the rate at which this stream is becoming perennial. In the past 10 years, the channel in the vicinity of Highway 65 has transformed from intermittent to perennial. The same is true of the south fork channel in the vicinity of Fairway Drive in Rocklin.

SECRET RAVINE

DATA SUMMARY and ASSESSMENT

A. Water Quality Data

Summary: The water quality data available is excellent in quality, but is spatially and temporally limited. The limited pH and nutrient data raise more questions than they answer. Also, the data on concentrations of copper, and to a lesser extent cadmium and zinc, indicates that all three metals are available to the water column during certain times of the year. Concentrations of nitrate and orthophosphate are at levels of concern.

Assessment: The situation with respect to large fluctuations in pH values is a unexplained, but occurs in other Placer County streams. In the other adjacent streams values also appear to increase in the fall/winter period to high levels. Review of the data in demonstrates the abnormal fluctuation in pH values recorded in this watershed. The potential for impacts on aquatic system productivity and organisms as a result of these fluctuations is not known, and obvious causal relationships are not apparent. This situation merits further investigation and evaluation.

Instream concentrations of nitrates and orthophosphates and the imbalance in the ratio between them have the potential for biostimulation of plant growth in the stream and subsequent declines in dissolved oxygen levels during certain times of the year. This situation needs further evaluation, particularly in light of the lack of comprehensive spatial and temporal data.

The Regional Water Quality Control Board and Dry Creek Conservancy data raises a question about the effect of copper concentrations on aquatic life in the watershed. Since no external source is readily apparent in the watershed, copper concentrations may be a natural feature of this system and the aquatic life may have adapted to this condition. However, additional spatial and temporal sampling may be warranted to further define the situation.

Nutrient balance in the stream should be evaluated and steps should be taken to ensure that nutrient levels are stabilized or decreased in the future or that the ratio of nitrates to phosphates is maintained at 10:1, with nitrates not exceeding 1.0 mg/l. In general, this stream shows an increase in nutrients and hardness as it flows down from the foothills. This is a natural occurrence, but this stream has some constituents in higher than normal levels, most likely because of runoff from suburban and urban areas.

B. Water Temperature Data

Summary: Water temperature data from Secret Ravine shows that only the upper portion of the watershed may have suitable conditions for summer rearing of steelhead. Water temperatures throughout the watershed are suitable for fall-run chinook salmon spawning and rearing as evidenced by their persistence in the stream.

Assessment: Although the data on water temperature is extremely limited (with the possible exception of the data soon to be available from CDFG Biologist, Rob Titus), the data do show that fall and winter temperatures are sufficient to support adult spawning and rearing of juvenile fall-run chinook salmon. Titus' data show that conditions for summer rearing of juvenile steelhead are possible. It is possible that if adult steelhead were allowed to migrate further upstream in the watershed and/or more consistently to upstream areas, then summer rearing conditions are suitable and the annual quantity of suitable habitat would increase.

C. Benthic Macroinvertebrate Data

Summary: Benthic macroinvertebrate data for this watershed is of excellent quality. However, the spatial and temporal extent of sampling is less than comprehensive. Also, additional data from 2002 are not yet available and may increase the spatial extent of sampling locations.

Assessment: The data from the watershed indicates that organisms moderately to highly tolerant of water quality impairment dominate the benthic invertebrate community. Some combination of flow fluctuations, water quality, and the amount of sediment in the stream channel probably contributes to the general lack of diversity and tendency towards benthic macroinvertebrate species that are pollution tolerant.

D. Physical Habitat Data

Summary: High quality and detailed physical habitat data is available for this watershed from the Li and Fields' habitat assessment completed in 1999. Less detailed and generally less useful data is available from the ECORP Consulting assessment completed in 2002.

Assessment: The summary data presented in the Stacy Li/Wayne Fields habitat assessment report is of value to assessing overall physical habitat conditions in the watershed. The ECORP data is of lesser value because of the different habitat typing protocol used and the use of presence/absence criteria used in assessing instream cover. Also, the cumulative percentage analysis in the Li/Fields report is of interest, but of limited value in defining specific problems. A more comprehensive and structured analysis of both sets of habitat assessment data, focused on site-by-site conditions, would yield a better overall assessment of the habitat conditions in this stream.

E. Fishery Resource Data

Summary: Data on fish species composition is sufficient to characterize the stream's fish fauna, but more detailed examination of Titus' data would be necessary since he has completed the most comprehensive assessment to date.

Assessment: There is sufficient data to support the conclusion that this stream supports chinook salmon. Also, it appears that the stream has more potential to support steelhead and potentially more chinook salmon if fish passage were available to upstream areas on an annual basis. The presence of steelhead juveniles and documented reproduction and extended rearing increases the priority for passage improvements in this watershed.

F. Fish Passage or Screening Data

Summary: Insufficient water depth, man-made obstructions and beaver dams during the adult migration period have been identified as problems in this stream.

Assessment: The data available to assess potential migration barriers is excellent, but the Li/Fields data could be analyzed in greater detail. The priority of various upstream passage options needs to be established on a site-specific basis.

CONSERVATION STRATEGY CONSIDERATIONS and RECOMMENDATIONS

In considering all of the factors which could influence the Secret Ravine watershed's potential to support anadromous fish on a continual basis, several factors deserve additional definition and consideration:

1. Genetic data on the origin of chinook salmon and/or steelhead trout using this watershed are needed to determine if the chinook salmon and steelhead populations using the watershed are even qualified as listed or candidate species under the provisions of the Endangered Species Act. Determining the genetic origins of the fish using the system is a key to developing a conservation strategy.
2. Providing adult access to upstream spawning areas on a consistent year-to year basis is also a key to maintaining juvenile production at its potential. Without consistent access to spawning areas, extensive investments in stream bank restoration, controlling sediment inputs to the channel, etc., will be marginalized. Providing sufficient water depth during the adult salmon migration period is an essential component of restoration actions. While beaver dams may be a problem, they can be overcome by either eliminating the beaver from the watershed at appropriate locations, or implementing a program to ensure adult fish passage over existing dams during the spawning migration periods for chinook salmon and steelhead (approximately November through February).
3. The physical habitat conditions in the channel are limiting juvenile fish production, even if only sedimentation effects are considered. Reducing the quantity of sediment entering the channel would improve hatching and emergence success and long-term juvenile rearing capability. Fish are currently successfully spawning and emergence and rearing of juveniles have been documented. However, the potential of this stream to produce anadromous salmonids is certainly greater than under current conditions.
4. Water quality conditions are a concern because of the levels of nutrients in the water, which could result in eutrophication in the stream channel. Maintaining a balance between nitrates and orthophosphates is important to understanding the potential impacts of dissolved oxygen sag during the summer rearing period for juvenile steelhead. Also of concern are the levels of copper, cadmium, and zinc documented to occur in the watershed. A more extensive assessment of this situation is warranted. In addition, the

wide swings in pH levels should be investigated. Water quality conditions may be limiting fish species distribution and composition.

5. The stocking of surplus hatchery origin fish should be discontinued. Continual introduction of fish of hatchery origin and from different stocks into Western Placer County streams is not biologically justified. In the future, if improving habitat conditions warrant, a genetically based, short-term supplementation program might be considered.
6. Watershed specific temperature tolerance studies for juvenile steelhead and chinook salmon should be conducted. Many laboratory studies base their temperature tolerance studies on hatchery origin stocks that are reared under controlled temperature conditions. Juveniles rearing in streams with fluctuating and higher daily maximum water temperatures develop physiological tolerances that are not found in hatchery reared juveniles. The objective of this study is to match the temperature tolerance of natal stream juveniles with the maximum amount of potential habitat. In other words, if the juveniles can tolerate higher temperatures than the literature suggests, then there may be additional potential habitat areas that could be improved or protected in order to increase the overall quantity of rearing habitat available.
7. The NCCP/HCP should pay careful attention to the current water management and water conservation practices in the watersheds of Western Placer County. Many of the streams under consideration have the quantity and quality of habitats for anadromous fish they do, because of the spatial and temporal delivery of water to downstream areas. However, reduction in stream flow at critical times (e.g., fall) reduces the quantity and quality of aquatic habitats available for a variety of aquatic species and constrains the migratory pathways of spawning adults (particularly fall-run chinook salmon). In addition, water transport conservation measures (e.g., lining canals with impermeable surfaces) may also reduce the amount of groundwater infiltration into the channel or eliminate direct seepage into the stream, thus reducing stream flow.
8. A second water management issue that should be strongly considered is the watershed of origin for water being transferred into the various streams in Western Placer County. Currently water being imported into most of these watersheds is of Yuba/Bear rivers origin. Some American River origin water is also being imported, but not during time periods when impacts to juvenile imprinting or adult migration would occur. However, that long-term situation is about to change when the Placer County Water Agency's new American River Pumping Station is completed. In addition, the Bureau of Reclamation's Sacramento River Water Supply Reliability Study (just being initiated) contains potential alternative water supply sources from the American, Sacramento, and Feather rivers. The potential of false attraction of chinook and steelhead stocks from these sources should be comprehensively examined in light of the objectives of the NCCP/HCP. Also, the potential to attract runs of chinook salmon (e.g. winter-run and spring-run), which are not native to these watersheds, must be evaluated.