Tracy Placer Mining Project

HYDROLOGY REPORT

Sucker Creek Watershed

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Prepared for the Draft EIS

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# HYDROLOGY REPORT
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A. INTRODUCTION

This report documents the impacts analysis of hydrologic conditions completed for a proposed placer gold-mining operation (named the Tracy Placer Mining Project) at a single, local site within the Rogue River-Siskiyou Siskiyou National Forest, Wild Rivers Ranger District. The mine site itself would encompass an area just less than five acres in area and mine operations are proposed to occur over a period of five years.

The proposed mining area is located on an alluvial terrace that parallels Sucker Creek. The proposed mine activity area is thus located within the riparian area of the mainstem of Sucker Creek and two small tributaries to Sucker Creek, Cedar Gulch and an un-named creek. Sucker Creek drains approximately 62,500 acres that is located within the Klamath Mountains Province of southwestern Oregon. Sucker Creek flows into the Illinois River and proceeds to the sea via the Rogue River.

B. HYDROLOGIC BACKGROUND - WATERSHED ANALYSIS SUMMARY

A Pilot Watershed Analysis Area (WAA) inventory was conducted in 1995 covering this watershed and resulted in the Grayback/Sucker Key Watershed Analysis. The Pilot Watershed Analysis was supplemented in 1998. These documents are summarized below and incorporated by reference to this analysis.

1. Sucker Creek Watershed Overview

Sucker Creek is a 5th field watershed (totaling approximately 62,500 acres) within the Illinois River Subbasin of the Klamath Mountain Physiographic Province of southwestern Oregon (Map 1). Sucker Creek watershed is part of the Rogue River basin. Sucker Creek flows into the East Fork Illinois River 2 miles south of Cave Junction and then into the Illinois River and finally the Rogue River at Agness (USDA FS 1995, 1998).

The Sucker Creek basin provides for many beneficial uses. Beneficial uses include domestic water supply, irrigation, livestock watering, mining, and cold water biota (salmonid). Water from the Sucker Creek is appropriated for irrigation, livestock, industrial and domestic use. There are no point source discharges within the Sucker Creek watershed.

Sucker Creek is also one of the better spawning and rearing tributaries for coho in the Illinois River sub-basin. Four anadromous fish species occur in the Sucker Creek watershed (Chinook salmon, Coho salmon, winter steelhead and Pacific lamprey); two native resident salmonids (coastal cutthroat and rainbow trout); and reticulate sculpin. Coho salmon are listed as threatened under the Endangered Species Act and Chinook salmon and coastal cutthroat trout are Regional Forester Sensitive species (USDA FS 1995, 1998).

The streams in the watershed are among the most productive of fish in the Illinois basin. Sucker Creek is the principal producer of salmonid fish in the Upper Illinois (above Cave Junction). Developed recreation and tourism are higher in this watershed than any other in the basin (USDA USFS 1995). The watershed itself provides habitat for many plant and animal species valued for their commercial, aesthetic, or intrinsic worth.
Within the watershed, public lands are administered by Forest Service (FS), Bureau of Land Management (BLM), State/County and the National Park Service. Approximately 70% of the watershed is managed by the FS. Private lands occupy 25% of the watershed. The Sucker Creek Watershed is a Tier 1 Key Watershed under the Northwest Forest Plan (USDA, USDI 1994) and contains approximately 200 miles of perennial streams on National Forest System land. Ownership and management responsibilities of the watershed are shown in Table 1.

Table 1. Sucker Creek Watershed Ownership/Management

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Acres (approximate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USFS</td>
<td>43,900 (70%)</td>
</tr>
<tr>
<td>BLM</td>
<td>5,800 (9%)</td>
</tr>
<tr>
<td>Private</td>
<td>12,000 (25%)</td>
</tr>
<tr>
<td>State/County</td>
<td>300 (0.5%)</td>
</tr>
<tr>
<td>Oregon Caves National Monument</td>
<td>500 (0.5%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>62,500</strong></td>
</tr>
</tbody>
</table>

The watershed is located between the north-facing slopes of the Siskiyou Mountains and the Illinois Valley. For purposes of this report, Lower Sucker Creek is defined as the area that includes all BLM-administered public lands below the national forest boundary at mile 10.4 on Sucker Creek as well as all private and county-managed lands in the watershed – both above and below mile 10.4. Lower Sucker Creek flows within the broad Illinois Valley, and its upper reaches occupy narrow valley floors and canyons.
Upper Sucker Creek includes the eastern and southern headwaters that begin at rocky peaks, such as Grayback Mountain and Tannen Mountain. Elevations range from 1,400 feet at the mouth of Sucker Creek to 7,000 feet on the divides (USDA FS 1995, 1998). The high ridges are very rocky with thin soils.

The current climate is characterized by moist and cool winters with warm and dry summers. Average precipitation generally increases with elevation, from 50 inches on the valley floor to 80 inches near Bolan Peak. It falls predominantly as rain below 2,500’ elevation, alternating rain and snow from 2,500’ to 4,000’, and winter snow pack above 4,000’ (USDA FS 1995, 1998). The peaks and high ridges are snow-covered for several months each winter, but no permanent snow fields or glaciers are present.

There are about a dozen glacial cirques (rock basins carved by mountain glaciers) of varying ages. The three youngest-appearing cirques are occupied by Bolan Lake and the Tannen Lakes, which are small lakes (tarns) ponded behind the moraines. The older glacial basins that no longer have lakes and other high elevation sites have numerous meadows and water seeps. Seeps, bogs, and fens are mostly high-elevation features where shallow soil, snow melt, and rainfall provide year-round (USDA FS 1995, 1998).

2. Limiting Factors Identified in the WAA

Aquatic resources have been degraded by past timber harvest, road construction, and placer mining operations. Channel modification due to hydraulic mining and other placer operations is especially intense along Sucker Creek (USDA FS 1995, 1998). Landslide activity and severe flooding of the watershed in 1964 and 1997 accentuated pre-existing channel changes. Many channels exhibit disturbance responses such as increased width, elevated water temperature, loss of pool habitat due to sedimentation or loss of substrate retention, loss of side channel habitat due to channel straightening, increased channel migration, and loss of channel structure and habitat due to lack of large wood. The road system contributes to habitat degradation in several ways: road-related slope failures generate sediment or aggravate existing landslides and slope failures; road drainage increases routes for sediment to enter channels; culverts and drainage fills often act as barriers to fish passage (USDA FS 1995, 1998).

Regeneration harvest and associated road construction has occurred throughout the watershed. Approximately 30% of the National Forest System lands have been harvested since 1940. Harvest included stream clean-out operations that removed large wood and built a moderately high road density (USDA FS 1995, 1998). Harvest rates on the National Forest lands in the Sucker Creek watershed have slowed substantially since 1990, allowing forest canopy to become reestablished in managed stands (USDA FS 1995, 1998).

3. Key Findings

The following are excerpts from the Grayback/Sucker Key Watershed Analysis (USDA FS 1995):

- **Summer low flows in Sucker Creek are not adequate to accommodate all beneficial uses.**
• *Summer water temperatures in the lower reaches of Sucker and Grayback creeks are outside of the historic range and can be lethal to salmonids. Warm temperatures favor non-native redside shiners that compete with salmonids for habitat.*

• *Fish habitat in the lower reaches of Sucker and Grayback Creeks has less large wood, and fewer high quality pools and side channels, than required for optimum habitat. The lower reaches should be areas of high productivity.*

• *Riparian areas along the lower reaches of Grayback and Sucker Creeks have been disturbed from the 1964 flood, salvage of large wood, mining, logging, and agricultural activities. Hardwoods and conifers growing along these reaches are not large enough to provide for habitat complexity, nor will be large enough for decades.*

• *Port-Orford-cedar root disease infection sites occur in the watershed, but the area adversely affected by the disease is small.*

• *Timber harvesting has resulted in a decrease in older forests in the watershed, and decreased the size of individual older forest stands. The predominance of Late-Successional Reserve allocation on federal lands in the watershed will likely lead to an increase in stand size and overall acreage of older forest (within 50-150 years, given no stand-replacement disturbances).*

• *Fire suppression has led to increased vegetation density in unmanaged stands. More stands have a developed understory (ladder fuels). Stands have a greater proportion of shade-tolerant trees (tanoak, white fir), which can lead to forest health stress and increased fire hazard.*

• *In the past, the oldest forests were on north aspects, in moist, lower elevation sites. Timber harvest patterns and fire suppression activities have shifted the predominance of older forest to higher elevations.*

**C. SETTING AND DESCRIPTION OF PROPOSED MINING**

1. **Site History**

Mining began in Sucker Creek in 1853. The terrace deposits in the area of the proposed mine site were previously mined sometime following 1853 and placer mining was undoubtedly repeated several times during subsequent decades and into the 1900’s. There are large piles of cobbles and stones on both banks of Sucker Creek that are the result of this past mining. Vegetation has since reestablished and is predominately mature conifer and hardwood trees. Cedar Gulch bisects the proposed mine area approximately in half.

Cedar Gulch flows in a fairly straight alignment from the hillslope to the mining flat and then to Sucker Creek, probably as a result of historic mining. On the mine flat, an old dry channel that turns in a more downstream direction, before reaching Sucker Creek, could represent the original alignment prior to the early mining.
2. Proposed Activities

The fundamental proposal, as submitted by principal claimant/miner Clifford R. Tracy (representing himself and 5 other claimants), is to mine less than five acres of a fluvial (placer) terrace to extract precious metals, primarily gold. Mining would be conducted annually on a seasonal basis (outside of the wettest months of the year) and work is proposed to begin in 2008 or 2009 and to end within 5 years. All operations, including extraction of gold from its substrate, would be implemented on site and no offsite materials processing would occur. As well, no permanent buildings would be constructed for housing or for gold extraction. Mr. Tracy’s proposal is the Proposed Action in the EIS and Figure 1 displays the proposed mine site and area surrounding the mine.

Figure 1. Proposed Tracy mine site adjacent to Sucker Creek
To access the mine site, an existing, rugged, low standard road (the 4612 058 road) would be used for the transport of heavy equipment, dump trucks and other vehicles. This road crosses Sucker Creek at a low-water crossing (ford) that is immediately adjacent to the proposed mine site (Figure 1). Mr. Tracy proposes to use this ford for getting heavy equipment and vehicles to the mine. Should the Proposed Action be implemented, vehicles would enter the stream and travel 40 to 100 feet diagonally across the channel to reach the mine site. Because Sucker Creek is a large stream, this crossing is only useable during low stream flows typical of the late spring, summer and early fall months.

In his submitted plan of operations, Mr. Tracy proposes to use mechanized earthmoving equipment (an excavator, crawler dozer and dump trucks) to excavate the existing placer deposit. The placer terrace consists of previously worked cobble and stone-sized rubble and smaller-sized rock and soil materials left from past placer mining efforts in the middle and later 1800’s and early 1900’s. Gold would be separated from its substrate using a suction dredge floating in a dug pond on the mine site. Mine operations would occur in two phases, with “phase 1” including the activity area that is northwest of and surrounding Cedar Gulch. “Phase 2” would include the activity area southeast of Cedar gulch.

Alternative 2, the Forest Service’s modification of the Proposed Action, includes a number of specifications, requirements and changes to proposed operations that are intended to minimize adverse environmental impacts to National Forest System surface resources. One of the primary alterations to the Proposed Action specifies a minimum of use for the Sucker Creek ford and use would occur only early in mine site development. Instead of using the ford continually for the entire duration of mining operations, a temporary bridge would be constructed to provide needed access to the mine site. A more detailed description of the Forest Service’s modification of the Proposed Action (Alternative 2), as well as the Proposed Action (Alternative 1) itself, is available in the Environmental Impact Statement (EIS) for this project.

D. CURRENT HYDROLOGIC CONDITIONS AND PROCESSES

1. Channel Morphology

The Sucker Creek watershed is located near the geographic center of the Klamath Mountains geologic province. Here, steep slopes, narrow canyon bottoms, and incised streams are products of glacial processes and of geologically recent and possibly continuing regional uplift. Nearly two million years of intermittent glaciation dramatically changed the landscape. At times, precipitation was perhaps several times as great as that of present, and rates of surface erosion and land sliding increased. Glaciation denuded the higher elevations of soil, exposing the rock ridges and peaks along the eastern edge of the watershed (USDA FS 1995, 1998). Consequently, headwater reaches of Sucker Creek have gentler stream gradients and broader canyon bottoms than the narrow, incised middle reaches that are characteristic adjacent to the proposed mine.

Rivers and streams can be classified into general types by organizing stream feature data into discreet combinations that typically occur together. The Rosgen classification scheme utilizes major stream categories identified as Aa-G, as shown in Figure 2. The Rosgen method outlines criteria for nine distinct Stream Types that are based on landscape morphology and stream reach characteristics (Rosgen 1996). For each stream type, a “most frequent range” of values is given for morphological descriptions, such as width-depth ratio (Rosgen 1996).
As determined from topographic maps and field observations, Figure 3 displays the longitudinal profile for the entire length of Sucker Creek as well as some selected characteristics of channel morphology for two stream segments. For comparison, Rosgen channel classifications and width to depth ratios are presented for the one segment of Sucker Creek that includes the mine site and for a segment downstream of the national forest boundary.

More specifically for the Sucker Creek reach that is next to the proposed mine site, and based on channel inventory data collected there, the channel adjacent to the proposed mine site is classified as a transport reach with a stream gradient of 4%. The channel is typed as Rosgen B2, boulder/cobble substrate, which is moderately entrenched and confined. The channel is in good condition and streambanks appear relatively stable with a high rock content.
The Sucker Creek streambank adjacent to the mine site that is perhaps most susceptible to flood impacts is located just upstream of the Cedar Gulch/Sucker Creek confluence. Here, Sucker Creek makes a sharp bend northward and this abrupt turn of the stream channel makes the outside bank susceptible to undercutting, bank sloughing and bank erosion during large flood events. Moreover, the adjacent alluvial terrace in this area is elevated only a few feet above Sucker Creek and is unevenly vegetated with hardwood trees and shrubs. This bend area appears to have experienced substantial erosion during the 1964 and 1997 storms (Figure 4).

**Figure 4. Outside river bend upstream of the Cedar Gulch confluence and adjacent to the mine site. Woody debris is piled here from past high flows.**

Cedar Gulch has a watershed area of approximately ½ square miles and its headwaters originate on the north side of Number Eight Peak (Map 2). More than a century ago, before the site was originally mined, the Cedar Gulch channel alignment across the alluvial terrace was likely located differently from the channel alignment today. Historical hydraulic mining probably relocated the Cedar Gulch channel on the terrace and the new alignment may be more linear and shorter than the natural alignment preceding mining.

The Cedar Gulch channel has since stabilized morphologically and is a Rosgen A3 step pool system with a well-vegetated riparian area. Upland portions of the Cedar Gulch channel are located in young conifer plantations that have established since clearcut harvesting. It should be noted that the alignment of Cedar Gulch at its confluence with Sucker Creek is not accurately depicted on Map 2 (which is based on the Oregon Caves 7.5’ USGS topographic quadrangle). Figure 1, above, more accurately shows the alignment of Cedar Gulch across the placer terrace and accurately displays the Cedar Gulch confluence with Sucker Creek.
The smaller un-named creek just east of Cedar Gulch drains a watershed of much less area. This un-named creek has a very indistinct channel across the alluvial terrace but most water from the drainage area merges with Sucker Creek at a discrete confluence that is shown on Figure 1.

2. Floodplains and Wet Areas

River deposits along lower Sucker Creek range from 10 feet to more than 100 feet deep and bedrock is generally not exposed in the stream beds. In places, floodplain terraces near the mine are inundated more-or-less annually along Sucker Creek but other terrace deposits (typically influenced by past mining) are many feet thick and so the terrace surfaces are perched above normal flood flow levels. Because of the relative confinement of Sucker Creek by these elevated alluvial terraces, there are low levels of large wood, low pool numbers and depths, and poor floodplain development and side channel habitat in the vicinity of the mine activity area.

With regard to the un-named creek, which is located in the phase 2 portion of the mine activity area, an indistinct channel and coarse, rocky substrate materials allows water to spread across the terrace, seep through alluvial aggregates and to form shallow pools in terrain depressions. Thus, the ground in the area around the un-named creek is more generally saturated and has more visible standing water than elsewhere in the mine activity area.
A determination will be made by the Army Corps of Engineers (COE), between the Draft and Final versions of the EIS, as to whether the wet area adjacent to the un-named creek is a jurisdictional wetland. If the COE determines the wet area (in the phase 2 portion of the mine activity area) is a jurisdictional wetland, they may impose mitigation or restoration requirements.

3. Stream Temperature

Changes in stream water temperature are most likely to be caused by changes in riparian vegetation and sediment delivery processes. Though much less likely to be significant under current forest practices, changes in runoff timing and water yield can also affect water temperature.

Stream temperature is affected by many variables. Energy exchange may involve solar radiation, long wave radiation, evaporative heat transfer, convective heat transfer, conduction, and advection (Lee 1980; Beschta 1984). With the exception of solar radiation, which only delivers heat energy, these processes are capable of both introducing and removing heat from a stream. Solar radiation is the most important radiant energy source for the stream heating during the daytime (Brown, 1983; Beschta, 1997). Reduced riparian vegetation (i.e., shade) can increase solar radiation and stream temperature. Current riparian forest conditions along Sucker Creek are good insofar as the shading provided for the Sucker Creek and Cedar Gulch channel. Figure 5 shows current forest stand development and the level of shading currently available at the proposed mine site.

Figure 5. The left photograph shows the riparian forest adjacent to Sucker Creek as seen from the stream channel. The right photograph shows forest conditions in the northwest portion of the proposed mine site where cobbles and stones predominate from past mining.

Stream temperature is protected under the Clean Water Act and State Water Quality Standards. On March 1, 2004, new water temperature standards were adopted by the State of Oregon. Water Temperature Standards are found in ORA, Chapter 340, Division 041, Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon, 340-041-0028, Temperature. The temperature policy of the Commission is to protect aquatic warming and cooling caused by anthropogenic activities.
At sites downstream from the proposed mine site, stream water temperatures have been elevated and have exceeded standards on Lower Sucker Creek between June and September. These excessive water temperatures have been measured from the mouth of Sucker Creek upstream to the confluence with Grayback creek for five years (1993-1997) of record (Blanchard et al. 1998, p. 6). As of 1998, the 303(d) list approved by the Environmental Protection Agency modified the temperature listing for Sucker Creek to indicate that the upstream limit for temperature ends at Grayback Creek. Thus, the water quality limited status for stream temperature applies to Sucker Creek below the national forest boundary.

A Water Quality Management Plan (WQMP) was completed for the national forest portion of Sucker Creek and for all of Grayback Creek (Blanchard et al. 1998). In this plan, the Oregon Department of Environmental Quality established a Total Daily Maximum Loading (TMDL) for stream temperature. In 2000, a Water Quality Management Plan and TMDL was completed for the remaining BLM and private lands. Both plans developed a strategy for maintaining existing stream temperature and future recovery through active and passive restoration of stream shade. Based on the WQMP and TMDL, Sucker Creek was removed from the 303(d) list in 2000.

At the mine site, existing stream shade percentages for both Sucker Creek and Cedar Gulch Creek were estimated using the SHADOW stream shade model created by Park (1993). The values estimated are:

- Sucker Creek = 52%
- Cedar Gulch = 97%

I also measured stream shade in the field along Cedar Gulch on May 25, 2005 (at the mine site) and calculated canopy shading to be 95%.

Monitoring of stream temperature for both Sucker Creek and Cedar Gulch was conducted for the summer of 2005 for the time periods of May 27 to August 30. The results of that monitoring are displayed in Table 2 and Figures 6 and 7, below.

**Table 2. Seven-day average high stream temperature, as measured at two points in Sucker Creek and Cedar Gulch.**

<table>
<thead>
<tr>
<th>Site Location</th>
<th>7 day average high (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cedar Gulch above Tracy</td>
<td>55.5</td>
</tr>
<tr>
<td>Cedar Gulch at the Mouth</td>
<td>56.4</td>
</tr>
<tr>
<td>Sucker Creek above Tracy</td>
<td>61.2</td>
</tr>
<tr>
<td>Sucker Creek below Tracy</td>
<td>61.5</td>
</tr>
</tbody>
</table>
Figure 6. Cedar Gulch at mouth - Daily High and Low Summer Stream Temperatures

May 26 - August 30

Temperature in Degrees F

7 day average high = 56.4 on August 3

Figure 7. Sucker Creek below Tracy Placer - Daily High and Low Summer Stream Temperatures

May 27 - August 30

Temperature in Degrees F

7 day average high = 61.5 on August 3, 2005
4. Water Clarity

Turbidity, or the loss of water clarity, is due to the presence of suspended particles of silt and clay, but other materials such as finely divide organic matter can contribute to the loss of water clarity. Turbid water is a common, natural result of high stream flows during the wet seasons of the year (typically late fall, winter and spring) but is seldom present under natural conditions during low stream flows. Soil disturbance from management activities can cause sediment to be delivered to a stream. Sediment delivered to a stream most often is comprised of both suspended sediment (silt and clays) and coarser materials (sand and gravels) that are transported as bedload. Most suspended sediments that affect water clarity are usually transported through the stream system during flood flows.

There is no monitoring data available for turbidity in Sucker Creek at the mine site. Visual observations from summer site visits by me and Hydrological Technician Howard Jubas found the water clarity in Sucker Creek and adjacent tributaries to be high. During the large winter storm of 1997, when multiple soil mantle failures occurred from roads and hillslopes in Sucker Creek, water clarity at the mine site was very low. For the years following 1997, during seasonal storms, water clarity remains high.

5. Stream Flow

Low flows vary naturally with the amount of total precipitation, whether it occurs as rain or snow, and when in the year it occurs. Most precipitation in the affected watershed falls during the winter months. This combines with transmissive soils and little elevation in the snow zone to produce low summer flows. Most hillslopes have thin soils that store little water. Fractures and faults in bedrock carry groundwater that feeds numerous seeps and springs.

Comparison of total precipitation and April snowpack to total water yield and low flow shows that in years of low total precipitation but high snowpack (1949, 1969, and 1985), the total water yield was low but the low flows were moderate to high (stream flow and precipitation records). Activities that increase peak flows may have the effect of decreasing low flows, by delivering more water to streams closer in time to the precipitation event and leaving less water for base flow.

The loss of water through infiltration into the alluvium in the “losing” portion of Sucker Creek greatly diminishes flows from Nelson Creek to the mouth. The pre-settlement condition of the stream may have included periods of negligible flow during the summer months, in years of little snowpack and low spring and summer precipitation.

On the portion of stream above Little Grayback Creek, 7-day low flows over the period of record (1942 to 1990) have varied from 13 cubic feet per second (cfs) in 1975 to 35 cfs in 1983. The 7Q10 (the seven-day average flow that occurs at a ten-year return interval) for the old gage site 1942-1965 was 24 cfs; for the current site 16 cfs.

Changes in channel morphology, such as aggradation, may change the amount of water available for fish habitat even if the amount of flow at the gage remains constant. Below Little Grayback Creek, water withdrawal has the greatest effect on low flows. Water rights were issued on Sucker Creek and its tributaries from 1853 to 1934, when a State Engineer withdrew the stream from further rights because of insufficient flow.
As of 1994, there are consumptive water rights for 47 cfs on Sucker Creek and 3 cfs on tributaries. As the flows decrease through the summer, water use is cut back to “prior rights” or the earliest dated rights. The cutoff is usually in the 1860s, with extreme dry years in the 1850s and extreme wet years in the 1870s (Josephine County Watermaster’s Office). Monthly reports for the Assistant Watermaster in 1924 state that water use on Sucker Creek was cut back to the single oldest right in July, and by the end of August there was “too little water to administer.”

In 1994, the cutoff date was 1865 - water rights dated more recently could not be used during the driest part of the summer. This would reduce the allowed withdrawal from a total of 50 cfs to 15 cfs. There is no record of how much of this legal limit is actually available in the stream, or how much is actually withdrawn. Observation of irrigation patterns in nearby drainages (Williams Cr.) found that because of variation in users’ irrigation patterns, actual withdrawals at any one time were about 30% less than the total legal limit (Pierce 1994).

Some of the water withdrawn for irrigation returns to the stream channel, either overland or subsurface. The quantity of this return flow has not been measured. From the rise in water table as measured in wells when the irrigation season begins, likely most excess irrigation water seeps into the subsurface aquifer.

The proposed mine site is located 8 miles above the Sucker Creek stream gage (#14375100). The drainage area above the mine site is 31.5 square miles. The following flows were estimated using the stream gage data adjusted to the mining site drainage area.

| Table 3. Average Month Flows at the Proposed Mine Site – Sucker Creek |
|--------------------------|------------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| JAN (CFS) | FEB (CFS) | MAR (CFS) | APR (CFS) | MAY (CFS) | JUN (CFS) | JULY (CFS) | AUG (CFS) | SEPT (CFS) | OCT (CFS) | NOV (CFS) | DEC (CFS) |
| 178 | 163 | 158 | 128 | 116 | 60 | 25 | 14 | 13 | 75 | 134 |

A low flow stream measurement was taken on September 6, 2005 on Sucker Creek at the mining site and found to be 17.6 cfs.

| Table 4. Storm Flows (Q) for various return intervals at the Proposed Mine Site – Sucker Creek |
|--------------------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Q2 (CFS) | Q5 (CFS) | Q10 (CFS) | Q25 (CFS) | Q50 (CFS) | Q100 (CFS) |
| 977 | 1613 | 1968 | 2335 | 2553 | * |

*Insufficient period of record to determine

Estimated flows in Cedar Gulch Creek range from an estimated monthly average of 4 cfs in January to 0.3 cfs in August. Two flow measurements were taken on Cedar Gulch on May 26, 2005 and September 6, 2005 and found to be 1.52 cfs and 0.31 cfs respectively.
6. Water Chemistry

**Dissolved Oxygen DO:** Dissolved oxygen concentration refers to the amount of oxygen available in water. Dissolved oxygen is important for the viability of fish and other aquatic life and for the breakdown of organic material. Dissolved oxygen concentrations are inversely related to water temperature, such that when water temperatures increase, oxygen concentrations decrease (USDI 1998).

High concentrations of dissolved oxygen are needed to benefit aquatic species. Low dissolved oxygen can stress aquatic species and lower resistance to environmental variables. Low concentrations can also lead to changes in water and sediment chemistry. Sucker Creek is not listed as water quality limited with respect to dissolved oxygen.

**Acidity/Basicity and Conductivity:** Acidity/basicity and conductivity are not limiting factors in this watershed. Acidity/basicity is measured by pH and values in Sucker Creek ranged from pH 7.7 (basic) at the Lower Holland Loop Bridge to pH 8.5 (slightly more basic) in Upper Sucker Creek and Limestone Creek (USDA Forest Service 1996). In summer 1994, conductivities of 100-110 micromhos were measured in various parts of the watershed.

There is no expectation that water chemistry would be altered by proposed mining operations and so no impacts analysis is needed for this parameter of hydrologic function.

E. AQUATIC CONSERVATION STRATEGY

1. Components of the Aquatic Conservation Strategy

An integral part of the Northwest Forest Plan is the Aquatic Conservation Strategy (ACS). According to the Northwest Forest Plan, the ACS was “developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The strategy would protect salmon and steelhead habitat on Federal lands managed by the Forest Service and Bureau of Land Management within the range of Pacific Ocean anadromy [USDA Forest Service and USDI Bureau of Land Management 1994, page B-9].”

The four primary components of the ACS are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. The four components are Riparian Reserves, Key Watersheds, Watershed Analysis and Watershed Restoration.

**Riparian Reserves** (RR) are established as a component of the Aquatic Conservation Strategy, designed primarily to restore and maintain the health of aquatic systems and their dependent species. Riparian Reserves also help to maintain riparian structures and functions and conserve habitat for organisms dependent on the transition zone between riparian and upland areas.

Riparian Reserves include lands along all streams, lakes, ponds, wetlands, unstable areas, and potentially unstable areas that are subject to special Standards and Guidelines designed to conserve aquatic and riparian-dependent species. Standards and Guidelines apply to activities in Riparian Reserves that may otherwise retard or prevent attainment of ACS objectives, as defined in the Northwest Forest Plan.
Widths for Riparian Reserves necessary to ensure ACS objectives for different waterbodies are established based on ecological and geomorphic factors. Widths are typically one site potential tree height (assumed to be 175 feet for this project) along each side of stream channels. Widths are twice this distance along fish-bearing streams. These widths are designed to provide a high level of protection to fish and riparian habitats.

**Key Watershed** designation is an additional component of the ACS that is applied to watersheds that contain at-risk fish species or anadromous stocks and that provide high quality water and fish habitat. The Sucker Creek drainage is defined as a Key Watershed as defined by the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994).

**Watershed Analysis** is required in Key Watersheds prior to determining how proposed land management activities meet ACS objectives. The Sucker Creek basin has been analyzed by a Watershed Analysis (USDA Forest Service 1996) which has been used during the analysis of this proposal.

A **Watershed Restoration** plan was recently completed for Sucker Creek (USDA Forest Service 2006). This watershed has been ranked as the Forest’s second highest of three priority watersheds (Coquille River is first and Applegate River is third). Aquatic resource specialists evaluated the Forest’s watersheds based on the following criteria:

- Key Watershed Designation
- High Erosion Potential
- Stream Crossings and Road Density in High Erosion Areas
- Depositional Reaches and Sensitivity to Disturbance
- Completed Water Quality Restoration Plan
- Miles of Coho Salmon within the Watersheds
- Total Number of Anadromous Species within the Watersheds

Channels needing large wood may be immediately aided by mechanical placement of large wood; however, reestablishment of large wood recruitment from riparian forests will require thinning and time for managed stands to grow trees of suitable size. For areas with Port-Orford-cedar stands, targeted management is required to contain the spread of disease and establish resistant strains to ensure that this riparian component endures.

Restoration projects described by this plan include large wood placement, streambank stabilization/revegetation, side channel habitat development, riparian planting, riparian thinning, culvert replacement, road crossing stabilization, road decommissioning and subsoiling, slope stabilization, and Port-Orford-cedar disease treatment.

Most of the projects described have a recovery timeline of up to 10 years. Projects that address riparian thinning may require 60 years for full recovery to mature forest conditions. According to the Restoration Plan, “Current placer mining operations are generally small in scale. Stream damage from small placer activities is negligible compared with legacy impacts from large historical placer mining” (USDA Forest Service 2006).
2. Consistency with the Aquatic Conservation Strategy


As a result of PCFFA IV, the Forest Service must now assess project consistency with the nine ACS objectives as was done prior to the 2004 ACS amendment. New project NEPA decisions must be consistent with the wording regarding ACS consistency, including consistency with the nine ACS objectives, as ACS consistency is described in the 1994 Northwest Forest Plan on page B-10. In making the ACS consistency finding, and to be guided by PCFFA II, the decision maker must:

- Review projects against the ACS objectives at the project or site scale, rather than only at the watershed scale. This review can be accomplished through cumulative effects analyses (e.g., by evaluating the incremental effect of the project added to the existing condition, and the effects of other present and reasonably foreseeable actions) on watershed conditions.
- Evaluate the immediate (short-term) impacts, as well as long-term impacts of an action.
- Provide a description of the existing watershed condition, including the important physical and biological components of the 5th field watershed.
- Provide written evidence that the decision maker considered relevant findings of watershed analysis.

The Northwest Forest Plan requires consistency with nine ACS Objectives. Below, is a summation of the assessed consistency with the elements and components of the Objectives. Specific rationale may be additionally found in other analysis documented under other resources (e.g., Soils, Fisheries, Wildlife, Botany, etc.).

Aquatic Conservation Strategy Objectives

This section focuses on evaluation for consistency with the nine Aquatic Conservation Strategy Objectives in regard to the alternatives considered in detail. In addition, consistency findings are provided for the specific Standards and Guidelines associated with Riparian Reserves (Northwest Forest Plan, C-33 & 34) and the Standards and Guidelines associated with Key Watersheds (Northwest Forest Plan, B-19).

Complying with the Aquatic Conservation Strategy objectives means that an agency must manage the riparian-dependent resources to maintain the existing condition or implement actions to restore conditions. The baseline from which to assess maintaining or restoring the condition is developed through a Watershed Analysis. Improvement relates to restoring biological and physical processes within their ranges of natural variability.

The Standards and Guidelines are designed to focus the review of proposed and certain existing projects to determine compatibility with the Aquatic Conservation Strategy objectives. The Standards and Guidelines focus on "meeting" and "not preventing attainment" of Aquatic Conservation Strategy objectives. The intent is to ensure that a decision maker must find that the proposed management activity is consistent with the Aquatic Conservation Strategy objectives. The decision maker will use the results of this review and the Watershed Analysis to support the finding.
In order to make the finding that a project or management action "meets" or "does not prevent attainment" of the Aquatic Conservation Strategy objectives, the analysis must include a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given watershed, and how the proposed project or management action maintains the existing condition or moves it within the range of natural variability.

For Tracy Placer, existing conditions are primarily contained in the Watershed Analysis, incorporated by reference, as well as the Environmental Impact Statement. The Northwest Forest Plan requires consistency with ACS with specific reference to nine ACS Objectives. Below is a summation of the evaluation regarding consistency with the elements and components of the Objectives.

**ACS Objective 1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.**

This project would not maintain and not restore the distribution, diversity or complexity of vegetation, terrestrial habitats or aquatic habitats in the Upper Sucker Creek drainage because the project leaves the area in a disturbed condition and decades would be needed to restore it to existing condition. The scale of streamside disturbance proposed is smaller than most natural disturbance events (such as slope failures, fires, windthrow and floods) that typically and repetitively occur in the drainage.

Both action alternatives would result in mining/excavation of a placer terrace located within a riparian area. The excavation process would remove all trees and leave the area treeless for a time. Historically, the mine activity area as well as much of the length of Sucker Creek was mined in the latter 1800’s and early 1900’s and so is currently not in a natural condition. Nevertheless, a mature conifer stand re-established on the site and so demonstrates the recovery of vegetation following disturbance.

As well, both action alternatives provide some level of protection for streamside vegetation growing on the banks of Sucker Creek. However, Cedar Gulch and an unnamed tributary creek would be completely excavated during the mining process. The action alternatives will not maintain and restore distribution, diversity nor complexity of watershed and landscape-scale features.

**ACS Objective 2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.**

No activities or results of the Proposed Action will sever existing linkages (movement conduits) between watersheds or permanently obstruct existing connections in the drainage network. While all or most existing vegetation will be removed inside the mine activity area and in slash disposal areas, the small size of the stand perforations that result would not hinder dispersal of flora, fauna and water across the terrestrial landscape.
As well, while temporary diversion of water or channel reconfiguration in Cedar Gulch and the un-named tributary creek may temporarily disrupt movement of aquatic flora and fauna for short periods, restored channel segments are anticipated to maintain lateral connectivity locally. Finally, none of the activities or results proposed will chemically or physically impede routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species, especially threatened coho salmon.

**ACS Objective 3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.**

The Proposed Action leaves a single row of trees on Sucker Creek. The loss of root strength will compromise the integrity of the streambank during flood flows. Alternate 2 increases the streambank protection buffer so that trees and associated root strength is not compromised. Cedar Gulch and the un-named creek are inside the mine activity area for both action alternatives. This will completely changed the physical integrity of both streams by changing the banks and bottom configuration. Following excavation, though, channel banks and cross-sections would be reconstructed. If the reconstructed channel bottom consists of highly permeability mining tailing the water could flow subsurface. Alternative 2 proposes to improve the alignment of Cedar Gulch by moving the confluence with Suck Creek downstream of its current location. This was most likely the natural streams alignment prior to mining activities at this site.

The action alternatives will not maintain and restore the physical integrity of the aquatic system, shorelines, banks and bottom configurations.

**ACS Objective 4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.**

Alternative 1 could fail to achieve Objective 4 because the Proposed Action threatens a violation of Clean Water Act quality standards by potentially increasing water temperatures downstream in Sucker Creek. Any potential increase in water temperatures may detrimentally affect some aquatic life in downstream ecosystems. Alternative 2, on the other hand, is designed to maintain and restore suitable downstream water temperatures in Sucker Creek because existing stream shade would not be altered and streamside vegetation would continue to grow larger.

Both action alternatives propose a gold processing pond constructed in the existing cobble boulder mining tailings. The large size of this material creates open spaces between the piled cobble boulders making it highly permeable to subsurface flow. It is likely that the muddy water in the pond could flow subsurface from the pond and discharge into Sucker Creek impacting water quality. Alternative 2 adds the requirement of sealing the pond to prevent subsurface flow.

The Proposed Action will not maintain the water quality of Sucker Creek.
Alternative 2 with the added protection will maintain but not improve the water quality of Sucker Creek.

**ACS Objective 5. Maintain and restore the sediment regime under which aquatic ecosystems evolved.** Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

As described in ACS 3 and 4 the Proposed Action has the potential to increase the sediment regime of Sucker Creek from the failure of a compromised streambank on Sucker Creek and the subsurface flow of muddy pond water into Sucker Creek.

Alternative 2 maintains the sediment regime including timing, volume, rate, of sediment input, storage and transport by increasing protection to the streambank of Sucker Creek and the sealing of the mining pond.

**ACS Objective 6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.** The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Neither action alternative under consideration is predicted to cause a change to existing in-stream base or peak flows within Sucker Creek. Vegetation cleared as part of the mine project would not be sufficient to create any measurable change in water volumes/flows (from anthropogenic tree removal) within any of the three stream watersheds affected (please see Effects on Stream Flow, below).

As an element of each action alternative, however, temporary partial diversion of available in-stream flow within Cedar Gulch would occur periodically to supply water to the proposed holding pond. This diversion of native water flows would be allocated through an existing (or obtained) water right associated with the claim. Such appropriation and beneficial use of available water flows is a State responsibility and authority that is not in the jurisdictional purview of the Forest Service, unless the water right is assigned to the United States.

Water rights associated with mining claims allow for water withdrawal during mine operations. Indeed, water employed for mining is classified as non-consumptive since the primary flow loss is evaporation (and diversion from the native channel during use) but most diverted water returns to the watershed system through seepage. The Oregon Department of Environmental Quality issues a General Permit #600 to authorize water withdrawals for small scale mine operations processing no more than 10,000 cubic yards of material per year. “Off-stream placer mining is allowed under this general permit as long as all wastewater is disposed of by evaporation and/or seepage with no readily traceable discharge to groundwater or surface water [Blanchard et al. 1998, p. 22].”

Cedar Gulch and the un-named creek are inside the mine activity area for both action alternatives. Following excavation the channel banks and cross-sections would be reconstructed. If the reconstructed channel bottom consists of highly permeability mining tailing the water could flow subsurface through the mined area. If this occurs the flow of Cedar Gulch and the un-named creek will not be maintained.
ACS Objective 7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The action alternatives will mine through a wet area (pending a wetland determination). The post mining condition of this area will consist of piled mining tailings. The highly permeable nature of mining tailing will not maintain surface water associated with a wet area or wetland. The action alternatives will not maintain the water table elevation in meadows and wetlands.

The action alternatives maintain the timing, variability, and duration of floodplain inundation.

ACS Objective 8. Maintain and restore the species composition and structural diversity of plant communities in Riparian Reserves and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Species composition and structural diversity of plant communities included in the Sucker Creek Riparian Reserve would not be maintained by the action alternatives. Vegetation would be completely cleared from as much as eight acres, should implementation of the mine project occur. Establishment of a new forest stand following reclamation will occur over several decades. However the wet area feature will not recover and the unique plants dependent on surface water table conditions will not be re-established.

The Proposed Action alternative removes trees that provide both bank stability and future large wood supplies. Sucker Creek is deficit of instream large wood (USDA Forest Service, 1995). Alternative 2 adds a protection buffer to Sucker Creek that will maintain bank stability and supply of future coarse woody debris.

ACS Objective 9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species would not be maintained at the site scale with the implementation of either action alternative unless mitigation occurred. The proposed dewatering, diverting and mining through Cedar Gulch has a high probability of extirpating the local cutthroat trout subpopulation in this stream. The action alternatives do not meet ACE Objective 9 at the site scale without proper mitigation. Mitigation could include relocating the majority of cutthroat trout in Cedar Gulch above the barrier falls and away from the mining activity.

Alternative Compliance with the Aquatic Conservation Strategy Objectives

The Proposed Action alternative prevents attainment of the Aquatic Conservation Strategy by not maintaining 8 ACS Objectives (1, 3, 4, 5, 6, 7, 8, & 9).
Alternative 2 prevents attainment of the Aquatic Conservation Strategy by not maintaining 5 ACS Objectives (1, 3, 6, 7, & 9).

Alternative 2 - No Action does not prevent attainment of the Aquatic Conservation Strategy by maintaining all 9 ACS Objectives

3. Consistency with RR Standards and Guidelines for Minerals Management

The following minerals management standards from the Northwest Forest Plan are applicable to the proposed Tracy Placer Mining Project.

MM-1. Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy objectives.

A Plan of Operations is being required and terms and conditions to minimize surface resource impacts are being analyzed within the EIS.

MM-2. Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with Aquatic Conservation Strategy objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet roads management standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.

No construction of new structures, support facilities or permanent roads is proposed. An existing low-standard access road (#058) is already in place and would continue to be needed for ongoing mineral of land management activities. One temporary log-stringer bridge and approximately 200 feet of primitive access across mined tailings would be constructed as part of the Forest Service Alternative. The bridge would lessen in-stream effects caused by traffic fording Sucker Creek and would be removed after all operations are completed.

MM-3. Prohibit solid and sanitary waste facilities in Riparian Reserves. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Reserves exists, and releases can be prevented, and stability can be ensured, then:

a. analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.

b. locate and design the waste facilities using best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Reserves.
c. monitor waste and waste facilities after operations to ensure chemical and physical stability and to meet Aquatic Conservation Strategy objectives.

d. reclaim waste facilities after operations to ensure chemical and physical stability and to meet Aquatic Conservation Strategy objectives.

e. require reclamation bonds adequate to ensure long-term chemical and physical stability of mine waste facilities.

All waste rock would be native materials only (cobbles, gravels, sand, soil, etc.) and the remaining materials on site following mining would be identical in composition to the present placer deposit. No rock materials would be altered physically (crushed, heated, etc.) nor would addition or use of any chemicals occur on site during processing. Insofar as sanitary waste handling, all black and grey water generated by on-site residency would be held in a self-contained trailer tank or other sanitary vault and collected wastes would be disposed of periodically off-Forest.

MM-6. Include inspection and monitoring requirements in mineral plans, leases or permits. Evaluate the results of inspection and monitoring to effect the modification of mineral plans, leases and permits as needed to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

A Forest Service Minerals Administrator would be responsible for the inspection and monitoring of the operations and reclamation. Monitoring during inspections would include; cleanliness of equipment to insure invasive plants and POC objectives are met, compliance with Industrial Fire Precautions Level (IFPL), campground cleanliness and sanitation, diversion and ditch line integrity, water usage, pond seepage, integrity and location, fuel storage and spill plan compliance, and compliance with water quality laws and regulations. Inspections would occur regularly and routinely and at minimum; twice weekly during the first month of operations and twice monthly thereafter.

F. DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

1. Effects on Channel Morphology

Channel morphology is influenced by substrate materials and by the integrity and stability of streambanks. Streambank failure can result if the shear stress acting on the material exceeds the available shear strength of that material (Swanston 1974). Plant roots can help stabilize streambanks by anchoring a weak soil mass to fractures in bedrock, by crossing zones of weakness to more stable soil, and by providing long fibrous binders within a weak soil mass. Streambank instability can develop after tree cutting on a site where most of the soil strength is provided by the binding action of roots (Ziemer 1981). Indeed, riparian vegetation exerts a number of mechanical and hydrologic controls on streambank stability, which can affect the delivery of sediment to channels (Pollen 2007).
**ALTERNATIVE 1 (Proposed Action; Miners’ Proposal)**

Under the Proposed Action, leaving but a single row of trees on the streambank (and excavating aggregate materials to within 20 or so feet of Sucker Creek) would remove much of the root strength provided by other trees further from the stream channel. This vegetation removal close to Sucker Creek may weaken loosely consolidated streambanks and make them more vulnerable to undercutting, sloughing and collapse during flood flow events.

In particular, the outside bank along Sucker Creek near the confluence of Cedar Gulch would be the bank most susceptible to flood flow erosion of any bank section adjacent to the mine site. While an intact streambank 20 feet wide, as measured from the toe of the streambank, would be left (except for mining of the Cedar Gulch channel itself nearly to Sucker Creek), the hydraulic forces present during flood flows can more easily erode the bank as the stream current makes the bend from west to north. This bank is sparsely vegetated currently, though, so root strength may not be a substantial factor here in binding alluvial aggregates together.

Nonetheless, the streambank for 100 feet upstream of Cedar Gulch would be somewhat more vulnerable to failure during large storm events because of removal of riparian vegetation beyond 20 feet and due to excavations on the back side of the bank. Therefore, erosion and undercutting of this outside bank may induce some channel widening. However, channel alignment and overall bottom morphology would likely remain little changed, in large measure because of the bedrock buttresses in this reach. Sediment from any streambank erosion or undercutting that occurs would cause some pool filling just downstream but no cumulative or long-term detrimental sedimentation effects would be expected to occur in the downstream mainstem of Sucker Creek, or the East Fork Illinois River, because eroded materials are expected to be limited in quantity.

**ALTERNATIVE 2 - Forest Service Proposed Changes and Additions**

The Forest Service alternative would increase the width of the tree buffer (and streambank) along Sucker Creek so that nearly all existing shade is retained over the stream. In the vicinity of the old ford and downstream from there, the buffer width would be about 65 feet wide and so would retain many of the taller near-stream conifers growing next to the stream. Along the bank upstream of the un-named creek, hardwood trees and shrubs would be left in a buffer measuring approximately 45 feet wide. However, near the confluence of Cedar Gulch and upstream for 100 feet, intact bank width may be widened only nominally to 30 feet (a minimum width for streambank stability) to accommodate Mr. Tracy’s interest in mining this area.

For Alternative 2, as in Alternative 1, the outside bank along Sucker Creek near the confluence of Cedar Gulch would also be the bank most susceptible to flood flow erosion. The same circumstances of channel morphology and streambank structure described for Alternative 1 would be operating in Alternative 2, as well. However, the extra intact width of the streambank, 30 feet, would better resist hydraulic pressures at flood flows and would probably retain greater inherent strength from live roots. Therefore, the extra width would likely improve streambank stability somewhat and in turn the added stability may deter any shifting or widening of Sucker Creek in this channel bend. As in Alternative 1, no cumulative effects would be expected to occur to the downstream mainstem of Sucker Creek or the East Fork Illinois River.
**ALTERNATIVE 3 - No Action**

The No-Action Alternative would have no direct effects to channel morphology or streambank stability since there would be no mining activities. Natural alterations in channel morphology and processes would continue to occur.

**2. Effects on Floodplains and Wet Areas**

**ALTERNATIVE 1 and ALTERNATIVE 2**

Within the (phase 2) area proposed for mining in both action alternatives, an area of less than one acre is present where saturated soils and surface water occurs. This wet area is pending a wetland determination. The post mining condition of this area will consist of piled mining tailings. The highly permeable nature of mining tailing would not maintain surface water associated with a wet area or wetland.

Under both action alternatives, there would be no effects to active floodplains that are inundated more-or-less annually along lower Sucker Creek.

**ALTERNATIVE 3**

The No-Action Alternative would have no direct effects on floodplains or wetlands since there would be no mining activities. Natural processes would continue to occur.

**3. Effects on Stream Temperature**

Maintenance of vegetative shading is the primary mechanism for improving stream water temperatures in Sucker Creek. Stream shade that is provided by tree cover is critical to retaining low stream water temperatures. Summer stream temperatures would be expected to decline with increasing shade along the length of Sucker Creek, until vegetative canopy and shading reaches maximum extent. Conversely, less shade translates into higher stream water temperatures.

Overstory trees on the south bank of Sucker Creek are the primary plants providing summer shade to the stream channel. These existing streamside trees act as screens that moderate water temperature by intercepting incoming solar radiation. Trees adjacent to Sucker Creek consist predominately of tall conifers downstream of Cedar Gulch and predominately hardwoods upstream of Cedar Gulch.

Angular canopy density (ACD) is the measure of canopy closure as projected in a straight line from the stream surface to the sun. ACD measures the quality of the shadow the canopy provides as the angle of the sun changes throughout the day. Therefore, ACD is the quality of the shadow cast. ACD is expressed as a percent where “100%” is complete canopy closure blocking all direct solar radiation from reaching the stream surface.

**ALTERNATIVE 1**

For the miners’ proposal, a single row of trees would be maintained in the riparian area. Leaving a single row of trees would decrease the ACD by removing critical shade trees. The amount of
shade along Sucker Creek at the mine site, both as it exists and as predicted following mining, was estimated using the SHADOW stream shade model (Park 1993). The results are as follows:

<table>
<thead>
<tr>
<th>Shade Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing shade on Sucker Creek</td>
<td>52%</td>
</tr>
<tr>
<td>Shade on Sucker Creek after tree removal</td>
<td>14% to 25%</td>
</tr>
</tbody>
</table>

Therefore, leaving a single row of shade trees along Sucker Creek would result in a decline of between 27% and 38% of the existing stream shade. Consequently, the SHADOW stream shade model calculated a potential increase in water temperature up to 1 degree Fahrenheit in the 900 to 1000-foot stream section next to the mine. This temperature increase would also have a cumulative effect on downstream stream temperature. An increase in water temperature at any point along the stream translates into higher stream temperature at any point downstream unless a cooling input (colder water added or increased shade) reduces the temperature of the water.

For Sucker Creek, the established TMDL does not allow for an increase in solar loading (stream temperature). Because an increase in Sucker Creek water temperature is forecasted, and the temperature increase at the mine site would be carried downstream, Alternative 1 threatens a violation of the Clean Water Act with regard to stream temperature in Sucker Creek.

With regard to a possible water temperature increase in Sucker Creek, as linked to water temperatures in the two creeks flowing through the mine activity area, the following summarizes the potential for increasing water temperature by cutting trees along these creeks. Cedar Gulch, together with the un-named creek, provides less than 2% of stream flow to Sucker Creek and thus the water volume contributed by these creeks is small in relation to water volumes in Sucker Creek within this reach.

Currently, both Cedar Gulch and the un-named creek have ample shade. The existing stream shade measured on Cedar Gulch is 95% within the mine activity area. Shade provided over the un-named creek is likely at 90% or higher, during summer.

As proposed in both action alternatives, all vegetation would be removed along approximately 250 feet of Cedar Gulch and so shade would be reduced to 0% during the mining operation and for a period after mining. Similarly, shade would be reduced to 0% along 250 feet of the un-named creek during phase 2 of the mining operation. Despite the total loss of shade on these creeks, however, the distance of stream channel exposed to heating and the volume of water that may be heated are too small to measurably influence Sucker Creek temperatures during summer.

**ALTERNATIVE 2**

Under this alternative, leave strips of trees adjacent to Sucker Creek were calculated based on the critical shade tree distance needed to avoid any decline in shade on the stream. From a little north of the confluence of Cedar Gulch and thence downstream, the critical shade tree distance calculated is 66 feet for the predominantly taller conifer trees that grow in this section. Upstream of the un-named creek, 33 feet the critical shade tree distance needed along Sucker Creek in the stream section predominated by shorter hardwood trees. The Forest Service’s proposed buffer widths along Sucker Creek would maintain the calculated critical shade tree distances and so would not cause any decrease in stream shading. As a result, there would be no change in Sucker Creek water temperature in the channel adjacent to the mine site due to shade loss.
The ACD would not be decreased by removing shade trees behind the critical shade tree distances. Although vegetation removal beyond the critical distances could affect existing shade slightly, so long as the critical shading vegetation is maintained along a stream the impacts on temperature should be negligible. This is to say that as ACD increases, more solar radiation is blocked and effective shade is increased. However, at some point, increases in ACD provide negligible increases in stream shading. This is because a “tree behind a tree” does not provide additional shade where the trees in front (close to streams) are already providing stream shade.

As explained above for the Alternative 1, loss of tree shade along Cedar Gulch and the un-named creek would have no impact on Sucker Creek water temperature. Therefore, Alternative 2 would not increase Sucker Creek water temperature adjacent to the proposed mine site nor would there be any downstream cumulative effects to stream temperature in Sucker Creek.

**ALTERNATIVE 3**

The No-Action Alternative would have no direct effects on stream temperature since there would be no mining activities. The composition and character of forest stands adjacent to streams affecting temperature would not be altered.

**4. Effects on Water Clarity**

**ALTERNATIVE 1 and ALTERNATIVE 2**

Both action alternatives propose a gold processing pond constructed in the existing cobble/boulder mining tailings. The large size of this material creates open spaces between the piled cobbles and boulders making it highly permeable to subsurface flow. The subsurface flow of muddy gold processing water could reach and discharge into Sucker Creek.

Carlon's Gravel Pit, LLC, is an active gravel and placer gold mining operation located on private land (Figure 8). This mine area extends from the Cave Creek/Sucker Creek confluence downstream to the national forest boundary. Similar to the Tracy proposal, this placer mine is operating in an alluvial substrate. Also similar to the Tracy proposal, the Sucker Creek channel itself is not being mined or dredged at the Carlon site. Much of the Carlon mine area has been mined one or more times in the past but some excavations are unearthing areas that have not been mined previously. The terrace at the Tracy site differs in substrate composition from those materials observed at the Carlon site. The alluvial material within the Carlon mine site has a higher proportion of sands and gravels than the cobble and boulder-dominated substrate covering most of the Tracy site. The smaller nature of the material creates much smaller spaces between the particles making it less permeable to subsurface flow than the cobble/boulder tailings at the Tracy site.
During August 2007, a pit about 30 feet away from the edge of Sucker Creek was being excavated at the Carlon site. In the process of excavating this pit, water from Sucker Creek flowed subsurface reaching the pit and discharging into it. The water mixed with the fines in the pit turning the water mud brown. On the downstream end of the pond the muddy water flowed subsurface back to and discharging into Sucker Creek. This created a continuous link of subsurface flow of water from Sucker into the pond then muddy water flowing subsurface back into Sucker Creek. The turbid water turned the mainstem of Sucker Creek brown for a time with sediment-laden water. The Carlon’s used stockpiled fines near the pit to seal the pit wall stopping the subsurface flow of both water from Sucker Creek into the pit and then muddy pit water back into Sucker Creek. Turbidity in Sucker Creek lasted less than one day.

A similar event is expected at the Tracy mine site because the larger rock is more permeable to subsurface flow than the finer material found at the Carlon site. This will affect the water quality of Sucker Creek and have a cumulative affect on the downstream Sucker Creek and potentially the E.F. Illinois River. Within the Sucker Creek watershed, two other placer mining operations could be working at the same time the Tracy project is proposed to operate. Two or three mining operations on Sucker Creek increase the potential of cumulative effects to water quality.

Alternative 2 adds the requirement that an effective plan be developed to seal the pond to prevent subsurface flow of muddy water into Sucker Creek. This will meet water quality standards and prevent downstream cumulative effects.

A new upland source of sediment would be created within the mine site (see Soils Report), due to exposure of rocks and soil caused by excavation, piling of overburden and heavy equipment movement. In addition, sediment is likely to be generated from mine vehicle use of native surface roads because trucks and other machinery mechanically loosen and displace otherwise consolidated earth and/or rocks that compose the running surface. While both the mine and
access roads are potential sources for deliverable sediments, excavation and transport of overburden at the mine is the more probable activity that would simultaneously liberate and deliver fine soil to Sucker Creek.

Furthermore, sediment mobilization would be constrained to the area where mining is active at the time and sediment delivery to Sucker Creek is likely at only two entry points. Given the likelihood for erosion to produce some sediment-laden (muddy) water as a result of mine operations, even with use of erosion control measures added to Alternative 2, the direct impact to Sucker Creek would be small and limited to the mining area. Therefore, such short-term turbidity or transient deposition effects as may occur are judged to be negligibly harmful within the Sucker Creek drainage as a whole. Losses of water clarity or increases in the stream’s sediment budget are unlikely to be consequential.

In addition to general exposure of the mine site to erosion and runoff during the operating season, some sediment delivery to Sucker Creek is expected when excavation of the tributary creek channels takes place (Cedar Gulch and the un-named creek). Although the creeks would be diverted before digging into the existing channel, some sediment would certainly be entrained in the creek water during diversion. As well, channel excavation itself is also likely to deliver some muddy water to Sucker Creek. Finally, reconnection of the creek channels to Sucker Creek would produce another pulse of sediment and muddy water. As with sediment delivered from the mine site generally, such turbidity as may occur would clear within a matter of hours and sediments deposited would be flushed through the stream system during the next flood stage.

The last source of turbidity for the project is from vehicle traffic on the mine access (058) road, particularly where this road crosses streams by means of a ford (low-water crossing) At Mule Creek, the first stream encountered on the 058 road, trucks and equipment crossing the ford there would probably produce some fine sediment when driving over the stream. However, water in Mule Creek goes subsurface just after the ford, where a sizeable area of waste rock from old placer workings is too porous to support summer base flows at the surface. Because of this subsurface flow and the several-hundred-foot distance to Sucker Creek, the possibility for any turbid water reaching Sucker Creek seems unlikely. Likewise, the ford proposed to cross a small creek immediately southeast of the proposed bridge (in Alternative 2) is unlikely to create sediment-laden water that reaches Sucker Creek.

The existing Sucker Creek ford on the 058 road, though, which provides for crossing the stream adjacent to the mine site, would produce sediment directly within the mainstem. While this ford is proposed for limited use in Alternative 2, the ford would be used continually over the duration of the project (2 to 5 years) in Alternative 1. For each trip across Sucker Creek, sediment would be stirred up from the creek bottom and would be entrained by the water flow and transported downstream.

However, the ford across Sucker Creek is located where the streambed is predominately cobbles and boulders. Therefore, the relatively small amount of fines dislodged with each pass of a truck or heavy equipment through the creek would create only short-term turbidity that would be quickly dissipated by the current. For Alternative 2, of course, where a temporary log stringer bridge is proposed for crossing Sucker Creek, the amount of turbidity created by use of the Sucker Creek ford would be limited and would mostly occur in a single season. Installation and removal of the temporary bridge would also produce sediment, though.
**ALTERNATIVE 3**

The No-Action Alternative would have no direct effects on water clarity since there would be no mining activities. The composition and character of the site would not be altered.

**5. Effects on Stream Flow**

**ALTERNATIVE 1 and ALTERNATIVE 2**

With implementation of either Alternative 1 or Alternative 2, there would not be a discernable effect positively or negatively on stream base (summer) flows in Sucker Creek, Cedar Gulch or the un-named creek. Projected removal of vegetative cover (≤8 acres) would be insufficient to measurably alter existing interception, evapotranspiration or infiltration rates in these watersheds and so incident moisture that translates into surface and subsurface flows would remain unchanged. Similarly, removal of vegetation in either of the action alternatives would not be sufficient to influence flood (peak) flow in the three streams so no measurable change would occur to high flows in Sucker Creek, Cedar Gulch or the un-named creek. As a result, no changes to in-stream mobilization of bed particles or alteration of channel substrates are anticipated in any of the three streams because of alterations to peak flow created by the mine project.

For both action alternatives, Cedar Gulch would be partially diverted as needed to fill the pond proposed for conducting on-site gold separation. While water would be diverted periodically from Cedar Gulch into the holding pond, water volumes used to fill the pond would be miniscule in comparison to the total annual flow output of Cedar Gulch. Overall, as a proportion of the entire Sucker Creek drainage, the water flow of Cedar Gulch contributes less than 2 percent of total stream flow on an annual basis. Moreover, water diverted to the pond would reach Sucker Creek as intergravel seepage and so contribute to base flow after passing through the terrace substrate. The only complete loss of water from the system is likely to result from surface evaporation of water held in the pond.

Due to the coarse and porous nature of the terrace substrate, residual surface flow in summer within Cedar Gulch could be lost during water diversion as remaining water infiltrates into the alluvial terrace materials. Similarly, surface flow may be temporarily lost when Cedar Gulch is placed into a newly-constructed channel. In both situations, though, stream flow would reach Sucker Creek as intergravel flow. Eventually, too, fine sediment and organic material would collect in voids in the coarse surface thus sealing the channel and restoring surface flow. Any fine-sized material generated during the mining operation could be used to help seal the channel bottom when the channel is re-constructed. In the long term, with the re-construction of Cedar Gulch, the channel may support improved habitat conditions for fish in comparison to existing conditions.

**ALTERNATIVE 3**

The No Action Alternative would have no direct effects on stream flow since there would be no mining activities. The composition and character of the site would not be altered.
G. REFERENCES


