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Department of Fish and Game

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# Memorandum

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**Subject:** Preliminary Bedload Sediment Budget for Salinas and Estrella Rivers
Pehl Mine Conditional Use Permit, DRC2005-00027
Paso Robles, San Luis Obispo

This memorandum presents a summary of most recent efforts to evaluate in-sediment bedload replenishment and potential bedload sediment bypass at in-stream mines on the Salinas and Estrella Rivers in the Paso Robles area. Although this recent work is part of an ongoing evaluation of the potential environmental impacts at the proposed Pankey mine and the framework for an area-wide adaptive management plan, it is relevant to the proposed Pehl mine because it attempts to establish a regional in-stream sediment budget for the mines in the area. Reference is made to my August 21, 2008 memorandum on Pehl mine for a full discussion of my comments and recommendations. The information in this memorandum is still being evaluated as part of the Pankey mine application, and details are subject to revision. The conclusions and recommendations in this memorandum are my own and do not reflect the opinions of the County staff or Pankey mine's consultants. I'm providing this preliminary opinion because the Pehl mine is before the County Board of Supervisors and the information supports my previous



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opinion that the current and proposed permits for in-stream mining in the Paso Robles area have over allocated the available resource. This conclusion of over allocation of the bedload resource should stand regardless of minor changes that will likely occur in the sediment budget as we finalize
the environmental evaluation of Pankey mine.

For the purpose of this long-term bedload sediment budget, the upper Salinas River near Paso Robles has been subdivided into five subreaches, Figure 1. The boundaries of these subreaches are somewhat arbitrary, but are intended to capture the potential impacts of the current and proposed in-stream mines and the introduction of additional sediment from major tributaries. The boundaries for the two most downstream these subreaches are defined where the Huerhuero Creek and Estrella River tributaries discharge into the Salinas River. This way the impact of a large additional sediment load can be evaluated. Table 1 describes the five subreaches and lists the total drainage area upstream from the downstream end of the subreach. The Salinas River drainage area for subreach S-1 includes 52 square miles of Vineyard Creek, a tributary that discharges below the confluence of the Estrella River. Table 2 lists the mines in the upper Salinas River area and provides the location on the Salinas River, the permitted extraction volume, whether the mine is in-stream, and the status of the mine.

This attempt to create a technical foundation for an area-wide in-stream mining adaptive management plan is based on the concept that the amount of sediment being delivered to the Salinas and Estrella Rivers is related to the total upstream drainage area. Subreach bedload sediment budgets are calculated by subtracting the cumulative permitted extraction volume of all the in-stream mines above each subreach from the estimated volume of bedload being delivered to the Salinas River at that subreach. The sediment balance is calculated at the downstream boundary of the subreach. In other words, subtracting the potential sediment that can be extracted under the current permits from the average sediment delivered results in the average amount of sediment being bypassed. It should be noted that this bedload sediment budget is for an "average" sediment yield that is developed from the measurement of sediment deposited in the Santa Margarita Reservoir over a long period of time, at least 34 years. Most of this sediment is delivered to the river system during rare, large storm events. Year-to-year sediment delivered and mobilized in the river can be expected to be much less than the "average" values used for this budget. Thus, this type of "average" sediment budget should not be used as an indicator of potential year-to-year impacts to the river system, but used to address the feasibility of in-stream mining over the long-term.

In calculating an in-stream bedload sediment budget, those mines that are off-stream or closed are not included. In addition, two mines, SMARA #91-004-0027 and #91-0040-0052 were not included in the sediment budget. Even though these mines are within the upper Salinas River drainage, their distance from the main stem mines suggests that they be excluded from this calculation. This removes from the sediment balance a permitted extraction volume of 100,000 cubic yards per year, which is a significant volume. To adjust for this, the sediment budget removes the drainage area from each of these mines as a sediment source. Because the estimated bedload yielded upstream of each of these mines is less than the permitted annual extraction, the mines can effectively take 100 percent the bedload being delivered. Thus, removal of their areas from the sediment budget effectively removes their area-wide impact. The site-specific impact of extracting more than replenishment however is not addressed, and the County may wish to evaluate this impact as part of the final area-wide adaptive management plan.

A subject of much discussion in developing a bedload sediment budget has been how to estimate the amount of bedload delivered to the river. The sediment budget has to extrapolated sedimentation rate from adjacent areas because we lack actual long-term measurements of the amount of sediment being transported in the upper Salinas or Estrella Rivers. The closest and likely most reliable is the measurement of sedimentation rate comes from studies on the sediment filling in the Santa Margarita Reservoir. Although we are actively discussing what long-term average sediment yield is appropriate for this in-stream sediment budget, that is, the average cubic yard of bedload delivered to the river per square mile of drainage area, I believe that bedload values of 300 and 200 cubic yards per square mile per year for the Salinas and Estrella Rivers, respectively, are within the range of what would be appropriate for this first attempt at a long-term bedload sediment budget. These unit bedloads values are based on the assumption that 30 percent of the total load on the Salinas River and 20 percent for the Estrella River, based on the recommendation of Watson and other, 2003.

Several tables are attached that I modified for the Pehl mine site from spreadsheets prepared by Pankey's engineering consultant Matt Smeltzer (April 30, 2009). In these tables, the amount of sediment delivered to each subreach is calculated assuming that bedload sediment from the 112 square mile area of the Santa Margarita Reservoir is trapped and therefore removed from the calculation. In addition, the drainage areas above mines #27 and #52 are removed from the calculation, as discussed above. The sediment yield for subreach S-1, the most downstream reach, is calculated by dividing the contributing area into the Salinas and Estrella Rivers and then multiplying the area by the unit bedloads for each river.

Tables 3A and 3B present the bedload sediment budget and percent bedload bypassed for the previous and current baseline conditions. The previous baseline condition does not include the recently permitted extraction of the Viborg-Estella mine because the mine is not yet operational. However, because the Viborg-Estrella mine is approved, the current baseline condition shown in Table 3B includes the mine's 45,000 cubic yards per year of in-stream extraction.

The percentage of bedload bypassed at each subreach is calculated by subtracting the cumulative permitted extraction from the estimate cumulative bedload being delivered at downstream end of each subreach, and then dividing that difference by the cumulative bedload being delivered. This gives a value that is a relative index of the bedload extracted to the bedload delivered. A negative value indicates that the volume of bedload being extracted exceeds the volume being delivered. In theory, a negative value means that the bedload bypassing the reach is coming from sediment in storage taken either from the channel bed or the channel banks. While the bypass percentage is a relative index, the magnitude of a negative bypass percentage can be interpreted as a relative measure of the potential for adverse impacts to the subreach. A greater the negative value suggests a higher the potential for adverse impacts. Adverse impacts that might occur can include downcutting, bank instability and bank erosion that result because the river needs to adjust to the lack of sediment load, similar to the "hungry water" condition termed for rivers downsteam of large reservoirs.

Also include in Tables 3A and 3B is a column listing the sediment balance if only 50 percent of the permitted extraction is taken. This was done because a recent cumulative tabulation by County staff of the average annual extraction over the most recent 7 years by nine County permitted in-stream mines in the Paso Robles found the reported extraction rates were

approximately half that permitted. Because specific information on what each mine extracted druing each year is considered proprietary, the 50 percent extraction rate was uniformly assigned to each mine for the purpose of this bedload sediment budget.

The baseline condition bedload sediment budgets show that in the reaches upstream of the Estrella River the permitted extraction rate is greater than replenishment. The greatest deficiency is calculated for subreach S-3, which extends approximately 3 miles upstream from the confluence of the Huerhuero Creek, Table 1 and Figure 1. The additional sediment from the Estrella River helps make up for this deficiency at the subreach S-1, which ends at the County Line. At the estimated 7-year historic average 50 percent extraction rate, the bedload bypass percentage downstream of S-1 was just above the 50% desired by NOAA. Unfortunately, the 50 percent reduction in extraction is not enforceable at this time, and the appropriate calculation of bedload bypass is the permitted 100 percent extraction rate. At 100 percent extraction rate, the calculated bedload bypass is only 5 percent downstream of subreach S-1 when the Viborg-Estrella mine is included, Table 3B. This calculation does not include the impacts of the proposed Pehl, Pankey or Weyrick mines that are in the process of being permitted.

Table 4 shows the bedload sediment budget scenario when the 80,000 cubic yards per year being requested by the Pehl mine is added to currently permitted mines. The negative bedload bypassed value implies that the addition of the Pehl mine extraction further increases the bedload deficiency and thereby increases the potential for channel impacts.

Table 5 shows the bedload sediment budget for a scenario where the proposed Pehl, Weyrick and Pankey mines are all approved to extract at the annual rates in their current applications. The Weyrick mine is applying for extraction volume of 40,000 cubic yards and the Pankey mine for 135,000 cubic yards, 125,000 cubic yards on the Salinas and 10,000 cubic yards on Vineyard Creek. As in Table 4, the sediment bypass percentage for all subreaches negative and the S-1 and S-2 bedload bypass values become significantly more negative. The potential for channel instability and impacts is further increased with the addition of these three mines if they extract at 100 percent of the permitted volume each year.

**Conclusions**

This preliminary bedload sediment budget for the in-stream mines on the Salinas and Estella Rivers near Paso Robles indicates that the permits for the current mines have over allocated the available sediment resource. If more than 50 percent of the sediment currently permitted for extraction is removed over a several year period, then the NOAA desired 50 percent bedload bypass will not be achieved on the Salinas River downstream of the San Luis Obispo/Monterey County line. Even with a long-term reduction in the extraction rate of 50 percent or greater, the bedload deficit will apparently continue for approximately 9 miles upstream of the Estrella River confluence. The permitting of additional mines on the Salinas River will only add to this long-term bedload deficit. This bedload deficit raises the potential for channel instability and erosion.

This cumulative impact evaluation of available bedload resources for in-stream mining on the Salinas and Estrella Rivers has been advocated by the Department of Fish and Game for all of the environmental reviews being undertaken for the recent use permit applications for in-stream mining. The conclusion I've reached by this preliminary analysis is that the desire for a cumulative effects analysis and an environmental impact report is well founded.

An additional conclusion that I've reached is that an area-wide adaptive management plan is needed to manage in-stream mining in the Salinas and Estrella Rivers near Paso Robles in order to protect all of the river's resources, and ensure long-term stability of the river and adjacent infrastructure. An area-wide adaptive management plan should include the monitoring and reporting of the volume of sediment being delivered and transported in the mine reaches as well as documentation of long-term effects of mining on the river's geomorphology and adjacent infrastructure.

**References**

Smeltzer, Matt, April 30, 2009, Final Review Draft, Chapter 4 Excerpts, Area-Wide Adaptive Management Plan, Pankey Mine Conditional Use Permit, DRC2005-00193.

Watson and others, May 28, 2003, Salinas Valley Sediment Sources, Central Coast Watershed Studies, The Watershed Institute, Monterey, California, 227 pp.

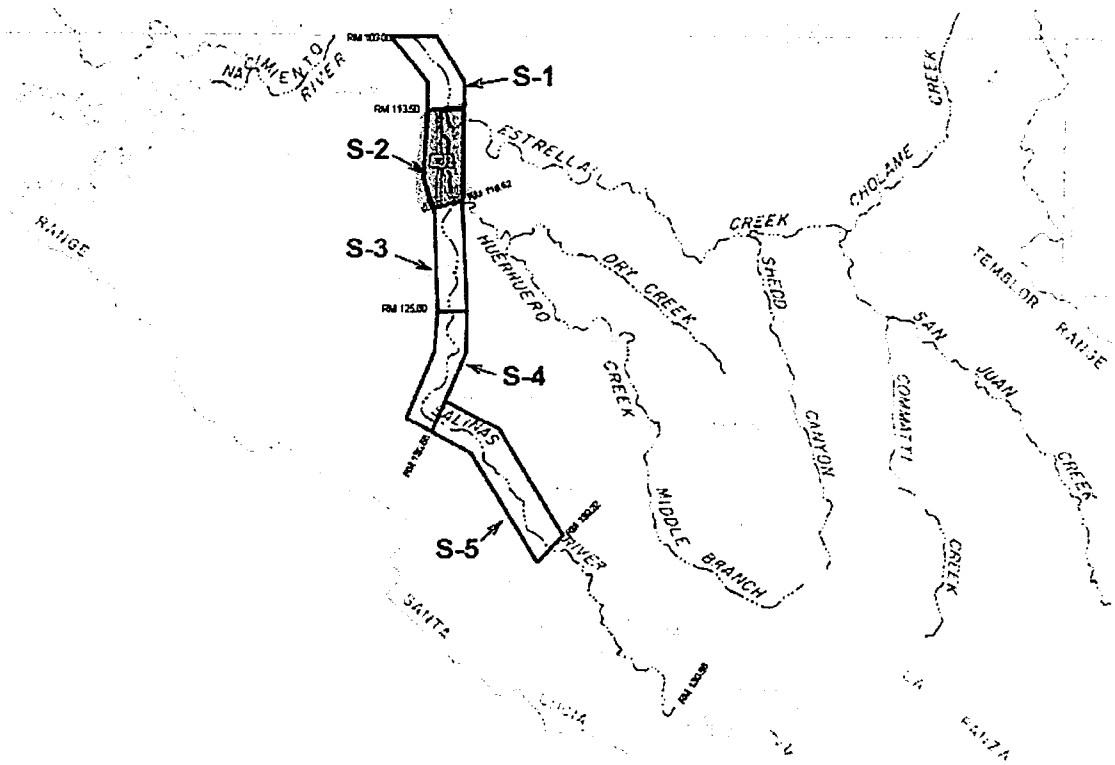


Figure 1: Geomorphic subreaches of the main stem of the Salinas River near Paso Robles. Note that Estrella River is included in subreach S-1. *(Map from Smeltzer, April 30, 2009 Draft Area-Wide Adaptive Management Plan).*

**Table 1 Drainage Areas Salinas and Estrella River near Paso Robles**

| Subreach | | Total Drainage Area Tributary to Downstream End (sq mi) | Drainage Area less Santa Margarita Reservoir (sq mi) | Unit Area Bedload Sediment Yield (CY/sq mi/yr) | *Cumulative* Estimated *Natural* Annual Average Bedload Supply (CY/yr) |
|---|---|---|---|---|---|
| **Reach S-5** | Upper Salinas River between approx. 9 mi upstream from Paso Robles to approx. 5 mi upstream from Atascadero | 253 | 141 | 300 | 42,300 |
| **Reach S-4** | Upper Salinas River between approx. 3 mi upstream to approx. 9 mi upstream from Paso Robles | 367 | 255 | 300 | 76,500 |
| **Reach S-3** | Upper Salinas River between Huerhuero Creek and approx. 3 mi upstream from Paso Robles | 407 | 295 | 300 | 88,500 |
| **Reach S-2** | Upper Salinas River between Estrella River and Huerhuero Creek confluences | 532 | 420 | 300 | 126,000 |
| **Reach S-1** | Upper Salinas River between County Line and Estrella River confluence | 1,526 | 1,414 | | 330,000 |
| | *Reach S-1 subtotals:* | Estrella | 942 | 200 | 188,400 |
| | | Salinas | 472 | 300 | 141,600 |

*Subreach S-1 Salinas River area includes 52 square miles of the Vineyard Creek drainage.*

**Table 2. Sand & gravel mines near Paso Robles, San Luis Obispo County.**

| Watershed Location | ID # or Permit Status | Mine Name(s) | Operator | Upper Salinas River Mile (RM) | In stream? | Permitted/ Proposed Annual Maximum Extraction (CY/yr) | County/ City Status | OMR Status |
|---|---|---|---|---|---|---|---|---|
| Reach S-5 | #42 | Sycamore Road F | Borzini S&G | 133.90 | Yes | 50,000 | | Active |
| | | | | | *Reach S-5 subtotal:* | *50,000* | | |
| Reach S-4 | #53 | Smith Pit | Viborg | 129.00 | Yes | 25,000 | | Active |
| Reach S-4 | #34 | Templeton/Ormor | Borzini S&G | 128.13 | Yes | 65,000 | | Active |
| Reach S-4 | #34b | Finley | nd | 127.77 | Yes | 35,000 | | nd |
| Reach S-4 | #15 | Miller Mine River | Union Asphalt | 127.40 | Yes | 20,000 | Closed | Closed |
| Reach S-4 | #48 | Nesbitt | Union Asphalt | 126.00 | Yes | 20,000 | | Active |
| | | | | | *Reach S-4 subtotal:* | *145,000* | | |
| Reach S-3 | #30 | Salinas River Bor | Paso Robles | 124.50 | Yes | 5,000 | Idle | Idle |
| Reach S-3 | #40 | Lone Oak Rock & | Union Asphalt | 122.36 | Yes | 20,000 | Active | Active |
| Reach S-3 | #23 | North River Rd Bo | Viborg | 121.85 | Yes | 50,000 | Idle | Closed |
| Off-channel | #23 | North River Road Bo | Viborg | na | No | 2,500 | | Closed |
| | | | | | *Reach S-3 subtotal:* | *75,000* | | |
| Huerhuero Ck | #51 | Creston | Union Asphalt | na | Yes | 50,000 | | Active |
| Reach S-2 | Proposed | Pehl | nd | 117.52 | Yes | 80,000 | | |
| Reach S-2 | Proposed | Weyrick | nd | 116.45 | Yes | 40,000 | | |
| Off-channel | #27 | North River Road Bo | Viborg | na | No | 15,000 | | Active |
| San Marcos Ck | Proposed | San Marcos Ck | nd | na | Yes | nd | | |
| Navajo Ck | #27 | Navajo Rock & Bl | Navajo Concrete | na | Yes | 40,000 | | Active |
| | | | | | *Reach S-2 subtotal:* | *120,000* | | |
| Estrella River | Pending | Viborg-Estrella | Viborg | na | Yes | 45,000 | | |
| Reach S-1 | Proposed | Pankey-Salinas | Pankey S&G | 112.04 | Yes | 125,000 | | |
| Vineyard Ck | Proposed | Pankey-Vineyard | Pankey S&G | na | Yes | 10,000 | | |
| | | | | | *Reach S-1 subtotal:* | *180,000* | | |
| | | | | | *Area-Wide Plan area total:* | *570,000* | | |

**Notes**

nd - not determined.

na - not applicable.

Grey denotes closed, off-channel, or mine deemed far enough from mainstem to have negligible impact.

Closed, off-channel, or distant mines not includes in subreach subtotals and area-wide plan total.

Finley (#34b) not in OMR database; assigned Mine ID #34b due to proximity to Templeton/Ormonde (#34).

Miller River (#15) is active according to OMR but closed according to County; assumed closed.

North River Road Borrow Pit (#23) is closed according to OMR but idle according to City; assumed idle.

Proposed Pankey mine shown as two line items to reflect mainstem and tributary extraction areas at site.

*Modified after Table in M. Smeltzer, April 30, 2009, Draft Area-Wide Adaptive Management Plan*

**Table 3A** **Previous Baseline Conditions Bedload Sediment Supply.**

| Subreach | *Cumulative* Natural Annual Average Bedload Supply (CY/yr) *(Input)* | *Existing* Mines* Annual Maximum Permitted Extraction (CY/yr) | *100% of Cumulative Mines* Annual Maximum Permitted Extraction (CY/yr) *(Output 1)* | *50% of Cumulative Total* Annual Maximum Permitted Extraction (CY/yr) *(Output 2)* | 100% of *Cumulative* Mining-Reduced Annual Bypass Bedload (CY/yr) *(In-Out 1)* | 50% of *Cumulative* Mining-Reduced Annual Bypass Bedload (CY/yr) *(In-Out 2)* | 100% Extraction Bedload Bypassed (%) | 50% Extraction Bedload Bypassed (%) |
|---|---|---|---|---|---|---|---|---|
| Reach S-5 | 42,300 | 50,000 | 50,000 | 25,000 | -7,700 | 17,300 | -18% | 41% |
| Reach S-4 | 76,500 | 145,000 | 195,000 | 97,500 | -118,500 | -21,000 | -155% | -27% |
| Reach S-3 | 88,500 | 75,000 | 270,000 | 135,000 | -181,500 | -46,500 | -205% | -53% |
| Reach S-2 | 126,000 | 0 | 270,000 | 135,000 | -144,000 | -9,000 | -114% | -7% |
| Reach S-1 | 330,000 | 0 | 270,000 | 135,000 | 60,000 | 195,000 | 18% | 59% |
| | *Totals:* | *270,000* | | | | | | |

**Viborg-Estrella is not included*

**Table 3B** **Current Baseline Conditions Bedload Sediment Supply.**

| Subreach | *Cumulative* Natural Annual Average Bedload Supply (CY/yr) *(Input)* | *Existing* Mines* Annual Maximum Permitted Extraction (CY/yr) | *100% of Cumulative Mines* Annual Maximum Permitted Extraction (CY/yr) *(Output 1)* | *50% of Cumulative Total* Annual Maximum Permitted Extraction (CY/yr) *(Output 2)* | 100% of *Cumulative* Mining-Reduced Annual Bypass Bedload (CY/yr) *(In-Out 1)* | 50% of *Cumulative* Mining-Reduced Annual Bypass Bedload (CY/yr) *(In-Out 2)* | 100% Extraction Bedload Bypassed (%) | 50% Extraction Bedload Bypassed (%) |
|---|---|---|---|---|---|---|---|---|
| Reach S-5 | 42,300 | 50,000 | 50,000 | 25,000 | -7,700 | 17,300 | -18% | 41% |
| Reach S-4 | 76,500 | 145,000 | 195,000 | 97,500 | -118,500 | -21,000 | -155% | -27% |
| Reach S-3 | 88,500 | 75,000 | 270,000 | 135,000 | -181,500 | -46,500 | -205% | -53% |
| Reach S-2 | 126,000 | 0 | 270,000 | 135,000 | -144,000 | -9,000 | -114% | -7% |
| Reach S-1 | 330,000 | 45,000 | 315,000 | 157,500 | 15,000 | 172,500 | 5% | 52% |
| | *Totals:* | *315,000* | | | | | | |

**Viborg-Estrella is included*

**Table 4** **Proposed Conditions with only Pehl mine**

| Subreach | *Cumulative Natural* Annual Average Bedload Supply (CY/yr) *(Input)* | *Existing* Annual Maximum Permitted Extraction (CY/yr) | *Proposed* Annual Maximum Permitted Extraction (CY/yr) | *Total* Annual Maximum Permitted Extraction (CY/yr) | *100% Cumulative Total* Annual Maximum Permitted Extraction (CY/yr) *(Output 1)* | 100% *Cumulative* Bypass Annual Average Bedload Supply (CY/yr) *(In-Out 1)* | 100% Extraction Bedload Bypassed (%) |
|---|---|---|---|---|---|---|---|
| Reach S-5 | 42,300 | 50,000 | 0 | 50,000 | 50,000 | -7,700 | -18% |
| Reach S-4 | 76,500 | 145,000 | 0 | 145,000 | 195,000 | -118,500 | -155% |
| Reach S-3 | 88,500 | 75,000 | 0 | 75,000 | 270,000 | -181,500 | -205% |
| ~~Reach S-2~~ | ~~126,000~~ | ~~0~~ | ~~80,000~~ | ~~80,000~~ | ~~350,000~~ | ~~-224,000~~ | ~~-178%~~ |
| Reach S-1 | 330,000 | 45,000 | 0 | 45,000 | 395,000 | -65,000 | -20% |
| | *Totals:* | *315,000* | *80,000* | *395,000* | *395,000* | | |

**Notes**

S-2 excludes proposed Sayer mine at 75,000 CY/yr

**Table 5 Proposed Conditions with Pankey, Pehl and Weyrick mines**

| Subreach | *Cumulative Natural* Annual Average Bedload Supply (CY/yr) *(Input)* | *Existing* Annual Maximum Permitted Extraction (CY/yr) | *Proposed* Annual Maximum Permitted Extraction (CY/yr) | *Total* Annual Maximum Permitted Extraction (CY/yr) | *100% Cumulative Total* Annual Maximum Permitted Extraction (CY/yr) *(Output 1)* | 100% *Cumulative* Bypass Annual Average Bedload Supply (CY/yr) *(In-Out 1)* | 100% Extraction Bedload Bypassed (%) |
|---|---|---|---|---|---|---|---|
| Reach S-5 | 42,300 | 50,000 | 0 | 50,000 | 50,000 | -7,700 | -18% |
| Reach S-4 | 76,500 | 145,000 | 0 | 145,000 | 195,000 | -118,500 | -155% |
| Reach S-3 | 88,500 | 75,000 | 0 | 75,000 | 270,000 | -181,500 | -205% |
| Reach S-2 | 126,000 | 0 | 120,000 | 120,000 | 390,000 | -264,000 | -210% |
| Reach S-1 | 330,000 | 45,000 | 135,000 | 180,000 | 570,000 | -240,000 | -73% |
| | *Totals:* | *315,000* | *255,000* | *570,000* | *570,000* | | |

**Notes**

S-2 excludes proposed Sayer mine at 75,000 CY/yr