Appendix C

Water Availability Analysis/ Cumulative Flow Impairment Index

WAA/CFII REPORT

TO: Chief, Division of Water Rights, State Water Resources Control Board

FROM: Waterways Consulting, Inc. on behalf of Lucky Star Investment Group LLC

DATE: November 9, 2010

SUBJECT: WATER AVAILABILITY ANALYSIS (WAA) FOR WATER RIGHT ID'S
A016512 & A023801 OF <u>LUCKY STAR INVESTMENT GROUP, LLC</u>

1.0 INTRODUCTION

The purpose of this report is to summarize the results of the water availability analysis conducted for the proposed project located within the Frenchmans Creek watershed in San Mateo County. The objectives of the analysis are as follows:

- To provide information required under California Water Code section 1275 (a), 1375 (d), 1243, 1243.5 and California Code of Regulations, Title 23, section 782, to demonstrate whether water is available for appropriation; and
- To determine the impact of the applications/project on streamflow in order to evaluate potential impacts to Public Trust Resources and provisions for compliance with various federal and state requirements. Examples include the California Environmental Quality Act (CEQA), the California Endangered Species Act (CESA), California Fish and Game (CDFG) Code and the federal Endangered Species Act (ESA).

2.0 PROJECT DESCRIPTION

This WAA pertains to the replacement of an existing water intake system to complete the installation of a water intake system in Frenchmans Creek in Half Moon Bay, located on a parcel of land at 37K Frenchmans Creek Road, Half Moon Bay, San Mateo County (see Figure 1). This action requires compliance with CEQA and compliance with CDFG regulations and Section 401 and 404 of the Clean Water Act. Consequently, the WAA is being prepared to determine a minimum bypass at the diversion site to protect downstream aquatic habitat. This flow will be equal to the estimated long-term unimpaired February median flow (FMF), which is calculated below, as required under the Draft Streambed Alteration Agreement with CDFG.

The applicants are in possession of water rights documentation (ID's A016512 & A023801) allowing the diversion and storage of a total of 10.7 acre-feet (af) of water from Frenchmans Creek, with a diversion season of January 1 to March 31 of each year. Water would be passively diverted from an instream structure, or Point of Diversion (POD), then settled in (2) existing, below-ground settling tanks, then pumped from a third subsurface tank to and stored in existing above-ground storage tanks and an off-channel reservoir. There are a total of (24) 1,500 gallon storage tanks and an in-ground reservoir with an approximate capacity of 12 acre-feet. The stored water will be used for the irrigation of orchids and cherries.
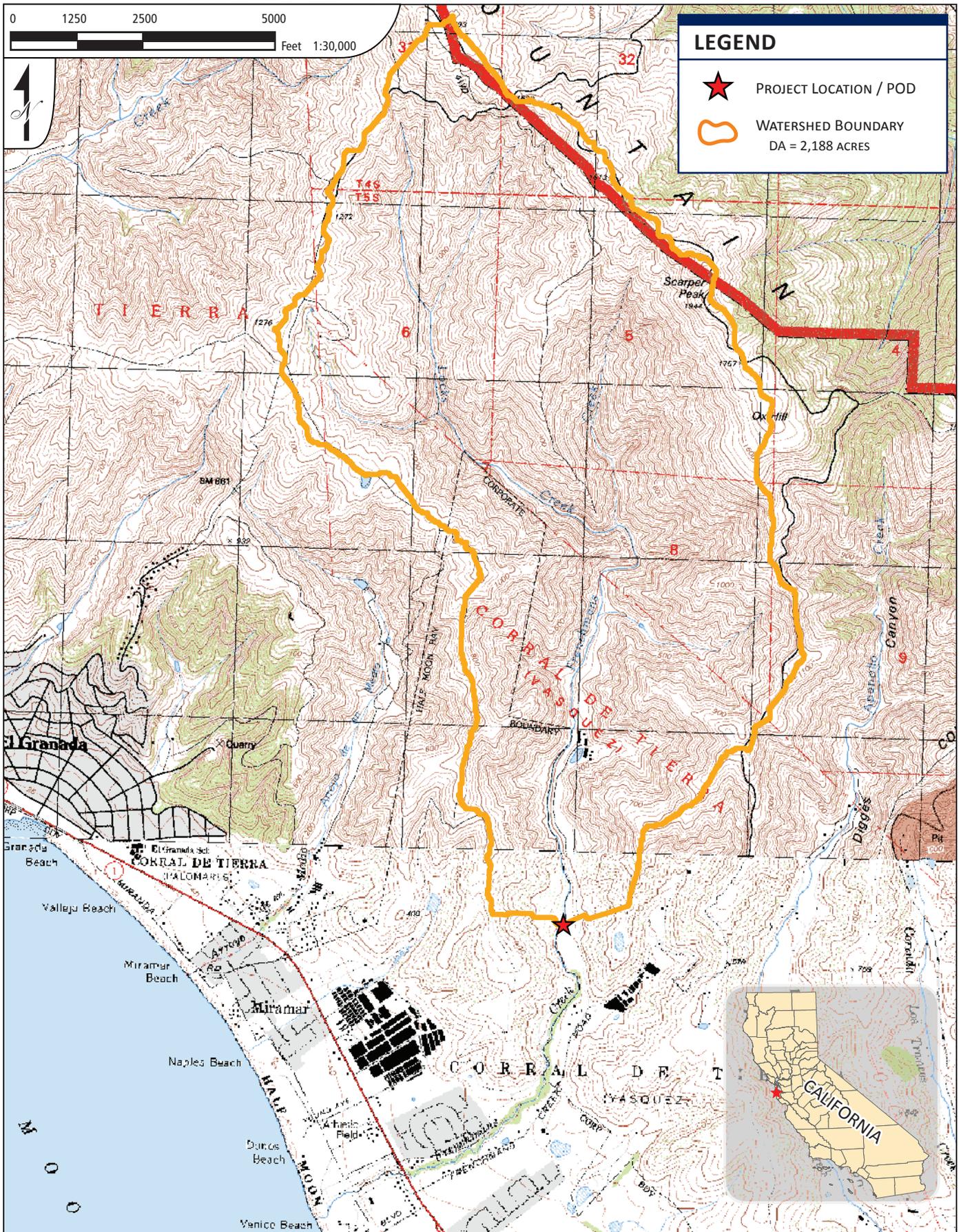
FIGURE 1
Project Location and Point of Diversion (POD) watershed, overlain on Half Moon Bay and Montara Mountain USGS 7.5' topographic quadrangles.

LEGEND

★ PROJECT LOCATION / POD

⬭ WATERSHED BOUNDARY
DA = 2,188 ACRES

Santa Cruz, CA | watways.com | Portland, OR

3.0 METHODS

3.1 Proration of U.S.Geological Survey Streamflow Data
Streamflow was estimated based on a proration of areas using the following formula:

$$Q_2 = Q_1 \times (A_2/A_1) \times (I_2/I_1)$$

Where: Q_2 = Daily flow (cfs) at point of diversion on tributary watershed;
Q_1 = Daily flow (cfs) at nearby gage;
A_2 = Watershed area above point of diversion;
A_1 = Watershed area above nearby gage;
I_2 = Precipitation at point of diversion; and
I_1 = Precipitation at nearby gage

ArcGIS was used to calculate the watershed area above the POD, using GIS data from the USGS National Hydrography Dataset (NHD) and georeferenced Digital Raster Graphics (DRG) of the Half Moon Bay 7.5' USGS quadrangle, giving an area of 3.42 mi^2 (2,188 acres).

Stream gage records of average daily flow were used from USGS gage # 111626000 on the nearby Purisima Creek with a record from 1958-1969. This gage was used due to its proximity, similar catchment area (4.8 mi^2), and relatively low amount of flow impairment during the period of record. Due to the relatively short record on Purisima Creek, gage records were also analyzed for USGS gage # 11162630 for the nearby watershed of Pilarcitos Creek (drainage area 27.1 mi^2), with a record from1967-2010. However, due to the larger watershed size and higher impairment, the Purisima Creek data was determined to be more appropriate for the WAA.

Average annual precipitation (I_2) for the POD was estimated to be 2.25 ft/yr using the annual average from the nearby NCDC gage at Half Moon Bay (#43714) with a record spanning the years 1939 to 2010. Average annual precipitation at the Purisima Creek stream gage (I_1) was estimated to be 2.44 feet/year, using the annual average precipitation from the NCDC gage at San Gregorio (#47807). This gage was used to due its proximity and similar elevation to the stream gage. Results of the estimations are shown in Table 1 of Section 4.

4.0 ANNUAL UNIMPAIRED FLOW

Annual unimpaired flow is the total volume of water, on average, that would flow past a particular point of diversion on an annual basis if no diversions (impairments) were taking place in the watershed above that point. Different methods may be used to estimate the unimpaired flow, including flow data from a relatively unimpaired streamflow gage (drainage area-ratio method) or a rainfall-runoff relationship. Flow is measured in units of acre-feet per year.

4.1 Data and Assumptions

Streamflow data collected at USGS gaging sites were used to calculate total annual flow volumes as described earlier. Annual unimpaired flow was estimated by augmenting the value derived from the record for Purisima Creek (WY 1959-1969) with the only water right issued during that period shown in the WRIMS database. After the annual runoff value estimated by gage data analysis was augmented by the modest diversion of 0.7 ac-ft/year (Application ID A018508), the resulting value was adjusted to reflect flow conditions at the POD by the drainage area-ratio method.

4.2 Calculations

Using the average daily flow values for water years 1959-1969 for the Purisima Creek gage # 111626000, total annual runoff volume was calculated for each year. The annual totals for the gage record were averaged to a single value and adjusted by multiplying by the ratio of the drainage area of the POD to the drainage area above the gage site, and the ratio of the estimated average rainfall at the POD to the average precipitation at the gage (see proration methods in section 3.0). We assumed that all gage records during this period are affected by the 0.7 ac-ft diversion approved in 1960 (Application ID A018508) and added that small amount to the total adjusted runoff to arrive at the annual unimpaired runoff value of 2,224 ac-ft. Although the record at the Purisima Gage is somewhat short, this appears to be the most appropriate choice due to the similar watershed sizes and low impairment. Data inputs and results from this estimate are presented in Table 1.

Annual Runoff at gage calc'd for each year (ac-ft) = sum of $(Q_{dv} * 86400 \text{ sec/day}) / (43560 \text{ ft/acre})$
Where Q_{dv} is the average daily flow value at a USGS gage site.

Avg. Annual Runoff (gage) = Sum of Annual Runoff (for all years) / # years

Avg. Annual Runoff (POD) = Avg. Annual Runoff (gage) $* (DA_{POD} / DA_{gage}) * (I_{POD}/I_{gage})$
Where DA_{POD} and DA_{gage} = Drainage Area at POD and Gage (acres) and
I_{POD} and I_{gage} = Avg. Annual Precipitation at POD and Gage (ft/yr)

Annual Unimpaired Flow = Avg. Annual Runoff (POD) + Upstream Diversions

Table 1: Annual Unimpaired Flow calculation inputs and results.

Water Year	Annual Runoff at USGS gage on Purisima Cr. (ac-ft)	Water Year	Annual Runoff at USGS gage on Purisima Cr. (ac-ft)
1959	902	1965	3955
1960	947	1966	1493
1961	632	1967	4940
1962	1428	1968	1460
1963	4199	1969	5520
1964	1120		
Average Annual Runoff	2418 ac-ft		

Site	Drainage Area (acres)	Precipitation (ft/yr)	Drainage Area Ratio (POD / gage)	Precip. Ratio (POD / gage)	Average Annual Runoff (ac-ft)	Annual Unimpaired Flow (ac-ft)
USGS Gage at Purisima Cr	3091	2.44	0.708	0.922	2417.7	2418.4*
POD	2188	2.25			1578.6	1579.1

Diversions Upstream of Gage during record 1959-69 (ac-ft) = 0.7 ac-ft

5.0 UNIMPAIRED FLOW DURING THE PROJECT'S DIVERSION SEASON

Unimpaired flow during the project's diversion season is the total volume of water, on average, that would flow past a selected point of diversion on a seasonal basis if no diversions (impairments) were taking place in the watershed above that point. Flow is measured in units of acre-feet.

5.1 Data and Assumptions

Streamflow data collected at USGS gage #111626000 at Purisima Creek was used to calculate total seasonal flow volumes as described earlier, using flow values from between January 1st to March 31st. Seasonal unimpaired flow was estimated by augmenting the conservative value derived from the record for Purisima Creek (1959-1969) by the only water right issued during that period shown in the WRIMS database. After the seasonal runoff value estimate by gage data analysis was augmented by the modest diversion of 0.7 ac-ft/year (Application ID A018508), the resulting value was adjusted to reflect flow conditions at the POD by the drainage area-ratio method.

5.2 Calculations

Seasonal Runoff at gage calc'd for each year (ac-ft) = sum of (Qdv * 86400 sec/day) / (43560 ft/acre)
where Qdv is the average daily flow value at a USGS gage site during the diversion season.

Avg. Seasonal Runoff (gage) = Sum of Annual Runoff (for all years) / # years

Avg. Seasonal Runoff (POD) = Avg. Annual Runoff (gage) * (DA_{POD} / DA_{gage})
where DA_{POD} and DAgage = Drainage Area at Point of Diversion and Gage (acres)

Seasonal Unimpaired Flow = Avg. Seasonal Runoff (POD) + Upstream Diversions

Table 2: Diversion Season (Jan 1st – Mar 31st) Unimpaired Flow calculation inputs and results.

Water Year	Diversion Season Runoff at USGS gage on Purisima Cr. (ac-ft)	Water Year	Diversion Season Runoff at USGS gage on Purisima Cr. (ac-ft)
1959	769	1965	1326
1960	449	1966	1346
1961	584	1967	1653
1962	1857	1968	1129
1963	1641	1969	1346
1964	1651		
Average Annual Runoff	1250 ac-ft		

Site	Drainage Area (acres)	Precipitation (ft/yr)	Drainage Area Ratio (POD / gage)	Precip. Ratio (POD / gage)	Avg. Diversion Season Runoff (ac-ft)	Unimpaired Divsersion Season Flow (ac-ft)
USGS Gage at Purisima Cr	3091	2.44	0.708	0.922	1250.2	1250.4*
POD	2188	2.25			816.3	816.4

*Diversions Upstream of Gage during record1959-69 (ac-ft) = 0.7 ac-ft

6.0 BYPASS FLOW

The bypass flow is the minimum flow rate to be maintained past a project's point of diversion, in units of cubic feet per second (cfs). The appropriate bypass is developed on a case-by-case basis. For projects located in the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa, the National Marine Fisheries Service (NMFS)/California Department of Fish and Game Guidelines recommend a bypass that is equal to the February median flow should be used where needed to protect fish habitat[1]. The adequacy of using the February median flow as a bypass depends on several factors, including the CFII (see section 7.0).

A total of 10.5 acre-feet of water is requested to be diverted / stored in the reservoirs. Using the drainage-area ratio method, the tributary area above the point of diversion has an estimated runoff of 816 acre-feet during the allowable season of January 1st to March 31st. The estimated bypass flow is 2.8 cfs, based on the prorated February median flow from the discharge data recorded at USGS Gage # 11162600 on Purisima Creek. During the allowable season of diversion, this bypass rate amounts to 500 acre-feet. Therefore, after the bypass flow has been met, there is approximately 316 acre-feet of water potentially available for diversion.

7.0 CUMULATIVE FLOW IMPAIRMENT INDEX (CFII)

Pursuant to CEQA, CESA and ESA, the Division is required to evaluate cumulative impacts to natural hydrology. The CFII is an index that is used to evaluate the cumulative flow impairment demand of all existing and pending projects in a watershed of interest. The CFII is a percentage obtained by dividing **Demand** in acre-feet by **Supply** in acre-feet at a specified **POD**[2], and for a specified time period, where:

> **Demand** is the "face" value entitlements of all existing and pending water rights, under all bases of right, above the POD in acre-feet, using the Division's Water Rights Information Management System (WRIMS) database and water right files (See Appendix A). For the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa, the season of October 1 to March 31 is used to compute demand. Demand includes existing and pending water right applications for "Post-1914" appropriators, Statements of Water Diversion and Use for "Riparian" and "Pre-1914" appropriators, small domestic use registrations, stockpond registrations, and any other known authorized diversions; and

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[1] National Marine Fisheries Service and The California Department of Fish and Game, *Guidelines .for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams*, June 17, 2002.

[2] Points of diversion (PODs), are designated by Division staff in consultation with DFG..

Supply is the seasonal average unimpaired flow above the POD in acre-feet. For the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa the season of December 15 through March 31 is used to compute supply[3].

Based on the WRIMS database, as of 10/4/2010 , the total entitlements of recorded water rights above the POD are estimated to be **45** acre-feet based on the WRIMS database (See Appendix B). Including the applicant's water rights of 10.7 acre-feet, the total entitlements are **56** acre-feet. The total unimpaired water available at the POD from December 15 through March 31 were estimated to be **1,075** acre-feet. The CFII values were estimated as follows:

CFII @ POD = Demand (af) ÷ Supply (af) x 100% = %

CFII @ POD = Demand (af) ÷ Supply (af) x 100% = %	Upstream of POD	45 af ÷ 1075 af * 100 = 4.2%
	Upstream and including POD	56 af ÷ 1075 af * 100 = 5.2%

[3] National Marine Fisheries Service and The California Department of Fish and Game, *Guidelines .for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams*, June 17, 2002 (Errata note, dated 8-19-02) .

Appendix B: Demand Above Point of Interest

Point of Interest ID: A016512, A023801 for Diversion to Storage from Frenchmans Creek

Water Right ID	Name	Source	Season	Maximum Face Value Demand Amount by Direct Diversion or Storage (ac-ft)	Adjustment to Maximum Face Value Demand Amount (ac-ft) Limited to Demand (Jan 1 - Mar 31)
A023846	Louie Figone	Unnamed Stream, Triburary to Locks Creek, then Frenchans Creek, then Pacific Ocean	1-Dec to 1-Apr	45.0	33.8
A016512	Lucky Star Investment Group	Frenchmans Creek, tributary to Pacific Ocean	1-Jan to 31-Mar	9.2	9.2
A023801	Lucky Star Investment Group	Frenchmans Creek, tributary to Pacific Ocean	1-Jan to 1-Mar	1.5	1.5
S009386	Peninsula Open Space Trust	Frenchmans Creek, tributary to Pacific Ocean	1-May 31-Oct	0.0	0.0
				Total Demand Face Value (ac-ft)	**Total Adjusted Demand (ac-ft)**
				55.7	44.5