Appendix I: Hydrology and Water Quality Technical Report

- **Water Supply Assessment (Lilburn, June 2013)**
- **Hydrology Technical Study (SLR, updated 2017)**
- **Drainage Control Program, Crystal Creek Haul Road (Pluess-Staufer, 1992)**
- **Spill Prevention, Control, and Countermeasures Plan (Webber & Webber Mining Consultants, Inc., 1997)**

Appendix I-1: Water Supply Assessment

(Lilburn, June 2013)

Water Supply Assessment

Amended Plan of Operations and Mine Reclamation Plans for the Butterfield - Sentinel Quarries and the White Knob - White Ridge Quarries

Prepared for:

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Prepared by:

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June 2013

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1.0 EXECUTIVE SUMMARY

Omya California's (Omya) has requested approval from the U.S. Department of Agriculture, Forest Service (USFS) and the County of San Bernardino (County) to expand the existing Butterfield – Sentinel quarries and White Knob - White Ridge quarries located south of Lucerne Valley in San Bernardino County. The Amended Plans are subject to the California Environmental Quality Act process (CEQA) and Environmental Impact Reports are being prepared. The County of San Bernardino, as CEQA Lead Agency, has requested a Water Supply Assessment (WSA) to be prepared to complete the CEQA process and to approve the Amended Plans.

The existing permitted Butterfield - Sentinel quarries are located within the San Bernardino National Forest and White Knob - White Ridge quarries are located on private property. The proposed Amended Plans would provide for mining at the various quarries to be extended up to the year 2055. The current production combined from all quarries would increase to a permitted maximum of 680,000 tons per year of ore to the Lucerne Valley processing plant. Mined material is crushed at the quarry sites and the ore is processed at the Lucerne Valley processing plant located north and east of the quarries. Reclamation will occur concurrently with mining.

Water is used at Omya's operations for dust control at the quarries, overburden placement areas, haul roads, crushers, and for establishment of vegetation in reclaimed areas. The water source is two wells owned and operated by Omya; one located at the processing plant site in Lucerne Valley, and one located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek Haul Road. Small increases in water use for dust control will occur with the implementation of the proposed Amended Plans for the quarries. Omya's existing operation's and proposed projects' water demands would total an estimated 17.55 acre-feet per year or 92.3% of Omya's current Free Production Allowance (FPA) of 19 acre-feet.

The proposed operational changes will not have a significant impact on agricultural, potable or industrial users. Neither will there by an affect on the water supply for any lower-income housing projects. As described herein, Omya has a right to groundwater extracted from a basin that has been adjudicated and the proposed projects combined with other existing and planned operations will not result in water demand exceeding that water right.

2.0 INTRODUCTION

2.1 BACKGROUND

Omya California's (Omya) is proposing to amend its Plan of Operations and Mine Reclamation Plans for the Butterfield - Sentinel Quarries and the White Knob - White Ridge Quarries. The quarries are located south of Lucerne Valley in San Bernardino County, California (see Figure 1). Omya California (Omya), a division of Omya Inc., has requested approval from the U.S. Department of Agriculture, Forest Service (USFS) and the County of San Bernardino (County) to expand the existing Butterfield - Sentinel, and White Knob - White Ridge quarries.

The existing permitted Butterfield - Sentinel quarries are located within the San Bernardino National Forest and the White Knob - White Ridge quarries are located on private property (see Figure 2). Once permitted, available ore resources will provide an additional 40 years to the mine life of the Butterfield Quarry, 20 years to the Sentinel Quarry, and 24 years to the White Knob - White Ridge quarries. Mining at the various quarries would be extended through the year 2055. The quarries combined ore production rates will be a maximum of 680,000 tons per year. Mined material is crushed at the quarry sites and the ore is processed at the Lucerne Valley processing plant located north and east of the quarries. Reclamation (including revegetation) will occur concurrently with mining.

Since the Amended Plans are subject to the CEQA process, Environmental Impact Reports are being prepared. The County, the CEQA Lead Agency, has requested a Water Supply Assessment (WSA) be prepared to complete the CEQA process and to approve the Amended Plans. The Butterfield - Sentinel Quarries are also subject to review under the National Environmental Policy Act with the U.S. Forest Service acting as lead federal agency.

Quarry development and expansion will be phased. Disturbance proposed for the Amended Plans includes expansion of the existing quarries, associated overburden placement sites, additional internal access roads and ancillary facility areas, and minor adjustments to existing disturbance boundaries. Less than ½-acre-foot of the total annual water use is hauled by truck for establishing vegetation at reclaimed areas.

2.2 PURPOSE OF DOCUMENT

Upon request of a local government, a public water supplier (PWS) is required by law to provide documentation regarding the water supply for new projects. The WSA is included in the CEQA documentation and it becomes information used in the approval process. In the case of the proposed projects, there is no PWS that provides water service to the area of the Project Site.

At completion, the proposed projects will generate a maximum water demand for dust control and irrigation totaling an estimated 3.75 acre-feet per year (over existing water use). This is based on historic water use records compared to proposed quarry production. The supply source

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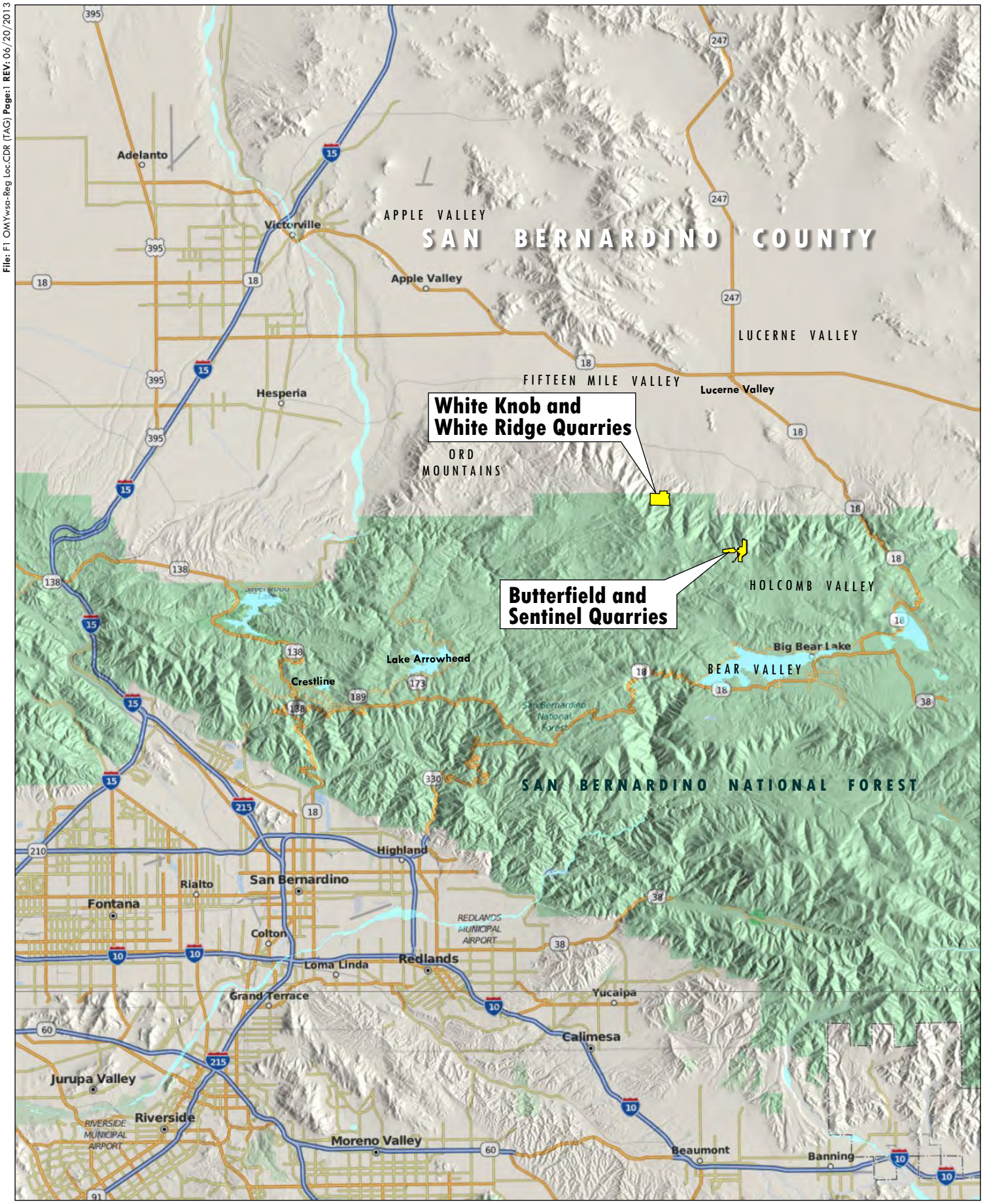

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Source: World Topo Map, 2012

LILBURN CORPORATION

REGIONAL LOCATION

WHITE KNOB-WHITE RIDGE QUARRIES and BUTTERFIELD-SENTINEL QUARRIES

Water Supply Assessment

Omya California, San Bernardino National Forest, California

FIGURE 1

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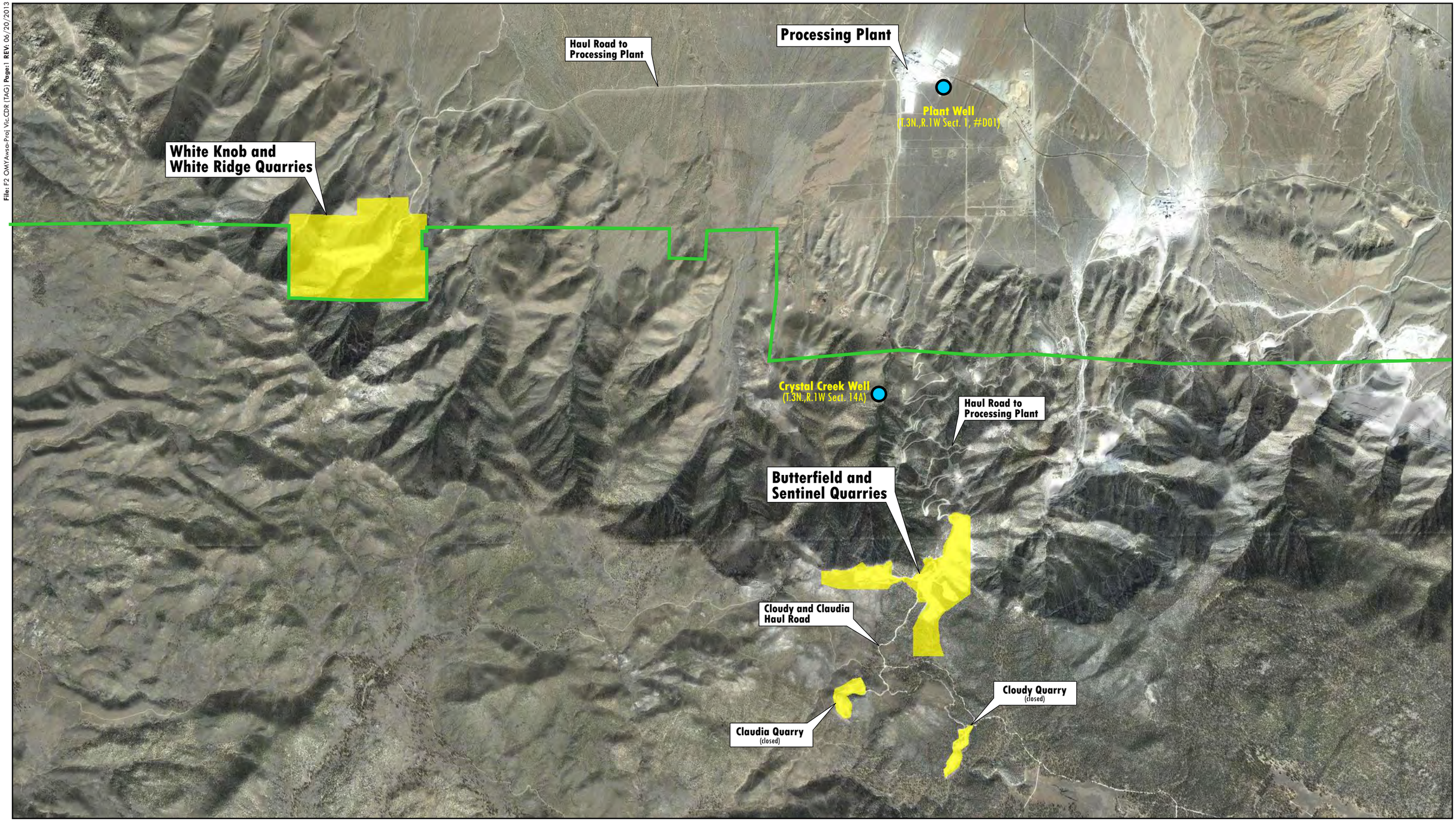

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Sources: Lilburn Corp., 2013

LILBURN CORPORATION

LEGEND

Well Location

USFS Boundary

WELL and QUARRY LOCATIONS

WHITE KNOB-WHITE RIDGE QUARRIES and BUTTERFIELD-SENTINEL QUARRIES

Water Supply Assessment

Omya California, San Bernardino National Forest, California

OMYA **FIGURE 2**

would be the existing groundwater wells currently owned and used by Omya, located both on-site and off-site. The total demand at maximum production would be approximately 17.55 acre-feet per year.

The regional water management agency overlying the source of water supply is the Mojave Water Agency (MWA) and therefore the MWA 2010 Urban Water Management Plan and the 2004 Regional Water Management Plan was referenced in preparation of this WSA. The WSA discusses the historic and current water supplies of the Project Site and the proposed projects' impact on the Este Subarea's water supplies. Project water demands are evaluated in light of the single dry year event and a multiple dry year event to determine the adequacy of the water supply.

2.2.1 Applicability of a Water Supply Assessment

A WSA is required for a project consisting of a "proposed industrial, manufacturing or processing plant" occupying more than 40 acres of land (Water Code Section 10912; SB 610). In the May 2010 decision in *Center for Biological Diversity v. County of San Bernardino*, the Court of Appeal held that a biosolids composting facility is a "processing plant" and thus a "project" within the meaning of SB 610 if it meets the 40-acre threshold, even if only small structures will be constructed on-site. It is less likely that Omya's proposed quarry expansions would be considered a "project" under SB610, since the project does not involve any new processing equipment within the mine, or any new or modified equipment at the plant. Nonetheless, given the uncertainty created by the *Center for Biological Diversity* decision, this Water Supply Assessment has been prepared to support Omya's quarry applications.

2.3 PUBLIC WATER SYSTEM

2.3.1 Description

The projects are located south of the unincorporated community of Lucerne Valley and north of the City of Big Bear Lake, in the San Bernardino Mountains. Residents of Lucerne Valley receive their water via individual wells, mutual water companies, or small County water districts. The County of San Bernardino has a County Service Area (CSA 29) in Lucerne Valley that serves commercial customers only and does not overlie the Project Sites. On the north shore of Big Bear Lake, the community of Fawnskin is served by the Big Bear Department of Water and Power, and the remainder of the north shore lies within a CSA 53-C. The Big Bear Department of Water and Power could not provide a water supply to the Project Sites without expansion of the City of Big Bear Lake incorporated boundaries. CSA 53-C lies approximately 8 miles south of the project site, and furthermore does not presently have a water supply system developed. A PWS therefore is not applicable to the proposed projects.

3.0 WATER DEMANDS

During operations, the existing and proposed quarry operations will generate a water demand for dust control totaling an estimated 17.55 acre feet per year. This assumes water application is

required based on historic data maintained by Omya. The existing mine and processing plant operations utilize on- and off-site wells for dust control. The average annual production from the two wells, verified by the Watermaster during the 5-year period of 2007/08 to 2011/2012 was 13.8 acre-feet.

Omya intends to increase production of processed materials to a permitted maximum from all quarries of 680,000 tpy. An increase in water consumption of 3.75 acre-feet per year to be used for dust control is expected concurrent with the increase in production rates. Future operations are estimated to require an additional 1.5 acre-feet/year for the Butterfield - Sentinel quarries, and 2.25 acre-feet/year for the White Knob - White Ridge quarries, for a total increase in water production of 3.75 acre-feet/year, representing an increase of 27% at maximum production over the most recent 5-year average verified water production. The supply would continue to be the existing Omya wells which use groundwater pumped from the Este Subarea of the adjudicated Mojave Basin.

Lucerne Valley lies within the Este Subarea of the Mojave Basin (see Figure 3). The Final 2010 UWMP shows that the subarea had a population of 6,680 in 2005 and the population was projected to grow to 11,785 by the year 2035. Water production in the Este subarea has declined according to reports filed with the Mojave Basin Watermaster. Water production was 9,700 acre-feet in 1996, 7,100 acre-feet in 1998 and 2000 and 5,900 acre-feet in 2003. Projected water demand within the Este subarea was estimated to increase from 6,981 acre feet in 2005 to 7,369 acre feet in 2035 (*Final 2010 Urban Water Management Plan, Mojave Water Agency, June 9, 2010*).

The proposed projects' net increase in demand of 3.75 acre-feet/year would represent 0.25% of the minimum Este Subarea groundwater deficit of 1,500 acre-feet projected to occur during a single dry year event, and 0.12% of the maximum deficit of 3,050 acre-feet. The single dry year event is based on the Agriculture 2 Scenario which was adopted as part of the Mojave Water Agency 2004 Regional Water Management Plan as the basis for future planning. Under this scenario, there are assumed significant decreases in agricultural consumptive use based on voluntary transfers of FPA from agricultural to non-agricultural uses. Existing water uses in the Este Subarea are primarily Agricultural followed by Industrial.

3.1 PROJECT-SPECIFIC WATER CONSERVATION

No water conservation measures are proposed for the proposed projects because water use will be limited to dust control and a minor amount (less than ½-acre-foot/year) used for occasionally establishing revegetation areas. In the event water supplies become limited, Omya could maintain a limitation on its annual water use to be equivalent or less than 65% of its BPA (65% of 23 = 14.95 acre-feet). Under current projections, this limitation on water use would not require the implementation of conservation measures but would limit the operations when sufficient water was not available during dry hydrologic conditions to meet dust control and/or irrigation demands.

MOJAVE WATER AGENCY ADJUDICATED BOUNDARY

WHITE KNOB-WHITE RIDGE QUARRIES and BUTTERFIELD-SENTINEL QUARRIES

Water Supply Assessment

Omya California, San Bernardino National Forest, California

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FIGURE 3

4.0 WATER SUPPLY ASSESSMENT

4.1 GENERAL

A requirement of the WSA is to identify and describe the water supply sources in the PWS that will serve the Project. Water Code Section 10910(d) requires a WSA to include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the PWS.

4.2 IDENTIFICATION OF WATER SOURCES

4.2.1 Primary Water Sources

The proposed projects will use well water for dust control. A water supply has been developed on Omya properties (two wells) and a PWS does not serve the site. The source of water for dust control will be the existing Omya wells located both on- and off-site (refer to Figure 2). These wells pump groundwater from the Este Subarea of the Mojave Water Basin.

The Watermaster for the Mojave Basin, the Mojave Water Agency, in its Nineteenth Annual Report of the Mojave Basin Area for Water Year 2011-12, dated May 1, 2013, indicates that water levels in the Este Subarea have remained stable for the past several years, indicating a relative balance between recharge and discharge. Unused Free Production Allowance (FPA) for the Este Subarea, as reported by the Watermaster, was 14,430 acre-feet for Water Year 2009-10, 13,632 acre-feet for Water Year 2010-11, and 14,800 for Water Year 2011-12. Based on the Watermaster report, the Water Year 2012-13 FPA for the Este Subarea is recommended to be set at 80% of the Base Production Allowance of 19,277 acre feet, or 15,422 acre feet. Table 1 below summarizes the 2011-12 Watermaster Report data.

Table 1
Watermaster Data for Este Subarea Groundwater Production
(in acre-feet)

2011-12 Verified Production	Production Safe Yield	2011-12 Free Production Allowance	2012-13 Recommended Free Production Allowance
5,433	7,156	16,376	15,422

4.2.2 Additional Water Sources

Omya is currently using both of the wells it has developed. Groundwater would continue to be the sole source of supply as long as Omya's available allowance under the Stipulated Judgment *(discussed below)* will meet production demands. No recycled water exists in the area that could be made available to the Project Sites.

4.3 ANALYSIS OF WATER SUPPLY

4.3.1 Aquifer Adjudication

The Mojave Basin, including the Este Subarea where the proposed projects will be located, has been the subject of an adjudication to determine the water rights of the various producers. The adjudication process of the groundwater in Mojave Basin began in 1990 with cross complaints filed in 1991. In 1992 numerous parties agreed to conduct good faith negotiations and by 1993 over 75 percent of the parties involved were agreed to the Stipulated Judgment, thus binding the involved parties. In 1995 a trial of the non-stipulated parties was completed. The final judgment was entered in 1996 adopting the physical solution set forth in the Stipulated Judgment. The purpose of the Stipulated Judgment was to create incentives to conserve local water, guarantee that downstream producers will not be adversely affected by upstream producers, and assess producers to obtain funding for the purchase of imported water.

In addition, the Stipulated Judgment required that the Mojave Basin Area Watermaster generate an annual report summarizing the yearly Watermaster activities and water supply conditions for the Mojave Water Basin. The Mojave Water Basin includes the Alto Subarea, Baja Subarea, Centro Subarea, Este Subarea and the Oeste Subarea. The Project Site obtains groundwater from wells located in the Este Subarea.

4.3.2 Groundwater

To carry out the Mojave Basin Judgment (the Adjudication), the MWA assigned Base Annual Production (BAP) amounts to each producer using 10-acre feet per year or more, based on historical production (1986-1990). The total BAP from all producers was ramped down in each year from 1994 to 2005 in order to achieve the point where water imports and inflows versus consumption achieve safe yield of the basin. The MWA achieved its target rampdown in 2004/2005.

Each pumper also has been assigned a variable Free Production Allowance (FPA), which is a uniform percentage of BAP set for each area. A substantial make-up water assessment is charged for water pumped in excess of the assigned FPA. Water purveyors also have the option of leasing additional water rights from the open market.

Omya has a FPA that was allocated as part of the Basin Adjudication. Omya's original (1993) base production was set at 23 acre-feet per year. This has been ramped down annually to a FPA that is currently 19 acre-feet per year (82.6% of BAP).

Any groundwater that Omya pumps over and above the FPA is subject to replacement. Replacement can occur either by paying the Watermaster to purchase supplemental water from MWA or by acquiring/transferring unused production rights within that subarea from another party to the Judgment. Historically, Omya has had prior year carryover from unused FPA. In 2011/2012, Omya produced (verified production) 14 acre-feet of its 19 acre-foot FPA, with a prior year carryover of 19 acre-feet, and a total adjusted FPA of 38 acre-feet. Table 2 shows

FPA, verified production, carryover credits, and unused FPA for the period of water years 2002-03 through 2011-12.

Table 2
Omya Free Production Allowance & Production
Water Years 2002-03 through 2011-12

Water Year	FPA	Verified Production	Carryover Credits	Unused FPA
2002-03	19	15	19	19
2003-04	19	14	19	19
2004-05	19	14	19	19
2005-06	19	18	19	19
2006-07	19	19	19	19
2007-08	19	14	19	19
2008-09	19	14	19	19
2009-10	19	14	19	19
2010-11	19	13	19	19
2011-12	19	14	19	19

4.3.3 Historical Groundwater Data

According to the MWA 2010 UWMP, verified groundwater production in the Este Subarea decreased from 8,800 acre-feet in 1994 to 6,500 acre-feet in 2004. Since 1998, verified groundwater production in the Este Subarea has been less than 7,100 acre-feet.

The Mojave Basin Area Adjudication mandates that groundwater extraction from the basin not exceed the estimated annual supplies, and empowers the Watermaster to enforce pumping limits as mandated by the Court. MWA will continue to recharge the aquifer so that groundwater will remain a reliable source of water for the foreseeable future. Among other things, MWA has established a groundwater replenishment program for the Mojave Basin, including the Este Subarea, the purpose of which is to reduce annual and cumulative groundwater overdraft through artificial recharge to the groundwater basin.

The Omya production well located near the plant ("Plant Well") was drilled in 1987; depth to groundwater at the time of well installation was 867 feet below ground surface (bgs). The second well located in Crystal Canyon ("Crystal Creek Well") was drilled in 1990 and depth to groundwater was recorded as 85 feet bgs. Omya has not recently maintained depth to water records for either well.

4.3.4 State Water Project Water

MWA is one of the 29 State Water Project (SWP) contractors. The SWP includes 660 miles of aqueduct and conveyance facilities extending from Lake Oroville in the north to Lake Perris in the south. The SWP is contracted to deliver 4.1 million ac-ft/yr to the 29 contracting agencies. However, State and federal biological opinions to protect endangered fish, climate change, and levee vulnerability in the Delta have decreased projected deliveries to 60% of contracted amounts until the year 2028, increasing to 61% in 2029. SWP delivery reliability factors of between 60 and 61% were utilized in the MWA 2010 UWMP, yielding projected supplies as shown in Table 3 below.

Table 3
Mojave Water Agency
Summary of Current and Planned Water Supplies (Acre Feet/Yr)

Supply Type	2010	2015	2020	2025	2030	2035
Local	131,994	137,633	141,314	147,121	152,921	54,778
State Water Project	49,680	51,480	53,880	53,880	54,778	158,712
Total	181,674	189,113	195,194	201,001	207,699	213,490

Source: Final 2010 Urban Water Management Plan, Table 3-1:

MWA has recognized the need for additional imported water in order to eliminate groundwater overdraft, and has purchased additional water from the SWP when available. Additional SWP water is not expected to be available on a regular basis in the future and should not be relied upon as the only long-term source of overdraft reduction in the Mojave Water Basin. Purchase of additional SWP water involves the purchase of water on the spot market, as opposed to the purchase of entitlement to an ongoing supply of that water. It should be noted that the spot market comes into play when all of MWA's entitlements are being imported into the basin.

MWA reached agreement with the Metropolitan Water District (MWD) of Southern California in 2003 to store up to 75,000 (45,000 delivered to date) acre-feet for MWD in the Mojave basin. This storage is being provided in exchange for MWD's right to receive an equal amount of water in the future, through entitlement exchange, should there be a significant drought. In addition to spot market, on an on-going basis MWA is pursuing additional SWP entitlements when they become available. In dry years when SWP or Colorado River supplies are reduced, MWD will have the ability to call back some of the transferred water stored in the Mojave Basin, based on the limitations of the storage agreement between MWD and MWA.

4.3.5 Surface Water

The Mojave River is the primary source for replenishment of the Mojave Basin, with an average natural inflow of 65,500 acre-feet. The local surface inflows depend on climatic conditions and represent a small portion of the total supply. Recharge flows are often sub-surface and not available for surface water capture or treatment. Water from the State Water Project is the only other surface water that may be considered for treatment or direct use, and is limited by the

variability of the supply from the delta and the amount of water MWA has available after contractual deliveries are met. Surface water is not treated or used for domestic water purposes.

4.3.6 Recycled Water

No recycled water is available to the project sites or within the area of the water supply. The existing plant administrative offices are connected to a septic system. Portable toilets are used at the quarry sites.

4.4 Sufficiency Analysis (see Example)

The Mojave Water Agency 2004 Regional Water Management Plan projects the single-dry year conditions to be based on the 1977 southern California drought conditions. Such hydrologic conditions are used by the State Department of Water Resources as conditions under which State Water Project water deliveries would be limited to 4% of SWP contractors' entitlements. As shown in Table 5-16 of the MWA 2004 Regional Water Management Plan, the Este Subarea would experience deficits (in 5-year increments) as follows:

2005	(2,650) acre-feet
2010	(2,850) acre-feet
2015	(3,050) acre-feet
2020	(1,500) acre-feet
2025	(1,650) acre-feet
2030	(1,850) acre-feet

The BPA is a percentage of water production that occurred during the "base year" as established in the Judgment and is used by the Watermaster for purposes of annually establishing a FPA for each major groundwater producer. According to the Nineteenth Annual Report of the Mojave Basin Area Watermaster, the Este Subarea may be subject to future rampdown of the BPA to 65% immediately if water use conditions change.

The projected additional net demand of 3.75 acre-feet/year over Omya's 10-year average production, would represent 0.25% of the minimum basin subarea groundwater deficit of 1,500 acre-feet during a single dry year event, and 0.123% of the maximum deficit of 3,050 acre-feet. As stated in Section 3.1 above, in the event water supplies become limited, Omya could maintain a limitation on its water use to be equivalent or less than 65% of its' BPA (65% of 23 = 14.95 acre-feet). Under current projections, this limitation on water use would not require the implementation of conservation measures.

The water supplies and demands of the Mojave Water Agency's entire service area were projected in the Final 2010 Urban Water Management Plan in the event of a single-dry year event and a four-year multiple-dry year event occurring during the period 2010 through 2035. The analyses presented in the UWMP show that MWA has adequate supplies to meet demands

during average, single-dry, and multiple-dry years throughout the 20-year planning period (*Final 2010 Urban Water Management Plan, Mojave Water Agency, pages 6-7).*

5.0 IMPACTS ON OTHER PROJECTS

These Projects will not have a significant impact on agricultural, potable or industrial users. Neither will these Projects affect the water supply for any lower-income housing projects. As described herein, Omya has a right to groundwater extracted from a basin that has been adjudicated. The Watermaster responsible for carrying out the terms of the adjudication establishes the amount of groundwater available to Omya on an annual basis. Since water year 1993/94, Omya has not utilized its full entitlement to groundwater and the proposed projects do not exceed Omya's FPA thereby requiring the acquisition of replacement water that might impact other projects.

6.0 RIGHTS TO GROUNDWATER

Under the Stipulated Judgment and applicable law, producers in Lucerne Valley continue to have the right to pump groundwater from the Este Subarea. As previously noted, the aquifer from which water supply would be produced for the proposed projects has been adjudicated. The MWA acts as the Watermaster for the adjudicated basin. The amount of water that may be produced in any subarea in any year by a producer free of any replacement obligation is that producer's share of the FPA. The BPA has been ramped down (from the base year of 1993-94) for the first ten years following the adjudication, as a part of the physical solution established by the Judgment. The Watermaster for the Mojave Basin, the Mojave Water Agency, in its Seventeenth Annual Report of the Mojave Basin Area for Water Year 2009-10, dated May 1, 2011 recommends that each Producer's FPA be established at 80% of the base year for the ensuing water year.

Omya has a FPA that was allocated as part of the Basin Adjudication. For the 2010-11, the Watermaster recommends a FPA for the Este Subarea at 80% of BAP, subject to future rampdown to 65% immediately if water use conditions change.

The existing operation's and proposed projects' water demand would total an estimated 17.55 acre-feet/ year or 92.3% of Omya's current FPA of 19 acre-feet/year. In the event the reliability of water supplies becomes limited due to State-wide or local hydrologic conditions, Omya could maintain a limitation on its water use to 65% of its Base Production Allowance (65% of 23 = 14.95 acre-feet/year) if imposed by the Watermaster. The proposed projects' water demands could be met by Omya purchasing replenishment water.

7.0 VERIFICATION

This document verifies the water supply for the Project as required by California Government Code 66473.7 is available.

List of Supporting Documentation

Supporting documentation was used in preparing this assessment. These include the following:

- California Department of Water Resources Water Data Base: www.water.ca.gov/waterdatalibrary
- Final 2010 Urban Water Management Plan, Mojave Water Agency, June 9, 2011
- Mojave Water Agency 2004 Regional Water Management Plan, Mojave Water Agency, September 2004
- Watermaster Annual Report for Water Year 2002-03, Mojave Basin Area Watermaster, April 1, 2004
- Watermaster Annual Report for Water Year 2003-04, Mojave Basin Area Watermaster, April 1, 2005
- Watermaster Annual Report for Water Year 2004-05, Mojave Basin Area Watermaster, April 1, 2006
- Watermaster Annual Report for Water Year 2005-06, Mojave Basin Area Watermaster, April 1, 2007
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- Watermaster Annual Report for Water Year 2007-08, Mojave Basin Area Watermaster, May 1, 2009
- Watermaster Annual Report for Water Year 2008-09, Mojave Basin Area Watermaster, May 1, 2010
- Watermaster Annual Report for Water Year 2009-10, Mojave Basin Area Watermaster, May 1, 2011
- Watermaster Annual Report for Water Year 2010-11, Mojave Basin Area Watermaster, May 1, 2012
- Watermaster Annual Report for Water Year 2011-12, Mojave Basin Area Watermaster, May 1, 2013

Appendix I-2: Hydrology Technical Study

(SLR, updated 2017)

global environmental solutions

Omya Inc., Sentinel and Butterfield Quarries Expansion

Hydrology Technical Study

SLR Ref: 117.01004.00001

01/2017

Hydrology Technical Study

Prepared for:

Omya Inc.
7225 Crystal Creek Rd.
Lucerne Valley, California 92356

This document has been prepared by SLR International Corp. The material and data in this report were prepared under the supervision and direction of the undersigned.

Ian Hutchison, P.E., Ph.D.
Director

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Table 1 Climate Data for Big Bear Lake, California (1960-2012)

1. BACKGROUND

Omya operates a limestone quarrying and production operation located approximately 7.5 miles south of Lucerne Valley, CA (Figures 1 and 2). The operation produces high purity limestone products used for various consumer and industrial products. Limestone has been produced at the site and vicinity since the 1950s. Omya currently operates under a Mine and Reclamation Plan that was approved in 2003. The operation has not disturbed or conducted mining in all of the currently permitted areas.

Omya is submitting to the San Bernardino National Forest (SBNF) and San Bernardino County an amended Plan of Operations, conditional use permit, and reclamation plan for the proposed expansion of the existing Butterfield and Sentinel Limestone Quarries (Figure 2). The total currently permitted operational area is approximately 137.5 acres. The proposed amended Plan of Operation (the Project) will add approximately 77.3 acres for a total Project Area of approximately 214.8 acres. In addition to expanded acreage, Omya seeks to extend the permitted operating life of the Sentinel and Butterfield quarries until 2055, and the Crystal Creek haul road until 2065.

Obtaining the necessary SBNF and County approvals for this expansion will require compliance with both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) and a joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) will be prepared. This report has been prepared to assess the Hydrology and Water Quality aspects of the Project, in support of the EIR/EIS preparation.

Objectives

The objectives of evaluations described in this report were to:

- Describe existing hydrologic conditions.
- Evaluate potential water quality impacts associated with the Project.
- Evaluate potential surface water and/or groundwater flow impacts associated with the Project.

1.1 EXISTING SETTING

The Project Area currently consists of a mining operation located in a mountainous area (Figures 2 and 3). The active Sentinel and Butterfield Quarries are located in the Project Area (Figure 3). Elevations in the Project Area range from 7,200 to 7,900 feet. The ore is drilled and blasted in the quarries, loaded into haul trucks and hauled to the primary crusher located just southwest of the Sentinel Quarry. Crushed ore is then loaded into off-road haul trucks and transported eight miles on the Crystal Creek Haul Road to the existing processing plant in Lucerne Valley, which is at an elevation near 3,900 feet amsl. Only about one mile of the Crystal Creek Haul Road near the quarries is within the Project Area, whereas the majority of this road is located outside of the Project Area. The plant is also not within the Project Area. Although most of the haul road is not within the proposed project quarry expansion area, SMARA requires

the POO to cover the entire project area of 215 acres thus the haul road is included down to the USFS land boundary in Lucerne Valley.

Interburden and overburden materials excavated during removal of ore grade materials are transported to the B5 overburden stockpile Pad, located west of the Sentinel quarry. Fines produced from the primary crusher are also stored in the B5 Pad. The majority of the waste rock materials at the B5 overburden Pad consist of carbonate rocks (mainly calcium carbonate). Waste rock deposited in the B-5 Pad consists of off-color and/or impure limestone and dolomite. Less than 1% of these materials consist of altered intrusive dike and clay materials. These materials are considered insufficient quality to process into marketable products. The quarry expansion involves generation of a similar mix of materials that will be stored in the B5 Pad.

1.2 GEOLOGY

The Project Area is located within the San Bernardino Mountains, one of the major ranges in the east-west-trending Transverse Ranges province of southern California. These mountains form the southern boundary of the Mojave Desert geomorphic province. The north slope of the range rises abruptly from the desert floor in Lucerne Valley, with elevations along the north range crest reaching 8,400 feet.

Rocks exposed in the San Bernardino Mountains range from Precambrian to Quaternary in age and include igneous, sedimentary and metamorphic rocks. Extensive exposures of pre-Mesozoic metasedimentary rocks uncomfortably overlie Precambrian basement in the San Bernardino Mountains. These rocks were subjected to complex and extensive folding and faulting during Mesozoic time. Intrusive rocks include a variety of Mesozoic plutonic and batholithic rocks. The mountain range has undergone geologically recent faulting and uplift during the last 2 million years, and the area continues to be seismically active in modern time.

The Mississippian Monte Cristo Limestone is the primary formation of economic interest in the Project Area. Lithologic units at the quarries consist largely of sedimentary rocks that were subjected to high grade metamorphism. Limestone formations in the quarry area are over 1,000 to 2,000 feet thick and generally highly fractured. These formations are generally underlain with granitic intrusive rocks at depth.

1.3 CLIMATE

The Project Area is located along the rugged semi-arid north range crest of the San Bernardino Mountains and extends south to the Holcomb Valley area. Climate in the Project Area is characterized by warm summers and cold winters. Climate data associated with a weather station located approximately 10 miles southeast the Project Area in the town of Big Bear, at an elevation of 6,757 ft amsl, is provided in Table 1 (Western Regional Climate Center, 2013).

Table 1: Climate data for Big Bear Lake, California (1960–2012)													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Average high °F (°C)	47 (8)	48 (9)	51 (11)	57 (14)	67 (19)	76 (24)	81 (27)	80 (27)	74 (23)	65 (18)	54 (12)	47 (8)	62.3 (16.7)
Average low °F (°C)	20 (−7)	22 (−6)	24 (−4)	28 (−2)	35 (2)	41 (5)	47 (8)	47 (8)	41 (5)	32 (0)	25 (−4)	20 (−7)	31.8 (−0.2)
Precipitation inches (mm)	4.56 (115.8)	4.16 (105.7)	3.10 (78.7)	1.30 (33)	0.49 (12.4)	0.14 (3.6)	0.72 (18.3)	0.94 (23.9)	0.54 (13.7)	0.82 (20.8)	2.00 (50.8)	3.21 (81.5)	21.98 (558.2)
Snowfall inches (cm)	14.8 (37.6)	15.3 (38.9)	13.0 (33)	3.3 (8.4)	0.6 (1.5)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.7 (1.8)	5.6 (14.2)	9.3 (23.6)	62.6 (159)

2. BASELINE SURFACE WATER HYDROLOGY

Figure 4 shows the currently permitted areas relative to surface watershed boundaries. For the purposes of this study, watersheds shown in Figure 4 were only delineated to the convergence points shown; the full aerial extent of these watersheds is actually larger than depicted.

The Project Area is located on the crest of the San Bernardino Mountains, along the divides of multiple watersheds, so drainage generally flows away from the Project Area (Figure 4). The currently permitted area is located within the Crystal Creek, Furnace Canyon Creek, and Holcomb Creek watersheds.

Crystal Creek, Furnace Canyon Creek, and all other watercourses near the site generally only flow after storm events. Crystal Creek terminates in a dry lakebed in the Lucerne Valley several miles north of the Project Area. Furnace Canyon Creek terminates several miles northeast of the Project Area in Lucerne Valley. Drainages flowing south toward Holcomb Creek from the Project Area are unnamed and only flow rarely in response to storm events. Holcomb Creek is tributary to Deep Creek, which ultimately flows into the Mojave River.

Omya staff indicated that the Crystal Creek Canyon contains several small seeps or springs that flow intermittently in response to storm events. Certain reaches of lower Crystal Creek contain intermittent flow as a result of these springs.

Most of the Project Area is graded to drain into the Sentinel or Butterfield Quarries to avoid discharges into the surrounding natural drainages. As a result, the quarries have created their own watersheds (Figure 4).

The Crystal Creek haul road provides a means of transportation between the Project Area at elevations around 7,500 feet, and the plant area at approximately 3,900 feet amsl. The haul road contains grades of up to 20%, and the road contains a series of switchbacks. The haul road drains to Crystal Creek or an unnamed tributary of Crystal Creek. A very small portion of the haul road may drain toward the Furnace Creek watershed.

2.1 CURRENT EROSION AND SEDIMENT CONTROL MEASURES AND POTENTIAL DISCHARGE AREAS

Omya has deployed structural control measures to minimize or eliminate erosion and releases of sediment from the Project Area into surrounding drainages. These controls are shown on Figure 3, and generally include the following:

- Where possible, the Project Area has been graded to direct runoff into the quarries, and to avoid offsite discharges.
- Haul roads within the Project Area are graded to direct runoff toward retention areas within the Project Area, such as the quarries, and to avoid offsite discharges.
- Rock dams have been installed at the toe of the B5 Pad slopes to detain runoff and avoid discharges.

Where practical, the Crystal Creek haul road is graded to direct runoff toward the inward portion of the road, and the outer rim of the road is bermed to inhibit down-slope discharges. Numerous other erosion and sediment control measures have been installed, including sediment detention basins, v-ditches, rip rap, and road sloping. These controls are documented in Drainage Control Program, Crystal Creek Haul Road dated 1992, which was reviewed and approved by the USFS. Omya inspects these control measures after each major storm event. Maintenance is then conducted as appropriate based on the results of the inspections.

Omya has installed sedimentation detention basins along the Crystal Creek haul road between the quarries to the processing plant at Turns 1, 2, 4, 6, 7, 10, 12, 13, and 14 (haul road Turns are depicted in Figure 2). These basins are used to detain storm water runoff, eliminating or reducing discharges of runoff from the road into surrounding drainages. Suspended solids within the runoff are allowed to settle during its residence time in the basins. Overflow from the basins, if any, drains to the surrounding drainages. These basins are cleaned out as needed to maintain their capacity and minimize sediment content of offsite discharges, if any.

SLR conducted inspections of the Project Area in July 2012 and April 2013 during dry weather conditions. No discharges or obvious evidence of extraordinary erosion or previous discharges from the Project Area were observed. Based on field observations and review of Project Area topography, discharges could potentially occur from Project Area at the following locations.

- Southward from the Project Area boundary along the Cloudy/Claudia Haul Road.

- The northwest-facing non-vegetated slope of the B5 pad is graded toward a tributary of Crystal Creek. This crown of this slope has been bermed so that the drainage area contributing to this possible discharge would be the slope itself. According to Omya, historic sediment releases may have occurred at this location, but none within the last 20 years through the implementation of grading and other control measures.

- The southern slope of the B5 Pad is graded to drain toward the Holcomb Creek watershed. However, this potential discharge is mitigated or precluded by sediment and erosion control measures. Areas along the base of the pad will convey runoff toward retention areas.

SLR observed evidence of erosion on the Crystal Creek haul road, such as development of rills. Such erosion is considered typical for dirt roads in mountainous areas, and not considered to be problematic warranting further study. SLR also observed evidence of discharges from the haul road sedimentation basins located at Turns 4 and 6 (Figure 2). These basins showed evidence of detaining runoff recently. Both basins were fitted with spillways to convey overflow into the unnamed Crystal Creek tributary east of the haul road. SLR observed formation of rills in areas downgradient of the spillway, suggesting previous discharges from the spillways have occurred.

2.2 FLOOD INSURANCE MAPS

The Federal Emergency Management Agency has not prepared flood insurance maps for the Project Area.

2.3 GROUNDWATER CONDITIONS AND WATER SUPPLY

Groundwater in the region is mainly stored in and produced from alluvial deposits located in the low lying areas north of the Project Area in Lucerne Valley. Little or no groundwater production is conducted in the mountainous vicinity of the Project Area. Groundwater gradient tends to follow surface topography, generally flowing from the mountain ranges toward the valley floor.

Omya has drilled more than 100 core holes within the Project Area near the Butterfield and Sentinel quarries, and groundwater has not been observed in any of these core holes. Exploration drilling 100 feet below the proposed final quarry floor has not penetrated any water sources or aquifers. Similarly, SLR did not observe springs or seeps in or near the Project Area during site visits.

Water used at the site is obtained from two production wells. One of these wells is located near the plant. A second well is located in Crystal Creek Canyon near Turn 5 on the Crystal Creek Haul Road at an elevation of about 5,360 feet.

The Crystal Creek well (Figure 2) is located approximately 2 miles north of the Project Area, near Crystal Creek. This well was replaced in 1990 specifically to avoid production of shallow groundwater from the alluvium underlying Crystal Creek, so that it would not affect Crystal Creek flows. The casing of the Crystal Creek well is sealed through the alluvium, which occurs between 0 and 80 feet below ground surface. The casing is screened between 137 and 182 feet below ground surface, which is entirely within the bedrock aquifer underlying the alluvium. Therefore, the well appears to only produce groundwater from the bedrock aquifer, and not shallow groundwater associated with Crystal Creek. The State Water Resources Control Board indicated in a letter dated January 10, 1991 that groundwater production from this well would not require a diversion permit.

Depth to groundwater at the time of the Crystal Creek well installation was recorded at 85 feet bgs (Montgomery Consulting Engineers, 1990). Water pumped from this well is conveyed via pipeline to the Project Area for dust suppression at the quarries, overburden placement areas, haul roads, and primary crusher site. This water is also used for irrigation at areas within the Project Area currently undergoing reclamation.

The Plant Well was installed in 1987. The well consists of an 18-inch casing, and is screened between 633 to 1,258 feet amsl, with several relatively short blank intervals within the screened interval. Depth to groundwater at the time of well installation was recorded at 867 feet bgs.

Groundwater quality data representing the Project Area is not available due to the lack of wells in the area. The Crystal Creek and Plant Wells are located several miles away and at much lower elevations than the quarries, and are not representative of conditions in the Project Area. However, groundwater quality is not considered an issue because the Project does not appear to have the potential to encounter or affect groundwater.

The Mojave Water Agency (MWA) is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin in which Omya's wells are located. Pursuant to the Mojave Basin Area Judgment, all producers are allowed to produce as much water as they need annually to meet their requirements, as long as they do not exceed their free production allowance. Omya has a free production allowance of 19 AF/year for its two wells. Omya's water production between 2007 and 2011 has averaged approximately 13.8 AF/year (18th Annual Report, MWA 2012).

Wells in the vicinity of the Project Area are listed on Figure 5.

2.4 BENEFICIAL USES OF SURFACE WATERS AND GROUNDWATER

According to the Lahontan Basin Water Quality Control Plan, beneficial uses of Holcomb Creek include municipal supply, agricultural supply, recreational, cold freshwater habitat, and wildlife habitat.

According to the Colorado River Basin Water Quality Control Plan (Plan), beneficial uses designated for Crystal Creek include municipal, agricultural, groundwater recharge, recreation, warm freshwater habitat, and wildlife habitat. Water bodies near the Project Area not specifically listed ("Unlisted") in the Plan are by default designated as municipal supply, freshwater replenishment, groundwater recharge, recreation, warm freshwater habitat, wildlife habitat, and for rare species habitat. Groundwaters in the Lucerne Valley Planning Area are designated with municipal, industrial, and agricultural supply beneficial uses.

3. PROPOSED MINE PLAN AND POTENTIAL IMPACTS

Figure 6 depicts the proposed Mine Plan and likely impacts upon watersheds in the Project Area vicinity. Sentinel Quarry will be expanded in the Furnace Canyon watershed by approximately 10.8 acres.

The Central Area will be enlarged by 15.2 acres into the Furnace Canyon, Holcomb Creek, and a very small amount of the Crystal Creek watersheds. The expansion will accommodate overburden fill pads, growth media storage, and additional haul road areas. Most of the central area expansion areas will be graded to convey runoff toward Sentinel Quarry. As described above, runoff discharges may occur on northwestern slope of the Central Area to Crystal Creek. A small portion of the Central Area may also discharge southward to the Claudia Haul Road.

The B5 Pad will be enlarged by 22.7 acres toward the south. This area will remain within the Holcomb Creek watershed. Based on the layout for the B5 Pad and the natural topography of the surrounding area, discharges from the B5 only appear feasible from its southern boundary. The B5 Pad will be graded to convey runoff to several local detention areas (Figure 3). Overflow from these detention areas, if any, would discharge to existing watercourses.

The proposed Butterfield Quarry expansion consists of 28.6 acres and includes expansion of the existing quarry approximately 900 feet to the west and 200 feet to the south and north, for an amended total disturbed area of approximately 50.4 acres. The expansion toward the west will remove approximately 3 acres from the East Fork Dry Canyon watershed. The remaining 24 acres of expanded area will be removed from the Holcomb Creek watershed.

The Project will therefore effectively remove approximately 12.9 acres from the Furnace Canyon watershed, or approximately 0.1% of that watershed. Approximately 27.9 acres will be removed from the Holcomb Creek watershed. The USFS has delineated entire the Holcomb Creek watershed at 30,231 acres (USFS, 2010), so the acreage removed due to the Project will represent a negligible proportion (much less than 0.01%) of this watershed. The Project will also remove approximately 3 acres (0.5%) of the East Fork Dry Canyon watershed, and a negligible portion of the Crystal Creek watershed. As described above, the entire East Dry Canyon and Furnace Canyon watersheds were not completely delineated for the purposes of this study; the total acreages of these watersheds is actually larger than what SLR delineated. Based on the relatively small areas that will be removed from these watersheds, reductions in surface flow caused by the Project are expected to be minimal.

Areas removed from the East Dry Canyon, Furnace Canyon, and Holcomb Creek watersheds will effectively become part of the watersheds created by the Butterfield and Sentinel quarries. Runoff retained within the quarries will evaporate or infiltrate.

A 1,200 foot segment of the Crystal Creek haul road currently located along the high wall of the Sentinel Quarry will be relocated approximately 100 feet west of its current location. This relocation is not expected to impact the existing hydrology or water quality of the Project Area or surrounding area, provided appropriate erosion and sediment control measures are implemented during construction and operation of the haul road.

3.1 SEDIMENT AND EROSION CONTROLS

Omya has obtained coverage under the General Permit for Discharges of Storm Water Associated with Industrial Activities (Permit; Order 97-03-DWQ). All of Omya's operational areas are covered by the Permit, including the mining area, haul roads, and plant area.

As required by the Permit, Omya has prepared and implemented a site specific Storm Water Pollution Prevention Plan (SWPPP). The SWPPP contains descriptions of aspects such as potential discharge areas, significant materials, and best management practices (BMPs). BMPs are generally synonymous with "sediment and erosion control measures." However, BMPs also include non-structural elements such as employee training, documented operating procedures, and general housekeeping.

Omya will continue to maintain coverage under the Permit for the life of the project, and will be subject to its requirements and conditions. The primary objective of the Permit conditions, including the SWPPP and BMPs, is to avoid discharges from the site which could pollute receiving waters. The Permit also emphasizes that BMPs be maintained and continually evaluated for effectiveness. In accordance with the Permit, Omya will conduct storm water inspections monthly during the wet season, before and anticipated storm event, and after each significant storm event. The objective of these inspections is to evaluate the status and effectiveness of BMPs. Pursuant to the Permit, BMPs will continually be maintained and modified as necessary, and additional BMPs will be implemented where needed, based on the results of routine inspections.

Pursuant to requirements of the Permit, storm water samples will be collected during the first hour of discharge from the first storm event of the wet season, and at least one other storm event in the wet season. Samples must be collected from all discharge locations. Laboratory results from these monitoring events will be used to provide the basis to continually evaluate the effectiveness of the site storm water program. The nature and frequency of sampling, monitoring, inspections, and reporting may change as a result of future Permit revisions. A Permit revision is expected sometime later in 2013.

The Amended Mine POO for the Project Area contains a variety of erosion and sediment controls (Figure 3). Runoff will continue to be directed into quarry pits or local detention areas to the extent practical. Energy dissipaters such as sediment catchment basins or sumps, rock dams, and berms, will reduce erosion, trap sediment, and minimize the potential for off-site transport of pollutants. Operations also minimize the extent of disturbed areas. When practical, reclamation and revegetation will be conducted concurrently, and will stabilize previously disturbed areas and slopes.

The Central Areas and the B5 Pad will be constructed with berms near the top of the slopes to prevent runoff over the slope. Rip rap, retention areas, and energy dissipaters have been or will be placed along the toe of fill slopes and in the drainage below the fill slope to trap sediment and minimize the potential for discharge.

As described above, the new crusher area will be placed on a fill pad that will be constructed in the Central Area. Berms near the crest of the fill pad will prevent runoff over the fill slope. Rip rap and energy dissipaters will be placed along the toe of fill and in the drainage below the fill slope to trap sediment and minimize the potential for offsite transport.

The haul road will continue to be inspected and maintained regularly. Inspections of the haul road condition and the status sediment and erosion control measures will be integrated with regular required storm water inspection pursuant to the Permit. Sediments will continue to be collected in existing sedimentation basins. These basins will continue to be cleaned out as needed. Sediments removed from these basins will be disposed at pre-approved sites.

As described above, the southern portions of the Project Area are located within the Holcomb Creek watershed. Holcomb Creek has been placed on the Section 303(d) list of impaired water bodies. The cause of the impairment has been listed as total dissolved solids. With proper design, installation, and maintenance of the sediment and erosion controls appearing on Figure 3, the Project is not expected to exacerbate the pollutant load of Holcomb Creek.

3.2 WATER SUPPLY AND GROUNDWATER CONDITIONS

Currently, approximately 1.5 AF/year are used in the Project Area, mainly for dust control, primary crusher operations, and irrigation of reclamation sites. The total water use in the Project Area is expected to increase to about 3 acre-feet per year as a result of the Project, mainly for dust control over an expanded area. The expansion of the nearby White Knob-White Ridge areas separately proposed by Omya will require an additional 2.25 AF/year. As stated above, total annual water use of the entire operation, including the processing plant and White Knob quarries which are outside of the project area, has averaged approximately 13.8 AF/year in recent years. Therefore, groundwater production is anticipated to increase to approximately 17.55 AF/year as a result of the Sentinel-Butterfield and White Knob-White Ridge projects.

The project will not require new or additional water supply entitlements, and all water supply needs will continue to be met using permitted sources. The cumulative incremental increase in groundwater production of 3.75 AF/year is minor, and Omya will remain within its free production allowance designated by the MWA of 19 AF/year.

Quarries or waste materials do not contain deleterious materials or chemical constituents capable of affecting groundwater. Groundwater will not be encountered during mining activities and groundwater quality will not be affected.

4. PROPOSED RECLAMATION PLAN AND POTENTIAL IMPACTS

The Reclamation Plan is shown in Figure 7. The post-mining end-use designated for the Project Area is open space and wildlife habitat. Reclamation of portions of the quarries and overburden storage facilities will begin occur contemporaneously with mining. Final reclamation will take place within 10 years after termination of mining. The primary elements of the reclamation plan for the Project Area include the following.

- Sentinel Quarry will be partially backfilled to an elevation of between 7,300 and 7,550 ft. amsl.
- Butterfield Quarry will be partially backfilled with quarry overburden material to an elevation of approximately 7,850 ft amsl.
- The Central Area and B5 Pad fill slopes will be finished at 2:1.
- Erosion control measures will be implemented such as installation of rip rap, boulder barriers, storm water sumps and berms, and revegetation of select areas.

All remaining equipment and facilities will be removed. Stockpiles of ore grade limestone will be removed or used as backfill. Internal roads not needed for site access, reclamation, and revegetation and general site monitoring will be reclaimed. Final sloping of quarry walls, backfilled areas, and overburden stockpiles; erosion control; and revegetation of any unreclaimed areas and waste rock stockpiles will be conducted.

Some access roads may be left onsite for use in revegetation and monitoring activities, and for public safety. Roads not needed for reclamation access will be ripped, scarified, covered with available growth media, and revegetated. Other onsite roads needed for quarry and pad access will be reclaimed after reclamation of quarries and pads are certified complete as determined by USFS to allow access to reclamation areas.

The Crystal Creek Haul Road will remain for 10 years after cessation of mining to provide access during the reclamation phases. After receiving reclamation certification from the USFS and County, this road will be reclaimed per the approved 1994 Reclamation Plan, unless requested by the USFS.

Post reclamation hydrology will be substantially similar to the Reclamation Plan described above. Following reclamation, the majority of surface runoff from quarry areas will continue to be retained in the quarries, where it will either infiltrate or evaporate. Sediment and erosion controls deployed during the mining phases will be preserved and maintained. The final reclaimed Sentinel Quarry including its planned backfill will be designed to create at a minimum a sized basin or grading towards the west high wall. Reclamation activities, such as revegetation and regrading of slopes, will reduce the chance of discharging sediment laden runoff from the site.

5. CONCLUSIONS

The Project may cause slight reductions of surface water flow quantities in Furnace Canyon, East Dry Canyon, or Holcomb Creek watersheds (less than 0.1%). Effects on surface flow, if any, are expected to be minor because the expansion area constitutes a very small proportion of the total watershed areas. Regardless, the project will not exacerbate flooding hazards in the Crystal Creek, East Dry Canyon, Furnace Canyon, or Holcomb Creek watersheds because the watershed area will essentially be unchanged. Runoff retained within the Project Area will either evaporate or infiltrate to recharge groundwater.

The Project is not expected to deplete groundwater resources or cause noticeable dewatering of offsite groundwater production wells. The project will not require new or additional water supply entitlements, and all water supply needs will continue to be met using existing sources. Groundwater production will increase by approximately 1.5 AF/year through increased production from existing wells. Cumulatively with the increase associated with the proposed nearby White Knob-White Ridge project of 2.25 AF/year, the incremental increase in groundwater production of 3.75 AF/year is minor, and Omya will remain within its free production allowance designated by the MWA.

The project is not expected to cause increased siltation or degrade water quality of surface waters or groundwater. The Mine and Reclamation plans contain erosion and sediment controls that are intended to reduce or eliminate runoff discharges. In addition, the Project Area will continue to be subject to conditions of the Permit, including provisions for inspections, monitoring, and reporting. As required in the 2003 Mining and Reclamation Plan, erosion and sediment control measures will remain in place until reclamation is completed. As a result of proper implementation or sediment and erosion control measures, the Project is not expected to exacerbate the pollutant load of Holcomb Creek, which has been placed on the Section 303(d) list of impaired water bodies.

The quarry pits or waste materials do not contain deleterious materials or chemical constituents capable of affecting groundwater. Groundwater will not be encountered during mining activities and groundwater quality will not be affected.

6. REFERENCES

Colorado River Regional Water Quality Control Board, 2006, Colorado River Water Quality Control Plan, Colorado River Basin, Region 7.

Lahontan Regional Water Quality Control Board, 2005, Lahontan Basin Water Quality Control Plan.

Mojave Water Agency, 2012, Eighteenth Annual Report of the Mojave Basin Area Watermaster, Water Year 2010-11.

Omya California, 2012, Amended Plan of Operations and Reclamation Plan for Omya California Butterfield and Sentinel Quarries.

United States Forest Service, 2010, Letter to State Water Resources Control Board re: Listing of Holcomb Creek as Impaired Water Body on the State 303(d) List. May 27.

Western Regional Climate Center, 2013, Period of Record Monthly Climate Summary. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca0741.

FIGURES

Figure 1 Location map

Figure 2 Project Area vicinity map

Figure 3 Mine Plan with Erosion and Sediment Control Measures

Figure 4 Watershed Map – Existing Permitted Area

Figure 5 Groundwater Well Locations, Mojave Basin, Este Subarea

Figure 6 Watershed Map – Post Mining and Reclamation

Figure 7 Reclamation Plan with Erosion and Sediment Control Measures

N

0 2.65 5.25

SCALE (MILES)

LEGEND

Project Site Location (Geographic Location)
California Zone 5 (FIPS 405): 6881064.78 1943854.58
Lat/Lon: 34° 19' 45.0165" N, 116° 56' 31.3945" W

Location Map

Omya Quarry
San Bernardino County California

Figure 1

April 2013

SLR Consulting USA Pty Ltd
Consulting Engineers & Scientists

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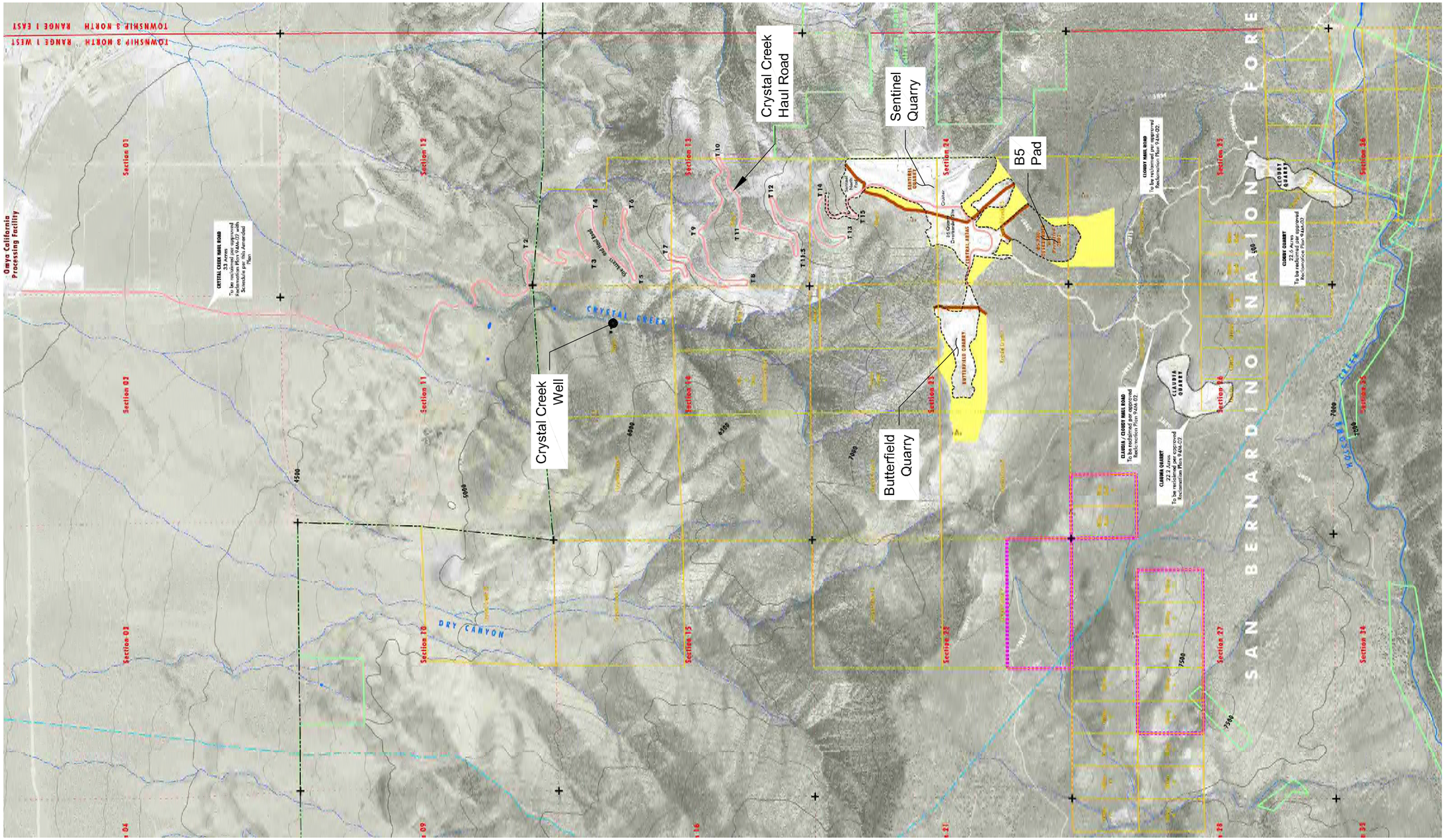

N

0 1,000 2,000

SCALE (FEET)

LEGEND

- Existing Operating Area
- Amended Operations
- Claims
- T 12 Crystal Creek Turn-out
- Proposed Carbonate Mitigation
- Patented land Owned by Others
- Major Contour
- Minor Contour
- 7500 Peak or Ridgeline Elevation
- SBNFS Boundary
- USGS Township
- USGS Section
- Streams
- Drainage
- Water Body
- Pipeline (not a part of project)

Project Area Vicinity Map

Omya Quarry
San Bernardino County, California

Figure 2 | April 2013 | SLR Consulting USA Pty Ltd Consulting Engineers & Scientists

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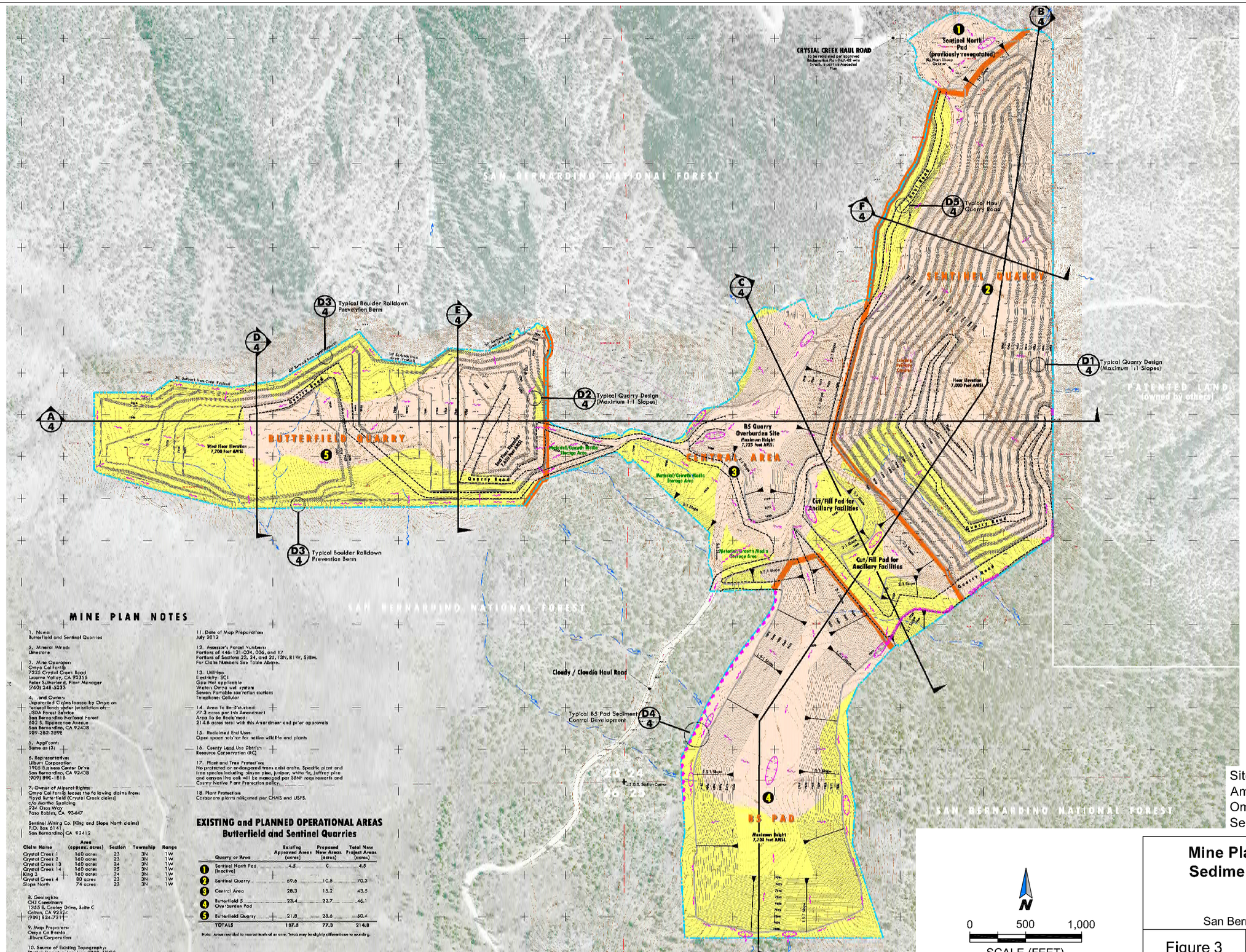


MINE PLAN NOTES

1. Name:
Butterfield and Sentinel Quarries

2. Mineral Mined:
Limestone

3. Mine Operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owners:
Disputed Claims leased by Omya on federal lands under jurisdiction of:
USDA Forest Service
San Bernardino National Forest
602 S. Tippecanoe Avenue
San Bernardino, CA 92408
909-382-2898

5. Applicant:
Same as (3)

6. Representatives:
Liliburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:
Omya California leases the following claims from:
Floyd Butterfield (Crystal Creek claims)
c/o Martha Spalding
934 Oaks Way
Paso Robles, CA 93447

Sentinel Mining Co. (King and Slope North claims)
P.O. Box 0141
San Bernardino, CA 92412

Claim Name	Area (approx. acres)	Section	Township	Range
Crystal Creek 1	160 acres	23	3N	1W
Crystal Creek 2	160 acres	23	3N	1W
Crystal Creek 13	160 acres	24	3N	1W
Crystal Creek 14	160 acres	25	3N	1W
King 3	160 acres	24	3N	1W
Crystal Creek 4	80 acres	23	3N	1W
Slope North	74 acres	23	3N	1W

8. Geologists:
CHJ Consultants
1565 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Omya California
Liliburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. June 2008; USGS

11. Date of Map Preparation:
July 2012

12. Assessor's Parcel Numbers:
Portions of 446-121-004, 006, and 17
Portions of Sections 23, 24, and 25, T3N, R1W, SBBM.
For Claim Numbers See Table Above.

13. Utilities:
Electricity: SCE
Gas: Not applicable
Water: Omya well system
Sewer: Portable sanitation stations
Telephone: Cellular

14. Area To Be Disturbed:
77.3 acres per this Amendment
Area To Be Reclaimed:
214.8 acres total with this Amendment and prior approvals

15. Reclaimed End Uses:
Open space habitat for native wildlife and plants

16. County Land Use District:
Resource Conservation (RC)

17. Plant and Tree Protection:
No protected or endangered trees exist onsite. Specific plant and tree species including canyon live oak, juniper, white fir, Jeffrey pine and canyon live oak will be managed per SBNF requirements and County Native Plant Protection policy.

18. Plant Protection:
Cactobrome plants mitigated per CHMS and USFS.

EXISTING and PLANNED OPERATIONAL AREAS
Butterfield and Sentinel Quarries

	Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total New Project Areas (acres)
1	Sentinel North Pad (Inactive)	4.5	0	4.5
2	Sentinel Quarry	59.6	10.8	70.3
3	Central Area	28.3	15.2	43.5
4	Butterfield 5 Overburden Pad	23.4	22.7	46.1
5	Butterfield Quarry	21.8	28.6	50.4
	TOTALS	137.5	77.3	214.8

Note: Areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.

LEGEND

- Amended Operations Limits of Disturbance
- Existing Permitted Operating Area
- Proposed Expansion
- Operating Major Contour
- Operating Minor Contour
- Haul Road
- Slope Indicator Top of slope
- Toe of slope
- Boulder Barrier
- RipRap
- Design Drainage
- Sump
- Storm Water Control Berm
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages

Site Reference From:
Amended Plan Of Operations For Omya, California Butterfield and Sentinel Quarries, September 2012

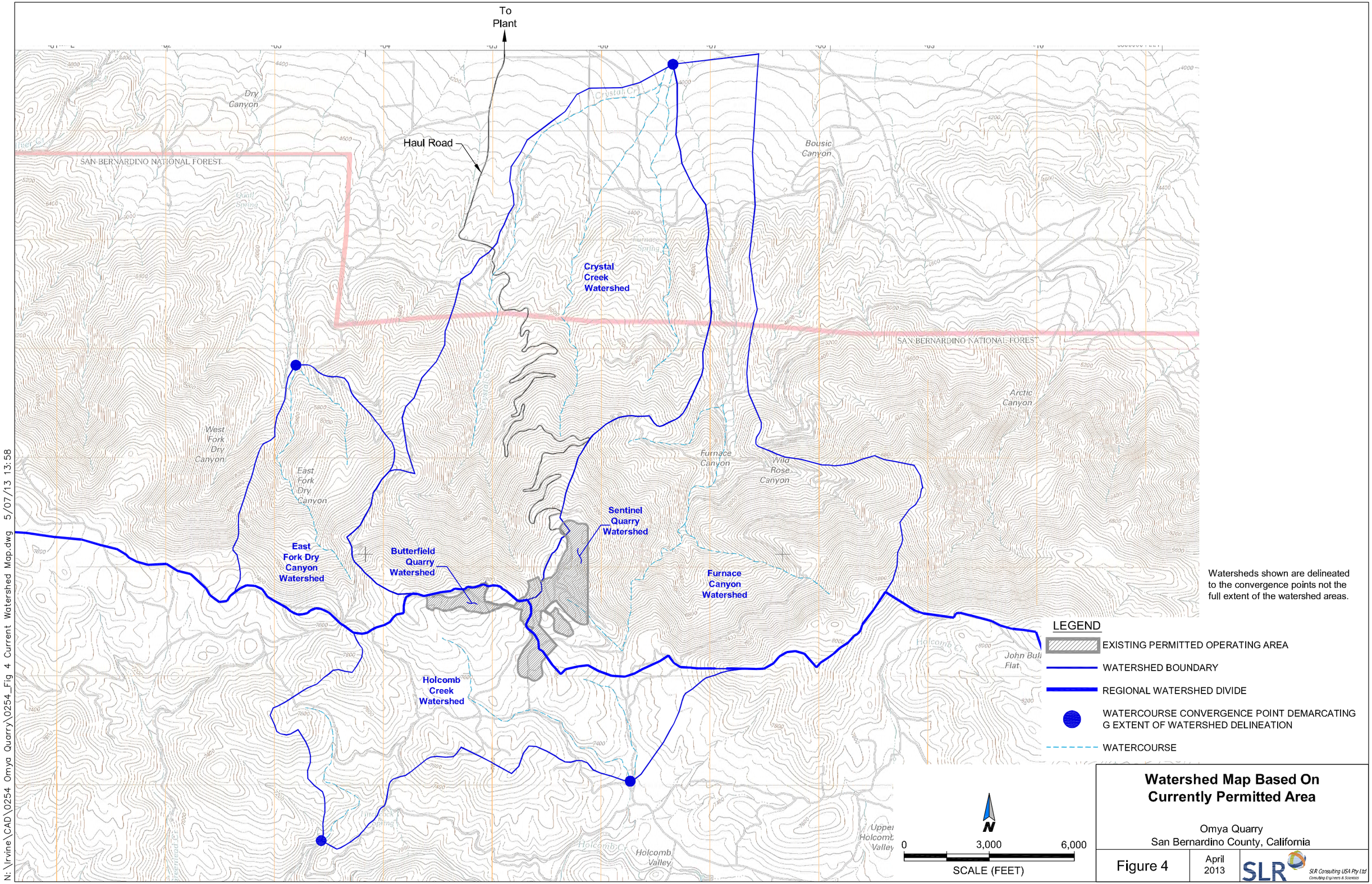
Mine Plan With Erosion And Sediment Control Measures

Omya Quarry
San Bernardino County, California

Figure 3 | April 2013

SLR Consulting USA Pty Ltd
Consulting Engineers & Scientists

N:\rvine\CAD\0254 Omya Quarry\0254_Fig 3 Mine Plan with Erosion Control.dwg 5/07/13 13:53

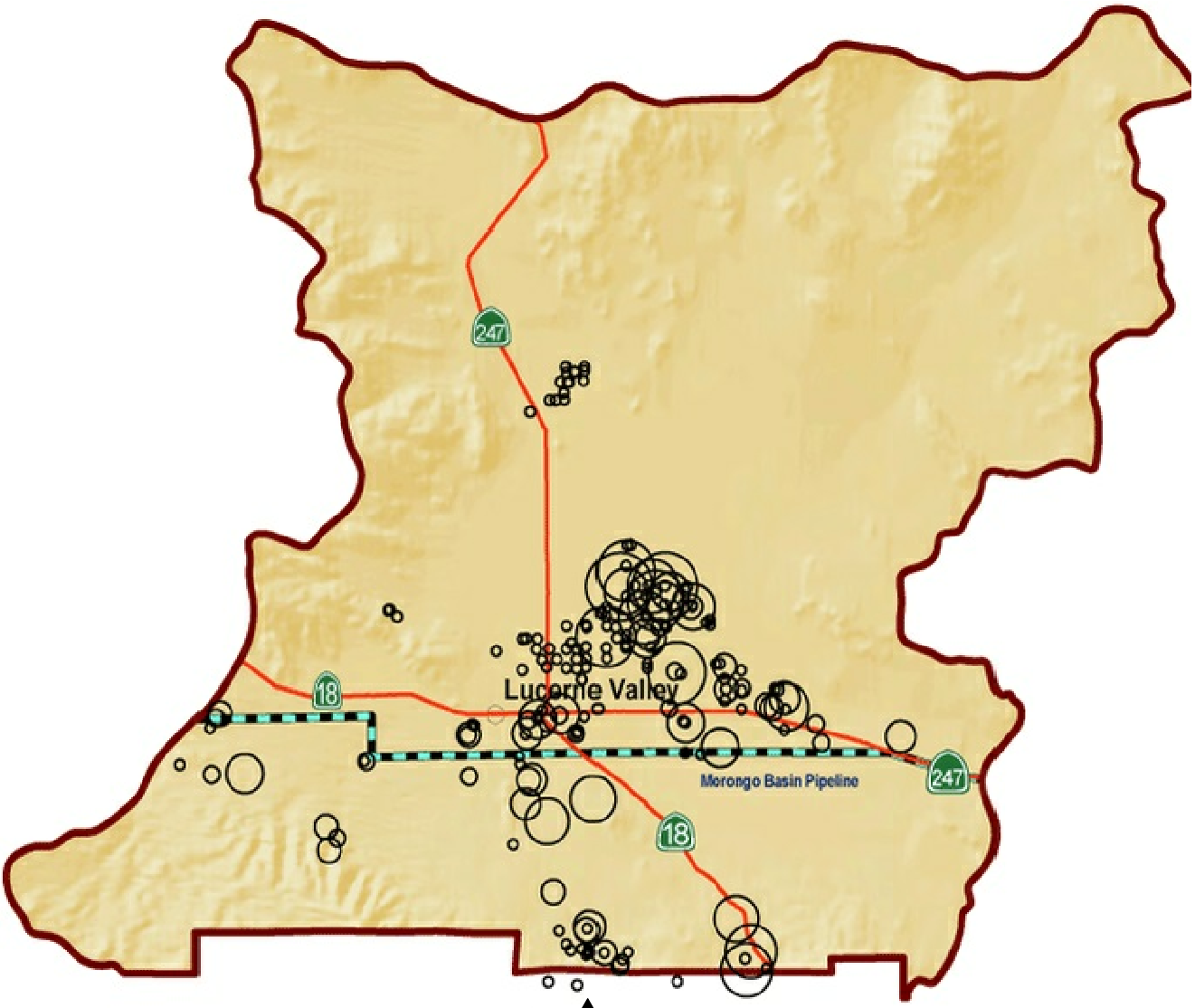


Watershed Map Based On Currently Permitted Area

Omya Quarry
San Bernardino County, California

Figure 4 | April 2013 | SLR Consulting USA Pty Ltd Consulting Engineers & Scientists

N:\Irvine\CAD\0254 Omya Quarry\0254_Fig 4 Current Watershed Map.dwg 5/07/13 13:58



Project Area

0 - 3	113 - 226
4 - 11	227 - 449
12 - 20	450 - 595
21 - 36	
37 - 62	
63 - 112	

Production in ac/ft/yr

N

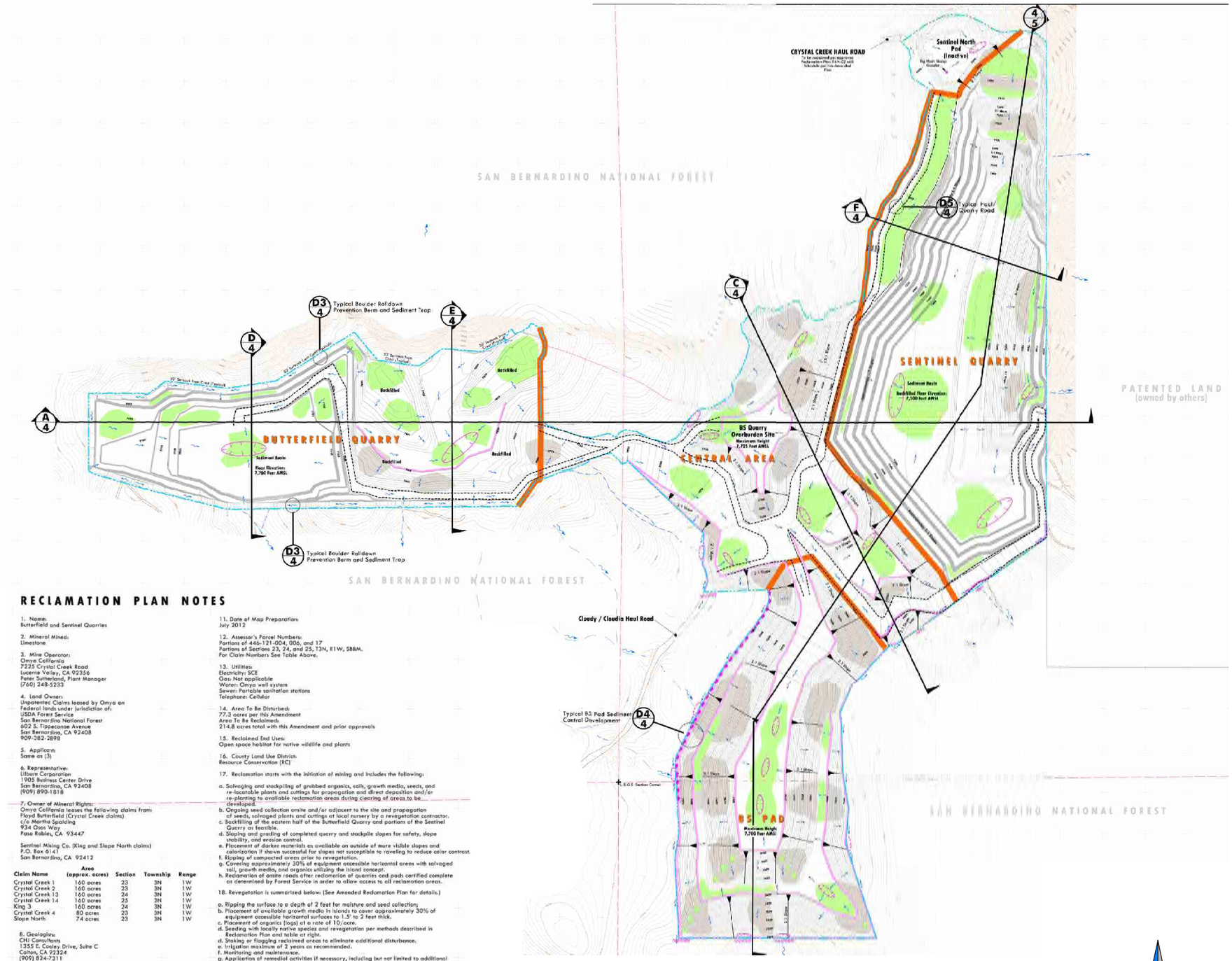
NOT TO SCALE

Groundwater Well Locations, Mojave Basin, Este Subarea

Omya Quarry
San Bernardino County California

Figure 5	April 2013	SLR Consulting USA Pty Ltd Consulting Engineers & Scientists

N:\Irvine\CAD\0254 Omya Quarry\0254_Fig 5 Ground Well Locations.dwg 5/07/13 08:07



LEGEND

- Amended Operations Limits of Disturbance
- Reclaimed Major Contour
- Reclaimed Minor Contour
- Roads to Remain
- Slope Indicator
  - Top of slope
  - Toe of slope
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages
- Boulder Barrier
- RipRap
- Design Drainage
- Sump (typical)
- Existing Natural Sump
- Storm Water Control Berm
- Sediment Control
- Berm as Necessary
- 3-strand Wire Fence (typical)
- Soil Islands for
- Growth Media (typical)

RECLAMATION PLAN NOTES

1. Name:
Butterfield and Sentinel Quarries

2. Mineral Mined:
Limestone

3. Mine Operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Unpatented Claims leased by Omya on
Federal lands under jurisdiction of:
USDA Forest Service
San Bernardino National Forest
602 S. Tippecanoe Avenue
San Bernardino, CA 92408
909-382-2898

5. Applicant:
Same as (3)

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:
Omya California leases the following claims from:
Floyd Butterfield (Crystal Creek claims)
c/o Martha Spalding
934 Oaos Way
Paso Robles, CA 93447

Sentinel Mining Co. (King and Slope North claims)
P.O. Box 6141
San Bernardino, CA 92412

Claim Name	Area (approx. acres)	Section	Township	Range
Crystal Creek 1	160 acres	23	3N	1W
Crystal Creek 2	160 acres	23	3N	1W
Crystal Creek 13	160 acres	24	3N	1W
Crystal Creek 14	160 acres	25	3N	1W
King 3	160 acres	24	3N	1W
Crystal Creek 4	80 acres	23	3N	1W
Slope North	74 acres	23	3N	1W

8. Geologists:
CHJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Omya California
Lilburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. June 2008; USGS

11. Date of Map Preparation:
July 2012

12. Assessor's Parcel Numbers:
Portions of 446-121-004, 006, and 17
Portions of Sections 23, 24, and 25, T3N, R1W, SBBM.
For Claim Numbers See Table Above.

13. Utilities:
Electricity: SCE
Gas: Not applicable
Water: Omya well system
Sewer: Portable sanitation stations
Telephone: Cellular

14. Area To Be Disturbed:
77.3 acres per this Amendment
Area To Be Reclaimed:
214.8 acres total with this Amendment and prior approvals

15. Reclaimed End Uses:
Open space habitat for native wildlife and plants

16. County Land Use District:
Resource Conservation (RC)

17. Reclamation starts with the initiation of mining and includes the following:

a. Salvaging and stockpiling of grubbed organics, soils, growth media, seeds, and re-locatable plants and cuttings for propagation and direct deposition and/or re-planting to available reclamation areas during clearing of areas to be developed.
b. Ongoing seed collection onsite and/or adjacent to the site and propagation of seeds, salvaged plants and cuttings at local nursery by a revegetation contractor.
c. Backfilling of the eastern half of the Butterfield Quarry and portions of the Sentinel Quarry as feasible.
d. Sloping and grading of completed quarry and stockpile slopes for safety, slope stability, and erosion control.
e. Placement of darker materials as available on outside of more visible slopes and colorization if shown successful for slopes not susceptible to raveling to reduce color contrast.
f. Ripping of compacted areas prior to revegetation.
g. Covering approximately 30% of equipment accessible horizontal areas with salvaged soil, growth media, and organics utilizing the island concept.
h. Reclamation of onsite roads after reclamation of quarries and pads certified complete as determined by Forest Service in order to allow access to all reclamation areas.

18. Revegetation is summarized below: (See Amended Reclamation Plan for details.)

a. Ripping the surface to a depth of 2 feet for moisture and seed collection;
b. Placement of available growth media in islands to cover approximately 30% of equipment accessible horizontal surfaces to 1.5' to 2 feet thick.
c. Placement of organics (logs) at a rate of 10/acre.
d. Seeding with locally native species and revegetation per methods described in Reclamation Plan and table at right.
e. Staking or flagging reclaimed areas to eliminate additional disturbance.
f. Irrigation maximum of 2 years as recommended.
g. Monitoring and maintenance.
h. Application of remedial activities if necessary, including but not limited to additional seeding and planting, plant protection, irrigation, and change of seed and plant mix.

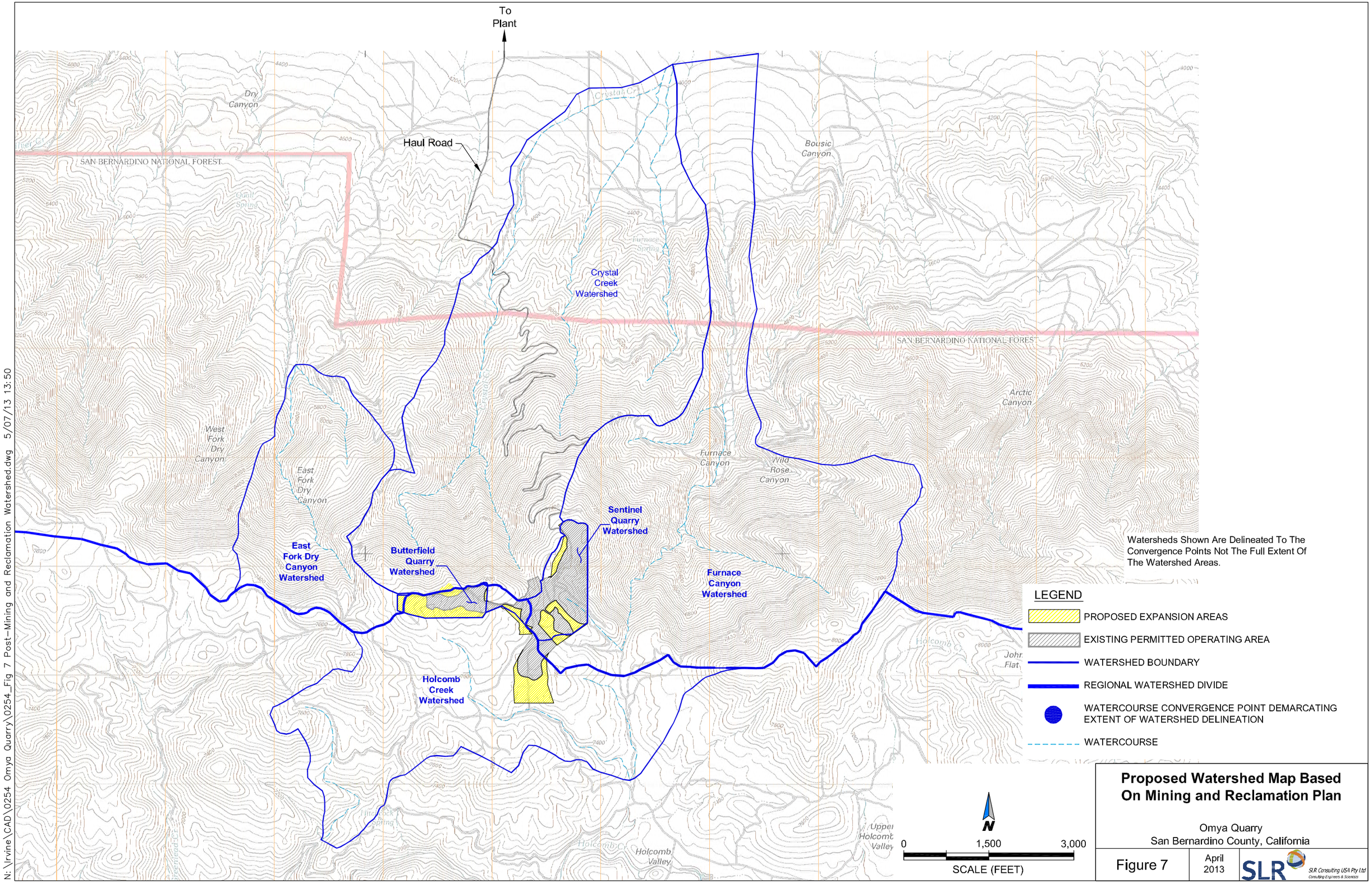
Site Reference From:
Amended Plan Of Operations For
Omya California Butterfield and
Sentinel Quarries, September 2012

Reclamation Plan With Erosion And Sediment Control Measures

Omya Quarry
San Bernardino County, California

Figure 6 | April 2013 | SLR Consulting USA Pty Ltd

N:\Irvine\CAD\0254 Omya Quarry\0254_Fig 6 Reclamation Plan With Erosion.dwg 5/07/13 14:01



Proposed Watershed Map Based On Mining and Reclamation Plan

Omya Quarry
San Bernardino County, California

Figure 7 | April 2013 | SLR Consulting USA Pty Ltd

N:\Irvine\CAD\0254 Omya Quarry\0254_Fig 7 Post-Mining and Reclamation Watershed.dwg 5/07/13 13:50

Memorandum

To: Maya Rohr, Sespe Consulting

From: Nestor Godinez P.E., Tom Patterson Ph.D.; SLR International

Date: June 5, 2017

Subject: Further Evaluation of Storm Water Management Conceptual Design; Omya Quarry Project

1. INTRODUCTION

As requested by Sespe Consulting (Sespe), SLR International (SLR) has performed an analysis of the storm water and erosion management concepts for mining and post-reclamation conditions at the Omya Quarry Project (Project) in the San Bernardino Mountains. The objective of this analysis is to verify that the storm water and erosion management concepts meet the requirements of the Surface Mining and Reclamation Act (SMARA).

In correspondence to San Bernardino County dated August 19, 2013, California Department of Conservation Office of Mine Reclamation (OMR) requested a study to verify that the storm water management concepts conform with the requirements of California Code of Regulations (CCR) Section 3706(d): surface runoff and drainage from surface mining activities must be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other Best Management Practices (BMPs) that are designed to handle runoff from not less than the 20-year, one-hour intensity storm event.

In this Technical Memorandum (TM), SLR reviews the mining and post-reclamation storm water management concepts and presents calculations to verify that the above requirements are met or exceeded with regard to storm water management and erosion control.

2. BACKGROUND

Attachment A presents relevant information from the Amended Mine Plan, Amended Reclamation Plan, and Cross Sections and Details prepared by others dated July 2015. The Amended Mine Plan and the Amended Reclamation Plan show the locations of proposed sumps, berms, and sediment control structures to manage storm water and erosion. Since mining operations are ongoing, the locations of storm water and erosion control structures may be temporary and will move as operations progress, so may not be in the same locations shown in the Amended Mine Plan. However, for the purposes of verifying the SMARA runoff and drainage system requirements are met, the designed features shown in the plans in Attachment A are considered representative.

Figure 1 presents the Watershed Boundary Map created for the post-reclamation conditions. The Project area is located on the crest of the San Bernardino Mountains, along the divides of multiple watersheds, and therefore surface runoff generally flows away from the Project area. Most of the Omya Quarry Project area is graded to drain into the Sentinel or Butterfield Quarries to avoid discharges into the surrounding natural drainages. As a result, the quarries generally create their own self-contained watersheds where runoff infiltrates or evapotranspires and sediment will be contained within the quarry.

In flat areas such as pads and benches, storm water runoff is directed to constructed sumps. Water is directed to these sumps by storm water control such as berms or ditches wherever needed. Storm water runoff collected by sumps infiltrates into the ground.

At the outer toes of reclaimed slopes, storm water runoff is channeled to natural low spots by storm water control berms. Sumps and/or sediment control structures (e.g., rock dams or silt fencing) are constructed in natural low spots to manage storm water runoff and sediment. Water passing through sediment control structures flows into natural drainages, which are generally steep and sparsely vegetated. Natural runoff from the surrounding wooded areas from the San Bernardino National Forest is generally flowing away from the project area, but to the small extent that a natural watershed drains onto a reclaimed area, the run-on water is directed to existing natural sumps in low spots.

The storm water and erosion management concepts for post-reclamation conditions are based on the same concepts currently being used during mining operations. Most of the operating mining area will be graded to drain into the Sentinel or Butterfield Quarries. Sumps will be used to infiltrate or evapotranspire storm water runoff. At the outer toes of the operating mine slopes, storm water runoff will be channeled to natural low spots by storm water control berms where sumps and/or sediment control structures will manage storm water runoff and sediment. The final planned configuration is shown in the drawings in Attachment A.

3. ANALYSIS

3.1 Design Storm Event

As noted above, CCR Section 3706(d) requires the control of storm water runoff to ensure that surrounding lands are protected from erosion, gullying, and sedimentation. The erosion control methods shall be designed to convey the storm water runoff from not less than the 20-year, 1-hour intensity storm event.

Total precipitation values for the 25-year storm frequency in the site area are readily available. The 25-year storm frequency will produce a higher total precipitation value than the 20-year storm frequency. Thus using the 25-year storm frequency is more conservative and meets the minimum requirement specified in the regulation. Attachment B provides the NOAA Atlas 14 site-specific total precipitation in inches for different storm events and storm durations in the project area. The 25-year, 1-hour storm will produce 1.34 inches of precipitation.

3.2 Storm Water Runoff Analysis

A storm water runoff analysis was conducted for the post-reclamation conditions of the Omya Quarry Project. Since post-reclamation storm water runoff management and control structures are based on the same designs and criteria used in current mine operations and because the methodology used in the analysis is inherently conservative, the analysis of the configuration in the post-reclamation configuration also represents the operational condition.

The rational method was used in the calculation of storm water runoff volumes and peak flows. The Project area was subdivided into 21 watershed catchment areas corresponding to specific sumps and/or sediment control structure outlets (see Figure 1). A runoff coefficient of 70% was selected for all reclaimed areas and a runoff coefficient of 30% was selected for the natural, steep wooded areas surrounding the Omya Quarry. Attachment C provides the analysis calculations and results.

The time of concentration was utilized to calculate the peak flow for each watershed. The time concentration for each watershed was calculated using the velocity method. The minimum time of concentration was 5 minutes. For watersheds with channelized flow due to storm water control berms, Manning's flow equation was used to calculate flow capacities.

As shown in the Cross Sections and Details Sheet in Attachment A, 4 feet was used as the height of all storm water control berms. Channelized flow locations were analyzed as triangular sections with 2 to 1 side slopes. The average flow path slopes were calculated from the proposed topography. A Manning's coefficient of 0.04 (i.e., for a rough rock filled channel) was selected. A 4-foot average water depth was also used for the water storage depth at all sump locations. Maximum sump areas were based on topography in the Amended Reclamation Plan drawings (Attachment A). Minimum required capacities for sediment control were calculated for the 25-year, 1-hour storm, and these can be used for design during implementation.

3.3 Results

The results of the calculations are presented in Tables 2, 3, and 4 in Attachment C. All sump locations in the quarry floors, benches, and pads were calculated to have sufficient capacities for the required 25-year, 1-hour storm water runoff volumes. Storm water runoff volumes ranged from approximately 3,200 cubic feet to 195,700 cubic feet (Table 2, Attachment C).

Sumps located on the southern toe of slope of the B5 Pad (Watersheds S14 and S15) have a limited capacity due to the steep topography. Water not able to be contained by the sumps will overflow the sump while being filtered through sediment control structures and discharging into the natural drainages. The required capacity of the sediment control structure at Watershed S14 is approximately 23,600 cubic feet per hour for the 25-year, 1-hour storm (Table 2, Attachment C). The required capacity of the sediment control structure at Watershed S15 is approximately 10,100 cubic feet per hour for the 25-year, 1-hour storm (Table 2, Attachment C).

A portion of the eastern B5 Pad slope does not have a sump and outlets into a sediment control structure (Watershed S18, see Figure 1). The required capacity of the sediment control structure at Watershed S18 is approximately 12,700 cubic feet per hour for the 25-year, 1-hour storm (Table 2, Attachment C).

Sump locations outside the boundary of the Project areas on the San Bernardino National Forest side (Watersheds S12, S13, S19, and S20) will receive storm water runoff from wooded areas and were calculated to have sufficient capacities for the 25-year, 1-hour storm water runoff volumes. These sumps are in areas that were seasonal natural drainages. The sumps must be constructed so that water does not overtop the adjacent storm water control berms and run onto Project areas.

Due to the steepness of the topography, the time of concentration for watersheds is short, ranging approximately from 5 to 16 minutes (Table 3, Attachment C). The average time of concentration is 6.5 minutes. Peak overland water flows reporting to the sumps and/or sediment control structure outlets ranged from 2.9 cubic feet per second to 169 cubic feet per second (Table 3, Attachment C). Channelized peak water flows ranged from 9.2 cubic feet per second to 90.6 cubic feet per second (Table 4, Attachment C). Channel slopes ranged from 4% to 23%. Maximum channel flow depth for the design channel was approximately 2 feet, resulting in a channel freeboard of 2 feet. The maximum channel flow capacity assuming a flow depth of 3 feet with 1 foot of freeboard and a minimum slope of 4% is 163 cubic feet per second (Table 4, Attachment C), which well exceeds the calculated maximum flows in Table 3 of Attachment C. Therefore the bermed channels are designed with sufficient capacity for the 25-year, 1-hour storm water peak runoff flows.

4. CONCLUSIONS

- The storm water management conceptual design for post-reclamation conditions that was used in this analysis is based on the current storm water management designs used by the operating mine.
- Sumps in quarry floor, benches, and pad areas are in large areas with sufficient space to construct large sumps that can contain all runoff and sediment for the rain event specified in the regulations.
- The area at the toe of slope of the B5 Pad has limited area for sumps resulting in sumps with insufficient capacity to fully contain the 25-year, 1-hour storm, so sediment control structures are necessary to capture sediment and prevent erosion from the excess storm water runoff. Sediment control structure capacities have been calculated for the designs during implemented.
- Proposed berms are necessary at the toe of slope of the B5 Pad to direct storm water runoff to sumps and sediment control structures. The berms will also prevent run-on from the adjacent San Bernardino National Forest wooded areas.
- Channelized flow locations at berms have sufficient capacity for 25-year, 1-hour storm water runoff flows.
- The storm water management conceptual design for mining and post-reclamation conditions therefore is sufficient for meeting or exceeding the SMARA criteria.

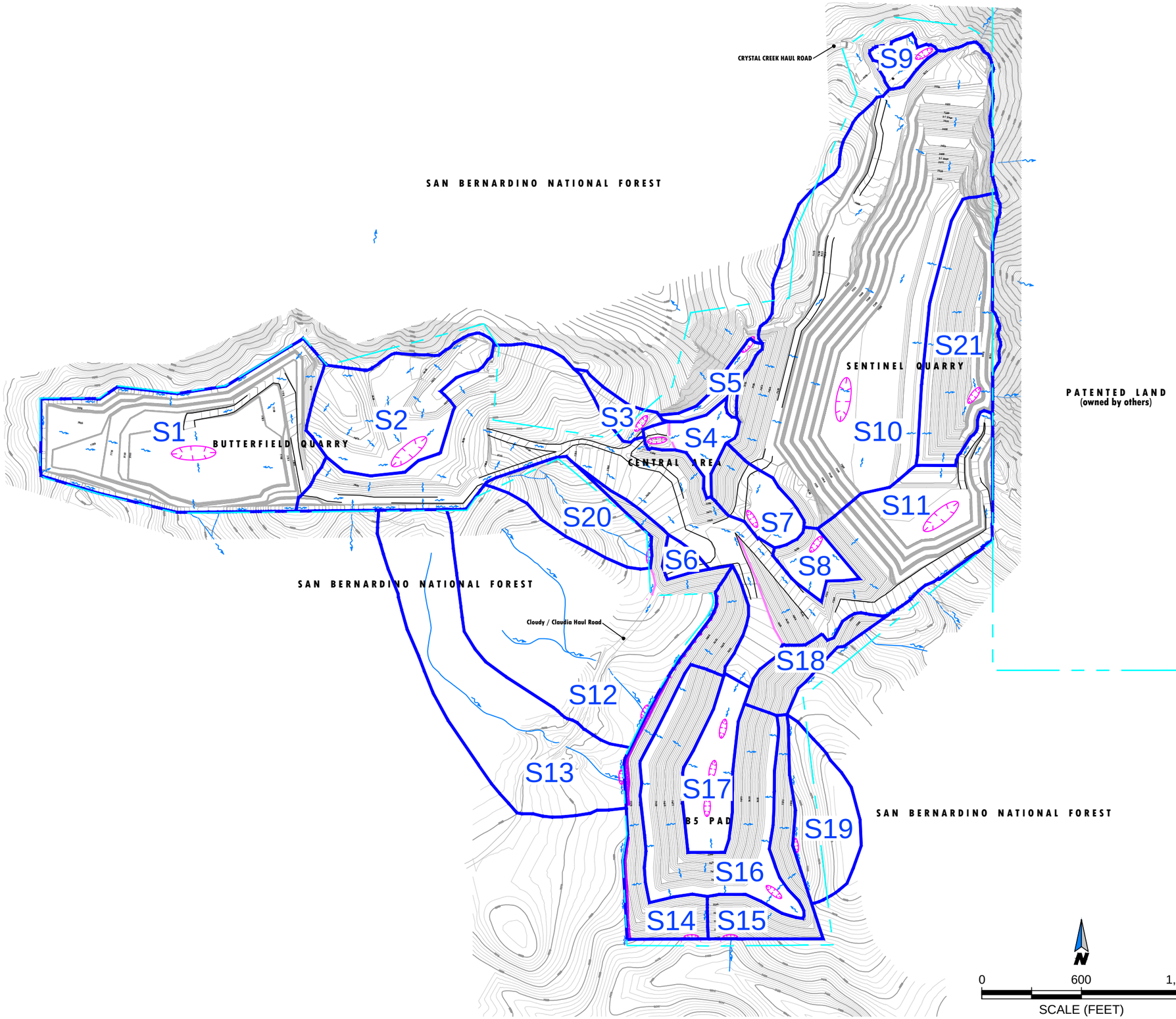
- Seasonal monitoring and maintenance/repair of runoff and erosion control measures are included in the Amended Mine Plan and Amended Reclamation Plan, and these measures are necessary to assure the performance of the measures for the design storm event.

5. LIMITATIONS

The analyses and recommendations presented in this report are intended for conceptual engineering design purposes only and not for construction. The information contained in this document has received technical review and approval. This acknowledgement is made in lieu of all warranties, either expressed or implied.

Nestor J. Godinez, P.E.
Registered Professional Engineer (Civil)
Certificate No. C77719

Attachment A
Amended Mine and Reclamation Plan, Cross Sections, and Details
July 2015



LEGEND

WATERSHED BOUNDARY

AMENDED OPERATIONS LIMITS OF DISTURBANCE

Site Reference From:
Amended Plan Of Operations For Omya California Butterfield and Sentinel Quarries, July 2015

Watershed Boundary Map

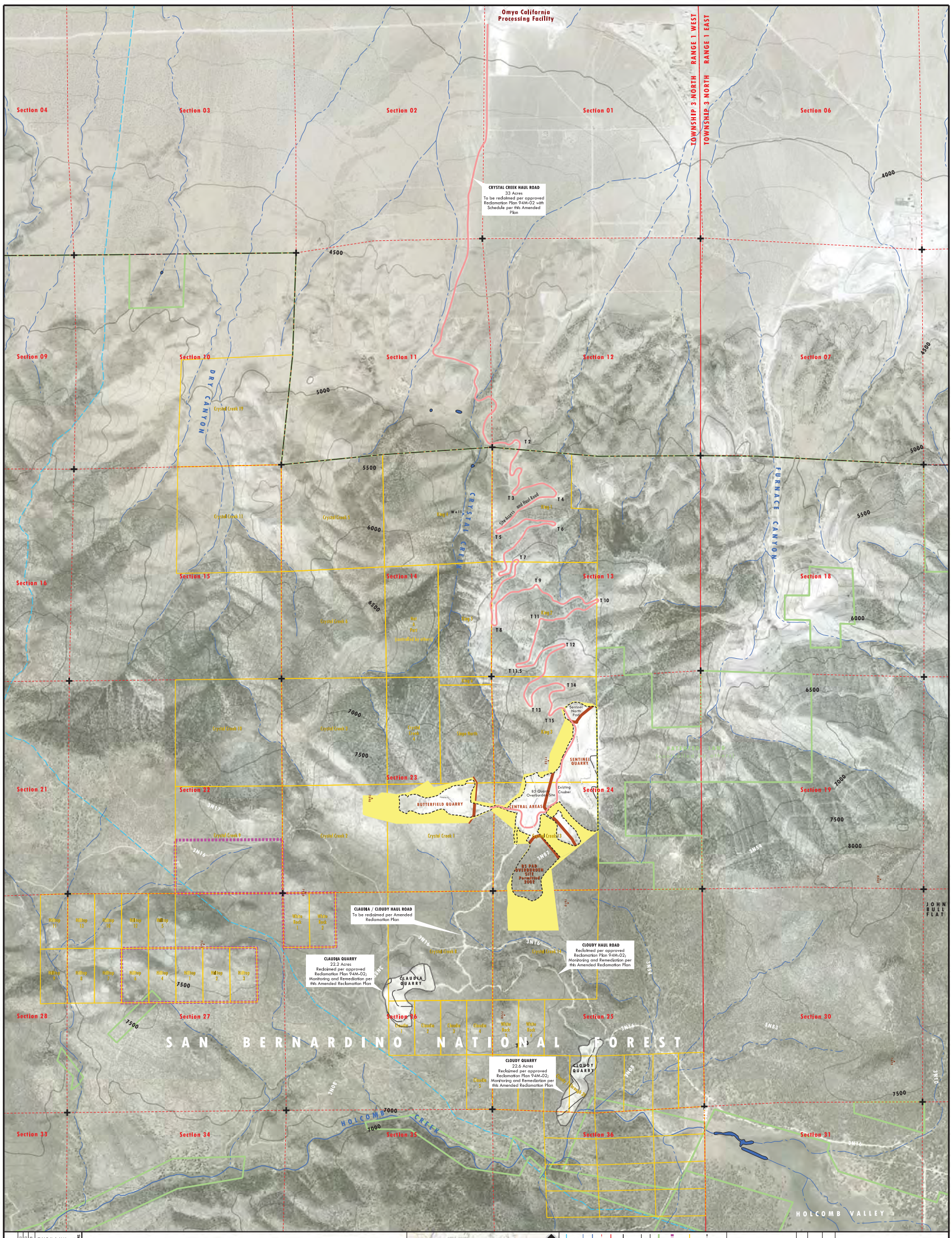
Omya Quarry
San Bernardino County, California

Figure 1

July 2017

SLR Consulting USA Pty Ltd
Consulting Engineers & Scientists

N:\Irvine\CAD\0254 Omya Quarry\Hydrolic Analysis\0254_Fig 1 Reclamation Plan With Erosion.dwg-6/2/2017 10:30 AM



AMENDED PLAN of OPERATIONS and RECLAMATION PLAN

Butterfield and Sentinel Quarries Expansion - Omya California

SAN BERNARDINO NATIONAL FOREST, SAN BERNARDINO COUNTY, CALIFORNIA

LEGEND

- Existing Operating Area
- Amended Operations
- Placer Claims
- T12 Crystal Creek Road Turn-out
- Proposed Carbonate Mitigation
- Patented Land by Others
- Major Contour
- Minor Contour
- 1,762 Peak or Ridgeline Elevation
- San Bernardino National Forest Boundary
- USGS Township Boundary
- USGS Survey Section
- Streams
- Intermittent Streams
- Water Body
- Pipeline (not a part of project)

Scale: 1 inch = 800 feet

Base Map: Aerial Photography Flown 2010 (NAD83)
Projection: California Zone 6 (NAD 83)
Vertical Datum: Mean Sea Level (MSL)
Topo Contour Interval: 20 feet

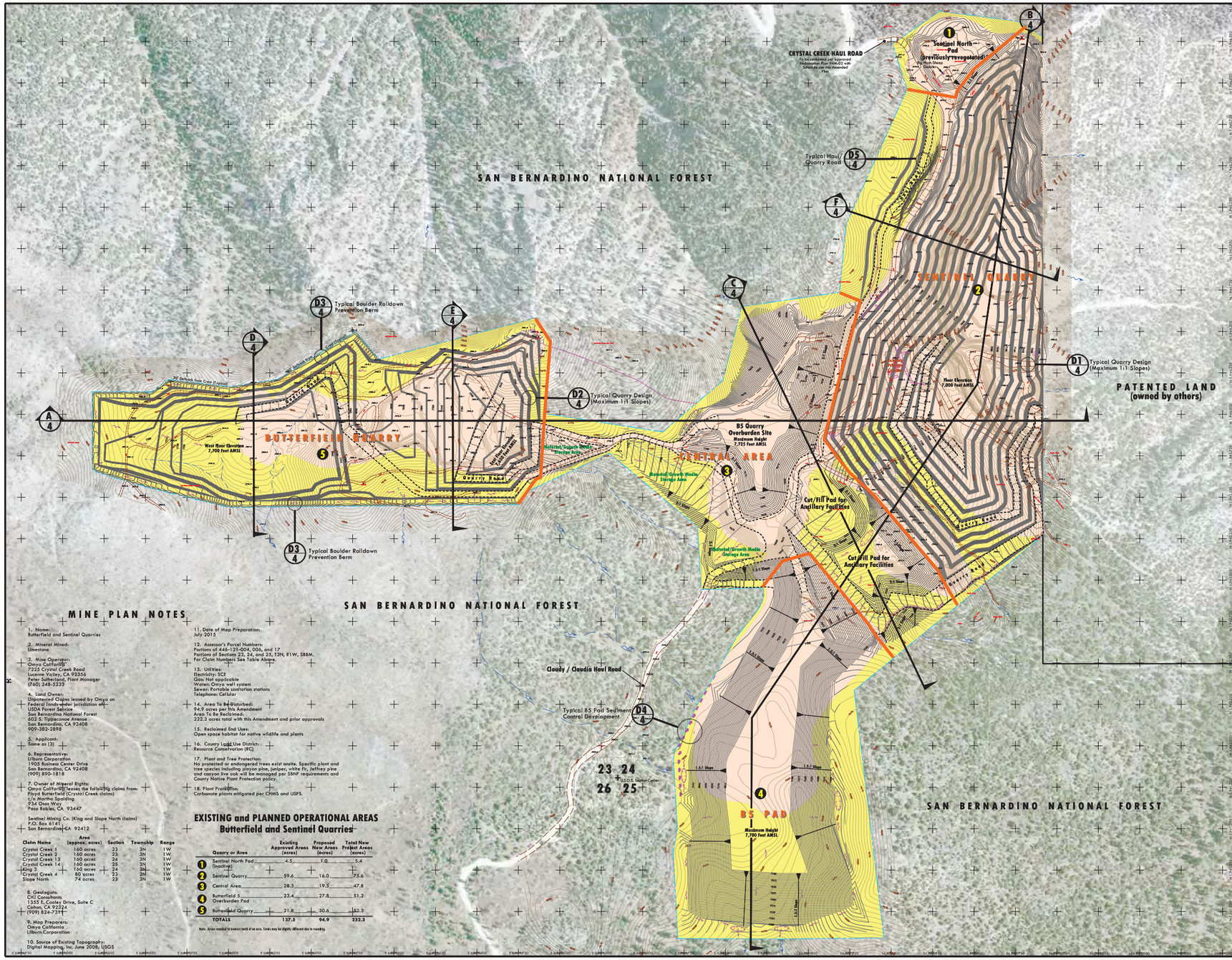
Prepared for: Omya California
Prepared by: Tetra Tech, Inc.
1905 Business Center Drive San Bernardino, CA 92408
909.890.1818 Fax 909.890.1809

No.	Date	By	Revision Description
4			
3			
2			
1			
4	06/15/15	JR	Revised limits of disturbance

Sheet 1 of 8

Date: 06/15/2015
Scale: 1" = 800'
Drawn: Kevin Chambers
Checked: TBW/JR

Sheet	Description
1	Amended Plan of Operations and Reclamation Plan
2	Reclamation Plan
3	Amended Reclamation Plan
4	Cross Section Details
5	Claudia Quarry Reclamation Plan
6	Cloudy / Claudia Haul Road Reclamation Plan
7	Cloudy / Sentinel Haul Road Reclamation Plan
8	Crystal Creek Haul Road Reclamation Plan



MINE PLAN NOTES

1. Name:
Butterfield and Sentinel Quarries

2. Mineral Mined:
Limestone

3. Mine Operator:
Onyx California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Unpatented Claims leased by Onyx on Federal land under jurisdiction of USDA Forest Service
San Bernardino National Forest
602 S. Tippecanoe Avenue
San Bernardino, CA 92408
909-382-2898

5. Applicant:
Same as (3)

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:
Onyx California leases the following claims from:
Floyd Butterfield (Crystal Creek claims)
c/o Martha Spalding
934 Oxen Way
Paso Robles, CA 93447

Sentinel Mining Co. (King and Slope North claims)
P.O. Box 6141
San Bernardino, CA 92412

Claim Name	Area (approx. acres)	Section	Township	Range
Crystal Creek 1	160 acres	23	3N	1W
Crystal Creek 2	160 acres	23	3N	1W
Crystal Creek 13	160 acres	24	3N	1W
Crystal Creek 14	160 acres	25	3N	1W
King 3	160 acres	24	3N	1W
Crystal Creek 4	80 acres	23	3N	1W
Slope North	74 acres	23	3N	1W

8. Geologists:
CHJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Onyx California
Lilburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. June 2008, USGS

11. Date of Map Preparation:
July 2015

12. Assessor's Parcel Numbers:
Portions of 446-121-004, 006, and 17
Portions of Sections 23, 24, and 25, T3N, R1W, SBBM.
For Claim Numbers See Table Above.

13. Utilities:
Electricity: SCE
Gas: Not applicable
Water: Onyx well system
Sewer: Portable sanitation stations
Telephone: Cellular

14. Area To Be Disturbed:
94.9 acres per this Amendment
Area To Be Reclaimed:
232.3 acres total with this Amendment and prior approvals

15. Reclaimed End Uses:
Open space habitat for native wildlife and plants

16. County Land Use District:
Resource Conservation (RC)

17. Plant and Tree Protection:
No protected or endangered trees exist onsite. Specific plant and tree species including pinyon pine, juniper, white fir, Jeffrey pine and canyon live oak will be managed per SBNF requirements and County Native Plant Protection policy.

18. Plant Protection:
Carbonate plants mitigated per CMMS and USFS.

EXISTING and PLANNED OPERATIONAL AREAS
Butterfield and Sentinel Quarries

	Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total New Project Areas (acres)
1	Sentinel North Pad (inactive)	4.5	1.0	5.4
2	Sentinel Quarry	59.6	16.0	75.6
3	Central Area	28.3	19.5	47.8
4	Butterfield S. Overburden Pad	23.4	27.8	51.2
5	Butterfield Quarry	21.8	30.6	52.3
	TOTALS	137.5	94.9	232.3

Note: Areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.

LILBURN CORPORATION
1905 Business Center Drive, San Bernardino, CA 92408
909.890.1818 Fax 909.890.1821

No.	Date	By	Revision Description
1	06/11/15	JK	Revised Limits of Disturbance

N

100 0 100 200
Scale: 1 Inch = 200 feet

Map Prepared by: Lilburn Corporation (1/15)
Projection: U.S.F.S., Zone 1, NAD27 Feet, SBBM.
Contour Interval: 5 Foot

LEGEND

- Amended Operations Limits of Disturbance
- Existing Permitted Operating Areas
- Proposed Expansion
- Operating Major Contour
- Operating Minor Contour
- Haul Road
- Slope Indicator Top of slope
- Toe of slope
- Boulder Barrier
- RipRap
- Design Drainage
- Sump
- Storm Water Control Berm
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages

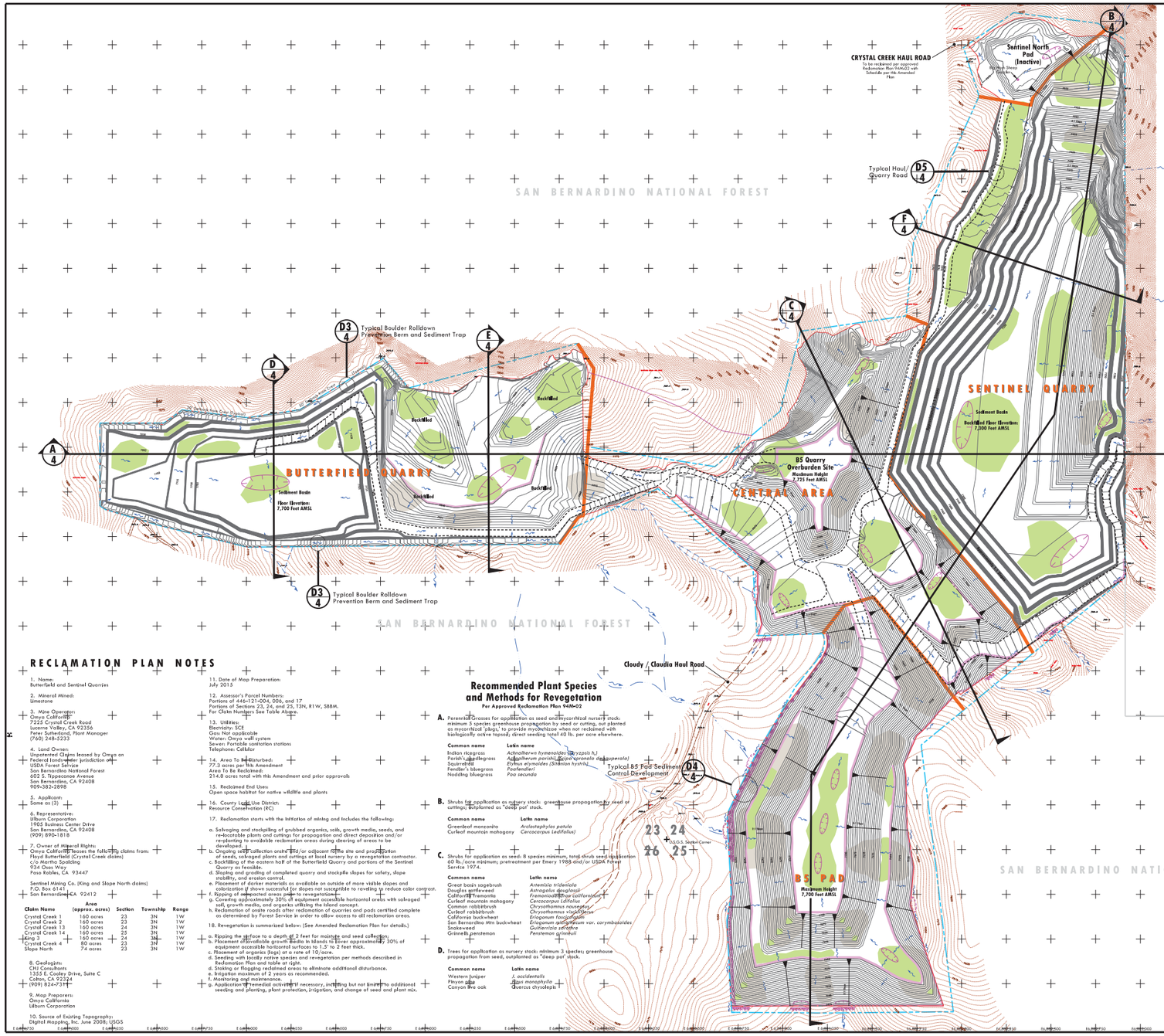
REGISTERED PROFESSIONAL ENGINEER
JAMES K. JOHNS
No. 51574
Exp. 12.31.15
CIVIL
STATE OF CALIFORNIA

AMENDED MINE PLAN
Butterfield and Sentinel Quarries Expansion - Onyx California
SAN BERNARDINO NATIONAL FOREST - SUTTER - SAN BERNARDINO COUNTY - CALIFORNIA

Sheet	Description
1	Amended Plan of Operations and Reclamation Plan
2	Amended Mine Plan
3	Amended Reclamation Plan
4	Cross Sections and Details
5	Claudia Quarry Reclamation Plan
6	Cloudy Quarry Reclamation Plan
7	Cloudy/Claudia Haul Road Reclamation Plan
8	Crystal Creek Haul Road Reclamation Plan

Scale: 1"=200'
Date: 06/2015 (1/16)
DCS: 0815 Sheet-based Rev.dgn

Sheet 2 of 8



RECLAMATION PLAN NOTES

1. Name:
Butterfield and Sentinel Quarries

2. Mineral Mined:
Limestone

3. Mine Operator:
Onyx California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Unpatented Claims leased by Onyx on Federal land under jurisdiction of the USDA Forest Service
San Bernardino National Forest
602 S. Tippecanoe Avenue
San Bernardino, CA 92408
909-382-2898

5. Applicant:
Same as (3)

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:
Onyx California leases the following claims from:
Floyd Butterfield (Crystal Creek claims)
c/o Martha Spalding
934 Oak Way
Paso Robles, CA 93447

Sentinel Mining Co. (King and Slope North claims)
P.O. Box 6141
San Bernardino, CA 92412

Claim Name	Area (approx. acres)	Section	Township	Range
Crystal Creek 1	160 acres	23	3N	1W
Crystal Creek 2	160 acres	23	3N	1W
Crystal Creek 13	160 acres	24	3N	1W
Crystal Creek 14	160 acres	25	3N	1W
King 3	160 acres	24	3N	1W
Crystal Creek 4	80 acres	23	3N	1W
Slope North	74 acres	23	3N	1W

8. Geologists:
CMJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Onyx California
Lilburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. June 2008; USGS

11. Date of Map Preparation:
July 2015

12. Assessor's Parcel Numbers:
Portions of 446-121-004, 006, and 17
Portions of Sections 23, 24, and 25, T3N, R1W, SBBM.
For Claim Numbers See Table Above.

13. Utilities:
Electricity: SCE
Gas: Not applicable
Water: Onyx well system
Sewer: Portable sanitation stations
Telephone: Cellular

14. Area To Be Disturbed:
77.3 acres per this Amendment
Area To Be Reclaimed:
214.8 acres total with this Amendment and prior approvals

15. Reclaimed End Uses:
Open space habitat for native wildlife and plants

16. County Land Use District:
Resource Conservation (RC)

17. Reclamation starts with the initiation of mining and includes the following:

a. Salvaging and stockpiling of grubbed organics, soils, growth media, seeds, and re-locatable plants and cuttings for propagation and direct deposition and/or re-planting to available reclamation areas during clearing of areas to be developed.
b. Ongoing seed collection onsite and/or adjacent to the site and propagation of seeds, salvaged plants and cuttings at local nursery by a revegetation contractor.
c. Backfilling of the eastern half of the Butterfield Quarry and portions of the Sentinel Quarry as feasible.
d. Sloping and grading of completed quarry and stockpile slopes for safety, slope stability, and erosion control.
e. Placement of darker materials as available on outside of more visible slopes and colorization if shown successful for slopes not susceptible to raveling to reduce color contrast.
f. Ripping of compacted areas prior to revegetation.
g. Covering approximately 30% of equipment accessible horizontal areas with salvaged soil, growth media, and organics utilizing the island concept.
h. Reclamation of onsite roads after reclamation of quarries and pads certified complete as determined by Forest Service in order to allow access to all reclamation areas.

18. Revegetation is summarized below: (See Amended Reclamation Plan for details.)

a. Ripping the surface to a depth of 2 feet for moisture and seed collection.
b. Placement of available growth media in islands to cover approximately 30% of equipment accessible horizontal surfaces to 1.5 to 2 feet thick.
c. Placement of organics (logs) at a rate of 10/acre.
d. Seeding of locally native species and revegetation per methods described in Reclamation Plan available at right.
e. Staking or flagging reclaimed areas to eliminate additional disturbance.
f. Irrigation monitoring of 2 years as recommended.
f. Monitoring and maintenance.
g. Application of remedial activities if necessary, including but not limited to additional seeding and planting, plant protection, irrigation, and change of seed and plant mix.

Recommended Plant Species and Methods for Revegetation

Per Approved Reclamation Plan 94AM-02

A. Perennial Grasses for application as seed and mycorrhizal nursery stock: minimum 5 species greenhouse propagation by seed or cutting, out planted as mycorrhizal "plugs," to provide mycorhizae when not reclaimed with biologically active topsoil; direct seeding total 40 lb. per acre elsewhere.

Common name	Latin name
Indian ricegrass	*Achnatherum hymenoides (Oryzopsis h.)*
Parish's needlegrass	*Achnatherum parishii (Stipa pramola deg.ipperalis)*
Squirreltail	*Elymus elymoides (Sitanion hystrix)*
Fendler's bluegrass	*Poa fendleriri*
Nodding bluegrass	*Poa secunda*

B. Shrubs for application as nursery stock: greenhouse propagation by seed or cuttings; outplanted as "deep pot" stock.

Common name	Latin name
Greenleaf manzanita	*Arctostaphylos patula*
Curleaf mountain mahogany	*Cercocarpus ledifolius)*

C. Shrubs for application as seed: 8 species minimum, total shrub seed application 60 lb./acre minimum; pretreatment per Emery 1988 and/or USDA Forest Service 1974.

Common name	Latin name
Great basin sagebrush	*Artemisia tridentata*
Douglas ephedra/weed	*Astragalus douglasii*
California Tremontia	*Fremontodendron californicum*
Curleaf mountain mahogany	*Cercocarpus ledifolius*
Common rabbitbrush	*Chrysothamnus nauseosus*
Curleaf rabbitbrush	*Chrysothamnus viscidiflorus*
California buckwheat	*Eriogonum fasciculatum*
San Bernardino Mtn buckwheat	*Eriogonum gracilipedum var. corymbosoides*
Snakeweed	*Gutierrizia sarothra*
Grinnell's penstemon	*Penstemon grinnelli*

D. Trees for application as nursery stock: minimum 3 species; greenhouse propagation from seed, outplanted as "deep pot" stock.

Common name	Latin name
Western juniper	*J. occidentalis*
Pinyon pine	*Pinus monophylla*
Canyon live oak	*Quercus chrysolepis*

Scale: 1 inch = 200 feet

Map Prepared by: Lilburn Corporation (TIN)
Projection: U.T.M., Zone 1, NAD27 Feet, SBM.
Contour Interval = 2'

LEGEND

- Amended Operations Limits of Disturbance
- Reclaimed Major Contour
- Reclaimed Minor Contour
- Roads to Remain
- Slope Indicator Top of slope
- Toe of slope
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages
- Boulder Barrier
- Riprap
- Design Drainage
- Sump (typical)
- Existing Natural Sump
- Storm Water Control Berm
- Sediment Control
- Berm as Necessary
- 3-strand Wire Fence (typical)
- Soil Islands
- Darker Waste Rock

NOTE:
Soil Islands and Darker Waste Rock placement areas are schematic only. Final placement will be determined in the field prior to Reclamation.

REGISTERED PROFESSIONAL ENGINEER
JAY F. COOK
No. 71278
Exp. 12.31.15
CIVIL
STATE OF CALIFORNIA

Mark	Date	Revision Description
1	8.6.15	Revised Depth of Disturbance

LILBURN
CORPORATION

AMENDED RECLAMATION PLAN

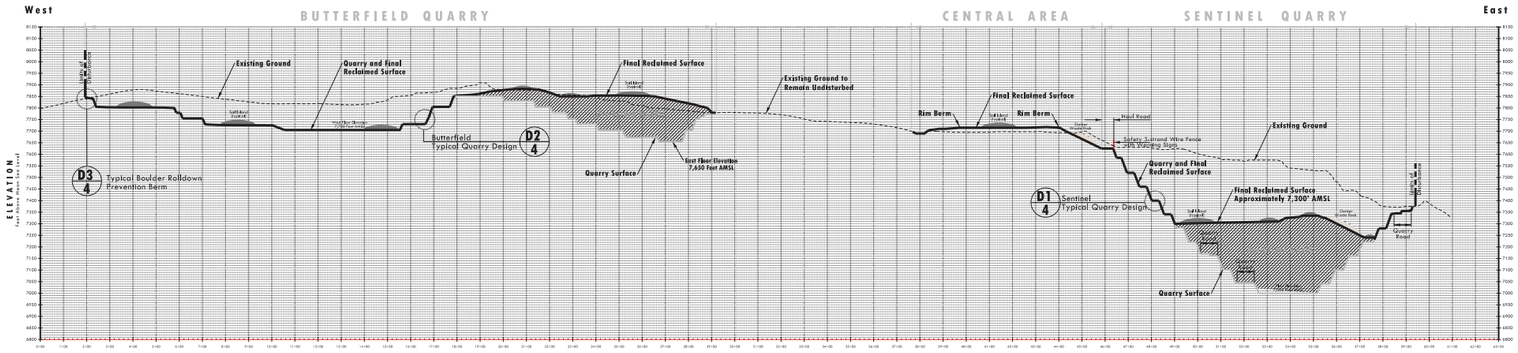
Butterfield and Sentinel Quarries Expansion - Onyx California

SAN BERNARDINO NATIONAL FOREST, SECTIONS 23, 24, 25, T3N, R1W, SBBM

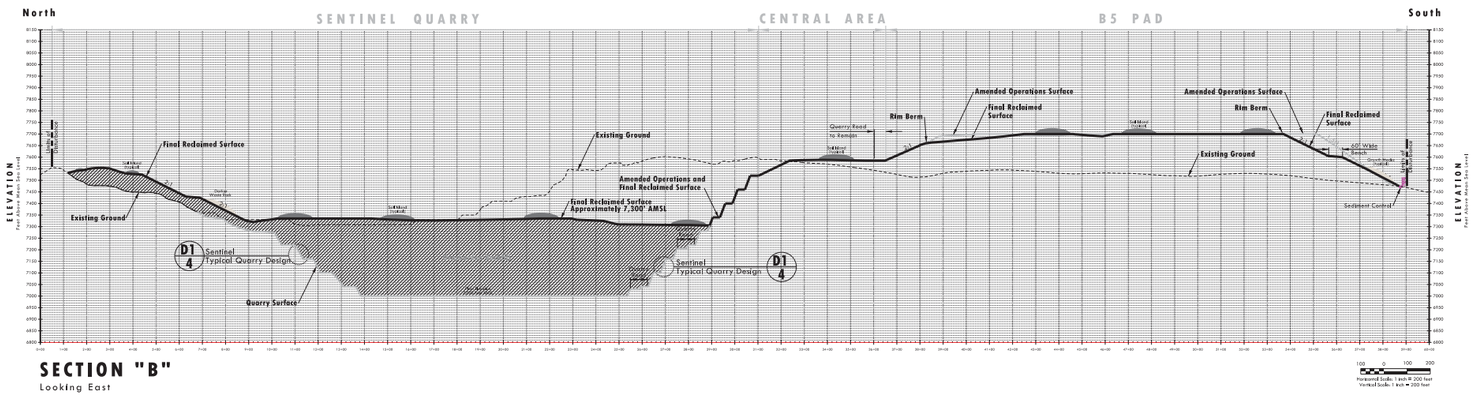
Sheet	Description
1	Amended Plan of Operations and Reclamation Plan
2	Amended Mine Plan
3	Amended Reclamation Plan
4	Cross Sections and Details
5	Cloudy Quarry Reclamation Plan
6	Cloudy Quarry Reclamation Plan
7	Cloudy/Claudia Haul Road Reclamation Plan
8	Crystal Creek Haul Road Reclamation Plan

Scale: 1"=200'
Date: 8/28/2015
Drawn: DRM, Kiran Rao Jaya

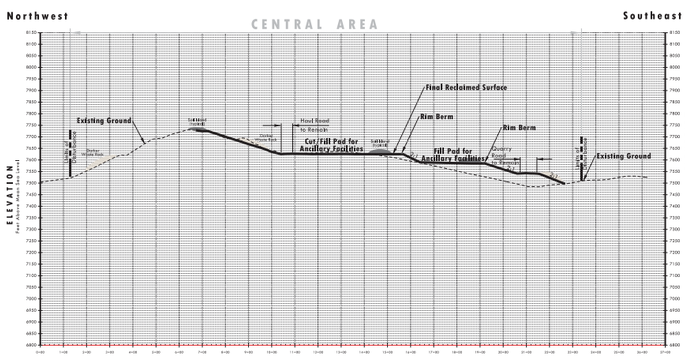
Sheet 3 of 8



SECTION "A"
Looking North



SECTION "B"
Looking East



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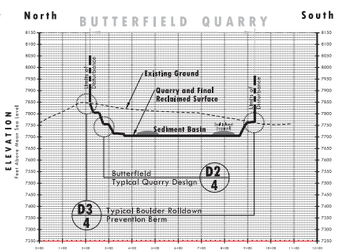
Looking Northeast



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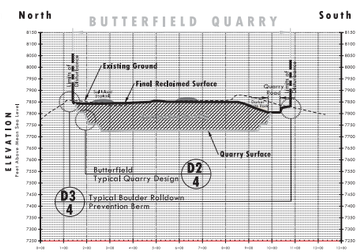
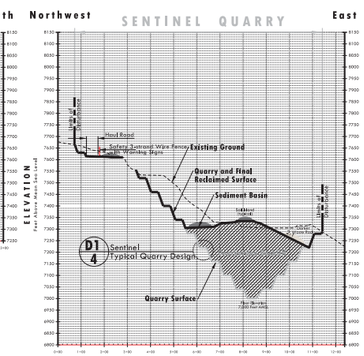
Looking East

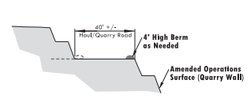


SECTION "E"
Looking East

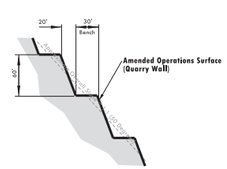


SECTION "F"
Looking Northeast

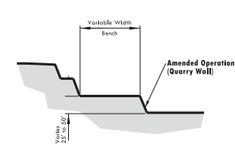
DETAIL 4
Typical B5 Pad
Sediment Control Development
(Not to Scale)



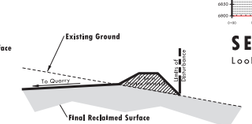
DETAIL 5
Typical Haul / Quarry Road
(Not to Scale)



DETAIL 1
Typical Sentinel Quarry Design
(Not to Scale)



DETAIL 2
Typical Butterfield Quarry Design
(Not to Scale)



DETAIL 3
Typical Boulder Rolldown Prevention Berm
(Not to Scale)

LEGEND

- Soil Islands
- Darker Waste Rock

NOTE:
Soil Islands and Darker Waste Rock Locations are approximate only. Final locations will be determined in the field prior to Reclamation.

REGISTERED PROFESSIONAL ENGINEER
JACK P. COOPER
No. 71278
Exp. 12-31-15
CIVIL
STATE OF CALIFORNIA

Rev. No.	Date	Description
1	4/2/13	Revised Depth of Excavation

LILBURN CORPORATION
1905 Business Center Drive, San Bernardino, CA 92408
909.889.8301 Fax: 909.889.5398

CROSS SECTIONS and DETAILS
Butterfield and Sentinel Quarries Expansion - Onyx California
SAN BERNARDINO COUNTY, CALIFORNIA

Sheet	Description
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8	Crystal Creek Haul Road Reclamation Plan

Scale: AS SHOWN
Date: 4/2/2013 (EAS)
Job: ONYX Elevations and Details.dgn

Sheet 4 of 8

Attachment B
NOAA Atlas 14 Precipitation Frequency Values

NOAA Atlas 14, Volume 6, Version 2
Location name: Lucerne Valley, California, USA*
Latitude: 34.3293°, Longitude: -116.94°
Elevation: 7650.36 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.131 (0.109-0.160)	0.177 (0.146-0.216)	0.240 (0.198-0.294)	0.295 (0.241-0.364)	0.374 (0.296-0.478)	0.440 (0.341-0.574)	0.511 (0.386-0.683)	0.588 (0.432-0.808)	0.700 (0.493-1.00)	0.794 (0.541-1.18)
10-min	0.188 (0.156-0.230)	0.253 (0.209-0.309)	0.344 (0.283-0.422)	0.422 (0.345-0.522)	0.537 (0.424-0.686)	0.631 (0.488-0.823)	0.732 (0.553-0.979)	0.842 (0.619-1.16)	1.00 (0.707-1.44)	1.14 (0.776-1.69)
15-min	0.228 (0.188-0.278)	0.306 (0.253-0.374)	0.416 (0.343-0.510)	0.511 (0.417-0.631)	0.649 (0.513-0.829)	0.763 (0.590-0.995)	0.885 (0.669-1.18)	1.02 (0.748-1.40)	1.21 (0.855-1.74)	1.38 (0.938-2.04)
30-min	0.328 (0.271-0.401)	0.441 (0.364-0.539)	0.599 (0.493-0.735)	0.736 (0.601-0.910)	0.935 (0.739-1.20)	1.10 (0.850-1.43)	1.27 (0.963-1.71)	1.47 (1.08-2.02)	1.75 (1.23-2.50)	1.98 (1.35-2.94)
60-min	0.471 (0.390-0.576)	0.633 (0.523-0.775)	0.861 (0.709-1.06)	1.06 (0.864-1.31)	1.34 (1.06-1.72)	1.58 (1.22-2.06)	1.83 (1.38-2.45)	2.11 (1.55-2.90)	2.51 (1.77-3.60)	2.85 (1.94-4.23)
2-hr	0.689 (0.569-0.841)	0.912 (0.753-1.12)	1.22 (1.01-1.50)	1.49 (1.22-1.84)	1.87 (1.48-2.38)	2.17 (1.68-2.84)	2.50 (1.89-3.34)	2.85 (2.09-3.92)	3.35 (2.36-4.79)	3.75 (2.55-5.56)
3-hr	0.862 (0.713-1.05)	1.14 (0.938-1.39)	1.51 (1.25-1.86)	1.84 (1.50-2.27)	2.30 (1.82-2.94)	2.67 (2.07-3.48)	3.06 (2.31-4.09)	3.48 (2.56-4.79)	4.07 (2.87-5.84)	4.55 (3.10-6.75)
6-hr	1.27 (1.05-1.55)	1.67 (1.38-2.04)	2.22 (1.83-2.72)	2.69 (2.20-3.33)	3.36 (2.66-4.30)	3.90 (3.02-5.09)	4.47 (3.38-5.97)	5.07 (3.73-6.97)	5.93 (4.18-8.50)	6.62 (4.51-9.81)
12-hr	1.74 (1.44-2.13)	2.35 (1.94-2.88)	3.19 (2.63-3.92)	3.91 (3.20-4.84)	4.94 (3.90-6.31)	5.77 (4.46-7.53)	6.65 (5.02-8.89)	7.59 (5.58-10.4)	8.93 (6.30-12.8)	10.0 (6.83-14.9)
24-hr	2.49 (2.21-2.86)	3.46 (3.06-3.99)	4.82 (4.25-5.57)	5.98 (5.24-6.96)	7.66 (6.49-9.22)	9.04 (7.50-11.1)	10.5 (8.52-13.2)	12.1 (9.57-15.7)	14.5 (11.0-19.5)	16.5 (12.0-23.0)
2-day	3.15 (2.79-3.62)	4.39 (3.89-5.06)	6.16 (5.44-7.12)	7.70 (6.74-8.97)	9.97 (8.45-12.0)	11.9 (9.86-14.6)	14.0 (11.3-17.6)	16.3 (12.8-21.0)	19.7 (14.9-26.5)	22.6 (16.5-31.5)
3-day	3.46 (3.07-3.99)	4.83 (4.28-5.57)	6.80 (6.01-7.86)	8.54 (7.48-9.95)	11.1 (9.43-13.4)	13.3 (11.1-16.4)	15.7 (12.7-19.8)	18.4 (14.5-23.9)	22.5 (17.0-30.3)	26.0 (19.0-36.2)
4-day	3.73 (3.30-4.29)	5.21 (4.61-6.00)	7.35 (6.49-8.50)	9.26 (8.11-10.8)	12.1 (10.3-14.6)	14.5 (12.0-17.8)	17.2 (13.9-21.6)	20.2 (15.9-26.1)	24.7 (18.7-33.3)	28.6 (20.9-39.9)
7-day	4.25 (3.77-4.90)	5.99 (5.30-6.90)	8.50 (7.51-9.83)	10.7 (9.40-12.5)	14.1 (11.9-17.0)	16.9 (14.0-20.8)	20.1 (16.2-25.2)	23.6 (18.6-30.5)	28.8 (21.8-38.9)	33.4 (24.4-46.5)
10-day	4.60 (4.07-5.29)	6.50 (5.76-7.50)	9.27 (8.18-10.7)	11.7 (10.3-13.7)	15.4 (13.0-18.5)	18.5 (15.3-22.7)	21.9 (17.8-27.6)	25.7 (20.3-33.3)	31.4 (23.8-42.4)	36.3 (26.6-50.7)
20-day	5.56 (4.93-6.40)	7.92 (7.01-9.12)	11.3 (9.99-13.1)	14.3 (12.5-16.7)	18.8 (15.9-22.7)	22.6 (18.7-27.8)	26.7 (21.6-33.6)	31.3 (24.7-40.5)	38.1 (28.8-51.4)	43.8 (32.1-61.2)
30-day	6.52 (5.78-7.51)	9.29 (8.22-10.7)	13.3 (11.7-15.3)	16.8 (14.7-19.5)	22.0 (18.6-26.5)	26.3 (21.8-32.3)	31.1 (25.2-39.1)	36.3 (28.6-47.0)	44.0 (33.3-59.3)	50.4 (36.9-70.4)
45-day	7.84 (6.95-9.03)	11.1 (9.84-12.8)	15.8 (13.9-18.2)	19.9 (17.4-23.2)	25.9 (22.0-31.2)	31.0 (25.7-38.1)	36.4 (29.5-45.9)	42.4 (33.4-54.9)	51.1 (38.7-69.0)	58.4 (42.7-81.5)
60-day	9.13 (8.09-10.5)	12.8 (11.4-14.8)	18.1 (16.0-21.0)	22.8 (19.9-26.5)	29.5 (25.0-35.6)	35.2 (29.2-43.2)	41.2 (33.4-51.9)	47.8 (37.7-61.9)	57.4 (43.4-77.4)	65.3 (47.7-91.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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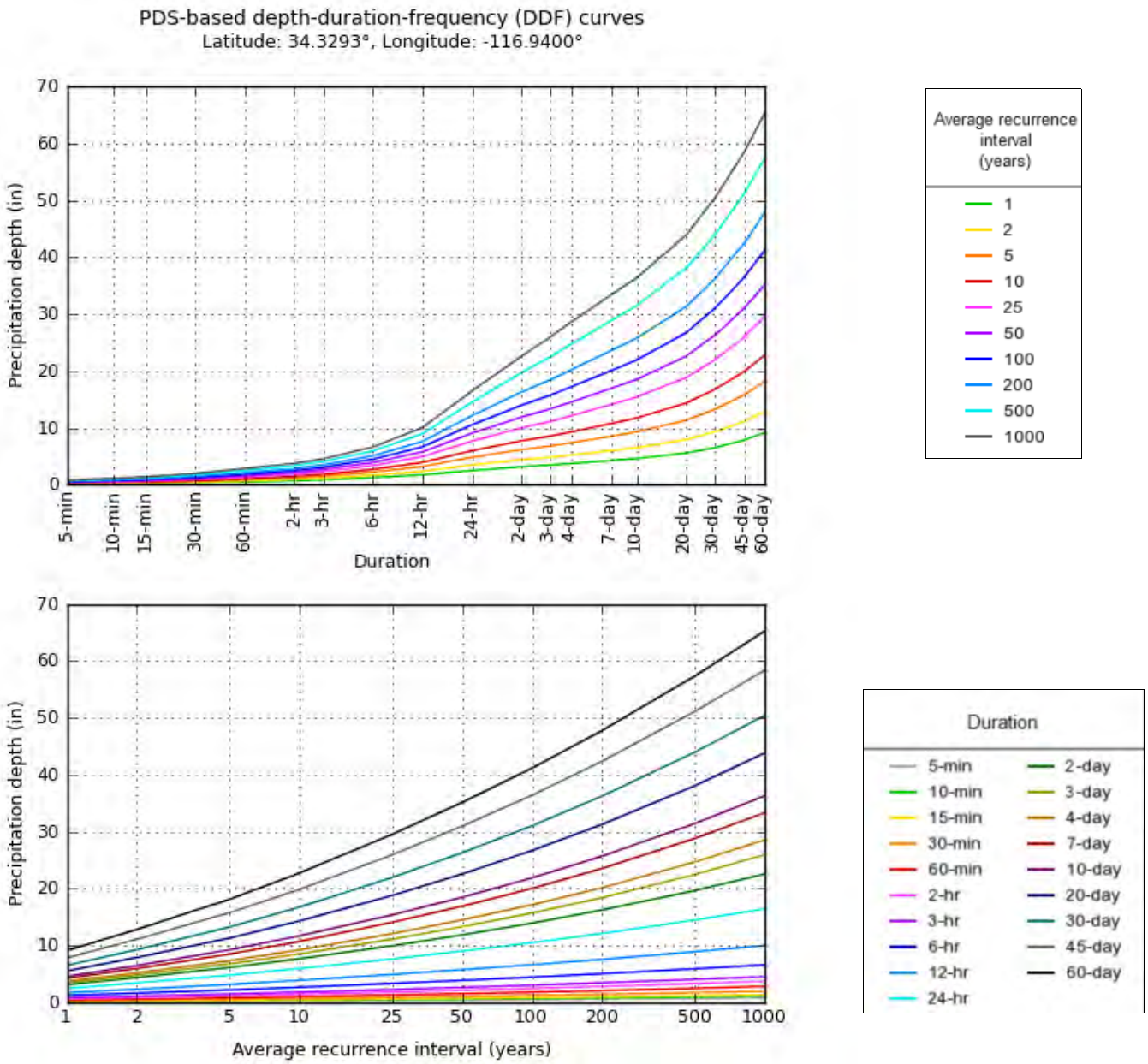
PF graphical



NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Fri Mar 31 21:34:50 2017

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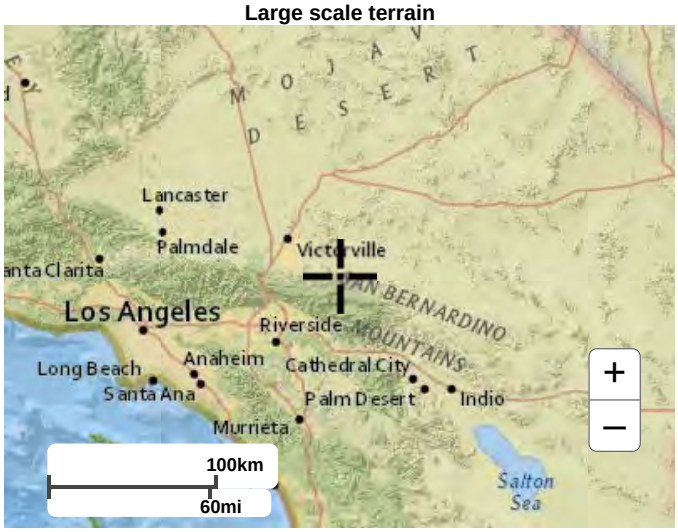
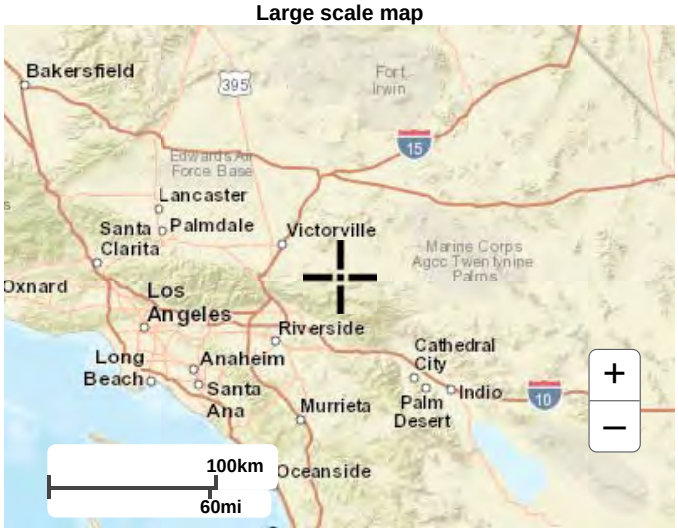
Maps & aerials

Small scale terrain

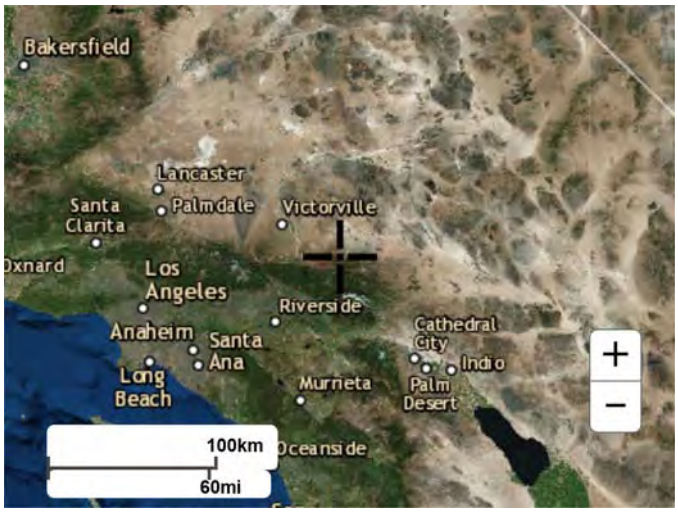
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Attachment C
Sump and Channel Capacity Calculations

Table 1 - Watershed Areas

Watersheds	Description	Storm Water Features
S1	Butterfield Quarry floor	Sump
S2	Butterfield Quarry	Sump
S3	Central Area	Sump
S4	Central Area Overburden Site	Sump, Berms
S5	Central Area	Sump
S6	Central Area pad	Sump, Berms
S7	Central Area Pad	Sump, Berms
S8	Central Area fad	Sump, Berms
S9	Sentinel North Pad	Sump
S10	Sentinel Quarry floor	Sump
S11	Sentinel Quarry floor, Central Area, and Butterfield Quarry slopes	Sump, Berms
S12	San Bernardino National Forest (outside Project)	Sump, Berms
S13	San Bernardino National Forest (outside Project)	Sump, Berms
S14	B5 Pad slopes	Sump, Berms, Sediment Control
S15	B5 Pad slopes	Sump, Berms, Sediment Control
S16	B5 Pad slopes	Sump, Berms
S17	B5 Pad	Sump, Berms
S18	B5 Pad slopes	Berms, Sediment Control
S19	San Bernardino National Forest (outside Project)	Sump, Berms
S20	San Bernardino National Forest (outside Project)	Sump, Berms
S21	Sentinel Quarry slope	Sump

Table 2 - Sump Capacity

Watersheds	Area (sq ft)	Area (Ac)	Runoff Coefficient	25-Yr 1-Hr Rainfall (in)	25-Yr 1-Hr Rainfall Runoff to Sump (cu ft)	Available Sump Water Storage Capacity (cu ft)	Required Sediment Control Filter 1- Hr Capacity (cu ft)	Note
S1	1,195,527	27.4	70%	1.34	93,450	1,568,800	0	N/A
S2	561,045	12.9	70%	1.34	43,855	282,000	0	N/A
S3	74,999	1.7	70%	1.34	5,862	16,000	0	N/A
S4	130,576	3.0	70%	1.34	10,207	13,600	0	N/A
S5	75,501	1.7	70%	1.34	5,902	16,400	0	N/A
S6	41,130	0.9	70%	1.34	3,215	13,200	0	N/A
S7	188,145	4.3	70%	1.34	14,707	39,600	0	N/A
S8	112,707	2.6	70%	1.34	8,810	30,800	0	N/A
S9	70,210	1.6	70%	1.34	5,488	17,600	0	N/A
S10	2,504,192	57.5	70%	1.34	195,744	462,000	0	N/A
S11	2,208,006	50.7	70%	1.34	172,592	340,400	0	N/A
S12	1,477,133	33.9	30%	1.34	49,484	76,000	0	Sump capacity to be large enough to prevent run-on onto site
S13	1,015,005	23.3	30%	1.34	34,003	70,800	0	Sump capacity to be large enough to prevent run-on onto site
S14	400,559	9.2	70%	1.34	31,310	7,700	23,610	Sump insufficient capacity, sediment control structure to supplement capacity
S15	265,088	6.1	70%	1.34	20,721	10,620	10,101	Sump insufficient capacity, sediment control structure to supplement capacity
S16	739,378	17.0	70%	1.34	57,795	156,400	0	N/A
S17	253,811	5.8	70%	1.34	19,840	269,200	0	N/A
S18	162,011	3.7	70%	1.34	12,664	0	12,664	No sump, sediment control structure only
S19	317,842	7.3	30%	1.34	10,648	12,000	0	Sump capacity to be large enough to prevent run-on onto site
S20	302,035	6.9	30%	1.34	10,118	46,000	0	Sump capacity to be large enough to prevent run-on onto site
S21	573,370	13.2	70%	1.34	44,818	48,000	0	N/A

Note: average sump water depth of 4 feet

Table 3 - Peak Flow

Watersheds	Area (Ac)	Runoff Coefficient	Length (ft)	Average Slope (%)	Time of Concentration (min)	25-Yr Rainfall Intensity (in/hr)	Peak Flow (cfs)	Bermed Channel (Y/N)
S1	27.4	70%	1,720	11.9%	5.1	4.44	85.3	N
S2	12.9	70%	1,080	4.2%	5.5	4.44	40.0	N
S3	1.7	70%	510	22.5%	5.0	4.44	5.4	N
S4	3.0	70%	510	4.9%	5.0	4.44	9.3	N
S5	1.7	70%	665	2.3%	5.0	4.44	5.4	N
S6	0.9	70%	140	3.6%	5.0	4.44	2.9	N
S7	4.3	70%	490	17.3%	5.0	4.44	13.4	N
S8	2.6	70%	310	1.6%	5.0	4.44	8.0	N
S9	1.6	70%	280	1.8%	5.0	4.44	5.0	N
S10	57.5	70%	2,180	13.8%	6.1	4.20	169.0	N
S11	50.7	70%	5,320	11.3%	16.4	2.55	90.6	Y
S12	33.9	30%	1,750	14.6%	5.0	4.44	45.2	N
S13	23.3	30%	2,280	11.8%	6.8	4.20	29.4	N
S14	9.2	70%	2,760	5.8%	11.8	3.11	20.0	Y
S15	6.1	70%	1,940	6.4%	7.9	3.96	16.9	Y
S16	17.0	70%	2,330	4.1%	11.9	3.11	37.0	Y
S17	5.8	70%	260	1.9%	5.0	4.44	18.1	N
S18	3.7	70%	980	23.5%	5.0	4.44	11.6	Y
S19	7.3	30%	750	4.7%	5.0	4.44	9.7	Y
S20	6.9	30%	1,075	18.1%	5.0	4.44	9.2	Y
S21	13.2	70%	1,280	24.2%	5.0	4.44	40.9	N

Note: minimum time of concentration is 5 minutes

Table 4 - Channel Flow

Watersheds	Depth, D (ft)	n	Slope, So (ft/ft)	Sideslope x:1	Top Width, B2 (ft)	Area, A (ft^2)	P_w (ft)	$R=A/P_w$	V (ft/s)	Q=V*A (ft^3/s)
S11	1.98	0.040	0.113	2	7.9	7.9	8.9	0.89	11.5	90.6
S14	1.27	0.040	0.058	2	5.1	3.2	5.7	0.57	6.2	20.0
S15	1.17	0.040	0.064	2	4.7	2.7	5.2	0.52	6.1	16.9
S16	1.71	0.040	0.041	2	6.9	5.9	7.7	0.77	6.3	37.0
S18	0.80	0.040	0.235	2	3.2	1.3	3.6	0.36	9.1	11.6
S19	1.01	0.040	0.047	2	4.1	2.1	4.5	0.45	4.7	9.7
S20	0.77	0.040	0.181	2	3.1	1.2	3.4	0.34	7.8	9.2
Maximum Capacity	3.00	0.040	0.040	2	12.0	18.0	13.4	1.34	9.1	163.1

Note: triangular bermed channel section assumed, 4 feet maximum height

Appendix I-3: Drainage Control Program, Crystal Creek Haul Road

(Pluess-Staufer, 1992)

DRAINAGE CONTROL PROGRAM

CRYSTAL CREEK HAUL ROAD

PLUESS-STAUFER (California), INC.

cc: JR
MK
HA
USFS

PLUESS-STAUFER (California),INC.
HOWARD J. BROWN
GEOLOGIST
JUNE 26, 1992

UNITED STATES
DEPARTMENT OF
AGRICULTURE

FOREST
SERVICE

Big Bear
Ranger District

P.O. Box 290
Fawnskin, CA 92333

2810
July 20, 1992

Mr. Jim Reddy
Pluess-Staufer (California) Inc.
P.O. Box 825
Lucerne Valley, CA 92356

Dear Mr. ~~Reddy~~: Jim

I have reviewed the Drainage Control Program for the Crystal Creek Haul Road that Howard Brown submitted to this office on July 7, 1992. I find that the solutions appear to be effective and reasonable.

I approve the plan with the stipulation that the district Mine Administrator, Susan Owen, be notified prior to any work being done so that this office can monitor the work.

Sincerely,

Becky Aus

REBECCA R. AUS
District Ranger

UNITED STATES DEPARTMENT OF AGRICULTURE | FOREST SERVICE | SBNF

Reply To: 7710

Date: August 9, 1992

Subject: Crystal Creek Haul Road

To: District Ranger, Big Bear

We have completed review of Pluess Staufer (California) Inc. proposed Drainage Control Program for the Crystal Creek Haul Road. This is a very aggressive program and will substantially reduce the erosion from the haul road that is ultimately deposited on private lands below the road. We have no suggestions for improvement. You, your staff, and Pluess Staufer are to be complimented for agreeing to this proposed program.

/s/Gene

GENE ZIMMERMAN
Forest Supervisor

cc R.Daniels
E.Dierking
R.Wenstrom

Appendix I-4: Spill Prevention, Control, and Countermeasures Plan

(Webber & Webber Mining Consultants, Inc., 1997)

PLUESS-STAUFER (CA), INC.

LUCERNE VALLEY, CALIFORNIA OPERATIONS

SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN

Prepared for:

PLUESS-STAUFER (CA), INC.
P.O. Box 825
Lucerne Valley, California 92356

Prepared by:

WEBBER & WEBBER MINING CONSULTANTS, INC.
1323 West Colton Avenue
Suite 217
Redlands, California 92374

August 5, 1997

Revised: September 11, 1997

MANAGEMENT APPROVAL

[40 CFR 112.7(d)(2)]

This Spill Prevention, Control, and Countermeasures Plan prepared for Pluess-Staufer (California), Inc. has full approval of management at a level of authority to commit the necessary resources toward spill prevention.

Signature: Manfred Keil **Date:** 9-26-97

Name: Manfred Keil **Title:** Plant Manager
(Printed)

PROFESSIONAL CERTIFICATION

[40 CFR 112.3(d); 112.5(c)]

I hereby certify that I have examined the Pluess-Staufer (California), Inc. Facility and, being familiar with the provisions of Title 40 Code of Federal Regulations (CFR) Part 112, Oil Pollution Prevention, attest that this Spill Prevention, Control, and Countermeasures Plan has been prepared in accordance with good engineering practices.

Webber and Webber Mining Consultants, Inc.
1323 West Colton Avenue, Suite 217
Redlands, California 92373

REGISTERED GEOLOGIST
MARK W. BULOT
No. 1659
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Mark W. Bulot, CEG

I hereby certify that I have reviewed the Pluess-Staufer (California), Inc. Spill Prevention Control and Countermeasures Plan revisions with respect to the requirements of Title 40 CFR part 112, and attest that these plan revisions adequately address applicable sections, thereof.

REGISTERED PROFESSIONAL ENGINEER
STEVEN C. HELFRICH
NO. 040046
exp 12/97
CIVIL
STATE OF CALIFORNIA

Steven C. Helfrich, PE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

August 19, 1997

Manfred Keil
Plant Manager
Pluess-Staufer(California)Inc
7299 Crystal Creek Road
Lucerne Valley,California,92356

Re: Notice of Compliance
SPCC Case No. 95-0009
Inspection Date: November 2, 1994

Dear Mr. Keil:

The Environmental Protection Agency (EPA) has completed review of your amended SPCC Plan for an inspection conducted on November 2, 1994. EPA is satisfied that your facility is in compliance with the Federal SPCC requirements and appreciates the efforts you have made to achieve this. This letter does not relieve your facility of liability should it experience an oil spill.

Please feel free to call Desmond Bain at (415) 744-2318 if you have any further questions.

Sincerely,

William M. Robberson
Oil Team Leader
Oil Team

Printed on Recycled Paper

CUPA
San Bernardino County Fire Department
HAZARDOUS MATERIALS DIVISION • EMERGENCY RESPONSE AND ENFORCEMENT
385 N. Arrowhead Ave, 2nd Floor, San Bernardino, CA 92415-0153 • PHONE: (909) 387-4631 FAX: (909) 387-4323

BUSINESS OWNER / OPERATOR IDENTIFICATION

I. IDENTIFICATION

ESTABLISHMENT #:					8	6	0	0	8	1	1	9	(This number is on your CUPA permit.)
FACILITY ID #	3	6		0	0	1		0	0	8	1	1	9

1 (The empty boxes are the last 6 digits of the above Establishment #.)

EFFECTIVE DATE	ENDING DATE
March 29, 2002	March 1, 2003

BUSINESS NAME (Same as FACILITY NAME or DBA)	BUSINESS PHONE
OMYA (CA), INC.	(760) 248-7306

BUSINESS SITE ADDRESS	CITY	COUNTY	STATE	ZIPCODE
7299 Crystal Creek Road	Lucerne Valley	San Bernardino	CA	92356

D&B NUMBER	PRIMARY SIC/NAICS CODE	DESCRIPTION OF BUSINESS ACTIVITY FOR THIS PRIMARY SIC CODE
N/A	1422	Mining & Processing Calcium Carbonate

BUSINESS OPERATOR NAME	BUSINESS OPERATOR PHONE
OMYA (CA), INC.	(760) 248-7306

II. BUSINESS OWNER

OWNER NAME	OWNER PHONE
OMYA (CA), INC.	(760) 248-7306

OWNER MAILING ADDRESS	CITY	STATE	ZIPCODE
P.O. Box 825	Lucerne Valley	CA	92356

III. ENVIRONMENTAL CONTACT

CONTACT NAME	CONTACT PHONE
Manfred Keil	(760) 248-7306

CONTACT MAILING ADDRESS	CITY	STATE	ZIP CODE
P.O. Box 825	Lucerne Valley	CA	92356

IV. EMERGENCY CONTACTS*

- PRIMARY -	- SECONDARY -
NAME	NAME
Manfred Keil	Patricia Smith
TITLE	TITLE
Plant Manager	Manager of Safety / Environmental Compliance
BUSINESS PHONE	BUSINESS PHONE
(760) 248-7306	(760) 248-7306
HOME PHONE (NOT CONFIDENTIAL - SEE NOTE BELOW)	HOME PHONE (NOT CONFIDENTIAL - SEE NOTE BELOW)
(760) 242-3946	(760) 247-4546
OTHER 24-HOUR PHONE (NOT CONFIDENTIAL - SEE NOTE BELOW)	24-HOUR PHONE (NOT CONFIDENTIAL - SEE NOTE BELOW)
(760) 243-7243 (7514) – Pager	(760) 883-3147 – Pager
PAGER/CELL #	PAGER /CELL #
(760) 900-0556 – Cell	(760) 447-6664 - Cell

*HOME PHONE NUMBERS ARE REQUIRED FOR ALL HAZARDOUS WASTE GENERATORS. IF YOU WISH TO KEEP 24-HOUR OR HOME PHONE NUMBERS CONFIDENTIAL, FILE THE SEPARATE CONFIDENTIAL EMERGENCY CONTACT PAGE (PAGE 3) AND LEAVE THE ABOVE 24 HR FIELDS BLANK. ALSO USE THE SEPARATE PAGE (PAGE 3) TO DESIGNATE MORE THAN 2 EMERGENCY COORDINATORS.

V. SIGNATURE

SIGNATURE OF OWNER/OPERATOR	NAME OF SIGNER (*print*)	DATE
Manfred Keil	Manfred Keil	4/5/0[illegible]

CUPA
San Bernardino County Fire Department
HAZARDOUS MATERIALS DIVISION • EMERGENCY RESPONSE AND ENFORCEMENT
385 N. Arrowhead Ave, 2nd Floor, San Bernardino, CA 92415-0153 • PHONE: (909) 387-4631 FAX: (909) 387-4323

BUSINESS EMERGENCY/CONTINGENCY PLAN COVER SHEET

I. IDENTIFICATION

ABLISHMENT #						8	6	0	0	8	1	1	9			
FACILITY ID #	3	6		0	0	1		0	0	8	1	1	9			

For Dept Use Only – Log In/Date Stamp

BUSINESS NAME (Same as FACILITY NAME or DBA)

OMYA (CA), INC.

BUSINESS SITE ADDRESS	CITY	ZIPCODE
7299 Crystal Creek Road	Lucerne Valley	92356

II. SUBMISSION CHECKLIST

(Complete this Section if submitting an entire business emergency/contingency plan whether new or revised)

☑ This submission is a complete business emergency/contingency plan

Submission Checklist (✓) *considered "inventory" under state disclosure laws

- ☑ *Business Activities Form and *Business Owner/Operator Identification Form
- ☑ *Supplemental Emergency Contact Page
- ☑ Emergency Response Plans and Procedures
- ☑ *Hazardous Materials Inventory Summary Form for the facility listing materials (including wastes) by item number.
- ☑ *One Hazardous Materials Inventory Form for each hazardous material (including wastes) which meet reporting criteria
- ☑ *Material Safety Data Sheets attached to the inventory form of each material not listed in Appendix I.
- ☑ *Facility map (using grid form provided) consisting of all required features including the location of each inventoried item.
- ☑ Site map (using grid form provided) consisting of all required features including surrounding facilities and areas.
- ☑ Area map - photocopied city map with location of site indicated
- ☑ Owner/Operator has signed and dated the plan and all required individual pages of the plan.

ubmit 2 copies to the Hazardous Materials Division. One is for distribution to the local fire jurisdiction.

☑ ***Retain one copy of the business plan at the facility.***

III. UPDATE/CERTIFICATION

(Complete this Section if submitting a partial update or recertifying an existing Plan)

Check the appropriate boxes below and sign the certification statement. Submit 2 copies of all update information.

☐ Please incorporate the following into the business emergency/contingency plan:

- ☐ New Business Owner/Operator Identification Form
- ☐ New Inventory Forms and new Inventory Summary Form (and maps, if affected).
- ☐ New Supplemental Emergency Contact Page.
- ☐ Other:

Brief Explanation of Changes:

☐ There have been no changes to the inventory. In place of submitting the annual inventory, I hereby attest to all of the following:

- The information contained in the inventory most recently submitted to the CUPA is complete, accurate and up to date.
- There has been no change in the quantity, storage, or handling of hazardous materials (including waste) reported in the most recently submitted inventory.
- No hazardous materials (including waste) subject to inventory requirements are being handled that are not listed on the most recently submitted inventory.
- This certification is not being made to meet annual inventory submission requirements of EPCRA. (EPCRA requires complete annual submission)

IV. SIGNATURE

(Complete this Section for all submissions)

Certification - Based on my inquiry of those individuals responsible for obtaining the information, I certify under penalty of law that I have personally examined and am familiar with the information submitted on this document and believe the information is true, accurate and complete.

SIGNATURE OF OWNER/OPERATOR	DATE	NAME OF DOCUMENT PREPARER
Manfred Keil	4/5/02	Webber & Webber Mining Consultants, Inc.
OF SIGNER (print)	TITLE OF SIGNER (print)	
Manfred Keil	Plant Manager	