SPECIAL REPORT 253

MINERAL LAND CLASSIFICATION: PORTLAND CEMENT CONCRETE AGGREGATE IN THE WESTERN VENTURA COUNTY AND SIMI PRODUCTION-CONSUMPTION REGIONS

2022

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By

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7/11/22

2022

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TABLE OF CONTENTS

Appendix

Figures

Tables

PLATES (In Pocket)

INDEX OF ACRONYMS AND ABBREVIATIONS

AC: Asphaltic Concrete

CGS: California Geological Survey

DOC: Department of Conservation

DOF: State of California Department of Finance

DMR: Division of Mine Reclamation

DMG: Division of Mines and Geology

GIS: Geographic Information System

GHG: Greenhouse Gases

MLC: Mineral Land Classification

MRZ: Mineral Resource Zone

OFR: Open File Report

P-C: Production-Consumption

PCC: Portland Cement Concrete

PRC: Public Resources Code

SMARA: Surface Mining and Reclamation Act (of 1975)

SMGB: State Mining and Geology Board

SR: Special Report

WVS: Western Ventura-Simi

EXECUTIVE SUMMARY

This report is the second update Mineral Land Classification (MLC) report for Portland cement concrete (PCC) aggregate in Ventura County. Ventura County contains both the Western Ventura County and Simi Production-Consumption (P-C) Regions, collectively referred to as the Western Ventura-Simi (WVS) P-C Regions. The original MLC report was published as Special Report 145 in 1981. The first update was published as Open-File Report 93-10 in 1993. This second update report reevaluates PCC aggregate resources, permitted reserves, past production, and includes an updated 50-year projection (through the year 2067) of demand for PCC and all other grades of construction aggregate.

Sand, gravel, and crushed rock are “construction materials.” These materials, collectively referred to as aggregate, provide bulk and strength to PCC, asphaltic concrete (AC), Class II Base, and other aggregate commodities such as subbase, drain rock, and fill. The material specifications for PCC aggregate are more restrictive than specifications for the other grades of aggregate. These restrictive specifications make deposits acceptable for use as PCC aggregate the scarcest and most valuable aggregate resource.

MLC reports contain the assignment of Mineral Resource Zone (MRZ) classifications (MRZ-1, MRZ-2, MRZ-3, or MRZ-4) to areas based on geologic factors alone without regard for current land uses. Areas classified MRZ-2 contain significant mineral resources. The mineral resource zone map for the WVS P-C Regions is shown on Plate 1.

Areas classified as MRZ-2 that have land uses deemed compatible with mining and meet a threshold value are delineated as “sectors.” The State Geologist calculates the available resources of each sector and identifies remaining resources that have been permitted for mining (i.e., reserves). The reserves and resources within all sectors are compared with a forecast of the 50-year needs of the region.

MLC report updates exclude resources in areas within sectors that no longer have compatible land uses. Additionally, MLC updates might contain newly delineated sectors based on reevaluation of MRZs. For this update, the determination of compatible land uses was based on information from satellite imagery, field reconnaissance, and information from local planning agencies. This update also includes a new sector (Sector D) in the Simi P-C Region. The updated aggregate sector map is shown on Plate 2.

The State Mining and Geology Board (SMGB) used Special Report 145 in a subsequent process called designation. Designation is the formal recognition by the SMGB of lands containing resources of regional or statewide significance that are needed to meet the future mineral resource needs of the region and the State. In 1982, the SMGB designated construction aggregate resource areas in the WVS P-C Regions in *SMARA Designation Report No. 2*. The designated WVS P-C Regions sectors are included in the California Code of Regulations chapter 8, sections 3550.2 and 3550.3. Approximately 27,179 acres, shown as Sectors A through J in the Western Ventura County P-C Region and Sectors A through C in the Simi P-C Region, were designated as containing construction aggregate deposits of “regional significance.” This updated report does not change those designations. However, the SMGB may choose to update or modify those designations based on information in this report.

EVALUATION OF PCC AGGREGATE RESOURCES

This report reevaluates the aggregate resources designated by the SMGB in the WVS P-C Regions. The reevaluation of resources included the following:

- Geographic Information System analysis of aerial photography showed that approximately 1,674 acres (6.2 percent) were lost due to incompatible uses.
- Areas within a recently expanded mine permit were changed from MRZ-3 to MRZ-2 resulting in a new sector comprising 111 acres.
- The methodology used for calculating resources in the Simi P-C Region was updated due to drill hole data available after Open File Report 93-10 was published.
- The estimated resources in the WVS P-C Regions increased to 5,593 million tons.

PCC AGGREGATE PRODUCTION

There are five permitted mines that produce PCC aggregate in the WVS P-C Regions on an annual basis. Due to policies that restrict mining in and adjacent to the Santa Clara River, the Western Ventura County P-C Region has not been producing aggregate consistently since approximately 2000. Currently, PCC aggregate mining occurs almost exclusively in the Simi P-C Region north of the cities of Moorpark and Simi Valley. In 2017, the WVS P-C Regions produced just under two million tons of aggregate (all grades), down from a high of 6.9 million tons in 1989.

The WVS P-C Regions reserves contain more sand than coarse material (approximately 4:1). Because PCC aggregate is approximately half coarse material, the coarse material is imported (from at least 40 miles away) to make PCC aggregate.

ESTIMATE OF THE 50-YEAR AGGREGATE DEMAND

The SMGB guidelines for the classification and designation of mineral land specify that MLC reports include an estimate of the total quantity of construction aggregate needed to fulfill the P-C Region's needs for the next 50 years.

To estimate 50-year demand in the WVS P-C Regions, the average annual per capita consumption rate (the amount of aggregate used per person per year) was calculated for years 1977 to 2017. That value (4.86 tons) was multiplied by the projected population within the WVS P-C Regions for the years 2018 to 2067. The 50-year demand estimate exceeds the reserves estimate of 118 million tons. If PCC grade aggregate is used to satisfy all aggregate demand, PCC reserves would be depleted in less than 23 years. Based on current PCC use and demand trends, PCC reserves would last less than 43 years.

CONCLUSIONS

The following list summarizes some of the major conclusions reached in this update report. Key results of this report are presented in Table ES-1:

- Of the 27,179 acres of Designated Sectors in the WVS P-C Regions, 1,674 acres (6.2 percent) were lost due to land uses incompatible with mining.
- There are an estimated 5,593 million tons of PCC resources in the WVS P-C Regions.

- The 118 million tons of permitted PCC aggregate reserves could last less than <23 years.
- The WVS P-C Regions PCC aggregate reserves are approximately 80 percent fine and 20 percent coarse.
- Approximately 25 percent of aggregate (coarse PCC aggregate) was imported to the WVS P-C Regions in 2017.
- Imports to the WVS P-C Regions are transported at least 40 miles, which increases costs and greenhouse gas emissions.
- Barriers to future mine permitting include housing, parks, environmental policies and land use decisions protecting wildlife habitat.

Table ES-1. Results Presented in this Update Report for the WVS P-C Regions

Total PCC Aggregate Resources	5,593 Million Tons
Total PCC Aggregate Reserves	118 Million Tons
Population (2017)	1.06 Million
Projected 50-year Demand for Aggregate (All Grades)	281 Million Tons
Years Until Depletion of PCC Reserves	<23 (2039)
Number of Permitted PCC Aggregate Mines	5
Area Lost in Sectors to Incompatible Uses	1,674 Acres (6.2 Percent)

PART I – INTRODUCTION

This report is the second update of the Mineral Land Classification (MLC) for the Western Ventura County and Simi Production-Consumption (P-C) Regions, collectively referred to as the Western Ventura-Simi (WVS) P-C Regions, for Portland concrete cement (PCC) aggregate resources. The original MLC was published as Special Report (SR) 145 in 1981. The first update was published as Open-File Report (OFR) 93-10 in 1993. This report reevaluates the region's PCC aggregate resources and includes an updated 50-year projection of PCC aggregate demand for the WVS P-C Regions through the year 2067.

Aggregate production data used in this update are current through December 2017 and land use data are current through at least 2018.

OVERVIEW OF AGGREGATE MATERIALS

Sand, gravel, and crushed rock are "construction aggregate." These materials, collectively referred to as aggregate, provide bulk and strength to PCC, asphaltic concrete (AC), Class II Base, and other aggregate commodities such as subbase, drain rock, and fill. Aggregate typically provides 80 to 100 percent of the volume in these uses.

The material specifications for PCC aggregate are more restrictive than the specifications for the other grades of aggregate. This restrictiveness makes PCC aggregate the scarcest and most valuable aggregate resource.

Aggregate materials are essential to modern society, both to support new construction and for maintaining the existing infrastructure. Because aggregate is a low unit-value, high bulk-weight commodity, it must be obtained from nearby sources to minimize economic and environmental costs associated with transportation. If nearby sources do not exist, transportation costs can quickly exceed the value of the aggregate. As transport distances increase, so do construction costs, fuel consumption, greenhouse gas (GHG) emissions, air pollution, traffic congestion, and road maintenance costs.

Land-use planners and decision-makers in California are faced with balancing a variety of needs in planning for a sustainable future for their communities. Mining is often seen as a controversial land use during the permitting process. However, there are many benefits to having local sources of construction aggregate. Increasingly, as existing permitted aggregate supplies are depleted, local land-use decisions regarding aggregate resources have regional impacts that go beyond local jurisdictional boundaries.

PRODUCTION-CONSUMPTION REGIONS

P-C Regions are defined as market regions in which 95 percent or more of the aggregate produced is also consumed. Research for this MLC update revealed considerable aggregate imports into the WVS P-C Regions. The individual P-C Regions presented in the previous MLC reports and combined WVS P-C Regions in this report no longer meet the definition of a P-C Region. Future MLC reports that include Ventura County will likely encompass a larger area that more accurately represents market conditions.

The WVS P-C Regions defined in SR 145 cover the urbanized southern part of Ventura County and small part of southwestern Los Angeles County. SR 145 divided the area into two P-C Regions based on production-consumption patterns at the time. The P-C Region boundaries are

retained in this report for comparison purposes although the market has changed. Figure 1 is a location map of the WVS P-C Regions.

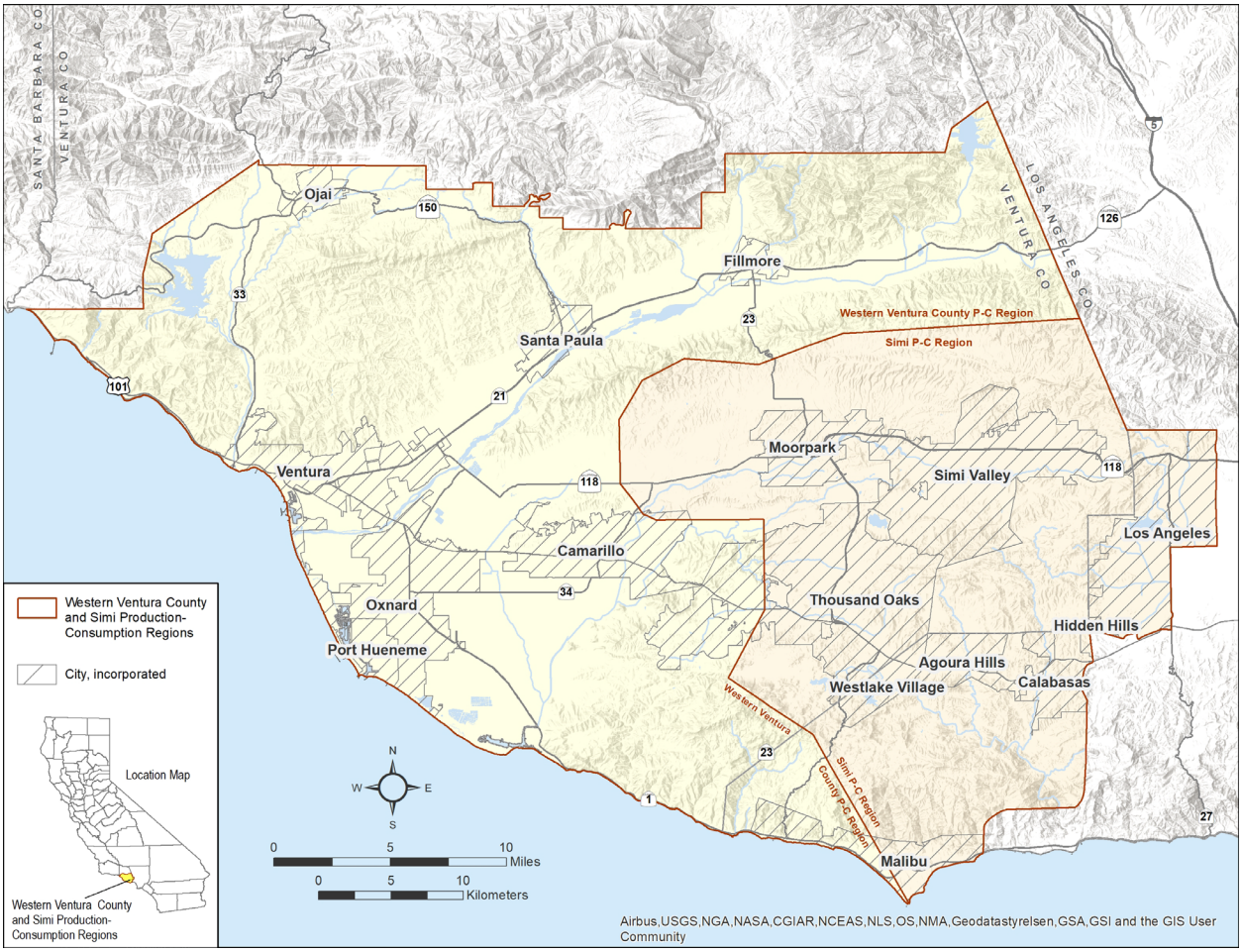

Figure 1. Location of the Western Ventura County and Simi Production-Consumption Regions

CLASSIFICATION-DESIGNATION PROCESS

Background

SR 145, OFR 93-10, and this update report were generated by the State Geologist as specified by the Surface Mining and Reclamation Act (SMARA) of 1975 (Public Resources Code [PRC] section 2710 et seq.). SMARA was passed by the California State Legislature in response to the loss of significant mineral resources due to urban expansion, the need for current information concerning the location and quantity of essential mineral deposits, and to ensure reclamation of mined lands. To address mineral resource conservation, SMARA mandates a two-phase process known as Classification-Designation.

The objective of the Classification-Designation process is to ensure, through appropriate local lead agency policies and procedures, that mineral materials will be available when needed and do not become inaccessible as a result of inadequate information during the land-use decision-making process.

SMARA mandates that the State Mining and Geology Board (SMGB) develop guidelines for mineral land classification. The SMGB adopted SMARA guidelines on June 30, 1978 and revised them in 2000. The guidelines are available on the California Department of Conservation (DOC) website at: https://www.conservation.ca.gov/smgb/Guidelines/Documents/ClassDesig.pdf

SMARA requires the State Geologist to assign Mineral Resource Zone (MRZ) classification to specified areas. The SMGB guidelines also direct the State Geologist to include the following additional information in regional classification reports for construction aggregate resources: (1) the location and estimated total quantity of construction aggregate in areas with land-uses compatible with potential mining; (2) limits of the market area that these potential resources would supply; and (3) an estimate of the total quantity of aggregate material that will be needed to supply the area for the next 50 years.

Overview of Classification

The regional classification of aggregate resources involves the six distinct but interrelated steps that are listed below:

1. Determination of Study Area Boundary: A study area may be a county, a part of a county, or a region that may contain all or part(s) of one or more counties.
2. Establishment of MRZs: All lands within the study area are assigned MRZ classifications (MRZ-1, MRZ-2, MRZ-3, or MRZ-4) based on geologic appraisal. The geologic appraisals include a study of pertinent geologic reports and maps, and field investigations of geologic units exposed in outcrops and at active and inactive mines and quarries.
3. Identification of Sectors: Lands known to contain significant aggregate resources (areas classified as MRZ-2 in Step 2, above) are evaluated to determine if current uses of these lands preclude mining. Lands currently permitted for mining and areas found to have land uses compatible with possible mining are identified as Sectors.
4. Calculation of Resource Tonnages within Sectors: Investigation and analysis of on-site conditions, measurement of the areal extent of deposits, drill-hole information, waste-material percentages, and deposit densities are used to calculate total tonnages of aggregate reserves and resources within each sector. Reserves are deposits permitted for mining; resources are all aggregate materials identified in sectors, including reserves.
5. Forecast of 50-Year Needs and the Life Expectancy of Current Reserves: The total tonnage of aggregate needed to satisfy the demand in the area over the next 50 years is estimated.
6. Identification of Alternative Resources: Alternative sources of aggregate are identified and briefly discussed.

The MRZ classification system previously used in SR 145 and OFR 93-10 is used in this report. The classification system is discussed in Part II of this report.

Overview of Designation

This update report contains the classification phase of the Classification-Designation process required by SMARA. The designation phase follows the receipt and acceptance of this classification report by the SMGB. Designation is the formal recognition by the SMGB, after

consultation with lead agencies and other interested parties, of areas containing mineral deposits of regional or statewide economic significance. Procedures for the designation of lands containing significant mineral deposits are specified in Section II.2 of the SMGB's Guidelines for Classification and Designation of Mineral Lands (California State Mining and Geology Board, 2000).

Lead Agency Response to Classification

The SMGB, upon receipt of the classification report from the State Geologist, transmits the report to the appropriate lead agencies and makes it available to other interested parties. Within 12 months of receipt of the report, each lead agency must develop and adopt mineral resource management policies to be incorporated in its general plan. These policies will:

1. Recognize the mineral land classification information, including the Mineral Resource Zone Maps transmitted to the lead agency by the SMGB.
2. Emphasize the conservation and development of the identified mineral deposits.

The information in this update and the revised projection of aggregate demands on the P-C Regions should be used by the lead agencies in evaluating the effectiveness of their current mineral resource management policies and in planning for future construction aggregate demands both in their jurisdictions and in neighboring areas. These policies should be updated as necessary. Table 1 shows lead agencies that have jurisdiction within the WVS P-C Regions.

Table 1. Lead Agencies in the WVS P-C Regions

Land Use Jurisdiction (County or Incorporated City)	**Areas Classified MRZ-2 in Jurisdiction**	**Designated Land in Jurisdiction**
County of Los Angeles (portion within the Simi P-C Region)		
County of Ventura	✔	✔
City of Agoura Hills		
City of Calabasas		
City of Camarillo		
City of Fillmore	✔	✔
City of Hidden Hills		
City of Los Angeles		
City of Malibu		
City of Moorpark		
City of Ojai		
City of Oxnard	✔	✔
City of Port Hueneme		
City of Santa Paula	✔	✔
City of Simi Valley	✔	✔
City of Thousand Oaks		
City of Ventura	✔	✔

HISTORY OF MINERAL LAND CLASSIFICATION IN THE WVS P-C REGIONS

In 1981, the California Division of Mines and Geology (now the California Geological Survey [CGS]) published the original land classification study for the WVS P-C Regions. An updated study was published in 1993. The studies are listed below in chronological order:

> Special Report 145 (1981): *Mineral Land Classification of Ventura County* (Anderson and others, 1981).
>
> Open-File Report 93-10 (1993): *Update of Mineral Land Classification of Portland Cement Concrete in Ventura, Los Angeles, and Orange Counties California: Part 1, Ventura County* (Miller, 1993a).

The SMGB used information in SR 145 to designate construction aggregate resource areas of regional significance in the WVS P-C Regions in SMARA Designation Report No. 2 - *Designation of Regionally Significant Construction Aggregate Resource Areas, Western Ventura County and Simi Production-Consumption Regions* (California Department of Conservation, 1982). In that action, the SMGB designated 13 areas (sectors) within the WVS P-C Regions as having aggregate resources of regional significance. Ten sectors located within and adjacent to the Santa Clara River were designated within the Western Ventura County P-C Region (delineated as Sectors A-J). Three sectors located in both the Santa Susana Mountains and Simi Hills were designated within the Simi P-C Region (delineated as Sectors A-C). The SMGB has taken no additional designation actions in the WVS P-C Regions since the 1982 designation.

GEOGRAPHY AND GEOLOGY

The following sections describe the geography and geology of each of the WVS P-C Regions.

Western Ventura County P-C Region

The Western Ventura County P-C Region is located in a wide river basin and floodplain surrounded by mountains to the north and south. The Western Ventura County P-C region includes:

- The Oxnard Plain.
- The Santa Clara River Valley downstream of Interstate 5.
- Portions of hills to the north and south of the Santa Clara River Valley.

Designated Sectors (Sectors A-J) are located within the Santa Clara River Valley, both in-stream and off-channel. The sectors are shown on Plate 2.

The Santa Clara watershed comprises 1,634 square miles and is the largest natural river system in Southern California (despite dams upstream on Castaic and Piru Creeks). The watershed area is approximately 90 percent mountainous terrain and 10 percent basin and floodplain, including the Santa Clara River Valley (Ventura County Public Works, 2020).

Mining in the Western Ventura County occurred in fluvial deposits in and adjacent to the Santa Clara River. The watershed receives sediment from the following sources:

- Mesozoic to Precambrian metamorphic and igneous formations in the San Gabriel Mountains.
- Cretaceous granites in portions of the northern and eastern watershed.
- Mesozoic metamorphics (Pelona schist) east of Castaic Reservoir.
- Lower Tertiary volcanics in part of the eastern watershed.
- Cenozoic sedimentary formations throughout the rest of the watershed.

Simi P-C Region

The Simi P-C Region is located in an area with several valleys and mountainous areas, including:

- Simi Valley.
- Las Posas Valley.
- A portion of the Santa Susana Mountains to the north of Simi Valley.
- Santa Monica Mountains.
- Simi Hills.
- Conejo Valley.
- The Malibu coastal area.

Designated Sector C, the majority of Designated Sector A, and new Sector D, are located in the Santa Susana Mountains north of the Simi and Las Posas Valleys. Designated Sector B and a

small area of Sector A are located in the Simi Hills southeast of Simi Valley and west of the San Fernando Valley. The sectors are shown on Plate 2.

Designated Sectors in the Simi P-C Region are located in Pleistocene to Paleocene sedimentary formations that have been uplifted and deformed by folding and thrust faulting. This deformation increases the variability of the location and depth of mineable deposits within the Simi P-C Region (Yeats and others, 1994).

Mining of PCC aggregate occurs predominately in the middle-Pleistocene to Pliocene Pico Formation occurring along the Oak Ridge area of the Santa Susana Mountains. The Pico Formation consists mainly of weakly cemented fine- to coarse-grained sandstone, with lesser conglomerate. Cross bedding is common, and conglomerates appear mainly in small, west-flowing channels formed in a deltaic environment. Conglomerate clasts are typically durable, pebble-sized, crystalline rocks derived from early uplift of the San Gabriel Mountains. The Pico Formation is rock-poor in most areas and is mainly mined for PCC aggregate sands and industrial sands, including specialty uses like golf course sand traps and beach volleyball courts. Mining within the Pico Formation produces approximately 20 percent rock and 80 percent sand.

Within the Simi P-C Region, the Pico Formation is overlain by the Plio-Pleistocene Saugus Formation and underlain by the Miocene Modelo Formation. Designated Sectors A and B in the Simi Hills are located in the Eocene to Paleocene Santa Susana Formation. These sectors are not currently being mined. Formation names used in this report are in accordance with the CGS Los Angeles Preliminary Geologic Map of the Los Angeles 30’ x 60’ Quadrangle, California (Campbell and others, 2014).

PART II – UPDATE OF MINERAL LAND CLASSIFICATION FOR PCC AGGREGATE IN THE WVS P-C REGIONS

This section of the report contains updated information concerning the location and quality of PCC aggregate resources in the WVS P-C Regions.

MINERAL RESOURCE ZONES

As set forth in PRC section 2761(b) of SMARA, the State Geologist shall classify land solely on the basis of geologic factors and without regard to existing land use. Areas subject to MLC are divided by the State Geologist into various MRZ categories that reflect varying degrees of mineral resource potential:

MRZ-1: Areas where available geologic information indicates that little likelihood exists for the presence of significant mineral resources.

MRZ-2: Areas where adequate information indicates that mineral deposits are present, or where it is judged that a high likelihood for their presence exists. This zone shall be applied to known mineral deposits or where well-developed lines of reasoning, based upon economic-geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is high.

MRZ-3: Areas containing mineral occurrences of undetermined mineral resource significance.

MRZ-4: Areas where available information is inadequate for assignment to any other MRZ category.

CLASSIFICATION CRITERIA

To be considered significant, a mineral deposit, or a group of mineral deposits that can be mined as a unit, must meet marketability and threshold value criteria adopted by the SMGB (California State Mining and Geology Board, 2000). Mineral deposits considered significant in this report meet the specifications for PCC aggregate. Threshold values are intended to indicate in a general way the approximate minimum size of a mineral deposit that will be considered significant for classification and designation. The value criteria vary for different mineral deposits depending on their uniqueness and commodity-type category.

The SMGB determined threshold value based on the gross selling price of the first marketable product in 1998 dollars to be $12,500,000 for construction aggregate deposits. This 1998 threshold value was adjusted for inflation to reflect 2020 dollars using the State of California Department of Finance (DOF) Consumer Price Index Calculator (California Department of Finance website, May 2020). The threshold value in 2020 dollars for construction aggregate is approximately $21.7 million. The price of PCC aggregate in 2020 averaged approximately $12.5/ton in the WVS P-C Regions. This equates to approximately 1.74 million tons of PCC aggregate.

RE-EVALUATION OF MINERAL LAND CLASSIFICATION FOR PCC AGGREGATE

This report reevaluates the original mineral land classification of the WVS P-C Regions in SR 145 published in 1981, and the update report (OFR 93-10) published in 1993.

Analysis of mine permits showed one mine permitted partially outside of an area classified MRZ-2. All other active mines in the WVS P-C Regions are permitted completely within areas classified MRZ-2. Analysis of geologic maps and field data did not justify reclassification of other areas. Plate 1 provides the updated Mineral Resource Zone Map.

Area Reclassified to MRZ-2 From MRZ-3

In this update report, one area is reclassified to MRZ-2 for PCC aggregate from MRZ-3:

- Tapo Canyon Mine: A portion of recently permitted excavation areas (totaling 111 acres) are reclassified to MRZ-2 from MRZ-3. All other permitted excavation areas are already classified MRZ-2 (designated Simi Sectors A and C).

PART III – REEVALUATION OF PCC AGGREGATE RESOURCE SECTORS IN THE WVS P-C REGIONS

This section of the report reevaluates PCC aggregate resource sectors in the WVS P-C Regions based on updated information. The areas of the Designated Sectors were calculated using a Geographic Information System (GIS). Areas of incompatible land use were determined using GIS and National Agriculture Imagery Program aerial imagery (2018). Mine production between 1992 and 2017 was subtracted from previous resource calculations. Some assumptions used in SR 145 and OFR 93-10 to calculate resources were modified in this report due to newer data related to deposits and market dynamics.

Resources were reevaluated for the following sectors:

- The ten Designated Sectors in the Western Ventura County P-C Region (Sectors A-J).
- The three Designated Sectors in the Simi P-C Region (Sectors A-C).
- A new sector (Sector D) in the Simi P-C Region.

Plate 2 shows existing sectors and the new sector in the WVS P-C Regions.

WESTERN VENTURA COUNTY P-C REGION

PCC aggregate resources in the Western Ventura County P-C Region were most recently evaluated in OFR 93-10. This report uses underlying assumptions from OFR 93-10 to determine PCC resources in the Western Ventura County P-C Region, including deposit thickness, density and percentage PCC. Resources were reevaluated for losses due to incompatible land uses and by subtracting mine production data from 1992 to 2017. Table 2 summarizes revised PCC resources.

The total area of Designated Sectors in the Western Ventura County P-C Region is 15,903 acres. A total of 1,502 acres have been lost to incompatible land uses. The largest loss occurred in Sector B, where there has been significant suburban development. Other Designated Sectors have lost resources due to residential and/or industrial development.

OFR 93-10 evaluated mining production in the Western Ventura County P-C Region through 1991. From 1992 to 2017 an estimated 7 million tons of PCC aggregate were produced.

Environmental concerns led to restrictions on mining in and adjacent to the Santa Clara River. In 1985 Ventura County and the Ventura County Flood District passed a joint resolution known as the “Red Line Profile and Width Policy for Mining and Excavation in the Santa Clara River” (Ventura County and Ventura County Flood Control District, 1985). This policy severely restricted the amount of material a mining operation could produce, preventing expansion of existing mines and permitting of new ones. Although geologically available resources remain in the Western Ventura County P-C Region, there will likely be little to no PCC aggregate production under current policies.

Table *2*. Revised Western Ventura County P-C Region Sector Resources

Sector	Sector Area (acres)	Area Lost to Incompatible Land Uses (acres)	Resources Estimated in OFR 93-10 (million tons)	Resources Estimated in this Report (million tons)
Sector A	1,488	33	300	293
Sector B	1,084	597	188	107
Sector C	1,949	539	298	277
Sector D	390	0	75	75
Sector E	2,205	238	306	283
Sector F	3,350	12	920	917
Sector G	2,398	66	620	608
Sector H	1,769	15	950	942
Sector I	966	2	410	409
Sector J	304	0	10	10
Total	**15,903**	**1,502**	**4,077**	**3,921**

SIMI P-C REGION

PCC aggregate resources in the Simi P-C Region were most recently evaluated in OFR 93-10. Resource calculations in OFR 93-10 assumed that aggregate mining in the Simi P-C Region was limited by the coarse fraction of PCC aggregate. OFR 93-10 states that PCC materials mined in the Simi P-C Region average only approximately 20 percent coarse (PCC aggregate requires an approximate 50/50 mix of coarse and fine material). The matching 20 percent of fine material to make a 50/50 mix totals only 40 percent of the available material. This report uses a revised methodology which assumes imports of coarse material to the Simi P-C Region allow for the production of all PCC fine material.

The estimated depth of deposit in Sectors A and C along Oak Ridge has been increased based on drill-hole data available after OFR 93-10 was published. The deposit density in Sectors A and C along Oak Ridge was adjusted based on survey responses from mine operators. Resource evaluation assumptions for Sector B and the portion of Sector A within the Simi Hills from OFR 93-10 were retained because there was no new information. Resources were also reevaluated for losses due to incompatible land uses and mining between 1992 and 2017. The revised estimate combines Sectors A and C because resource losses due to mining in individual Sector areas could not be calculated accurately.

A new Sector (Sector D) consists of several small areas outside of Sector C. The sector boundaries are based on the amended permit boundaries of the Tapo Canyon Mine. Resources for Sector D were calculated using the same assumptions as Sectors A and C. Table 3 summarizes revised PCC resources.

The total area of Designated Sectors in the Simi P-C Region is 11,276 acres. A total of 172 acres have been lost to incompatible land uses. The largest loss occurred in Sector B, due to suburban development. Other Designated Sectors have lost resources due to residential and/or industrial development.

OFR 93-10 evaluated mining production in the Simi P-C Region up to 1991. Between 1992 and 2017 an estimated 43 million tons of PCC aggregate were produced.

Due to revised methodology and deposit depth, Sector A and C resources are estimated to be considerably larger than reported in OFR 93-10 despite losses due to incompatible uses and mine production.

Table 3. Revised Simi P-C Region Sector PCC Resources

Sector	Sector Area (acres)	Area Lost to Incompatible Land Uses (acres)	Resources Estimated in OFR 93-10 (million tons)	Resources Estimated in this Report (million tons)
Sectors A & C	10,425	129	220	1,144
Sector B	851	43	500	500
Sector D*	111	--	--	28
Totals	**11,387**	**172**	**720**	**1,672**

**New Sector*

The Western Ventura and Simi P-C Regions combined contain an estimated 5,593 million tons of PCC aggregate. This estimate includes resources that remain in Designated Sectors after subtracting incompatible land uses and mine production. It also includes the newly identified Sector D, which adds 28 million tons of PCC resource. Table 4 provides a summary of combined resources for the WVS P-C Regions.

Table 4. Summary of All Identified PCC Aggregate Resources in the WVS P-C Regions

PCC Aggregate Resources Remaining in Designated Sectors	5,565 million tons
PCC Aggregate Resources Identified Since Designation	28 million tons
Total Identified PCC Aggregate Resources	**5,593 million tons**

PART IV – PCC AGGREGATE PRODUCTION IN THE WVS P-C REGIONS

PCC aggregate production in the WVS P-C Regions currently occurs exclusively along Oak Ridge in Simi Sectors A and C. Production in the Western Ventura County P-C Region almost completely ceased by 2000 with the exception of an Army Corps of Engineers flood control project and minor stockpile reductions. Current and past aggregate producers are shown on Plates 1 and 2.

AGGREGATE PRODUCTION DATA

Aggregate production data (all grades) for the WVS P-C Regions from 1960 to 2017 were compiled for this report. Data from 1960 to 1991 were compiled from SR 145 and OFR 93-10. Data from 1992 to 2017 were obtained from the DOC's Division of Mine Reclamation (DMR). Figure 2 shows aggregate production (all grades) for the WVS P-C Regions. Individual P-C Region production is not shown due to proprietary information. In cases where only one or two mines were producing aggregate in a P-C Region, the production data are withheld to keep individual mine production data confidential.

As of 2017, based on data from the DMR, five mines are currently producing PCC aggregate on an annual basis:

- Grimes Rock (Grimes Rock, Inc.)
- Moorpark Mine (CEMEX Construction Materials, LP)
- Tapo Canyon Mine (Gillibrand Industrial Sands, Inc.)
- Tapo Rock and Sand (Tapo Rock and Sand, Inc.)
- Wayne J. (Wayne J. Sand and Gravel, Inc.)

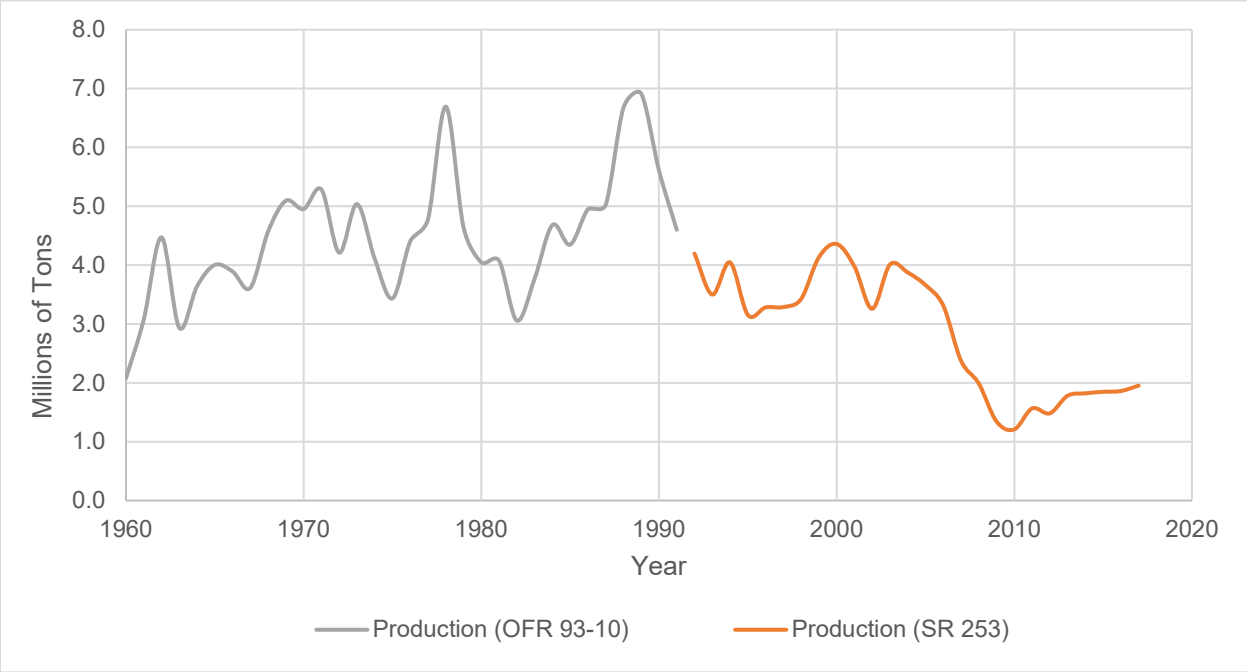

Figure 2. Aggregate Production in the WVS P-C Regions (All Grades)

AGGREGATE IMPORT AND EXPORT

Simi P-C Region PCC aggregate deposits average approximately 80 percent sand (as stated in OFR 93-10 and verified by fieldwork conducted in 2019). Coarse PCC material is imported to the WVS P-C Regions to supply aggregate suitable for use in PCC aggregate. Based on conversations with operators and lead agency personnel, the majority of the imported material comes from the Mojave Desert. Some material is trucked from the Palmdale P-C Region (see SR 143 Part V and OFR 94-14) to the WVS P-C Regions (Miller 1993a; Miller, 1994). Imported material is transported at least 40 miles to the WVS P-C Regions.

The exact amounts and sources of imports are unknown and proprietary; however, the amount was estimated by calculating the amount of coarse material needed to make PCC aggregate. Mine operators in the WVS P-C Regions were surveyed to determine the amount and percentage of coarse PCC material produced by each mining operation. The deficit of coarse material was then calculated and assumed to be the import amount. Between 1992 and 2017, the estimated percentage of aggregate (all grades) that was imported ranged from 5 to 27.

A minor amount of WVS P-C Regions PCC aggregate is exported. The percentage of exports is unknown but assumed to be negligible based on information obtained from mine operators. PCC aggregate has been exported for occasional projects (e.g., housing tract development) outside of the WVS P-C Regions. Currently, the Moorpark Mine (operated by CEMEX) exports some PCC sand to ready-mix plants outside of the WVS P-C Regions. Aside from PCC sand, specialty sands produced in the Simi P-C Region are exported throughout the State. Specialty sands are significantly more valuable than PCC sand making greater transportation distances more economically feasible.

AGGREGATE CONSUMPTION

Aggregate consumption for this report is defined as the amount of aggregate (all grades) used within the WVS P-C Regions. Consumption is therefore the amount of aggregate produced within the WVS P-C Regions plus imports, minus exports. Since export quantity is unknown and assumed to be minor, consumption was calculated as production plus imports. Figure 3 shows the estimated imports of coarse PCC aggregate compared to production and consumption for the period from 1992 to 2017.

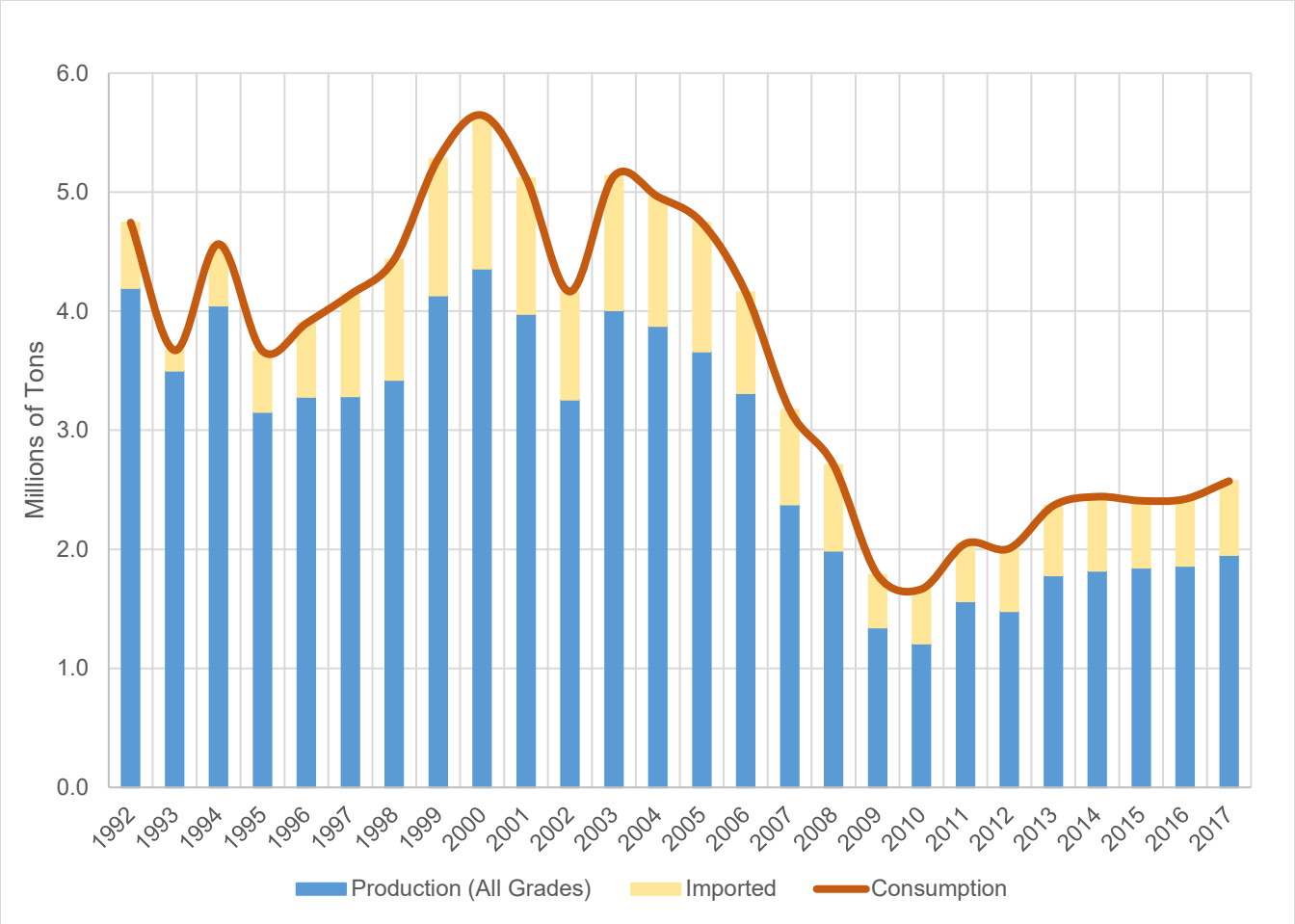

Figure 3. Consumption, Production, and Estimated Imports (All Grades) in the WVS P-C Regions

PART V – ESTIMATE OF THE 50-YEAR DEMAND FOR AGGREGATE IN THE WVS P-C REGIONS

The SMGB guidelines for the classification and designation of mineral land (California State Mining and Geology Board, 2000) specify that MLC reports for regions containing construction materials classified as MRZ-2 include:

> "[an] estimate of the total quantity of construction aggregate that will be needed to supply the requirements of the county or marketing region in which it occurs for the next 50 years. The marketing region is defined as the area within which such material is usually mined and marketed. The amount of construction aggregate needed for the next 50 years is projected using past consumption rates adjusted for anticipated changes in population."

This section of the report contains the estimate of future aggregate demand for the WVS P-C Regions projected through the year 2067.

POPULATION

The historical population estimate for the WVS P-C Regions between 1977 and 1991 are from OFR 93-10. This estimate included the "population of Los Angeles County served by Ventura production."

Population estimates for the WVS P-C Regions between 1992 and 2017 were calculated using data from the California DOF and U.S. Census Bureau (State of California Department of Finance E-4, 2007; State of California Department of Finance E-4, 2012; State of California Department of Finance E-4, 2020; U.S. Census Bureau, 2010). Population estimates for all of Ventura County and two percent of Los Angeles County were used to determine the total population of the WVS P-C Regions for each year (an estimate similar to "population of Los Angeles County served by Ventura production" used in OFR 93-10). By area, six percent of Los Angeles County is within the WVS P-C Regions; however, this portion has a lower population density due to open space areas and single-family homes. Los Angeles census tract GIS data from the U.S. Census Bureau show that approximately two percent of the fixed population census tract polygons (each tract is intended to represent an area containing 4,000 residents) are within the WVS P-C Regions (U.S. Census Bureau, 2010). Figure 4 shows historical population data. Historical population for 1960 to 1977 are omitted due to a different methodology used in SR 145.

A population forecast for the WVS P-C Regions for years 2020 through 2060 was made using California DOF data (Sate of California Department of Finance P-1, 2019). The forecast was extrapolated to years 2061 through 2067 using the Microsoft® Excel ETS Forecast function, an exponential smoothing algorithm. All Ventura County and two percent of the Los Angeles County population were used. Figure 4 shows the forecast population to 2067.

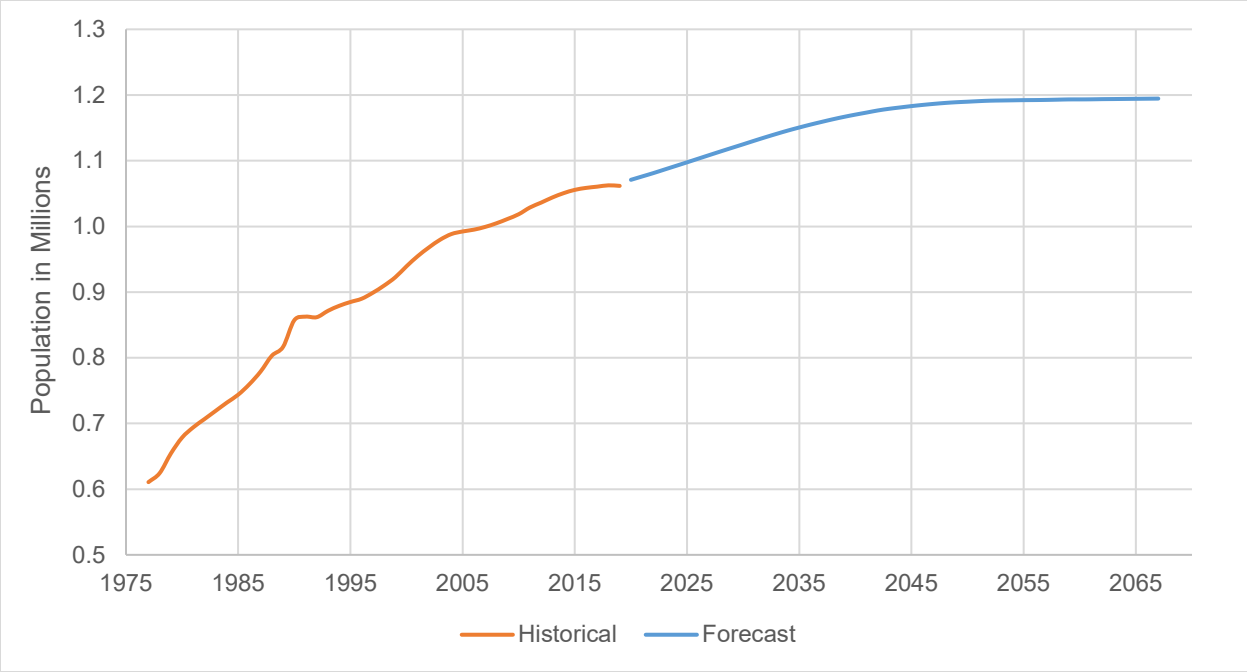

Figure 4. Historical and Forecast Population in the WVS P-C Regions (1977-2067)

HISTORICAL PER CAPITA AGGREGATE CONSUMPTION

For the period of 1977 to 1991, per capita consumption is from OFR 93-10. For the period of 1992 to 2017, per capita consumption was calculated using the reported production plus estimated imports divided by the WVS P-C Regions population. The estimated average annual per capita consumption rate between 1977 to 2017 is 4.86 tons. Within this time period, the rate fluctuates considerably. The calculated annual per capita consumption rate ranges from a low of 1.63 tons in 2010 to a high of 10.7 tons in 1979.

PROJECTED AGGREGATE DEMAND THROUGH THE YEAR 2067

The projected demand for all grades of construction aggregate within the WVS P-C Regions was estimated for the years 2018 to 2067. The estimate was calculated by multiplying the average annual per capita consumption rate by the projected population for each year. Figure 5 shows historical aggregate consumption and the projected aggregate demand.

This projection shows that an estimated 281 million tons of aggregate (all grades) will be needed to satisfy the future demand of the WVS P-C Regions through the year 2067. If PCC grade aggregate is used to satisfy all aggregate demand, PCC reserves would be depleted in less than 23 years (2039). Based on current PCC use and demand trends, PCC reserves would last less than 43 years (2060).

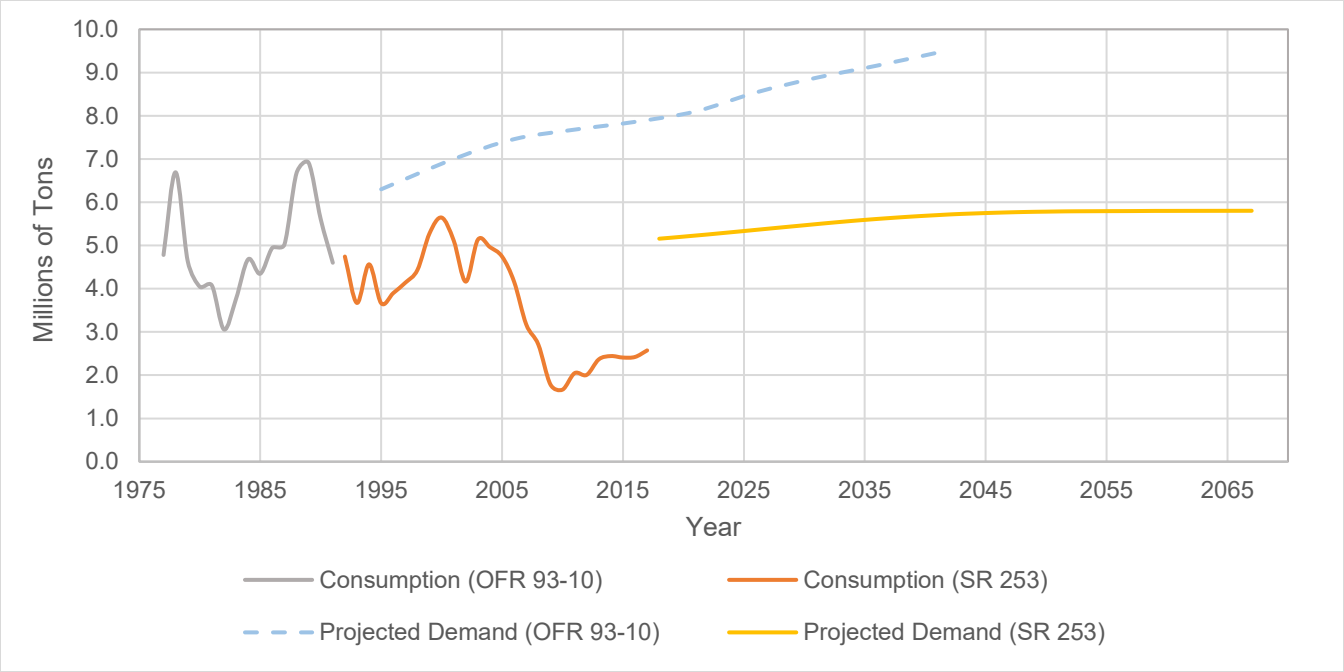

Figure 5. Consumption and Projected Demand (All Grades) in the WVS P-C Regions

COMPARISON OF THE 50-YEAR AGGREGATE DEMAND WITH CURRENT AGGREGATE RESERVES

The term “reserves” is used in this report to refer to identified mineral resources that are permitted to be mined. Generally, this implies the operator possesses a current permit and reclamation plan approved by the lead agency.

Aggregate reserves in the WVS P-C Regions were calculated based on review of lead agency permit files, approved reclamation plans, and consultation with mine operators and SMARA lead agency staff. Reserves of all aggregate grades are estimated to be approximately 235 million tons. PCC aggregate reserves are estimated to be approximately 118 million tons as of 2017. Reserves for all aggregate grades are below the 50-year projected demand of 281 million tons. Table 5 shows the estimated reserves, projected 50-year demand, and depletion date.

The projected lifespan of the aggregate reserves assumes that mining of these reserves continues at the calculated per capita rate until they are depleted. Factors besides population growth could change both the rate of utilization and the availability of these identified aggregate reserves, including:

- Significant infrastructure projects.
- Reconstruction in the wake of a disaster.
- Economic recessions or expansions that impact aggregate consumption.
- Fluctuations in imports and/or exports due to specific aggregate product needs and availability.
- Permitting of new and/or existing mines.
- Land use restrictions affecting aggregate reserve amounts and/or available products.

Table 5. WVS P-C Regions Summary of Reserves, and Projected 50-year Demand

PCC Aggregate Permitted Reserves	118 million tons
All Grades Permitted Reserves	235 million tons
Projected 50-year Demand for Aggregate (All Grades)	281 million tons
Years Until Depletion of PCC Reserves	<23 (Year 2039)

ECONOMIC, SOCIETAL, AND ENVIRONMENTAL COSTS OF INCREASING TRANSPORT DISTANCE

Increasing aggregate transport distance increases the economic, societal, and environmental costs of aggregate. Construction aggregate is a low unit-value, high bulk-weight commodity – it is relatively cheap and heavy. If nearby sources do not exist, transportation costs may significantly increase the cost of the aggregate by the time it reaches the consumer. In some cases, the cost of transporting aggregate can equal or exceed the base cost of the aggregate. Increased cost of aggregate translates to more expensive construction projects in both the public and private sectors.

Societal costs include damaged roads and increased traffic congestion due to increased truck traffic. Environmental costs include air pollution as GHG such as carbon dioxide, and particulate emissions. Transport distance is the fundamental control on all of these costs. Local aggregate sources are needed to minimize transport distance.

In the case of the WVS P-C Regions, cessation of mining in and adjacent to the Santa Clara River has resulted in an increase in aggregate transport distances for two reasons:

- Aggregate is transported from the Simi P-C Region to the Western Ventura County P-C Region.
- Coarse PCC aggregate is imported to the WVS P-C Regions from areas at least 40 miles away.

The recognition, conservation, and permitting of local aggregate resources, by local lead agencies, maximizes the availability of nearby sources. This minimizes transport distance, and thereby minimizes the economic, societal, and environmental cost of aggregate to the inhabitants of the WVS P-C Regions.

POTENTIAL ALTERNATIVE SOURCES OF AGGREGATE

Local Potential PCC Aggregate Sources

The following local sources could potentially provide PCC aggregate to the WVS P-C Regions:

- The Simi Conglomerate (Sector B) in the Simi Hills, which has not been mined on a commercial scale. Historically there was one small mining operation in Sector A south of Sector B.
- The Santa Clara River, especially off-channel, could be mined again if policies are changed to allow for economically feasible mining operations.

- Isolated conglomerate deposits (lenses) in various sedimentary formations could be mined on a small scale.

Imported Aggregate

Coarse PCC aggregate will continue to be imported to the WVS P-C Regions as long as mining occurs exclusively in the Simi P-C Region. Additionally, complete PCC aggregates could be imported to the region from outside the WVS P-C Regions if necessary. Mines located in the following areas are likely candidates to import to the WVS P-C Regions in the future:

- Palmdale P-C Region including areas classified in the following CGS publications:
    - SR 143 Part V (Joseph and others, 1984)
    - OFR 94-14 (Miller, 1994)
- San Bernardino County including areas classified in the following CGS publications:
    - SR 143 Part VII (Miller, 1984)
    - OFR 92-06 (Miller, 1993b)
    - SR 206 (Miller and Busch, 2008)
    - OFR 94-04 (Bezore and Shumway, 1994)
    - OFR 94-07 (Shumway and Hill, 1995)
    - OFR 94-08 (Shumway and Silva, 1995)
    - OFR 97-16 (Bezore, 1997)
- Other areas within the Mojave Desert.

The mining areas listed above are greater than 40 miles from the WVS P-C Regions. Transport of aggregate by rail, which has increased in areas northeast of the Greater Los Angeles Area, reduces costs and GHG compared to truck transport. Due to increases in population, the subsequent loss of lands compatible with mining, and local opposition, it appears likely that PCC aggregate will continue to be transported significant distances to populated areas in Southern California, including the WVS P-C Regions.

PART VI – CONCLUSIONS

The WVS P-C Regions contain approximately 5,593 million tons of PCC aggregate resources. Of that, 3,921 million tons of PCC resources are located in the Western Ventura County P-C Region, which is not currently mined on a regular or large-scale basis. Mining of PCC aggregate occurs almost exclusively in Sectors A and C in the hills north of Simi Valley and Moorpark.

The WVS P-C Regions contain PCC aggregate reserves totaling 118 million tons. If PCC grade aggregate is used to satisfy all aggregate demand, PCC reserves would be depleted in less than 23 years (2039). Based on current PCC use and demand trends, PCC reserves would last less than 43 years (2060). To meet future aggregate demand, either reserves in the WVS P-C Regions must increase or additional PCC aggregate must be imported from a significant distance. Enough resources exist within the WVS P-C Regions for mining well beyond 50 years; however, restrictions on mining and increases in areas with land uses incompatible with mining within sectors reduce future resources. Table 6 summarizes key report findings for the WVS P-C Regions.

Table 6. WVS P-C Regions Findings Summary

Total PCC Aggregate Resources	5,593 Million Tons
Total PCC Aggregate Reserves	118 Million Tons
Population (2017)	1.06 Million
Years Until Depletion of PCC Reserves	<23 (2039)
Number of Permitted PCC Aggregate Mines	5
Area Lost in Sectors to Incompatible Uses	1,674 Acres (6.2 Percent)

Land-use planners and decision-makers in California are faced with balancing a wide variety of needs in planning for a sustainable future for their communities. Mining is often seen as a controversial land use during the permitting process. However, there are substantial benefits to having local sources of construction aggregate.

Increasingly, as existing permitted aggregate supplies are depleted, local land-use decisions regarding aggregate resources can have regional impacts that go beyond local jurisdictional boundaries. Planning for future construction aggregate needs in the WVS P-C Regions should not only take into account local needs, but also the needs of the region as a whole.

Relying on aggregate from distant source areas leads to more rapid depletion of reserves and resources in those areas, potentially contributing to price increases or aggregate shortages. In addition to the greater economic costs, there are often increased environmental and societal costs associated with transporting material from more distant sources when compared to utilization of local sources. The environmental impacts include higher emissions of GHG and particulate matter air pollution. The societal impacts include increased traffic congestion and road maintenance due to increased truck traffic. These environmental and societal impacts occur within the area of aggregate consumption, in the aggregate source area, and in areas through which the material is transported. Reliance on more distant sources may also place responsibility and authority for permitting in the hands of decision makers in other jurisdictions.

ACKNOWLEDGEMENTS

CGS gratefully acknowledges the cooperation of local government agencies, mining organizations, and mine operators. The following CGS staff helped produce this report: Matt O'Neal conducted the initial research; Janine Bird produced the map plates; Anita Carney produced the location map; Milton Fonseca provided GIS support; Brenda Callen and Catherine Wesoloski provided review.

REFERENCES CITED

Anderson, T.P., Loyd, R.C., Kiessling, E.W., Kohler, S.L., and Miller, R.V., 1981, Classification of the Sand, Gravel, and Crushed Rock Resource Areas, Western Ventura County Production-Consumption Region: California Division of Mines and Geology Special Report 145.

California Department of Conservation, 1982, Designation of Regionally Significant Construction Aggregate Resources Areas in the Wester Ventura County and Simi Production-Consumption Regions: SMARA Designation Report no. 2.

Bezore, S.P., 1997, Mineral Land Classification of a Part of Southwestern San Bernardino County: the Barstow-Newberry Springs Area, California: California Division of Mines and Geology Open-File Report 97-16.

Bezore, S.P., and Shumway, D.O., 1994, Mineral Land Classification of a Part of Southwestern San Bernardino County: the Barstow-Victorville Area, California: California Division of Mines and Geology Open-File Report 94-04.

California State Mining and Geology Board, 2000, California Surface Mining and Reclamation Policies and Procedures: Guidelines for Classification and Designation of Mineral Lands, p. 27. (available at: http://www.conservation.ca.gov/smgb).

Campbell, R.H., Wills, C.J., Irvine, P.J., and Swanson, B.J., 2014, Preliminary Geologic Map of the Los Angeles 30' × 60' Quadrangle, California: California Geological Survey Preliminary Geologic Map Series, scale 1:100,000.

Joseph, S.E., Miller, R.V., Tan, S.S., and Goodman, R.W., 1984, Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas: Part V: Saugus-Newhall Production-Consumption Region and Palmdale Production-Consumption Region: California Division of Mines and Geology Special Report 143.

Miller, R.V., 1984, Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas: Part VII: San Bernardino Production-Consumption Region: California Division of Mines and Geology Special Report 143.

Miller, R.V., 1993a, Update of Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California: Part I Ventura County: California Division of Mines and Geology Open-File Report 93-10.

Miller, R.V., 1993b, Mineral Land Classification of Concrete Aggregate Resources in the Barstow-Victorville Area, California: California Division of Mines and Geology Open-File Report 92-06.

Miller, R.V., 1994, Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California, Part II - Los Angeles County: California Division of Mines and Geology Open-File Report 94-14.

Miller, R.V. and Busch, L.L., 2008, Update of Mineral Land Classification for Portland Cement Concrete-Grade Aggregate in the San Bernardino Production-Consumption Region, San Bernardino and Riverside Counties, California: California Division of Mines and Geology Special Report 206.

Shumway, D.O., and Hill, R.L., 1995, Mineral Land Classification of a Part of Southwestern San Bernardino County, California: A Part of the Eastern San Gabriel Mountains and the Western San Bernardino Mountains: California Division of Mines and Geology Open-File Report 94-07.

Shumway, D.O., and Silva, M.A., 1995, Mineral Land Classification of a Part of Southwestern San Bernardino County: The San Bernardino Valley Area, California: California Division of Mines and Geology Open-File Report 94-08.

State of California, Department of Finance, E-4, 2007, Historical Population Estimates for City, County and the State, 1991-2000, with 1990 and 2000 Census Counts. Sacramento, California, August 2007.

State of California, Department of Finance, E-4, 2012, Population Estimates for Cities, Counties, and the State, 2001-2010, with 2000 & 2010 Census Counts. Sacramento, California, November 2012.

State of California, Department of Finance, E-4, 2020, Population Estimates for Cities, Counties, and the State, 2011-2020, with 2010 Census benchmark. Sacramento, California, May 2020.

State of California, Department of Finance, P-1, 2019, Total Population by County (Projection) 2010-2060. Sacramento, California, January 2020 (initial public data release).

U.S. Census Bureau, 2010, TIGER/Line Shapefile, 2010 state, California, 2010 Census Block State-based.

Ventura County and Ventura County Flood Control District, 1985, Joint Resolution of the County of Ventura and the Ventura County Flood Control District establishing a “Red Line” profile and width policy for mining and excavation in the Santa Clara River.

Ventura County Public Works, 2020, The Santa Clara River: https://www.vcpublicworks.org/wpd/santa-clara-river/ (accessed February, 2020).

Yeats, R. S., Huftile, G. J., and Stitt, L. T., 1994, Late Cenozoic tectonics of the eastern Ventura basin, Transverse Ranges, California: American Association of Petroleum Geologists Bulletin, v. 78, no. 7, p. 1040-1074.

Appendix

Data Used to Generate Report Charts

Data for Figure 2. Aggregate Production in the WVS P-C Regions (All Grades)

Year	OFR 93-10	SR 253
1960	2,079,000	n/a
1961	3,076,000	n/a
1962	4,471,000	n/a
1963	2,934,000	n/a
1964	3,641,000	n/a
1965	4,003,000	n/a
1966	3,891,000	n/a
1967	3,614,000	n/a
1968	4,572,000	n/a
1969	5,094,000	n/a
1970	4,953,000	n/a
1971	5,284,000	n/a
1972	4,212,000	n/a
1973	5,037,000	n/a
1974	4,106,000	n/a
1975	3,434,000	n/a
1976	4,405,000	n/a
1977	4,781,000	n/a
1978	6,693,000	n/a
1979	4,639,000	n/a
1980	4,046,000	n/a
1981	4,075,000	n/a
1982	3,058,000	n/a
1983	3,769,000	n/a
1984	4,681,000	n/a
1985	4,347,000	n/a
1986	4,947,000	n/a
1987	5,023,000	n/a
1988	6,674,000	n/a
1989	6,914,000	n/a
1990	5,609,000	n/a
1991	4,601,000	n/a
1992	n/a	4,195,103
1993	n/a	3,499,842
1994	n/a	4,046,277
1995	n/a	3,153,580
1996	n/a	3,281,516
1997	n/a	3,287,331
1998	n/a	3,424,126
1999	n/a	4,132,101
2000	n/a	4,358,597
2001	n/a	3,977,006
2002	n/a	3,258,195
2003	n/a	4,009,896
2004	n/a	3,875,355
2005	n/a	3,660,756
2006	n/a	3,312,249
2007	n/a	2,376,016
2008	n/a	1,988,776
2009	n/a	1,343,049
2010	n/a	1,208,927
2011	n/a	1,564,636
2012	n/a	1,481,627
2013	n/a	1,780,879
2014	n/a	1,821,381
2015	n/a	1,847,423
2016	n/a	1,860,597
2017	n/a	1,952,824

Data for Figure 3. Consumption, Production, and Estimated Imports (All Grades) in the WVS P-C Regions

Year	Production (All Grades)	Imported	Consumption
1992	4,195,103	549,360	4,744,463
1993	3,499,842	171,359	3,671,201
1994	4,046,277	517,726	4,564,003
1995	3,153,580	511,316	3,664,896
1996	3,281,516	616,952	3,898,468
1997	3,287,331	852,302	4,139,633
1998	3,424,126	1,009,782	4,433,908
1999	4,132,101	1,148,021	5,280,122
2000	4,358,597	1,287,297	5,645,894
2001	3,977,006	1,138,378	5,115,384
2002	3,258,195	906,586	4,164,781
2003	4,009,896	1,125,218	5,135,114
2004	3,875,355	1,086,525	4,961,880
2005	3,660,756	1,083,387	4,744,143
2006	3,312,249	845,722	4,157,971
2007	2,376,016	796,351	3,172,367
2008	1,988,776	719,174	2,707,950
2009	1,343,049	441,828	1,784,877
2010	1,208,927	456,792	1,665,719
2011	1,564,636	482,699	2,047,335
2012	1,481,627	525,345	2,006,972
2013	1,780,879	584,868	2,365,747
2014	1,821,381	620,531	2,441,912
2015	1,847,423	560,277	2,407,700
2016	1,860,597	561,286	2,421,882
2017	1,952,824	620,055	2,572,879

Data for Figure 4. Historical and Forecast Population in the WVS P-C Regions (1977-2067)

Year	Historical	Forecast
1977	610,688	n/a
1978	624,401	n/a
1979	654,289	n/a
1980	678,552	n/a
1981	694,187	n/a
1982	706,761	n/a
1983	719,333	n/a
1984	731,907	n/a
1985	743,824	n/a
1986	759,812	n/a
1987	779,125	n/a
1988	803,158	n/a
1989	816,641	n/a
1990	857,201	n/a
1991	862,597	n/a
1992	861,792	n/a
1993	871,485	n/a
1994	879,083	n/a
1995	884,908	n/a
1996	889,866	n/a
1997	899,003	n/a
1998	909,906	n/a
1999	922,563	n/a
2000	939,293	n/a
2001	954,746	n/a
2002	968,022	n/a
2003	979,770	n/a
2004	988,352	n/a
2005	992,285	n/a
2006	995,021	n/a
2007	999,188	n/a
2008	1,004,679	n/a
2009	1,011,306	n/a
2010	1,018,550	n/a
2011	1,028,795	n/a
2012	1,036,227	n/a
2013	1,044,039	n/a
2014	1,050,600	n/a
2015	1,055,620	n/a
2016	1,058,603	n/a
2017	1,060,511	n/a
2018	1,062,508	n/a
2019	1,061,672	n/a
2020	n/a	1,070,915
2021	n/a	1,076,039
2022	n/a	1,081,159
2023	n/a	1,086,622
2024	n/a	1,092,070
2025	n/a	1,097,544
2026	n/a	1,103,109
2027	n/a	1,108,662
2028	n/a	1,114,155
2029	n/a	1,119,597
2030	n/a	1,124,976
2031	n/a	1,130,475
2032	n/a	1,135,822
2033	n/a	1,140,985
2034	n/a	1,145,969
2035	n/a	1,150,564
2036	n/a	1,154,977
2037	n/a	1,159,095
2038	n/a	1,163,099
2039	n/a	1,166,782
2040	n/a	1,170,157
2041	n/a	1,173,282
2042	n/a	1,176,491
2043	n/a	1,179,024
2044	n/a	1,181,097
2045	n/a	1,183,139
2046	n/a	1,184,929
2047	n/a	1,186,533
2048	n/a	1,187,933
2049	n/a	1,189,031
2050	n/a	1,189,821
2051	n/a	1,190,694
2052	n/a	1,191,377
2053	n/a	1,191,677
2054	n/a	1,191,932
2055	n/a	1,192,204

2056	n/a	1,192,333
2057	n/a	1,192,558
2058	n/a	1,192,922
2059	n/a	1,193,299
2060	n/a	1,193,343
2061	n/a	1,193,459
2062	n/a	1,193,734

2063	n/a	1,193,873
2064	n/a	1,194,052
2065	n/a	1,194,220
2066	n/a	1,194,389
2067	n/a	1,194,557

Data for Figure 5. Consumption and Projected Demand (All Grades) in the WVS P-C Regions

Year	Consumption (OFR 93-10)	Consumption (SR 253)	Projected Demand (OFR 93-10)	Projected Demand (SR 253)
1977	4,781,000	n/a	n/a	n/a
1978	6,693,000	n/a	n/a	n/a
1979	4,639,000	n/a	n/a	n/a
1980	4,046,000	n/a	n/a	n/a
1981	4,075,000	n/a	n/a	n/a
1982	3,058,000	n/a	n/a	n/a
1983	3,769,000	n/a	n/a	n/a
1984	4,681,000	n/a	n/a	n/a
1985	4,347,000	n/a	n/a	n/a
1986	4,947,000	n/a	n/a	n/a
1987	5,023,000	n/a	n/a	n/a
1988	6,674,000	n/a	n/a	n/a
1989	6,914,000	n/a	n/a	n/a
1990	5,609,000	n/a	n/a	n/a
1991	4,601,000	n/a	n/a	n/a
1992	n/a	4,744,463	n/a	n/a
1993	n/a	3,671,201	n/a	n/a
1994	n/a	4,564,003	n/a	n/a
1995	n/a	3,664,896	2,514,286	n/a
1996	n/a	3,898,468	n/a	n/a
1997	n/a	4,139,633	n/a	n/a
1998	n/a	4,433,908	n/a	n/a
1999	n/a	5,280,122	n/a	n/a
2000	n/a	5,645,894	n/a	n/a
2001	n/a	5,115,384	2,800,000	n/a
2002	n/a	4,164,781	n/a	n/a
2003	n/a	5,135,114	n/a	n/a
2004	n/a	4,961,880	n/a	n/a
2005	n/a	4,744,143	n/a	n/a
2006	n/a	4,157,971	2,980,000	n/a
2007	n/a	3,172,367	n/a	n/a
2008	n/a	2,707,950	n/a	n/a
2009	n/a	1,784,877	n/a	n/a
2010	n/a	1,665,719	n/a	n/a
2011	n/a	2,047,335	3,080,000	n/a
2012	n/a	2,006,972	n/a	n/a
2013	n/a	2,365,747	n/a	n/a
2014	n/a	2,441,912	n/a	n/a

2015	n/a	2,407,700	n/a	n/a
2016	n/a	2,421,882	3,140,000	n/a
2017	n/a	2,572,879	n/a	n/a
2018	n/a	n/a	n/a	5,157,119
2019	n/a	n/a	n/a	5,180,318
2020	n/a	n/a	n/a	5,204,991
2021	n/a	n/a	3,240,000	5,229,891
2022	n/a	n/a	n/a	5,254,779
2023	n/a	n/a	n/a	5,281,328
2024	n/a	n/a	n/a	5,307,810
2025	n/a	n/a	n/a	5,334,414
2026	n/a	n/a	3,420,000	5,361,464
2027	n/a	n/a	n/a	5,388,451
2028	n/a	n/a	n/a	5,415,152
2029	n/a	n/a	n/a	5,441,600
2030	n/a	n/a	n/a	5,467,743
2031	n/a	n/a	3,560,000	5,494,470
2032	n/a	n/a	n/a	5,520,460
2033	n/a	n/a	n/a	5,545,551
2034	n/a	n/a	n/a	5,569,774
2035	n/a	n/a	n/a	5,592,109
2036	n/a	n/a	3,660,000	5,613,555
2037	n/a	n/a	n/a	5,633,573
2038	n/a	n/a	n/a	5,653,031
2039	n/a	n/a	n/a	5,670,935
2040	n/a	n/a	n/a	5,687,336
2041	n/a	n/a	3,780,000	5,702,523
2042	n/a	n/a	n/a	5,718,121
2043	n/a	n/a	n/a	5,730,435
2044	n/a	n/a	n/a	5,740,509
2045	n/a	n/a	n/a	5,750,434
2046	n/a	n/a	n/a	5,759,134
2047	n/a	n/a	n/a	5,766,930
2048	n/a	n/a	n/a	5,773,735
2049	n/a	n/a	n/a	5,779,069
2050	n/a	n/a	n/a	5,782,913
2051	n/a	n/a	n/a	5,787,153
2052	n/a	n/a	n/a	5,790,471
2053	n/a	n/a	n/a	5,791,930
2054	n/a	n/a	n/a	5,793,172
2055	n/a	n/a	n/a	5,794,495

2056	n/a	n/a	n/a	5,795,118
2057	n/a	n/a	n/a	5,796,213
2058	n/a	n/a	n/a	5,797,982
2059	n/a	n/a	n/a	5,799,816
2060	n/a	n/a	n/a	5,800,027
2061	n/a	n/a	n/a	5,800,592
2062	n/a	n/a	n/a	5,800,990
2063	n/a	n/a	n/a	5,801,389
2064	n/a	n/a	n/a	5,801,787
2065	n/a	n/a	n/a	5,802,185
2066	n/a	n/a	n/a	5,802,584
2067	n/a	n/a	n/a	5,802,982