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California Department of Conservation

SUPPLEMENT TO MAP SHEET 52

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AGGREGATE SUSTAINABILITY IN CALIFORNIA (2026)

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CALIFORNIA GEOLOGICAL SURVEY

California Department of Conservation

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Cover: Image depicting Cemex Clayton Quarry, Contra Costa County.

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ACRONYMS AND ABBREVIATIONS

AASHTO – American Association of State Highway and Transportation Officials

AC – Asphaltic Concrete

ASTM – American Society for Testing Materials

CGS – California Geological Survey

CO_2 – Carbon Dioxide

DOF – California Department of Finance

DOF – California Division of Mine Reclamation ETS – Exponential Triple Smoothing (Microsoft Excel FORECAST.ETS method)

MLC – Mineral Land Classification

NO_X – Nitrogen Oxides

OFR – Open-File Report

P-C Region – Production-Consumption Region

PCC – Portland Cement Concrete

PM – Particulate Matter

SANDAG – San Diego Association of Governments

SMARA – Surface Mining and Reclamation Act of 1975

SR – Special Report (CGS publication series)

INTRODUCTION

Sand, gravel, and crushed stone are construction materials, collectively referred to as aggregate. Aggregate provides the bulk and strength of Portland Cement Concrete (PCC) and Asphaltic Concrete (AC, commonly referred to as "asphalt" or "black top"). It is also used as road base, subbase, and railroad ballast.

California's building and paving industries consume large quantities of aggregate, and demand is expected to increase statewide. Aggregate is essential to maintaining existing infrastructure and supporting new construction, making it a resource of critical economic importance. Because aggregate is a low unit-value, high-bulk-weight commodity, it must be sourced close to where it is used to reduce transportation-related economic and environmental costs. When nearby sources are unavailable transportation costs can quickly exceed the value of the material and result in increased construction costs, fuel consumption, greenhouse gas emissions, air pollution, traffic congestion, and road maintenance.

From 1991 to 2023, California consumed an average of approximately 145 million tons of construction aggregate (all grades) per year. Transported in 25-ton truckloads, this equates to about 5.8 million truck trips annually. With an average haul distance of 25-miles (50 miles round trip), aggregate transport during this period resulted in approximately 290 million truck miles traveled, more than 41 million gallons of diesel fuel consumed, and more than 460,000 tons of carbon dioxide emissions each year. Doubling the haul distance to 50 miles (100 miles round trip) would approximately double these impacts.

Land-use planners and decision makers in California balance a wide range of needs when planning for sustainable communities and regions. Mining is often a controversial land use during the permitting process; however, local sources of construction aggregate provide important economic and environmental benefits. As permitted aggregate supplies are depleted, local land-use decisions regarding aggregate resources increasingly have regional consequences beyond individual jurisdictions.

The universal need for aggregate, increasing demand, transportation-related costs, and competing land uses make information on aggregate availability and demand essential for effective planning. The California Geological Survey (CGS) Map Sheet 52 and this accompanying report provide an overview of the current availability and projected future demand for California's permitted aggregate reserves.

Map Sheet 52 was originally published in 2002 (Kohler, 2002) and subsequently updated in 2006 (Kohler, 2006), 2012 (Clinkenbeard, 2012), and 2018 (Clinkenbeard and Gius, 2018). Map Sheet 52 (2026) updates the version published in 2018.

Map Sheet 52 and this report compile data from 53 CGS mineral land classification (MLC) and aggregate studies covering more than 30 aggregate study areas statewide (see Appendix). These study areas encompass approximately 30 percent of California's land area and supply aggregate to about 85 percent of the state's population. This report is organized into three parts:

- Part I - describes data sources and methods used to develop the map.
- Part II - compares the updated 2026 map with the 2018 version.
- Part III – provides an overview of construction aggregate.

Unless otherwise noted, all references to "aggregate" in this report and on the map refer to construction aggregate, defined as alluvial sand and gravel or crushed stone that meets standard specifications for use in PCC or AC.

Estimates of permitted aggregate resources, projected demand, and years of permitted reserves remaining are based on conditions as of January 1, 2024.[1] These estimates do not reflect subsequent changes such as production, mine closures, or new or expanded permits. While the statewide and regional information presented here may assist decision makers, it should not be used as the basis for local land-use decisions. Local planning and decision making should rely on the more detailed information provided in the individual aggregate studies used to compile Map Sheet 52.

[1] Reserves estimates for Map Sheet 52 incorporate production data from the DMR for years 2017 through 2023. Mine operators are required to report calendar year mine production annually to the DMR. These annual reports are due on July 1st of the following year; however, not all reports are submitted on time. For reserves estimates, 2023 production data was not available until the beginning of 2025.

PART I: DESCRIPTION OF MAP SHEET 52, AGGREGATE SUSTAINABILITY IN CALIFORNIA

Map Sheet 52 is a statewide compilation of data on aggregate availability collected over approximately 45 years and updated to January 1, 2024. The primary purpose of the map is to compare projected 50-year aggregate demand with currently permitted aggregate reserves across regions of California. The map also presents estimates of the remaining years of permitted aggregate supply. The following sections describe data sources and methods used to develop Map Sheet 52.

Mineral Land Classification and Aggregate Studies

MLC reports have been published by the CGS since 1979 in accordance with the California Surface Mining and Reclamation Act of 1975 (SMARA), which requires the State Geologist to classify lands based on their known or inferred mineral resource potential. SMARA, along with its implementing regulations and guidelines, is described in Special Publication 51 (State Mining and Geology Board, 2000). Current regulations and guidelines are available from the State Mining and Geology Board website at http://www.conservation.ca.gov/smgb. A list of these MLC reports (both Open File Report and Special Reports) is included as the Appendix.

The mineral land classification process identifies lands containing economically significant mineral deposits. Its primary objective is to ensure that mineral resource potential is recognized and considered in land-use planning. For aggregate resources, the process includes evaluating the quantity, quality, and areal extent of aggregate deposits within a defined study area.

Mineral land classification reports vary in scope. Some focus specifically on aggregate resources, while others address aggregate in combination with other mineral commodities or do not include aggregate at all. Reports that focus on aggregate typically include resource classification and mapping, estimates of permitted and non-permitted aggregate resources, projections of 50-year aggregate demand, and estimates of when permitted reserves are likely to be depleted. Map Sheet 52 provides a statewide, updated summary of permitted aggregate reserves and projected 50-year demand derived from these regional SMARA classification reports.

As reflected on Map Sheet 52, aggregate-focused mineral land classification studies use either a Production-Consumption (P-C) region or a county as the study area boundary. A P-C region consists of one or more aggregate producing mines and the market area they serve; these regions may cross county boundaries. For clarity, each P-C region or county evaluated in an aggregate study is referred to in this report as an "aggregate study area."

SMARA guidelines recommend periodic review of mineral land classification to determine whether updates or new classifications are needed. As part of this review process, projected 50-year aggregate demand may also be revised to reflect changes in production, population, or market conditions.

Fifty-Year Aggregate Demand Forecasts

Fifty-year aggregate demand forecasts were developed for each aggregate study area and are shown on Map Sheet 52. Demand forecasts are also summarized in Table 1 of this report. All demand forecasts shown on Map Sheet 52 cover the period January 1, 2024, through December 2073.

The aggregate study area with the highest projected future demand is the Greater Sacramento Area, which is expected to require more than a billion tons of aggregate by the end of 2073. Other study areas with high projected demand include the Temescal Valley-Orange County P-C Region and San Fernando Valley-Saugus Newhall P-C Region, each with projected demand exceeding 750 million tons over the next 50 years.

Aggregate study areas with lower demand are generally located in rural, less densely populated regions. Glenn County, Shasta County, Stanislaus County, and Tehama County are each projected to require less than 100 million tons of aggregate over the next 50 years.

Map Sheet 52 also depicts aggregate mines in areas where CGS has not completed MLC studies. Aggregate demand in these areas are undetermined.

Demand Forecast Methods

The fifty-year aggregate demand for each study area was estimated using one of four methods:

- Study area per capita demand
- Statewide per capita demand
- Microsoft Excel FORECAST.ETS production forecast
- Average production multiplied by 50 years

For most study areas, the demand forecast method is the same as was used in Map Sheet 52 (2018). However, for study areas with an updated MLC published after 2018, the demand forecast method used in the updated MLC was used for this report. Table 2 shows the demand method and basis for each study area.

The study area per capita consumption model has been used in most MLC reports. However, this approach may not be appropriate in study areas that import or export a large proportion of their aggregate resulting in a poor correlation between production and population. In such cases, demand projections may instead be made based on historical production.

Table 1. Comparison of 50-Year Demand to Permitted Aggregate Reserves for Aggregate Study Areas as of January 1, 2024

AGGREGATE STUDY AREA	PERMITTED RESERVES (MILLION TONS)	50-YEAR DEMAND (MILLION TONS)	YEARS OF PERMITTED RESERVES REMAINING
Bakersfield P-C Region	1,690	207	**More Than 50 Years**
Barstow-Victorville P-C Region	118	101	**More Than 50 Years**
Claremont-Upland P-C Region	48	163	**11 to 20 Years**
Fresno P-C Region	530	227	**More Than 50 Years**
Glenn County	15	57	**11 to 20 Years**
Greater Sacramento Area*	1,480	1,026	**More Than 50 Years**
Merced County	87	156	**31 to 40 Years**
Monterey Bay P-C Region	187	283	**31 to 40 Years**
North San Francisco P-C Region	279	239	**More Than 50 Years**
Palm Springs P-C Region	175	174	**More Than 50 Years**
Palmdale P-C Region	120	537	**11 to 20 Years**
San Bernardino P-C Region	133	636	**10 or Fewer Years**
San Fernando Valley-Saugus Newhall P-C Region	9	754	**10 or Fewer Years**
San Gabriel Valley P-C Region	240	512	**11 to 20 Years**
San Luis Obispo-Santa Barbara P-C Region	57	177	**11 to 20 Years**
Shasta County	52	70	**31 to 40 Years**
South San Francisco P-C Region	478	651	**31 to 40 Years**
Stanislaus County	27	99	**11 to 20 Years**
Stockton-Lodi P-C Region	167	479	**11 to 20 Years**
Tehama County	27	28	**41 to 50 Years**
Temescal Valley-Orange County P-C Region	861	836	**More Than 50 Years**
Tulare County	86	100	**41 to 50 Years**
Western San Diego County P-C Region	224	374	**21 to 30 Years**
Western Ventura-Simi P-C Region**	104	106	**41 to 50 Years**

* Combines multiple study areas from Map Sheet 52 (2018): El Dorado County, Nevada County, Placer County, Sacramento County, Sacramento-Fairfield P-C Region, and Yuba City-Marysville P-C Region
**Described as "Ventura County" in Map Sheet 52 (2018)

Table 2. Study areas demand forecast method and basis

Aggregate Study Area	Demand Forecast Method	Demand Method Basis
Bakersfield P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Barstow-Victorville P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Claremont-Upland P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Fresno P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Glenn County	Production FORECAST.ETS	Map Sheet 52 (2018)
Greater Sacramento Area*	Per Capita Demand	Special Report 245
Merced County	Production FORECAST.ETS**	Special Report 252
Monterey Bay P-C Region	Average Production**	Special Report 251
North San Francisco P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Palm Springs P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Palmdale P-C Region	Production FORECAST.ETS	Map Sheet 52 (2018)
San Bernardino P-C Region	Per Capita Demand	Map Sheet 52 (2018)
San Fernando Valley-Saugus Newhall P-C Region	Statewide Per Capita Demand**	Special Report 254
San Gabriel Valley P-C Region	Per Capita Demand	Map Sheet 52 (2018)
San Luis Obispo-Santa Barbara P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Shasta County	Per Capita Demand	Map Sheet 52 (2018)
South San Francisco P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Stanislaus County	Per Capita Demand	Map Sheet 52 (2018)
Stockton-Lodi P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Tehama County	Production FORECAST.ETS	Map Sheet 52 (2018)
Temescal Valley-Orange County P-C Region	Production FORECAST.ETS	Map Sheet 52 (2018)
Tulare County	Per Capita Demand	Map Sheet 52 (2018)
Western San Diego County P-C Region	Per Capita Demand	Map Sheet 52 (2018)
Western Ventura-Simi P-C Region* **	Per Capita Demand	Special Report 253

* Combines multiple study areas from Map Sheet 52 (2018): El Dorado County, Nevada County, Placer County, Sacramento County, Sacramento-Fairfield P-C Region, and Yuba City-Marysville P-C Region
** These areas used the study area per capita demand method in Map Sheet 52 (2018)
**Described as "Ventura County" in Map Sheet 52 (2018)

The study area per capita demand method was used to determine the 50-year aggregate demand for most study areas and involved the following steps:

- Collecting annual historical aggregate production and population data for the study area for years 1991-2023.

- Dividing the study area annual aggregate production by the study area population for that same year to determine annual historical per capita consumption.
- Determining the average annual historical per capita consumption values (expressed as tons per person per year) for years 1991-2023.
- Using the projected annual population for years 2024-2070 from the California Department of Finance (DOF).[2]
- Projecting the annual population for years 2071-2073 using the 2070 population.
- Multiplying each year of projected population by the average historical per capita consumption and adding the results for each year to obtain the 50-year aggregate demand.

The statewide per capita demand method was used for the San Fernando Valley-Saugus Newhall P-C Region, based on CGS Special Report (SR) 254. This method differs from the per capita (study area method) only in that the per capita value was calculated using statewide production divided by statewide population. Demand forecasting was then estimated using the per capita demand (4.1 tons per person per year) multiplied by the statewide population forecast.

The Microsoft Excel FORECAST.ETS production forecast was used for five study areas. For this report, Excel's built-in exponential triple smoothing (ETS) forecasting function was used to estimate the 50-year demand based on the production trend from 1991 to 2023.

The average annual production method was used for the Monterey Bay P-C Region, based on SR 251. This method is a simplified forecast using average production instead of a forecasting function. For this report, the average production from 1991 to 2023 was multiplied by 50 to estimate the 50-year demand.

For all demand forecast methods, production data was limited to SMARA database production data provided by the California Division of Mine Reclamation (DMR) for the years 1991-2023. This time period was selected to ensure high-quality production data and consistency across study areas.

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[2] DOF population data are available at the statewide and county levels (DOF, 2025). In cases where the study area is a P-C region, the region may comprise only a portion of a county or span portions of multiple counties. To estimate population for a portion of a county, geographic information software (ArcGIS) was used to intersect P-C region boundaries with census block data from 2020 (U.S. Census Bureau, 2025). Dividing the census block population within the P-C Region by the county population resulted in a fraction that was then applied to demand forecasting. For example, the Western Ventura-Simi P-C Region includes all of Ventura County and only a small portion of Los Angeles County. Based on the ArcGIS intersection of 2020 census blocks with the P-C Region, approximately 1.98% of the Los Angeles County population falls within the P-C Region. For both per capita demand and forecasting, the P-C Region population is estimated using the Ventura County population plus 1.98% of the Los Angeles County population.

Permitted Aggregate Reserves

Approximately 7.2 billion tons of permitted aggregate reserves are located within the aggregate study areas shown on Map Sheet 52. Permitted aggregate reserves consist of aggregate deposits that are suitable for commercial use, occur on properties owned or leased by aggregate producers, and are authorized for mining under valid permits. A permit is a legal authorization issued by a SMARA lead agency (such as a county or city government), without which mining operations cannot occur.

Permitted aggregate reserves increase due to permitting of new mines or the expansion of existing operations. Mine reserves decrease due to mine production or in cases where mines with non-zero reserves are reclaimed.

Permitted aggregate reserves estimates shown on the map and in Table 1 were updated from the more recent of either Map Sheet 52 (2018) or the MLC report for each study area. Permitted reserves estimates were updated through an extensive review of SMARA mine files. The mine file review included information from lead agency approved reclamation plans, mining plans, and use permits, as well as investigation of the mine status (including those certified reclaimed). Decreases in reserves due to production were determined using DMR aggregate production data for years 2017 through 2023.

Projected Years of Permitted **Reserves Remaining**

The estimated number of years of permitted aggregate reserves remaining for each aggregate study area is shown on Map Sheet 52 and in Table 1. These estimates are calculated by comparing the currently permitted reserves with projected annual aggregate consumption on a year-by-year basis. Results are presented as ranges: 10 or fewer years, 11-20 years, 21-30 years, 31-40 years, 41-50 years, and more than 50 years.

As of January 1, 2024, the San Fernando Valley-Saugus Newhall P-C Region and San Bernardino P-C Region are projected to have fewer than 10 years of permitted aggregate reserves remaining. Seven study areas are projected to have between 11-20 years remaining, one has 21-30 years, four have 31-40 years, three have 41-50 years, and seven have more than 50 years of permitted reserves remaining.

The estimated ranges have uncertainties that are not quantified in this assessment for Map Sheet 52. These include increased demand from periods of strong economic growth, major infrastructure projects, post-disaster reconstruction, or from neighboring regions with limited aggregate supplies that accelerate depletion of permitted reserves. Conversely, reduced economic activity and aggregate recycling may lower demand and extend reserve life. In addition, the approval of new or expanded permits may increase permitted reserves and extend their projected lifespan.

Non-Permitted Aggregate Resources

Non-permitted aggregate resources are deposits that may meet specifications for construction aggregate, are recoverable using existing technology, have no land uses that are incompatible with mining, and are not currently permitted for extraction.

Although non-permitted resources are not shown on Map Sheet 52, they are identified and discussed in the MLC reports used to compile the map (see Appendix).

Due to social, environmental, or economic restraints only a portion of non-permitted aggregate reserves will become available for extraction. Aggregate deposits located near urban development or environmentally sensitive areas may be restricted or precluded from mining, while deposits located far from potential markets may not be economical to develop.

Despite these limitations, non-permitted aggregate resources represent the most likely future sources of construction aggregate available to meet California's ongoing demand. The criteria and methods used to estimate non-permitted resource quantities and to delineate their areal extent are described in the individual MLC reports listed in the Appendix.

PART II: COMPARISON OF THE 2018 AND 2026 EDITIONS OF MAP SHEET 52

Permitted aggregate reserves data for the updated 2026 Map Sheet 52 are current as of January 1, 2024, and the associated analytical work was conducted between 2023 and 2026. The most recent aggregate production data used for the updated map are from calendar year 2023. Aggregate demand projections (in study areas where population was used) were based on DOF county population estimates and projections derived from the 2020 U.S. Census (DOF, 2025; U.S. Census Bureau, 2025). Fifty-year aggregate demand was calculated for the years 2024 through 2073.

The prior edition of Map Sheet 52 was published in 2018. Permitted aggregate reserves data for that map were current as of January 1, 2017, and analytical work for the study was conducted during 2017 and 2018. The most recent aggregate production data available for the 2018 map were from calendar year 2016. Aggregate demand projections (in study areas where population was used) for the prior edition were based on DOF county population projections derived from the 2010 U.S. Census Fifty-year aggregate demand was calculated for the years 2011 through 2060.

Changes in permitted aggregate reserves between the two editions are summarized in Table 3, and changes in projected 50-year aggregate demand are summarized in Table 4.

Table 3. Changes in permitted aggregate reserves.

Aggregate Study Area	**Map Sheet 52 (2026) Permitted Reserves (million tons)**	**Map Sheet 52 (2018) Permitted Reserves (million tons)**	**Percent Change**
Bakersfield P-C Region	1,690	1708	-1
Barstow-Victorville P-C Region	118	117	1
Claremont-Upland P-C Region	48	90	-47
Fresno P-C Region	530	556	-5
Glenn County	15	22	-32
Greater Sacramento Area*	1,480	1569	-6
Merced County	87	61	43
Monterey Bay P-C Region	187	297	-37
North San Francisco P-C Region	279	263	6
Palm Springs P-C Region	175	163	7
Palmdale P-C Region	120	163	-26
San Bernardino P-C Region	133	156	-15
San Fernando Valley-Saugus Newhall P-C Region	9	17	-47
San Gabriel Valley P-C Region	240	297	-19
San Luis Obispo-Santa Barbara P-C Region	57	58	-2
Shasta County	52	49	6
South San Francisco P-C Region	478	506	-6
Stanislaus County	27	39	-31
Stockton-Lodi P-C Region	167	203	-18
Tehama County	27	30	-10
Temescal Valley-Orange County P-C Region	861	862	0
Tulare County	86	53	62
Western San Diego County P-C Region	224	265	-15
Western Ventura-Simi P-C Region**	104	84	24

* Combines multiple study areas from Map Sheet 52 (2018): El Dorado County, Nevada County, Placer County, Sacramento County, Sacramento-Fairfield P-C Region, and Yuba City-Marysville P-C Region
**Described as "Ventura County" in Map Sheet 52 (2018)

Table 4. Changes in 50-year aggregate demand

AGGREGATE STUDY AREA	MAP SHEET 52 (2026) 50-YEAR DEMAND (MILLION TONS)	MAP SHEET 52 (2018) 50-YEAR DEMAND (MILLION TONS)	PERCENT CHANGE
Bakersfield P-C Region	207	338	-39
Barstow-Victorville P-C Region	101	163	-38
Claremont-Upland P-C Region	163	202	-19
Fresno P-C Region	227	305	-26
Glenn County	57	41	39
Greater Sacramento Area*	1,026	1,724	-40
Merced County**	156	154	1
Monterey Bay P-C Region**	283	333	-15
North San Francisco P-C Region	239	492	-51
Palm Springs P-C Region	174	188	-7
Palmdale P-C Region	537	569	-6
San Bernardino P-C Region	636	939	-32
San Fernando Valley-Saugus Newhall P-C Region**	754	387	95
San Gabriel Valley P-C Region	512	751	-32
San Luis Obispo-Santa Barbara P-C Region	177	226	-22
Shasta County	70	82	-15
South San Francisco P-C Region	651	1,320	-51
Stanislaus County	99	160	-38
Stockton-Lodi P-C Region	479	409	17
Tehama County	28	49	-43
Temescal Valley-Orange County P-C Region	836	1,079	-23
Tulare County	100	130	-23
Western San Diego County P-C Region	374	763	-51
Western Ventura-Simi P-C Region7**	106	241	-56

* Combines multiple study areas from Map Sheet 52 (2018): El Dorado County, Nevada County, Placer County, Sacramento County, Sacramento-Fairfield P-C Region, and Yuba City-Marysville P-C Region
** These areas used the study area per capita demand method in Map Sheet 52 (2018)
**7Described as "Ventura County" in Map Sheet 52 (2018)

Changes to Aggregate Study Areas

This edition of Map Sheet 52 includes the Greater Sacramento Area, which was defined in CGS Special Report 245. This new study area combines and replaces the following study areas:

- El Dorado County
- Nevada County
- Placer County
- Sacramento County
- Sacramento-Fairfield P-C Region
- Yuba City-Marysville P-C Region

In the 2006 and 2012 editions of Map Sheet 52, aggregate demand and reserve information for Merced County and Tulare County was reported separately for eastern and western Merced County and northern and southern Tulare County, reflecting the presence of distinct market regions within those counties. Although these market distinctions may still exist, the 2018 edition of Map Sheet 52 reported aggregate information for Merced and Tulare Counties as a single study area rather than as subdivided regions.

Six aggregate study areas on the original 2002 edition of Map Sheet 52 were modified for the 2006 update, resulting in a net reduction of three study areas. These included the southern California P-C regions of Orange County, Temescal Valley, San Fernando Valley, Saugus-Newhall, Western Ventura County, and Simi Valley. As permitted reserves in these areas were depleted and production increasingly relied on aggregate imported from neighboring regions, the six study areas were combined into three larger regions.

Changes in Permitted Aggregate Reserves

Total permitted reserves for all the included study areas decreased by 435 million tons, from 7,628 million tons in Map Sheet 52 (2018) to 7,193 million tons in Map Sheet 52 (2026).

Sixteen of the 24 study areas shown on the updated map are estimated to have less permitted aggregate reserves since the 2018 map was completed (see Table 3). Most of these decreases are due to aggregate production within those study areas. In several cases reserves also decreased due to mines that were closed and reclaimed prior to depletion of their permitted resources.

Seven of the study areas shown on the updated map had increases in permitted aggregate reserves due to newly permitted or expanded mining operations. An expansion may increase the footprint of the mine or increase permitted mining depth.

Changes in Fifty-Year Demand

Of the 24 study areas shown on the updated Map Sheet 52, four are estimated to have increases in projected 50-year demand, and 20 are estimated to have decreases in projected 50-year demand (see Table 4). The large number of study areas with decreasing projected 50-year demand is likely due in part to reduced overall construction, increased aggregate recycling, and updated population forecasts showing reduced population growth rates or even net decreases in population over the 50-year demand forecast period.

PART III: OVERVIEW OF CONSTRUCTION AGGREGATE

Construction aggregate was the leading non-fuel mineral commodity produced in California in 2023. Valued at $2.23 billion (based on sand and gravel and crushed stone values from the U.S. Geological Survey), aggregate made up about 42 percent of California's $5.6 billion non-fuel mineral production in 2023 (Marquis, 2026; U.S. Geological Survey, 2025).

Aggregate Quality and Intended Use

Aggregate typically makes up 80 to 100 percent of the material volume in PCC and AC and provides the bulk and strength of these materials. Even in high-quality deposits, in-place aggregate is rarely physically or chemically suited for all intended uses. Each potential deposit must be tested to determine what proportion of the material meets specifications for a given application, and what processing may be required.

Specifications for PCC, AC, and other aggregate uses have been established by agencies such as the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and the California Department of Transportation to ensure satisfactory performance in specific applications. These agencies, along with major consumers, test aggregate using standard procedures developed by organizations including the American Society for Testing Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), and related standards organizations.

Most PCC and AC aggregate specifications are designed to ensure the production of strong, durable materials, capable of withstanding the physical and chemical effects of weathering and service conditions. For example, specifications for PCC and concrete products commonly prohibit or limit the use of rock materials containing minerals such as gypsum, pyrite, zeolite, opal, chalcedony, chert, siliceous shale, volcanic glass, and some high-silica volcanic rocks. Gypsum retards the setting of portland cement; pyrite can oxidize to produce sulfuric acid and iron oxide staining leading to accelerated degradation of PCC; and, other certain silica-bearing materials can react with alkalis in cement, resulting in cracking and surface "pop-outs."

Specifications also require precise particle-size distribution for different aggregate uses. Aggregate is commonly classified into two general size categories: coarse and fine. Coarse aggregate consists of material retained on a 3/8-inch or a No. 4 U.S. sieve, whereas fine aggregate passes a 3/8-inch sieve and is retained on a No. 200 U.S. sieve (200 openings per inch).

For certain applications, such as asphalt paving, particle shape is also specified. Aggregate used with bituminous binder (asphalt) to form sealing coats on road surfaces must consist of at least 90 percent by weight of crushed particles that are angular in shape. Crushed stone is generally preferred to natural gravel for AC because asphalt adheres more effectively to broken surfaces than to rounded surfaces, and the interlocking of angular particles increases the strength of the AC and underlying road base.

The material specifications for PCC and AC aggregate are more restrictive than those for other applications such as Class II base, subbase, and fill. As a result, deposits that meet PCC or AC specifications are the scarcest and most valuable aggregate resources. Aggregate produced from these deposits can be, and commonly is, used in a wide range of less demanding applications in addition to concrete.

Because of their versatility, higher value, and relative scarcity, PCC- and AC-grade aggregate deposits are of particular importance in planning for the long-term availability of construction aggregate.

Factors Affecting Construction Aggregate Quality

The primary factors influencing the quality of construction aggregate are rock type and the degree of weathering. Rock type determines hardness, durability, and potential chemical reactivity when the material is mixed with cement to produce concrete. In alluvial sand and gravel deposits, rock type is typically variable and reflects the lithologies present in the contributing drainage basin. In crushed stone deposits, rock type is generally more uniform, although some deposit types, such as sandstones and volcanic rock deposits, may exhibit lithologic variability.

Rock type also influences aggregate particle shape. For example, some metamorphic rocks, such as slate, tend to break into thin, platy fragments that are unsuitable for many aggregate uses, while many volcanic and granitic rocks fracture into blocky fragments better suited to a wide range of applications. Deposit type also affects aggregate shape. In alluvial sand and gravel deposits, natural abrasion during stream transport rounds particle edges, whereas crushed stone deposits produce particles with sharper, more angular edges.

Weathering refers to the in-place physical or chemical breakdown of rock materials at or near the Earth's surface. Weathering commonly reduces the physical strength of rock and may render material unsuitable for high-strength or high-durability applications. Weathering can also alter the chemical composition of aggregate, making it less suitable for certain uses. If weathering is sufficiently advanced, the material may not meet specifications for PCC or AC aggregate. In general, older deposits are more likely to have experienced prolonged weathering, and the severity of weathering commonly increases with deposit age.

Comparison of Alluvial Sand and Gravel and Crushed Stone Aggregate

The selection of one aggregate material over another in construction practice depends not only on specification requirements but also on economic considerations. Alluvial sand and gravel are typically preferred to crushed stone for PCC aggregate because their rounded particles produce a wetter, more workable mix than one made of angular fragments. Crushed stone is also less desirable in applications where concrete is placed by pumping, as sharp particle edges increase wear and damage to pumping equipment.

The workability of a PCC mix containing crushed stone aggregate can be improved by adding more sand and water; however, additional cement must then be added to meet durability standards. This adjustment increases the cost of the concrete mix and, ultimately, the cost to the consumer.

Aggregate from crushed stone deposits is generally more expensive than aggregate from alluvial deposits due to the additional costs associated with ripping, drilling and blasting to remove material from quarries, as well as the crushing required to produce various aggregate sizes. Manufactured sand produced by crushing is also more costly than mining and processing naturally occurring sand. Although greater care is required when placing wet mixes containing crushed stone, PCC made with crushed stone of comparable rock quality performs as well as PCC made with alluvial sand and gravel.

Owing to environmental concerns and regulatory constraints in many areas of the state, extraction of sand and gravel from instream and floodplain settings is likely to become less common in the future. If this trend continues, crushed stone is expected to play an increasingly important role in meeting California's aggregate demand.

Aggregate Prices

Aggregate prices in California vary widely depending on location, material quality, and supply and demand. This regional variability makes it difficult to estimate a statewide average price for PCC-grade aggregate. The highest-quality aggregate, and typically most expensive aggregate is material that meets specifications for use in PCC or AC. Transportation costs, which add to the final delivered cost of aggregate, are discussed in the following section.

Transportation Costs and Increasing Haul Distances

Transportation is a major component of the delivered cost of aggregate. Because aggregate is a low unit-value, high bulk-weight commodity, it must be sourced close to where it is used to minimize both direct costs to consumers and the broader environmental and economic costs associated with transportation. When nearby sources are unavailable, transportation costs can significantly increase the final price of aggregate.

These factors make aggregate mining far more sensitive to location than most other mineral commodities. The proximity of a deposit to its market, access to major transportation routes, and overall distance to consumers strongly influence the economic feasibility of an aggregate operation.

Most aggregate in California is transported to its final point of use by truck. Hauling is typically charged at an hourly rate, which varies by region. Average travel distances per hour also vary, generally being greater in rural or less congested areas and lower in densely populated urban regions. Additional factors affecting hauling rates include fuel prices, toll bridges and roads, road conditions, and terrain. Transportation cost is the primary factor defining the market area for an aggregate mine, and over long distances, hauling costs can equal or exceed the base cost of the aggregate.

Across California, average aggregate haul distances have gradually increased as local sources are depleted. As a result, older P-C regions, many of which were established in the late 1970s, have changed considerably since their original boundaries were drawn. This trend is particularly evident in Los Angeles, Orange, and Ventura counties, where aggregate shortages led to the consolidation of six P-C regions shown on the original 2002 map into three regions on later editions. In some parts of the state, one-way haul distances were 20-30 miles several decades ago are now sometimes 100 miles or more.

Increasing haul distances not only raise aggregate costs to consumers but increase environmental and societal impacts including higher fuel consumption, increased carbon dioxide (CO_2) emissions, greater air pollution, more traffic congestion, and higher road maintenance demands.

Imported Construction Aggregate

In some regions, local aggregate production is sufficient to meet the demand; in others, demand exceeds local supply, resulting in shortfalls that are typically met by importing construction aggregate from neighboring producing regions.

Importing aggregate has both advantages and disadvantages. Imports can provide needed material in areas with depleted reserves or limited local resources and can supply specific aggregate types that are scarce within a region. However, imported aggregate is generally more expensive due to added transportation costs. Higher aggregate costs increase the cost of construction projects in both the public and private sectors. Importing aggregate from neighboring regions can also accelerate the depletion of reserves and resources in those supplying regions, potentially contributing to future price increases or localized aggregate shortages.

In addition to higher economic costs, importing aggregate is often associated with increased environmental and societal impacts compared to local production. Environmental effects include higher greenhouse gas emissions, such as CO_2, and increased air pollution. Societal impacts include greater traffic congestion, road wear, and maintenance demands resulting from increased truck traffic. These impacts occur not only within the importing region but also in the supplying regions and along transportation corridors through which the material is hauled.

Currently almost all aggregate produced or imported into California is transported to its final point of use by truck. In discussions of aggregate import, other modes of transportation such as rail, barge, or ship are often cited as potential alternatives.

In 2011, the San Diego Association of Governments (SANDAG) Service Bureau published the San Diego Region Aggregate Supply Study (SANDAG Service Bureau, 2011), which evaluated fuel use and CO_2 emissions for several aggregate import scenarios using different transport modes. Although the study focuses on the San Diego region, it provides a useful comparative analysis of the transportation-related impacts associated with importing construction aggregate. The following discussion is adapted from Special Report 240 (Gius, Busch, and Miller, 2017).

The SANDAG study evaluated five transportation scenarios:

- In-region production
- Import by truck from neighboring regions
- Import by rail and truck from San Bernardino County
- Import by barge and truck from Baja California, Mexico
- Import by ship and truck from British Columbia, Canada.

For each scenario, fuel consumption, CO_2 emissions, and other pollutant emissions, including nitrogen oxides (NO_x) and particulate matter (PM), were estimated assuming round-trip travel, with aggregate delivered to the point of use and the transport vehicle returning empty. Scenarios included rail, barge, or ship transport, delivery from the terminal to the final point of use by truck. Transportation scenarios, transport type, and associated mileage assumptions are summarized in Table 5. More detail can be found in the SANDAG study (SANDAG Service Bureau, 2011).

Table 5. Summary of SANDAG Aggregate Transport Scenarios

Transport Option	**Mileage by Mode**
Local: Truck	26 miles one way / 52 miles round trip
Import: Truck	100 miles one way / 200 miles round trip
Import: Rail + Truck	Rail: 200 miles one way / 400 miles round trip Truck: 20 miles one way / 40 miles round trip
Import: Barge + Truck	Barge: 70 miles one way / 140 miles round trip Truck: 20 miles one way / 40 miles round trip
Import: Ship + Truck	Ship: 1,540 miles one way / 3,080 miles round trip Truck: 20 miles one way / 40 miles round trip

Adapted from SANDAG Service Bureau, 2011

Transportation methods capable of moving larger quantities of aggregate per load are often more efficient in terms of fuel consumption (gallons of fuel consumed per net ton per mile traveled) and emissions of CO_2, NO_x, and PM (grams emitted per net ton per mile traveled). However, total fuel consumption also depends on the distance traveled. When transport distances are large, the total fuel consumption and emissions can exceed those associated with less efficient transportation methods operating over shorter distances.

This effect is demonstrated by the findings of the SANDAG study. Although rail, barge, and ship transport have lower fuel consumption and CO_2 emissions per net ton per mile than transport by truck (Table 6), the total fuel use and CO_2 emissions for those scenarios exceed those of in-region production with truck delivery because of the longer transport distances involved (Table 7).

Table 6. Fuel Consumption and CO_2 Emissions from Aggregate Transport

MODE	PAYLOAD	FUEL CONSUMPTION (GALLONS/NET TON PER MILE)	CO_2 EMISSIONS (GRAMS/NET TON PER MILE)
Truck	25 tons	0.0086	86.9
Rail	100 tons per hopper car	0.0021	21.4
Barge	1,500 tons	0.0068	69.6
Ship	72,786 tons	0.0004	5.3

Adapted from Tables 4-2 and 4-4, SANDAG Service Bureau, 2011

Table 7. Fuel Consumption and Emissions for Aggregate Transport Scenarios – Estimates per Million Tons of Aggregate Transported

TRANSPORT OPTION	TOTAL FUEL CONSUMPTION (GALLONS)	TOTAL CO_2 EMISSIONS (METRIC TONS)	TOTAL NO_X EMISSIONS (METRIC TONS)	TOTAL PM EMISSIONS (METRIC TONS)
Local: Truck	296,000	3,000	26.5	1.1
Import: Truck	1,138,000	11,537	102	4.4
Import: Rail + Truck	788,000	7,985	120.4	3.3
Import: Barge + Truck	804,000	8,210	147.1	5.1
Import: Ship + Truck	1,406,000	16,703	282.2	16.3

Adapted from SANDAG Service Bureau, 2011

Table 7 shows that, per million tons of aggregate transported, local production with truck delivery consumes less fuel and generates less CO_2, NOx, and PM than any other transportation options evaluated by SANDAG. Transport Option 2, import of one million tons of aggregate by truck from neighboring regions, consumes almost four times as much fuel and produces almost four times the emissions compared to local production and delivery of an equivalent amount of aggregate. In addition, these impacts occur not only within the Western San Diego County P-C Region, but also in neighboring regions through which the aggregate is transported.

Although this analysis pertains to San Diego County, similar evaluations could be conducted for other regions using region-specific requirements. The results highlight that even when certain transportation modes are more efficient on a net ton per mile basis, long haul distances can result in overall impacts that exceed those associated with local aggregate production.

Factors Influencing Aggregate Demand

Several factors can influence aggregate demand. During periods of strong economic growth, demand may increase, depleting permitted reserves more rapidly than projected. Large projects, such as the construction or maintenance of major infrastructure or post-disaster rebuilding following events such as earthquakes, can also increase aggregate consumption over short time periods.

Demand may also rise when neighboring regions with dwindling or depleted permitted reserves import aggregate, thereby accelerating the depletion of reserves within supplying study areas. Conversely, periods of economic decline or of slow growth, such as during the 2007 to 2009 recession and the subsequent slow recovery, can reduce aggregate demand for a time, extending the projected life of permitted reserves.

In some cases, the importation of aggregate from other regions may temporarily extend the life of a region's permitted reserves by supplementing local production.

SUMMARY AND CONCLUSIONS

Aggregate is essential to modern society, providing the basic material for the construction and maintenance of roadways, dams, canals, buildings, and other elements of California's infrastructure. Aggregate is also a fundamental component of homes, schools, hospitals, and commercial facilities.

In the 33-year period from 1991 to 2023, Californians consumed an average of about 145 million tons of construction aggregate (all grades) per year, or about 4.1 tons per person annually. Demand will continue as the state maintains a large population, economy, and infrastructure.

Because aggregate is a low unit-value, high bulk-weight commodity, it must be obtained from nearby sources to minimize costs to the consumers and to reduce the economic and environmental impacts associated with transportation. Environmental impacts include increased greenhouse gas emissions, such as CO_2, and air pollution. Societal impacts include increased traffic congestion and road maintenance associated with higher truck traffic volumes.

Comparing regional aggregate needs with available reserves and resources highlights important issues facing lead agencies in California. These include the need to plan carefully for the long-term use of lands containing aggregate resources and to consider permitting additional resources before currently permitted deposits are depleted.

As existing permitted aggregate supplies are exhausted, local land-use decisions increasingly have regional consequences that extend beyond jurisdictional boundaries. Planning for future construction aggregate needs should account not only for local community requirements but also for the needs of surrounding regions. Importing aggregate from neighboring regions can accelerate the depletion of reserves and resources in those areas, potentially contributing to price increases or localized aggregate shortages.

For approximately 45 years, CGS has conducted ongoing studies under SMARA to identify and evaluate aggregate resources throughout California. Map Sheet 52 (2026) provides an updated summary of supply and demand information from these studies and presents a statewide overview of projected future aggregate needs and currently permitted reserves.

The following conclusions can be drawn from Map Sheet 52 (2026) and this accompanying report:

- In the next 50 years, the study areas identified on Map Sheet 52 (2026) will need approximately 8.0 billion tons of aggregate.
- The study areas shown on Map Sheet 52 currently have about 7.2 billion tons of permitted reserves.
- Two study areas are projected to have 10 or fewer years of permitted aggregate reserves remaining as of January 2024 (San Bernardino P-C Region and San Fernando Valley- Saugus Newhall P-C Region).

- Seven study areas have between 11 and 20 years of aggregate reserves remaining.
- One study area has between 21 and 30 years of aggregate reserves remaining.
- Four study areas have between 31 and 40 years of aggregate reserves remaining.
- Three study areas have between 41 and 50 years of aggregate reserves remaining.
- Seven aggregate study areas have more than 50 years of aggregate reserves remaining.

The information presented on Map Sheet 52 (2026) and in the referenced reports is intended to assist land-use planners and decision makers in identifying areas that contain construction aggregate resources and in estimating potential future demand for these resources across different regions of the state. This information is intended to help planners and decision makers balance the need for construction aggregate with other competing land-use priorities and to plan for adequate supplies to meet future needs.

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APPENDIX: MINERAL LAND CLASSIFICATION REPORTS BY THE CALIFORNIA GEOLOGICAL SURVEY

Below is a list of Special Reports and Open-File Reports with information on aggregate resources.

Special Reports (SR)

*****SR 132: Mineral Land Classification: Portland Cement Concrete-Grade Aggregate in the Yuba City-Marysville Production-Consumption Region. By Habel, R.S., and Campion, L.F., 1986.

*****SR 143: Part I: Mineral Land Classification of the Greater Los Angeles Area: Description of the Mineral Land Classification Project of the Greater Los Angeles Area. By Anderson T. P., Loyd, R.C., Clark, W.B., Miller, R.M., Corbaley, R., Kohler, S.L., and Bushnell, M.M., 1979.

*****SR 143: Part II: Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas, San Fernando Valley Production-Consumption Region. By Anderson T.P., Loyd, R.C., Clark, W.B., Miller, R.M., Corbaley, R., Kohler, S.L., and Bushnell, M.M., 1979.

*****SR 143: Part III: Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas, Orange County-Temescal Valley Production-Consumption Region. By Miller, R.V., and Corbaley, R., 1981.

*****SR 143: Part IV: Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas, San Gabriel Valley Production-Consumption Region. By Kohler, S.L., 1982.

*****SR 143: Part V: Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas, Saugus-Newhall Production-Consumption Region and Palmdale Production-Consumption Region. By Joseph, S.E, Miller, R.V., Tan, S.S., and Goodman, R.W., 1987.

*****SR 143: Part VI: Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas, Claremont-Upland Production-Consumption Region. By Cole, J.W., 1987.

*****SR 143: Part VII: Mineral Land Classification of the Greater Los Angeles Area: Classification of Sand and Gravel Resource Areas, San Bernardino Production-Consumption Region. By Miller, R.V., 1987.

*****SR 145: Part I: Mineral Land Classification of Ventura County: Description of the Mineral Land Classification Project of Ventura County. By Anderson, T.P., Loyd, R.C., Kiessling, E.W., Kohler, S.L., and Miller, R.V., 1981.

*****SR 145: Part II: Mineral Land Classification of Ventura County: Classification of the Sand, Gravel, and Crushed Rock Resource Areas, Simi Production-Consumption Region. By Anderson, T.P., Loyd, R.C., Kiessling, E.W., Kohler, S.L., and Miller, R.V., 1981.

*****SR 145: Part III: Mineral Land Classification of Ventura County: Classification of the Sand and Gravel, and Crushed Rock Resource Areas, Western Ventura County Production-Consumption Region. By Anderson, T.P., Loyd, R.C., Kiessling, E.W., Kohler, S.L., and Miller, R. V., 1981.

*****SR 146: Part I: Mineral Land Classification: Project Description: Mineral Land Classification for Construction Aggregate in the San Francisco-Monterey Bay Area. By Stinson, M.C., Manson, M.W., and Plappert, J.J., 1987.

*****SR 146: Part II: Mineral Land Classification: Aggregate Materials in the South San Francisco Bay Production-Consumption Region. By Stinson, M.C., Manson, M.W., and Plappert, J.J., 1987.

*****SR 146: Part III: Mineral Land Classification: Aggregate Materials in the North San Francisco Bay Production-Consumption Region. By Stinson, M.C., Manson, M.W., and Plappert, J.J., 1987.

*****SR 146: Part IV: Mineral Land Classification: Aggregate Materials in the Monterey Bay Production-Consumption Region. By Stinson, M.C., Manson, M.W., and Plappert, J.J., 1987.

*****SR 147: Mineral Land Classification: Aggregate Materials in the Bakersfield Production-Consumption Region. By Cole, J.W., 1988.

*****SR 153: Mineral Land Classification: Aggregate Materials in the Western San Diego County Production-Consumption Region. By Kohler, S.L., and Miller, R.V., 1982.

*SR 156: Mineral Land Classification: Portland Cement Concrete-Grade Aggregate in the Sacramento-Fairfield Production-Consumption Region. By Dupras, D.L., 1988.

*****SR 158: Mineral Land Classification: Aggregate Materials in the Fresno Production-Consumption Region. By Cole, J.W., and Fuller, D.R., 1986.

*****SR 159: Mineral Land Classification: Aggregate Materials in the Palm Springs Production-Consumption Region. By Miller, R.V., 1987.

*****SR 160: Mineral Land Classification: Portland Cement Concrete-Grade Aggregate in the Stockton-Lodi Production-Consumption Region. By Jensen, L.S., and Silva, M.A., 1989.

*****SR 162: Mineral Land Classification: Portland Cement Concrete Aggregate and Active Mines of All Other Mineral Commodities in the San Luis Obispo-

Santa Barbara Production-Consumption Region. By Miller, R.V., Cole, J.W., and Clinkenbeard, J.P., 1989.

*SR 164: Mineral Land Classification of Nevada County, California. By Loyd, R.C., and Clinkenbeard, J.P., 1990.

*SR 165: Mineral Land Classification of the Temescal Valley Area, Riverside County, California. By Miller, R.V., Shumway, D.O., and Hill, R.L., 1991

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SR 198: Update of Mineral Land Classification for Portland Cement Concrete-Grade Aggregate in the Palm Springs Production-Consumption Region, Riverside County, California. Busch, L.L., 2007.

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SR 202: Update of Mineral Land Classification for Portland Cement Concrete-Grade Aggregate in the Claremont-Upland Production-Consumption Region, Los Angeles and San Bernardino Counties, California. Miller, R.V. and Busch, L.L., 2007.

SR 205: Update of Mineral Land Classification of Aggregate Resources in the North San Francisco Bay P-C Region: Sonoma, Napa, and Marin Counties and Southwestern Solano County, California. Miller, R.V. and Busch, L.L., 2013

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

SR 209: Update of Mineral Land Classification for Portland Cement Concrete-Grade Aggregate in the San Gabriel Valley Production-Consumption Region, Los Angeles County, California. Kohler, S.L., 2010.

SR 210: Update of Mineral Land Classification: Aggregate Materials in the Bakersfield Production-Consumption Region, Kern County, California. Busch, L.L., 2009.

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SR 251: Update of the Mineral Land Classification for Construction Aggregate Resources in the Monterey Bay Production-Consumption Region. Key, E., 2021.

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SR 254: Update of the Mineral Land Classification for Portland Cement Concrete Aggregate Resources in the San Fernando Valley and Saugus-Newhall Production-Consumption Regions. Wesoloski, C., Reioux, D., Callen, B., 2021.

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Open-File Reports (OFR)

OFR 92-06: Mineral Land Classification of Concrete Aggregate Resources in the Barstow-Victorville Area. By Miller, R.V., 1993.

*OFR 93-10: Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California: Part I - Ventura County. By Miller, R.V., 1993.

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*OFR 94-15: Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California: Part III - Orange County. By Miller, R.V., 1995.

*OFR 95-10: Mineral Land Classification of Placer County, California. By Loyd, R.C., 1995.

OFR 96-03: Update of Mineral Land Classification: Aggregate Materials in the South San Francisco Bay Production-Consumption Region. By Kohler-Antablin, S.L., 1996.

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OFR 97-01: Mineral Land Classification of Concrete Aggregate Resources in the Tulare County Production-Consumption Region, California. By Taylor, G.C., 1997.

OFR 97-02: Mineral Land Classification of Concrete-Grade Aggregate Resources in Glenn County, California. By Shumway, D.O., 1997.

OFR 97-03: Mineral Land Classification of Alluvial Sand and Gravel, Crushed Stone, Volcanic Cinders, Limestone, and Diatomite within Shasta County, California. By Dupras, D.L, 1997.

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