California Geological Survey
Mineral Resources Program

CALIFORNIA’S CONSTRUCTION AGGREGATE RESOURCES
Value of Non-Fuel Mineral Production 1940-2010

Other 24%
Portland Cement 25%
Gold 5%
Borates 14%
Construction Aggregate 32%

$272 Billion in 2013 Dollars
Construction Aggregate

- Essential to the state’s infrastructure
- Effectively irreplaceable
- Produced and consumed throughout the State
- Low cost per unit volume
- Transportation costs can be significant
- Highest value commodity mined in California
Who Uses Construction Aggregate?

- Residential Housing: 34%
- Commercial Buildings: 17%
- Private Roads: 3%
- Utilities: 4%
- Other Public Buildings: 3%
- Other Public Facilities: 3%
- Water and Sewer: 5%
- Hospitals and Schools: 2%
- Public Highways, Streets, and Transit: 26%
- Other Private Facilities: 2%
- Private Aggregate Use: 57%
- Public Works Aggregate Use: 43%

Transportation

1980 to 2010 - 179 million tons per year
About 7.2 million truck trips per year
The Aggregate Sustainability Map

- Summarizes 31 study areas
- Compares permitted reserves to projected 50-year demand by region
- Estimates the remaining lifespan of permitted reserves
2012 AGGREGATE SUSTAINABILITY MAP
Shasta County
52/93 Million Tons
21 to 30 Years
October 16, 2014
CALAFCO 2014 Annual conference

Do We Really Need to Protect Our Mineral Resources?

Kerry Shapiro

Jeffer Mangels Butler & Mitchell LLP
Reiterating Key Principles

• It is impossible to build and maintain infrastructure without adequate supplies of construction aggregate
  – E.g., a single lane of road construction requires 20k tons of aggregate

• Many areas in the State face identified shortages of permitted construction aggregate supplies over the next 50-year years
  – E.g., San Bernardino faces projected shortfall of 752 million tons

• When local supplies of aggregate are insufficient to meet demand, the material is trucked in from remote locations
  – The length of these truck trips is directly correlated with air quality and traffic impacts
The Challenge to LAFCOs

- Mineral resources have regional value, i.e., mineral resources are important beyond the localized areas where they are situated.
- Local interests seeking to expand municipal boundaries or spheres of influence typically do so to promote urban uses that are incompatible with mining.
- Mineral resources are “vanishing” due to incompatible uses that prevent mineral resource development.
- LAFCOs are in a unique position that allows them to balance local development demands with regional mineral resource requirements.
How Competing Land Use Policies Impact Mineral Resources

- **Direct Constraints** – Land use controls applied directly to mineral resource lands that preclude resource recovery
- **Indirect Constraints** – Incompatible land uses encroach upon (while not directly affecting) mineral resource lands and create conflicts that make it difficult if not impossible to recover resources
What are “Direct Constraints” to Mineral Resources?

• Direct constraints to mineral resources occur when mineral resource lands are subjected to land use controls that either prohibit or excessively constrain the potential to develop the underlying resources

• Examples
  – #1 A city’s general plan and zoning controls preclude mining in a residential or commercial district
  – #2 A city annexes land containing mineral resources for purposes of developing uses incompatible with mining
  – #3 Regional resource conservation plans (e.g., NCCPs) establish land use overlay zones by agreements among stakeholders for the protection of biological resources
Example: NCCPs
Conservation Plan Coverage in Southern California

For complete NCCP listing go to: http://http://www.dfg.ca.gov/habcon/nccp/
How NCCPs Impact Mineral Resource Development

• Western Riverside County MSHCP: “Implementation of the MSHCP could result in up to 4,300 acres of land with known potential to be used for mineral extraction being set aside for conservation…This represents approximately 22 percent of such lands within the MSHCP Plan Area. *Areas set aside for conservation will not be available for mineral extraction.*” (Riverside County Resolution No. 2003-299, Certifying Final EIR for Western Riverside County MSHCP.)

• Coachella Valley MSHCP: “In the Plan Area there are 17,527 acres that have been designated as Mineral Resource Zone 2 (MRZ-2)…of this acreage, *10,007 acres are included in the Conservation Areas.*” (Final Recirculated Coachella Valley MSHCP Environmental Impact Report/Statement, p. 4.4-2.)
Example: Desert Renewable Energy Conservation Plan (DRECP)

- Joint Plan by CDFW, CEC, BLM and USFWS
- NCCP/HCP to protect desert species & encourage renewable energy
- Spans 22 million acres & 7 counties
- EIS/EIR comment period ends January 9, 2015
- Over 1.5 million acres of “high mineral potential area”
- “Significant and unavoidable impacts” to mineral resources
Indirect Constraints to Mineral Resources

- Indirect constraints arise when agencies allow for the development of incompatible uses in close proximity to mineral resources.

- **The Concern:** Policy decisions that allow for urban encroachment on mineral resource lands set up land use conflicts that can have the same effect as direct constraints on mineral resources.

- **Basic Example:** LAFCO approves the annexation of non-mineral county land near MRZ-2 land into a city for purpose of expanding residential development. What was once a remote mineral resource area surrounded by open space is not a mineral resource area surrounded by urban uses. 10 years later, residents sue long-standing mine operation and/or city due to intolerance of standard mining outputs (e.g., noise, dust, odor, light, trucks).
State Policy Requires Protection of Mineral Resources From the Encroachment of Incompatible Uses

• SMARA recognizes that urban encroachment jeopardizes the development of important mineral resources
  – PRC Sections 2726 and 2727 recognize if such mineral lands are “prematurely developed for alternate incompatible land uses,” that “permanent loss of minerals” that are important to the region or the state may result
  – Land uses considered “inherently incompatible with mining” include “high density residential,” and “low density residential with high unit value” (14 CCR § 3765)

• SMARA imposes protections from encroachment
  – Mineral Resource Management Policies may be required to include special overlay zones or other zoning controls to prevent encroachment of incompatible uses (14 CCR § 3676(c)(3))
  – Lead agencies amending or adopting general plans/specific plans required to make specific findings regarding impacts to designated mineral resources in their jurisdiction when such plans authorize encroachment that may jeopardize resource development (PRC § 2764)
Ventura County/City of Simi Valley Example

- KS to send image
City Constrained by Developer’s Argument that City had No Responsibility to Protect Mineral Resources

Theme #2: [Redacted] and its attorneys allege that the City failed to comply with the Surface Mining and Reclamation Act ("SMARA"), but the City has no legal obligation under SMARA with respect to the [Redacted] Mine.

The responsibilities that are outlined in SMARA for lead agencies with respect to the Mine are responsibilities of the County of Ventura, not of the City of Simi Valley. So, for example, the obligation under SMARA that a lead agency prepare a Mineral Resource Management Plan and incorporate it into its General Plan, is an obligation of the County of Ventura.

- Had the same project been proposed to the County, compatibility with the adjacent mineral resources would be required by State law.

- Annexation of the project area into the city allowed the City and developer to avoid consideration mineral land in the County.
What Could Happen in Ventura County/Simi Valley?

Attend the Coalition’s Quarry Permit Meeting Sept. 7 at 6:00 pm

Our Last Chance To Get It Right.
Or Wait Another 14 Years.

Blasting
Truck Traffic
Air Pollution
Operating Hours
Road Damage
Dust and Debris
Noise Limits
Reclamation Plan
Barge Operations

Three Crucial Steps We Must Take:

1. Sept. 7 at 6:00 pm
   Attend the Informational Meeting about the proposed Quarry Operations
   Peakcock Gap Golf and Country Club
   333 Biscayne Drive, San Rafael, CA

2. Sept. 14 at 6:00 pm
   Speak out at the Supervisors Public Hearing on the merits of the Quarry’s Proposal
   Board of Supervisors’ Chambers
   Marin Civic Center, Room 330

3. Sept. 28 at 1:30 pm
   Attend the Final Public Hearing and Supervisors Final Vote
   Board of Supervisors’ Chambers
   Marin Civic Center, Room 330

POINT SAN PEDRO ROAD COALITION • 369 “B” THIRD STREET • SAN RAFAEL, CA 94901 • www.sprcoalition.org • 415-460-9982

“we have reduced our operating hours by 64 percent, barging by 54 percent, and truck trips by 72 percent... [t]he coalition wants further reductions... we simply cannot make one more reduction... [i]t would not be an economically viable business”
San Bernardino/Victorville – A LAFCO Success Story

- Competing sphere of influence proposals from City of Victorville and Helendale CSD – Victorville proposal would have subsumed important mining areas
- LAFCO staff engaged the City, the CSD and mining stakeholders to identify compromise boundaries
- Balancing of interests resulted in creation of buffer between mineral resources and potential residential/commercial development
- LAFCO awarded the Most Effective Commission Achievement Award by CALAFCO in 2011
Why should LAFCOs care about mineral resources?

• The Importance of Conserving Mineral Resources
  – Avoid shortfalls of needed construction materials

• LAFCO uniquely positioned to protect mineral resources
  – Statutorily empowered to balance local and regional needs
  – Can prevent future land use conflicts before they arise (i.e., before encroaching uses have been established)

• Prevent increased environmental impacts (“distance matters”)

What can LAFCOs do to help?

- Balance the need for mineral resources with competing land use policies
- Preserve mineral resource lands as open space pursuant to LAFCOs’ statutory authority
- Demand comprehensive review of impacts to mineral resources in CEQA evaluations
Do We Need to Protect Our Mineral Resources?

John Clinkenbeard – Supervising Engineering Geologist with CGS

Steven Testa – Executive Officer of the SMGB

Kerry Shapiro – Jeffer Mangels Butler & Mitchell LLP

George Kenline – Mining/Engineering Geologist with San Bernardino Co.
Uses

- Metals/Manufacturing
- Jewelry/Makeup
- Concrete/Construction
- Fertilizers/Agriculture
- Pharmaceuticals
- Electronics
- Green Energy
- National Defense
## Mineral Commodities

### 2012 U.S. NET IMPORT RELIANCE

| Commodity                        | Percent | Major Import Sources (2006–11)
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>ARSENIC (trioxide)</td>
<td>100%</td>
<td>Morocco, China, Belgium</td>
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<tr>
<td>ASBESTOS</td>
<td>100%</td>
<td>Canada, Zimbabwe</td>
</tr>
<tr>
<td>Bauxite and ALUMINA</td>
<td>100%</td>
<td>Jamaica, Brazil, Guinea, Australia</td>
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<tr>
<td>CESIUM</td>
<td>100%</td>
<td>Mexico, China, South Africa</td>
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<tr>
<td>FLUORSPAR</td>
<td>100%</td>
<td>China, Mexico, Canada, Brazil</td>
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<tr>
<td>GRAPHITE (natural)</td>
<td>100%</td>
<td>China, Canada, Japan, Belgium</td>
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<tr>
<td>INDUM</td>
<td>100%</td>
<td>South Africa, Gabon, Australia, China, Brazil</td>
</tr>
<tr>
<td>MANGANESE</td>
<td>100%</td>
<td>Brazil, Canada, Germany</td>
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<tr>
<td>MICA, sheet (natural)</td>
<td>100%</td>
<td>China, Japan, Russia</td>
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<tr>
<td>NIQUIBON (columbium)</td>
<td>100%</td>
<td>China</td>
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<tr>
<td>QUARTZ CRYSTAL (industrial)</td>
<td>100%</td>
<td>China, Germany, Mexico, Germany</td>
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<tr>
<td>RUBIDIUM</td>
<td>100%</td>
<td>France, England, India</td>
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<tr>
<td>SCANDIUM</td>
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<td>Germany, United Kingdom, China, Canada</td>
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<tr>
<td>STRONTIUM</td>
<td>100%</td>
<td>China, Belgium, United Kingdom</td>
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<tr>
<td>TANTALUM</td>
<td>100%</td>
<td>Germany, South Africa, United Kingdom, Canada</td>
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<tr>
<td>THALLIUM</td>
<td>100%</td>
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<td>THORIUM</td>
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<td>Germany, South Africa, United Kingdom, China</td>
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<tr>
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<td>Germany, United Kingdom, China, Canada</td>
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<tr>
<td>GEMSTONES</td>
<td>99%</td>
<td>India, France, Russia, Germany</td>
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<tr>
<td>VANADIUM</td>
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<td>Germany, United Kingdom, China, Canada</td>
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<td>BISMUTH</td>
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<td>Rep. of Korea, Korea, Russia</td>
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<td>PLATINUM</td>
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<td>ANTIMONY</td>
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<tr>
<td>DIAMOND (dust, grit, and powder)</td>
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<td>STONE (dimension)</td>
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<td>RENIUM</td>
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<td>TITANIUM MINERAL CONCENTRATES</td>
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<td>TIN</td>
<td>75%</td>
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<td>SILICON CARBIDE (crude)</td>
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<td>CHROMIUM</td>
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<td>GARNET (industrial)</td>
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<td>China, Brazil, Italy, Turkey</td>
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<td>TITANIUM (sponge)</td>
<td>64%</td>
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<td>PEAT</td>
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<td>China, Brazil, Italy, Turkey</td>
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<td>PALLADIUM</td>
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<td>NICKEL</td>
<td>49%</td>
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<td>MAGNESIUM COMPOUNDS</td>
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<td>TUNGSTEN</td>
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<td>SILICON</td>
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<tr>
<td>COPPER</td>
<td>35%</td>
<td>China, Brazil, Italy, Turkey</td>
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<tr>
<td>NITROGEN (fixed), AMMONIA</td>
<td>35%</td>
<td>China, Brazil, Italy, Turkey</td>
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<td>MAGNESIUM METAL</td>
<td>31%</td>
<td>China, Brazil, Italy, Turkey</td>
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<tr>
<td>MICA, scrap and flake (natural)</td>
<td>31%</td>
<td>China, Brazil, Italy, Turkey</td>
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<td>SALT</td>
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<td>SULFUR</td>
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<td>PUMICE</td>
<td>15%</td>
<td>China, Brazil, Italy, Turkey</td>
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<td>GYPSUM</td>
<td>12%</td>
<td>China, Brazil, Italy, Turkey</td>
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<tr>
<td>IRON and STEEL</td>
<td>11%</td>
<td>China, Brazil, Italy, Turkey</td>
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<tr>
<td>BERYLLIUM</td>
<td>10%</td>
<td>China, Brazil, Italy, Turkey</td>
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<td>IRON and STEEL SLAG</td>
<td>9%</td>
<td>China, Brazil, Italy, Turkey</td>
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<td>CEMENT</td>
<td>7%</td>
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<tr>
<td>PHOSPHATE ROCK</td>
<td>5%</td>
<td>China, Brazil, Italy, Turkey</td>
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USGS Mineral Commodity Summaries 2013
Emerging Global Norm

**USA Today** - China could prove the ultimate winner in Afghanistan, having shed no blood and not much aid

**CNN** - Is China Buying Up Africa

**SHARMA** - India keen to partner with African countries for buying minerals

**The Guardian** - Australia leases out mineral-rich land as China's hunger for resources grows

Conflict Minerals - National Geographic
Mineral Needs

IF IT CAN’T BE GROWN
IT HAS TO BE MINED
Distance Matters

20-Mule Team – Calico Mountains
Concrete

CaO + SiO₂ + Al₂O₃ + Fe₂O₃ + CaSO₄ + HEAT + GRINDING →
2Ca₃SiO₅ + 7H₂O → 3(CaO)·2(SiO₂)·4(H₂O)(gel) + 3Ca(OH)₂

Calcite  Silica  Gypsum  Alumina  Iron

Sand  Gravel
No Botox for Aging Infrastructure
Disaster Recovery

1994 Northridge Earthquake

2005 Laguna Beach Landslide

2008 Sylmar Fire

2014 Napa Earthquake

1989 Loma Prieta Earthquake
Summary

Do We Need to Protect Our Mineral Resources?

Only if the following is important to you:

- Project Costs
- Economic Growth
- Taxes
- Greenhouse Gas Emissions
- Traffic Congestion
- Infrastructure Replacement
- Disaster Recovery
- National Security
From Aggregate Availability to Sustainability

California Association of Local Agency Formation Commissions
CALAFCO 2014 Annual conference
October 15-17, 2014

Stephen M. Testa
Executive Officer,
State Mining and Geology Board
1929 – 1965: Mineral Resources Development Era
State Mining Board

First to hold the title of State Geologist
Ph.D. out of Cal Tech (1931-59)
Foremost authority on nonmetallic mineral

Ian Campbell also served as president for
Geological Society of America (GSA),
Association of American State Geologists (AASG),
Mineralogical Society of America (MSA),
and American Geological Institute (AGI).

Mount Ian Campbell in the Sierra Nevada is
also a reminder of Ian's service to California.

Dr. Ian Campbell
State Geologist
(1959-1969)
In 1960, Campbell justified to the State Mining Board and initiated a small geologic mapping program in the Palos Verdes area, and several other areas throughout Los Angeles County that were rapidly being urbanized, but threatened by landslides.

He also noted that these areas being developed also threatened to pave over vast deposits of sand and gravel, which were among the state’s most valuable mineral resources.

His mapping program however would also aid in the delineation of areas susceptible to landslides, earth shaking due to earthquakes, and other geologic hazards (SMB, Minutes, January 28, 1960).
32 minerals are produced commercially from about 900 actively working mines – there are about 1,230 mines total in the State (2010).

California ranks sixth after Alaska, Minnesota, Utah, Arizona and Nevada in the value of non-fuel mineral production, accounting for approximately 4.2 percent of the nation’s total, with a market value for 2010 of $ 2.9 billion. California also leads the nation in the production of sand and gravel, and ranks second behind Texas in the production of portland cement.
SB 391 (Lue, 2009) and SB 375 (Steinberg, 2008)
• Reduce greenhouse gases

Caltrans (last 5 years)
• 1,700 highway projects ($19 billion)
• 825 construction contracts (> $10 billion)

CA High Speed Rail Authority (CHSRA)
• Fall 2012 – 179 mile stretch from Bakersfield to Merced
• 5 million tons or 4% of State’s total; production in 2009

California’s mines, regulatory agencies, and local governments must
• develop ways to increase the current amount of aggregate production,
• bring additional, already identified but not yet permitted mineral resources timely into production, if they successfully are to meet the aggregate demands for the State’s future projected development.
SMARA: Mineral Conservation and Reclamation

SMARA (1975)

THREE GOVERNMENT PARTNERS IN THE PROTECTION OF AGGREGATE RESOURCES

CGS:
Provides objective classification data, including forecasting, to the SMGB, lead agencies, and others in an easily understood format.

SMGB:
Conduct public hearings in compliance with CEQA and SMARA, to determine which resource areas identified by CGS are of statewide or regional significance, and DESIGNATE those areas.

Lead Agencies:
Incorporate the information provided by CGS and the SMGB into their general plans and use it in their daily land-use decisions to protect a 50-year supply of aggregate.
Aggregate Availability Group

• Aggregate Availability Group (AAG) was established in 2009.

• Included representatives from CalCIMA, CalTrans, DOC, CGS, OMR, SMGB, and OPR.

• Adopted a Charter in 2009

• Goals
  • Enhance State’s economy
  • Promote concept of “Distance Matters”
  • Build partnerships through education and outreach
  • Collaborate in production of decision-making tools and information

• Develop current and relevant aggregate availability maps that incorporate economic, social and environmental factors.
Concept of Availability

Availability is being present and ready for use.

Well established in the literature of stochastic modeling and optimal maintenance, availability of a system is typically measured as a factor of its reliability - as reliability increases, so does availability.

The most simple representation for availability is as a ratio of the expected value of the uptime of a system to the aggregate of the expected values of up and down time, or

\[
A = \frac{E[\text{Uptime}]}{E[\text{Uptime}] + E[\text{Downtime}]}
\]
For humans in social systems or ecosystems, sustainability is the long-term maintenance of responsibility, which has environmental, economic, and social dimensions, and encompasses the concept of stewardship, the responsible management of resource use.

Challenge: Moving from a concept of availability to sustainability!
The Problem

HOW CAN A CONSCIENTIOUS LOCAL GOVERNMENT PLAN FOR AGGREGATE MINING IN ITS OWN JURISDICTION IF IT DOES NOT KNOW WHERE THE AGGREGATE DEPOSITS ARE?

Whether you are referring to:
Nimbys, Not In My Backyard folks
Bananas, Build Absolutely Nothing Anywhere Near Anything folks
Caves, Citizens Against Virtually Everything folks
Niabys, Not in Anyone’s Back Yard folks
Goombys, Get Out of My Back Yard folks
Loons, Lock Out Others Now folks
Lulus, Locally Unwanted Land Users folks
Numbys, Not Under My Backyard folks
Nimrods, Not In My Road And Driveway folks
Imbys, In My Back Yard folks
Nambis, Not Against My Business or Industry folks
Nopes, Not On Planet Earth folks, or
Notes, Not Over There Either folks

…they say the resource is everywhere,
and the mine operator says theirs is the only remaining deposit.

The Problem is not a lack of resources.
It’s a lack of Permits”

State Geologist John Parrish --
SMGB Meeting February, 2007
“The pressure of urban growth is being felt by producers in southern California and expansion of existing pits becomes increasingly difficult in view of tightening zoning restrictions. In some counties it is impossible to virtually impossible to obtain a permit to open a new pit.”

- Sand and gravel plant
- Gravel pit
- Sand and gravel deposit

“It may become necessary to import sand and gravel from deposits which are beyond the present economic limit of hauling.”
First classification report

Incorporated concepts such as “distance matters”

Mineral Classification Scheme (based on BOM and USGS)
“Distance matters”

60 mi

40 mi

20 mi
Very useful for the regional planner or general citizenry, maps like this provided a broader perspective not apparent in the P-C Region maps.

- List of Aggregate sources
- Aggregate reserves/production area
- Aggregate consumption
- Population
- 20 years or less life span
Very useful for the regional planner or general citizenry, and provide a broader perspective not apparent in the P-C Region maps.
SMARA Synthesis Maps – Statewide “Bedsheet”
What Do We Know?

- Construction grade aggregates have their best value when they are consumed near their place of production.
  - Aggregates are a low-unit-value, high-bulk-weight commodity, which results in high transportation costs.

- Shorter haul distances mean lower costs, and less social, economic and environmental impact.
  - For straight hauls with minimal traffic, the price of aggregate increases about 15 cents per ton for every mile that it is hauled from the plant. Transporting aggregate a distance of 30 miles will increase the price by about $4.50 per ton.

  - Lower fuel costs
  - Less air pollution ("green house gases")
  - Less traffic congestion
  - Less road wear
  - Less tire and equipment wear
  - Shorter delivery times
Aggregate Transport and Sustainability in the San Francisco Bay Region

Distance from PCC Producing Mines

Distance from Designated Aggregate Resource Areas
Distance from PCC Producing Mines

Conceptual maps only at this point. (No region specific conclusions can be drawn from these sample maps)

Sample maps illustrate some of possible types of information and graphical presentation that might be used in a series (7-10) of regional aggregate resource sustainability maps covering the state. Each such map would incorporate multiple smaller Production-Consumption (P-C) Regions based on previous mineral land classification studies.

Combining multiple P-C Regions into “Super Regions” should allow better estimates of future regional aggregate demand and a better analysis of production and consumption patterns within the “Super Region”.

Aggregate Transport and Sustainability in the San Francisco Bay Region
The maps show, in a simplified manner, the distance from current aggregate sources (or potential source areas) to points of consumption and can be used to illustrate the relationship between distance and aggregate costs (both economic and environmental). In addition to the added dollar cost of aggregate to the consumer, transportation of aggregate over longer distances results in increased fuel consumption, air pollution, greenhouse gas emissions, traffic congestion, and road maintenance.
Aggregate Transport and Sustainability in the San Francisco Bay Region

Distance from PCC Producing Mines

Presenting the information on an appropriate regional basis allows us to emphasize the regional nature of aggregate supply and highlight the potential impacts (economic, environmental, and societal) that land use decisions related to aggregate mining in one jurisdiction may have on neighboring jurisdictions and the larger region.
Aggregate Transport and Sustainability in the San Francisco Bay Region

Displaying the distance from designated aggregate resource areas in the San Francisco Bay Region as of 2012. The map shows different color codes for distances ranging from 0 to 40 miles, including:

- **0 - 10 Miles**
- **10 - 20 Miles**
- **20 - 30 Miles**
- **30 - 40 Miles**
- **40+ Miles**

Legend:
- Production-Consumption Region
- Designated Areas
- Population: 1 Dot = 1,000 People
The relationship between the projected 50-year aggregate demand, reserves (permitted resources), and resources for each P-C Region (within the larger super region) to emphasize the region’s future aggregate needs, current supplies, and potential future sources.

**Reserves (permitted)** - Are aggregate deposits that have been determined to be acceptable for commercial use, exist within properties owned or leased by aggregate producing companies, and have permits allowing mining of aggregate material (also called permitted aggregate resources).

**Demand** - Is the projected 50-year demand for aggregate within the P-C Region based on either the per capita consumption model or a projection based on the P-C Regions past production.

**Resources (unpermitted)** - Unpermitted aggregate resources are deposits that may meet specifications for construction aggregate, are recoverable with existing technology, have no land use overlying them that is incompatible with mining, and currently are not permitted for mining.
Estimated Annual CO2 Emissions from Aggregate Transport

The estimated annual CO$_2$ emissions from aggregate transport in each P-C Region related to haul distance.

- Estimates are for highway transport by heavy truck from source-to-point of use only.
- Based on average regional aggregate production
  - 25 tons load
  - Round trip mileage
  - Fuel efficiency of 0.13 gal/mi for diesel in heavy trucks (CARB)
  - 22.2 pounds of CO2 produced per gallon of diesel used (EPA)
Aggregate Transport and Sustainability in the San Francisco Bay Region

Distance from PCC Producing Mines

Presenting the information on an appropriate regional basis will allow us to emphasize the regional nature of aggregate supply and highlight the potential impacts (economic, environmental, and societal) that land use decisions related to aggregate mining in one jurisdiction may have on neighboring jurisdictions and the larger region.
Summary

• Aggregate availability has its government roots in the mid-1960s, although large scale operations such as in the Yuba Goldfields were determining estimated reserves decades prior.

• Current aggregate availability maps and previous maps are useful but show a narrow view of the issue, and limited in their respective use.

• RTPs and the Aggregate Availability Group (AAG) established in 2009, are new efforts to address the future aggregate problem.

• Current and relevant maps should incorporate economic, social and environmental factors. “Mineral Resources Plan”, similar in intent with the California Water Plan, has merit relevant maps as currently being considered by the DOC would be a tool that could be used in developing such a plan.