REPORT CARD FOR
CALIFORNIA'S
INFRASTRUCTURE
2019

GOLDEN GATE BRIDGE ON A SUNNY DAY IN SAN FRANCISCO
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REPORT CARD FOR CALIFORNIA'S INFRASTRUCTURE

Region 9 of the American Society of Civil Engineers

INFRASTRUCTUREREPORTCARD.ORG/CALIFORNIA

MAY 2019

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

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EXECUTIVE SUMMARY

Californians use infrastructure each day, with or without realizing it. **Infrastructure** includes facilities and structures **providing essential services to residents** of a city, county, or state. Infrastructure includes Aviation, Bridges, Dams, Drinking Water, Energy, Hazardous Waste, Inland Waterways, Levees, Ports, Public Parks, Rail, Roads, Schools, Solid Waste, Stormwater, Transit, and Wastewater facilities, each of which are evaluated in this report. These 17 infrastructure categories were each assessed on capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation.

In May 2018, California's economy surpassed that of the United Kingdom to become the world's fifth largest. Over the next 20 years, California's population is expected to grow by another 25% or over 10 million people. A strong and sustainable infrastructure is imperative to the continued **economic prosperity** Californians enjoy; it is also important for our **public safety**, and our **quality of life**.

For example, our transportation system, which includes roads, bridges, transit and rail, allows Californians to travel to work, access our iconic coastlines, lakes, and vineyards, and receive packages from online retailers. Water systems deliver clean drinking water to our homes, communities, and businesses. School buildings provide a safe place for our children to learn. Wastewater collection and treatment systems protect our lakes, rivers, and beaches from raw sewage, E. coli and other toxins.

All infrastructure deteriorates with time, and can fail prematurely unless rigorous maintenance programs are implemented. What happens when infrastructure fails?

- In February 2017, Oroville Dam's Emergency Spillway failed resulting in the emergency evacuation of over 180,000 nearby residents causing disruption, economic impact and public safety concerns.
- In July 2014, a 92 year-old 30-inch Los Angeles water main failed flooding Sunset Boulevard and portions of the UCLA campus causing significant damages to both public and private properties.

Googling "water main breaks" in California will unfortunately yield a very long list of infrastructure failure stories covered by the media, and many more occur every day that don't receive media attention. As

SHASTA DAM IS A CONCRETE ARCH-GRAVITY DAM ACROSS THE SACRAMENTO RIVER IN NORTHERN CA © PUNG PUNG

EXECUTIVE SUMMARY (CONT.)

our California infrastructure continues to age, the frequency of failure will increase significantly, unless we take corrective measures.

This report assigns a letter grade to each category and to the overall report card, to more effectively communicate the general state of our California infrastructure to state and local legislators, as well as to the public. The grade is based upon a simple "A through F" school report card format: "A" for Exceptional, Fit for the Future, "B" for Good, Adequate for Now, "C" for Mediocre, Requires Attention, "D" for Poor, At Risk, and "F" for Failing/Critical, Unfit For Purpose. The 2019 California Infrastructure Report Card gave the overall infrastructure a **grade of C-**, which means California's infrastructure is **in mediocre condition and requires attention**.

Infrastructure maintenance, renewal and replacement programs are critical for sustaining California's economic engine, but funding constraints continue to severely delay much-needed improvements. Our state's infrastructure renewal and replacement programs have been significantly underfunded for a long time. While the state legislature, municipalities, and California voters have made strides in recent years to raise additional revenue for our infrastructure, we have a lot of catch-up to play, and **large funding gaps remain**.

This report card, and the grade, are not meant to be not a commentary on agencies and their personnel's performance, as we know they are doing the best they can with the limited available resources. This report card should serve as a tool to help us request the resources needed to more adequately maintain our infrastructure and plan for the future.

To raise California's infrastructure grade, ASCE developed the following four recommendations:

- Promote effective and collaborative **leadership**.
- Develop **smart plans** to better identify funding needs.
- Increase state and local **funding**.
- Inform the public and raise **awareness**.

Each chapter in this report includes additional recommendations specific to each assessed infrastructure category. As the stewards of our infrastructure, California's civil engineers have a moral duty to advocate for sustainable infrastructure capable of supporting our state's robust economy, while maintaining public safety and our quality of our life. Join us in increasing infrastructure investment as it is a high priority for California.

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GRADING METHODOLOGY

The 2019 Report Card for California's Infrastructure was completed by a committee of over 100 professionals and experts from California who dedicated their valuable time to collect and evaluate existing data, assess the infrastructure, document their findings, and develop recommendations. The committee worked with staff from ASCE National and ASCE's Committee on America's Infrastructure to provide a snapshot of our infrastructure, as it relates to us at home, and on a national basis.

The Report Card Sections are graded based on the following eight criteria:

CAPACITY Does the infrastructure's capacity meet current and future demands?

CONDITION What is the infrastructure's existing and near-future physical condition?

FUNDING What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?

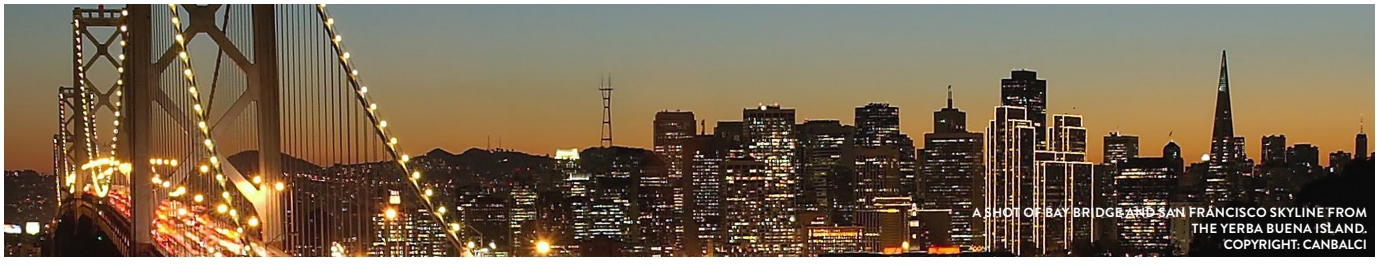
FUTURE NEED What is the cost to improve the infrastructure? Will future funding prospects address the need?

OPERATION AND MAINTENANCE What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?

PUBLIC SAFETY To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?

RESILIENCE What is the infrastructure system's capability to prevent or protect against significant multihazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?

INNOVATION What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?



A SHOT OF BAY BRIDGE AND SAN FRANCISCO SKYLINE FROM THE YERBA BUENA ISLAND. COPYRIGHT: CANBALCI

REPORT CARD FOR CALIFORNIA'S INFRASTRUCTURE 2019

GRADING SCALE

A — EXCEPTIONAL: FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.

B — GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Safe and reliable with minimal capacity issues and minimal risk.

C — MEDIOCRE: REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.

D — POOR: AT RISK

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of significant concern with strong risk of failure.

F — FAILING/CRITICAL: UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

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2019 REPORT CARD FOR CALIFORNIA'S INFRASTRUCTURE

GPA C-

AVIATION	C+
BRIDGES	C-
DAMS	C-
DRINKING WATER	C
ENERGY	D-
HAZARDOUS WASTE	C-
INLAND WATERWAYS	D
LEVEES	D
PORTS	C+
PUBLIC PARKS	D+
RAIL	C
ROADS	D
SCHOOLS	C
SOLID WASTE	C-
STORMWATER	D+
TRANSIT	C-
WASTEWATER	C+

NOTES ABOUT THE GRADES

Across the country, budget issues, and deferred maintenance are taking their toll on critical infrastructure systems constructed by the generations before us and which now must be maintained and modernized.

The analysis in this report card and associated grades, are intended to increase understanding by the public and the state and local legislators, of the importance and value of long-term consistent infrastructure investments, the importance of leadership and planning, and the need to prepare for the future.

The Grades reflect the condition of the infrastructure, and not the diligent local agency personnel who are doing their best to manage, repair, renew, and replace aging systems, with the limited available resources. Rather, this Report Card is intended to reflect current infrastructure conditions and be a tool to help agencies request and receive the resources they need.

REPORT CARD FOR CALIFORNIA'S INFRASTRUCTURE 2019

RECOMMENDATIONS TO RAISE THE GRADE

To Raise California's Infrastructure grade, ASCE developed the following four recommendations: 1) Promote effective and collaborative **leadership**, 2) Develop **smart plans** to better identify funding needs, 3) Increase state and local **funding**, and 4) Inform the public and raise **awareness**.

1. PROMOTE EFFECTIVE AND COLLABORATIVE LEADERSHIP

The Challenges of addressing California's aging infrastructure will require effective public and private leadership coupled with implementation of sustainable practices.

- **Continue to promote effective infrastructure leadership** within agencies, and empower leaders in key positions with applicable decision-making authority.
- **Streamline the project permitting process** across infrastructure sectors, with safeguards to protect the natural environment, to make regulatory requirements clearer, bring priority projects to reality faster, and **secure cost savings.**
- **Encourage Leaders** from all levels of government, business, labor, and nonprofit organizations to **come together and collaborate** to ensure all investments are spent wisely, prioritizing projects with critical benefits to the economy, public safety, and quality of life.

2. DEVELOP SMART PLANS TO BETTER IDENTIFY FUNDING NEEDS

One of the more important smart plans an agency can develop is an asset management plan, which enables them to make informed decisions on where - and when - to spend limited public funds.

- **Advocate for the enactment of Asset Management Plans,** which will assist state and local agencies in maintaining a desired level of service expected by the customer, with the most strategic use of limited available funding.
- **Enact policies that require high quality data gathering,** tracking, and regularly scheduled maintenance on existing infrastructure assets.
- **Perform life cycle cost analysis and risk analysis,** and develop Renewal and Replacement Plans to repair or replace failing infrastructure at the right time.
- **Develop operations and maintenance (O&M) strategies** to avoid having to repair infrastructure systems after they fail as this approach has adverse consequences, including higher repair costs, customer service interruptions, and property damage.
- Require all projects greater than $5 million to use **life cycle cost analysis** and develop a funding plan to support capital, operation and maintenance costs until the end of the project's service life.

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RECOMMENDATIONS TO RAISE THE GRADE (CONT.)

3. INCREASE STATE AND LOCAL FUNDING

Each category evaluated in this Report indicates currently available funding to state and local agencies is not adequate to maintain sustainable and safe California infrastructure systems.

- **Establish long-term agency funding strategies,** based on thorough evaluations of existing capacity and conditions, O&M needs, and the intended levels of service.
- Garner public and legislative support for **legislation that will generate new and sustained revenue sources for all aging infrastructure systems.** Examples of such legislation include the Road Repair and Accountability Act of 2017 the State Revolving Funds program.
- **Support local efforts to increase funding** for infrastructure including sales tax measures, Enhanced Infrastructure Financing Districts, and other measures.
- **Create incentives** for state and local governments and the private sector to invest in maintenance, upgrades, repairs, and replacement of infrastructure.
- **Support research and development into innovative new materials, technologies, and processes** to modernize and extend the life of infrastructure, expedite repairs or replacement, and promote cost savings over the life of the asset.

4. INFORM THE PUBLIC AND RAISE AWARENESS

There is a need for additional consumer education on the current funding needs and the negative impacts of further delaying action to fund infrastructure improvements statewide. The education needs to also extend to the local and state legislators, locally elected boards and commissions, as well as to the media.

- **Develop a program for improved communication and messaging** to clearly articulate the need for maintaining sustainable and resilient infrastructure that will have positive impacts to the environment and improve quality of life.
- **Raise awareness with state and local legislators.** One key to addressing our infrastructure needs is to continue building relationships with decision-makers at the local and state levels. State and local legislators make the critical decisions on passing bills that promote funding and improving our infrastructure.
- **Raise awareness with the public.** ASCE's continued efforts will result in a better-informed public, which can more effectively cast votes on state and local ballot measures impacting California's infrastructure.

AVIATION

C+

LOS ANGELES INTERNATIONAL AIRPORT

EXECUTIVE SUMMARY

California has 26 commercial service airports and 217 general aviation airports. Based on the Federal Aviation Administration passenger boarding data, 11 airports in California rank nationally within the top 100 Commercial Service Airports, with Los Angeles International Airport ranking second nationally and San Francisco International Airport ranking seventh. The condition of the runways at California airports is healthy, but the airport capacity remains a challenge. On average, 17% of flights were delayed at the 11 busiest airports in California in 2017, just under the national average of 18% the same year. Looking ahead, sufficient investment in commercial and general aviation airports is needed to keep pace with a growing economy and population. According to the 10-year California Capital Improvement Plan published in 2017, there are 1,735 aviation projects that need a total of $2.77 billion in funding over the next 10 years.

INTRODUCTION

Eleven commercial airports in California rank within the top 100 Commercial Service Airports nationally: Los Angeles International (LAX), John Wayne (SNA), Burbank Bob Hope (BUR), Long Beach (LGB), Ontario International (ONT), Palm Springs International (PSP), and San Diego International (SAN) in Southern California; and San Francisco International (SFO), Oakland International (OAK), San Jose International (SJC), and Sacramento International (SMF) in Northern California. These facilities are currently serving 222.3 million annual passengers, according to 2017 data.

CAPACITY

Based on California Division of Aeronautics (DOA) passenger service data, 11 of the California airports rank within the top 100 Commercial Service Airports nationally, with LAX and SFO ranking second and seventh, respectively. In 2017, California's share of the national passenger enplanements was over 11%.

The capacity of the state's airport system is impacted by many factors, including the regulatory environment, airline business models, airport layouts, airport procedures, inadequate funding and revenue streams, weather conditions, aircraft types, and technology. Additional factors that have an impact are airfield configuration, including separation of parallel runways, the ability to separate operations by size, and the presence of bypass taxiways, one-way taxiways, and taxiway holding bays. However, perhaps the most important components of capacity is related to terminal facilities. Specifically, there must be sufficient terminal frontage for drop-offs and pickups, enough gates to fit the fleet mix serving each individual airport, and taxiway capacity to move aircraft to and from gates without gridlock.

Each of these considerations contributes to a leading indicator of capacity: delay. According to the United States Department of Transportation, Bureau of Transportation Statistics, across California commercial airports delays have increased slightly at some airports and at others airports delays have slightly decreased over the last five years, indicating that overall capacity of California commercial airports remains adequate. On average, 17% of flights were delayed at the 11 busiest airports in California in 2017, just under the national average of 18% the same year.

AIRPORT	PERCENTAGE OF DEPARTURES DELAYED (2017)
BUR	19.57%
LAX	17.63%
LGB	16.93%
OAK	19.08%
ONT	16.38%
PSP	15.31%
SAN	17.21%
SFO	20.26%
SJC	16.80%
SMF	15.31%
SNA	***15.75%***
California's Busiest Airports Average	***17.29%***
National Average	***18.08%***

It should also be noted that several airports in California are undergoing or have recently completed major projects that improve landside access to airports and ease congestion chokepoints on surrounding roadways. For example, in 2014 the Bay Area Regional Transit district opened a new "train to plane" automated people mover servicing the Oakland International Airport. In Los Angeles, the ongoing Landside Access Modernization Program will build a two-mile automated people mover to better connect the terminals with rental car centers and transit lines. These projects provide relief for congestion surrounding airports and provide customers with mobility alternatives.

CONDITION

Airport condition can be measured in a variety of ways. First, there's the condition of the surfaces or pavements, including runways, taxiways, ramps, aprons, helipads, service roads and general airfield. The California Airport Pavement Management System (APMS) project started its upgrade in 2017 and is expected to complete it in 2019. APMS will include a pavement management system to evaluate airport pavements, including runways, taxiways, aprons, tie downs. APMS also includes inventory, assessment of the pavement, data analysis, development of a pavement maintenance and a rehabilitation strategy recommendation. The overall condition of the runways, taxiways, ramps and general airfield facilities is relatively good based on previous APMS.

OPERATIONS AND MAINTENANCE

Preventative maintenance must be regularly performed to protect and preserve the airport infrastructure that provides so much value to the state of California. Budget for improvement projects at airports largely rely on grants, and when grants are awarded, there are often times competing priorities among projects that must be accomplished.

Currently, the APMS study is being conducted to provide pavement condition inspections and develop maintenance, repair, rehabilitation and reconstruction recommendations for California airports. The updated findings in 2019 will be critical for DOA and the FAA in determining how much preventative maintenance remains cost-effective, and how much major rehabilitation is required in coming years.

PUBLIC SAFETY

The DOA considers promoting a safe aviation environment for passengers, pilots, and persons on the ground its most important obligation. The Division's most visible safety efforts are the airport and heliport inspections conducted by the Office of Airports. Aviation Safety Officers work with airport operators to keep their facilities consistent with state and FAA safety standards. Additionally, the Office of Aviation Planning is involved with land use compatibility planning around airports.

Aside from ensuring aviators have a safe take-off and landing locations, California's 243 public use airports are potential staging areas for emergency response activities in the case of any major catastrophic event. For example, lifesaving operations conducted by search and rescue and firefighting agencies rely on aircraft to transport equipment and supplies, personnel deployment, as well as to provide reconnaissance during emergencies, like wild fires and earthquakes.

In California, U.S. Forest Service, Fire and Aviation Management coordinates nine federal firefighting air-tanker bases, three air-tanker reload bases and 20 helicopter bases. In support of ground forces, Cal Fire coordinates the state-owned firefighting air fleet with 13 air attack and nine helicopter attack bases strategically located to provide air support within 20 minutes.

During an emergency, the California National Guard can be activated to bring in additional aviation resources on an as-needed basis.

FUNDING

Funding for airports is primarily provided by the FAA through Airport Improvement Program (AIP) grants, state, regional, and local sources, as well as passenger and cargo-based fees. Other potential funding sources include: Airport Bonds, Passenger Facility Charges, and Airport Revenues.

According to the "California Capital Improvement Plan – California Aviation System Plan, 2017 – 2026," there are 1,735 aviation projects that need a total of $2.77 billion over the next 10 years. Of that total need (Chart 1), 54% is from projects located in Commercial Service Primary Airports, or airports with more than 10,000 boardings per year. An additional 44.9% of the $2.77 billion in needs is from General Aviation and Reliever airports in the NPIAS, while 1.15% is from Non-NPIPAS General Aviation and Commercial Service Non-Primary Airport projects. Chart 3 shows the breakdown from the same report where the total funding for CIP projects will come from.

Chart 1 CIP Project Cost By Airport Category
Total: $2.77 Billion

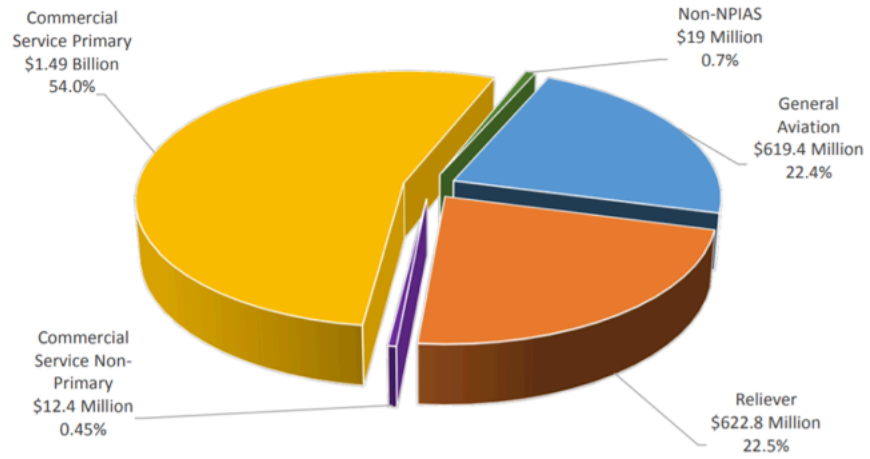
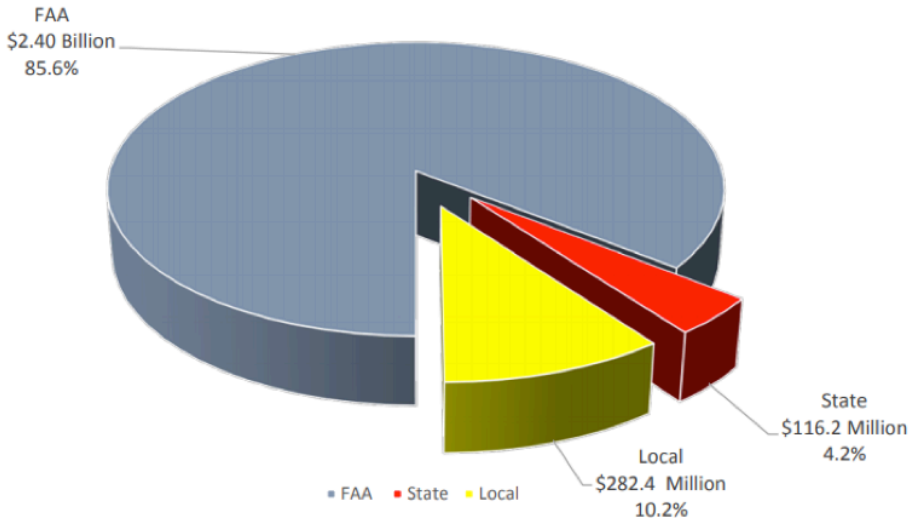


Chart 3 Federal/State/Local Split For CIP Projects
Total: $2.77 Billion



In California in 2017, total FAA grant spending was $584 million.

Strong advocacy is needed to assure adequate funding is programmed from both federal and state sources to meet objectives. California aviation fuel taxes raise significant funds every year, but revenue is sometimes diverted to the state general fund. As of December 2017, the FAA required the proceeds from state and local taxes on aviation fuel to be spent on airport capital or operating costs. However, as of December 2017, the State of California and most of the state's local governments and airport authorities are still coming into compliance with the requirement.

FUTURE NEED

Funding issues have been compounded by the failure of Congress to regularly reauthorize FAA programs. Between 2007 and 2012 and again from 2015 to 2018, the FAA operated under a series of short-term authorizations, leading to delays in investment decisions of FAA-funded airport projects. In October 2018, the FAA reauthorization bill was successfully passed to provide renewed agency funding for another five years. Unfortunately, even with the most recent FAA bill, authorization levels are unchanged. There also hasn't been an increase in the Passenger Facility Charge (PFC) since 2000. The PFC is a fee that commercial airports charge per enplaned passenger, currently set at $4.50, with proceeds going toward airport projects that enhance safety, security, or capacity.

In the past, short-term authorizations and lapses in FAA authorizations have led to the slowdowns of work on aviation and support projects, resulting in withholding billions of dollars in grants to new airport projects, such as the new terminal at LAX, a new rental car facility in San Diego, the Oakland airport expansion and San Francisco's modernization project, as a few examples. A permanent extension of user fees is needed to assure adequate funding for the AIP from FAA's Airport and Airway Trust Fund. Additionally, Public Private Partnerships (PPP) should be explored to augment future funding needs.

RESILIENCE

Airports that are in close proximity to the Pacific Ocean, including San Francisco, San Diego and Oakland, all will need to start preparations for possible sea-level rise. Additionally, a major earthquake could seriously damage airports throughout the state, either by seismic activity or a subsequent tsunami. For example, a 2017 report "Preparing A Region For Earthquake Disasters – The San Diego - Tijuana Earthquake Scenario Project" that was published by the Earthquake Engineering Research Institute found that a magnitude 6.9 earthquake would produce widespread liquefaction in the area where San Diego International Airport is located. Further, the study found that that severe shaking would cause landslides into Coronado Canyon in the Pacific Ocean, thereby producing a tsunami that would enter San Diego Bay within minutes.

INNOVATION

Each airport has adapted to modern technological services, including surveillance systems, as well as terminal Wi-Fi internet availability. Each airport has an interactive website with links to administrative, operational, customer service and aviation planning documents.

The promise of the Next Generation Air Traffic Control System (NextGen) has been a long time coming. NextGen is designed to increase efficiency and flexibility, while offering environmental benefits by using better Global Positioning System (GPS) technology to plot and guide flight paths. NextGen is currently due for implementation across the United States in stages, to be completed by 2025. Enhanced technology will be used to increase routing efficiency, which will shorten routes, save time and fuel, reduce traffic delays, increase capacity, and permit controllers to monitor and manage aircraft with greater safety margins. Implementation is costly, and will require airlines to make expensive investments, but will increase flight efficiency and safety.

RECOMMENDATIONS TO RAISE THE GRADE

- Encourage Congress to ensure the long-term reauthorization of full Airport Improvement Plan (AIP) funding and Aviation Trust Fund.
- Remove or increase the federally-imposed cap on Passenger Facility Charges (PFCs) which will allow commercial service airports to finance a greater share of their projects with local revenue and allow more of the limited AIP funding to be allocated to smaller general aviation airports that rely on federal assistance the most.
- Continue the practice that all monies collected from taxes/user fees be deposited in the Aviation Trust Fund with budgetary firewalls to eliminate the diversion of transportation revenues from non-airport capacity, air traffic and maintenance and improvement purposes.
- Encourage the state to conform to the FAA requirements to eliminate revenue diversion from of the aviation fuel tax to the State general fund.
- Continued to accelerate implementation of the NextGen air traffic control system.
- Funding for security measures must not impact needed infrastructure funding.
- Continue to partner with the State DOA and local City and County jurisdictions to seek matching funds for both onsite and offsite improvements to increase efficiency and safety of airport operations.
- Work to partner with Regional Transportation Agencies to both develop and enhance bus and fixed rail transit links to airport facilities.

SOURCES

Southern and Northern California Commercial Airport: Administrative, Planning Operational and Capital Improvement and Financial Databases

Caltrans Division of Aeronautics Databases including:
California Aviation System Plan 2013 Inventory Element

Capital Improvement Plan California Aviation System Plan – 2017-2026

Aviation in California Fact Sheet – February 2018

Caltrans Fact Book – June 2017

California Airport Pavement Management System (APMS)

ASCE National Infrastructure Report Card - Aviation 2017

ASCE California Infrastructure Report Card – Aviation 2012

US Department of Transportation - Federal Aviation Administration

FAA Aerospace Forecast Fiscal Years 2013 to 2035

FAA The Economic Impact of Civil Aviation on the U.S. Economy – June 2014

FAA Next Gen – Next Gen Priorities – Joint Implementation Plan Update - October 2017

FAA National Plan of Integrated Airport Systems (NPIAS) 2019–2023

United States Department of Transportation, Bureau of Transportation Statistics

Airline On-Time Statistics and Delay Causes

Earthquake Engineering Research Institute
Preparing A Region For Earthquake Disasters – The San Diego - Tijuana Earthquake Scenario Project

BRIDGES

C-

GOLDEN GATE BRIDGE, SAN FRANCISCO

BRIDGES

EXECUTIVE SUMMARY

Progress has been made over the past decade to increase the percentage of California bridges in good condition and to reduce the number that are classified as structurally deficient (SD). Today, California has fewer SD bridges than the national average, and this number is expected to continue declining thanks to the passage of the Road and Repair Accountability Act (SB 1), which increased funding for badly-needed repairs to the state's transportation system. However, much more remains to be done, especially as it relates to seismic retrofitting to improve the safety of bridges in the event of an earthquake. Approximately 50% of bridges in the state have exceeded their design life and the backlog of recommended maintenance, repair and replacement work continues to grow. California is home to the second largest percentage of "functionally obsolete" (FO) bridges, or bridges with outdated designs that frequently contribute to congestion chokepoints. Over 7% of California's bridges are structurally deficient and California has ranks among the top states for bridges in "poor" condition by bridge deck area. In other words, some of our largest bridges, along corridors such as I-5 in San Diego, Highway 101 in Los Angeles, and I-80 in Sacramento need major repair and rehabilitation.

This Chapter was previously released as part of the 2018 Report Card for California's Surface Transportation Infrastructure.

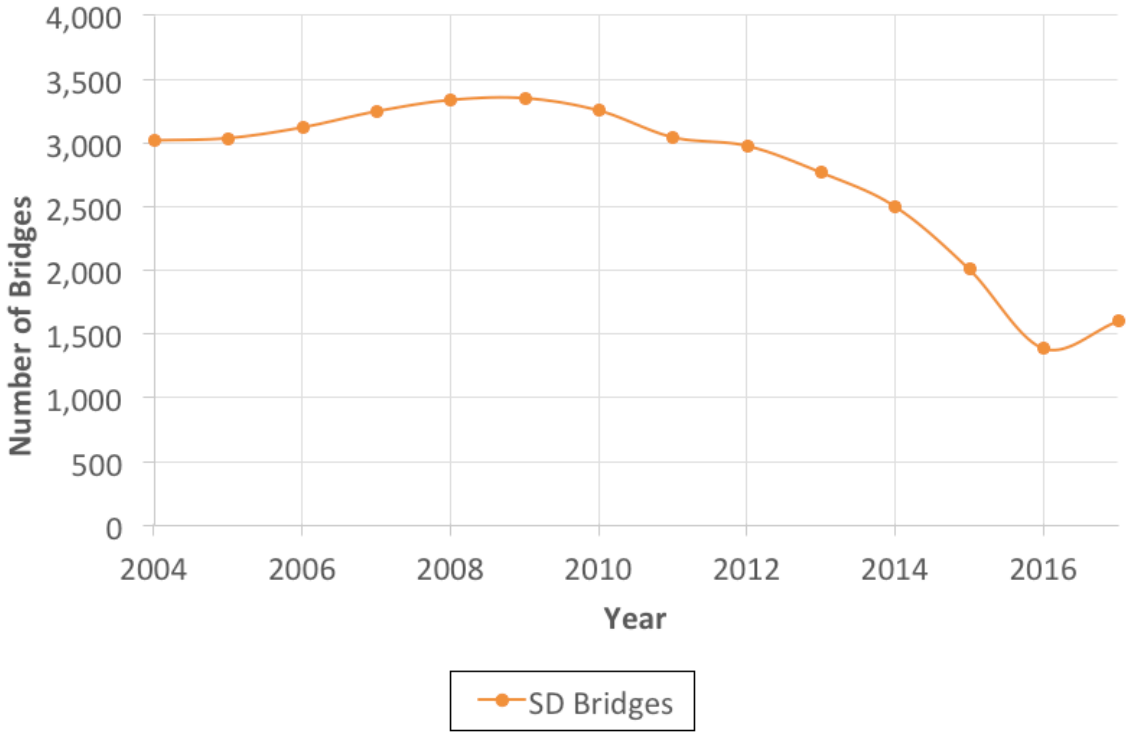
CAPACITY AND CONDITION

As of December 2017, there were 25,657 bridges in California, the fourth largest state inventory of bridges in the United States, behind Texas, Ohio, and Illinois. California's bridges cross a variety of terrains including arid deserts, marine environments, and mountainous areas with extreme winter snowfall. Each environment poses unique challenges to the service life of the bridges.

Roughly half of California's 25,657 bridges are owned and maintained by the California Department of Transportation (Caltrans). The remainder are owned and maintained by local jurisdictions.

A structurally deficient (SD) bridge is a bridge that requires significant maintenance, rehabilitation, or replacement because critical load-carrying elements were found to be in poor condition due to deterioration or damage. The number of SD bridges in California has decreased dramatically over the past few years from 2,769 in 2013 to 1,603 (6% of the state's inventory) in 2017. (See Figure 1.) While SD bridges do not generally pose an immediate danger to public safety, they must be inspected at least once every year.

FIGURE 1: STRUCTURALLY DEFICIENT BRIDGES IN THE STATE OF CALIFORNIA

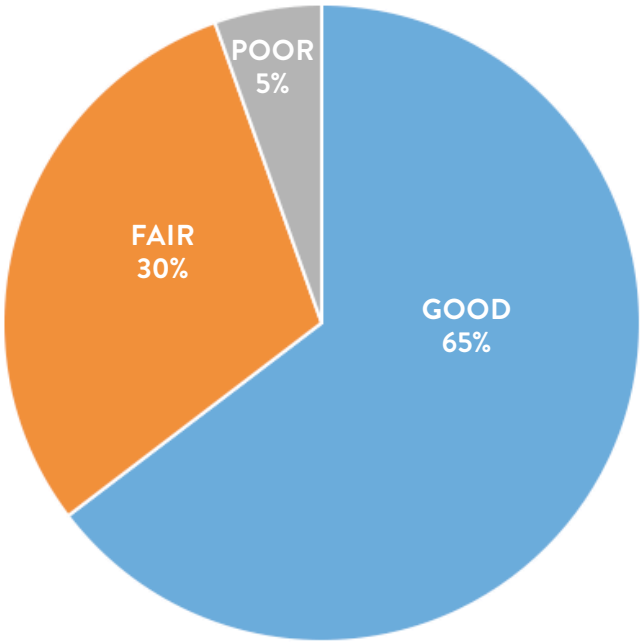


Nearly 50% of California's SD bridges are state-owned and maintained. The remaining 50% of California's SD bridges are owned and maintained by local jurisdictions. While many local agencies have kept up with their bridge maintenance needs, some have not due to limited resources and funding. There have been instances where some local agency bridges have been closed to traffic due to disrepair.

In addition to identifying bridges as "structurally deficient," the Federal Highway Administration (FHWA) also collects data on the condition of bridges and classifies them as in good, fair, or poor condition. Bridge condition is determined based on the lowest condition rating assigned to various components of a bridge, including its deck, superstructure, and substructure. If the lowest rating is greater than or equal to seven, the bridge is classified as "good." Bridges rated five or six are classified as "fair." If it's less than or equal to four, the classification is "poor."

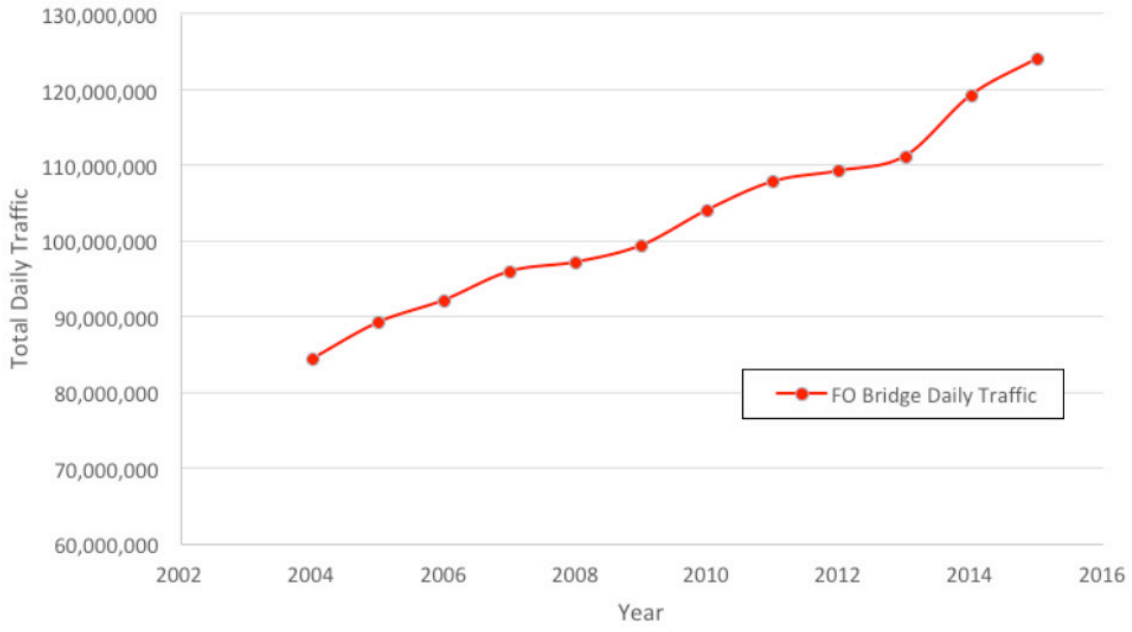
In California, 16,586 bridges —or 65% of the total bridge stock in the state —are in good condition. 7,676 bridges —or 30% —are in fair condition, and the remaining 1,395 bridges — or 5% — are in poor condition. (See Figure 2.) The number of bridges in "Poor" condition roughly correlates to the number of structurally deficient bridges (1,603).The 30% of bridges in the state that are in fair condition require maintenance to ensure they do not slip down to the "poor" category.

FIGURE 2: DISTRIBUTION OF CALIFORNIA'S BRIDGES IN GOOD, FAIR, AND POOR CONDITION



Another measure of the overall condition and capacity of a state's bridge network is the number of bridges previously defined by the FHWA as FO. The term FO has been sunset by the FHWA. FO bridges were previously defined as having substandard geometric designs such as not being wide enough, or having enough under clearance, to facilitate efficient movement of their traffic demands. The latest available data indicates there are about 4,400 FO bridges in California (approximately 17% of the total number of bridges in the state). The trend in the traffic on FO bridges has been upward since 2004. (See Figure 3.)

FIGURE 3: TOTAL DAILY TRAFFIC ON FUNCTIONALLY OBSOLETE BRIDGES IN CALIFORNIA



FO bridges are a source of congestion in California. Between 2004 and 2015, the total daily traffic on California's FO bridges increased by 47% (from 84,000 to about 124,000). As the population of California increases, traffic demands are expected to increase. While great strides have been achieved in reducing the number of SD bridges in California, less is being done to address FO bridges. This will lead to lost productivity due to longer travel times and higher levels of pollution and personal stress.

FUNDING AND FUTURE NEEDS

Funding for bridge improvements in California is done through a mix of federal, state, and local sources. Federal revenue is provided through the Federal Highway Bridge Program (FHBP). During Fiscal Year (FY) 2016, $296 million in federal funding was programmed to California bridges from the FHBP.

State revenue is collected through transportation-related user fees. In 2017, the California State Legislature took an important step to provide additional revenue to the transportation system. They passed the Road and Repair Accountability Act (SB 1), which is slated to provide $4 billion for bridge projects over the next 10 years. The SB 1 transportation package is funded by increases in excise taxes on fuel and surcharges on vehicle registration fees. State and local agencies have already applied for $1.8 billion in SB 1 funds to complete bridge rehabilitation, replacement, and maintenance projects.

SB 1 provides much-needed funding for bridges owned at both the state and local level, especially for jurisdictions that have limited resources. These funds ensure bridges that were at risk of being closed will instead be repaired or replaced. Localities may still need to raise their own revenues to further close the bridge funding gap. Regardless of state funding, the federal government must also be a part of the solution as well by increasing the revenue it collects and distributes to the states.

According to the American Road & Transportation Builders Association, nearly 4,400 bridges have been identified as needing repair in California and it is estimated that these repairs will cost about $12.2 billion.

OPERATION AND MAINTENANCE

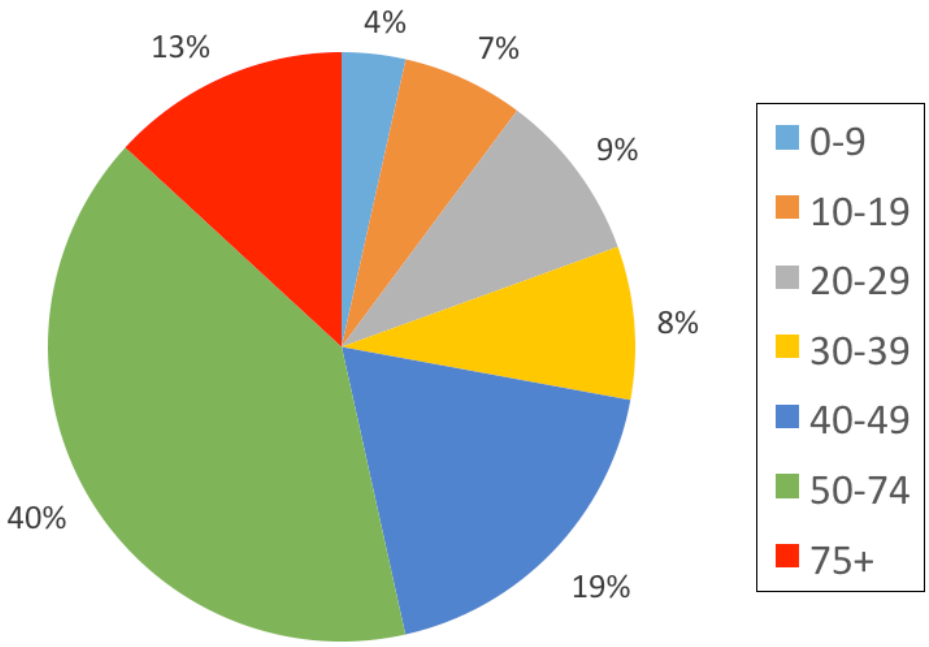
One cannot overstate the importance of proper maintenance to extend the life of a bridge. Bridges are subjected to repeated truck loads, debris, severe weather conditions, and in the case of bridges in marine environments, have elements such as foundations and columns that are exposed to corrosive seawater. The joints, deck, and elements that are near or under water are most vulnerable to wear-and-tear and require periodic maintenance.

In the FY 2017-18 State Budget, $131 million was allocated to bridge major maintenance. However, the ongoing annual need for bridge maintenance alone is estimated to be about $200 million. The shortfall in funding for maintenance will mean that the backlog of bridges requiring maintenance, and potentially, the number of bridges falling into the SD category, may continue to grow. Making maintenance a priority represents a better way to make use of the scarce amount of transportation funds available. According to the Legislative Analyst's Office, each dollar spent on maintenance can defer between $4 and $12 of cost needed for major rehabilitation.

State bridges are adequately operated and maintained but some local agencies lack the funding to properly maintain their bridges. In some cases, work recommendations from bridge inspectors are never implemented because of funding shortfalls. The failure to address such recommendations can lead to possible advanced sectional loss, which may substantially degrade bridge capacity. Proper bridge maintenance is required for a bridge to reach its expected lifespan.

Aging bridges are a growing concern. Many bridges in service today were designed for a 50-year lifespan. Today, over 50% of California bridges exceed 50 years in age and 13% are over 75 years old (see Figure 4). Preventive maintenance can extend the lifespan of a bridge, but most of the older bridges – particularly those that are SD – will need major rehabilitation or reconstruction. Whether a bridge can be rehabilitated or reconstructed is heavily dependent on the availability of funding. In the meantime, older bridges may require more frequent inspection and monitoring to ensure they remain safe for public travel. Increasing shortfalls in funding resulting in deferring badly needed repairs will likely lead to more of California's aging bridges falling into "poor" condition or SD category.

FIGURE 4: CALIFORNIA BRIDGES BY AGE



INNOVATION

Innovations in bridge design and materials have potential to increase the durability of a bridge or prolong its lifespan. Advances in material have made concrete stronger or more durable to withstand weather conditions. High performance steel has greater strengths, ductility, and fracture resistance. Electrochemical Chloride Extraction (ECE) treatment, by applying an electric field at the deck, prolongs the life of historic bridges.

Advances in Accelerated Bridge Construction, when properly implemented, have made construction in very challenging conditions possible. Innovative construction methods can also be used to overcome issues relating to limited space, environmental restrictions, or public safety in high traffic areas.

Innovation and new technology come with a price. Specialty products, services and construction are high ticket items and can escalate construction costs. While initial costs may appear to be prohibitive, the intangible benefits such as increased safety, reduced environmental and traffic impacts, and faster construction, can more than justify the added costs. Additionally, research and testing of new products need funding along with agency and industry acceptance.

PUBLIC SAFETY

Public safety is of paramount concern to all government agencies. In the aftermath of the 1989 Loma Prieta earthquake and 1994 Northridge earthquake, major strides have been taken to seismically retrofit vulnerable older bridges. However, there are still bridges requiring seismic retrofit. As of June 30, 2017, there are 241 locally owned bridges in the state of California that have been deemed eligible for funding from the Local Bridge Seismic Retrofit Account, but funding has not yet been programmed. In comparison, construction is underway and is expected to be complete by June 2019 on the last remaining state-owned bridge requiring seismic retrofit.

Vehicle heights and weights have increased over the years. Barriers on older bridges in service were not designed to protect today's vehicles. Thus, barrier rail upgrade to current standards is also a public safety concern. However, limited funding has delayed implementation of needed upgrades.

RESILIENCE

In addition to earthquakes, California faces many different types of natural and man-made disasters, including fires, tsunamis, droughts and landslides. Structural resiliency is the ability to withstand unexpected loads brought about by climate change or natural disasters. Change in climate conditions has produced heavier rains, stronger storms and higher winds. This is the new normal.

Old bridges were not designed for these loads. As previously noted, over 50% of California bridges are over 50 years old, making them vulnerable to such load increases. Bridges over waterways are most vulnerable. There are over 17,000 bridges over waterways in California. Risks are exacerbated in fire-ravaged areas that are vulnerable to landslides.

A consistent strategy on resiliency is needed for California bridges. New guidelines need to be developed to address the risk and safety issues associated with climate change. Prioritizing and strengthening vulnerable bridges will require major funding.

RECOMMENDATIONS TO RAISE THE GRADE

- Prioritize funding for maintenance on bridges that FHWA has deemed to be in "fair" condition to mitigate further deterioration and prevent these bridges from falling into the "poor" condition or SD category. This will be vital as California's bridges continue to age.
- Continue to explore and invest in innovations that provide better and more efficient bridge inspection, maintenance, and rehabilitation, leading to prolonged bridge lifespan and public safety.
- Continue to track the number of FO and SD bridges to get a better understanding of the condition of the State's bridge transportation network.
- Reserve funding to address specific issues such as substandard railings.
- Make bridge maintenance a major priority.
- Continue to develop, preserve and support legislation similar to SB 1, to promote bridging the gap for repairing and rehabilitating our state's aging infrastructure.
- Encourage localities to raise revenue for surface transportation revenu
- Explore alternative revenue models, such as taxation based on vehicle-miles-traveled.

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DAMS

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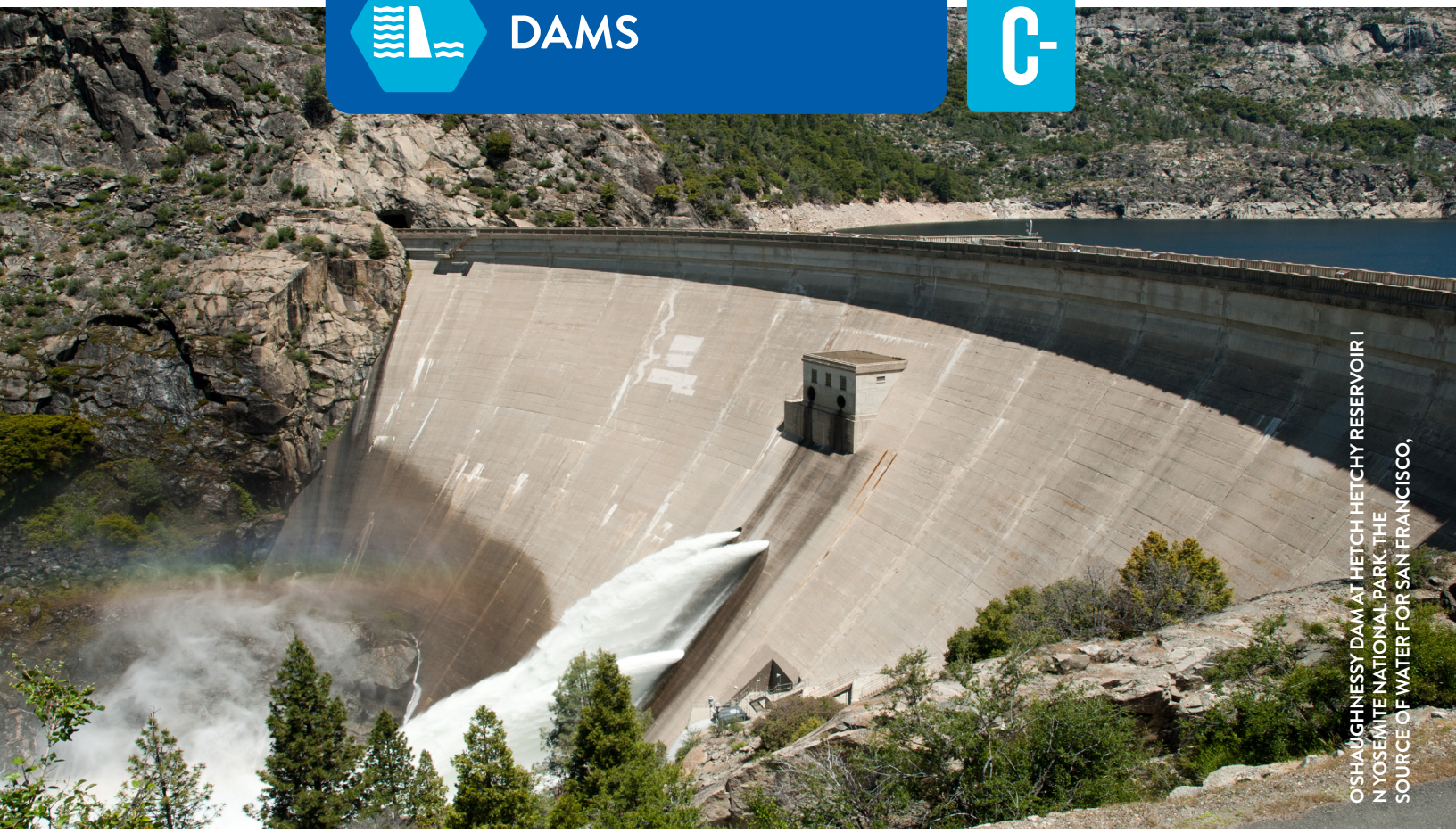


O'SHAUGHNESSY DAM AT HETCH HETCHY RESERVOIR I N YOSEMITE NATIONAL PARK. THE SOURCE OF WATER FOR SAN FRANCISCO,

DAMS

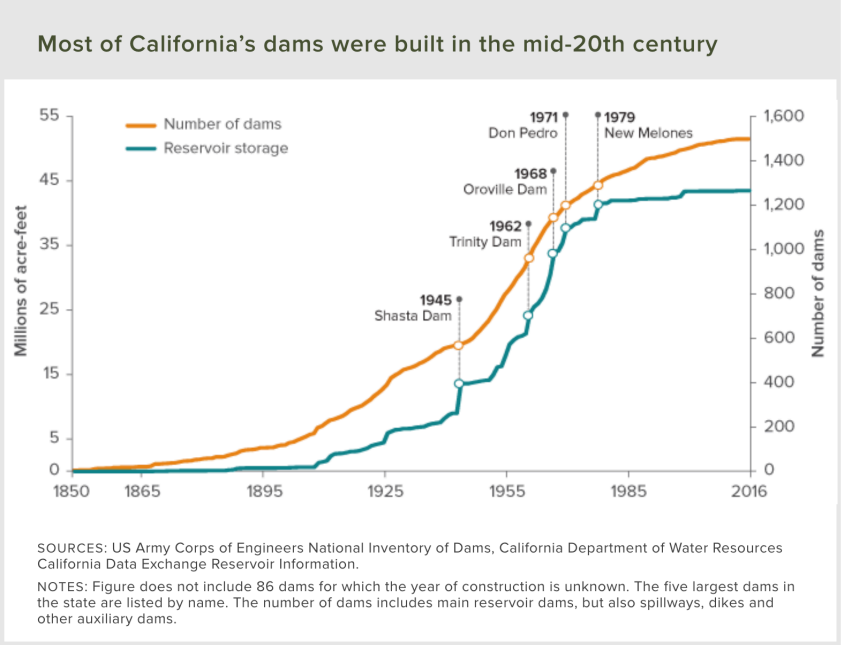
EXECUTIVE SUMMARY

Dams are a critical element of California's infrastructure. The public depends on them for 70% of state's water supply, 15% of the power, as well as for flood control, recreation, fisheries and wildlife habitat. Changes in climate and population growth require new operational strategies. Over half of California's 1,476 state, federal and locally owned dams are considered high hazard dams, meaning their failure would result in probable loss of human life and economic damage. Approximately 70% of the dams are greater than 50 years old. Aging dam infrastructure challenges must be met with increased resources to ensure their reliability and safety. Fortunately, funding for dam inspection has increased in recent years. In 2015, the California Division of Safety of Dams (DSOD) budget was approximately $13 million, up from $11 million in 2010. This increase kept funding on par with inflation. However, while DSOD's budget is significantly higher per regulated dam than the national average, it does not fully fund the necessary programs to ensure adequate dam safety.

BACKGROUND

In 1929, California established the California DSOD in the aftermath of the St. Francis Dam Failure. DSOD regulates more than 1,250 dams in the state. DSOD's responsibilities include independent annual inspections of each dam, reviewing and approving new dams, dam enlargements, repairs, alterations, and removals to ensure that the dams and their appurtenant structures are designed, constructed and maintained to ensure the safety of the public. DSOD also performs in-depth independent evaluations. The Federal Energy Regulatory Commission co-regulates about 200 hydropower dams with DSOD in the State of California. Some large public agencies have dam safety programs within their organizations, while smaller and individual dam owners generally lack the resources to have in-house expertise. Repairs to dams are often initiated as a result of DSOD and FERC evaluations and processes, and only occasionally would dam owners discover issues on their own.

FIGURE 1 - SOURCE: PUBLIC POLICY INSTITUTE OF CALIFORNIA



Dams need regular routine maintenance, inspections, repairs and in-depth evaluations to maintain their reliability and provide for safe operation. In February 2017, historic rainfall led to a major incident at the Oroville Dam. Approximately 180,000 people were evacuated and the emergency spillway was utilized.. The Oroville incident highlights the need for increased scrutiny of original construction records, thorough engineering evaluations, and the associated funding for these complex studies and to allow for the resulting required maintenance and repairs for all dams and their appurtenant structures.

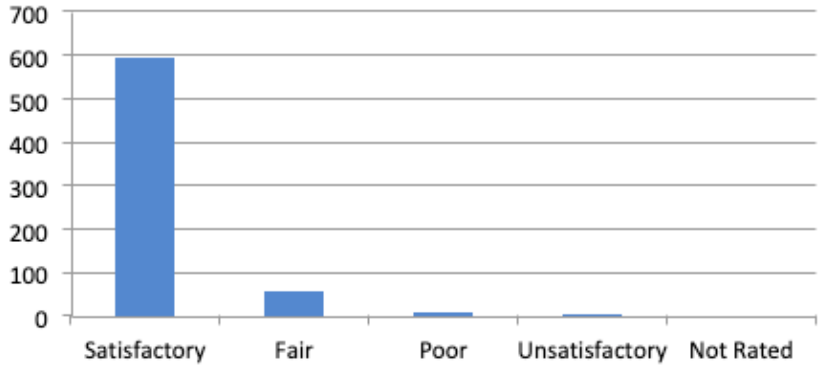
CAPACITY AND CONDITION

Dams provide 70% of California's urban and agricultural water supply and are an important component in providing flood management. Population growth and climate change will create a larger dependence on the existing reservoirs within the State to provide adequate water supply and protect the public from more extreme rainfall events.

Environmental regulations and political challenges have caused dam maintenance projects, even in emergencies, to be lengthy, costly, and difficult. New dam construction is nearly impossible.

While most dams are built for a 50-year lifespan, the average age of a California dam is 70 years old. As dams age, more thorough inspections and evaluations are needed with corresponding timely remediation. Increased funding for rehabilitation of dams and their appurtenant structures are needed to extend their life and provide protection to the public.

FIGURE 2 - 2018 CONDITION ASSESSMENT RATING OF STATE REGULATED HIGH AND EXTREMELY HIGH HAZARD POTENTIAL DAMS



In September 2017, DSOD released a listing of the condition of dams. More than 30 dams operate with restrictions and may require repairs. However, the timeline for repair and rehabilitation work is lengthy. Although operating restrictions minimize public risk, water supply and their intended function are limited. Of the 105 federally-owned, high hazard dams, three are listed as satisfactory condition, 40 are listed as fair, 40 are listed as poor, and 14 are unsatisfactory, the lowest condition rating.

There are also 251 federally-owned dams in California listed in the 2018 National Inventory of Dams. Of the federally-owned dams, 105 are high hazard, 27 are significant hazard, 61 are low hazard, and 68 are undetermined hazard potential. Of the 105 federally-owned, high hazard dams, three are listed as satisfactory condition, 40 are listed as fair, 40 are listed as poor, and 14 are unsatisfactory, the lowest condition rating.

OPERATION AND MAINTENANCE

Dam operation and maintenance must include frequent and thorough inspections, followed by corrective actions to address deficiencies. Scheduled maintenance, performed regularly, is the surest and cheapest insurance against the costly failure of dams and their components, provided of course that inspections adequately identify problems and that repairs are properly engineered and constructed. The investment in this infrastructure is economically sound when comparing the costs of maintenance to the exponentially greater cost to repair failed dams and the resulting collateral damage.

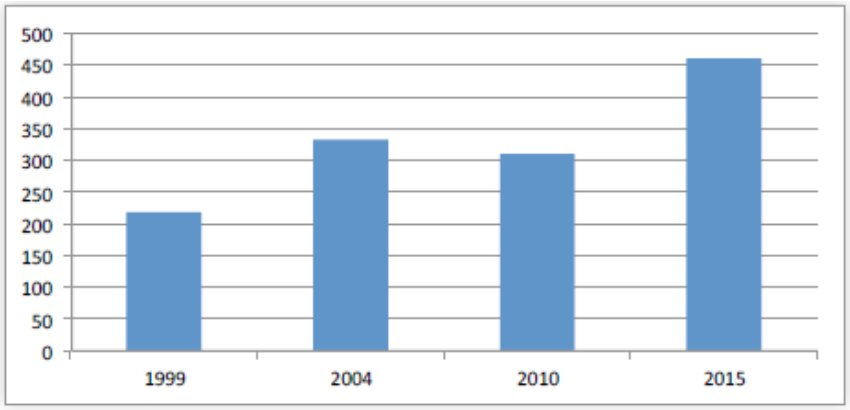
The proactive search for identifying deficiencies is a vital part of dam stewardship. Dam problems may be hidden or difficult to identify. Therefore, dam owners and regulators must have a sufficient number of qualified engineers to inspect and evaluate dams. Engineers must assess the dam based on the original construction which is sometimes difficult and time consuming and often requires costly explorations and evaluations. Careful consideration should be given to ensure that engineers and dam safety reviewers be trained and well qualified. In addition, any regulatory body, even if internal to an agency, must have appropriate enforcement authority and be functionally independent from any organization that own the dams.

DOSD's budget has increased in recent years. In 2015, available funding was approximately $13 million, up from $11 million in 2010. The budget is significantly higher per regulated dam than the national average. In the aftermath of the Oroville Dam incident, additional funding was required to fund DSOD oversight of in-depth evaluations. This funding was paid for by increasing dam owner regulatory fees by approximately 35%. The additional revenue funds new programs to oversee the development of Emergency Action Plans, dam spillway studies, inundation modeling and increased inspection. The sizable regulatory fee increases are a hardship for small dam owners.

PUBLIC SAFETY

Of the more than 1,250 dams regulated by the DSOD, 681 are considered high hazard. There are also 251 federally-owned dams in California listed in the 2018 National Inventory of Dams. Of the federally-owned dams, 105 are high hazard, 27 are significant hazard, 61 are low hazard, and 68 are undetermined hazard potential. A high hazard dam is a one in which failure or mis-operation is expected to result in loss of life and may also cause significant economic damage.

FIGURE 3 - ASDSO CALIFORNIA DAM SAFETY SUMMARY 2015



Emergency Action Plans and inundation maps have been required for many years by statue at Title 2, Government Code, Section 8589. However, this law has not been enforced. In the aftermath of heavy rainfall and the high-pro Oroville Dam incident in 2017, the state legislature voted to require all high hazard and significant hazard dams under their jurisdiction to develop Emergency Action Plans and update inundation maps for emergency preparedness. The deadline for all high hazard dams to develop these plans was January 1, 2019, but at time of print, new EAP numbers are not available. EAPs improve dam safety by identifying potential emergency conditions at dams and outline a preplanned set of actions to help prevent loss of life and minimize property and environmental damage. In 2018, just 74% of high hazard dams in California had EAPs, lower than then the national average of 77% reported in 2017 by the ASCE Infrastructure Report Card.

FUNDING AND FUTURE NEED

Many dams go unrepaired due to limited available resources by their owners. Few federal funds are specifically reserved for non-federal dams. Congress authorized the High Hazard Potential Dam Rehabilitation program in 2016 but to date has appropriated limited funds. Funding provides a vital source of revenue for state and local dam rehabilitation projects. On occasion, limited state funds have been made available for the repair of dams. State and local funding for publicly-owned dams could be made from a variety of sources, including bonds, water rates, dam safety fees, and general fund monies. In 2014 California voters approved Proposition 1, which included $2.7 billion for new dams to improve the state's water supply, but there were no funds available for the repair of dams.

Funding is needed to perform scheduled maintenance and repairs of deficiencies found during inspections. O&M funding needs are often significantly more than dam owner budgets will allow. This is especially true for many smaller dam owners. Estimates from the Association of State Dam Safety Officials and dam owners indicate that in excess of $2.5 billion in funding is needed to repair dams statewide. These estimates do not include the current estimated cost of the Oroville dam repair, which is projected to exceed $1 billion. Nor does the amount include the $2.5 billion dollars of Proposition 1 funding, which is being directed to the construction of three new dam projects in the state.

Another challenge facing dam owners are lengthy and costly environmental reviews which can delay necessary repairs. An expedient method of fast-tracking urgent repairs is needed, especially for immediate and urgent life-safety repairs.

RESILIENCE

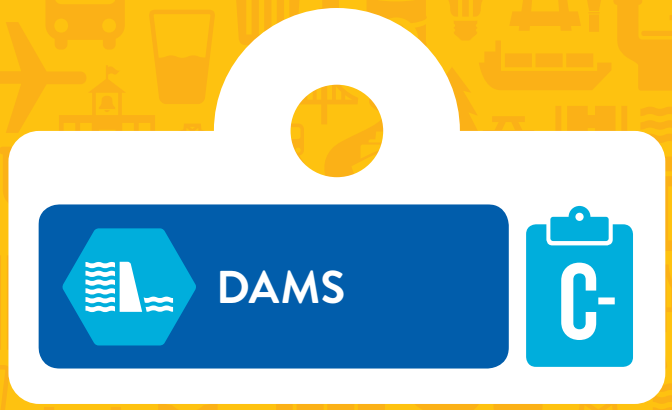
The California Department of Water Resources reported in April 2018 that the Sierra Nevada snowpack was approximately 50% of its historical average. Comparatively, the year before snowpack was over 160% of its historical average. This phenomenon, "precipitation whiplash," has major implications for the state's population and agricultural production capabilities. Dams are critical to regulating the supply of water and storing excess precipitation for use during dry periods. Sufficient capacity at reservoirs will be extremely important as climate change worsens the rapid transitions between extreme wet and dry spells.

It's also important to acknowledge the risk dams pose should a major earthquake impact the state. Because of this, DSOD has required dam owners to evaluate the seismic safety of their dams. Dams with deficiencies have either been repaired or have operational restrictions to mitigate risks and ensure public safety if earthquake damage were to occur.

INNOVATION

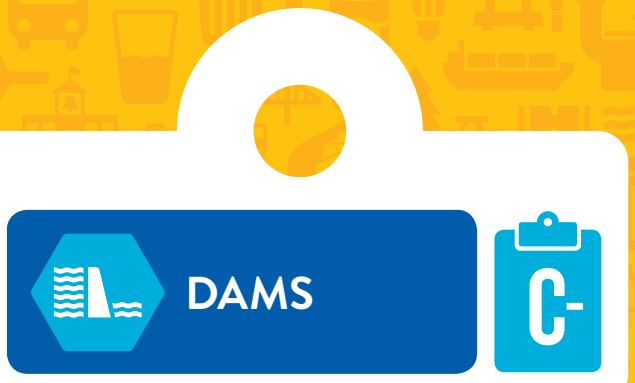
Over the last several decades, innovative technologies have been implemented in dam operations and evaluations. Specialized products are being developed to allow for better and more timely repairs. At major dams, remotely monitored instruments measure and record dam conditions. Major valves and spillway gates can now be remotely operated to allow more instantaneous operations. At some dams, seismographs have been installed to monitor how dams respond to earthquakes, which provide valuable data for the engineering analysis of the dam. Recent advances in technology can also greatly improve dam inspection and repair efforts. Advances in improved inspection technology and imaging such as GPS data, LIDAR, automated survey systems and ground penetrating radar can be used to expose defects on and within dams, spillways and buried pipelines and provide real time data to dam operators. However, the majority of smaller dams do not yet have these technologies.

Because it is difficult to build new dams or increase existing dam capacity, innovative operational methods are needed to address the primary functions of dams: water storage and flood control. Use of modern meteorological forecasting including snow-melt predictions and storm forecasting can help dam owners predict the best times of the year to release water for flood control and store water for maximum water supply. Innovations in this area also hold the potential to increase the percentage of energy produced with no increase in environmental impact.



RECOMMENDATIONS TO RAISE THE GRADE

- Empower the California DSOD by providing additional tools to enforce timely repairs of deficiencies.
- Develop new laws and approaches to expedite environmental reviews associated with the repair of dams. Initiate advanced environmental coordination with Resource Agencies and prepare standby mitigation plans so that regulations do not inhibit necessary repairs. Resource Agencies should balance the environmental impact of repairs against the exponentially greater adverse impact of dam failure.
- Seek regional solutions, interagency cooperation and consider technical advances such as flood forecasting to better coordinate and balance water supply and flood control space.
- Provide training programs to ensure qualified engineering inspections and evaluations are being conducted by well qualified, experienced, and professional engineers. Regulatory agencies should continue to thoroughly review inspection reports and designs, and require independent expert technical review boards, when appropriate.
- Provide research to improve technology for better dam operation strategies, dam safety monitoring and complex evaluations of dams.
- Provide simplified grant funding and low-cost loans for dam owners of high hazard dams for repairs and maintenance; urge Congressional appropriations for the High Hazard Potential Dam Rehabilitation Program, which provides federal grant assistance for the repair, rehabilitation, or removal of non-federally owned high hazard potential dams.
- Ensure dam owners understand their risks and prioritize upgrades based on those risks. Continue to urge dam owners to fund timely maintenance to avoid more costly repairs or remediation of damage. Emphasize inspections and maintenance to extend the useful life of dams.



RECOMMENDATIONS TO RAISE THE GRADE (CONT.)

- **Educate dam owners and those with property around dams about dam basics to avoid unintentional impacts to dam safety (e.g. filling in emergency spillway to increase lakefront.)**
- **Dam owners should provide independent engineering oversight of the state's Critical Infrastructure dams. This work must be performed by qualified engineers, using expert technical review boards for major design projects or studies.**
- **Regulatory agencies such as DSOD or internal dam safety groups at large federal agencies should have appropriate enforcement authority and be functionally independent of their parent organizations that own and operate dams.**

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DRINKING WATER

EXECUTIVE SUMMARY

Providing effective water supply and treatment in California has always been challenging due to great variations in water availability and demand from year to year across the state. Historically, California has adapted to this challenge by building a vast network of water storage and conveyance facilities. Today, much of this network is aging. In San Francisco, approximately 150 of the 1,200 miles of water mains are over 100 years old. The Los Angeles Department of Water and Power reports that approximately 28% of the city's 6,780 mainline pipes were installed before 1938. And while California's urban centers generally have state-of-the-art water treatment facilities, many of the state's rural areas are dependent on wells, many of which are inadequate in dry years. To fund and finance necessary drinking water infrastructure projects, water rates have risen, and voters passed both Proposition 1 and Proposition 68 to finance water quality and supply projects. While the additional revenue is helpful, it does not cover all needs throughout the state.

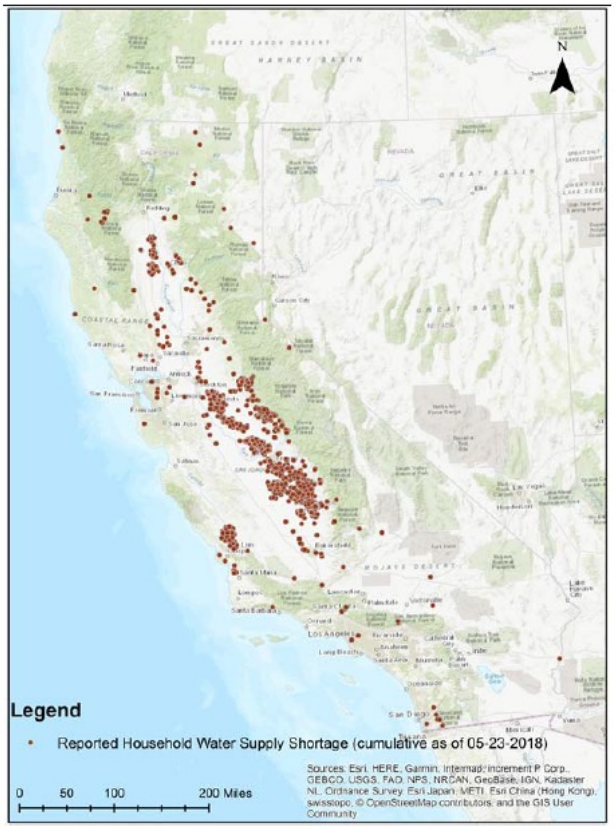
In 2017 the Environmental Protection Agency reported that a 20-year infrastructure need of $51 billion exists in California for necessary transmission, distribution, treatment and storage.

To address the challenges identified in this report, several key actions are recommended which closely follow the Governor's 2016 Water Action Plan to achieve statewide goals for reliability, restoration and resilience. This plan recognizes there are no single actions that will fix the problem. Rather it reflects a portfolio approach in which California not only adapts to a "new normal," but achieves economic and environmental resilience and reliability

CAPACITY

Any discussion about drinking water infrastructure in California must include an acknowledgement about the availability of water, which can vary statewide within a single year and vary widely year to year. For example, in 2016-17, northern California's water infrastructure was strained to capacity handling near-record levels of rain and snow, while, at the same time, supply was limited in southern California due to persistent drought conditions. To thrive in the future, drought and climate change impacts must be addressed to avoid further groundwater depletion and subsidence. The 2014 Sustainable Groundwater Management Act has begun to address the 2 million acre-foot annual shortfall, but more work is needed to ensure a sustainable supply for California's water needs.

FIGURE 1 - LOCALLY REPORTED HOUSEHOLD WATER SHORTAGES, DWR, CUMULATIVE TO 2018



CONDITION

California's drinking water infrastructure is aging. In many places, the complex system of filtration plants, pipes, pumps, and more are nearing the end of their useful life. In some places, utilities have raised rates and leveraged bonds and are increasing rates of repair and replacement, but in other areas, more attention is needed.

In San Francisco approximately 150 of the 1,200 miles of drinking water pipes are over 100 years old. Old pipes leak over time due to age, ground movement and other factors. This results in significant loss of treated drinking water. In 2015, the California Legislature passed SB 555, which tasked the State Water Resources Control Board with developing formal water loss standards for urban water agencies, which will go into effect in 2020. However, major water agencies have been conducting water audits, following EPA standards, and have installed advanced leak monitoring, which have helped prioritize main replacements to effectively control water loss. For example, the San Francisco Public Utilities Commission reported in 2018 they were replacing between 12 and 15 miles of pipeline annually, or about 1% each year.

Across the Bay, the East Bay Municipal Utility District serves 1.3 million customers in 28 cities with more than 4,200 miles of pipeline. Much of the system was built between the 1930s to the 1960s. EBMUD has typically replaced 10 miles per year, in recent years has increased this rate to 15 miles per year, and has plans to ramp up 20 miles or more per year in order to reduce leaks and improve system reliability.

In Southern California, the City of San Diego Public Utilities department operates over 3,000 miles of pipeline. They report that cast-iron mains, which have been in service for almost 100 years, comprise 10% of the system but account for 60 to 80% of water main breaks. While water main breaks are a problem in San Diego, it should be noted that numbers reported by the agency to show the number of breaks has steadily decreased over the past six years, due to approved rate increases supporting necessary repair and replacement projects.

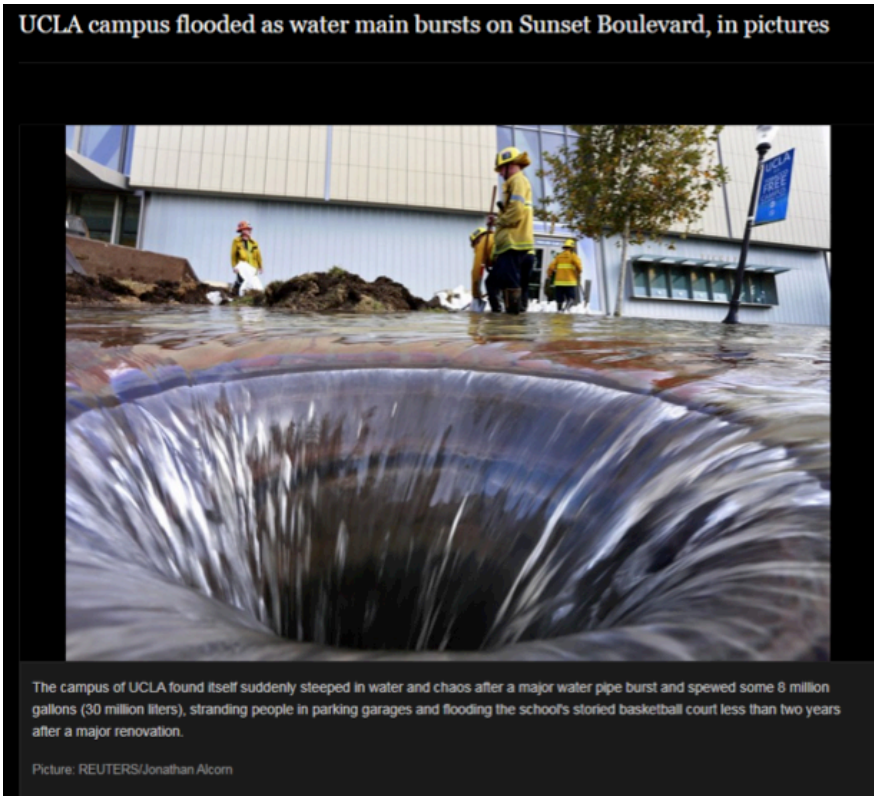
Los Angeles also struggles with aging drinking water pipelines. According to the Los Angeles Department of Water and Power (LADWP) 2017-2018 Water Infrastructure plan, about one-third of the city's 6,780 miles of water pipes were installed before 1938 and will reach the end of their useful life in the next two decades. LADWP is prioritizing the replacement of leaky mainline pipes as well as investing $6.3 billion in water storage and filtration systems over the next five years.

California's urban centers generally have state-of-the-art water treatment systems. However, many of the state's rural areas are not as well equipped. The San Joaquin region includes 329 of the 3,323 water systems in the state, and most of those systems are dependent on wells, many of which need treatment to mitigate contaminated water. Eighty-three percent of such systems serve less than 1,000 people or 400 service connections, often to disadvantaged communities, and sometimes provide unreliable service due to inadequate infrastructure. More must be done to assist operators of struggling small water systems.

OPERATION AND MAITENANCE

Cities are beginning to prioritize the repair and replacement of aging water treatment and distribution systems. California water agencies are focusing on advanced asset management to maximize infrastructure service life and reliability. However, the infrastructure in many communities is near the end of its useful life. In Los Angeles, 20% of pipes account for about half of all water main leaks and replacing them is a looming financial problem. The DWP has a $1.3 billion plan to replace 435 miles of deteriorating pipe from 2015-2025, but difficult questions remain about how the agency will find the money, how much the plan will inconvenience commuters, and whether the utility can ever catch up with its aging infrastructure. To reach its goal by 2025, the DWP will need to more than double its rate of pipeline replacement.

FIGURE 2 - JULY 2015 UCLA MAIN BREAK CLAIMS $13 MILLION IN FLOOD DAMAGE



FUNDING

Statewide, approximately 84% of water infrastructure funding is from local water rates, with the balance coming from state (13%) and federal sources (3%), which is typical of private and publicly operated drinking water systems nationally. According to a national survey of the 30 largest metropolitan areas in the country, in 2016 the average monthly water bill for a family of four was $77.25 in San Diego, $75.00 in San Jose, $57.79 in Los Angeles, $41.17 in San Francisco, and $21.96 in Fresno. Local funding sources are threatened by various laws passed over the years such as Propositions 13, 218, and 26, which have constrained the ability of local agencies to raise revenue for essential programs.

Water rates have been rising in California, in part to help fund drinking water infrastructure repairs and upgrades. However, there is significant historical pressure to maintain low rates. As a result, rate increases have not covered all needs and scarcely begin to address impacts of climate change. The State Water Resources Control Board is drafting a plan to address affordability in an effort to ensure water rate increases, while critical to address deferred maintenance, are not disproportionally impacting disadvantaged communities. Currently, the agency reports that over 50% of water providers do not offer low income customers with rate assistance.

FUTURE NEED

Water needs will grow as the State's population rises to an estimated 44.1 million by 2030. However, reduced demand as a result of agricultural and urban conservation measures and recycled water programs have shown success.

Key components of California's water system include the State Water Project and the federal Central Valley Project, both of which serve to move water from wetter parts of the state to more arid regions. The Sacramento-San Joaquin Delta provides water to both of those systems, but it's jeopardized by aging levees, land subsidence, seismic and flood threats, regulatory restrictions, and sea level rise. To address these problems, lawmakers in Sacramento have proposed the $17 billion "California WaterFix" program to convey water from upstream of the Delta to pumping plants in the south Delta. Much work remains to bring that project to fruition.

A huge funding need exists to bring drinking water infrastructure throughout California up to 21st century standards. In 2017, the U.S. Environmental Protection Agency (EPA) reported that a 20-year infrastructure need of $51 billion exists for necessary transmission, distribution, treatment and storage in California.

In recent years, California voters have supported bonds for drinking water infrastructure. In 2014, Proposition 1 provided $7.5 billion in water bonds, including $520 million to improve water quality, $900 million for projects that prevent or clean up contamination of groundwater, and $725 million for water recycling and advanced water treatment technology projects. Additionally, in June 2018, California voters approved Proposition 68 which authorized $4 billion in bonds for, among other things, water quality and supply projects. The benefits from these ballot measures have not yet been fully realized as projects are still underway and funding has yet to be distributed.

While bond measures and local initiatives are helpful, they are insufficient to comprehensively address drinking water infrastructure needs in California. Recently passed bonds cover less than half the needed amount identified by the EPA.

PUBLIC SAFETY

Typically, water quality standards in California exceed federal standards. Overall, according to the California State Water Resources Control Board 2016 Annual Compliance report, "water systems in California have a high rate of compliance with [state] drinking water standards. However, more work needs to be done to deal with serious water quality problems and ongoing violations particularly with small local community systems." This statewide concern prompted California, in 2012, to legislatively recognize a human right to water.

RESILIENCE AND INNOVATION

With much of the state facing threats from natural disasters, the demands to retrofit and prepare for hazards is ever present. According to former U.S. Geological Survey seismologist Lucy Jones, water infrastructure is "the single biggest vulnerability we're facing in Southern California." Recognizing this threat, seismic retrofits are being made in the most earthquake prone zones along California's coastal cities. For instance, since 1998, the Metropolitan Water District of Southern California has invested over $250 million in seismic upgrades of key structures. The San Francisco Public Utilities Commission has invested $4.8 billion in its Water System Improvement Program, and many agencies statewide have done the same. However, smaller agencies and rural systems lack the necessary financial resources to ensure resilience.

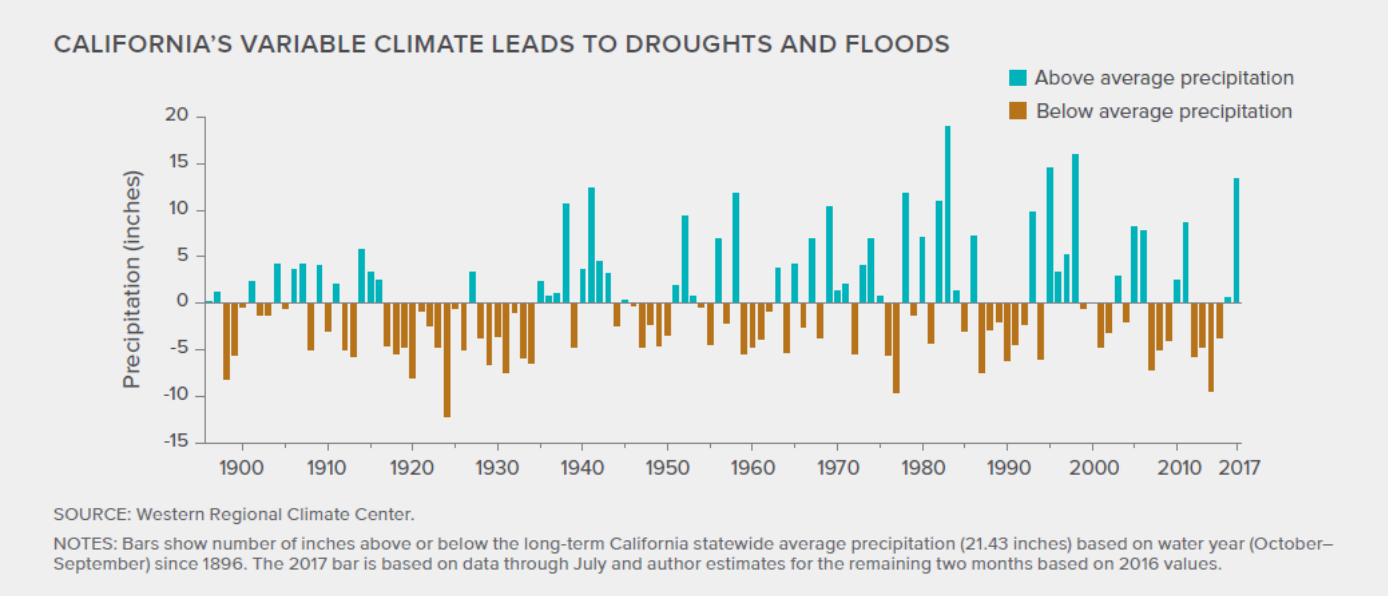
In addition to retrofitting drinking water infrastructure to improve its ability to withstand natural disasters, many agencies across the state are also increasing reliance on local water sources. The scarcity of water across the state has presented an opportunity to drive innovation.

California has taken the lead in developing integrated regional water management plans and projects that reflect the benefits of collaboration and integrated approaches to addressing multiple water resource needs. In southern California, for example, the Metropolitan Water District of Southern California is working toward sourcing 65% of its water from local supplies by 2040, up from 41% in 1990, in an effort to improve system resilience.

The Santa Clara Valley Water District is also a national leader in deploying cutting-edge technology to enable recycled and reclaimed water, with a goal of using it for 10% of the area's total water supply by the year 2025. Orange County Water District has also taken the lead in using highly treated recycled water through its ASCE Opal Winner Groundwater Replenishment System project to recharge groundwater basins thus reducing dependence on increasingly expensive imported water.

Desalination also holds promise to boost resilience, and even with its high capital and O&M cost, has proven to be cost effective in very arid regions. Groundwater basin desalination plants particularly have been very effective in helping to clean up high saline inland groundwater supplies. For coastal communities, seawater desalination is an option to diversify water portfolios as the San Diego County Water Authority has found with the construction of its 40 billion gallons seawater desalination facility serving drinking water to residents of San Diego County.

FIGURE 3 - CALIFORNIA'S VARIABLE CLIMATE -
SOURCE WESTERN REGIONAL CLIMATE CENTER, PUBLIC POLICY INSTITUTE OF CALIFORNIA



SOURCE: Western Regional Climate Center.

NOTES: Bars show number of inches above or below the long-term California statewide average precipitation (21.43 inches) based on water year (October–September) since 1896. The 2017 bar is based on data through July and author estimates for the remaining two months based on 2016 values.

RECOMMENDATIONS TO RAISE THE GRADE

- **ADDRESS AGING INFRASTRUCTURE NEEDS.** As water rates are usually set by locally elected boards and commissions that generally run on low water rate platforms, there is a need for additional consumer education on the current funding needs and the negative impacts of further delaying action to facilitate fair and appropriate water rates needed to fund infrastructure improvements for all water systems statewide.
- **CONTINUE TO MAKE CONSERVATION A CALIFORNIA WAY OF LIFE.** The Water Conservation Act of 2009 requires a 20% reduction in urban per capita water use by December 31, 2020. Though a great start, more can and must be done. Key areas of future focus include expanded development of sustainable water supplies at the regional level and agricultural water use efficiency.
- **INCREASE REGIONAL SELF-RELIANCE AND INTEGRATED WATER MANAGEMENT ACROSS ALL LEVELS OF GOVERNMENT.** The State's Integrated Water Management Planning program is a 21st century approach that supports regionally-driven, multi-benefit projects that increase regional self-reliance and sustainable practices. Funding for the program should be expanded to foster improved alignment between land use and water, provide assistance to disadvantaged communities, and support better use of local water supplies such as recycling, stormwater capture, and desalination.
- **ACHIEVE THE CO-EQUAL GOALS FOR THE DELTA.** The co-equal goals of the Delta Stewardship Council are to provide a more reliable water supply for California and to protect, restore and enhance the Delta ecosystem. Implementation must start on the Delta Plan, including California EcoRestore, which will restore more than 30,000 acres of critical Delta habitat.
- **MANAGE AND PREPARE FOR DRY PERIODS.** Temporary shortages caused by extended, severe dry periods will become more frequent with climate change. Effective management of water resources through all hydrologic conditions will reduce impacts of shortages and lessen costs of response actions. Among the necessary steps to secure more reliable water supplies is updating dam and delivery operations to respond to extreme conditions. This will require continued improvement in water forecasting and cooperation among agencies.

RECOMMENDATIONS TO RAISE THE GRADE (CONT.)

- **EXPAND WATER STORAGE CAPACITY AND REDUCE RELIANCE ON IMPORTED WATER. We need to expand our state's water storage capacity, whether surface or groundwater, big or small, to address the effects of drought and climate change. Climate change will bring more frequent drought conditions and could reduce by half our largest natural storage system—the Sierra snowpack—as more precipitation falls as rain rather than snow, and as snow melts earlier and more rapidly. Moreover, we must better manage our groundwater basins to reverse alarming declines in groundwater levels.**

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ENERGY

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RENEWABLE ENERGY WINDMILLS LINE THE MOUNTAINTOPS OF PALM SPRINGS AT SUNSET
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ENERGY

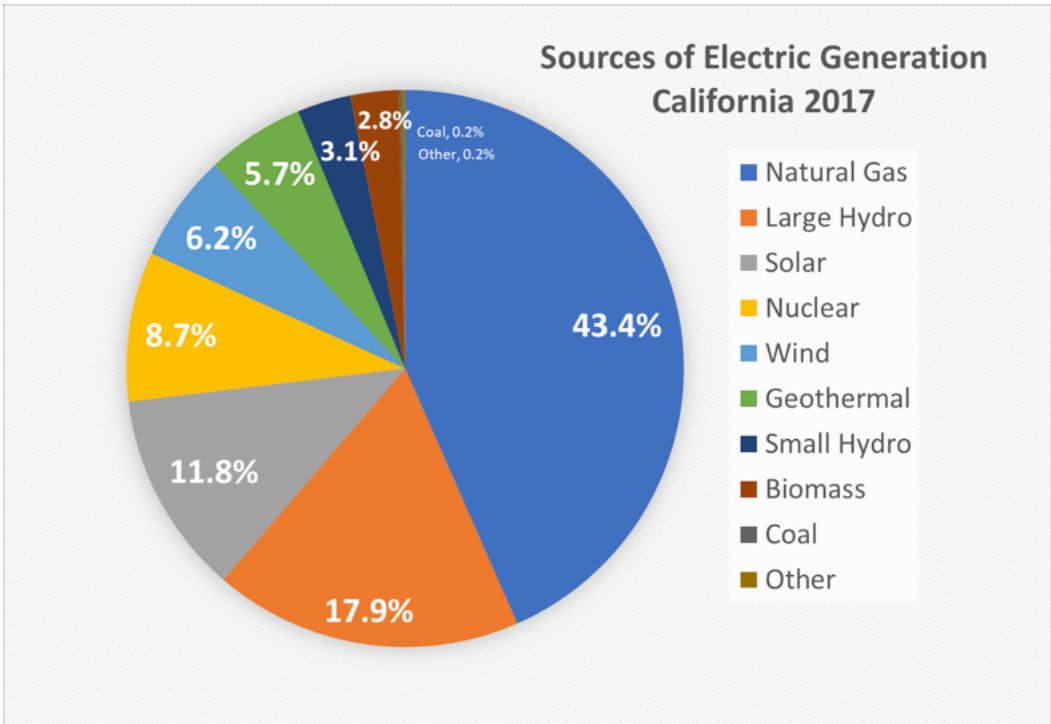
EXECUTIVE SUMMARY

California receives and generates energy through a variety of sources, primarily from natural gas, nuclear, and utility-scale solar and wind. Although under duress, California's energy systems have generally met the needs of consumers. However, the threat of natural and anthropogenic stresses, including fires, seismic events, storms, and gas storage mishaps, as well as the elevated cost of service, threaten energy system sustainability. Aging equipment, inferior design, and poor right-of-way vegetation management have caused electrical and oil/gas infrastructure incidents and, in some cases, resulted in deadly wildfires. In another trend, the increased renewable energy contribution has had dramatic impacts on the overall capacity of the California electric grid. California now has a legislatively-mandated target of 100% clean energy by 2045, but the true cost of building infrastructure to support this goal is unknown. Meanwhile, natural gas continues to help meet peak electric and heating demands, but the state depends on in-state production and imports that requires extensive processing resulting in high pricing to the consumer.

INTRODUCTION

California's roughly 40 million citizens rely on energy produced by an array of sources, including solar, nuclear, hydroelectric, wind, and geothermal sources and in-state or imported coal, oil, and natural gas. California's 2017 in-state net electric generation, by sector, was obtained from the California Energy Commission and documented on Figure 1. Electric power is delivered by conventional transmission and distribution (T&D) circuits, while oil/gas energy is delivered by pipeline from in-state sources and refineries.

FIGURE 1 SOURCES OF ELECTRIC GENERATION (CALIFORNIA 2017)



Source: California Energy Commission 1

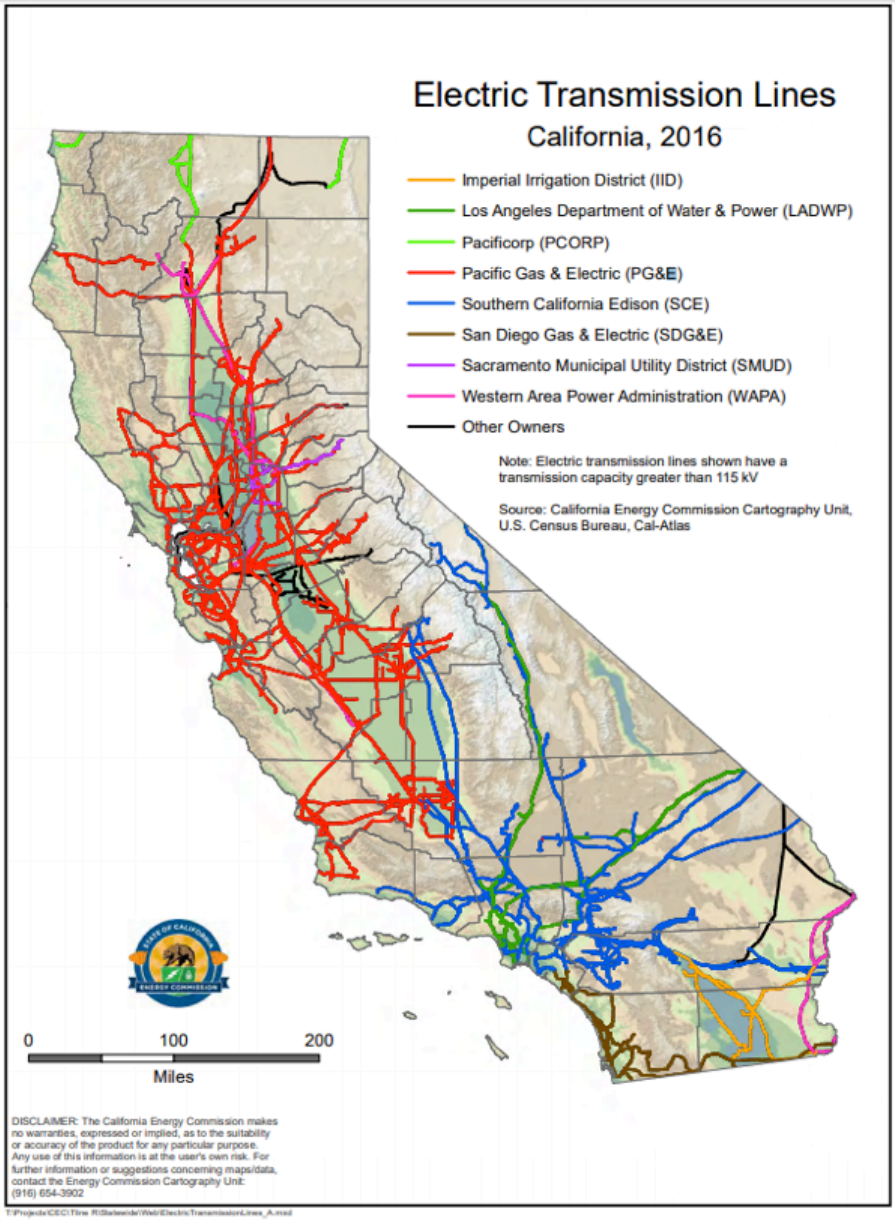
California is an energy-rich state. Nearly half of the state's net electricity generation in 2017 was from renewable resources, including hydropower. Natural gas-fired power plants accounted for 43.4% of California's in-state net electricity generation the same year. Nuclear power production is decreasing; in 2017, it accounted for less than 10% of total generation in the state, down from 20% in 2012. Southern California Edison (SCE) shut down the nuclear generating facility at San Onofre (SONGS) in 2013, which was generating 2,200 megawatts of power. Pacific Gas & Electric (PG&E) will be closing Diablo Canyon, which generates 2,160 megawatts of power, in 2024. It should be noted that Diablo Canyon, which currently provides 8.7% of California's electricity, is the last remaining nuclear plant, and will soon be replaced with other generation. California's current reliance on energy sources from outside the state includes 25% of electricity supply and over 95% of natural gas consumed. An increasing fraction of oil comes from sources outside the state as well. This reliance on supplies from outside the state is concerning given the challenges of building and maintaining a delivery infrastructure.

Electric T&D lines span the state and are owned and operated by a variety of investor owned and publicly owned utilities. The three largest investor-owned utilities, which provide approximately 75% of electricity supply in the state, are SCE, PG&E, and San Diego Gas & Electric (SDG&E). In California, utilities are regulated by the California Public Utilities Commission (CPUC).

Meanwhile, there are approximately 40 publicly owned utilities in the state, which together provide approximately 25% of electricity supply in California. Publicly owned utilities are non-profit entities and may be organized as city departments, municipal or irrigation districts, community choice aggregators (CCAs), or rural cooperatives. Publicly owned utilities typically serve between 1,000 and 100,000 customers, but the Los Angeles Department of Water and Power, as the largest publicly owned utility, provides service to 2.9 million customers.

Figure 2 illustrates the transmission lines and their associated owner/operators can be viewed in Figure 2.

FIGURE 2 – ELECTRIC TRANSMISSION LINES (CALIFORNIA 2016)



California's utilization of renewables and energy storage will grow. Assembly Bill 32 (AB 32) mandates California to reduce its greenhouse gas emissions to 40% of 1990 levels by 2020. In September 2018, Senate Bill 100 (SB 100) was signed into law and requires California to generate 100% clean energy by 2045, which includes renewables such as wind and solar, non-carbon emitting sources (hydro), and battery storage.

CAPACITY

Increased generation of renewable energies is having dramatic impacts on the overall capacity of the California electric transmission grid. Solar energy production peaks mid-day and then dips as the sun goes down (sometimes referred to as a "duck curve"). Currently, if too much solar power is generated without demand, it is curtailed or transmitted elsewhere to avoid overloading and possibly damaging the power grid. This has resulted in several instances of California paying neighboring states to take its renewable power production. Grid managers are currently unable to store excess solar power generation to mitigate increasingly drastic supply and demand swings.

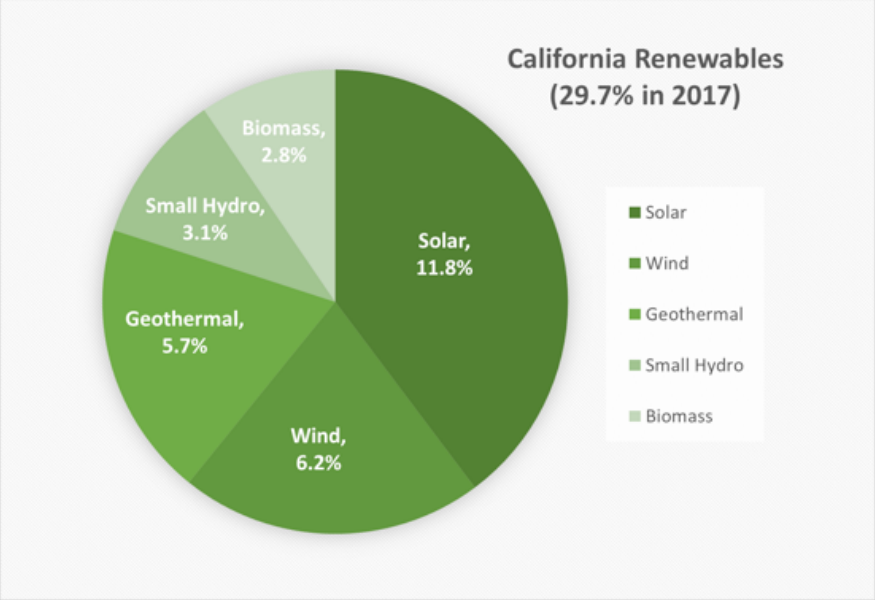
While solar is creating new capacity challenges, natural gas continues to help meet peak electric and heating demands, as it has for decades. Natural gas storage will continue to be important in California's energy future as daily peak use, particularly in the winter heating season, and until it has been displaced by either solar storage or other clean technologies.

California is considered a natural gas energy island, bordered between the Pacific Ocean and the Arizona/Nevada state lines, with no transmission pipelines over the Sierra Nevada Mountains. Transportation fuels are principally derived in-state.

Electric vehicles represent another one of the many dynamic influences that are driving fast-paced modernization of the grid in California. Currently, the transportation sector relies heavily on petroleum. California's motor gasoline and jet fuel consumption rates are the highest in the nation. The state is incentivizing investments in electric vehicle charging infrastructure.

With the passage of SB 100, the electrical grid capacity is moving towards 100% clean energy in 2045. California is already at 29.7% renewables, as shown on Figure 3, and since SB 100's planning target of 100% for 2045 also counts large hydro (currently at 17.9%), this indicates that California is currently at 47.5% of that target.

FIGURE 3 – CALIFORNIA RENEWABLES (2017)



CONDITION

Utilities typically do not share the age or condition of their electric infrastructure. However, a proxy for condition can be recorded outages. A long-term study by the U.S. Department of Energy showed that between 2008 and 2013, an average of almost 4 million Californians were impacted by electricity outages each year. The leading causes of electric outages were faulty equipment and human error. Outages remain a major concern with California having the most reported outages among states in 2015, 2016 and 2017 according to the Eaton Blackout Tracker. In 2017, 438 outages were reported in California, over double second place Texas. Nearly 3 million people in California were impacted by these outages.

In crude oil/petroleum and gas product pipelines, respectively, the leading event impact from 1986 to 2014 was corrosion and equipment failure. The leading disruption to California's natural gas systems have included corrosion, fuel supply problems, and human error. In 2015, the 112-day leak at the Aliso Canyon gas storage facility released about 5 billion cubic feet of methane into the atmosphere, making it by far the largest greenhouse gas emission event in US history. This prompted regulatory changes and yielded emergency addition of large-scale battery storage.

The public utilities are modernizing their grids to accommodate the changing energy market. For example, from 2018-2020, SCE is replacing over 2,000 miles of cable, upgrading lower voltage wires so they can better accommodate two-way power flows, automating more than 850 distribution circuits, and replacing overhead conducts and circuit breakers. Developing the next generation electric grid to meet GHG reductions will drive technological innovations in Transmission and Distribution/Information Technology programs.

California is the only state in the nation that exempts itself from national standards for minimum designs of overhead lines. The National Electrical Safety Code (NESC) is followed by the other 49 states, District of Columbia, and all U.S. territories. The NESC requires many ASCE Standards and Manuals of Practices be followed. California uses its own General Order 95 (GO 95), which is antiquated and in great need of modernization. As a result, California's minimum design weather loadings for overhead electric lines are lower and minimum structural requirements are weaker than the rest of the U.S. This creates unreliability as overhead lines are impacted and sometimes taken out during inclement weather.

FUNDING

As of July 2018, electricity cost an average of 18.41 cents per kilowatt hour. California households are paying about 40% more than the national average for electricity according to 2018 data from the U.S. Energy Information Administration. Those costs are expected to increase significantly with the implementation of SB 100 because embedded renewable goals will require large T&D investment to add renewable capacity.

The CPUC is undertaking an effort to modernize the CA electric grid into a "Smart Grid" that better utilizes existing and emerging technology. Changes include providing customers with the option to install monitors in their homes that provide energy costs in real-time and allow them to adjust usage in response to changing prices. The CPUC California Smart Grid 2018 Annual Report to the Governor and Legislature has reported the CPUC cannot attest to the cost estimates of Investor-Owned Utilities smart grid savings. The CPUC report also does not give exact costs for constructing a new smart grid, implementing deployment of storage to enhance renewable energy use, or the if rates will rise or fall. It is not clear whether sufficient funding is available to meet the various divergent energy goals in California.

In 2018, the California utility regulators made a major investment in the promotion of electric vehicles, with a total of $776.5 million to fund and evaluate projects that will promote the use of EVs. For example, SDG&E will spend $137 million on rebates for households installing up to 60,000 charging stations. Meanwhile, PG&E and SCE are spending $258 million and $343 million, respectively. The latter two utilities are prioritizing the installation of charging infrastructure for buses, electric trucks, and heavy-duty equipment. Funding for this effort comes from ratepayers through charges to households based on energy consumption

There are major implications for infrastructure that is expected to accommodate increased utilization of electric vehicles. Communities aren't necessarily built to accommodate spikes in power demand created by large numbers of people plugging in their cars at night. Households with multiple electric vehicles, or neighborhoods with widespread adoption, can overload transformers and potentially cause damage or outages. For example, the Sacramento Municipal Utility District (SMUD) reports that approximately 17% of transformers may need replacements as a result of electric vehicle-related overloads. Each replacement costs approximately $7,400.

OPERATION AND MAINTENANCE

Aging equipment, inferior minimum design requirements, and poor right-of-way vegetation management causes electrical and natural gas infrastructure incidents. California's deadliest wildfires have burned in the last 15 years. In June 2018, California state investigators faulted PG&E for power lines that caused a series of deadly blazes in the fall of 2017 and 2018. In January of 2019PG&E filed for bankruptcy protections as a result of lawsuits related to the fires.

Investigators looking into the fires found that trees were too close to power lines and poles failed under wind loadings, causing energized lines to fall into vegetation. PG&E wrote in a court filing that such a move would necessitate a $75 billion to $150 billion investment and the hiring of 650,000 workers to completely clear cut all of the vegetation around their power lines. Rather than strengthen their

infrastructure, PG&E and other California utilities have submitted plans to shut off power during periods of high winds when weather conditions are ripe for wildfires to break out.

It should be noted that technologies exist to rapidly identify, prioritize and eliminate such vegetation encroachment violations that would not necessitate such extreme funding requirements. Additionally, increasing the minimum CPUC design requirements for overhead lines, and proper maintenance of and investment in transmission and distribution infrastructure by utilities is critical to ensuring public safety.

FUTURE NEED AND RESILIENCE

A 2012 study prepared for the California Energy Commission explored the risks climate change poses to California's energy infrastructure. Specifically, the report looked at increasing temperatures, growing incidences of wildfire, sea level rise and storm surge. The study found that higher temperatures will decrease the capacity of existing natural gas-fired power plants, especially during hot time periods by 3% to 6%. Similarly, transformer and substation capabilities will be decreased, transmission and distribution losses will rise slightly, and transmission line capacity will shrink between 7% and 8%. Simultaneously, hotter climates will drive demand for air conditioning which will strain the existing system, not to mention a system with diminished capacity.

Meanwhile, the 2012 California Energy Commission study shows that under some climate change scenarios, the likelihood of fire exposure for some major transmission lines will jump by 40%. Fires do not necessary cause electricity outages, but rather, increase maintenance costs and decrease transmission line efficiency. However, the public safety risks posed by wildfires are substantial.

Finally, sea level rise stands to impact up to 25 power plants along the coastline of California, along with electricity substations and natural gas facilities. Sea level rise could be combatted with proper preventative actions, including moving plants out of low-lying areas and building flood protection infrastructure. Paying to storm-harden the infrastructure now will likely save California ratepayers significant funding down the line.

PUBLIC SAFETY

In 2015, the Eaton Blackout Tracker reported the failure of power lines and other electrical equipment was responsible for burning nearly 150,000 acres during subsequent wildfires. Customers around the state are frequently left without power during fire season. In 2017 for example, SDG&E discontinued service to 12,000 customers, in some cases for over three days, in an attempt to avoid wildfires. Meanwhile, 279,000 customers lost power in Sonoma County in 2017 for the same reasons. Adequate investment in infrastructure is not occurring, and as a result, electricity is cut. This has major impacts for vulnerable populations and the regional economy.

Public and worker safety is a core priority in the service of electrical power and natural gas. The PUC has a comprehensive oversight and repository of the state's safety record.

The Bureau of Labor Statistics shows the downstream-energy-refining-sector has reduced injuries for over 20 years. The Bureau of Labor Statistics charts show that the petroleum-refining sector of health and safety is one of the safest industries for work environments.

INNOVATION

Renewable energy and efficiencies have reduced energy consumption. Electric vehicle sales are still overcoming "range/charging anxiety," and "higher costs". It is unknown if the grid can handle the clean energy transition.

Technologies such as LiDAR, NDVI, the use of UAVs to collect this information, and the abilities to consider the wire movements under various weather events have made the identification of dangerous vegetation encroachments easily accessible and would negate the need to shut off power during wind events.

RECOMMENDATIONS TO RAISE THE GRADE

- **California needs to identify costs and define milestones to: (1) achieve 100% renewable electricity, (2) develop storage technology to meet Smart Grid requirements while providing 24/7 resilient electrical power, and (3) reduce the need for future oil/gas imports via enabling electric vehicle utilization.**
- **California should adopt national design standards (NESC, ASCE) for the minimum designs of in-state overhead transmission and distribution lines.**
- **California should use modern technologies to identify, classify, and eliminate fire-causing vegetation that encroaches on overhead power lines.**

DEFINITIONS

ANTHROPOGENIC: Relating to, or resulting from the influence of human beings on nature.

LiDAR: Light Detection and Ranging (LiDAR) is a remote sensing method, often by air, that uses light to measure variable distances to the Earth

NDVI: The Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring the difference between near-infrared (which vegetation reflects) and red light (which vegetation absorbs).

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HAZARDOUS WASTE

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HAZARDOUS WASTE

EXECUTIVE SUMMARY

California's hazardous waste infrastructure principally consists of the management of generated hazardous wastes and the cleanup of contaminated sites. In 2017, California entities generated 3.8 million tons of hazardous waste and cleaned up 1,800 contaminated sites. It is estimated that 90,000 properties in California are contaminated with some level of toxic substances. The cost of operating California's existing hazardous waste infrastructure is around $3.4 billion per year, with most of this funding coming from the private sector. The results of this spending are improved human health and a cleaner environment. Economic benefits result from reduced health-care costs for exposure-related illness and increased land values—putting surplus land towards productive reuses such as housing and conservation, and returning hazardous recyclables back into industrial production. The infrastructure is challenged by the fluctuating funding levels, new contaminants and new knowledge of health effects, a vast increase in use of consumer electronics, and rising compliance costs for private businesses and public entities. California does not meet its own hazardous waste disposal needs. Over half of all hazardous waste generated is exported to surrounding states for landfill disposal.

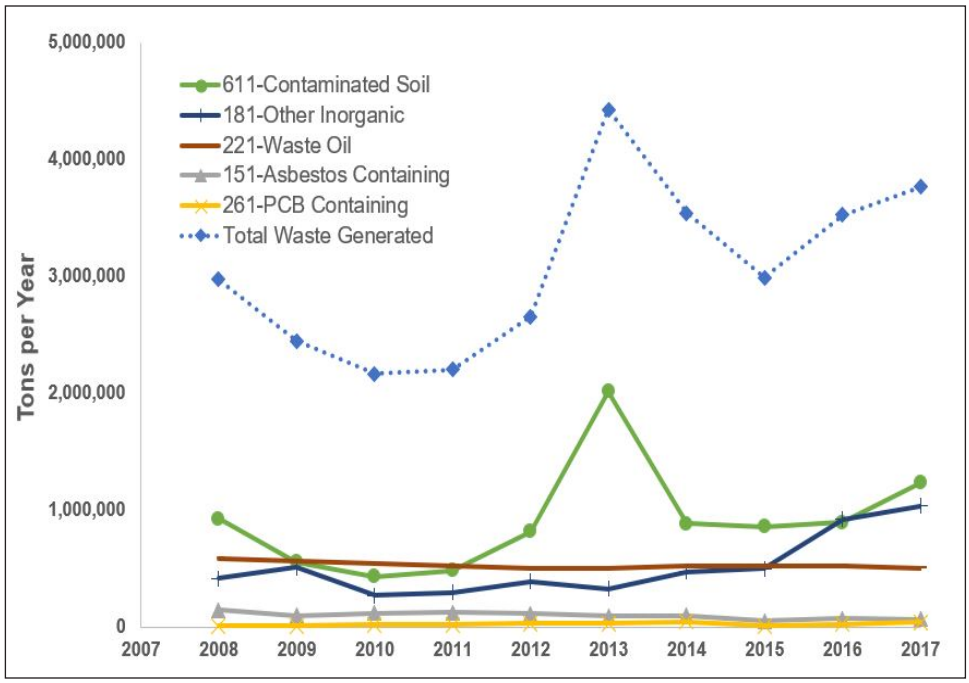
CAPACITY AND CONDITION

California hazardous waste infrastructure principally consists of the management of generated hazardous waste at treatment, storage and disposal facilities (TSDFs), and the cleanup of contaminated sites. Perhaps more than any other infrastructure category, hazardous waste infrastructure is shaped by government regulation. In most cases, California has developed stricter versions of federal hazardous waste laws and regulations. The California Department of Toxic Substances Control (DTSC) is the primary state agency regulating hazardous waste and its cleanup in California. The California State Water Resources Control Board (SWRCB) also regulates cleanup of contaminated sites when the quality of groundwater or surface waters of the state is threatened. These state agencies are assisted on the local level by the Certified Unified Program Agencies who provide county- and city-level oversight for hazardous waste facilities.

HAZARDOUS WASTE DISPOSAL

California's diverse economy produces a variety of state and federal hazardous wastes each year. In 2017, California generated approximately 3.8 million tons of hazardous waste, including contaminated site soils (~33%), used oil and oil-contaminated materials (~27%), universal waste such as electronic waste and fluorescent lights (~18%), and other categories (22%) that include industrial, asbestos, and PCB wastes.

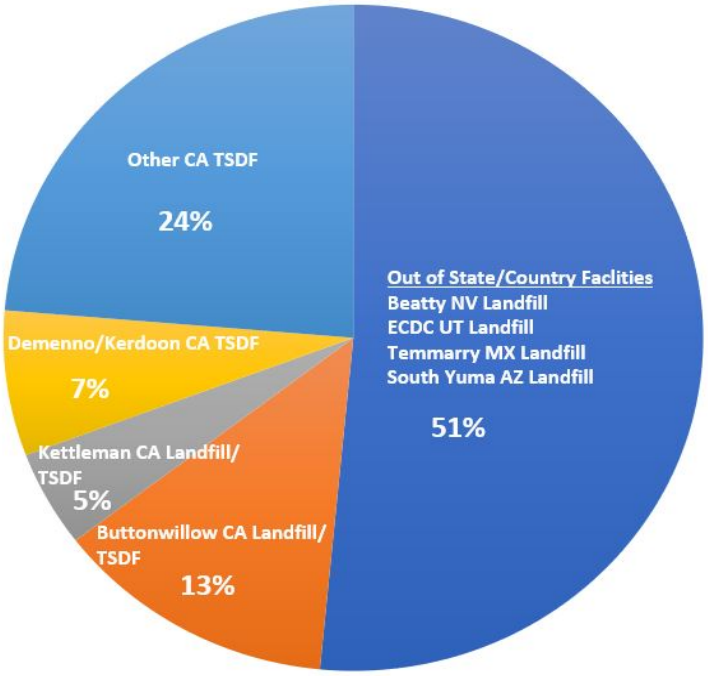
FIGURE 1. YEARLY HAZARDOUS WASTE TONNAGE



In general, the volume of waste generated in California has increased over the past 10 years, owing in part to an increase in consumer electronics disposal and sporadic very large contaminated site cleanups, such as in 2013 when approximately 30% of the waste generated in the state was due to a single contaminated site cleanup project. Figure 1 shows a 10-year trend for overall hazardous waste generation and the primary waste categories.

In 2017, hazardous waste generated in California was sent to a landfill (64%), recycled or recovered offsite (17%), managed offsite without recovery e.g., incineration or blended for fuel (10%), or was handled in some other way (9%) (DTSC, 2018b). California has three permitted hazardous waste landfills: Kettleman City, Westmoreland and Buttonwillow. Together these facilities accommodated less than one-half of the landfilled waste generated in California. The majority of hazardous waste is exported to Utah, Arizona, Nevada or Mexico where it is placed in nonhazardous waste landfills (Figure 2).

FIGURE 2. DISPOSAL FACILITIES FOR CALIFORNIA'S HAZARDOUS WASTE

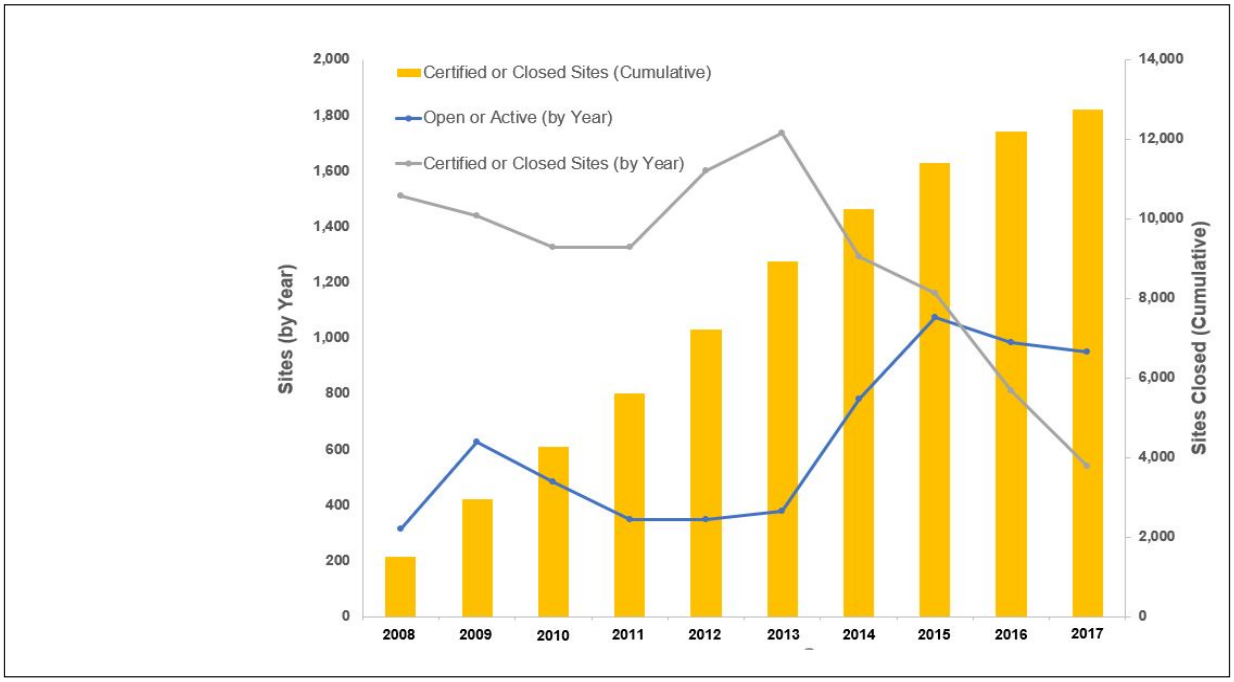


(2017)

CONTAMINATED SITE CLEANUP

In California, the DTSC estimates that 90,000 sites are contaminated with some level of toxic substances. Together, DTSC and SWRCB report over 60,000 of these sites as managed through their cleanup programs. During the 10 years between 2008 and 2017, DTSC and SWRCB oversaw the cleanup of 11,273 sites. Figure 3 shows a ten-year trend for contaminated site cleanups. Regulatory programs such as the Low Threat Underground Storage Tank Cleanup program have incentivized responsible parties to undertake cleanup and have resulted in many site closures. The effect of this program can be observed in the increase in closed sites in 2012 and 2013.

FIGURE 3. SUMMARY OF DTSC AND SWRCB CLEANUP SITES BETWEEN 2008 AND 2017.



OPERATION AND MAINTENANCE

Both the government and private sector share responsibility for operating and maintaining hazardous waste infrastructure. The three hazardous waste landfills in the state are all privately owned and maintained. Site cleanup and the resulting operations and maintenance (O&M) is performed by land owners or site operators, which can be either government or private. O&M for TSDFs includes ensuring equipment or site integrity to prevent releases and encourage safe handling, as well as environmental monitoring to detect releases. Operators of active TSDFs perform and report on O&M under the regulatory oversight of DTSC, who issues permits and performs inspections. In general, DTSC uses its inspection and enforcement authority as a check on adequacy of O&M and also requires financial assurance for operation and closure of the TSDF. However, it is not uncommon for a small hazardous waste treatment facility (e.g. a plating facility with an acid or metal treatment system), or in rare circumstances a large landfill operator, to go out of business and have inadequate funding for long term O&M. In these cases, the hazardous waste law allows the government to recoup closure costs from the parties generating the waste that was treated or disposed. Since this regulatory structure for active hazardous waste treatment sites was implemented around 1976, it seems to function effectively.

For contaminated site cleanup, contamination may be contained or managed in place or may require many years of active remediation. In many cases, responsible parties perform maintenance of containment systems or groundwater extraction systems and the cost for long term maintenance will exceed the initial capital costs. Often (but not always) these sites are required to undergo five-year review to assess performance of the site remedy, which includes evaluating the effectiveness of site O&M. Similar to TSDFs, entities responsible for long term site cleanups may go out of business, and the government has some authority to seek funding from successors or related parties, but may ultimately be required to assume responsibility for the site.

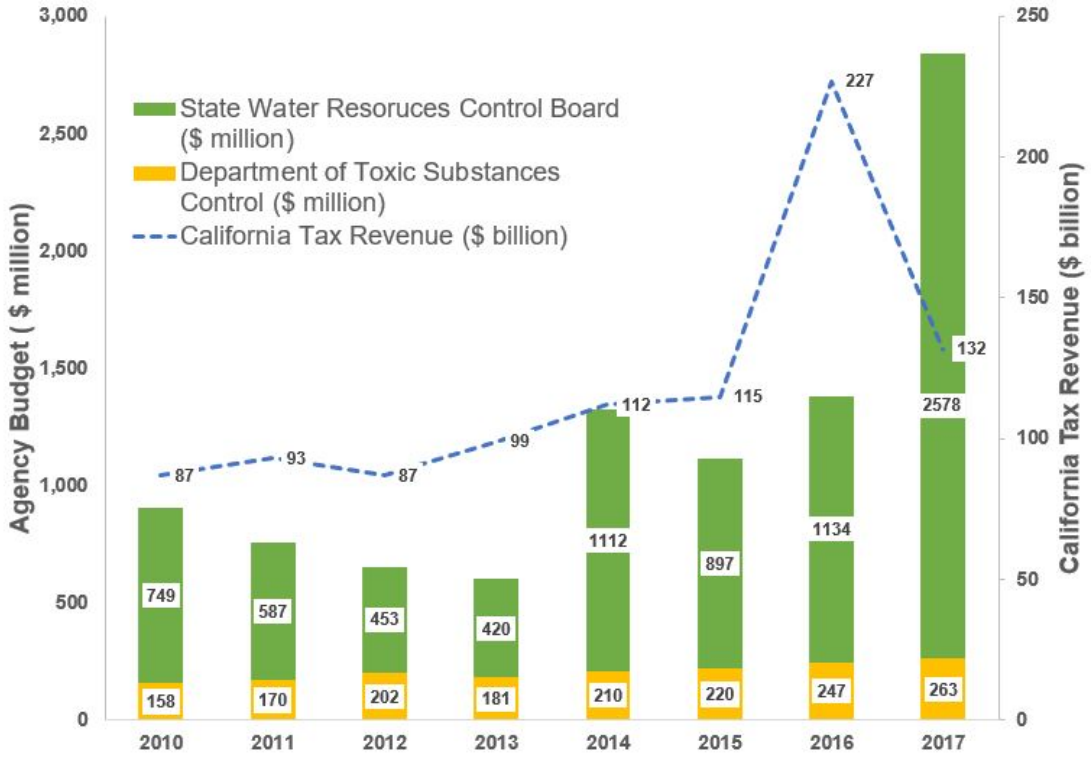
FUNDING AND FUTURE NEED

The federal government estimates that the combined waste management and remediation services costs in the United States will approach $100 billion in 2018. California's combined hazardous waste disposal and contaminated site clean-up cost in 2017 exceeded $3.4 billion per year. DTSC and SWRCB's combined budgets in 2016 were only $1.4 billion (LAO, 2018). The majority of costs to utilize and maintain California's hazardous waste infrastructure is born by private business, residents, consumers and public entities paying to manage and cleanup their waste. Figure 4 summarizes DTSC and SWRCB budgets in comparison to California's overall tax revenue. Funding decreased drastically in 2018 as the temporary funding expired for 2014's Water Quality, Supply, and Infrastructure Improvement Act of 2014 expired.

The vast increase in use of consumer electronics (e.g., smartphones) and battery driven vehicles as well as the fact that these materials utilize hazardous materials, including toxic metals, is putting pressure on the state's infrastructure to keep these materials out of municipal solid waste landfills. Roughly $55 billion is lost globally each year because of e-waste being trashed instead of recycled. California should encourage reclamation of consumer electronic waste through streamlined permitting and recordkeeping for waste recycling facilities, protective standards for waste management and tax incentives to encourage technology development for the systematic reclamation and reuse of consumer electronics. The challenge is to avoid the transport of harder to recover waste materials into other states which is both wasteful of resources and damaging to the environment because of the greenhouse gases generated.

Protection of human health and the environment is the primary benefit of improvement of California's hazardous waste infrastructure. Liability provisions in federal and state law generally allow the state to designate responsible parties for hazardous releases and force those parties to clean up the contamination. In many cases, responsible parties are unable to meet financial obligations and the state steps in where there is a risk to public health. DTSC estimates that it spent approximately $20 million in 2017 to cleanup of these so-call "abandoned" or "orphan" sites. Government funding is also redistributed use-tax funds. Through fuel taxes, the SWRCB redistributes approximately $50 million in funding each year to cleanup Leaking Underground Storage Tank (LUST) sites. No similar program exists to fund cleanup of current or former drycleaner sites where environmental damage or risk to human health can exceed the resources of the drycleaner, which are often small, family-owned businesses.

FIGURE 4. COMPARISON OF DTSC AND SWRCB BUDGET TO CALIFORNIA TAX REVENUE



Secondarily, land values for nearby properties are improved by site cleanup. California dissolved its 400 plus redevelopment agencies in 2011 in a time of fiscal crisis, which vastly decreased available funding for contaminated site cleanup. After more than seven years of continuous economic expansion, no true successor agency or process has been established in place of the redevelopment agencies. Instead, limited grant funding is distributed through SWRCB and DTSC. SWRCB distributes an annual appropriation of $20 million in grants through its Site Cleanup Subaccount Program (SCAP) and additional funds through the Orphan Site Cleanup Fund and the Emergency Abandoned or Recalcitrant Account. Other cleanup related programs include DTSC Targeted Site Investigation Program ($350,000 in 2018) and through the EPA-funded Revolving Loan Fund ($5.6 million in in 2017).

In general, available funding sources are small compared to the state-wide costs involved with returning a contaminated site to productive use. Government funds are directly towards high risks sites and low to medium risk sites can languish for years or decades. Studies have led to the consistent conclusion that Brownfields Program cleanups yield positive, statistically significant, but highly localized effects on housing prices of up to a 15% increase in home values. California must continue to find new and innovative ways to encourage property cleanup.

PUBLIC SAFETY AND RESILIENCE

Hundreds of contaminated sites that have been cleaned up, or certified to have no further action required, are in areas susceptible to impacts of sea level rise even under modest future projections. It is estimated that over 330 hazardous waste sites are in areas susceptible to sea level rise of less than 1.4 meters (California Climate Change Center, 2009). There is currently no regulatory mechanism to evaluate the adequacy of historic remediations implemented in these areas under various sea level rise scenarios considering long term threats to human health and the environment.

Radioactive waste is an unresolved legacy of the nuclear power industry. Spent fuel from commercial reactors is scattered across roughly 80 sites in 35 different states, with 25 in California. At the San Onofre generating facility in Southern California alone, 1,700 tons of spent nuclear fuel will remain interred in enormous concrete casks behind a seawall with no permanent disposal facility. Given the apparent trajectory of California's energy industry away from nuclear power, the federal government, with input from California, must determine a permanent and protective disposition for radioactive waste. A similar problem exists with low level radioactive waste generated by the health care and other industries.

There are an estimated 47,000 abandoned mines in California. On Federally administered land alone, there are an estimated 20,000 abandoned mines, of which 1,000 likely affect water quality, and over 3,000 contain hazardous mine openings. While DTSC has taken steps to prioritize assessment and cleanup of abandoned mines, hazardous waste from these mines presents a risk to the environment and can present a risk to the health of recreational users of public lands.

INNOVATION

California regulatory agencies have developed numerous tools that make it easy to understand the state's hazardous waste infrastructure. The DTSC Hazardous Waste Tracking System is a database with web access where all hazardous waste manifest data is archived. DTSC also maintains the Envirostor, which is a GIS application and fill tracking system for hazardous waste cleanup sites. The SWRCB manages the Geotracker website, which, like Envirostor, houses data for SWRCB-programs, such as the state's LUST program. These databases show the location of hazardous waste facilities and enable the quick transfer of information among environmental engineering professionals and policymakers.

The California Office of Environmental Health Hazard Assessment developed the webtool CalEnviroScreen. CalEnviroScreen scores every census tract in the state for exposure to environmental contamination. It incorporates criteria for hazardous waste generation and contaminated site locations. This tool enables policy makers to consider pollutant exposure in forming public policy and in infrastructure spending.

RECOMMENDATIONS TO RAISE THE GRADE

- Increase funding and incentives for contaminated site cleanup by including incentives for infill development in a state-wide infrastructure spending plan; revamp certain programs that cause delays, confusion and poor allocation of resources; expand the SCAP to add affordable housing as a priority use and revise calculation for "ability to pay;" expand the California Land Reuse and Revitalization Act (CLRRA) to more broadly address transit-served areas; reinvigorate the Cleanup Loans and Environmental Assistance to Neighborhoods (CLEAN) program to increase lending.
- Re-evaluate California hazardous waste characteristic standards, minimization programs, and landfill capacity to develop an integrated and rational statewide management strategy for preventing unnecessary disposal of waste in out of state/country non-hazardous waste landfills.
- Direct DTSC and SWRCB to assess and make recommendations concerning human health and environmental risk from contaminated sites in areas vulnerable under mid-century and end-of-century sea level rise scenarios.
- Encourage reclamation of consumer electronic waste through: streamlined permitting and recordkeeping for waste recycling facilities; protective standards for waste management; and, tax incentives to encourage technology development for vast and systematic reclamation and reuse.
- Increase public awareness of the cost and risk associated with current uncertainty regarding long term management of nuclear waste and low-level radioactive waste with the goal of encouraging state and federal agencies to develop a long-term solution.
- Continue to expand information transfer and risk-based decision-making for hazardous waste problems to allocate resources based on science.
- Emphasize a robust technical focus and increased, stable, designated funding source for mining site cleanup.

DEFINITIONS

BROWNFIELDS: Contaminated sites potentially eligible for cleanup and redevelopment.

CLRRA: California Land Reuse and Revitalization Act.

CLEAN: Cleanup Loans and Environmental Assistance to Neighborhoods.

DTSC: CalEPA Department of Toxic Substances Control is California agency with most broad responsibility for hazardous waste management.

LUST: Leaking Underground Storage Tanks

NPL: US EPA National Priority List is the federal list of the nation's most contaminated sites aka the Superfund.

RCRA: Resource Conservation and Recovery Act

SCAP: Site Cleanup Subaccount Program.

SWRCB: California Station Water Resources Control Board is the state agency for with authority for contaminated site cleanup and Brownfield that threaten groundwater or other waters of the State.

TSDF: Treatment Storage and Disposal Facilities

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INLAND WATERWAYS

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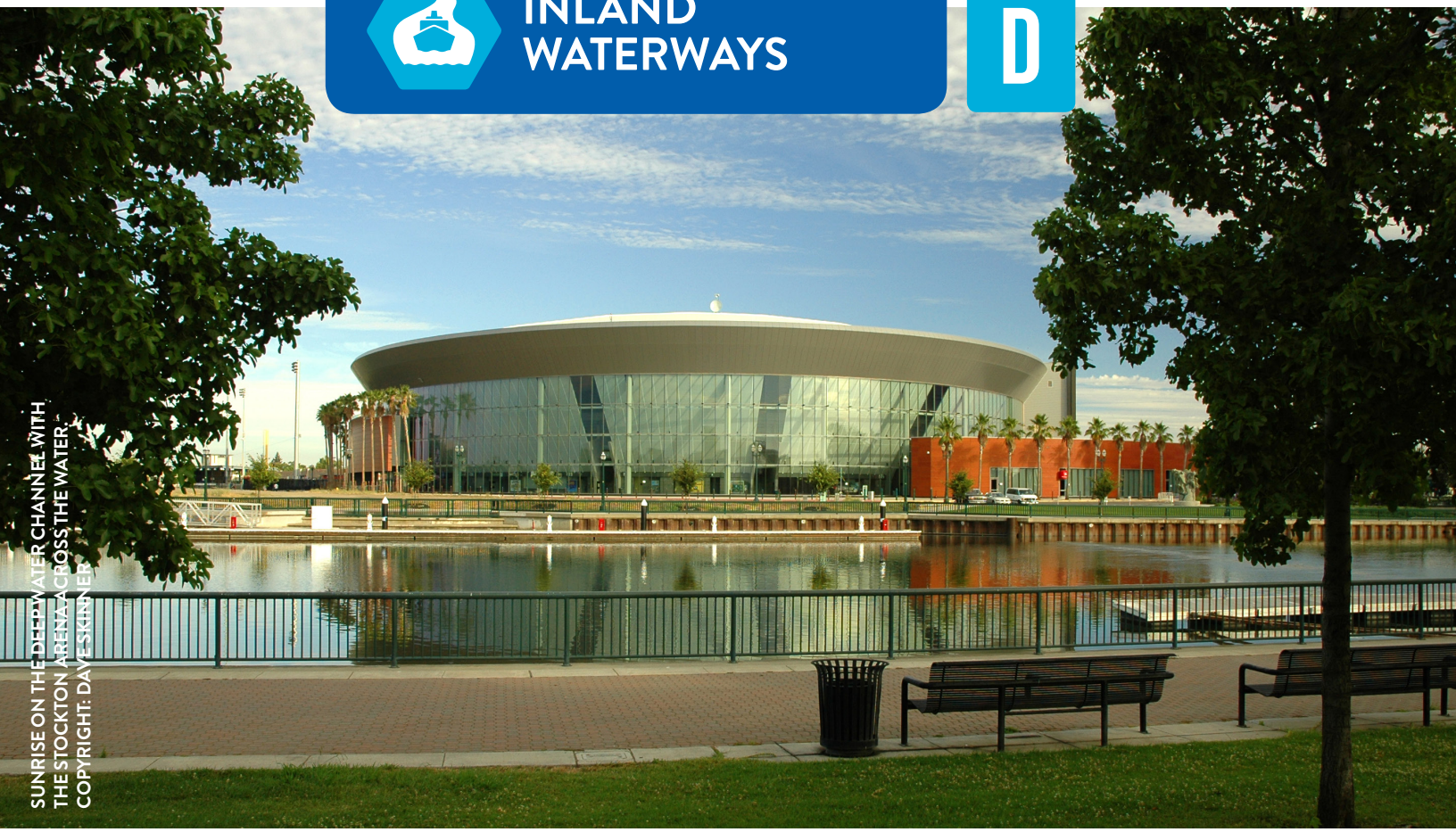
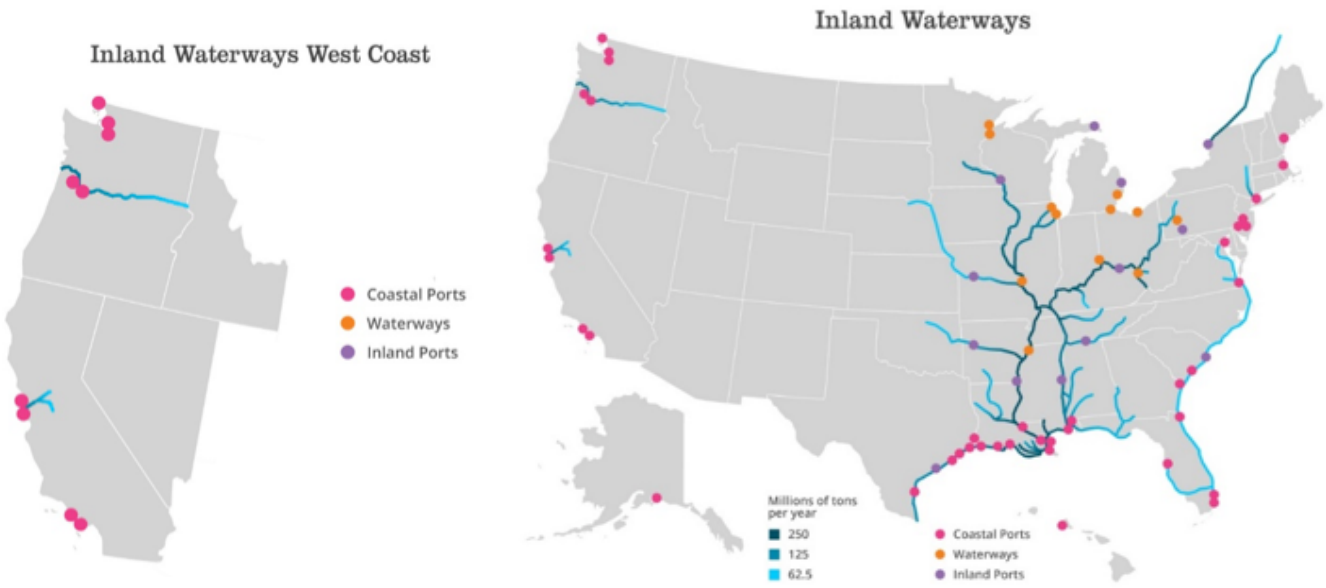


SUNRISE ON THE DEEPWATER CHANNEL WITH THE STOCKTON ARENA ACROSS THE WATER. COPYRIGHT: DAVE SKINNER

INLAND WATERWAYS

EXECUTIVE SUMMARY

The U.S. Army Corp of Engineers operates and maintains two inland waterways in California: the Sacramento Deep Water Ship Canal (Sacramento DWSC), and the Stockton Deep Water Ship Channel (Stockton DWSC). Both waterways face similar issues of being neither wide enough nor deep enough for larger ships. Construction costs for projects to deepen the two waterways are estimated at $17 million for the Sacramento DWSC and between $175 and $225 million for the Stockton DWSC. Both projects have been on hold since 1990, while no funding is programmed for future fiscal years. Meanwhile, the current Sacramento DWSC width is unsafe, particularly for marine vessels navigating the canal in inclement weather. There are significant opportunities for improvement for both waterways when considering seismic readiness, ecological hazards, and lack of necessary inspections.



CAPACITY AND CONDITION

California's inland waterways are critical modes for moving cargo from the West Coast to inland communities in the state and beyond. Both inland waterways are in need of infrastructure upgrades that are currently on hold due to budget cuts and lack of political prioritization.

The Stockton DWSC consists of navigation channels that extend approximately 35 miles from the San Francisco Bay to the Port of Stockton through San Francisco, Marin, Contra Costa, Solano, Sacramento and San Joaquin Counties. The USACE is assessing the feasibility of deepening the existing 35-foot channel to realize significant transportation cost savings. However, the Stockton DWSC area is located in the environmentally sensitive and dynamic Sacramento-San Joaquin Delta, which includes a unique ecological zone where saltwater transitions into the freshwater Delta. The project area serves as habitat for several federally-listed endangered or threatened species. The most pressing and apparent risks and uncertainties of deepening the Stockton DWSC relate to minimizing adverse effects to ecological resources.

The Sacramento DWSC is a 43.4-mile long, 30-foot deep channel that lies within Contra Costa, Solano, Sacramento, and Yolo Counties, and serves the marine terminal facilities at the Port of West Sacramento. Current conditions in the Sacramento River channel limits both the load per vessel and the vessel type that can access the Port. Light-loading increases the cost of transportation and the cost of the shipped products passed on to the consumer. In addition, the existing widths of sections of the Sacramento River can make navigating to the Port difficult, particularly in inclement weather.

OPERATION AND MAINTENANCE

In terms of the operations and maintenance necessary for California's inland waterways, dredging due to sedimentation is the largest undertaking each year; dredging of the Sacramento DWSC exceeds 8.1 million cubic yards and the dredging of the Stockton DWSC exceeds 30 million cubic yards. Operation and maintenance also includes the navigation channels, concrete structures, structural steel, buildings, salinity control, electrical and mechanical maintenance for the locks and drawbridges, as well as the operation of use, administration and navigation. With climate change increasing the risk for higher water levels and temperature rises, this exacerbates the need to maintain this infrastructure so that it is resilient to the subjected higher water pressures and harsher conditions.

PUBLIC SAFETY

The current Sacramento DWSC width is unsafe, particularly for marine vessels navigating the canal in inclement weather. Improving resiliency and flood management for these two inland waterways, as well as creating safer channel widths for navigating commercial vessels, are necessary for the public safety of its users and nearby occupants. Annual structural condition assessments must also be performed, but due to the limited number of inspectors and the amount of infrastructure needed to be inspected annually, these structural assessments are not always accomplished. Funding for more inspectors, as well as funding to address sea-level rise risks and navigation improvements, will also benefit public safety.

FUNDING

Public funding for the nation's inland waterway system dates back to 1824, when Congress assigned the USACE with making America's key waterways navigable. Funding for inland waterways construction and repair projects comes in part through the Inland Waterways Trust Fund (IWTF) established in 1978 and originally created as a 4-cents-per-gallon fuel tax for waterways users. The IWTF tax increased to 20-cents-per-gallon in 1995 and to 29-cents-per-gallon in 2015. The most recent increase equates to less than one cent per year between 1995 and 2015. The 2015 increases made an additional $80 million annually available to the IWTF.

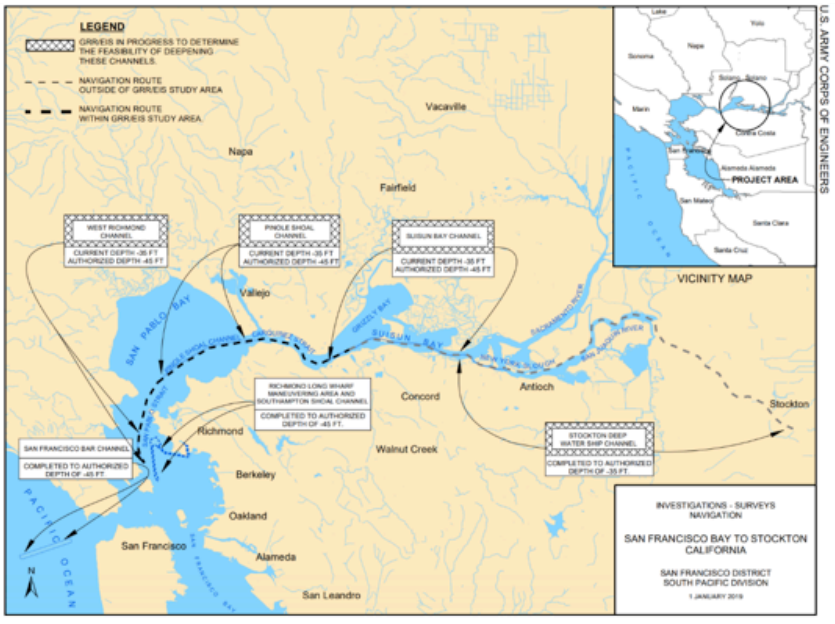
In addition to the IWTF, funding for inland waterways projects is provided through the authorization of water resources bills and subsequent appropriations. The Water Resources Reform & Development Act (WRRDA) signed into law in 2014 provides the mechanism to increase national water resources infrastructure spending to $1.1 billion annually by 2019. However, Congress has declined to fully appropriate this funding. Further, even if all of this revenue was appropriated, it still falls well below the $8.7 billion backlog of inland waterway infrastructure, repair, and deferred maintenance project needs across the country.

Fortunately, there has been some progress by Congress to better prioritize investment in inland waterways. In September 2018, the FY19 Energy & Water Development appropriations bill was signed into law stipulating revenue in the IWTF will be used solely for inland navigation construction projects and to increase operation and maintenance budgets. Therefore, the operations and maintenance costs for inland waterways continue to be covered in full by the federal government and not by the vessel users.

FUTURE NEED

The Sacramento DWSC work to deepen the canal has been suspended since 1990 at the request of the Port due to funding constraints. Construction costs to extend the channel depth from 30 ft to the Congressionally authorized depth of 35 ft requires approximately $17 million. No funding has been programmed for future fiscal years to complete this work.

A further deepening study of the Stockton DWSC has been on hold since 2014. Dredging construction has been suspended since 1990. Completing the San Francisco Project Feasibility Study for deepening the navigation channels of the San Francisco Bay from 35 ft to the Congressionally authorized depth of 45 ft requires approximately $1 million. The future construction costs for this work are estimated in the $175 million to $225 million range.



Deepening of the Sacrament DWSC and Stockton DWSC will increase economic benefits associated with a reduced transportation cost of moving goods to the port and provide safe navigation for commercial marine traffic.

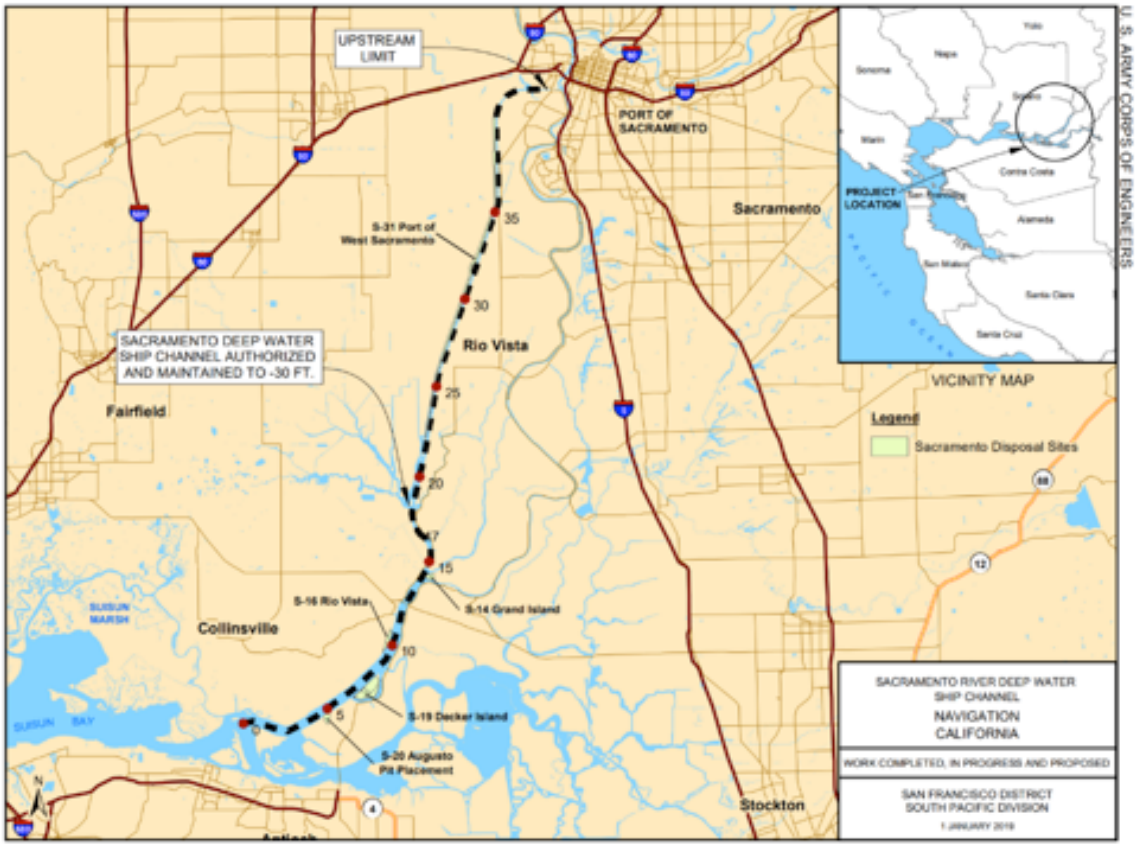
RESILIENCE

As currently constructed, existing widths and depths of the inland waterways of California are too narrow and too shallow to allow for safe passage of large vessels. Projects were in place to alleviate these concerns, but have been on hold for years due to budget cuts and low national priority of these infrastructure projects. With the budget cuts, underwater inspections have also decreased, making these waterways very susceptible to environmental changes such as water levels rising due to climate change.

Additionally, much of the Bay Delta is kept dry by levees that channel the inland waterways. Any modifications to foundation loads along the channel bank, whether on the surface (i.e. raising existing levees) or underwater (i.e. cutting channel slopes toes), would have to be done carefully to prevent slope instability that might cause flooding of adjacent crops, buildings, people and public infrastructure. Moreover, a breach could result in a change of the overall salinity concentration of the Bay Delta. To this end, both inland waterways appear to be unprepared for a large natural disaster, and the detrimental effects would be both costly and difficult to recover from. With California's seismic history, it should be highlighted that large breaches to the waterways and unpreparedness for handling such breaches could cost California hundreds of millions of dollars and decades of recovery to return to current conditions.

INNOVATION

In March 2016, the USACE published the "Technologies to Extend the Life of Existing Infrastructure" that compiles new and emerging materials, technologies, methods, and best practices to help extend the service life of existing infrastructure, specifically for lock and dam assets. The USACE's "Technologies to Extend the Life of Existing Infrastructure" contains several technologies and methods that could be incorporated into future projects of the Inland Waterways of California, should appropriate funding and priorities be set.



RECOMMENDATIONS TO RAISE THE GRADE

Inland waterways serve as a key component of California's multi-modal trade and transportation networks. This critical infrastructure has faced several challenges securing proper resources to keep up with the developing demand of interconnected global trade, and is in dire need of an upgrade for both operational and safety purposes. The American Society of Civil Engineers recommends the following:

- Congress must appropriate funding for the widening and deepening of the two California Inland Waterways. The needs for both inland waterways have been well documented and are ready for necessary upgrades but lack funding.
- Both Inland Waterways need to be reviewed from a resiliency point of view on how they are prepared to handle natural disasters and the underlying results (cost, accessibility, salt water intrusion, aquatic life, etc.).
- While deepening and widening the channels will provide better safety and opportunities for the use of the channels, there will be environmental impacts that need to be mitigated. Proper environmental impacts will need to be identified and researched as work is proposed on the channels.

DEFINITIONS

DELTA:	Accumulation of sediments borne by the rive to form a landmass
DWSC:	Deep Water Ship Canal
INLAND WATERWAY:	Viable alternatives or additions to road and rail transportation.
IWTF:	Inland Waterway Trust Fund
USACE:	United States Army Corps of Engineers
WRRDA:	Water Resources Reform & Development Act

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LEVEES

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LEVEE ALONG SACRAMENTO RIVER AT THE POCKET AND GREENHAVEN NEIGHBORHOODS, SACRAMENTO.

EXECUTIVE SUMMARY

Over the last six years, unprecedented funding was invested in California's aging levee system, and many miles of levee were improved during that time. Yet the fiscal impacts of climate change, increased regulatory pressure, more rigorous maintenance, updated safety standards and higher cost estimates render this investment a mere down payment on the much larger bill. A capital investment of $45 billion is needed to rehabilitate and improve California's levees, and unfortunately, the path to this funding is unclear. Local agencies currently spend $1.3 billion annually on all flood management activities. However, additional annual funding of at least $100 million is necessary to repair infrequent but inevitable flood damage.

INTRODUCTION

Since publication of the last California Report Card in 2012, a number of remarkable events have highlighted the importance of levee infrastructure investment. 2012-15 was the driest period since statewide records began in 1896, and was immediately followed by the second wettest water year on record in 2016-17. Climatologists report that this whiplash is the new normal. Recent events, such as the 2017 storms and associated damage emphasize the need for critical and immediate investment in flood infrastructure.

Management of California's flood risk is complex, fragmented and expensive. Multiple institutions have flood management responsibilities, including the planning, design, construction, operation, maintenance and regulation of levees. A recent study estimated that flood management responsibilities are spread over 1,300 local agencies across the state.

The magnitude of California's flood risk is tremendous: $580 billion of assets (buildings, crops and infrastructure) and over 7 million people are exposed to flood hazards in California. Key to protecting these lives and livelihoods is a complex system of 20,000 miles of levees and channels that convey both floodwaters and much of the state's water supply. All levees can fail: even a well-built levee can succumb to floodwaters.

Recently, California has taken steps to not only improve levees, but also to reduce impacts if/when a levee fails. Flood insurance can reduce the consequences of a levee failure, but unfortunately, less than one-third of all California homeowners who should have flood insurance are covered.

CAPACITY AND CONDITION

Levees are being designed to higher standards than in the past. The Federal Emergency Management Agency (FEMA), acting through the National Flood Insurance Program (NFIP), has historically played an important role in the design capacity of levees by requiring 100-year level of protection to avoid high flood insurance rates and building restrictions. In 2007, California Senate Bill 5 (SB5) raised this de facto safety standard to 200-year level of protection for urban and urbanizing areas in the Central Valley. While other jurisdictions are not subject to the 200-year standard, highly populated areas such as Orange County have adopted standards for many levees that exceed the FEMA 100-year standard.

Central Valley Levees

The Central Valley's largest and most important levees are state/federal "project" levees (also referred to as State Plan of Flood Control levees). The landmark Paterno v. State of California decision in 2003 found the state had total liability for a failure of a Yuba River levee in 1986, resulting in the payout of almost $500 million for this one levee failure. Despite the completion of major levee infrastructure improvements on the Feather River and significant progress on other Sacramento River levees since the 2012 Report Card, only three-fifths of the Central Valley urban areas have achieved 200-year level of flood protection mandated by SB5. For small communities and rural areas, the picture looks grim: with a few exceptions, small communities lack the necessary fiscal resources to attain the minimum standard of 100-year level of protection, and over half of rural levees do not meet U.S. Army Corps of Engineers (USACE) standards, making them ineligible for federal assistance.

Sacramento-San Joaquin Delta Levees

The 1,100 miles of Delta levees of the Sacramento-San Joaquin Delta pose unique risks to California. A Delta levee breach could have catastrophic consequences not only for Delta farmers and residents, but also communities far downstream. Both the State Water Project and federal Central Valley Project pump water out of the south Delta; a levee breach could result in increased salt water intrusion into the Delta, disrupting deliveries of drinking water to 25 million people and fresh irrigation water for 3 million acres of farmland. These levees are also subject to subsidence as well as risk from earthquakes.

EMERGENCY REPAIR OF THE TYLER ISLAND LEVEE IN 2017

PUBLIC SAFETY

The Central Valley has among the tallest, oldest and most dangerous levees in the state. This is largely due to the fact that most levees, particularly on the Sacramento River, were constructed by pioneer farmers to protect farms, not the 1.3 million people who later took up residence behind these structures. In addition, many Central Valley levees are subject to deep under-seepage, a deficiency that can produce sudden and deadly failures.

The coastal areas of Southern California and San Francisco Bay Area have the greatest number of people living in areas protected from flooding by levees. Many Southern California levees provide protection from alluvial fan flooding, and because of high sediment load in floodwaters, these levees pose special safety risks. Furthermore, intense wildfires remove vegetation which normally minimizes the impacts of storm runoff, thereby increasing the risk of debris flow for many years.

OPERATION AND MAINTENANCE

Levee operation and maintenance (O&M) standards have become more difficult to meet, causing a net decrease in O&M adequacy. Recently, the federal government began enforcing requirements that non-federal maintaining agencies take additional responsibility for rehabilitation, repair and replacement of levee facilities. Furthermore, the state has instituted more stringent standards for O&M, particularly for recently constructed/repaired urban levees in the Central Valley. This situation is complicated by the myriad O&M agencies and the limited capacity of rural areas.

The USACE plays an important role before, during and following a flood through a federal authority termed Public Law 84-99. However, cash-strapped agencies have difficulty meeting eligibility requirements of the USACE PL84-99 program, to the extent that some agencies are declining to participate.

Among the biggest challenges facing routine levee O&M throughout the state is the increasing burden of environmental regulatory compliance coupled with the often-conflicting demand for environmental stewardship in levee maintenance practices.

FUNDING AND FUTURE NEED

Statewide, the California Department of Water Resources estimates that $80 to $100 billion must be invested in flood management. Roughly $45 billion of this amount is necessary in capital investment to rehabilitate and improve levees and associated structures to meet acceptable standards; of this amount, $7 billion is required for Central Valley levees alone.

The USACE has traditionally played the predominant role constructing and rehabilitating large-scale flood infrastructure, such as levee systems, for which there is a federal interest. And while this approach will continue for larger projects, local agencies have recently constructed approximately $1.5 billion of flood control projects in the Central Valley, saving time and money over the federal process. This trend is partly due to the narrow criteria for federal investment, which often reduces federal funding of flood management projects needed by state and local interests.

California has frequently self-funded flood management projects ahead of the lengthy, traditional federal process via Statewide bond initiatives and local assessments. For example, Proposition 1E was passed by voters in November 2006, authorizing the state to sell $4.1 billion in general obligation bonds for flood management projects and programs. While substantial, this investment is merely a down payment.

Frustration with lengthy federal funding processes is borne out by numbers: An estimated $96 billion in authorized USACE flood management and dam safety work is eligible for USACE construction appropriations, yet annual appropriations have averaged just $2 billion in recent years.

Maintenance and capital improvements are often delayed due to funding shortfalls or regulatory challenges, resulting in increased risk of levee failure. As an example, rehabilitating an existing federal levee requires at least four dozen permits, including a lengthy, complex federal process required of non-federal agencies to fix federal levees.

Since primary responsibility for managing flood risk lies with local governments, most funding is generated and spent at the local level. A Public Policy Institute of California (PPIC) report estimates local agencies currently spend $1.3 billion annually on all flood management activities. However, additional annual funding of at least $100 million is necessary to repair infrequent but inevitable flood damage to levees.

Local maintaining agencies face increasing financial burden from increased regulatory pressures, aging infrastructure, changing state and federal levee standards, and taxpayer protection laws. In the Central Valley, local maintaining agencies are underfunded by a factor of two to three, due to the revenue shortage to pay for higher maintenance standards and contemporary environmental compliance requirements to maintain a deteriorating flood system. Increasingly, routine O&M is encumbered with expensive compensatory mitigation for environmental impacts. Under the California Constitution (amended by Proposition 218), assessments for levee maintenance must be approved by a majority of voters. This is a difficult and expensive process, particularly for rural levee agencies.

RESILIENCE AND INNOVATION

Resilience is the capability of levees to withstand and/or quickly recover from a single or multiple hazards. Climate change is predominant among the many hazards threatening California's levees. A community is flood-resilient—recovering rapidly in the event of a flood—when the flood system is robust, incorporates redundant features, and is supported by ample resources. Many of California's aging levees were not designed to meet modern engineering standards, much less climate change impacts. Multiple agencies and standards noted above also complicate a statewide resiliency standard.

To provide greater resiliency under climate change impacts and other hazards, recent levee projects are now planned and implemented on a system-wide scale, rather than as separate levees or water courses.

The natural intersection of water supply, flood management and the riverine environment provide opportunities for multi-benefit levee projects that can leverage more revenue sources, reduce environmental regulatory burdens and provide for greater long-term sustainability (reduced O&M). To be successful, multi-benefit projects require collaboration from unlikely partners, such as farmers and environmentalists, and proactive involvement by regulators.

RECOMMENDATIONS TO RAISE THE GRADE

- Invest $45 billion in capital improvements to improve California levees and appurtenant structures through additional federal, state and local funding
- Annually invest at least $100 million to repair levees damaged from inevitable floods
- Increase appropriations to the USACE Civil Works construction account to reduce the $96 billion backlog
- Exercise and expand existing federal authority allowing local agencies to plan, design and construct federal levee projects
- Reduce and streamline the regulatory burden on routine levee O&M and capital projects
- Streamline Proposition 218 requirements for O&M or provide funding for State-mandated elections
- Consolidate levee maintenance agencies to provide more efficient O&M

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PORTS

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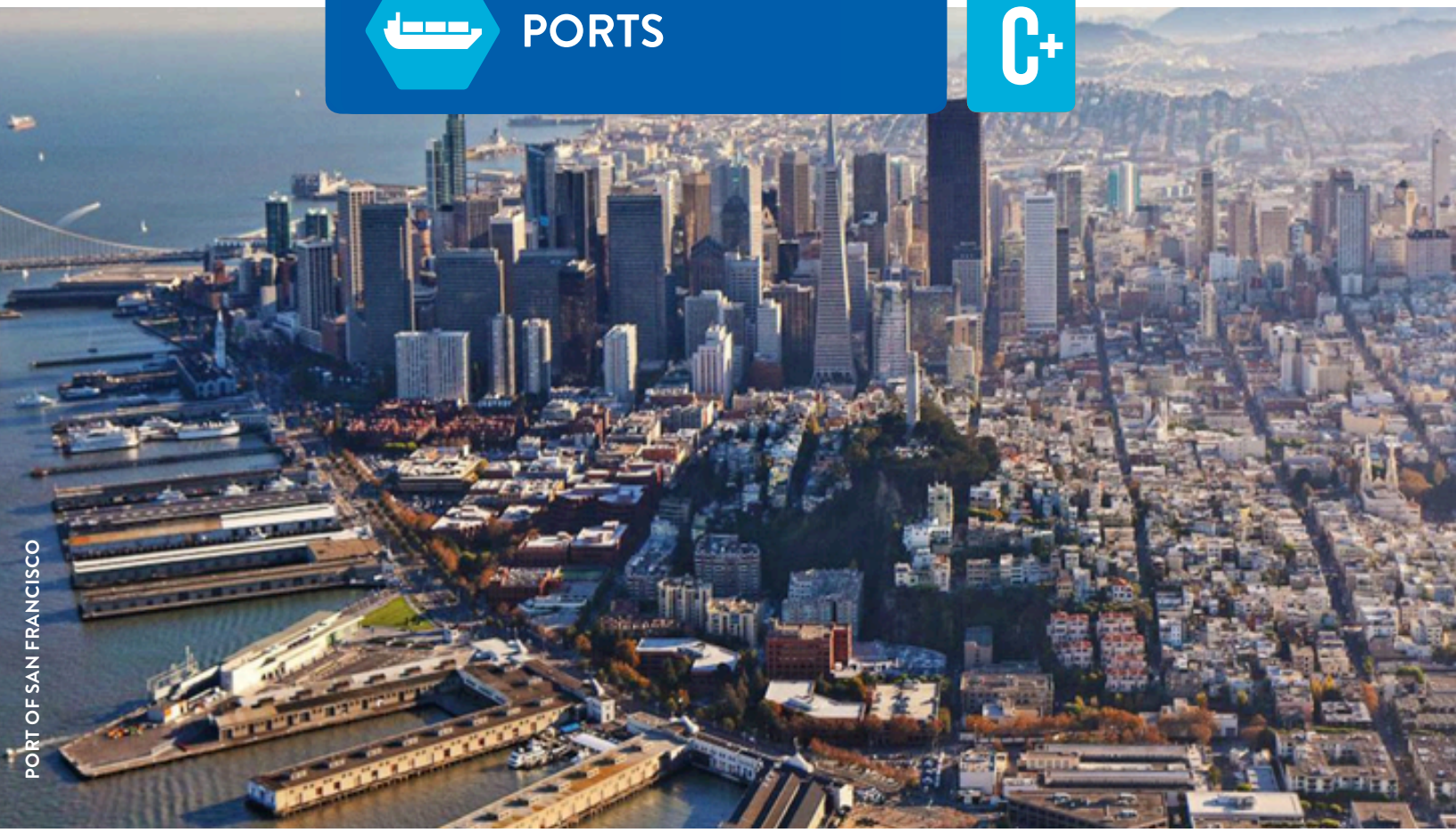


PORT OF SAN FRANCISCO

PORTS

EXECUTIVE SUMMARY

California ports play a vital role in maintaining waterborne trade essential to the nation's economy. In 2017, California's ports handled 40% of all containerized cargo entering the U.S. and 30% of the nation's exports. Since 2012, maritime traffic volumes have increased by over 16%, while other factors have also begun impacting port operations: the need to protect against potentially catastrophic natural disasters such as earthquakes and sea-level rise, increased demands for security and emergency management, tighter regulatory requirements including air quality regulations, and modernization to incorporate new technologies to maintain competitiveness. California ports are in satisfactory condition for the time being, but require significant improvements to maintain existing conditions and meet new demands. The funding gap is estimated at $10.7 billion over the next 10 years, and available revenue has been insufficient to fill the gap as needs continue to outpace available funds.

CAPACITY

California sea ports consist of 11 large- to moderate-sized maritime facilities. The state's ports are ranked among the most productive in the nation, with the Ports of Los Angeles, Long Beach and Oakland within the top ten in import volume in the U.S. The economic benefits of California's ports cannot be understated. Ports serve as a critical component of the state's complex freight transportation system – a system that is responsible for one-third of the state's economy and jobs, and over $700 billion in revenue from freight-dependent industries. Thus, California ports serve a vital and unique role for the state and the nation.

For the year 2017, shipping ports in California handled 403.3 million tons of goods (19.5 million twenty-foot equivalent units, also known as TEUs). Compared to the year 2012, this is a 16% percent increase in TEUs. Based on national waterborne imports for 2017, the ports in California processed almost 40% of all U.S. container freight. Other ports in the state (including San Diego and San Francisco as well as the local specialty ports of Humboldt Bay, Hueneme, Redwood City, Richmond, Stockton, and West Sacramento) focus on general bulk cargo, fresh produce and agricultural products, automobiles, aggregate, steel, liquid bulk and project cargo. California's ports also provide non-cargo related services and facilities such as passenger cruise line services, restaurant and hotel accommodations, entertainment and tourist attractions, and maintain commercial fishing facilities and recreational harbors. These as well as cruise ship operations also provide tremendous economic benefit to local economies.

While California's ports are meeting existing capacity requirements, future increases in goods movement will put greater demands on capacity. The specific capacity challenges are unique to each of California's 11 ports; challenges include needing to upgrade vital off-terminal transportation links and accommodating larger and larger vessels.

PORT OF LOS ANGELES

CONDITION

The underlying infrastructure needed to support trade and commercial activity at California's ports requires constant maintenance and improvements to support existing functions and required performance.

PORT OF LONG BEACH

For example, the Port of Long Beach needs to expand its rail network to meet the increasing demand for cargo movement by on-dock rail. In addition, ports throughout California need to construct infrastructure required to support the transition to zero-emission cargo handling equipment by 2030. The Port of San Diego needs more rail tracks to accommodate larger trains and improve operational flexibility, as well as more open space to increase existing cargo capacity. The Port of San Francisco needs to rehabilitate its 3+ mile historic seawall as well as seismically retrofit numerous historic piers, wharves, and buildings. Overall, California ports are currently in satisfactory operational condition, though they require significant improvements to sustain existing conditions and resist catastrophic natural disasters.

OPERATION AND MAINTENANCE

The importance of proper maintenance to extend the life of port infrastructure cannot be overstated. Port facilities are subjected to repeated truck loads, debris, severe weather conditions, rising seas, and, in some cases, infrastructure is partially or completely underwater. The underwater facilities are the most vulnerable and require substantial periodic maintenance. Seaport infrastructure such as sea walls and piers are often large-in-scale which translates into maintenance and repair costs being significantly higher than for other categories of infrastructure. Also, contractors specializing in marine infrastructure have large investments in marine construction equipment, making entry into the marine construction market difficult and contributing to higher construction costs.

Ports operate and maintain their core facilities, but local port agencies lack the funding to properly maintain all of their infrastructure. Proper facility maintenance and funding are required for infrastructure systems to reach their expected lifespan.

FUNDING

Funding for port operations comes primarily from revenue generated by the shipping companies as well as landside resources and tenant leases. With respect to channel maintenance and dredging to maintain waterways, federal funding is provided through the Harbor Maintenance Trust Fund. While these resources provide funds for port operations, funding availability for capital programs and projects is limited at both the local and state levels, creating an ongoing deficit in the required funding.

Federal funding programs for ports have included the Transportation Investment Generating Economic Recovery (TIGER) program and Department of Homeland Security's Port Security Grant Program. Since 2009, the TIGER Program has provided over $829 Million in grant funding for port related infrastructure improvements; $134 million of these funds were designated for California ports. California handles 38% of the national container volume and since 2009 has only received 16% of available grant funds.

More recent Federal programs such as the FAST Act, INFRA (formerly FASTLANE) and BUILD (formerly TIGER) are in process; allocation to port improvement and modernization programs, however, have yet to be determined. Federal grant programs are incredibly competitive and needs far outpace available funds. Ports must compete with other modes and worthy projects in both INFRA and BUILD, and INFRA limits the amount of funding that can go towards multimodal projects.

PORT OF SAN DIEGO, TENTH AVENUE MARINE TERMINAL

FUTURE NEED

Statewide, funding needs over the next 10 years are projected to be significant. A summary of projected funding required in the various regions of the state is indicated.

There is increased need for state and federal funds assistance, particularly for modernization, roadway, rail, bridge, security, sea level rise, seismic, and sustainability projects. Landside connections and freight improvements are critical to the efficient movement of goods through California's global gateways and sustainability and climate change needs are continuing to grow.

With a projected widening in the gap between available funding sources and infrastructure needs, California ports do not have sufficient funding to carry out the required maintenance and capital improvements. All California ports are seeking alternate methods for funding their investment needs.

FUNDING NEEDS PROJECTIONS BY CALIFORNIA PORT REGION (2019 TO 2029)

	$ BILLION
Los Angeles	$ 2.0
Long Beach	$ 3.0
Bay Area (San Francisco, Oakland)	$ 4.5
San Diego	$ 0.7
Other California Sea Ports	$ 0.5
Total	$ 10.7

PORT OF SAN DIEGO, NATIONAL CITY MARINE TERMINAL

PUBLIC SAFETY

California is at significant and increasing risk of major seismic, flood, or terrorist events at and around its seaports. The state's port facilities, typically built on dredged fill or weak soils, are particularly at risk of failure in the event of a large earthquake. The ports serve as the transportation link for post-disaster emergency resources, and preparing for recovery from operational disruption due to external events is a high priority. To meet this goal, ports need to prioritize repairs and upgrades to their infrastructure through the lens of emergency preparedness, innovation, and resiliency.

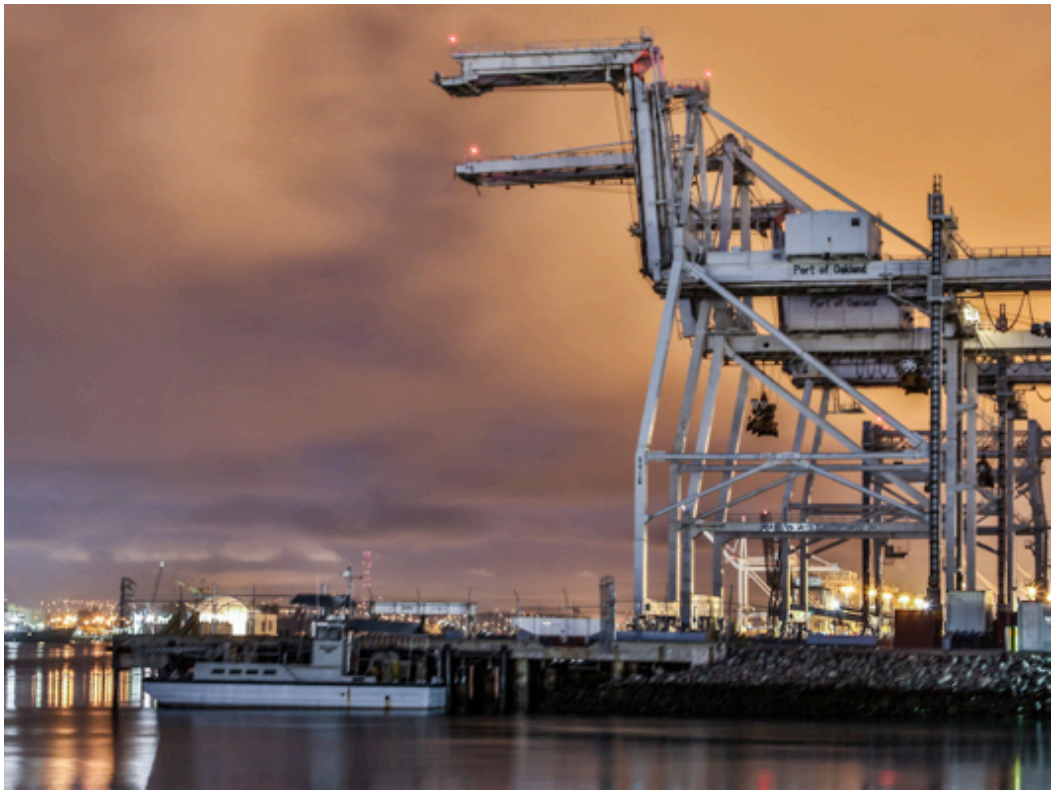
As an example, the City of San Francisco has embarked on a major strengthening project of its historic seawall and is using this opportunity to begin addressing sea level rise into the next century. The project is expected to cost $3 to 5 billion and take 30 years to complete.

Statewide, projects such as these will require funding beyond the capability of normal funding streams and require local, private, state, and federal funding to assess and address the risks.

RESILIENCE AND INNOVATION

Infrastructure security and resilience requires collaboration across all government levels and the promotion of effective public and private sector partnerships. Regional ports have recently joined together to create an innovative coordinated unity of effort to reopen ports after a disaster. State and federal plans cite ports as the primary means of delivering post-disaster resources. Funding for these programs must be provided at all levels to continue to protect the nation's security and preparedness.

PORT OF OAKLAND



To further address resiliency, the State of California is initiating statewide resilience efforts, including the Safeguarding California Plan 2018 Update, the Ocean Protection Council's (OPC) Sea Level Rise Guidance and the Office of Planning and Research's Integrated Climate Adaptation and Resiliency Program.

The OPC Sea Level Rise Guidance is intended to set the water levels that state and local jurisdictions, including the ports, should consider during planning and implementation of projects. In addition to these efforts, there are several state laws and state agencies that are implementing laws and policies related to resilience. These include the San Francisco Bay Conservation and Development Commission (BCDC) which has climate change policies related to sea level rise and the State Lands Commission which administers the public trust and manages over 4 million acres of tide and submerged lands, also known as the Public Trust lands. BCDC's climate change policies require a risk assessment for certain types of projects and states that projects be resilient to 2050 sea level rise projections and adaptable to 2100 projections.

Recent regulatory requirements are also spawning innovations related to sustainability, including shore power to lower emissions, zero waste to landfills, clean transportation requirements, green building practices, renewable energy in operations, and minimization of carbon emissions.

As California's legislative, regulatory, and guidance approach to resilience and sustainability continues to evolve rapidly, effectively addressing existing and new regulations and programs to protect the State's critical port infrastructure will require far greater resources than currently available.

RECOMMENDATIONS TO RAISE THE GRADE

- Increase funding towards projects critical to freight movement and transport to provide additional rail to accommodate larger trains and improve operations.
- Allocate resources to modernization and expansion projects to increase cargo storage areas, install new and efficient gantry cranes, utilize state of the art technologies, protect ports from increased risk of cyber threats, and replace aging berthing systems.
- Prioritize funds for projects to protect California's ports and tidelands from potentially catastrophic seismic events, flooding and inundation, and man-made threats impacting national security.
- Sustain funds for projects to dredge channels and berths and accommodate vessels that are continuing to increase in size and capacity. Congress should fully appropriate the revenues generated each year by the Harbor Maintenance Trust Fund.
- Provide targeted resources for planning and design of climate action plans and resiliency and energy efficiency plans which are at the forefront in maintaining sustainability of coastal infrastructure.

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PUBLIC PARKS

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YOSEMITE NATIONAL PARK VALLEY WITH YOSEMITE FALLS AT CLOUDY AUTUMN MORNING, LOW CLOUDS LAY IN THE VALLEY. CALIFORNIA, USA. COPYRIGHT: HAVESEEN

PUBLIC PARKS

EXECUTIVE SUMMARY

California is home to 28 national parks and monuments, two World Heritage Sites, 284 state parks, and 14,000 local parks managed by nearly 1,000 agencies. In total, 47 million acres of outdoor recreational areas and local parks are enjoyed by residents of, and visitors to, the state. Unfortunately, park budgets have declined significantly as a result of the 2008 recession and infrastructure deficiencies have been on the rise. Deferred maintenance at state parks is estimated at $1.2 billion, while local parks report an estimated $1 billion in unmet needs. The National Parks Service estimates the maintenance backlog for its parks in California is $1.8 billion. Meanwhile, access to parks continues to be insufficient. Sixty two percent of Californians live in areas that do not meet the California Department of Parks and Recreation recommendation of three acres of park land per 1,000 residents. Fortunately, the tide is turning, as voters approved Proposition 68 in 2018, which will provide $4 billion in bonds for state and local parks and water projects.

The grade does not reflect on one agency but the effects of the social economic impact over the last few years. The resulting grade was based on deferred maintenance, financial needs and limited capacities with growing use. With the improving economy and local governmental changes that have occurred over the past decade, park and recreational services may be on the upsurge. Optimism is prevalent and the desire to learn from others and create partnerships is the norm. Many of the "seasoned" leaders have been replaced by young, energetic professionals who are willing to try new approaches. With new perspective and guidance, the future of public parks and recreation look promising.

Parks best practices and lessons learned can impact how we think about parks in the future. Improvements can minimize financial burdens and maintain aesthetically pleasing and energy-efficient park infrastructure.

CAPACITY AND CONDITION

California contains some of the largest and most diverse natural features and cultural heritage holdings of any state in the nation, some of which are the most recognizable features in the world. Among them are 28 national parks visited by 42 million people annually, two World Heritage Sites, 284 state parks, and 14,000 local parks managed by nearly 1,000 agencies. In total, the California Department of Parks and Recreation (DPR), National Park Service (NPR), U.S. Army Corps of Engineers (USACE), Counties, Cities, and non-profit organizations manage 47 million acres of outdoor recreational areas and local parks.

A LOVELY AUTUMN DAY PEERING AT THE YOSEMITE HALF DOME WATERFALL

Californian landmarks continue to be sought out for their marveled beauty, attracting 67 million day-use visitors and 6.5 million overnight users; both totals are up about 7% in recent years based on DPR reports which go underestimated. A recent study shows in-state park users spend $3.2 billion on goods and services directly related to park visits, while out-of-state visitors spend $13.3 billion.

The past decade has been extremely challenging for local parks as well as recreational services at all levels of government in California. The struggle is a result of decreased funding and lack of political support for parks, resulting in a slow decline of programs and capital development and a deteriorating infrastructure.

At a local level, communities are striving to meet the (DPR) recommendation of three acres of park land per 1,000 residents. Sixty-two percent of Californians live in areas that do not meet this criterion. According to DPR, a park should exist within a half mile of neighborhoods. Underserved communities are identified as overpopulated with limited park space. Historical data proves well-maintained parks near neighborhoods revitalizes community diversity, health, culture, and even property value.

"Complete Street Programs," which better enable safe access to roads for pedestrians, bicyclists, motorists and transit riders, paired with capital improvements and increased mobility access, are improving California residents' abilities to walk to nearby parks. Based on California's Survey on Public Opinion and Attitudes on Outdoor Recreation (SPOA), 72% of park users walk to a park, while the remaining drive, bike or use public transit.

SUMMER PERFORMANCES ARE ENJOYED BY ALL, LIKE VICTORY PARK IN STOCKTON AND MISSION DOLORES PARK IN SAN FRANCISCO

OPERATION AND MAINTENANCE

An increasing interest in outdoor recreational activities coupled with a slow financial recovery from the Great Recession (2008) has contributed to a significant amount of deferred maintenance. The 2015 Statewide Comprehensive Outdoor Recreation Plan (SCORP), a 10-year plan for public outdoor recreation, found 55% of leaders and City officials had reported parks in rough conditions and in need of rehabilitation within their jurisdiction. Many statewide recreational areas have a high demand for personnel, cabins and restroom needs.

Deferred maintenance of state parks in California has accumulated to over $1.2 billion. Meanwhile, local parks have deferred maintenances that exceed $1 billion. National parks in California report a backlog of $1.8 billion. Deferred maintenance can result with unsafe environments and create undesirable social activity. Additionally, old park equipment cannot keep up with park needs.

FUNDING AND FUTURE NEED

Parks infrastructure is typically funded with a combination of general fund monies, special funds, dedicated funds, bonds, user fees, and sometimes rental fees and concessions. Parks dependent on the general fund monies show the greatest deficiencies. Those supported by special funds, dedicated funds, or public/private partnerships are in better condition.

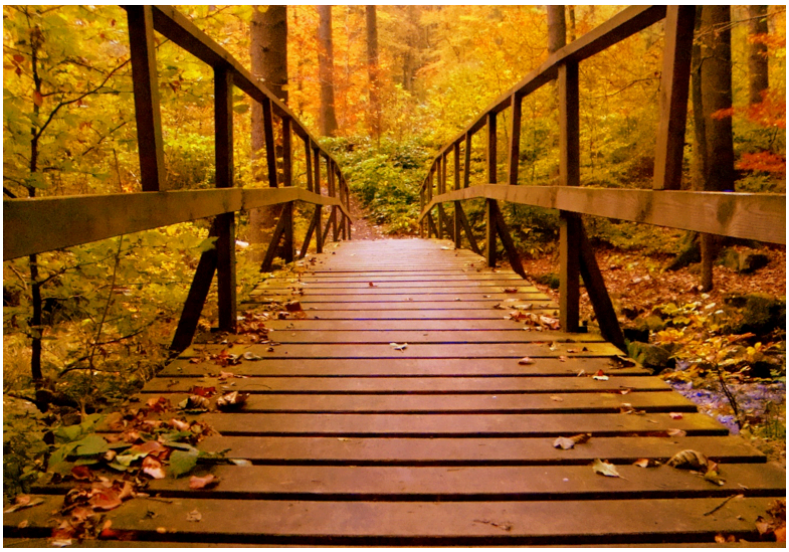
Parks, for the most part, are discretionary services and are the one which are first to be impacted during budget reductions, and the last to receive additional funds when money is available. Since Proposition 13 (1978), the property tax reform on local and state government, park and recreation services have struggled for funding. After Proposition 13, general fund allocation to parks and recreation dropped an estimated 47%, as property taxes

declined. Compounded by the Great Recession of 2008, park and recreation services have further deteriorated to the extent that 40% of the park agencies that existed in 2008 no longer exist as separate entities. Many have consolidated with other city departments or their personnel have shifted to police departments, library services, public works or other functional departments.

PARK GOERS SEEK OUT SECLUDED RETREATS AWAY FROM THE CITY MISSION DOLORES PARK IN SAN FRANCISCO

More recently, some localities are beginning to reverse the trend of underinvestment in parks infrastructure. In 2016, the County of Los Angeles created a Regional Park and Open Space District and received voter support for Measure A, which imposed an annual 1.5 cent per square foot parcel tax – a tax assessed on units of property rather than value. Funding is directed to neighborhood parks, open spaces, rivers and beaches, as well as water conservation projects. This is an example of an agency shifting park infrastructure support away from the general fund and establishing their own funding destiny.

California parks also benefit from the Quimby Act, which allows for a City or County to require a developer to dedicate land or pay fees to provide park facilities and offset the impact of new development. Quimby Act fees, however, cannot be used to maintain parks or recreation facilities, but rather must be used for initial development. For example, the City of Folsom opened a large community park constructed from developer fees. The $8 million park was a result of community and political support to increase fees and borrow against that future income to provide immediate benefit.



UNIVERSAL ACCESSIBILITY HAS BEEN ENCOURAGED TO MAXIMIZE PARK VISITOR OPPORTUNITIES AND ENJOYMENT

Figure 1

Uses of Proposition 68 Bond Funds

(In Millions)

Natural Resource Conservation and Resiliency	**$1,547**
State conservancies and wildlife conservation	767
Climate preparedness and habitat resiliency	443
Ocean and coastal protection	175
River and waterway improvements	162
Parks and Recreation	**$1,283**
Parks in neighborhoods with few parks	725
Local and regional parks	285
State park restoration, preservation, and protection	218
Trails, greenways, and rural recreation	55
Water	**$1,270**
Flood protection	550
Groundwater recharge and cleanup	370
Safe drinking water	250
Water recycling	100
Total	**$4,100**

PROP 68 BOND USE AND ALLOCATIONS

Proposition 68, passed in June of 2018, was the first statewide park funding proposition in 15 years. $4 billion in bonds were authorized for state and local environmental protection and restoration water projects.

Most, if not all, park agencies in California will benefit from this funding source. The money allocated to parks will be used to acquire park land in underserved communities or capital improvements to enhance deteriorating parks. For state parks, funds will be directed to replace or repair parks on the "deferred maintenance list." Although this funding will help address local parks deferred maintenance, it doesn't account for future maintenance. State parks would require a much larger solution.

RESILIENCE

Drought conditions forced many new facilities to turn to alternative approaches to green space. Today some demonstrate a refined water system saving technology and self-efficient structures with solar panels in addition to drought tolerant vegetation.

The state park system and local agencies have been proactive in ensuring facilities prepare for future drought conditions. Implementation of Low Impact Developments (LID) like bio-swales in parks or stormwater basins can manage the runoff water collected. Having LID systems has become beneficial to densely populated cities in the removal of pollution and replenishing local aquifers and increasing water reuse, according to the Environmental Protection Agency (EPA). The County of Los Angeles has been a great proponent of LID implementation by establishing an ordinance in October of 2008. Since then, various projects have been built in a cost-effective manner that minimize pollution and regenerate the local water systems.

OVER 2 MILLION TOURISTS VISIT JOSHUA TREE ANNUALLY (YUCCA BREVIFOLIA)

INNOVATION

A SERIES OF ROCK STACKS DEVELOPED BY TRAIL HUNTERS

Local parks and recreational areas have developed various methods of generating revenue to facilitate their outgrowing budgets against deteriorating capital. Many have added parking fees, farmer's markets, concessions and partnered with local non-profits and businesses. The City of Vista partnered with Vista Unified School District, and through a collaborative financial and coordination effort, built a $4.9 million gymnasium and synthetic turf soccer fields for their underserved communities. Cell towers were added to soccer field lights, with resulting rental fees being allocated for future maintenance.

In addition, DPR has developed new resources to provide local governments with the means to better identify park deficiencies. New GIS technology and Park Access Tools provided by DPR have also helped as well.

PUBLIC PARKS

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RECOMMENDATIONS TO RAISE THE GRADE

- Government entities create funding alternatives by partnering with local assistance and non-profits to invigorate park finances and address local needs.
- Continue a sustainable approach to infrastructure with a keen eye toward reducing maintenance costs for both new and old facilities.
- Improve methods of writing and reporting bond measures and propositions data for accuracy, reliability, accountability and understanding of future allocation needs.
- Additional statewide bond measures, such as Proposition 68 to address the severe deficits. When funded in the 2019-2020 budget year, should be put in place (or implemented) Proposition 68 will provide much-needed funding for improvements to parks throughout California. Specifically, funding will address deferred maintenance at parks and park infrastructure for underserved communities.

TOGETHER WE CAN LEAVE A LASTING IMPRESSION
FOR OUR FUTURE GENERATIONS TO ENJOY

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RAIL

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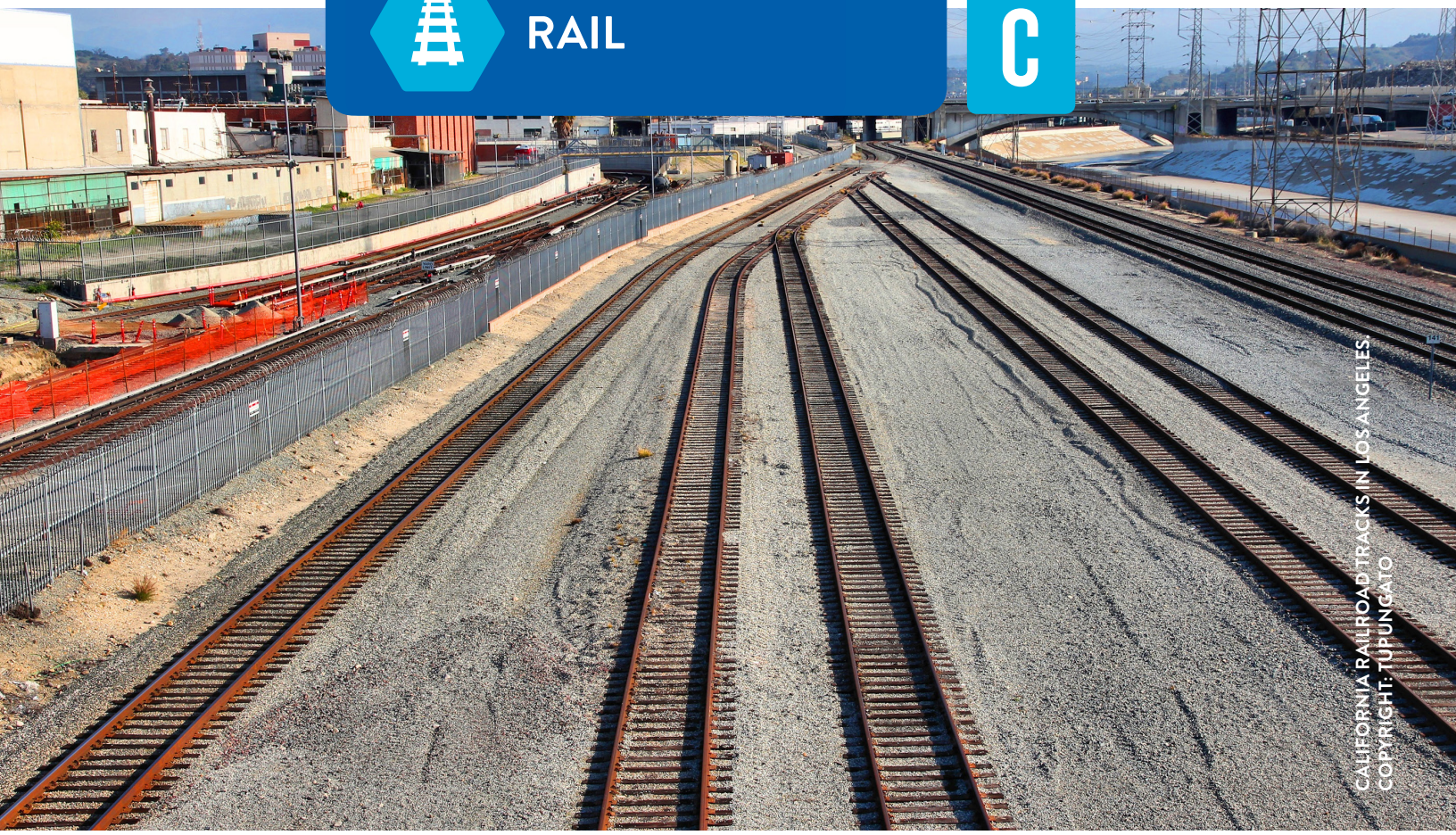

CALIFORNIA RAILROAD TRACKS IN LOS ANGELES.
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RAIL

EXECUTIVE SUMMARY

California is home to an extensive network of freight and passenger rail. A major portion of California's passenger rail system operates on right-of-way owned by Class I freight railroads, which are also the major carrier of freight in the state. Passenger rail systems and smaller freight carriers (Class II and III), to a lesser degree, rely on public funding for operations and maintenance. Class I freight railroads are able to fund maintenance and capital investment from their revenues, and generally operate on infrastructure that is in good condition. Progress is being made on safety related Positive Train Control (PTC) systems and most of the state's railroads implemented the service by the December 31, 2018 statutory deadline. However, some of the challenges that remain include lack of adequate funding for grade crossing safety programs, and commuter rail and state-supported intercity passenger rail that lack a dedicated revenue source for operations, maintenance, and capital investment programs. California, and the public agencies managing passenger rail systems, are working to remedy the issues regarding funding, interconnectivity, and capital investment, which have been outlined in the 2018 California State Rail Plan.

CAPACITY AND CONDITION

Passenger rail consists of intercity passenger rail, commuter rail, and long-distance Amtrak trains. Most of these operate over trackage owned by the Class I freight carriers, the BNSF Railway and the Union Pacific Railroad, thereby straining the capacity of the state's rail corridors. In most cases, transportation agencies cannot add new passenger service without adding track capacity in accordance with operating agreements. Expansion of freight service also requires additional tracks and related infrastructure. Right of ways constraints, especially in urban centers, combined with environmental and regulatory constraints, further confines the opportunity for capacity expansion on the rail network.

The Federal Railroad Administration (FRA) and the Federal Transit Administration (FTA) have strict requirements regarding maintenance of the track and related infrastructure which govern allowable operating speeds. Deficiencies require "slow orders" to be placed on a segment of track which can impact freight and passenger rail service. Consequently, agencies and railroads must maintain the infrastructure to ensure safety, reliability, and operations.

The median age of the Class I railroad locomotive fleet ranged from 16 to 20 years in 2015, which further impacts service reliability. Passenger carriers are reporting existing locomotives are at or near the end of their useful life. In some cases, scheduled equipment overhauls have not occurred due to budget constraints of the passenger rail agencies. While some funding has become available through local and state grants with an emphasis on air quality, a substantial financial obligation from the operating agency is required where there are already significant budget constraints.

Much of the existing railroad infrastructure is aging, with many of the railroad bridges over 100 years old. The replacement of these aging bridges and other infrastructure is limiting capital investment in new railroad infrastructure. The California Public Utilities Commission (CPUC), in its annual safety report to the state legislature in 2017, reported that nine out of 143 bridges needed significant repairs. They also commented this was a sampling of the bridges currently in service within the state. Aging and degraded infrastructure conditions place additional funding burdens on public agencies and freight railroads.

UNION PACIFIC FREIGHT TRAIN NEAR DUNSMUIR CALIFORNIA
© BORROWED LIGHT IMAGES

Freight Rail

Local industries, such as mining and agriculture are also served by Class I and II carriers. Currently there are 5,418 Class I route miles and 1,317 Class II route miles in the state, with a small portion of Class II railroads operating over Class I trackage. The use of double stack intermodal trains from the ports is increasing with the growth of the economy. Freight carloads in 2013 totaled 62.1 million tons and intermodal freight totaled 98.6 million tons of goods. By 2040 freight traffic is forecasted to increase to 213.3 tons of intermodal goods.

SAN ELIJO LAGOON DOUBLE TRACK/BRIDGE REPLACEMENT PROJECT (SAN DIEGO COUNTY)

Passenger Rail

California has three successful state-supported intercity rail corridors – Capitol Corridor, Pacific Surfliner, and San Joaquins; and three nationally supported corridors – Coast Starlight, California Zephyr, and Southwest Chief. These trains operate over 2,550 miles of trackage owned by the Class I carriers or public regional railroads.

The following five commuter rail systems operate in the state of California and total over 830 route miles: 1) Altamont Corridor Express (ACE), 2) Caltrain, 3) COASTER, 4) Metrolink, and 5) Sonoma-Marin Area Rail Transit (SMART). Four of these are operated with diesel electric locomotives with cab cars, posing noise and air quality issues. Four of the commuter lines mostly operate over trackage owned and maintained by their agency, where the freight railroads operate as tenant railroads, while the fifth operates exclusively over trackage owned by the freight carriers.

FUNDING AND FUTURE NEED

Freight Rail

In 2018, the BNSF capital expenditure program for California included a maintenance component of $230 million. Railroads have been increasing their capital program to replace aging infrastructure. In many cases, the railroads are operating over right-of-way which was initially constructed more than 100 years ago. Increasing operational demands are requiring upgrades to alignment, infrastructure, and signaling to keep up with the demand brought on by increasing passenger rail and goods movement needs. Furthermore, increasing port traffic and shifting geographic freight requirements have magnified the need for additional railroad yards and near and on-dock rail facilities. Additionally, the expansion of the Panama Canal will have an impact on intermodal freight traffic in California.

Passenger Rail

Passenger rail receives funding from several sources at the federal, state, and local level. Federal funding for capital projects and programs is provided through discretionary grant programs and formula programs. State funding for capital projects and programs is provided through the State Transportation Improvement Program, the Transit and Intercity Rail Capital Program, and others. In 2017, the California legislature passed Senate Bill 1, which provides an estimated $52 billion over the next 10 years to California's surface transportation system, including some funding for intercity and commuter rail capital and operational needs.

The 2018 California State Rail Plan includes a short-term plan (to 2022), a 10-year plan (to 2027), and a longer-term plan for 2040 which feature better connections, more frequent rail service, and the electrification of Caltrain. In particular, it shows the development

of the high-speed rail network as the backbone of a transportation system fed by intercity, commuter rail, and local transit, specifically calling for an increase in passenger rail infrastructure investment to meet the transportation needs of the future. While there have been high speed rail funding uncertainties raised by the state of California government officials, this does not change the need for additional capacity. Since many of the passenger rail services operate over trackage owned by the Class I railroads, this will require adding capacity to existing freight corridors. The 2027 capital cost estimate for the passenger rail system, aside from the high-speed rail program, is $47 billion. This includes additional service capacity as well as upgrades of locomotive fleets, the privately funded high-speed rail service to Las Vegas, and service to new markets. In addition, the State Plan identifies a 2040 capital cost need of $85 billion.

Aging infrastructure and equipment are a concern of passenger railroads, mostly subsidized by local governments, which often lack a dedicated funding source for maintenance and rehabilitation. This is compounded by federal requirements regarding track maintenance as a function of operating speed. This becomes an even more pressing issue as the existing infrastructure continues to age and the demand for higher speed passenger and freight services increases.

CALIFORNIA HIGH SPEED RAIL CONSTRUCTION - CEDAR VIADUCT, FRESNO

PUBLIC SAFETY, RESILIENCE, AND INNOVATION

Both passenger and freight railroads have continuously innovated their infrastructure and maintenance procedures, including accelerated bridge construction, signal system improvements, and general design enhancements to mitigate seismic event impacts, flooding and other resilience issues. In addition, the subject of climate change and sea level rise are of concern with the coastal passenger rail network as capacity is added to the corridors and bridges are expanded or replaced.

Passenger and freight rail systems are actively installing Positive Train Control (PTC) on their infrastructure and equipment to meet the federally mandated deadline of December 2018. The development and installation of this system has required an investment of hundreds of millions of dollars, reducing funds available for other capital improvements.

Several of the passenger railroads are introducing Tier 4 diesel locomotives to replace aging equipment, with the Metrolink and Capitol Corridor systems beginning to operate this equipment. This technology will also be introduced in the COASTER, Pacific Surfliner, and San Joaquins. It should be noted that Caltrain is electrifying its system. Others are working with federal and state agencies to explore other alternative technologies for improved performance as well as reduced operating costs and environmental impacts.

Increasing passenger and freight rail traffic has amplified safety issues at roadway-railroad at grade crossings. The FRA has reported an increase in grade crossing accidents. Several local governments are either upgrading or grade separating some crossings. However, the lack of consistent funding constrains the development of a more comprehensive and widespread grade crossing safety program.

RECOMMENDATIONS TO RAISE THE GRADE

- **Building on the state rail plan, identify and implement a long-term capital improvement program for passenger rail systems to upgrade, rehabilitate, and replace aging rail infrastructure.**
- **Continue replacement of the aging locomotive and passenger car equipment with an emphasis of improving operational reliability, reducing costs, and reducing greenhouse gas emissions.**
- **Provide additional track capacity as well as operational improvements to avoid passenger and freight rail scheduling conflicts.**
- **Establish dedicated and ongoing funding sources to financially support passenger operations and maintenance and fund capacity improvements.**
- **Provide additional funding for grade crossing enhancements and grade separation projects.**
- **Work with State and Federal regulators to streamline rail corridor environmental mitigation requirements and review process timelines.**

DEFINITIONS

CAB CAR – A car attached to a passenger train on the opposite end from the locomotive and used to control the train in push-pull operations.

COMMUTER RAIL – Passenger rail used to commute to destinations within a region.

FREIGHT RAILROADS – Class I, Class II, and Class III freight carriers. The class distinction is related to volume shipped. The Union Pacific Railroad and BNSF Railway are the two Class I carriers in the state of California.

INTERMODAL – A freight railroad term referring to the shipping containers which can be transported by ship, rail, or by truck.

INTERCITY PASSENGER RAIL – State supported rail service managed locally by Joint Powers Authorities in California. These are longer distance services for transportation between cities but with locally provided service as well.

DEFINITIONS (CONT.)

POSITIVE TRAIN CONTROL – A train control signal system which prevents train-to-train collisions, over-speed conditions, and railroad worker accidents among other features. The federal deadline for railroads to install this system is December 2018.

RAIL – The system of freight and passenger railroads operating over mostly privately-owned right-of-way and regulated by the FRA. This includes heavy passenger rail such as commuter rail, intercity rail, and high-speed rail.

SLOW ORDER - A speed restriction placed on a section of track based on a deficiency in the infrastructure.

TIER 4 DIESEL LOCOMOTIVE – Next-generation diesel locomotives with cleaner operations than conventional equipment. The tier rating is given to diesel engines based on the level of pollution generated.

TRANSIT – Passenger operations and facilities, located within cities, operated by a local transit agency. This includes bus, light rail transit, heavy rail transit, streetcars and ancillary services.

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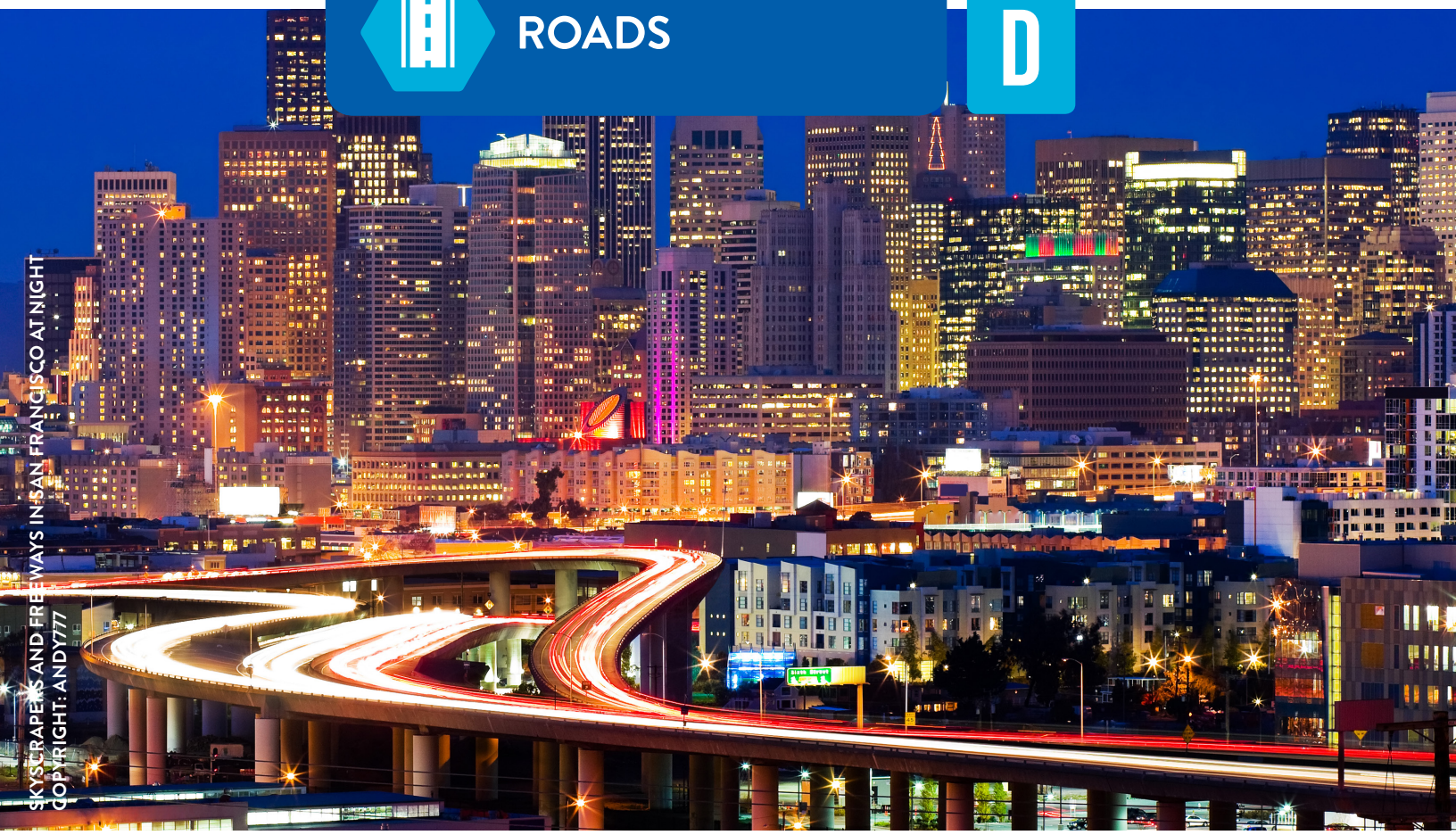

SKYSCRAPERS AND FREEWAYS IN SAN FRANCISCO AT NIGHT
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ROADS

EXECUTIVE SUMMARY

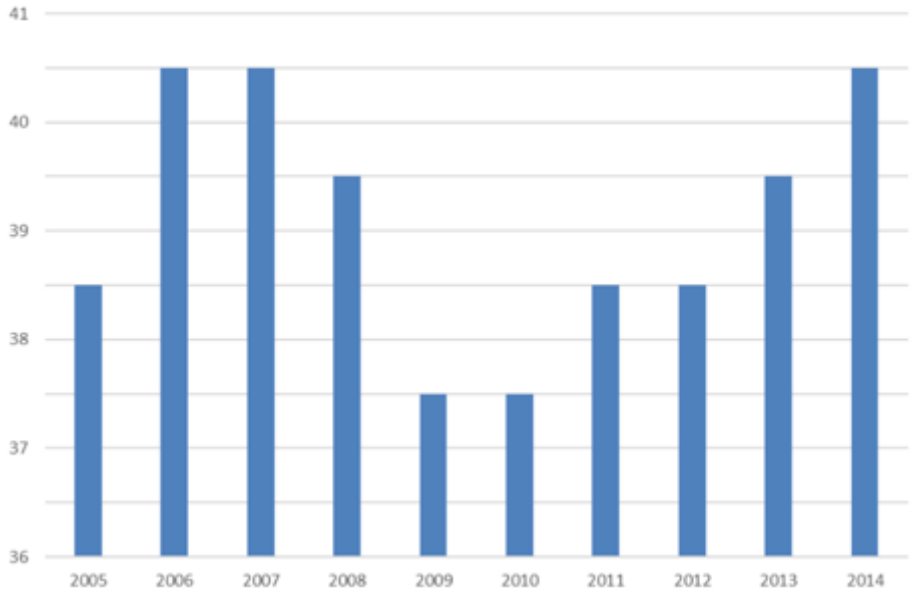
Driving on deficient roads costs Californians $61 billion annually due to congestion-related delays, traffic collisions, and increased vehicle operating costs caused by poor road conditions. The condition of California roads is among the worst in the nation, ranking 49th according to the latest US News & World Report Ranking. Meanwhile, Southern California and the Bay Area are the second and third most congested urban areas in the nation, respectively. Repair and improvement to these roads is vital to California's economic health and public safety. The Road and Repair Accountability Act (SB 1) passed in April 2017, provides $52 billion in additional funds for local and state roads over the next 10 years. However, a total of more than $130 billion over that same time is needed to bring the system back to a state of good repair. A good transportation system enables efficient movement of goods and people and is critical to California's economic well-being.

This Chapter was previously released as part of the 2018 Report Card for California's Surface Transportation Infrastructure.

CAPACITY

Safe and reliable roads are critical to meeting the demands of California's growing population and maintaining the state's status as the world's fifth largest economy. California's population was nearly 40 million in 2018, a 17% increase since 2000. As population increases, so does vehicle-miles-traveled (VMT). According to TRIP, a national transportation research organization, VMT in California increased by 11% from 2000 to 2016, from 307 billion miles to 340 billion miles travelled each year. The average driver now spends over three full days stuck in traffic, and congested roads cost Californians $29.1 billion each year from lost time and wasted fuel. This equates to drivers losing between $299 and $1,774 in annual costs per driver. The Los Angeles-Long Beach—Anaheim region area is the second most congested area in the nation, according to the Texas Transportation Institute's 2015 Urban Mobility Scorecard, and the San-Francisco-Oakland region is the third.

AVERAGE DELAY (HRS) PER COMMUTER



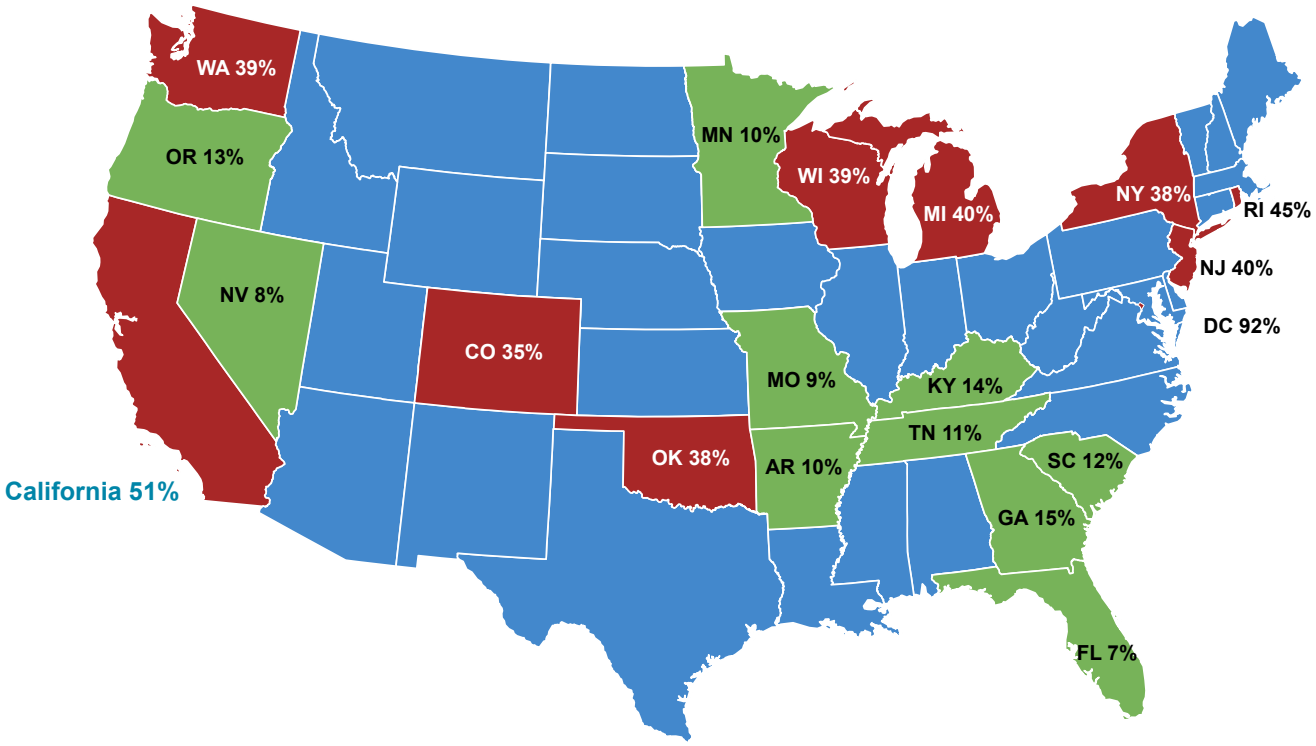
CONDITION

According to the California Legislative Analyst's Office, California has almost 51,000 lane miles of state highways and 335,000 lane miles of local streets and roads. According to the 2018 TRIP's analysis of Federal Highway Administration (FHWA) data, only 19% of California's major roads and highways are in good condition, whereas 68% are in mediocre or poor condition, and 13% are in fair condition.

On the Pavement Conditions Index (PCI) a scale of zero (failed) to 100 (new), California's average local street and road PCI has continued to deteriorate over the years and was at an "at risk" PCI score of 65 in 2016. The average PCI scores in 52 of the state's 58 counties are categorized in the "at risk" or "poor" categories.

Additionally, most California roads today are at least 40 years old. While roads may be resurfaced, they will continue to age and reach a point of deterioration where reconstruction is necessary for roads to be safe.

CALIFORNIA HAS THE SECOND WORST ROADS IN THE COUNTRY.
51% OF THE MAJOR URBAN ROADS IN CALIFORNIA ARE IN POOR CONDITION.



FUNDING

The primary funding source for transportation infrastructure is the motor fuels tax levied by both the federal and state governments. The federal motor fuels tax is 18.3 cents-per-gallon and has not been raised since 1993. Increased vehicle fuel efficiency, hybrid and electrical vehicles, and a failure to index the tax to inflation has reduced the federal fuel tax's purchasing power by more than half in the last 25 years. At the state level, the California legislature acted in 2017 to shore up transportation revenues and provide additional funding for the state's road network. The Road and Repair Accountability Act, Senate Bill 1 (SB 1) transportation package provides an estimated $52 billion in transportation revenue over the next 10 years to repair some of California's subpar infrastructure.

10-YEAR MAINTENANCE BACKLOG

Total Backlog: $137B

SB 1 Funding: $52B

Funding Gap: $85B

While SB 1 provides much-needed revenue, more must be done. As of 2018, roads face an $85 billion funding gap over the next 10 years. To fill the gap, cities and counties must raise and continue to invest their own revenues, and the state must explore new and innovative funding models including increased participation from the private sector. The federal government must also be a partner by providing significant, sustainable funding, ideally through an increase in the federal gas tax.

FUTURE NEED

The California Department of Transportation's (Caltrans) California Transportation Plan 2040 (CTP 2040), adopted in June 2016, identifies goals and recommendations to achieve a safe, sustainable, universally accessible, and globally competitive transportation system. CTP 2040 acknowledges highway and road investments alone will not solve congestion problems exacerbated by the more than five million people added to California's population every decade. The plan recommends new methods focusing less on specific projects and more on improving corridors through holistic approaches. The Federal Highway Administration estimates each $1.00 spent on road, highway and bridge improvements can return $5.20 in benefits by reducing vehicle maintenance costs, traffic delays, fuel consumption, road repair costs and vehicular emissions, resulting in improved safety and traffic flow on our roads.

OPERATION AND MAINTENANCE

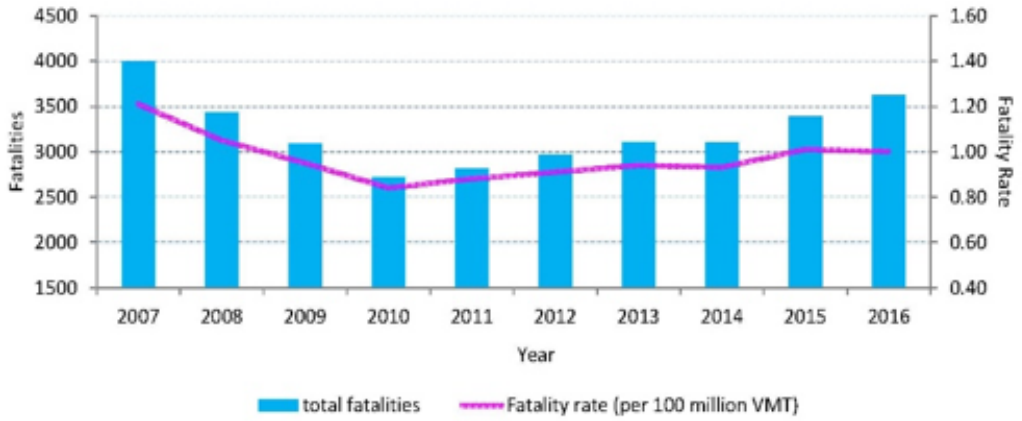
Caltrans has an approximately $57 billion deferred maintenance backlog, by far the largest such backlog in the state. Projections suggest this deferred backlog will increase over the next decade due to chronic underfunding.

SB 1 and California's 2017 Five-Year Infrastructure Plan (FYIP) begins to address these deferred maintenance issues by directing the largest percentage of money from SB 1 to be spent on maintenance of state highways and local streets and roads. SB 1 allocates $1.8 billion annually toward Caltrans' Highway Maintenance Program (CHMP) and State Highway Operations and Protection Program (SHOPP). CHMP performs maintenance on highways in good or fair condition while SHOPP delivers capital projects to rehabilitate or reconstruct highways when they have reached the end of their useful lives. Additionally, the FYIP will provide an annual $1.5 billion for local road maintenance and rehabilitation. However, the average annual funding of $2.3 billion for SHOPP repair and rehabilitation work is insufficient to address the annual $8 billion needed, and localities themselves need to direct additional funding to these projects to help close the investment gap.

PUBLIC SAFETY

Between 2012 and 2016, 16,185 people were killed in motor vehicle accidents in California (an average of 3,237 fatalities per year). Statistically there is one fatality for every million vehicle miles traveled, which is slightly better than the national average of 1.16 fatalities per million vehicle miles traveled. Since 2014, California has seen increases in fatalities among motorcyclists (+5%), bicyclists (+14%) and pedestrians (+22%), which emphasizes the needs for improvements in roadway safety. Highway improvements such as removing or shielding obstacles, adding or improving medians, improving lighting, adding rumble strips, widening lanes, widening and paving shoulders, upgrading roads from two lanes to four lanes, and providing better road markings and traffic signals can reduce traffic fatalities and crashes while improving traffic flow. Improving safety on California's roadways can also be accomplished through further enhancements in vehicular safety and advancements in vehicle automation.

MOTOR VEHICLE FATALITIES



RESILIENCE

Most urban areas in California have robust networks of alternate roadways, for use if primary roadways were inoperable due to emergency events such as earthquakes, wildfires, flooding, or tsunamis. However, the main intercity north-south and east-west roadways have limited alternate routes of comparable capacity for most of their routes.

California's transportation infrastructure is vulnerable to the effects of climate change including extreme weather conditions and sea level rise (SLR). The effects of SLR will have impacts on all modes of transportation located near the coast. If greenhouse gas emissions continue undiminished, it is possible for SLR to accelerate thirty to forty times faster than during the last century. Aggressive reductions in greenhouse gas emissions may substantially reduce, but not eliminate the risk California will face from extreme SLR. According to the National Oceanic and Atmospheric Administration (NOAA), the global sea level continues to rise at the rate of 1/8 inch per year. California Climate Change Center forecasts that if the rate of SLR continues to accelerate, and combined with major storm events, a resulting sea level rise of 4.5 feet by the year 2100 may cause risk of flooding to approximately 3,500 miles of California roadways.

INNOVATION

In recent years the automobile and technology industries have made significant advancements in automated vehicular (AV) mobilization. Two of the 10 U.S. Department of Transportation Designated Automated Vehicle Proving Grounds are located in California. California must now prepare for the implementation of AVs as well as other mobility technologies including vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-other communications deployment. New technologies have the potential to fundamentally alter transportation systems by reducing crashes, providing critical mobility to the elderly and disabled, increasing road capacity, saving fuel and lowering emissions. Trends in shared mobility may lead to shared ownership of vehicles and increased reliance on on-demand mobility services. Testing of fully AVs on California's public roads began in April 2018 but, pending sufficient legislation, may take a while to be widely adopted.

There have been recent trends toward sustainable road design and construction, with projects certified for sustainability using rating systems such as Greenroads, Envision, and INVEST. Also, Intelligent Transportation System (ITS) technologies such as adaptive signal systems and electronic toll collection systems, and Regional Integration Systems of Intelligent Transportation Systems such as LA Metro's RIITS are common on many of California's urban and rural highways. In addition, numerous programs have been developed to incentivize and accelerate the adoption of zero and near-zero emission vehicles.

RECOMMENDATIONS TO RAISE THE GRADE

- Localities should act to raise revenue for their transportation infrastructure. California state and local governments will face a deferred maintenance backlog of $137 billion over the next 10 years. The Road and Repair Accountability Act (SB 1) provides $52 billion to address this backlog; in order to raise the state's roadway grade to the desired level of "B", long term, dedicated and consistent transportation funding from all levels of government is vital.
- Invest in future mobility technologies to increase capacity, enhance safety, improve the quality of life, provide a heathier economy and engender a sustainable California.
- Policymakers should consider the findings and recommendations made in the Road Charge Pilot Program completed in March 2017 and continue progress towards using a mileage-based user fee approach to pay for transportation improvements.
- Continue development, adoption and implementation of advanced multimodal transportation systems and ITS technologies to increase safety, improve mobility, reduce greenhouse gas and air pollution emissions, and minimize energy demand.
- Commit to preserving and improving the quality of the road system using cost effective and environmentally responsive applications, e.g. sustainable pavement management and maintenance approaches.
- Improve the adaptability and resilience of the road network against natural and man-caused events.
- Continue to develop, preserve and support legislation similar to SB 1, to promote bridging the gap for repairing and rehabilitating our State's aging infrastructure.

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SCHOOLS

C

SCHOOLS

EXECUTIVE SUMMARY

There are 1,026 school districts in California and over 10,000 public elementary and secondary schools serving more than 6,220,000 students statewide. In some municipalities, capacity is sufficient and overall population is declining, while in others, new facilities to accommodate growing enrollment rates are required. Today, most of California's K-12 school facilities are in fair to good condition thanks to upgrades to structures, roofing systems, fire alarms, ADA access, electrical, HVAC and technology. However, the outdoor environment of the K-12 school facilities, including parking lots, play areas and playfield areas, are only in fair condition. Looking ahead, there is a lack in adequate funding for future routine and major maintenance issues.

INTRODUCTION

California has a robust K-12 public school system. It consists of 1,026 school districts, over 10,000 public elementary and secondary school sites as well as three state special schools for blind and deaf children. Together, these public schools service more than 6,220,000 students statewide, with a total operation budget in excess of $50 billion dollars per year. In spite of the generally good condition of school facilities, the overall rating is a C due to the current lack of funds to maintain these facilities, and the poor prognosis for both local school district and state funding for future infrastructure maintenance. In summary, our state's schools are in good condition today, but with little future funding guaranteed for routine and major maintenance, these facilities will deteriorate and become a future deferred maintenance issue.

The State of California's Division of State Architect (DSA), the California Department of Education (CDE) and the office of Public School Construction (OPSC) provided information about the number of classrooms and schools in California. It is well known, however, even though the K-12 public school facilities are one of the largest sectors of public infrastructure spending for the State of California, it lacks comprehensive data for its facilities. Policy makers in Sacramento have discussed this issue since at least 2012, but as of the date of publication, no legislative proposal has been introduced to fund the creation of such a data base.

This report card was prepared through an analysis of national and state K-12 school facilities publications and reports, information provided by the CDE and OPSC, the Governor's 2018 budget, California's 2017 five-year infrastructure plan, local school district facilities master plans, as well as other state and local K-12 school facilities' report cards previously completed by ASCE. Together with testimony from the K-12 educational facilities experts, the following is an assessment of the K-12 school infrastructure.

CAPACITY

Over the past five decades, the population of California doubled from 20 million to 40 million residents. High enrollment growth during this time resulted in classrooms and school sites becoming overcrowded. Many school districts had no other option than to transition to multi-track, year-round education and double sessions. In 1996 the State of California issued a policy calling for class size reduction. As a result, California's K-12 school system had to construct new schools, alter existing facilities and add portable classrooms to provide additional capacity. In recent years, overall K-12 student enrollment has declined, a trend that's forecasted to continue, according to the California's five-year infrastructure plan.

Although many of California's school districts are experiencing declining student enrollments, some school districts located in expanding areas of California are still experiencing student enrollment growth and need additional capacity. In larger school districts, there are disparities in classroom capacity. These school districts will have to strike a balance between maximizing the instructional time for students, the importance of having a neighborhood school, and the cost of transporting students from an overcrowded school to a school that has available capacity.

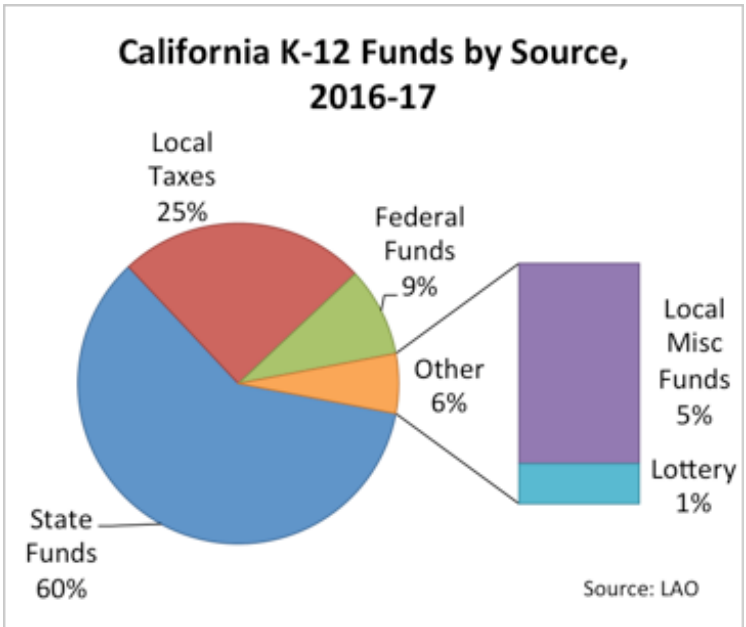
CONDITION

In 1933, California passed Assembly Bill 2342 which required the DSA to review and approve construction documents for school construction and alteration. Today, as a result of DSA oversight and the DSA requirement of continuous on-site inspection, California's K-12 school facilities are considered some of the safest school buildings in the U.S. Over the past three decades, many of these facilities have been upgraded through the State's School Facility Program (SFP) in the areas of fire alarm and access compliance. In 1999 the legislature passed and then Governor Gray Davis signed AB 300, a bill that required the DSA to study the structural integrity of certain types of public K-12 school buildings built prior to 1971. In 2006, the state bonding provided funding for a Seismic Mitigation Program that continues to be available to school districts. As a result of these actions, many schools with seismic issues have been replaced or have undergone needed structural repair.

The outdoor environment of the K-12 school facilities can be an issue. In some communities, parking lots, play areas and playfield areas are considered to be only in fair condition. While others have newly paved play areas, well maintained play fields, and newly installed artificial turf on soccer and football fields thanks to community support of local bonds. The issue of equity in capital funding for K-12 public schools continues to be unresolved.

FUNDING

Since 1998, California voters approved $44 billion in state school facilities bonds and $90 billion in local general obligation bonds. School districts have also collected approximately $10 billion in developer fees. All of the state school bonds had been allocated to school projects and no additional funding from the State is available. The State of California has clearly shifted funding responsibilities with regards to providing new capacity to local school districts. It should also be noted that voters in high property value school districts are more likely to support providing funds for their school districts than voters in lower property value school districts. The figure in this section denotes school funding sources, including instructional, in the school year 2016-2017.



FUTURE NEED

New construction and major modernization projects for K-12 school facilities generally requires both state and local funding. The State's school facility program is funded by school facility bonds and State dedicated funding. Local funding usually comes from local general obligation bonds, developer fees and sale, lease or rent of the vacant school. New construction grant programs generally provide funding on a 50/50 state/local match basis. School districts that cannot provide local funding can apply for hardship under certain circumstances. Modernization grant programs generally provide funding on a 60/40 state/local match basis. School buildings are eligible for modernization grants every 20 years for portable classrooms and every 25 years for permanent buildings.

OPERATION AND MAINTENANCE

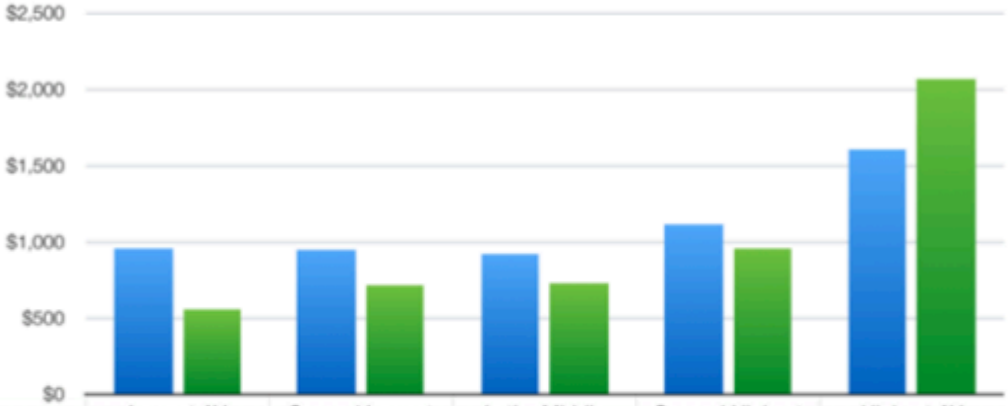
California's K-12 public school facilities have a large amount of infrastructure, such as buildings, parking lots, play areas, athletic fields and buses that require annual operation and maintenance spending. Most of California's school districts underspend on operations and maintenance of their facilities. It is believed that 60% of the school districts fail to meet the benchmark industry standards for operation and maintenance. Between 1994 and 2013, California spent only $909 per student (per year) on the operation and maintenance of its K-12 public school facilities. This is approximately $130 per student (per year) below the national average, even though the cost of operation and maintenance on facilities is more expensive in California than many other states.

A 2015 study of California school district funding found that low-income school districts were less likely to spend funding for refurnishing and modernizing their facilities as shown in Figure 1 Preventative maintenance saves money in the long term, and therefore, as buildings in low-income school districts become older, they will need to spend more on maintenance and repairs of their facilities than the high-income school districts.

For many years, the cost of operation and maintenance for K-12 public school facilities has been funded from local school districts' operating budgets as well as with some state funding. Due to unreliable funding sources, maintenance projects are frequently deferred, leaving some elements of K-12 public school facilities in a weakened state. California does not have a comprehensive inventory, nor a cost on deferred maintenance projects, that is required to bring all the public school facilities to a state of good repair. It is estimated that an annual funding of $7 billion is required for all maintenance needs. During the period between 2008 and 2012, California school districts have collectively spent only $5.7 billion per year on the operations and maintenance of its K-12 public school facilities.

In 2014, the Governor initiated a new Local Control Funding Formula (LCFF) for the funding of all K-12 public school facilities. While it provides more funding to the school districts with higher needs students, it also provides more funding for all the school districts and allows districts to prioritize projects for available funding. The LCFF requires any school district that receives facilities funding to spend 3% of its expenditure on operations and maintenance. However, the building industry believes that the current 3% spending by the school district is only 1/3 of the necessary funding requirements for maintenance needs.

FIGURE 2: AVERAGE ANNUAL SCHOOL DISTRICT EXPENDITURES PER STUDENT ON M&O AND CAPITAL OUTLAY BY ASSESSED VALUE QUINTILES, 2008-2012 (2014$)



	Lowest AV (less than $435,000)	Second Lowest ($435,000 to $699,000)	In the Middle ($699,000 to $1,084,000)	Second Highest ($1,084,000 to $1,857,000)	Highest AV (More than $1,857,000)
Average Annual Maintenance & Operations per Student	$955	$946	$916	$1,112	$1,598
Average Annual Local Capital Outlay per Student	$556	$706	$718	$952	$2,067

PUBLIC SAFETY AND RESILIENCE

The main purpose of the K-12 public school facilities is to provide students a safe and healthy environment for education. However, schools have gradually assumed a greater role within their community. They are the center of the community, a gathering place, a space for youth sporting and community events, and frequently, an emergency shelter. With the recent tragic consequences from unfortunate shootings on school grounds, it has also become more important than ever to consider securing school facilities.

It is well established that school facilities affect students' health and performance. Fresh air, good ventilation, proper interior lighting and acoustics improve the health and alertness of students during instruction time. The State Superintendent of Schools and the CDE engaged to help all school districts in achieving California sustainability and climate adaptation goals to provide a healthy environment for all students.

INNOVATION

Location and design of school district facilities significantly impacts the community and environment. The CDE has implemented new standards to guide K-12 public education school facilities to select and design new school facilities through the California Building Code. Through new operations and maintenance of their facilities, school districts also play an important role in protecting the environment. Solar energy to reduce electrical usage, the latest irrigation technology to reduce water usage and using recycled products to reduce landfill waste are just a few of the techniques which current school districts are using to reduce the use of natural resources, support the local environment and protect human health.

RECOMMENDATIONS TO RAISE THE GRADE

- Establish a stable and dedicated state funding source for operation and maintenance of the K-12 public school facilities.
- Distribute state funds equitably to all school districts, with an adjustment to the distribution based on the local wealth of the district.
- Require all school districts to prepare a master plan to assess the condition of its facilities and identify new facilities and operational needs.
- Establish a K-12 public school facilities database to guide needs and spending.

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SOLID WASTE

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METAL CONSTRUCTIONS OF GARBAGE SORTING CONVEYOR ON MODERN WASTE RECYCLING PROCESSING PLANT. SEPARATE GARBAGE COLLECTION. STORAGE OF WASTE FOR FURTHER DISPOSAL. BY IVAN TSYRKUNOVICH

EXECUTIVE SUMMARY

California has adequate infrastructure for the minimization, collection, processing, recycling, and disposing of solid waste to protect human health, public safety, and the environment with its 1,390 existing solid waste facilities and operations. However, the existing infrastructure is inadequate to meet existing and recent legislative and regulatory solid waste reduction and recycling goals. While well intentioned, these aspirational policies are being implemented without sufficient markets, planning, infrastructure development and funding, and consideration of recent restrictions by other countries on imported recyclables. Overall, the condition of the solid waste category has declined significantly in recent years, largely due to the insufficient infrastructure to meet new recycling goals and adequately manage the improper discharge of solid waste to the environment. California is considering policies to reduce both the generation and disposal of solid waste including greater manufacturer responsibility, waste reduction, improved recyclability, and increased waste fees. These approaches would likely be implemented through future legislation and regulations that would impose mandated restrictions on solid waste generation and handling, as well as penalties on stakeholders failing to comply. More importantly, California needs to

refocus its attention on technologies and internal markets that can help meet its recycling goals/ policies, including waste conversion technologies to safely and cost-effectively convert waste residuals (organics, paper, plastics) into low carbon fuels, energy, and chemicals.

CAPACITY

For three decades, the legislature has tasked CalRecycle, the lead state solid waste agency, with increasing recycling capacity. New increased recycling capacity for 24 million tons of recyclables is now required to meet existing 75% recycling and waste disposal reduction goals by 2020 – a virtual impossibility given the lack of recycling infrastructure and markets for recovered materials. In contrast to State recycling and disposal reduction goals, California's overall disposal in 2016 increased for a fourth consecutive year to 42.7 million tons and recycling decreased to its lowest level since 2011 due to insufficient recycling infrastructure and end markets. In addition, China and other countries have recently imposed severe restrictions on imported recyclables requiring California to seek alternate markets for recyclables.

Multiple state, regional, or local government agencies regulate solid waste management in California, all with their own set of regulations and priorities. California's regulatory structure complicates the permitting of new or expanded facilities – more so than other states.

The California Air Resources Board (CARB) has identified methane generated by organic waste decomposition in landfills a priority greenhouse gas (GHG) pollutant. Even though California has one of the most robust landfill methane capture and destruction regulatory programs in the world, CalRecycle/CARB are attempting to further indirectly reduce landfill methane emissions by mandating that organic waste be recycled rather than disposed in existing state-of-the-art landfills.

California's waste *disposal* infrastructure is adequate to meet needs for the foreseeable future (see chart of unused landfill capacity). However, *recycling* infrastructure and commodity markets for recycled materials are currently inadequate to meet new recycling goals. The policies to divert organics and recyclables from landfills require building a more robust an state-of-the-art recycling infrastructure. Similar to landfills, these new recycling and processing facilities can face significant permitting challenges and will make recycling much more expensive. Without performing comprehensive life-cycle analysis, California has not fully characterized the potential impacts and costs sufficiently to realistically assess alternative measures to protect human health, public safety and the environment.

Further exacerbating its capacity problem, California's Biomass and Mixed Waste to Energy (MWTE) infrastructure is in a state of near collapse. One of the three existing MWTE plants and numerous biomass plants have closed. Competition from cheaper energy sources (e.g., natural gas, wind, solar), increased costs to meet more stringent air quality, GHG standards, and uncertainty of power purchase agreements, limit the continuing viability of many traditional energy from waste operations.

CONDITION

Current enforcement actions indicate that the majority of solid waste facilities operate in conformance with state minimum standards. Although there are currently over 86 pending enforcement actions at California's 1,390 active solid waste operations (~6%), the vast majority are resolved within a short period of time. There are only 15 facilities (1%) on the state's *Inventory of Facilities Violating Minimum Standards* for extended violations. Thirteen facilities are small local landfills, one is a composting facility, and another is a recycling facility.

However, new policies mandate decreased disposal and increased recycling which exceeds the capability of existing recycling infrastructure. While existing recycling infrastructure was able to meet the historical quality standards for export recyclables to other countries, the majority of California's existing recycling facilities cannot cost effectively meet new quality standards imposed by end-markets.

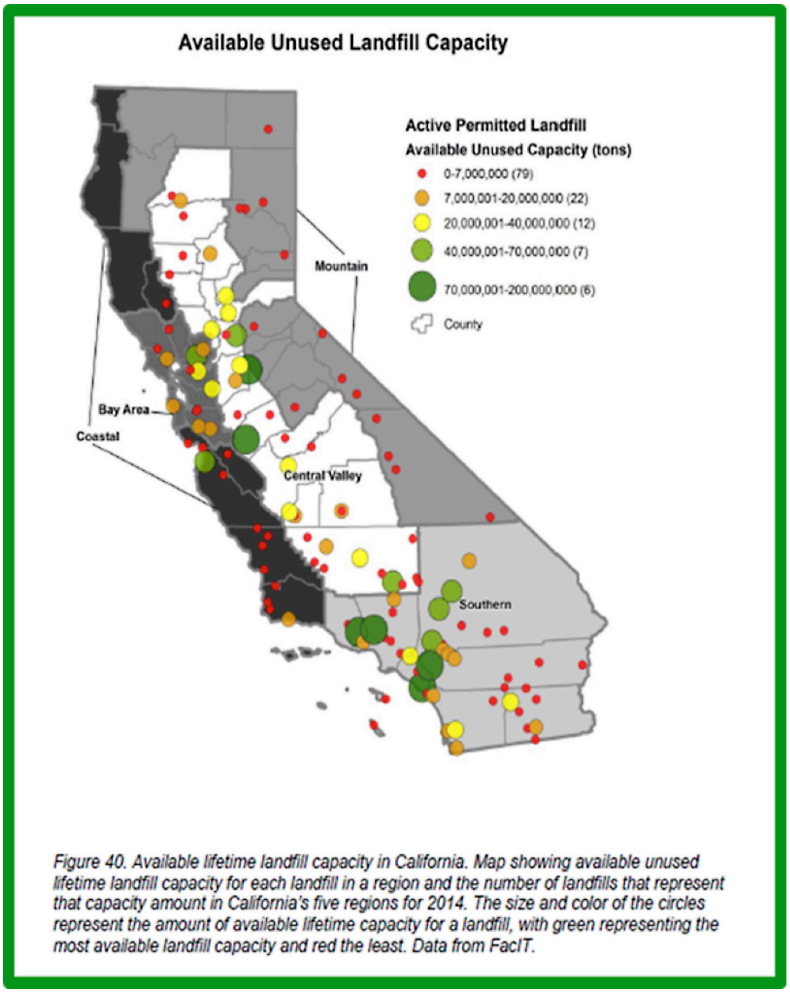

Figure 40. Available lifetime landfill capacity in California. Map showing available unused lifetime landfill capacity for each landfill in a region and the number of landfills that represent that capacity amount in California's five regions for 2014. The size and color of the circles represent the amount of available lifetime capacity for a landfill, with green representing the most available landfill capacity and red the least. Data from FacIT.

FUTURE NEED

Future solid waste infrastructure will combine existing disposal capacity with new and expanded recycling infrastructure. However, there is widespread public misunderstanding that recycling pays for itself. Increased recycling goals, combined with new lower contaminant levels demanded by current end-markets, will make recycling much more expensive. The funding necessary to make up recycling capacity short-falls is estimated below, based on an average annual net recycling cost range of $50 to $100/ton/year (costs minus revenues). This includes the increased cost of collecting, processing, recycling and marketing all forms of recycled solid waste to achieve an overall 75% reduction in disposal by 2025 as mandated by existing statutes and regulations. The cost implications are tabulated in this section.

FUTURE NEED	COSTS
• 25 million tons per year existing capacity shortfall	$1.25 to $2.5 Billion/yr
• 10 million tons per year lost export capacity	$0.50 to $1.0 Billion/yr
• 5 million tons per year lost Biomass/MWTE capacity	$0.25 to $0.5 Billion/yr
Total Added Recycling cost	$2.0 to $4.0 Billion/yr

Additionally, the cost of further collecting and managing trash to achieve zero stormwater discharge by 2030, as mandated by the State Water Resources Control Board, is estimated to exceed $1 billion/year.

FUNDING

Unfunded mandates to achieve 75% recycling levels vastly exceed California's existing recycling infrastructure capacity. California does offer loan and financing options to help support investment, but nothing approaching the level necessary. An estimated expenditure of $2 billion per year for the foreseeable future is estimated to be necessary to cover capital expenditures, operation and maintenance expenses, and logistical expenses to achieve California's recycling goals.

CalRecycle has a $25 million annual grant/loan program that represents less than 1% of funding needed for recycling and organics programs required by state policies. The rest will likely come from fee increases ranging from $12.50 to $25.00 per household per month (estimated) and more for commercial enterprises. These fees could take the form of recycling fees or added fees on the cost of commodities to be recycled, or both. Current refuse collection rates range from $25 to over $75 per household in California, consistent with the national average. At least a 50% increase in refuse collection rates may be required to achieve California's recycling goals.

OPERATION AND MAINTENANCE

For the most part, solid waste facilities operate in compliance with established standards with adequate funding to meet existing operation and maintenance (O&M) costs, which vary widely by facility. Local solid waste fees on waste generators cover O&M costs. However, the investments needed to upgrade California's waste recycling infrastructure to replace existing disposal capacity and achieve mandated recycling and waste reduction goals will have to be supported by increased fees.

PUBLIC SAFETY

Vehicular and on-the-job accidents are an ongoing concern, but are being aggressively addressed by advanced safety technology and practices. Public concerns persist regarding the acceptability of certain disposal practices such as landfills and combustion. This is an underlying reason the state is emphasizing waste minimization and recycling over solid waste disposal. Although viewed by many as an outdated, unsafe, and wasteful practice, landfill disposal is still heavily relied upon for more than 50% of the solid waste produced. Recycling technologies are becoming increasingly advanced (and expensive) for paper, plastics, glass, and metals. California policies discourage the production of energy, fuels, and chemicals from wastes due to past public health concerns, although technology to safely process wastes has advanced significantly – but with increasing costs.

RESILIENCE

California faces threats such as earthquakes, fires, and floods. These can temporarily disrupt waste collection, processing, recycling, and composting services. Waste debris from disasters is difficult to recycle, usually requiring some degree of hazardous waste and recyclable material sorting, but largely relying on landfill disposal to manage disaster debris. Fortunately, California has significant remaining landfill capacity – at least at the present.

[1] CalRecycle has recently released their final Standardized Regulatory Impact Assessment (SRIA) for the currently proposed regulations mandating recycling, rather than disposal, of organic wastes. The SRIA presents CalRecycle's estimated cost to comply with the proposed regulations. The Committee has not yet determined if we agree, or disagree with the estimated cost.

SOLID WASTE

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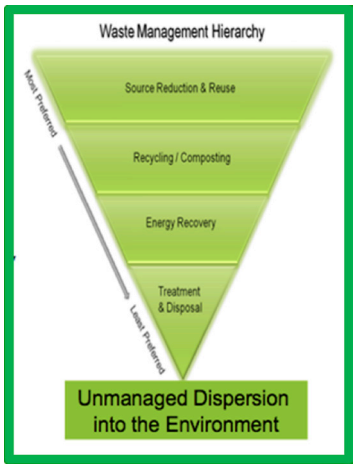
RECOMMENDATIONS TO RAISE THE GRADE

- Mandatory recycling goals should be revisited and re-evaluated based on available capacity and market demand for recyclables. Incentives and funding along with capacity and markets must be planned in advance to ensure recycling goals can be realistically achieved.
- Determine whether organic waste diversion from landfills is the most cost effective (and verifiable) means to reduce landfill methane emissions. A comprehensive and transparent evaluation of natural resource, energy, and GHG lifecycle impacts is essential.
- Revisit statutes that limit the use of solid waste to produce lower carbon fuel and to displace other higher carbon fuels, energy and chemical sources. Provide incentives to customers, such as utilities, agriculture, or manufacturing, to purchase fuels, energy, chemicals and recyclables derived from wastes.
- Implement a Waste Management Hierarchy that includes energy recovery above disposal and seeks to minimize unmanaged dispersion of waste into the environment.
- Due to new global limitations on exports of recyclable materials and California's aggressive recycling goals, the state must take responsibility for adequately educating the public on proper recycling practices to reduce contamination and encourage markets – before expecting that such goals can be realistically achieved.



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STORMWATER

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FUNCTIONAL, AESTHETICALLY PLEASING DETENTION POND. CITY OF SOUTH SAN FRANCISCO.

STORMWATER

EXECUTIVE SUMMARY

Stormwater infrastructure in California includes storm drains, pipes, ditches, canals, and channels. It also includes green infrastructure like vegetated areas that provide habitat, flood protection, cleaner air and cleaner water. Much of the drainage infrastructure in California was constructed prior to the 1940s and needs repair or replacement. Further, the new and innovative drainage systems necessary to meet water quality standards and promote a sustainable environment are significantly underfunded. For example, over the next 20 years in Los Angeles County the cost of achieving water quality objectives is estimated at about $20 billion, and in San Diego County, it is estimated at about $5 billion. Clean water is fundamental to our way of life in California and significant investment is needed to insure sustainable clean water for future generations.

INTRODUCTION

The Stormwater report card category encompasses local drainage and water quality infrastructure throughout the state. In addition to mitigating flood risk, local drainage infrastructure must also meet the requirements of the federal Clean Water Act (CWA) and the companion Porter-Cologne Water Quality Control Act.

The major barrier to improving and rehabilitating local drainage and water quality infrastructure is a lack of adequate funding. Unlike drinking water and sewer utilities that receive dedicated funding from ratepayers, maintenance and improvement of municipal drainage systems is typically paid for through the city or county general fund. Municipalities will need billions of dollars over the next several decades to meet water quality objectives and rebuild aging stormwater infrastructure that is beyond its useful service life.

Many of the state's waterbodies do not currently meet water quality objectives. Further, the current trend for water quality in California (the overall quality of the state's streams, rivers, and lakes) is relatively static, not showing any significant or sustained improvement. To achieve the objectives of the federal CWA, local drainage systems must be modernized and redesigned. Funding the redesign of our drainage infrastructure will require public education and outreach to communicate the environmental and social benefits that will result from these investments in the health of our receiving waters.

CAPACITY

Existing drainage infrastructure capacity is generally sufficient to meet the demands of our growing urban areas. Most large open channels and natural river systems maintain sufficient capacity through carefully managed urban development across the state. However, in some rural areas, flooding events still occur, and as a consequence of climate change the frequency of these flooding events may increase.

Local governments are working hard to meet increasingly stringent Municipal Separate Storm Sewer System (MS4) Permit water quality requirements. MS4 Permits are issued by the State Water Resources Control Board through their nine Regional Boards, in compliance with the CWA's National Pollution Discharge Elimination System (NPDES). At present, few of the MS4 systems within the state incorporate water quality treatment sufficient to meet all NPDES standards.

CONDITION

The existing drainage infrastructure in California is in moderate condition. Many storm drain systems were constructed over 50 years ago, indicating they are reaching the end of their useful design life or are not adequate to protect the community. An example is the 2018 major flooding in Malibu, California. California State Route 1 (the Coast highway) was inundated with mud and debris, exacerbated by recent fires in the watershed. Although most agencies have extensive inspection programs to detect and repair problems before a failure occurs, budgetary constraints slow the pace of inspection and rehabilitation.

The health and condition of the states' waters are best represented by the fact that most major creeks and rivers in the state have at least one approved Total Maximum Daily Load (TMDL) receiving water objective. TMDLs are applied to water bodies that do not meet water quality standards and are typically enforced through NPDES permits. TMDL's require dischargers to reduce the quantity of the pollutant released into the waterbody until the waterbody meets the water quality standard.

FUNDING

Funding for water quality and flood risk mitigation come from various sources, including state grants, bonds, general funds, stormwater fees, and property taxes. Although many municipalities can fully fund current minimum programmatic and maintenance costs for existing infrastructure, additional funding sources will be needed to meet future needs. Long-term projections indicate a significant funding shortfall. For example, over the next 20 years in Los Angeles County the cost of achieving water quality objectives is estimated at about $20 billion, and in San Diego County, it is estimated at about $5 billion.

There is an effort on the state level to modify how storm drainage infrastructure is funded by treating it as a utility. Domestic water and sanitary sewerage utilities are both funded on a rate-based system with funds collected from the users of the system. In 2017, Senate Bill 231 was signed into law, which clarified the definition of "sewer" to include both sanitary sewers and storm sewers, effectively allowing municipalities to adopt fees to support stormwater programs. The city of Los Angeles voted to provide additional revenue for stormwater management and associated infrastructure with the passage of "The Safe, Clean Water Act," or Measure W. Measure W taxes property owners for parcels located in the Los Angeles County Flood Control District at a rate of 2.5 cents per square foot of impermeable area. An estimated $300 million per year will be collected and reserved for projects that help the county meet federal water quality laws and capture, treat, and recycle runoff.

FUTURE NEED

Future drainage infrastructure and water quality maintenance and improvements will require a large increase in funding. Preliminary estimates range from $37.5 billion to $75 billion over the next 20 years. Current master planning efforts in the state are developing cost estimates for this effort. Comprehensive drainage and water quality plans can bring efficiencies that will reduce the financial burden to some extent.

There is also an urgent need for enhanced programs to educate the public and elected officials about drainage infrastructure, its purpose, condition, and importance in meeting flood risk and water quality objectives. Almost universally, state-wide and nationally, municipalities report a lack of support for increased funding for drainage infrastructure. This lack of support largely results from inadequate information on the role our drainage systems play in protecting our environment as well as reducing risk of personal injury and property damage from flood events.

OPERATION AND MAINTENANCE

Local agencies generally try to be proactive in maintaining existing drainage infrastructure to ensure proper operation. However, a lack of adequate infrastructure funding has forced local agencies to be reactive instead of proactive, completing the repairs only after the infrastructure has failed.

New water quality facilities are generally adequately maintained. The State of California Water Board requires new water quality facility projects to develop operation & maintenance plans and commit to fund and execute the plans to perpetuity. The Water Board also maintains a publicly-available project database and reporting system for all new water quality facility development.

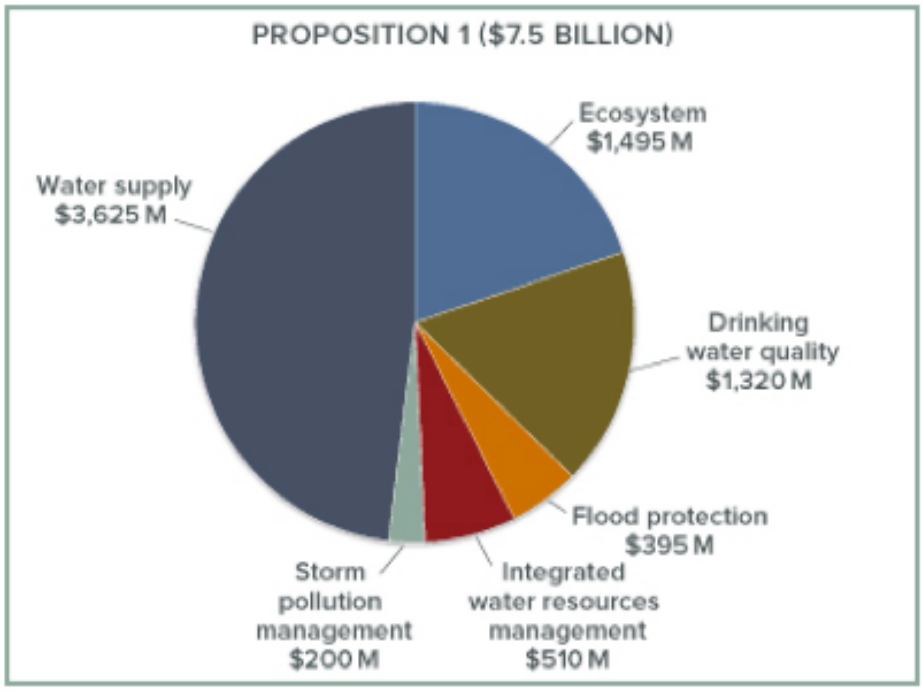
Storm drainage infrastructure for new developments is subject to uniform design guidelines and standards to insure proper sizing for capacity for the storm drainage and flood control infrastructure. However, unlike water quality facilities, storm drainage operation & maintenance plans and related funding appear to be lacking.

Local municipalities work in conjunction with the U.S. Army Corp of Engineers (USACE) to help maintain federal drainage systems like levees and associated infrastructure. Most O&M expenditures are covered by general funds, along with some funding from the Department of Water Resources, and state-funded grants. For example, Proposition 1 (2014) provided $395 million for flood protection, $1,495 million for the protection of rivers, lakes and streams, and $200 million for stormwater pollution control, but these are one-time funds.

Municipalities need to implement asset management and improvement programs for drainage infrastructure. An asset management system inventories all the components of the Municipal Separate Storm Sewer System (MS4) and assesses the condition to estimate the remaining useful life. Asset management systems support planning for needed repairs and upgrades as well as construction of new components to provide sustainable flood risk management and water quality improvement. Relatively few municipalities across the state currently maintain an asset management system.

PUBLIC SAFETY

The challenges to public safety from stormwater are many: drought, pollutants in stormwater runoff, adequate supply of water for groundwater recharge and surface reservoirs, impacts of changing climate and sea level rise, aging infrastructure and flooding from inadequate maintenance.



In order to maintain public safety, assessment management and maintenance efforts need to be ongoing. Local municipalities often work directly with the USACE to address potential deficiencies in the federal storm drain network and with the Federal Emergency Management Agency (FEMA) for any development within the floodplain. Most of the state's agencies participate in the National Flood Insurance Program (NFIP) administered by FEMA. Public safety remains a high priority throughout the state. However, failures can and do occur, usually associated with infrastructure that has exceeded its design life.

For example, in the town of Moraga, a sinkhole formed in March of 2016 due to the failure of an underground 96-inch diameter storm drain pipe. The sinkhole grew to a depth of 15 feet and was affectionately referred to as "Sinky the Sinkhole" by the local residence of the town.

RESILIENCE

Stormwater and flood control infrastructure are regional in scope, with many interdependent components such as pipes, catch basins, ditches, creeks, detention basins, levees and dams. Failure in one part of the network can impact the entire system. When flooding occurs, the damage and disruption can be devastating and very costly. Flooding impacts more than just residential housing – it also impacts commercial and industrial areas, our roadways, and our public transit network. Resilience of our storm drainage and flood control infrastructure is dependent upon condition and age assessment, asset management, maintenance, rehabilitation and system upgrades based on need as well as being aware of changing conditions brought on by new development, climate change and sea level rise. State MS4 NPDES Permits require the integration of green infrastructure in new and redevelopments and incentivize retrofit of green infrastructure.

TOWN OF MORAGA, CALIFORNIA SINKHOLE THAT FORMED IN MARCH OF 2016 DUE TO THE FAILURE OF AN UNDERGROUND 96-INCH DIAMETER STORM DRAIN PIPE. THE SINKHOLE GREW TO A DEPTH OF 15 FEET AND WAS AFFECTIONATELY REFERRED TO AS "SINKY THE SINKHOLE" BY THE LOCAL RESIDENCE OF THE TOWN.

INNOVATION

Innovative stormwater control measures have been implemented in recent years to improve the quality of stormwater and support water conservation. California's water quality requirements promote innovative solutions. Stormwater pretreatment, retention, and re-use are emphasized in most development standards. Various proprietary systems have been developed to more efficiently manage stormwater. Collaboration across agencies has proven effective at developing innovative solutions.

RECOMMENDATIONS TO RAISE THE GRADE

- **COMMUNICATION.** Develop a program for improved communication and messaging to clearly articulate the need for municipal stormwater services. This communication program should be designed to show the public the return on investment they will receive through positive impacts on environment and the improvement to quality of life.
- **PLANNING.** Municipalities must develop an infrastructure improvement plan. The first step in this process is an asset management plan which includes a condition assessment. Once the asset management plan is complete, an infrastructure improvement plan can be developed that addresses needed system repairs and upgrades to meet water quality requirements as well as flood risk mitigation.
- **COST ESTIMATE.** A cost estimate should be prepared for the infrastructure improvement plan. The cost estimate should include repair and improvement to the existing drainage system as well as construction of new facilities.
- **FUNDING AND FINANCING.** Simply put, find a way to pay for implementation of the infrastructure improvement plan. This funding may come from a combination of sources such as the jurisdiction's general fund, a new or existing improvement district, a new tax or fee, or through traditional or emerging methods of financing, including private sector financing.

Each of these four steps is critical to ensuring that stormwater services provided by municipalities and other jurisdictions throughout the state will be able to provide residents and visitors a healthy and safe urban, suburban, coastal, and rural environment, and protect the state's water resources.

DEFINITIONS

MS4 — **Municipal Separate Storm Sewer System. This is a regulatory term that refers to the system of streets, storm drain inlets, pipes, and man-made ditches and channels that provide drainage and food control for municipalities.**

NPDES PERMIT — **This is a permit required under the Federal Clean Water Act, National Pollutant Discharge Elimination System, that nearly all municipalities must have to discharge stormwater to Waters of the United States. Sometimes, the term MS4 is used to refer to a municipality that holds an NPDES Permit.**

WOTUS — **Waters of the United States, defined as waters that receive federal protection under the Clean Water Act. Municipalities must have an NPDES Permit to discharge stormwater (rainwater) to a WOTUS.**

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Watershed Management Programs, Plans and Reports

Watershed Asset Management Plans

Water Quality Improvement Plans

Drainage Master Plans

Jurisdictional Runoff Management Plans

MS4 Outfall Monitoring Plans and Studies

Municipal Capital Improvement Plans and Budgets

Local Floodplain Management Practices and Standards

FEMA Floodplain Maps

Local BMP/LID Design Manuals

NPDES Monitoring Data

EPA MS4 Permit

EPA 2012 Clean Watershed Needs Survey

MS4 Needs Survey

Independent Surveys

TRANSIT

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TRAM SAN FRANCISCO
BY FLUCAS

TRANSIT

EXECUTIVE SUMMARY

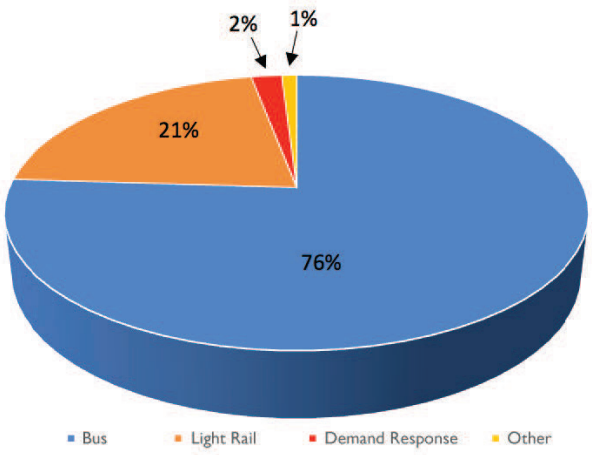
California needs robust, flexible, and reliable transit systems to reduce peak congestion on our highways, provide options for citizens who do not drive, and improve air quality. Public transit in California provides nearly 1.5 billion trips annually on 139 transit systems throughout the state. The California Transportation Commission estimated in 2011 the state needed approximately $174 billion for expansion and state of good repair transit projects over the next 10 years, but at the time only 45% of funding had been identified, leaving a shortfall of $96 billion. Fortunately, recent legislative initiatives and ballot measures are attempting to close the funding gap, including an additional $750 million annually for transit agencies across the state provided through the Road and Repair Accountability Act of 2017 (SB 1). Adequate resources must be provided to our transit systems or we risk retreat on sustainability gains as well as the current state of good repair.

This Chapter was previously released as part of the 2018 Report Card for California's Surface Transportation Infrastructure.

CAPACITY

California has 139 transit systems, including urban, small urban, and rural systems serving a population of over 38 million. Transit services include Light Rail, Bus, and Demand Response with the breakdown of ridership shown in Figure 1.

FIGURE 1. TRANSIT SERVICE TYPES



Public transit in California provides nearly 1.5 billion trips annually. Approximately 5.3% of Californians commute to work using public transit. The population in California is projected to grow to 48 million by 2040. The millennial generation has shifted away from owning individual cars and the older baby boomer generation is aging and either in retirement or approaching retirement. These two groups make up the largest portion of the population and will increase the need for alternative modes of transportation.

Transit ridership increased from 2.2% in 2000 to 4.4% in 2012. Since 2015, the national trends have shown approximately 6% decrease in transit ridership. In late 2017, Los Angeles (LA) Metro was operating 5% fewer bus hours than in 2005 and 20% fewer bus miles. Likewise, most major providers were forced to cut service in response to the 2008 recession and have continued to cut service as ridership decreases. Factors leading to lower ridership include a decrease in service caused by inadequate funding for operations, resulting in eliminating routes and increasing headways, making transit less convenient. The improved economy has also likely contributed to additional private passenger vehicle trips and further increasing traffic congestion in many California cities.

Caltrans' California Transportation Plan 2040 includes goals and strategies to reduce congestion, move people and goods efficiently for economic growth and reduce greenhouse gases. All strategies presented include significant increases in public transit ridership. Keys to increasing ridership include providing convenient and reliable service with first mile/last mile connections readily available.

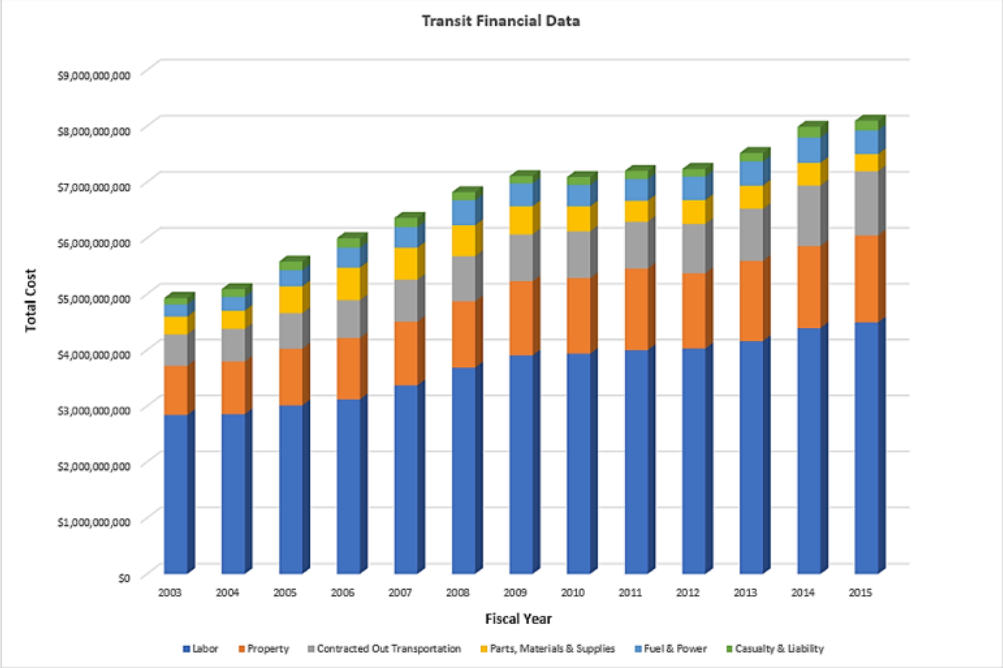
CONDITION

Significant progress has been made by most major transit agencies in recent years to upgrade older systems to a state of good repair. San Diego Metropolitan Transit System (SDMTS) has rehabilitated the Blue Line and Orange Line and LA Metro has been updating the Blue Line (with significant improvements yet to come). The average age of San Diego's bus fleet in 2015 was 6.58 years old, or slightly below the national average. Bay Area Rapid Transit (BART) recently passed a $3.5 billion measure to complete long overdue state of good repair improvements. Currently, BART reports owning the oldest big-city fleet in the U.S.; its cars are on average 30 years old, and funding will go towards replacement. According to the 2016 California State Transportation Plan and the 2011 California Transportation Commission Needs Assessment, there will be a shortfall of $74 billion for state of good repair improvements needed through 2020. Funding from the 2017 transportation package (SB 1) is essential to addressing the shortfall.

OPERATION & MAINTENANCE

Transit operation and maintenance (O&M) includes staff labor costs, property, contract labor, parts, materials and supplies for vehicles and facilities and fuel and power costs as shown in Figure 2. O&M costs have held steady since 2009 with total maintenance costs of $8 billion in 2015, as shown in Figure 2. Approximately 25% of the total funding is from the fare box. A decline in ridership generally starting in 2009 lowered fare box revenue. Transit agencies were forced to decrease costs by reducing service and raising fares. Restoring and improving transit services and increasing ridership will require increased funding for operations and maintenance, at least in the shorter term until ridership grows and fare box revenues increase.

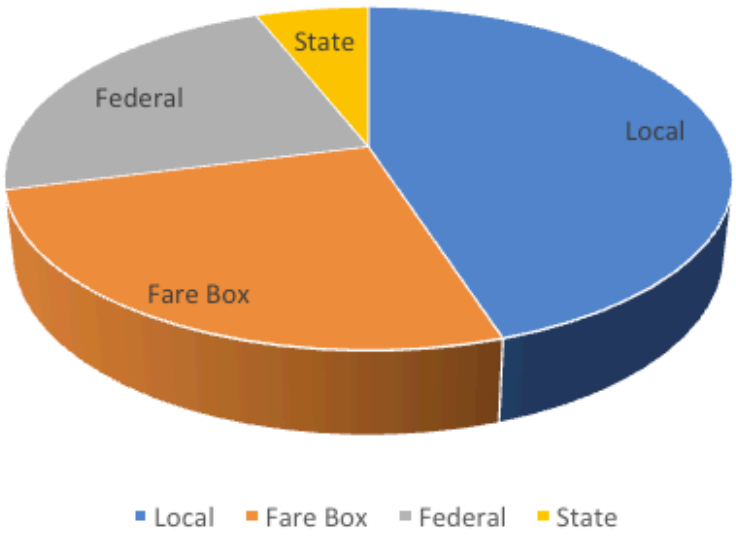
FIGURE 2. COMPONENTS OF O&M EXPENSES



FUNDING AND FUTURE NEED

Transit in California is funded by fare box, state, local, and federal sources , as shown in Figure 3. In 2015, $7 billion was provided to transit systems.

FIGURE 3. SOURCES OF TRANSIT OPERATING FUNDING

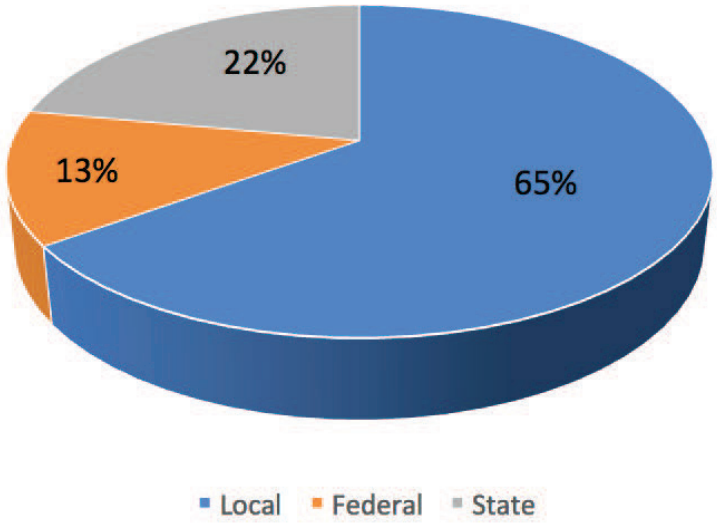


The California Transportation Commission (CTC) completed a 10-year needs assessment to identify state of good repair and expansion funds needed by transit between 2011 to 2020. The report showed an estimated cost of $174 billion with only 45% of funding available leaving a shortfall of $96 billion. The SB 1 transportation package passed in 2017 stands to provide some of the much-needed funding for transit. SB 1 is slated to provide $750 million annually in new revenue, including $25 million for local and regional planning as well as $7 million in transportation research.

The California Air Resources Board is proposing a requirement for all transit vehicles to be zero emission by 2040. Limited funding is identified to purchase new buses as well as upgrade or construct maintenance facilities for the new buses. Electric or hydrogen fuel cell technology would comply with the new requirements, however the technologies are still emerging, very costly, are not currently reliable, and have unknown infrastructure requirements. The higher implementation costs are adding to the capital funding gap.

Capital project funding identified in the CTC 10-Year Needs Assessment included state, federal, and local sources as shown in Figure 4.

FIGURE 4. SOURCES OF CAPITAL FUNDING



Several new local funding sources have been added as a result of voter-approved tax initiatives in 2016. These initiatives provided funding to LA Metro, BART and Santa Clara Valley Transportation Authority (VTA). Similar initiatives in San Diego, Ventura and Contra Costa Counties were not successful. While the new taxes are significant for the Bay Area and Los Angeles, the overall deficit for the state through 2020 will be more than $80 billion.

SB 1 will generate an additional $1 billion for transit annually for all of California. Increasing transit ridership plays a significant role in decreasing congestion on our highways and local streets. While this is a good step toward funding, more investment is still needed to meet future need.

As an example, in 2014 California generated $2.26 billion for transit or $58.23 per capita compared to New York, Illinois, and Pennsylvania that generated between $242.38 to $299.92. Per capita transit investment in California is well below other states with large metropolitan cities.

PUBLIC SAFETY

California transit agencies have prioritized maintenance and replacement of vehicles even when funding is limited to provide safe public transportation. In 2017 there were 25 fatalities associated with rail transit as shown in Figure 5, down slightly from a 6-year average of 26 fatalities. Most of the fatalities were not passengers. The total number of fatal accidents involving buses and large trucks (reported together) has been decreasing since 1979. In addition, the total number of fatal accidents per 1,000 miles driven and per registered owner has decreased significantly as shown in Figure 6.

FIGURE 5. STATEWIDE REPORTED INJURIES AND FATALITIES

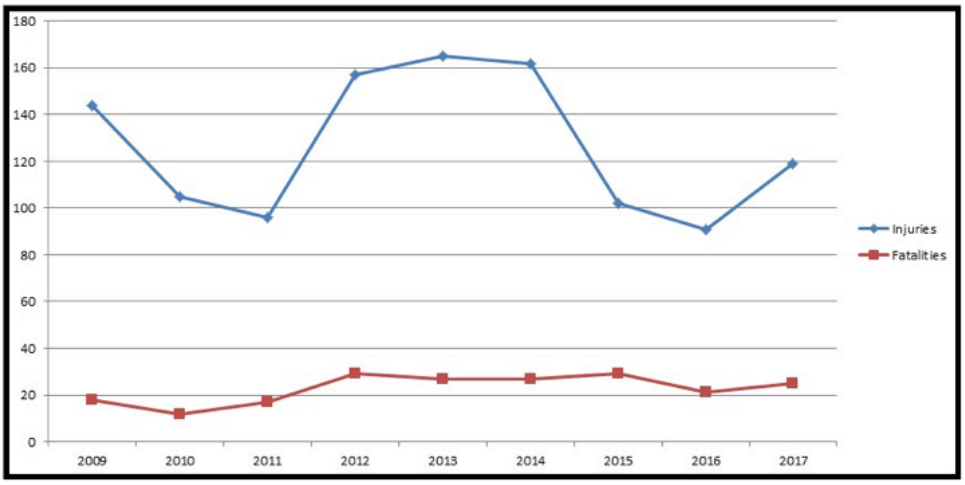
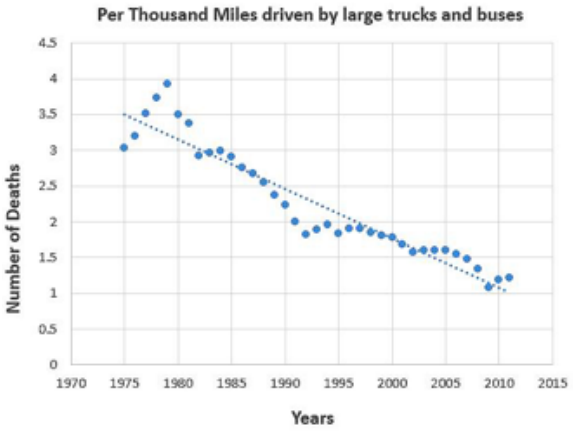
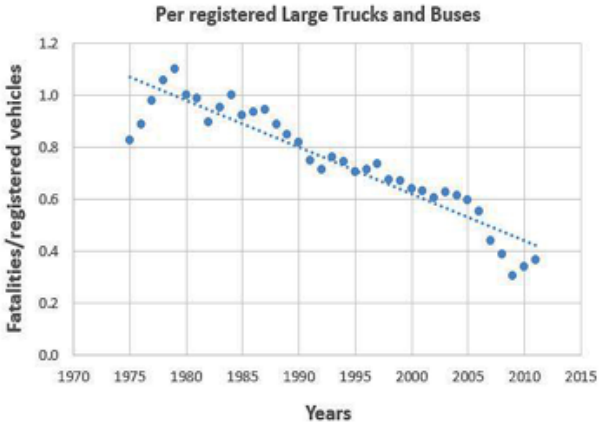


FIGURE 6. TOTAL FATALITIES OF LARGE TRUCK AND BUS ACCIDENTS





RESILIENCE

California transit systems are critical to the overall resiliency of a region as they provide critical alternatives for efficiently transporting or evacuating large numbers of people during natural disasters or other incidents. The Federal Transit Administration (FTA) and the California Department of Transportation (Caltrans) provide guidance for transit emergency response plans. Transit operates as both dedicated guideway and vehicles on surface streets, providing the flexibility of bridging damaged infrastructure to provide continued service. The system uses alternative fuel types providing redundancy should some fuels not be available as a result of an emergency.

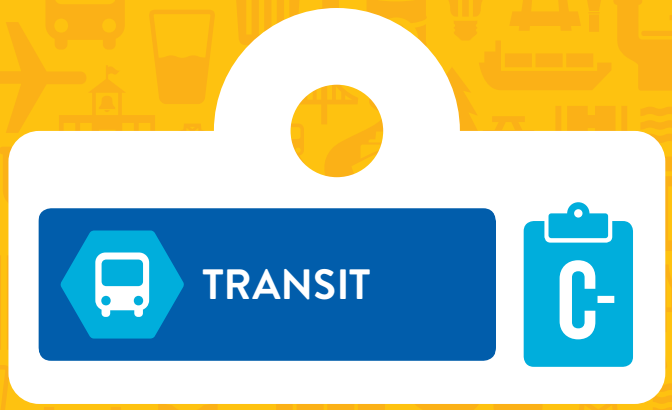
Transit agencies in California have been at the forefront of clean energy. Most rail transit systems use clean electricity. Many agencies including SDMTS and North County Transit District (NCTD) have transitioned to 100% non-fossil fuel buses. Alternative fuel (CNG and electric) is used for 60% of bus transit in California compared to the national average of 47%. Even smaller agencies such as Antelope Valley Transit and Porterville Transit are embarking on aggressive plans to transition to 100% electrical buses by 2019.

INNOVATION

Rapid Bus Routes are successfully implemented on freeways and local streets using traffic signal priority and other technologies, offering a higher level of service with significantly less capital investments than LRT systems.

Use of technology for automated fare collection is implemented by many of the transit agencies in California along with real-time communication and wifi to improve rider experience. Multi-agency fare collection systems are in the planning stages for most regions, with implementation partially completed in LA.

Autonomous and connected vehicles have the potential to dramatically change transportation. Driverless vehicles are currently being tested in San Ramon. Contra Costa County may be deploying as many as 100 vehicles by 2020.



RECOMMENDATIONS TO RAISE THE GRADE

- Continue to develop, preserve and support legislation similar to SB 1, to promote bridging the gap for repairing and rehabilitating our State's aging infrastructure.
- Encourage local ballot initiatives to provide additional tax revenue to support transit systems. Self-help counties provide funding and control prioritization of improvements.
- Increase funding for demonstration projects to test new technologies and research and development to expedite electric / hydrogen fuel options as cost-effective alternatives to fossil fuels.

DEFINITIONS

Unlinked Passenger Trips (UPT)

The number of passengers who board public transportation vehicles. Passengers are counted each time they board vehicles no matter how many vehicles they use to travel from their origin to their destination.

Farebox Recovery

The percentage of transit operating expenses that are covered by revenues from passenger fares.

Fixed Guideway (FG)

Fixed Guideway is a public transportation facility

- Using and occupying a separate right-of-way for the exclusive use of public transportation;
- Using rail;
- Using a fixed catenary system;
- For a passenger ferry system;
- For a bus rapid transit system.

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AERATION TANKS IN A SEWAGE TREATMENT PLANT

WASTEWATER

EXECUTIVE SUMMARY

California wastewater systems serve a population of 40 million in over 13 million homes and treat 4 billion gallons of sewage per day while protecting surface waters, the coastline and public health. There are approximately 900 publicly-owned collection and treatment systems, while approximately 10% of the population is served by onsite wastewater systems such as septic tanks. The average age of collection system pipes and manholes is approximately 40 years. Most, although not all, systems and treatment plants appear to have adequate capacity and are prepared to meet the population needs for the next 10 to 20 years. Modest progress has been made in recent years to prioritize and invest in wastewater infrastructure. For example, in 2014 Proposition 1 authorized over $7.5 billion in general obligation bonds to fund ecosystems and watershed protection and restoration projects. California also continues to advance in technologies aimed at treating and discharging wastewater at a higher water quality standard. However, the cost to maintain wastewater systems continues to rise with the age of the systems. We must maintain the condition of the infrastructure, meet discharge requirements, and continue elimination of sanitary sewer overflows.

CAPACITY AND CONDITION

California wastewater systems collect and treat 4 billion gallons per day of sewage for over 13 million households in 58 counties and 482 cities. Approximately 10% of the 39 million persons served are on 1.2 million onsite septic systems, with the remainder served by publicly owned centralized treatment systems. Septic systems collectively require annual removal (pumping and hauling) of 230 million gallons of sludge residual, with approximately 85% of that volume accepted and treated at publicly owned treatment plants.

California includes over 100,000 miles of sewer collection pipelines, ranging in size from 6- to 144-inch diameter and over 900 wastewater treatment plants. Most of these treatment plants are small or moderate in size and treatment capacity; only 270 can treat over one million gallons per day (MGD). The largest individual treatment plants in California are in San Francisco and Los Angeles and can treat approximately 450 MGD.

The average age of collection system pipes and manholes is approximately 40 years. However, older population centers may have areas where more than half the collection systems are over 50 years old. These older systems typically demand more maintenance and increased funding for inspection and remediation. Due to the critical nature of treatment facilities and pump stations, they typically receive more frequent maintenance and renewal when compared with buried systems. Additionally, changing regulatory factors on these vertical assets results in a replacement and renewal period that is generally less than 25 years.

Most, but not all, systems and treatment plants appear to have adequate capacity to treat average dry weather flows as well as peak wet weather flows and are planned to meet future population needs. Some sewer systems in the Bay Area have combined wastewater and storm systems where peak wet weather flows can be up to four times the average flow, burdening both the gravity pipelines and treatment systems.

OPERATION AND MAINTENANCE, FUNDING, AND FUTURE NEED

Sewer system management plans have largely been effective in guiding agencies to precautionary cleaning and sewer inspection activities. As funding becomes available, inspection activities, such as closed-circuit television (CCTV), are becoming more prevalent as a means to identify operations and maintenance issues before resulting in Sanitary Sewer Overflows (SSO). Generally, overflows related to grease issues have decreased, but clogs related to "flushable" wipes continue to be a concern for sewer agencies. The disposal of unused pharmaceuticals in the wastewater system is also of growing concern. Thus, further public education and industry awareness is recommended.

The amount of sewer pipe inspected and cleaned per year varies widely across California. This is largely based on three governing factors:

- Reactionary versus precautionary philosophies;
- Funding levels; and
- Staffing levels.

Typically, four sources of funding drive the budgetary funding of wastewater systems, including:

- Tax Revenue
- User Fees
- Connection Charges
- Grants / Loans

Average monthly user charges and new connection fees are the primary sources of funding for wastewater collection and treatment systems. For fiscal year 2016-17, 591 respondents to questionnaires distributed by the State Water Resources Control Board indicated that the average monthly user charge for wastewater services was $44.10 for a single-family dwelling, while the average connection fee for new single-family dwellings is reported as $4,297.26.

California's Clean Water State Revolving Fund (CWSRF) has historically been the primary funding mechanism for improving water quality in California, with over 780 financing agreements totaling over $10 billion since the inception of the program. The 2016-2017 Annual Report for the CWSRF indicates that approximately 80% of funded projects were related to advanced treatment, water reuse, or system rehabilitation. State Water Board staff were interviewed as part of this report preparation and they expect this market share to continue or increase as technology advances and systems age.

While the CWSRF is an important financing source for wastewater projects, it is insufficient to cover all needs, and typically funds only a nominal portion of the cost to own and operate a wastewater system. California's Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) authorizes an additional $7.545 billion in general obligation bonds to fund ecosystems and watershed protection and restoration, water supply infrastructure projects, including surface and groundwater storage, and drinking water protection.

The Environmental Protection Agency Clean Watersheds Needs Survey, conducted in 2012, estimated California wastewater systems required $26.2 billion in investments. Meanwhile, the population of California is expected to reach 46 million by the year 2037. This means there will be a need to treat an additional 720 million gallons per day of wastewater, thus requiring planned system expansions and/or new plants at various locations throughout the state. Needs are estimated at $4.5 billion annually for capital projects, and an additional $2 billion annually for operations and maintenance.

Areas where the condition of the wastewater system is still unknown (approximately 50% of non-surveyed sewer agencies) will rely on a reactive approach to aging and potentially failing infrastructure. Thus, on-going funding programs should be maintained to allow the continued rehabilitation and expansion of existing infrastructure, without placing an undue burden on the agency and their ratepayers.

PUBLIC SAFETY, RESILIENCE & INNOVATION

Wastewater agencies throughout California are very sensitive to public safety and are ensuring that the consequences of an infrastructure failure are minimized. Wastewater managers are documenting the state of infrastructure by completing condition assessments, developing asset management programs, and managing through Computerized Maintenance Management Systems (CMMS). The increased use of CMMS by medium and large wastewater agencies will highlight the current hidden costs to safeguard the general public from consequences of failure. However, small to medium wastewater agencies do not have the resources (funds or staffing) to implement such maintenance management systems and may be at a higher risk for failed infrastructure, thus impacting public safety.

From December 2011 through March 2017, California experienced the worst drought in recorded history. By mid-2014, the State of California had drafted new rules designed to promote the use of recycled water either by Indirect Potable Reuse (IPR) or Direct Potable Reuse. In late 2014, the California legislature passed the Sustainable Groundwater Management Act, designed to halt over-use of aquifers and bring groundwater basins into balanced levels of pumping and recharge, thus, further emphasizing water reuse.

In the past year, California has provided up to $750 million for water recycling projects to offset the use of potable water in areas of irrigation, industrial, and commercial water use. California recently released new IPR rules for adding reclaimed wastewater to surface waters. These rules regulate the amount and time the reclaimed water must be retained before being used in drinking water supplies. San Diego has the infrastructure in place to begin this form of IPR, and several other municipalities are capable of implementing this technology as well. Most municipalities, especially in the drier portions of California, have already begun, or are planning to implement, some form of IPR. The State of California has directed the Water Resources Board to develop rules for Direct Potable Reuse. These rules are expected by 2023. In the next 10 to 20 years, a greater effort will be made to reuse wastewater to offset potable water supply.

RECOMMENDATIONS TO RAISE THE GRADE

- Make risk-based decisions on capital improvements, maintenance, and operations (i.e. – implement asset management programs).
- The State of California should continue to provide loans and grant funding for the repair and rehabilitation of wastewater collection and treatment systems, as well as reuse projects.
- The State of California should continue to implement indirect and direct potable reuse regulations.
- Implement an education program at the state and local level about what a wastewater treatment plant is, what kind of wastes it can treat, as well as what impact wastes have on the sewer pipes such as grease and flushable wipes, etc. Continue educational programs on how to identify a sewer overflow and who to call if such an event occurs.
- Continue advancements in water reuse/recycling. Expand recommendation on re-use/recycling

SOURCES

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REPORT CARD FOR
CALIFORNIA'S
INFRASTRUCTURE
2019

GRADE COMPARISONS

	CALIFORNIA			NATIONAL
Category	2006	2012	2019	2017
Aviation	C-	C+	C+	D
Bridges		C-	C-	C+
Dams			C-	D
Drinking Water	C+	C	C	D
Energy			D-	D+
Hazardous Waste			C-	D+
Inland Waterways			D	D
Levees	F	D	D	D
Ports	C	B-	C+	C+
Public Parks			D+	D+
Rail			C	*B*
Roads	D+	C-	D	D
Schools			C	D+
Solid Waste	B	B	C-	C+
Stormwater	D+	D+	D+	C+
Transit		C-	C-	D-
Wastewater	C+	C+	C+	D+
GPA	**C-**	**C**	**C-**	**D+**

2012 Report Card categories of Bridges, Roads, and Transit were consolidated into the Transportation category.

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