2021 Review of Orange County's Infrastructure

To enhance the infrastructure literacy of the residents of Orange County, each infrastructure segment review, with the volunteer contributions from UCI Civil and Environmental Engineering (CEE) Affiliates and the CSUF Civil and Environmental Engineering Department, has been condensed with hyperlinks to further educational sources of information.

UCI CEE Affiliates

CALIFORNIA STATE UNIVERSITY FULLERTON
COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

ORANGE COUNTY BUSINESS COUNCIL
The Leading Voice of Business

Individual members of Orange County Business Council's Infrastructure Committee voluntarily contributed to the review and development of this report. The report reflects their views and may not necessarily reflect the views of the organization.

October 26, 2021
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Preamble:
Historically, every four to five years, the UCI Civil and Environmental Engineering (CEE) Affiliates and the local Chapter of ASCE have sponsored volunteer efforts to update the ASCE Regional Orange County Infrastructure Report Card with grades for the various segments.

The last **ASCE Infrastructure Report Card for Orange County was in 2016**. The most recent California **ASCE Infrastructure Report Card for California was in 2019.** In the past, the ASCE has "rolled" Regional Report Cards into State Report Cards and then into a National Report Card. Going forward, ASCE will not be supporting Regional Report Cards, only State and National Report Cards.

The ASCE Region 9 (California) is in full concurrence with the preparation of a local Review by an independent entity affiliated with the OCBC, UCI, and CSUF. ASCE Region 9 has been kept abreast of the progress of the Review and the final Review will be shared with them.

With the economy recovering in 2021 from the impact of the COVID-19 pandemic, the members of the **UCI Civil and Environmental Engineering (CEE) Affiliates**, the **CSUF Civil and Environmental Engineering Department,** and the **Orange County Business Council** (OCBC), were supportive of a "Review", not a "Report Card with grades", of the Orange County Infrastructure Segments to educate and inform Orange County leadership and the greater community, as well as foster stronger connections between local engineering businesses with the OCBC, UCI, and CSUF.

The intent is to present the Review in a PDF format with easy access to hyperlinks and keyword searching (CTRL+F in a PDF). The Review of the 13 infrastructure segments of Orange County shall be circulated via social media and shared as an educational and outreach document for the 3 million residents of Orange County, City Councils, Public Agencies, Schools, and member companies of the OCBC.

Sponsors of the 2021 "Review":
The Sponsoring entities behind this voluntary Infrastructure Review effort are:

- **UCI Civil and Environmental Engineering (CEE) Affiliates**
- **CSUF Civil and Environmental Engineering Department**
- **Orange County Business Council** (OCBC) and the **Infrastructure Committee**

Message from the Departments of Civil and Environmental Engineering at UCI and CSUF, and the OCBC

Dear Friends:

Much of the success of Orange County can be attributed to its infrastructure because of extensive planning, preparation, and execution. The members of the **UCI Civil and Environmental Engineering (CEE) Affiliates**, and the **CSUF Civil and Environmental Engineering Department**, representing virtually every infrastructure segment, have supported a 2021 review of the 13 Infrastructure segments serving the 3 million residents of O.C. Members of Orange County Business Council (OCBC), including members of OCBC's Infrastructure Committee, also provided information and contributed to the review of this document.

The purpose of the Review is to help the community become more infrastructure literate by informing and educating via "stories" and sharing in a layman's explanation, the infrastructure conditions that are providing a strong foundation for the growth and prosperity of the County. Extensive use of Hyperlinks has been implemented to provide the readers with further detailed information about the infrastructure segments. Several "Virtual Tours" have been linked to provide the readers with an opportunity to further their infrastructure literacy via virtual tour on various segments.

The Review is presented in a PDF format, with easy access to the Hyperlinks and keyword searching, and circulated via Social Media and shared, as an educational and outreach document, with City Councils, Agencies, Schools, all the member companies of the OCBC, and all the residents of O.C.

As an added benefit to the reader, each Segment of the Infrastructure is a stand-alone read on thirteen segments of our infrastructure. The readers may not be interested in the entire spectrum of our infrastructure but can selectively pick and choose hot topics trending on current news or social media coverage.

The needs of our society are most likely going to remain a constant for reliable, efficient, and well-maintained infrastructure such as uninterruptable electricity,

clean and safe water, advanced telecommunications, manufactured derivatives of crude oil, and everything else that's part of our daily lifestyles and economies.

The following 13 infrastructure areas were reviewed for the residents of Orange County for them to attain a better level of infrastructure literacy.

- Bridges
- Ground Transportation
- John Wayne Airport
- Cable Communications
- Electrical
- Levees
- Natural Gas
- Oil
- School District Facilities
- Solid Waste & Recycling
- Surface Water Quality
- Wastewater
- Water Supply

UCI and CSUF Students participated in the data collection that enhanced their industry connections and formulated relationships with some of the leaders within the infrastructure areas. Students learned about the review methods and the challenges that have been overcome and the obstacles that need to be conquered in implementing, planning, and execution to complete projects for the continued growth, maintenance, and expansion of some of the best infrastructure in California, for the residents of Orange County.

The Review of the Orange County Infrastructure is designed to engage Orange County's community leaders and the citizenry at large for better infrastructure literacy in our county's infrastructure as Orange County stands poised on the brink of tremendous growth.

Ronald Stein, P.E.
Executive Chairman of the 2021 Orange County Infrastructure Review Project

Introduction:

Orange County, in some respects, is a microcosm of our nation. As such, our infrastructure is beginning to show its age, especially in the northern and central portions of the County. Additionally, Orange County is still recovering from the COVID-19 pandemic recession and, therefore, needs to plan all its infrastructure investments very carefully. Six years ago, through the efforts of the UC Irvine CEE Affiliates and ASCE, Orange County became the first County in California to release its third comprehensive Infrastructure Report Card.

A lot has happened since 2016, and this year we are grateful for the opportunity to be able to provide you with an OCBC, UCI and CSUF sponsored Review of 13 infrastructure segments. The Review is not a Report Card, but an educational and outreach document about the Orange County Infrastructure.

Over the next 20 years, Orange County is expecting continued growth. Orange County is also transitioning from a suburban county to an urban county. With a population of over 3 million people, Orange County is the third most populous county in the state of California and the sixth most populous in the United States. This makes it one of the most sought-after places to work and live in the world. In the meantime, our task is to educate our public on the importance of infrastructure maintenance, encourage our colleagues in the public sector to continue advocating for infrastructure funding and maintenance, and to actively communicate to our elected officials the important role that infrastructure maintenance plays in our everyday lives.

The regional infrastructure systems that impact our County's quality of life receive significant funding derived from general obligation bonds. For example, the bonds support the state water supply infrastructure projects, such as public water system improvements, surface, and groundwater storage, drinking water protection, water recycling and advanced water treatment technology, water supply management and conveyance, wastewater treatment, drought relief, emergency water supplies, and ecosystem and watershed protection and restoration.

Communities with efficient road systems, good schools, and sewers can better attract residents and businesses. With updated water treatment plants, we can trust our tap water is safe. When traffic flows, goods and services move to market faster and more efficiently, lowering the cost to consumers. Modern school buildings provide a

secure and healthy environment where our children can concentrate on learning. Efficient waste management programs reduce waste volume and dispose of and contain waste effectively.

Our public works are public assets. We all have a stake in their upkeep and operation, and we all share in the expense of construction and maintenance. Sometimes, infrastructure is paid for by those who use it most, through tolls, utility bills, or special taxes on gas, airline tickets, and other items. But because infrastructure improvements affect us all by supporting our economy and providing fundamental community services, a portion of the cost is usually borne by the public through general tax revenues. For years, the federal government has played a large role in collecting and distributing funds for infrastructure improvements.

Orange County is a relatively young region and enjoys the benefits of relatively new water, sewer, and transportation systems. Yet, even comparatively new infrastructure systems require continuous care, maintenance, and ongoing improvement. We rely upon these systems every day and their dependability and quality are silent, but significant contributors to our economic prosperity and quality of life. A well-designed and maintained infrastructure anchors our economy and lifestyles and secures the public health and well-being.

In the meantime, our task is to educate the public:

1. on the importance of infrastructure renewal,
2. encourage our colleagues in the public sector to continue advocating for infrastructure funding, and
3. to actively communicate to our elected officials the important role that infrastructure maintenance plays in our everyday lives.

As you read through this Review, think about being a more infrastructure literate citizen.

Demand continuous and timely maintenance of infrastructure segments. If transportation, water, and other infrastructure facilities are not kept in sound condition, they cannot support the level of service they are designed to handle. Regular maintenance prolongs use and minimizes the need for costly repairs. The money saved can be used to fund other community priorities.

Thinking long-term about renewing the county's infrastructure is an ambitious goal. It cannot be achieved overnight. Furthermore, the roads, bridges, water treatment plants, and other facilities built today must serve for decades to come.

Comprehensive planning and long-term investment are key to sound decisions about infrastructure. Consider all the factors influencing infrastructure decisions. Building a new highway has implications beyond the immediate highway corridor. For example, concern that a new highway may displace wetlands must be balanced against the reduction in air pollution that will result from decreased traffic congestion.

To preserve the environment, and to use the nation's resources most effectively, we must balance environmental and economic goals. Land use and transportation patterns designed to foster economic growth and personal mobility can be developed in harmony with environmental benefits.

Solutions to urban problems such as traffic congestion and contaminated water require new technologies and approaches. Research can help identify more efficient designs and longer lasting, maintenance-free materials. And we can change our behavior through recycling, telecommuting, or using mass transit, as examples to reduce the demand on our infrastructure.

Look at the bigger picture beyond the immediate, individual benefits you gain from infrastructure improvements, as there are broader community benefits. For example, even though you may not use the new mass transit system, its construction will reduce traffic congestion on local roads and increase nearby property values.

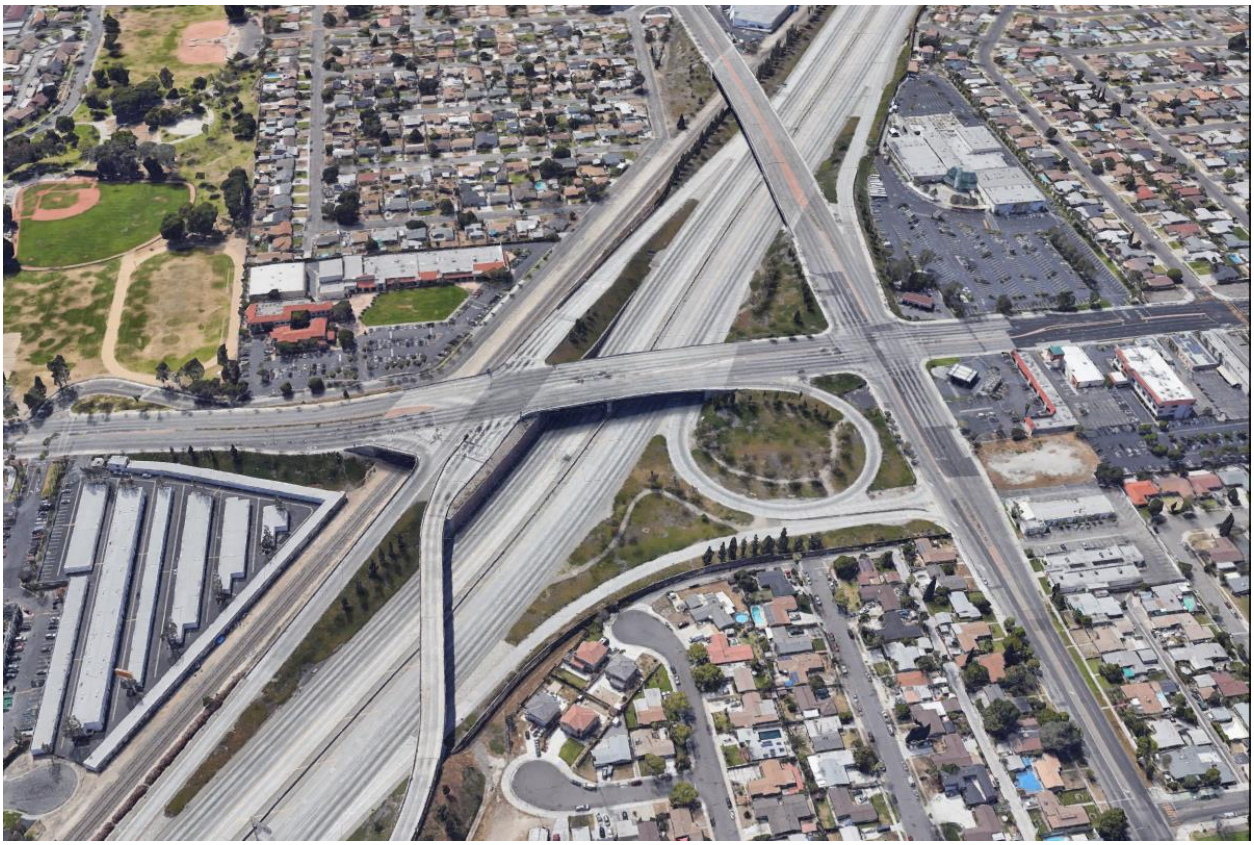
This Review offers continuing evidence that Orange County's public works challenges are enormous and complex and will not solve themselves. It is now up to you, the concerned citizen, who understands the economic and environmental benefits of a healthy infrastructure, to push for action. We have reviewed what has happened and is happening in Orange County. Here are some steps you can take to do your part in renewing its infrastructure:

1. Learn all you can about Orange County's infrastructure problems and become an Infrastructure Champion.
2. When you see a problem, find out what level of government has jurisdiction over it. Sometimes various levels of government deal with different aspects of the same problem.
3. Search the Internet. Agencies at all levels of government now have websites that list laws and regulations that pertain to your problem. Your mayor and state representatives probably have sites too, which may be your link to other government and advocacy group resources. If you know of an interest group that deals with the area you are interested in, visit its site.

4. Contact the California Department of Transportation, your city, and/or county government and other sources to learn about plans for ensuring adequate roads, schools, parks, and water systems.
5. Ask business groups, such as the OCBC or your Chamber of Commerce, to examine the infrastructure in your community and its effect on local businesses, employment, and the economy.
6. Regularly attend meetings held in your community about pressing infrastructure problems.
7. Express your concern to public officials such as your mayor and school board. Ask them how they plan to solve infrastructure problems.
8. Volunteer for, or organize, citizen advisory committees dealing with your community's infrastructure issues.
9. Support local, State and Federal officials who understand and are committed to infrastructure renewal. Ask them to make infrastructure an election issue, just as they would education, crime, or health care.
10. Work to help pass local bond issues to repair, replace, and expand your roads, parks, water systems, and schools.
11. Write letters to the editor of your newspaper, your state representatives, and members of Congress, expressing your concerns and opinions on infrastructure.

Infrastructure is a complex network of public works, which includes roads, bridges, airports, dams, school facilities, and utilities. The rules governing its planning, financing, construction, and upkeep are equally complex. Whether your goal is to shorten your daily commute, attract new business to your community, or protect the environment for your children, gaining a better level of infrastructure literacy and an understanding of these issues is the first step toward becoming an advocate for infrastructure renewal in your community.

Bridges



Capacity

In Orange County, there are a total of **1,170 bridges**, which are owned and maintained by either the **California Department of Transportation** (Caltrans) or local agencies. The average age of these bridges is 42.9 years, which is within their typical design life of 50 years. Progress has been made over the past decade to increase the percentage of Orange County bridges in good condition. However, much more remains to be done as it relates to addressing the backlog of recommended maintenance, repair/replacement work, and seismic retrofitting to improve the safety of bridges that have exceeded their design life.

Condition

The **Federal Highway Administration** (FHWA) **National Bridge Inventory** collects data on the condition of bridges and classifies them as being 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. All California bridges in the nationwide inventory are inspected every two years per FHWA guidelines and criteria. The inspections are typically performed by Caltrans bridge engineers.

In California, 12,224 of 25,737 total bridges — or 47.5 percent of the total bridge inventory in the state —are in good condition. 12,020 bridges — or 46.7 percent — are in fair condition, and the remaining 1,493 bridges — or 5.8 percent — are in poor condition. The 46.7 percent of bridges in the state that are in fair condition require maintenance to ensure they do not slip down to the "poor" category.

In Orange County, 582 of 1,170 total bridges — or 49.7 percent of the total bridge inventory in the state —are in good condition. 556 bridges — or 47.5 percent — are in fair condition, and the remaining 32 bridges — or 2.7 percent — are in poor condition. The 47.5 percent of bridges in Orange County that are in fair condition require maintenance to ensure they do not slip down to the "poor" category.

Funding

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, nearly $4.3 billion 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 on the State Highway System 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 bridge rehabilitation, replacement, and maintenance projects**. Caltrans has already utilized $33.5 million in SB 1 funds to bridge and culvert rehabilitation, replacement, and maintenance projects in Orange County.

Future need

SB 1 provides much-needed funding for bridges owned at both the state and local level, especially 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** (ARTBA), 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 2018 State Budget, $131 million was allocated to bridge major maintenance** and in the 2020 Caltrans State Highway Operation and Protection Program (SHOPP), $ 2.3 billion was allocated to bridge major maintenance for FY 2021 to FY 2024. The ongoing annual need for bridge maintenance alone is estimated to be about $200 million. Any shortfall in funding for maintenance will mean that the backlog of bridges requiring maintenance, and potentially, the number of bridges falling into the "poor" condition category, may 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** (LAO), every 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. As reported by the American Society of Civil Engineers in their **2019 Infrastructure Report Card for California,** over 50 percent of California bridges exceed 50 years in age and 13 percent are over 75 years old. Preventive maintenance can extend the lifespan of a bridge, but most of the older bridges – particularly those that are in the "poor condition" category – 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 the 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.

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 older bridges that were vulnerable. 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** (LBSRA), but for which funding has not been programmed.

Vehicle heights and weights have increased over the years. Barriers on older bridges in service today 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.

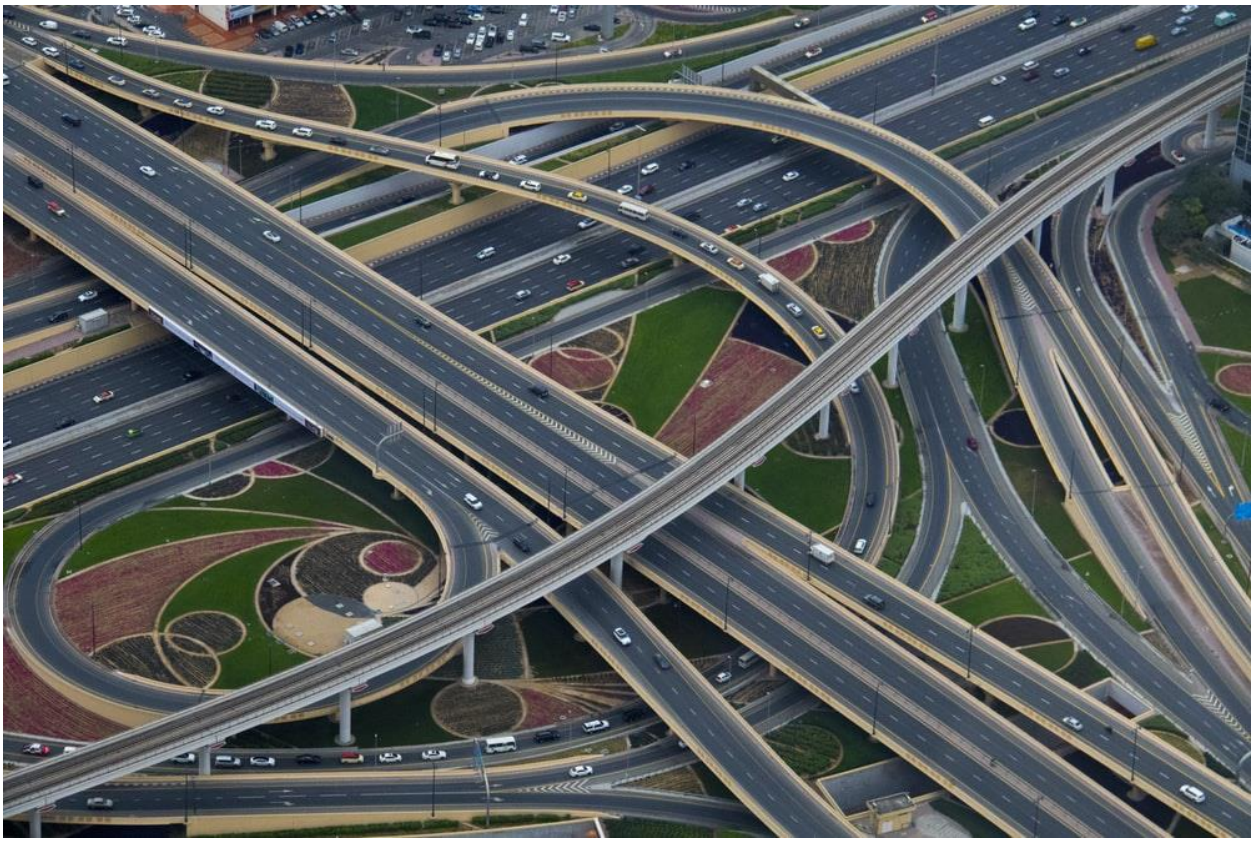
Change in climate conditions has produced heavier rains, stronger storms, and higher winds. This is the new normal. Old bridges were not designed for these loads. As previously noted, 54 percent of more than 25,737 **California bridges** are now 50 years old or older, making them vulnerable to such load 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.

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** (ABC) 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 to facilitate agency and industry acceptance.

Ground Transportation



Capacity

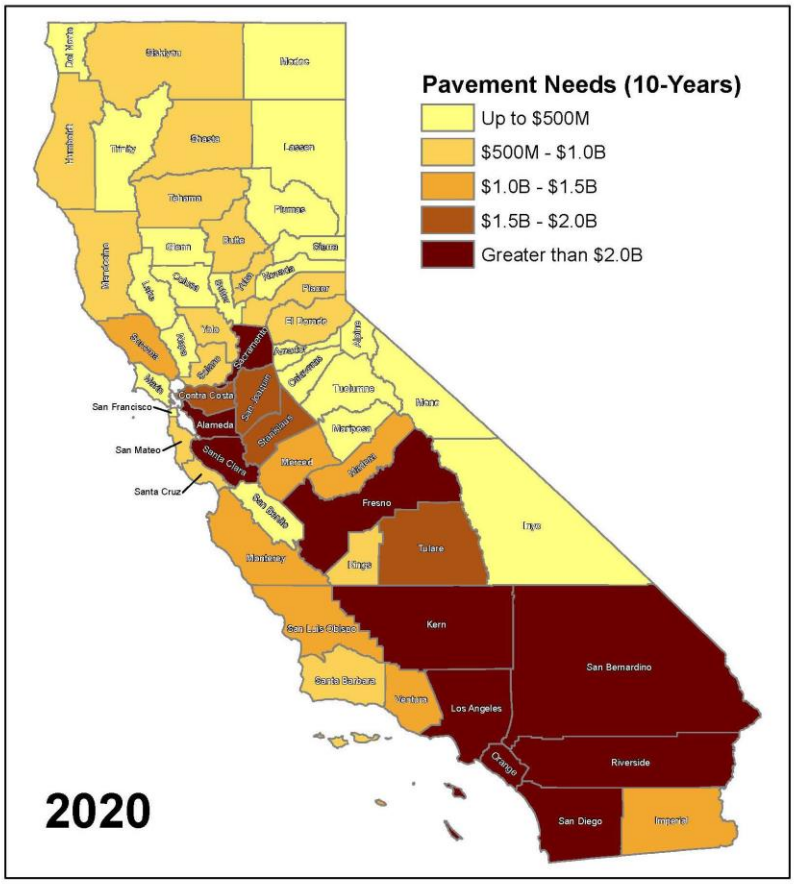
Orange County consists of 34 cities and the unincorporated areas; it has approximately 1,886 freeway lane-miles which Caltrans is responsible for operating and maintaining, 1,170 bridges, thousands of lane-miles of local arterial roadways, **three commuter rail (Metrolink) routes** with 11 stations, Amtrak services connecting to Los Angeles and San Diego, a freight network run by Burlington-Northern Santa Fe Railroad (BNSF) along with freight service by the Union Pacific Railroad, and 58 bus routes by **Orange County Transportation Authority** (OCTA) with nearly 5,500 bus stops. The current infrastructure serves approximately **3 million Orange County residents**, with **approximately 700,000 people commuting into Orange County** from surrounding San Diego, Los Angeles, Riverside, and San Bernardino counties daily. As infrastructure ages, and with the population of Orange County continuing to grow, the local transportation infrastructure must be maintained in order to accommodate population projections and to avoid current pervasive issues that result in Orange County residents spending an average of **18.5 hours sitting in traffic on Orange County highways**. The new challenge is to increase roadway and highway capacity, without impacting the footprint of existing roads.

The definition of "capacity" of roadway systems is undergoing modifications where the measure is not how many vehicles can traverse a given roadway segment but how many people can move through the system. With the passage of **Senate Bill 743**, **Vehicle Miles Traveled** (VMT) replaced Level of Service (LOS) as the metric for measuring traffic related impacts and greenhouse gas

analysis. Capacity enhancements may be achieved without adding new lanes but by using **Intelligent Transportation Systems** (ITS) and/or Travel Demand Management (TDM) such as optimizing signal timings, demand pricing (tolls), preferential facilities for High Occupancy Vehicles (HOV) and buses, as well as new and emerging technologies such as autonomous vehicles, Vehicle to Vehicle (V2V) communications and Vehicle to Infrastructure (V2I) communications.

Condition

The conditions of local roadways and arterials controlled by traffic signals and intersection stop control were ascertained from the 2020 California Local Streets and Roads Needs Assessment. Pavement conditions are quantitatively graded on a scale of 0 to 100 using the Pavement Condition Index or PCI. Orange County's average score was 79. The study also shows that Orange County's pavement needs (calculated based on existing conditions, appropriate treatment to be applied, performance models, and funding available) in the next 10 years will cost upwards of $2.6 billion (see 2 Figures below). Despite the high price tag, Orange County is one of only two counties statewide projected to have greater than 80 percent of local streets and roads pavement needs met over the next ten years. For more information on State Highway System (SHS) asset conditions, refer to Caltrans' State Highway System Management Plan (SHSMP).



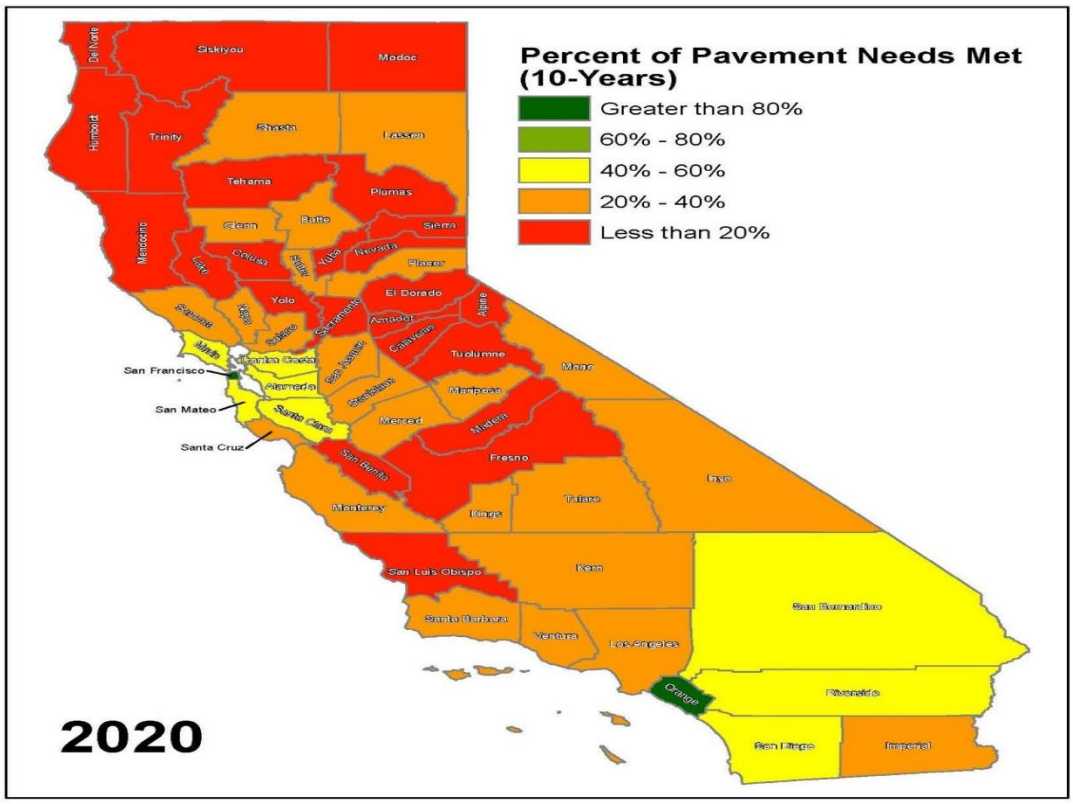


Figure 1: Pavement Needs by County (Source: 2020 California Local Streets and Roads Needs Assessment

Funding

OC Go (formerly Measure M) is Orange County's half-cent sales tax dedicated to funding local transportation improvements. Wider freeways, well-maintained streets, synchronized traffic signals and transit programs that improve travel connections are all part of OC Go. Local OC Go sales tax revenue projections dropped substantially from previous projections due to the impact of the COVID-19 pandemic but have since nearly returned to pre-pandemic levels. Already low bus and transit ridership passenger fares present an additional revenue source loss, as nationwide declines in ridership over the last decade or so, which were accelerated due to the COVID-19 pandemic. Transit ridership has since started to rise as schools return to in-person instruction and the overall economy continues to open up.

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OC Transit Vision, developed in 2018, will require modification as Orange County moves into the future to address the issues behind the long-term decline in transit ridership and emerging trends like work-from-home.

Senate Bill 1 was signed into law in 2017. SB 1 funding sources include increases in fuel (gas and diesel) excise taxes, commercial vehicle weight fees, vehicle license fees, $100 annual registration fee for zero emission vehicles model year 2020 and later. SB 1 does not sunset, and the law includes an annual inflation adjustment. State and local **transportation programs** were either augmented or created by SB 1. Transportation programs augmented include: State Highway Operation and Protection Program (SHOPP) and the State Transportation Improvement Program (STIP), which is divided between regions and Caltrans at a 75 percent to 25 percent ratio

respectively, and the Active Transportation Program (ATP). Newly created programs include: Local Streets and Roads Program (LSRP) available only to cities, Local Partnership Program (LPP) only available to self-help counties, Trade Corridor Enhancement Program (TCEP), and Solutions for Congested Corridor Program (SCCP).

Additional funding was provided by the federal government through the Federal Coronavirus Response and Relief Supplemental Appropriations Act (CRRSAA) of 2021, apportioning a total of $911.8 million to California. The Act allows states to cover revenue declines during the pandemic. California experienced about $1.5 billion in revenue losses due to the pandemic.

Over the long run, the purchasing power of the gas tax will decline as vehicles become more fuel efficient and increasingly do not use gasoline at all. In addition, potential increases in work-from-home may further reduce fuel consumption.

As the passage of Senate Bill 743 indicates, there is a push towards more sustainable transportation options throughout the state of California and Orange County. **The Active Transportation Program** (ATP) has become an increasingly popular and competitive funding source, as it encourages increased use of active modes of transportation, such as walking and biking, rather than projects that promote more vehicular use. The ATP Cycle 5 Program (2021) revealed **over $2.2B in funding requests across the state of California**. Understanding the need to active transportation components to move projects forward and make them more appealing for funding will be a critical consideration for Orange County municipalities seeking funding for local projects.

Future Need

The future needs of Orange County residents continue to be accessible transportation infrastructure, sustainable transportation means, and more reliable transportation funding sources. Prior to the events of 2020, 77 percent of drivers (in 2019) reported commuting to work alone, with only 9 percent carpooling, and only about 2 percent utilizing public transportation. Given that most Orange County residents and workers commute by driving, an effective network of highways is critical to mobility. Unfortunately, as the number of people who live in and commute to Orange County continues to grow, average highway speeds are decreasing. This means commuters are spending more time in traffic, away from home and work.

Conversely, as Orange County began to feel the effects of the coronavirus pandemic that hit in March of 2020, a new precedent was set for working from home for many workers. This resulted in less frequent commuting, and more frequent working from home. It is unclear how likely this trend will continue into the future. Although increased working from home reduces the congestion that has historically plagued Orange County freeways such as Interstate 405, State Route 55, and State Route 57, it also impacts gas tax revenue collected statewide to fund road maintenance projects.

Resilience

The resiliency of a piece of infrastructure is measured by assessing its ability to withstand damage or disruption, and whether it can readily, and cost effectively be restored, as well as considering infrastructure interdependence and the presence of alternate routes. Orange County scores well on resiliency overall due to its vast network of local roadways and conventional highways with

parallel freeway routes. However, the extreme southern portion of the county and the coastal areas are more sensitive to disruptions.

Innovation

Innovative projects continue to be at the forefront of conversations among Orange County municipalities and transportation agencies. A critical goal for OCTA is expanding connectivity within this sprawling county. The **OC Streetcar** represents an innovative step towards connecting existing rail and bus routes in Orange County and beyond, including the Santa Ana Regional Transportation Center that serves Metrolink and Amtrak travelers. Its 4.15-mile route will promote sustainable local travel into and out of the heart of Santa Ana, a fast-growing economic hub that in turn generates significant foot traffic with its local businesses, bars, restaurants, and shopping opportunities.

Along the lines of expanding system choices are projects such as the **Oso Parkway Bridge Project** and the **Los Patrones Parkway Extension Project**. The **Transportation Corridor Agencies** (TCA) and Orange County Public Works have replaced a portion of Oso Parkway with a new bridge structure to provide motorists with a direct connection between Los Patrones Parkway (a new road connecting with Rancho Mission Viejo) and State Route 241. By increasing access to the toll roads, projects such as these connect south Orange County to the more urban areas of OC, while also providing TCA with opportunities to generate funds by charging toll users a small fee to avoid the congestion on more crowded highways.

Improving system performance is another means of innovating existing infrastructure in Orange County, and **OCTA's I-405 Improvement Project** is a great example of this. In Orange County, there are 1,170 bridges. The average age of these bridges is 42.9 years. OCTA, in cooperation with Caltrans, is widening the San Diego Freeway (I-405) between SR-73 and I-605. This $2 billion project will improve 16 miles of some of the most congested segments of the I-405 including **18 bridge overcrossings replacements** over the I-405, rehabilitating and/or reconstructing on-and-off-ramps, rehabilitating pavement, and constructing **new express lanes which will in turn pay for a major portion of the improvements**.

Caltrans also has a number of innovative projects in Orange County including the **I-405 Multi-Asset Project** from I-5 to Harbor Boulevard, which is proposed to extend life expectancy of pavement, improve safety and efficiency for all modes of travelers and maintenance crews, enhance traffic operation, manage congestion, and provide ability to collect, analyze, and utilize data for systems performance along the I-405 corridor. Caltrans' Integrated Corridor Management (ICM) project in Anaheim will update the freeway infrastructure for effective management of traffic congestion during planned and unplanned special events, manage availability of excess capacity along parallel arterials, and provide transit services within the corridors through system integration and collaboration with partner agencies. Caltrans also conducted a countywide study on a managed lanes network in Orange County and has a managed lanes project planned along I-5.

John Wayne Airport

Overview

John Wayne Airport (JWA) is owned and operated by the **County of Orange** and is the second busiest airport in the Greater Los Angeles Area, serving more than 10.6 million passengers annually. The airport is home to nearly 500 general aviation aircraft and is served by eleven commercial passenger airlines and two cargo airlines. There are approximately 300,000 commercial and general aviation operations each year, placing JWA in the top 30 busiest airports in the country.

With two runways, three terminals, four parking garages, a central utility plant, and numerous roadways, aprons, taxiways, and support facilities housed on over 500 acres, JWA maintains over $1B worth of facilities and assets. The **Thomas F. Riley Terminals** (A, B, & C) are 730,505 square feet in total, with 20 commercial passenger gates and two smaller commuter passenger gates. The Riley Terminal is also home to numerous restaurants, shops, and other services.

JWA's service area includes more than three million people within the 34 cities and unincorporated areas of Orange County. The airport has been a vital part of the Orange County community for nearly 100 years and prides itself on delivering a superior guest experience.

Click here for a short video on JWA from its inception as Orange County Airport to today. You can also view **JWA's 2020 Annual Report** to learn about the airport's operations and accomplishments during one of the most challenging years in aviation history.

Regulatory Structure

JWA falls under the authority of multiple federal, state, and regional governmental agencies including, but not limited to, the Federal Aviation Administration (FAA), the Transportation Security Administration (TSA), U.S. Customs and Border Protection (CBP), the Caltrans Division of Aeronautics, the South Coast Air Quality Management District (SCAQMD), and the Regional Water Quality Control Board (RWQCB). The airport is governed by a wide variety of local, state, and federal laws and regulations under the purview of these agencies and others, directly impacting how JWA's infrastructure is designed and maintained.

Additionally, JWA is one of the most highly regulated airports in the United States due to the noise and access regulations that apply to both commercial and general aviation operations. The landmark **1985 Settlement Agreement** formalized the nature and extent of facility and operational improvements that could be implemented at JWA and has since been amended twice. The Settlement Agreement established quarterly noise limits at ten defined noise monitoring locations, created an annual passenger cap, defined certain noise-based classes of aircraft operations, and set limits on the number of operations.

Funding and Future Needs

JWA is a department of the County of Orange and uses an enterprise fund to account for its operations. All costs to construct, operate, and maintain the airport are generated by the airport and through various grant programs. There are no city, county, or state general funds used. JWA's budget is directly linked to the number of aircraft operations and passengers that travel through the airport.

The airport's sources of revenue include Airline Revenue, Non-Airline Revenue, **Passenger Facility Charges (PFC)**, Federal Grants, and General Aviation. Airline Revenue consists of terminal rents, landing fees, and other items that account for roughly 41 percent of total operating revenue. Non-Airline Revenues account for approximately 54 percent of total operating revenue and include sources such as rents or fees on automobile parking, car rental, food & beverage, and other concessions, ground transportation, and transportation network companies. PFCs are fees imposed on enplaned passengers by airports to generate revenue for projects that increase capacity, enhance competition among air carriers, improve safety and security, or mitigate noise impacts. In 2000, the Aviation Investment and Reform Act ("AIR-21") increased the maximum PFC airport sponsors could collect to $4.50 per enplaning passenger. The PFC cap has not been increased since then. JWA's average PFC collection has been about $19M annually, which pays for debt service on bonds issued to fund FAA-approved PFC projects. JWA is also eligible to receive approximately $2M annually in FAA entitlement grants to fund eligible **Airport Improvement Program (AIP)** projects. AIP funds originate from the Airport and Airway Trust fund, which draws support from user fees, fuel taxes, and other revenue sources. The General Aviation segment contributes the remaining 5 percent to JWA's operating revenues.

According to a recent **Airport Infrastructure Needs Study** conducted by Airports Council International, America's airports have a backlog of $115B in planned and much-needed infrastructure projects. To continue responding to the changing needs of the traveling public and the aviation industry, JWA anticipates spending more than $250M over the next five years to upgrade and modernize facilities.

The following sections describe some of the airport's infrastructure, factors that drive needed upgrades, and how the team maintains JWA's complex facility and assets.

Safety and Security

Safety and security at airports mean protecting the traveling public, the facility, and critical systems from disruption or outside threats, as well as maintaining structurally sound facilities. Safety and security infrastructure encompasses everything from physical barricades, fences, and hard infrastructure to high technology security cameras and systems.

To enhance public safety and ensure emergency operational use of the airport during and after a major disaster, critical facilities and equipment at the airport have been engineered and retrofitted to meet Seismic Risk Category IV (essential facility) design requirements. Standardizing a higher category for design improves structural resiliency in the face of natural disasters, allowing for continued use and increased levels of safety for our employees and the public.

The airfield is a critical piece of the airport safety infrastructure. JWA maintains continual FAA operating certification to ensure compliance with operational and safety standards. The combination of our airfield pavement management system, daily airfield inspections, and continuous airfield maintenance activities support the uninterrupted certification at the airport. Maintaining this high level of safety and incorporating changes and innovations required by the FAA requires continuous capital improvement of pavement, lighting, signage, communication, and emergency equipment.

An example of a typical airport infrastructure project is the recently completed airfield lighting and signage improvements project, in part using LED technology. Converting to LED technology reduces energy usage and maintenance, increases service life, and improves visibility. This $8M project included various airfield upgrades to meet FAA requirements and was funded primarily through a federal AIP grant.

Maintenance

JWA's facilities have miles of plumbing and electrical infrastructure, thousands of doors, and hundreds of HVAC units. Breaking it down even further, there are over 80 restrooms, one-half million square feet of floors, and millions of square feet of pavement.

The role of JWA's Maintenance Division is to ensure all facilities and assets operate in a safe, clean, efficient, and cost-effective manner. In doing so, facilities and assets run cleaner, last longer, and have a lower life cycle cost before needing major repairs and replacement. Many assets have a life expectancy of 10 to 50 years. As equipment gets older, the cost to maintain typically increases. For reference, Terminals A and B opened in 1990 (31 years ago) and Terminal C in 2011 (10 years ago).

As an industry rule of thumb, maintenance investment should be between one percent and six percent of the total facility value, increasing from the low end in the facility's younger years to the higher end as the facility ages. With $1B in assets, this equates to $10M per year in the early years and $60M per year in the later years for a facility such as JWA.

Deferred maintenance, or maintenance that is delayed due to available resources, results in unexpected downtime, emergencies, and a much greater cost to replace equipment that was not properly maintained.

Changing Needs

The traveling public wants efficiency and convenience in arriving, departing, and navigating the airport environment. The airport accommodates this need through infrastructure modifications in parking, roadways, and public transportation. These efficiency improvements have the added benefit of reducing air emissions caused by traffic congestion. Airports have also begun to transform from providing vast parking lots to facilitating mass transit and ease of connection with transportation network companies such as Uber and Lyft. Planning and building for these changes are ongoing.

These days, government agencies and the public call for cleaner and quieter aircraft. Advancements in aviation technology are also continuously underway. The airlines are responding with new, cleaner, and quieter aircraft. The airport evaluates future proposed aircraft to program projects that accommodate for changes in design, given the limitations and restrictions at JWA. This can result in the needed modification of passenger gates, taxiways, and vehicle service roads to maintain the proper safety clearances and zones. For example, the airport is currently planning to reconstruct and repave its taxiways and adjust turning radiuses to support changes in aviation design.

Resiliency and Sustainability

As the population grows, so do the stressors on our natural resources, particularly in highly urbanized areas. The airport is constantly evaluating its need for resources and impacts on the community. JWA plans and implements improvements to ensure resilient infrastructure that is sustainable into the future.

JWA's energy is supplied by a combination of Southern California Edison and the airport's Central Utility Plant (CUP), which is a cogeneration plant consisting of four natural gas engines. The CUP is the primary power supply for JWA Terminals and the airfield, and supplies cooling for the airport through various systems. To improve resiliency and future sustainability, the airport is engaging in an upgrade project that includes an energy storage system using large batteries, improved metering and power management systems, and water conservation equipment.

Orange County's South Coast Air Basin is listed by the EPA as an extreme air quality non-attainment area. This means that there is increasing urgency for public entities to reduce air emissions through changing paradigms and improved infrastructure. At the airport, this means providing cleaner electricity to replace hydrocarbon-fueled engines and equipment, providing charging stations for electric vehicles, replacing hydrocarbon-fueled shuttle buses with zero-

emission buses, developing the corresponding bus charging grid, and implementing electrical upgrades and infrastructure projects that increase efficiency and reduce electricity demand.

In an urbanized area such as Orange County, pollutants make their way into stormwater runoff and ultimately channel to our beautiful beaches and bays. Public entities are called on to be ever more vigilant to reduce urban and transportation-related pollutants in stormwater runoff. Infrastructure projects to accomplish this can require capturing and treating millions of gallons of stormwater and have been estimated at upwards of $35M to implement. The airport is currently evaluating infrastructure projects to support our region's clean water goals.

Cable Communications

Capacity

Orange County receives its cable and internet from major providers including **Cox Communications**, **AT&T**, **Google Fiber**, **Verizon**, and **Charter Communications** aka Spectrum.

According to the **California Cable and Telecommunications Association** (CCTA), "cable's broadband service is available to 98 percent of all California households, which encompass 6.25 million California cable subscribers, 3.7 million digital voice customers, 7.9 million high-speed data customers." Currently top residential broadband speeds reach up to 2 GBPS. Orange County providers provide these services to more than 3 million residents, small and regional businesses, including health care providers, K−12 and higher education, financial institutions, and federal, state, and local government organizations.

Collectively, the major providers in the county maintain and operate thousands of network miles delivering video, phone, and high-speed internet service to homes and businesses. Spectrum alone serves 268 communities across the entire state of California and twenty of Orange County's cities. From 2018-2020, Spectrum extended its network to reach an additional 2.5 million homes and small businesses, about a third in rural areas. In 2020 alone, Spectrum extended its network to reach an additional 145,000 home and small businesses in California.

Condition

California is one of the most connected states in the country and is home to technology companies that have reshaped the way people around the world communicate with one another. Statewide more than $40 billion has been invested in infrastructure and network since 1996 according to the California Cable and Telecommunications Association (CCTA). The industry also maintains more than 1.9 million Wi-Fi access points statewide, employs nearly 230,000 people, and is responsible for more than $50 billion in economic revenue in the state.

According to SNL Kagan, 89 percent of households with a broadband connection rely on Wi-Fi. The maintenance of networks by all providers is more essential than ever for telecommuting, distance learning, business operations, smart home devices, cloud computing, telemedicine, wireless communications, social media, and entertainment.

Economic Impact

Each year, the State of California and its local governments collects millions in tax revenues and fees generated by the operations and construction activities of telecommunications companies its employees, subcontractors, and all related indirect and induced employees. These tax revenues go to the State, counties, and cities budgets within California.

Telecommunications providers contribute to the generation of thousands of direct, indirect, and induced jobs per year in California with a total income (including benefits) to these workers equals hundreds of millions of dollars. Further, the total economic impact from operations, construction, and capital expenditures in California, including indirect and induced impacts, is in the billions of dollars annually.

Through Access from the AT&T program, AT&T offers internet access for $10 a month or less to qualifying limited income households who participate in the Supplemental Nutrition Assistance Program (SNAP) or receive Supplemental Security Income (SSI) benefits in California.

Bridging the Digital Divide

The major telecommunications providers all offer broadband adoption programs for Orange County residents.

Cox's Connect2Compete program offers low-cost high-speed internet and in-home WIFI for $9.95 a month for K-12 families that receive food or housing government subsidies. Similarly, **Charter's "Spectrum Internet Assist"** program is a low-cost, high speed broadband services that provides qualifying households with internet service for $17.99 per month. When schools switched to online learning due to the Covid-19 pandemic, Cox provided up to four months of free internet

service through Connect2Compete for low-income families that needed an internet connection at home for their children's education.

In 2020, **Cox spearheaded a "Meet the Need"** technology drive in partnership with **Orange County Department of Education** (OCDE) and **Orange County Business Council** (OCBC) to collect technology for low-income students statewide.

Electrical

Capacity

Serving the ongoing and future electric energy needs of Orange County involves not only improving the Electric Power Infrastructure within Orange County, but also improving the Electric Power Infrastructure external to Orange County. Both SCE and SDG&E have made significant strides in planning and implementing improvements. In addition to addressing aging existing infrastructure, SCE and SDG&E plan new infrastructure needed for growing needs, and plan infrastructure improvements such as the new Smart Meter technology. All these efforts work to the benefit of Orange County, along with other areas.

Resulting from the Golden State decommissioning natural gas and nuclear generated electricity for decades that have provided continuous uninterruptable reliable electricity in the past, California **imported more electricity than any other state**– between 2013 and 2017 at 32 percent from the Northwest and Southwest. California electrical grid regulators and policymakers continue relying on other states to generate enough power to meet the future growing demands of California.

The range of Electric Power Infrastructure issues involving Orange County is challenging. There is no doubt that there is an extensive network of aging Electric Power Infrastructure. At the same time, SCE and SDG&E, which largely serve the electric requirements of Orange County, are seen to be aware of the issues.

While California pursues **100 percent intermittent electricity from wind and solar renewables by 2045 (SB100)**, it continues to be unable to produce enough in-state electricity to meet the states demands. This problem with state electrical demands, and the need to continually import electricity from other nearby states, does not conform with the California 2017 Climate Change Scoping Plan that requires accountability for and the **avoidance of GHG emission displacement**. This "displacement" is called "leakage." This leakage of environmentally damaging pollution and emissions continues to be relocated from California to other countries and states, shifting the GHG emissions contributing to overall global warming impacts.

California's Global Warming Solutions Act of 2006, commonly known as **Assembly Bill 32, or AB 32**, allows for **a state-wide program for reducing greenhouse gas emissions** to 40 percent below 1990 levels by 2030 from all sources initiated CO2 "leakage" from energy intensive manufacturing industries in California to other locations with significantly less environmental control than California.

Condition

California has the least reliable electrical power system in the nation. Between 2008 and 2017, California was the leading **U.S. state for power outages with almost 4,297 blackouts** in the ten-year period, more than 2.5 times as many as its closest rival, Texas. Power outages have been increasing in California.

The origin of the problem is partly California's Senate Bill 1368, which in 2006 established the state's emission standards to reduce greenhouse gases from power plants. Following 2006, **eleven coal-fired power plants were closed** and three were converted to biomass. Biomass is now a significant contributor to GHG and is considered a greater polluter and cause of environmental degradation than coal-fired power plants.

California continues its intention to transition to 60% renewable energy by 2030 and 100% "climate-friendly energy" by 2045, as required by state law SB-100. Shutting down coal, gas and nuclear power plants in California and increasing imported electricity from the Northwest and Southwest.

It also means people trying to run their homes, offices, factories, hospitals and schools on intermittent, weather-dependent, much more expensive wind and solar power will have to get used to never knowing when or for how long their electricity will be on or off. Battery energy storage systems for electrical grids do not have enough capacity to store electricity for home, consumer, and business for more than minutes at a time.

Despite California's **high cost of electricity,** which is already fifty percent higher than the national average for residents, and double the national averages for commercial, electricity rates are projected to go even higher as more closure of continuous uninterruptable electrical generating plants are implemented. California has largely failed to replace plants coming offline by enough renewable generation to provide continuous uninterruptable electricity for Orange County.

Adding to the onerous problem of affordable electricity, California is closing nuclear reactors that have been safely generating uninterrupted carbon dioxide-free electricity for decades. In 2013, California shutdown Southern California Edison's San Onofre plant, which generated 2,200 MW. It has ordered the closure of Pacific Gas & Electric's Diablo Canyon 2,160 MG generators by 2024, which will remove that power from the grid.

Following the eleven closures after 2006, 2018 saw three natural gas-fired power plants shuttered. The **natural gas power plant retirements in 2018 were**: 1) Encina at 854 MW, 2) Mandalay at 560 MW, and 3) Etiwanda at 640 MW.

Blackouts have forced the State to admit in 2020 that industrial solar panel and wind turbine farms are falling short of meeting California electrical generation daily needs. The State has acknowledged transitioning away from fossil fuels has left California with a gap in the reliability of its electrical infrastructure.

In addition to the 2020 announced **closure of the Natural Gas Power Plant at Redondo Beach**, The City of Los Angeles recently announced **forthcoming closures of three natural gas-powered plants** at Scattergood, Haynes, and Harbor. The four upcoming closures are:

- The 1, 310 MW Natural Gas Power Plant at Redondo Beach, that was scheduled to be shuttered in 2023.
- The 823 MW Natural Gas Power Plant at Scattergood in Playa Del Rey, that was scheduled to be shuttered in 2024.
- The 575 MW Natural Gas Power Plant at Haynes in Long Beach, that was scheduled to be shuttered in 2029.
- The 472 MW Natural Gas Power Plant at Wilmington, that was scheduled to be shuttered in 2029.

In September 2020, following blackouts from a lack of generated electricity being available, **State officials threw a lifeline to four natural gas power plants** along the Southern California coast, deciding the facilities are still needed to provide reliable electricity even as State officials and policymakers pursue reductions from natural gas contributions to the global climate change crisis. The four plants, that were given a shuttering deferral for the time being allows them to continue providing continuous and uninterruptable generated electricity.

Funding

The utilities each have periodic **General Rate Cases** (GRCs) that are proceedings used to address the costs of operating and maintaining the utility system and the allocation of those costs among customer classes. Each large electric utility files a GRC application every three years. To the extent that local governments and others express support for increasing funding for replacing aging infrastructure in subsequent GRCs, progress can be made, and an acceptable level of reliability can be maintained.

Future need

Ramifications from Governor Newsom's Executive Order from 2020 to ban the sale of gas-powered vehicles by 2035 may be devastating to the state's economy and environment. The State

wants to add more electrical charging demands onto a dysfunctional energy program that has already shuttered one nuclear power plant and three natural gas power plants in recent years (total of 4 in recent years), and has five more to shutter in the cross hairs – the last nuclear plant at Diablo Canyon and **four more natural gas power plants**. The growth of EV's will further add to the electrical demands from the grid as **electricity consumption may double if the world's car fleets are electrified**.

Efforts by Southern California Gas Company are continuing to reduce carbon emissions by switching to renewable natural gas, methane, and biogas which will reduce overall greenhouse emissions while also keeping a blended energy profile and reduce costs on California residents.

Trends throughout the state, aimed at banning the use of natural gas hook-ups for cooking, heating, and cooling, and washing and drying clothes, imposes a regressive energy tax on low- and middle-income consumers. Prohibiting the direct consumption of natural gas in furnaces, stoves, clothes dryers, and water heaters forces consumers to buy electricity, which in California is four times as expensive as natural gas on an energy-equivalent basis.

The inability to replace the closure of continuously uninterruptable electricity from nuclear, natural gas power plants, and hydroelectric plants with intermittent electricity from renewables of industrial wind and solar will cause the state to increase its importing of electricity and most likely continue to inflate the cost of electricity to residents and businesses which is already among the most expensive in the nation.

Recent fires both in Southern California and Northern California have exposed the questionable reliability of the electrical system. When it is hot and when customers need power most, fires are more prevalent and electric companies are now authorized to implement Public Safety Power Shutoff (PSPS) events, shutting down their system to prevent dangerous fires leaving many customers without power.

While the state needs support of clean-burning or renewable energy generation projects in Orange County for its over-reliance on intermittent electricity from wind and solar, the state is facing increasing resistance from the Not-In-My-Backyard ((NIMBY) residents that are rejecting large renewables in their backyard. Communities like **San Bernardino** the state's largest county, has banned the construction of large solar and wind farms of more than 1 million acres of private land. Residents have become more vocal about not wanting their rural desert communities littered with renewables.

Electricity demands from the grid will be increasing as **California now requires that all new homes be all-electric**. It wants citizens to switch their natural gas stoves to electric, as part of their global warming initiatives. More than 40 cities have already enacted bans to achieve a gas-free future and the use of more electricity.

The **August 2019 "common interest agreement" agreement between the California Public Advocates Office and Sierra Club** to help the California Public Utility Commission (CPUC) ban the use of natural gas will inflict more costs onto those that can least afford more expensive utility costs as electricity is four times more expensive as natural gas on an energy-equivalent basis.

This means demand for reliable, affordable electricity will rise by leaps and bounds, just as in-state supplies are steadily reduced. The shuttered power plants are partially replaced by expensive, intermittent, weather-dependent power, and the hope that neighboring Northwest and Southwest States will have sufficient excess capacity to export electricity to California.

It also means people trying to run their homes, offices, factories, hospitals and schools on intermittent, weather-dependent, much more expensive wind and solar power will have to get used to never knowing when or for how long their electricity will be on or off. However, it may spur sales of candles, flashlights, propane heaters, and natural gas, gasoline, and diesel generators.

Operation and Maintenance

To meet the renewable electricity targets with wind and solar by 2045 has necessitated a supply chain from foreign countries that have less stringent environmental regulations than California for the mining of exotic mineral and metals required to support wind turbines, solar panels, and EV battery construction. The leakage of the supply chain for renewables continues to impose environmental degradation, humanity atrocities, and greater emissions from developing countries. Virtual Tours are available for the **Diablo Canyon Nuclear Generating Plant**, a **Combined Cycle Natural Gas Turbine Power Plant.** and a **Coal-Fueled Power Plant Virtual Tour**

Public Safety

Residents relocating from the high costs of living in urban areas have created a problem for California's forestry maintenance guidelines. Utility services are expected to be brought to them no matter where they live.

This expansion into once forested areas is causing challenges for utility providers who want more customers but do not appreciate the burden minimal forest maintenance has placed on their ability to safeguard their equipment and the public who use it. It has caused them to petition California Public Utility Commission (CPUC) and receive the authority to shut down services where it deems those services create a public hazard.

Today, electric utility companies up and down the state have all implemented Public Safety Power Shutoff (PSPS) events, aka rolling blackouts, as a last line of defense against electric service disruption and possible massive wildfires to vulnerable communities caused by utility equipment.

Resilience

Work is progressing to address aging infrastructure issues, and yet there continues to be funding issues as well as great public opposition to most any form of infrastructure improvement that involves any environmental impact whatsoever. There is no cause for panic, nor is there reason to rest easy. Extensive planning, engineering, and design, environmental, regulatory, and legal efforts must continue with determination to maintain and improve the Electric Power Infrastructure necessary to keep Orange County healthy and assist in the widespread economic recovery that is needed.

Innovation

The present state of the electric power infrastructure might be characterized as “average” or “mediocre”, and at the same time events and trends toward more intermittent electricity from renewables seem to be driving the state of the infrastructure in a negative direction with the shuttering of nuclear and natural gas power plants, and an absence of plans to replace the shuttered plants. California will need to increase its imports of high-priced electricity from the Northwest and Southwest to fill the void.

Orange County’s future under the political platform toward reliance on intermittent electricity from wind and solar renewables may see more blackouts for the foreseeable future. California’s trouble is explained by officials who now openly admit to an over-reliance on industrial solar panel and wind turbine farms for electricity, over the continuous uninterruptible and reliable coal, natural gas, and nuclear power plants.

Levees

Background

Within Orange County, approximately 84 miles of levees are part of the 380 miles of **Orange County Flood Control District**'s (OCFCD) flood control system. It is a priority as efforts to complete a study lasting a dozen plus years have been successful and the County's aging levee system is being maintained and improved to the best of the County's ability with the resources available where funding and regulatory restrictions will allow.

The fiscal impacts of climate change include increased regulatory pressure, more rigorous maintenance, updated safety standards and higher cost estimates factor into the County's ability to maintain and improve its flood control system including levees. OCPW currently spends approximately $3.2 Million annually on all flood management activities. Part of our required activities are to recertify and accredit the levees every 10 yrs. Due to aging facilities and exceeding the service life of the facilities (much of the OCFCD flood control systems were constructed decades ago), more work and cost is required just to maintain the levees.

Since 2012, several remarkable events have highlighted the importance of levee infrastructure investment. The past several years, except for 2016-17, have been the driest period since statewide

records began in 1896. Climatologists report that this pattern of extreme conditions (prolonged severe drought with intermittent seasons of severe storms) is the new normal.

The flood risk in Orange County is generally with higher risk in certain watersheds more than others due to topography and development over the decades. The key to protecting these lives and livelihoods is our system of flood control channels (including levees), retarding basins, dams and pump stations that convey floodwaters. All levees can fail even a well-built levee can succumb to floodwaters.

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

Some of the older levees in Orange County were constructed by farmers to protect farms, not the people who later took up residence behind these structures. In addition, levees generally are subject to settlement, under seepage, and seismic activity. 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. Orange County has adopted standards for many levees that exceed the **FEMA 100-year standard**.

This does not mean the 100-year flood will occur only once every 100 years, and in fact, California has endured many such floods within the last 100 years. Originally an actuarial insurance value—not a public safety standard—this became the de facto design event until relatively recently, highly populated areas such as Orange County have adopted standards for many levees that exceed the FEMA standard. DWR and other experts have even proposed a goal of 500-year level of protection for levees with high consequences of failure, but this has not yet been approved as a standard.

The County, **U.S. Army Corps of Engineers** (USACE), Federal Emergency Management Agency (FEMA), and the State of California (State) all play key roles that are integrated and often overlap. The Corps has traditionally played the predominant role constructing and rehabilitating large-scale flood infrastructure, such as levee systems, for which there is a federal interest.

Operations and Maintenance

Levee operations and maintenance (O&M) standards have become more difficult to meet. Among the biggest challenges facing routine O&M of levees is the increasing burden of environmental regulatory compliance. Among the biggest challenges facing routine levee O&M is the increasing burden of environmental regulatory compliance coupled with the often-conflicting demand for environmental stewardship in levee maintenance practices.

As an example, floodways that are clogged with sedimentation and vegetation often cannot be cleaned out in a timely manner, thereby increasing loading on levees. Increasingly, compensatory mitigation for O&M activities that were once considered routine is having a significant negative effect on preventative maintenance. Along with other levee owners, OCPW participates in various

flood management associations that have a combined collective voice to change regulations that would help with easing restrictions related to levee maintenance.

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 such as the Santa Ana River.

The USACE plays an important role before, during and following a flood through a federal authority termed Public Law 84-99. However, Orange County has challenges meeting eligibility requirements of the **USACE PL 84-99 program**. U.S. Army Corps of Engineers (USACE) standards must be met to be eligible for federal assistance, for levee repairs through PL 84-99. (Public Law) program.

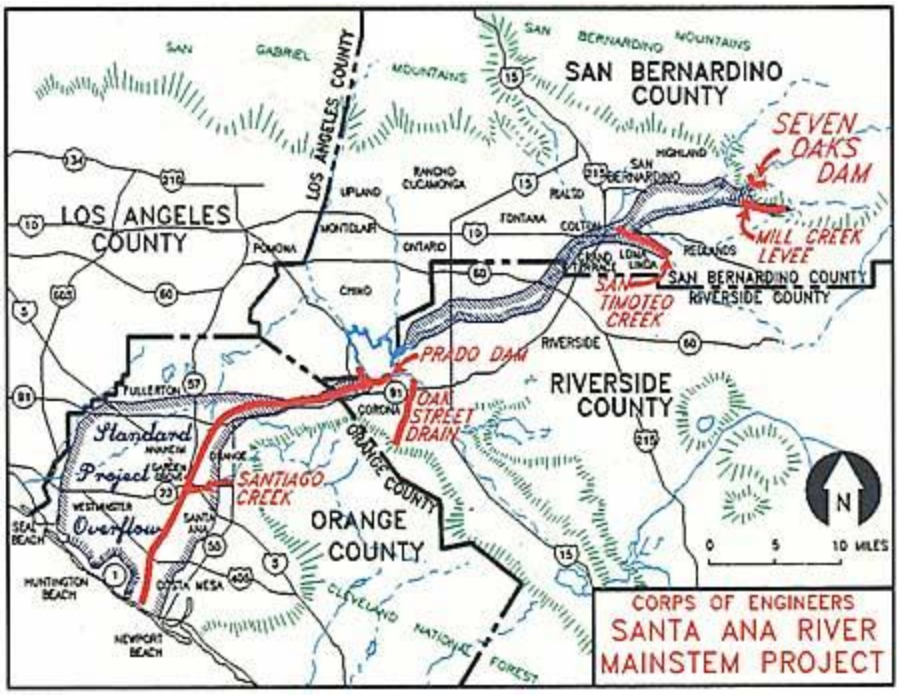
Levees are susceptible to seepage and settlement are required to be recertified and re-accredited every 10 years. OCPW is pro-active in its work with FEMA to comply as funding will allow. This work also includes major and minor repair projects.

Hopefully, the current regulations can be streamlined and the regulatory burden on routine levee O&M and capital projects can be reduced.

Improvement Projects

The Santa Ana River

The Santa Ana River as we know it today, has a long history that is anchored on much work and coordination by OCPW with USACE. The Mainstem project is designed to provide flood protection for residences and business in the Southern California communities of Orange, Riverside, and San Bernardino counties along 75-mile reach. All three counties, collectively, working closely with the U.S. Army Corps of Engineers to design and construct the project.



The Orange County Flood Control District (OCFCD) was formed by the State Legislature in 1927. The Federal Flood Control Act of 1936 authorized a flood control project to protect metropolitan Orange County that included the construction of Prado Dam. Major floods in Orange County in 1937 and 1938 prompted Congress to direct the U.S. Army Corps of Engineers (Corps) to proceed with design and construction of the dam, which was subsequently completed in 1941.

The re-study of the SAR system was approved in 1964 was completed in 1975 by the Corps LA District Office that concluded that the existing Prado Dam and Santa Ana River improvements only provided a 70-year level of flood protection. The report recommended an "All River Plan" alternative (later renamed the Santa Ana River Mainstem) that included the Seven Oaks Dam in San Bernardino County and the raising of Prado Dam (to increase flood storage capacity) and improvement of its outlet works, and reconstruction of the lower Santa Ana River Channel to increase its capacity.

The goal of the 1975 study was to develop a plan to address the "Standard Project Flood", one that has about a ½ percent chance of occurring any given year. Congress in the Water Resources Development Act of 1976 authorized a study for the project that was completed in 1980. In 1986 a more detailed study was completed. The project was authorized for construction that began in 1989 for improvements to the Lower River near the Pacific Ocean.

Over the ensuing 35 years, much of the construction work for the 21 miles of levees have been improved to provide ultimate capacity for this system as needed by current standards; however, several key elements remain. The County continues with some of the last major projects in the system that includes the completion of the Prado Dam and Santiago Creek improvements.

San Juan Creek

The **Pineapple Express Storms** of January 2005 resulted in a breach to the west levee along two reaches of San Juan Creek Channel. As a result, the County immediately planned for a series of 8 projects to fortify the San Juan and Trabuco Creek channel levees. The completion of 7 of the major levee fortification projects over the past 12 years along these systems has provided greater safety and protection to the immediate community covering approximately 6.2 miles of levees in south Orange County.

Westminster East Garden Grove Wintersburg

The OCPW current focus is on the "C" system facilities where the County recently received authorization through the 2020 **Water Resources Development Act** (WRDA), as part of the Omnibus bill signed in December 2020, for a federal project along four of OCFCD's regional flood control systems. In the area of these deficient systems is the largest remaining FEMA floodplain in Orange County. Some of the fragile levees along these systems have been improved by OCPW during the past 10 years ahead of the formal agreement with USACE. Our partnership with the USACE, along with federal and possible State funding will help Orange County complete this series of projects over the next 12 years or more.

OCPW levee projects incorporate recreational elements where possible. Many OCPW flood control projects have included bikeways and trails.

Resilience and Innovation

Resilience is the capability of levees to withstand and/or quickly recover from hazards. Climate change is one of the predominant factors along with the many hazards threatening levees. A community is flood-resilient when it recovers rapidly after a flood event and can do this when the flood system is robust, incorporates redundant features, and is supported by ample resources. Older levees were not designed to meet modern engineering standards, much less climate change impacts. Some are rather fragile and required study and new methods that are applied successfully to mitigate their existing conditions. Currently, there is no Statewide resiliency standard. Better design and higher standards will help to provide more resilient facilities resulting in less frequency and effort to operate and maintain the levees and thus allowing for use of savings towards other projects.

Funding/Future Need

More grant money -federal, State, and local funding is needed. OCPW is involved in legislative efforts including visits to Washington D.C., work with lobbyists and involvement with organizations such as the **Association of State Floodplain Managers** (ASFPM) and the **National Association of Flood & Stormwater Management Agencies** (NAFSMA) that regularly meet, review and comment on proposed changes to upcoming requirements, mandates, and regulations regarding the design and maintenance of levees. These organizations have a voice in determining what future legislation, funding and standards will be. OCPW has been a member or participant of these organizations for many years.

Although funding is sometimes available through State or Federal grants, these opportunities are not provided on a regular basis.

The USACE has traditionally played the predominant role constructing and rehabilitating large-scale flood infrastructure, such as levee systems, for which there is federal interest. And while this approach will continue for larger projects, local agencies such as OCPW has recently constructed projects on its own saving time and money; however, local funding for other flood control projects are greatly needed. This trend is partly due to the narrow criteria for federal investment, which often reduces federal funding of flood management projects needed by local interests.

The State 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. Orange County was able to benefit by receiving funding for some of its levee projects.

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.

Because primary responsibility for managing flood risk lies with local governments, most funding is generated and spent at the local level. Local maintaining agencies face increasing financial burden from increased regulatory pressures, aging infrastructure, changing State and federal levee standards, and taxpayer protection laws.

Natural Gas

Overview

As the nation's largest natural gas distribution utility, **SoCalGas delivers clean, safe, and reliable energy** to 21.8 million consumers through 5.9 million meters in more than 500 communities. For more than 150 years, SoCalGas has served Central and Southern California as an environmental leader, employer, and neighbor. SoCalGas' service territory encompasses approximately 24,000 square miles in diverse terrain throughout Central and Southern California, from Fresno to the Mexican border. Orange County specifically accounts for 14,656 miles of distribution pipelines and 190 miles of transmission pipelines, serving over 980,000 customers using over 50 billion cubic feet of natural gas annually. These customers range from the most popular tourist resort destinations to power generators, industrial manufacturers, hospitals, colleges, universities, government buildings, grocery stores, and of course residents. Some of these customers have even added natural gas electric generation facilities or operate natural gas fuel cells to provide efficient and reliable electricity for their operations.

Orange County customers can rest assured that their investment in gas infrastructure is secure. The infrastructure offers safety, resiliency, choice, affordability, and increasingly **renewable energy** for the future.

In March 2021, SoCalGas announced its **commitment to achieve net zero greenhouse gas (GHG) emissions in its operations and delivery of energy by 2045**. This commitment makes SoCalGas the largest gas distribution utility in North America to set a net zero target including scopes 1, 2, and 3 GHG emissions, which would reduce not only its own direct emissions, but also those generated by customers' energy delivered by SoCalGas' energy infrastructure. SoCalGas' commitment aligns with the Paris Climate Agreement's recommendations and reflects the company's focus on supporting California with a resilient gas grid through the energy transition to support a carbon neutral economy.

Safety

Safety is paramount to SoCalGas as evidenced by the $600 million the company has invested over the last six years in the operation and maintenance of pipes that run through Orange County. Whether it is preventive maintenance of pipelines, or repairing leaks caused by damage during construction, there are crews working 24/7 to ensure the gas is safely flowing to generate electricity, provide hot water, heat for your equipment or appliances, and fuel to cook.

To safely transport and deliver natural gas, SoCalGas rigorously maintains the natural gas pipeline system, monitors natural gas quality, *and* adds a distinctive odor to the gas to help detect leaks. By using advanced safety inspection tools to monitor pipe conditions, SoCalGas can verify the effectiveness of ongoing maintenance activities and address any necessary upgrades.

One such upgrade recently occurred at the intersection of Chestnut Street and Grand Avenue in Santa Ana. Four transmission lines intersect at the corner where SoCalGas routinely conducts pipeline inspections. The scope and frequency of the work has historically been quite extensive and required complete excavation of the intersection and blocking lanes of traffic. To address this issue, SoCalGas purchased the land adjacent to the intersection to allow work equipment to be relocated from traffic lanes to its own property. This project provided a long-term solution to the ongoing need to inspect transmission lines to maintain safe natural gas service for Orange County customers.

Since 2014, SoCalGas has converted approximately 263 mobile home communities to direct utility service, enhancing both public safety and service reliability of 17,800 mobile homes and providing families with enhanced access to energy efficiency and customer assistance programs. Specific to Orange County, there are 55 mobile home communities (4,063 homes) that have benefitted from the **Mobile home Park Utility Conversion Program**, a statewide voluntary safety effort that offers mobile home community owners the opportunity to replace their own natural gas and/or electric master-metered systems with new utility-owned systems at no cost.

SoCalGas implemented another innovative measure with the update to **Advanced Meters—automated meters** that can be read remotely. Advanced Meter technology allows customers to enhance their privacy, security, energy savings, and can proactively identify possible gas leaks in a home. It also allows customers to set up **Bill Tracker Alerts** so they can monitor their gas usage. Through this remote meter reading, SoCalGas was able to remove 1,000 service vehicles from the streets which eliminated close to 7 million miles driven to read meters and saves approximately 140,000 tons CO_2 emissions each year.

Another proactive pipeline safety measure taken is focused on preventing leaks. SoCalGas has a long-standing commitment to modernizing its system infrastructure to increase safety and reliability and reduce methane emissions. Some of the most effective steps include:

- Modernizing its equipment at **Metering and Regulating** (M&R) facilities to more accurately pinpoint leaks and to increase safety and reliability and reduce methane emissions.
- Eliminating cast iron pipe from its natural gas system.
- Implementing new operating protocols to minimize any gas released to atmosphere during routine maintenance.
- Prioritizing the replacement of pipe that does not meet current standards for corrosion prevention.
- Using helicopters to monitoring methane emissions from the air.

Not all pipeline safety is proactive. Accidents involving contractors and excavators are one of the leading causes of pipeline damage. It is especially important for contractors and excavators to be informed of the potential safety issues that might arise when working around natural gas pipelines. To reduce such damage, SoCalGas partnered with Angel stadium to ensure Orange County is educated about the importance of **notifying 811** prior to any excavation. More than 94 million impressions were made with tens of thousands of baseball fans. Creative campaigns like this run across SoCalGas' entire service territory to highlight the importance of allowing the company to mark gas line locations prior to construction. These efforts are effective. Excavation damage decreased by 29 percent from 2018 to 2020 in Orange County while **Underground Service Alert** (USA) ticket requests increased by 11 percent.

Reliability & Resilience

Infrastructure investment provides safety, but also increases the resiliency of the SoCalGas system- and energy reliability—including the electric grid. Some of SoCalGas's biggest customers are electric generators. As much as 60 percent of the electricity generated in Orange County is produced with natural gas power plants. This source of energy provides stability with extreme weather incidents. For example, **during the heatwave of August 2020, more than 800,000 Californians experienced rotating electrical outages over the course of 2 days.** The **California Public Utilities Commission** (CPUC), **California Independent System Operator** (CAISO), and the **California Energy Commission** (CEC) all agreed that "The excessive heat put a strain on the demand for energy that renewables just cannot supply. In transitioning to a reliable, clean, and affordable resource mix, resource planning targets have not kept pace to lead to sufficient resources that can be relied upon to meet demand in the early evening hours. This makes balancing demand and supply more challenging." By providing energy anytime the demand for electricity exceeds what solar and wind power can supply, the **gas grid supports California's ability to put more and more renewable energy onto the electric grid**. Because continuing to decarbonize the electric grid requires more dispatchable energy from the gas grid, the gas it provides will likewise be decarbonized over time.

When the sun and wind stop shining and blowing, so do their contributions to the electric grid. Being weather-dependent, wind and solar are intermittent and unreliable. Natural gas, however, is readily available to deliver energy at a moment's notice to maintain a constant source of electricity. Hospitals, fire stations, and water district are just a few of the critical customers that operate 24/7.

So, it is fortunate that natural gas is abundant, easily stored, and protected in underground pipes to make it a resilient energy choice. Electric generators, as well as the millions of additional customers relying on a stable source of energy, will increasingly depend on natural gas as California expands its network of renewable sources.

In fact, Orange County is home to several state-of-the-art projects that demonstrate how natural gas plays that critical role in expanding **California's renewable energy portfolio**:

- **University of California, Irvine (UCI) showcases a Power-to-Gas (P2G) Project**. SoCalGas worked with the university to study technology that converts surplus clean energy from solar panels or wind farms into hydrogen, which can be blended with natural gas and used in everything from home appliances to power plants. This **renewable hydrogen** can also be converted to methane for use in a natural gas pipeline and storage system or used in hydrogen fuel cell vehicles. Importantly, the hydrogen can enable long-term storage of large amounts of carbon-free power.
- **Renewable Natural Gas** (RNG) is a renewable fuel produced from food waste, farms, landfills, and even sewage. It can rapidly cut greenhouse gas emissions (GHGs) because it takes more climate pollution out of the air than it emits as an energy source. Orange County is home to three **landfill gas-to-energy sites** (i.e., RNG) where customers like **Anaheim Public Utilities can take advantage of using that RNG** to provide clean electricity to its customers.
- **Huntington Beach hosts an Advanced Energy Community project.** UCI worked with City of Huntington Beach, Altura Associates, the National Renewable Energy laboratory, Southern California Edison, and SoCalGas to provide the Huntington Beach neighborhood of Oak View with a full spectrum of clean energy options, including solar, wind, and RNG. The partners found they could reduce GHG emissions by 6,849 metric tons annually.

While Orange County is at the forefront of these innovative programs, SoCalGas has much more on the horizon to address California's environmental goals, including the company's pledge to achieve net zero emissions in its operations by 2045. The state has a goal to **reduce greenhouse gas emissions to 40% below 1990 levels by 2030** (AB32); and to get **100 percent of its electricity from clean sources by 2045** (SB100). As part of its commitment to achieve net zero GHG emissions in its entire operation, **SoCalGas has $1 billion planned for 2020-2024 in support of these goals**. SoCalGas plans to invest in initiatives to decarbonize, diversify, and digitalize the business. To guide SoCalGas' path to net zero, the company announced **this Climate Commitment.** .

One cornerstone of this **clean energy strategy is SoCalGas'** commitment to replace 20 percent of its traditional natural gas supply with renewable natural gas (RNG) by 2030. RNG is already helping eliminate emissions from trucks and buses, and recently SoCalGas received approval from the CPUC to bring this renewable fuel to homes and businesses.

A 2016 law requires 40 percent of methane from California's landfills and farms to be captured (SB-1383) with provisions to deliver that energy to customers. This will bolster the supply of RNG that is already growing rapidly as cities and towns across the country look to divert organic waste from landfills. In addition, the Coalition for Renewable Natural Gas projects that in California, RNG can generate $14.3 billion in economic growth.

In addition to using RNG to decarbonize its system, SoCalGas is researching the use of **green hydrogen** to support the growth of renewable electricity and California's quest to become **carbon neutral by 2045** (California executive order B-55-18). Made from renewable electricity, green hydrogen is a zero-carbon fuel that can be used in fuel cells or in traditional gas-fired power generation plants to provide electricity when the sun is not shining, and wind is not blowing. Unlike batteries, green hydrogen can be stored for days, months, even years, then re-converted to electricity. The production, transportation, storage, and distribution of large volumes of green hydrogen will be required to achieve carbon neutrality in California, and SoCalGas' system and its 100,000 miles of pipeline is well-positioned to provide these clean molecules to Californians.

The company recently filed an application with the CPUC to begin a **hydrogen blending demonstration program**. The first proposed project in the program will blend hydrogen into an isolated section of primarily polyethylene (PE) plastic distribution system in SoCalGas' service territory. The initial hydrogen blend level is planned at 1 percent and may increase to as much as an industry-leading 20 percent. The projects within the program will provide the crucial technical knowledge needed to identify safe blending standards that preserve the safety, reliability and integrity of the gas system and our customers' end use equipment.

In addition, SoCalGas announced recently that it is field testing a new technology that can **separate and compress hydrogen from a blend of hydrogen and natural gas**. This technology would allow hydrogen to be easily and affordably transported via the natural gas pipeline system, then extracted and compressed at fueling stations that provide **hydrogen for fuel cell electric vehicles**. SoCalGas is also building a home to demonstrate, in a microgrid setting, the use of hydrogen converted from solar energy. Called the "**H2 Hydrogen Home**," the project will use solar panels to create electricity that can be converted to green hydrogen via electrolysis. The hydrogen will be blended with natural gas for the home's appliances as well as converted back to electricity using a residential fuel cell.

Funding

SoCalGas keeps its system safe and reliable with funding provided by ratepayers. Every 3-5 years the utility submits a **General Rate Case** (GRC) to the CPUC requesting approval for how much revenue the utility can collect from each customer class. The **CPUC approved SoCalGas' 2019 GRC** request which allocated nearly 60 percent of the increase associated with modernizing and upgrading our infrastructure; and 13 percent to support the growth of more renewable energy options, as well as improvements to customer services and technology solutions. The next GRC will be filed in 2022.

Gas infrastructure is an energy storage and delivery system that seamlessly facilitates and advances the transition to clean fuel solutions like RNG and green hydrogen, recognized around the world by scientists and experts as crucial components of the clean energy future. Achieving 100 percent clean energy in California depends on the actions SoCalGas has taken, is taking, and will take to make renewable deployment and decarbonization achievable.

Oil

Foreign Crude Oil tankers off the coast of California awaiting offloading at ports.

Capacity

Orange County receives 100 percent of its demand for transportation fuels of gasoline, diesel, and jet fuel from California manufacturers located throughout California to service the **more than 3 million residents of O.C.** and **almost 3 million vehicles registered in Orange County**.

With the closure of the Marathon Martinez refinery in Northern California, the future supply of fuels looks uncertain for the more than 40 million residents of the state as the economy starts to recover back to near-normal fuel demands after the pandemic for the 5th largest economy in the world. The near-normal daily fuel demand for California's **145 airports** (inclusive of 33 military, 10 majors, and more than 100 general aviation) was **13 million gallons of aviation fuels**, or one-fifth of the nation's jet fuel consumption. California's **31 million registered vehicles** were consuming **10 million gallons a day of diesel and 48 million gallons a day of gasoline.**

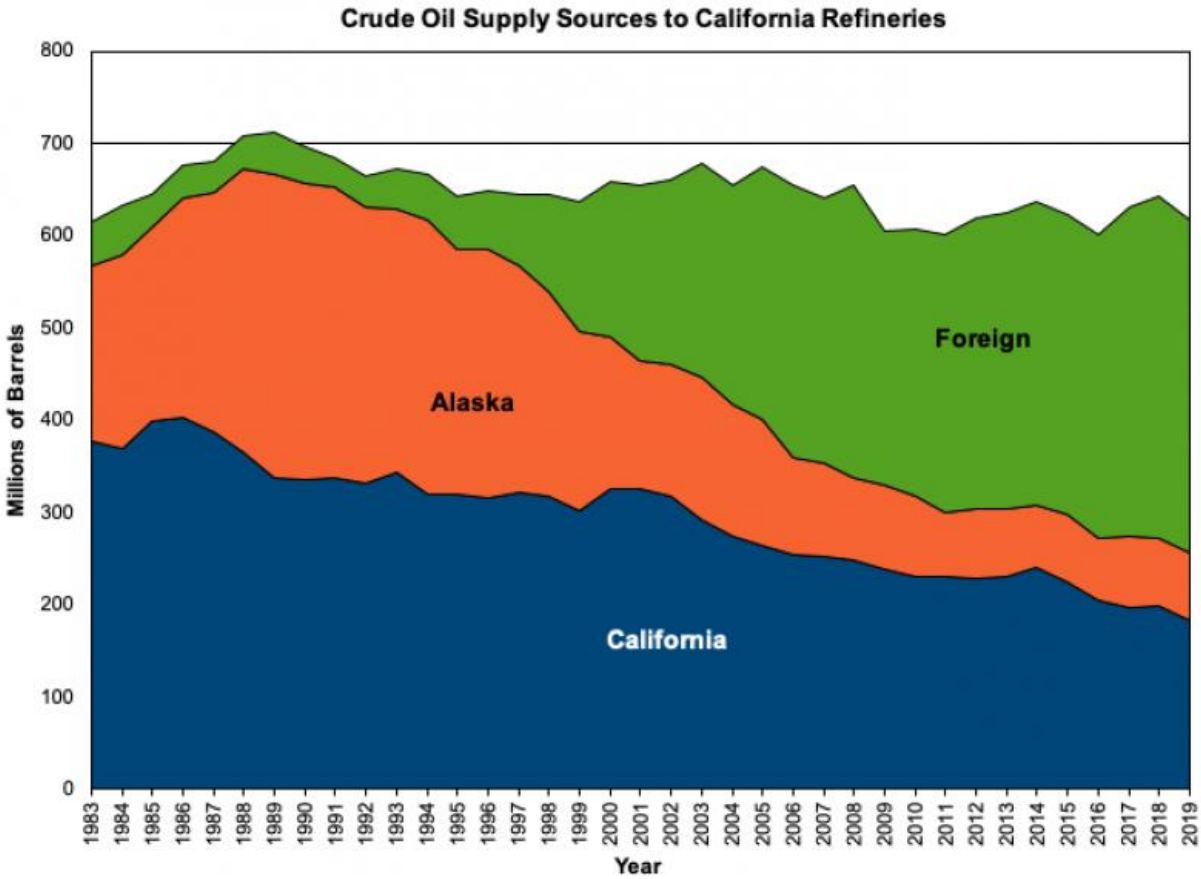
Collectively, that is about 65 million gallons of various fuels demanded daily to run the California economy and the lifestyle of its residents, but now with the Marathon Martinez refinery out of business, the future in-state supply may not be able to meet the demand.

In 2019-20 and 2020-21, it was estimated that fuel consumption accounted for more than $7 billion for taxes to help maintain the 400,000 miles of roadways in the state. The fuel tax is one of several sources of **revenue for the transportation program.**

Condition

California is an "energy island" inhabited by roughly 40 million citizens and situated between the Pacific Ocean and the Arizona/Nevada Stateline, with no existing crude oil pipelines over the Sierra Nevada Mountains that run along the eastern California border and effectively separates most of the state from the rest of the country.

With the state having no easy access to the abundance of crude oil east of the Sierra Mountains, California as there are no pipelines over those mountains, it is the only state in contiguous America that imports most of its crude oil demands from foreign country suppliers to meet the energy demands of the state. With in-state crude oil production at an all-time low and going lower with pressure from State regulations, The California Energy Commission (CEC) document's the states dependency on other suppliers has **increased imported crude oil from foreign countries from 5 percent in 1992 to 58 percent today** of total consumption. The imported crude oil costs California more than $60 million dollars a day, being paid to oil-rich foreign countries.



California Energy Commission graph of the Crude Oil Supply Sources to California Refineries

Funding

The state's few refineries are privately funded by the manufacturers without government funding for operation, maintenance, and refinery turnarounds (T/A's), planned and unplanned. The T/A's provide essential opportunities for various T/A maintenance and repair issues, improvements, and modifications to implement technological enhancements.

The fuel taxes paid by those using fuels help maintain California's almost **400,000 miles of roadways** that are heavily dependent on those taxes from fuel that contribute more than **$7 billion annually**, the same tax base that will be diminishing in the decades ahead as Governor Gavin Newsom's 2020 Executive order to ban the sale of gas-powered vehicles by 2035 will reduce the fuel tax funds. Increasing fuel efficiencies of the mobile fleet are causing less tax revenue available to fund the transportation infrastructure and the movement toward more EV's will see the future implementation of a VMT (vehicle mileage tax) to require all users of the roadways to pay their fair share, inclusive of electric vehicles and gas-powered cars and trucks.

Future need

Renewables have a role in our energy usage, but we need to consider what they can do, and what they cannot do. Science shows that wind and solar can generate electricity, but science also shows us that wind and solar cannot manufacture the oil derivatives that are the basis of more than 6,000 products that we did not have before 1900 that now are part of every transportation infrastructure, electricity generation, cooling, heating, manufacturing, agriculture, and virtually every product used in our daily and leisurely lifestyles.

The world has had almost 200 years to develop clones or generics to replace the crude oil derivatives that are the basis of thousands of products for societies and economies.

Supply side economics has demonstrated that the exotic minerals and metals required to support the need of wind, solar, and EV batteries and the lack of transparency in the supply chain, are being provided by developing countries where environmental degradation and humanity atrocities are occurring to support green electricity in developed countries.

Electricity alone has not, and will not, run the economies and lifestyles in the world, as electricity alone is unable to support the military, airlines, cruise ships, supertankers, container shipping, and trucking infrastructures, as wind and solar are incapable of manufacturing any of the oil derivatives that are required for the thousands of products of the world's economy.

The two prime movers that have done more for the cause of the advancement of global trade than any others are the diesel engine and the jet turbine. Both movers get their fuels from oil, and without this fuel and the 6,000 products that come from oil and petroleum products, transportation and commerce would return to the pre-Industrial revolution age.

In addition to anti-fracking and anti-directional drilling in the State, there are serious considerations of minimum "setbacks" for all new oil and gas development outside federal land, to be located at least 2,500 feet (nearly half a mile) from any residence, school, childcare facility, playground, hospital, or health clinic. These setback regulations would define re-drilling of a previously plugged and abandoned well, or other rework operations, as a new development.

There are more than 8,000 active or newly permitted oil and gas **wells located within a 2,500' buffer of sensitive sites**, that represents about 30% of the 30,000 active wells in California. These setbacks would further reduce California crude oil production to the point that the foreign imports

needed to make up for the in-state reduction would drive up the monthly cost to more than $80 million dollars a day being sent to oil rich foreign countries, at **current crude oil pricing**.

The needs of California's energy island's growing population would result in transferring the responsibility for California's energy island demand requirements to other States or Countries which have less stringent environmental laws than California with resulting increases in greenhouse gases "leaked" to other locations in the world, and the increases in cost for Californians from those imports from afar.

Operation and Maintenance

While California pursues 100 percent intermittent electricity from wind and solar renewables by 2045, it continues to be unable to produce enough in-state crude oil to meet the state's demands and disregards the California climate policy that is supposed to account for and avoid GHG emission displacement, or "leakage" to foreign countries that have less stringent environmental regulations than California and transport their crude oil via air polluting ships delivering that oil to California ports.

Public Safety

According to American Fuel and Petrochemical Manufacturers (AFPM) Occupational Injury & Illness Report, the total recordable incident rate for both company employees and on-site contractors working at petroleum refining facilities, were 0.5 incidents per 100 full time employees. The data shows that it is **safer to work within a refinery** than in an office building. Refineries manufacture the various fuels for the transportation industries and the crude oil derivatives that are the basis of more than **6,000 products** that are the basis of lifestyles and economies around the world. A **Virtual Tour of a refinery** is available.

Resilience

Now, more than a decade since the passage of AB32, California, with 0.5 percent of the world's population (40 million vs. 8 billion) remains the most environmentally regulated location in the world, **California continues to contribute a minuscule less than one percent**, of global greenhouse gas emissions. Californians continue to pay almost **$1.00 more per gallon of fuel** than the rest of the country due to a) the state sales tax per gallon which is some of the highest in the country; b) refinery reformatting costs per gallon; c) cap and trade program compliance costs per gallon; d) low-carbon fuel standard program compliance costs per gallon; and e) renewable fuels standard program compliance costs per gallon.

Innovation

The ongoing and future needs of Orange County are a balance of different sources of affordable, plentiful, reliable, accessible, and dependable supplies of fuels, inclusive of sustainable aviation fuels and alternative fuels, electricity, and the thousands of products made from petroleum derivatives. Therefore, regulators and community leaders need to think broadly to find solutions across the entire energy system, inclusive of the intermittent electricity from renewables, and fossil fuels to meet California's ambitious environmental goals without severely impacting the economy. With in-state crude oil production on a continuous decline, creative methods to use truck and rail

to move that oil over the Sierra Mountains and into the California “energy island” will be required to meet the energy demands of the 5th largest economy in the world.

School District Facilities

Irvine USD, Heritage Fields #3 K8, Courtesy PJHM Architects

Overview

Orange County's public school educational facilities consist of thirteen (13) Elementary School Districts, three (3) Union High School Districts, and twelve (12) Unified School Districts providing educational services to 500,000 students in kindergarten through twelfth grade. Collectively, the **districts** manage and maintain nearly 600 school facilities.

The condition of school facilities that serve the needs of Orange County have continued to decline in the past five years, due to a lack of facilities funding. The majority of school districts' enrollment has either decreased or remained constant easing near term demand to expand and add new facilities. Deferred maintenance and upgrading of older school buildings continues to be a daunting problem to solve.

The School Facilities Subcommittee's work reflects the following goals and objectives:

1. To increase the accuracy and thoroughness of the discussion of recent school facility financing activities.
2. To determine if recent school facility financing activities have impacted school infrastructures in the last five years.
3. Considering the COVID-19 pandemic, reflect upon recent changes in school enrollment, including changes in overall, as well as the effects of student distribution on capacity issues.
4. To provide awareness to the public, city officials and representatives alike on the status of our schools.

The following report assesses Orange County's school infrastructure from five perspectives:

- Condition
- Cost/Operation
- Capacity
- Resiliency & Sustainability

- Innovation

Condition

Condition is linked to a diversity of factors. Compared to industry standards, there is an ongoing, structural pattern of inadequate and inequitable spending in many school districts. Because of Orange County's wide range of socio-economic zones, there are varied development levels within those zones. This defines the extreme delta in facilities conditions not only neighboring county districts, but within districts themselves. Funding, whether it be federal, state, or local, is in constant fluctuation and requires districts to keep up on funding availability status.

Federal grants, such as the recent COVID-19 relief efforts put out by the current administration, seek to provide much needed, but temporary alleviation of overall conditional needs.

In response to escalating construction costs, increasing restrictions on state funding for schools, and additional pressure to upgrade and proactively maintain school facilities, Orange County school districts have aggressively sought to pass local general obligation facility bonds, and have worked closely with residential developers to finance schools through developer fees and the establishment of **Community Facilities Districts** (CFDs)

From 1996 to 2006, California voters approved about $109 billion in school construction bonds at the state and local level. In 2016, voters approved **Proposition 51**, which authorized $9 billion in school and college construction bonds. In March 2020 voters rejected **Proposition 13**, which would have provided $15 billion in general obligation bonds for school and college facilities, including $9 billion for preschool and K-12 schools, $4 billion for universities, and $2 billion for community colleges. Proposition 13 is the first statewide education-related bond issue that voters rejected since 1994.

Additionally, in March 2020, seven Orange County K-12 School Districts and one Community College District were unable to pass their local bond measures that would have provided $2.6 billion for renovations and repair of aging facilities.

With voters last passing a State-funded construction bond in 2016, the State has run out of money. With no other State funds identified for the State Facility Program and federal funds not yet available for school facilities, local school districts in California must now cover essentially all costs of construction renovation and maintenance of their schools alone.

School districts typically spend money on their facilities from two separate budgets: the general district operating budget and the capital budget. Each has different funding streams. General operating funds largely come from local property tax and State transfers such as those through the **Local Control Funding Formula** (LCFF) Capital budgets are largely funded by a combination of local general obligation bonds, lease obligations, Community Facilities District bonds, statewide general obligation bonds, locally imposed development fees, and special taxes levied for Community Facilities Districts.

The conditional status of school facilities depends highly on the fiscal responsibilities of individual local districts. How do Orange County districts define equality of facilities? Some focus on

providing capital improvements district wide and spreading funding when available. Some bridge the gap by integrating technology into schools with variable vintages. One constant is there is no constant when it comes to conditional status.

Cost & Operation

In addition to constructing and reconstructing school infrastructure, Orange County school districts have an obligation to keep existing facilities in a state of good repair. Due to restrictions on the expenditure of certain state and local bond funds on maintenance activities, and the need to spend General Fund monies on instructional programs and with the state's poor economy negatively impacting schools, many districts have postponed maintenance and repairs, which has left some elements of infrastructure in an impaired state.

The School Districts estimate the value of deferred facilities maintenance at approximately $1 billion. School Districts expend on average over $50 million annually on facilities maintenance. School Districts have accessed developer fees, utility rebates and federal grants to supplement local dollars available for maintenance and repairs.

Funding is driving life cycle costs. High impact, low energy design decisions play a huge role in how districts can maintain their facilities. For example, California's recent drought restrictions has allowed districts to rethink their approach on maintaining their exterior grounds and water usage. Many districts have gone to xeriscape or low water planting to eliminate excess. The days of turf may be gone, other than for athletic purposes.

Capacity

The Orange County region has historically and looks to continue harvesting international talent and commercial endeavors, providing strong, long term foundational infrastructure for educational facilities moving forward. Although growth continues to happen, many school districts have or are nearing capacity, and have begun to focus on modernizations and/or new construction on existing properties in lieu of new school sites. Growth and demographic projections such as aging population also plays a large role in whether certain facilities are built, modernized, or renovated.

Each district is tasked with specific mixture of conditions. For example, Santa Ana is a fully built out district, and must manage and maintain mainly smaller, dense sites, with demographic needs shifting the priorities between existing facilities. Irvine is reaching the end of an era of expansion and is slowly making the shift toward modernizations in lieu of new construction. Heritage Park #3 K8 School, within the Great Park development, pictured above, is in fact the last new school to be built in Irvine for Irvine Unified School District under current projections.

Developer fees are focused on increasing capacity of a certain restricted area, thus inevitably creating a divergence of equality. One school within a district may receive funding for improvements, whilst others may be held to nearly 30-year-old facilities.

COVID-19 has played a large role in the fluctuation of enrollment throughout the county. Measures are in place to allow for hybrid on-campus / remote learning, but it is difficult to say whether this will remain a permanent option. Schools are continuing to be renovated based on pre

COVID-19 student count projection requirements, and no definite county or statewide measures have been taken to alter this model.

Resiliency & Sustainability

Every public school district that utilizes state funds for site improvement or construction is held to State building codes, overseen by the **Division of State Architect** (DSA). Structural integrity, Fire and Life Safety and Accessibility are the key elements DSA reviews and approves. **Further code compliance to Title 24 Energy Code** and **Cal Green**, the first-in-the-nation mandatory green building standards code, are setting the standard for creating efficient, low energy focused design and construction of schools. Recent focus for educational facilities has been the ability to provide clean, healthy spaces for learning and work. Initiated by the cultural shifts of COVID-19, many districts have initiated **Indoor Air Quality** (IAQ) upgrades via **HEPA 13 filtration**, a turn towards natural ventilation, and outdoor learning.

Funding plays a large role in providing resilient, sustainable educational infrastructure. The ability to select and construct school facilities with durable, weather resistant and natural materials sometimes are limited by funding.

The long-term consequences of the COVID-19 pandemic are yet to be determined. We face not only the direct impact associated with facility "health and safety" upgrades, the increased operating expenses associated with more frequent and extensive maintenance requirements, but an evolution in educational delivery seems to be increasingly inevitable. As a result, the future of our business and our supporting infrastructure needs are most certainly going to change in the coming months and years.

Innovation

Trends within California's energy codes are moving toward requirements for school districts that greatly reduce or eliminate the need for outside power supply. As laid out by the **California Public Utilities Commission in the California Energy Efficiency Strategic Plan**, we can anticipate as early as 2030 all commercial buildings, including educational facilities, are to be designed and built to **Net Zero Energy** (ZNE), and 50 percent of commercial buildings will be retrofit to ZNE. Because most Orange County districts are built out, the latter applies, districts have begun to plan for it, or have already implemented solutions.

Districts are pursuing multiple innovative strategies that bring us closer to Net Zero Energy. Many districts have recently installed Photovoltaic array systems to supplement their power usage and reduce dependance on power supply. **Power Purchasing Agreements** (PPA's) are another way districts' have provided renewable energy to benefit their school sites and their budget. Some Orange County districts have begun to implement the use of electric or natural gas power buses.

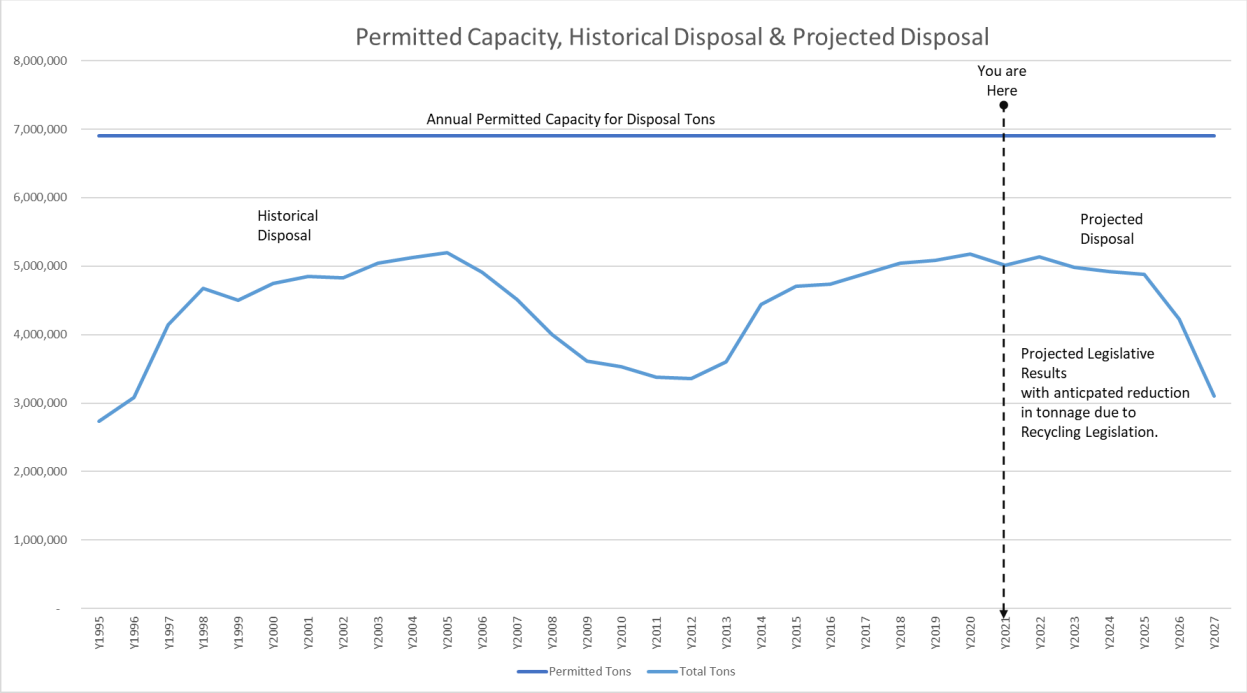
Due to Orange County's temperate climate conditions, the region is a prime location for novel high-performance, climate-based design for school districts, such as furthering reliance on natural ventilation and daylighting and addressing the growing need for flexibility of learning spaces, both indoor and outdoor.

Solid Waste and Recycling

Capacity

OC Waste & Recycling (OCWR) oversees the **Countywide Integrated Waste Management Plan** (CIWMP), and is comprised of a landfill system including three active sites, 20 closed sites and four **Household Hazardous Waste Centers**. OCWR currently receives and manages all the municipal solid waste generated by residents and businesses within the County. The landfill system has a combined permitted capacity of 22,500 tons of waste per day and currently receives approximately 16,500 tons of waste per day. The current waste stream volume is made up of 10,500 tons per day of in-county municipal solid waste and approximately 6,000 tons per day of importation. Combined, our three landfills provide another estimated 40 years plus of capacity.

As required by CalRecycle, we update the CIWMP every five years. The update includes review by an Ad Hoc committee from the **Waste Management Commission**. The CIWMP specifies capacity for future disposal. However, increased diversion is mandated by the State of California, through **CalRecycle**, to minimize reliance on disposal. CalRecycle is the state agency and regulatory body that grants permits and sets the standards for recycling and landfill diversion.



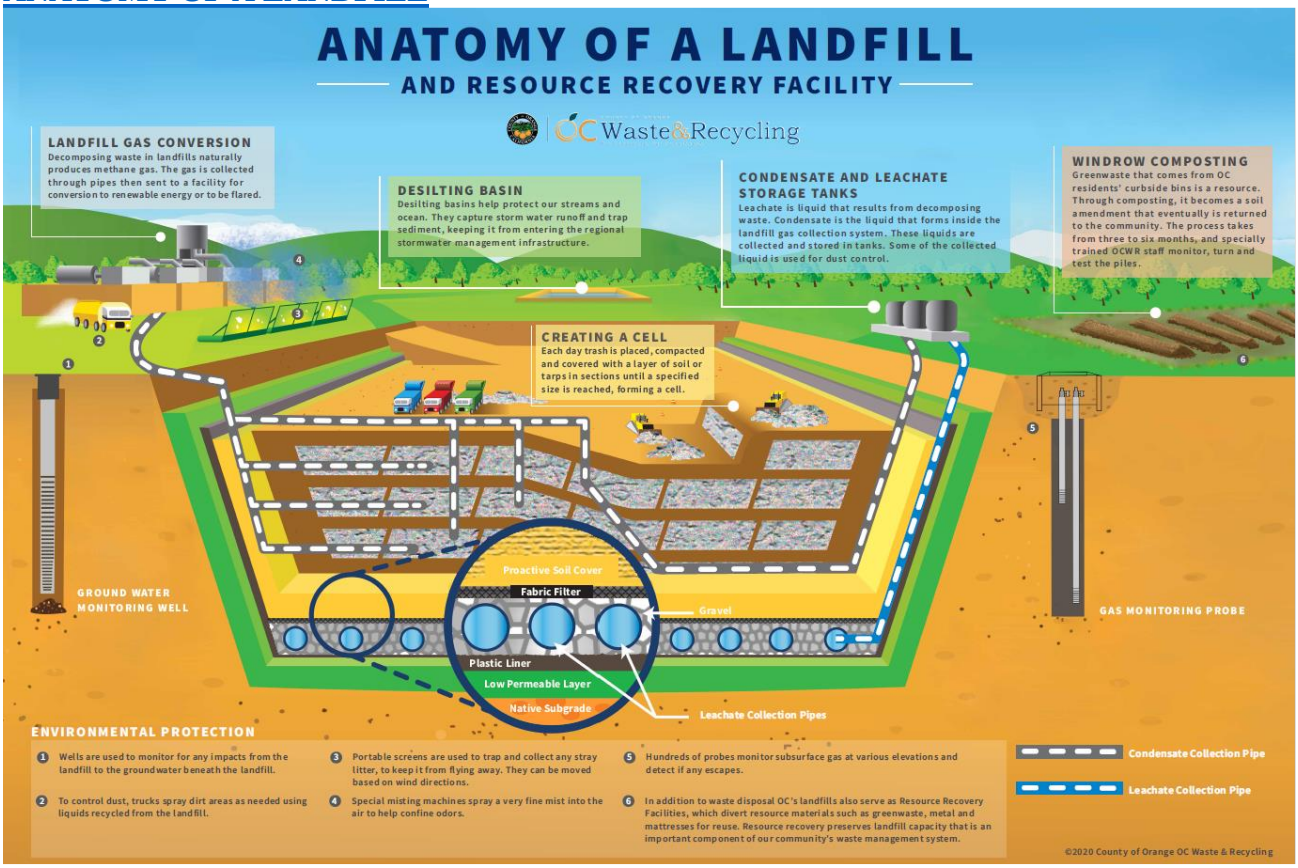
- *Annual Permitted Capacity is the maximum allowable amount of waste per year within the landfill system.*
- *Historical Disposal is the actual amount of disposal received for the year.*
- *Projected Disposal is the estimated tonnage to be received in the landfill system based on industry indicators such as, economic factors, recycling efforts and new recycling legislation impacts for increased landfill diversion.*
- *Historical Disposal has never reached permitted capacity due to diminishing waste generated, increased recycling, increase in regulated waste, change in waste stream due to economic impacts, and operational efficiencies.*

Condition

OCWR is **highly regulated** by local, state, and federal entities. We must comply with our permit requirements for tonnage, material acceptance, air and water quality, and operational practices. A team of industry professionals oversees the design, construction, and operations of the landfill system. The OCWR landfill system is a perpetual construction site, changing daily by building lifts – areas where waste is buried -- with municipal solid waste that arrives throughout the day. The daily lifts – the active fill areas -- are designed to create waste prisms or waste cells. The lifts are engineered to maintain the waste in place in perpetuity, meeting standards for such naturally occurring conditions as earthquakes, storm events, and flooding.

In addition, the requirements address ground water monitoring, stormwater management, leachate (liquid waste) management and the management of the natural byproduct of landfill gas. The leachate is collected and either re-used for dust control or sent to a sanitary sewer. OCWR maintains compliance by meeting the regulatory conditional standards and exceeds compliance that helps mitigate the impacts of landfills on the nearby residential communities.

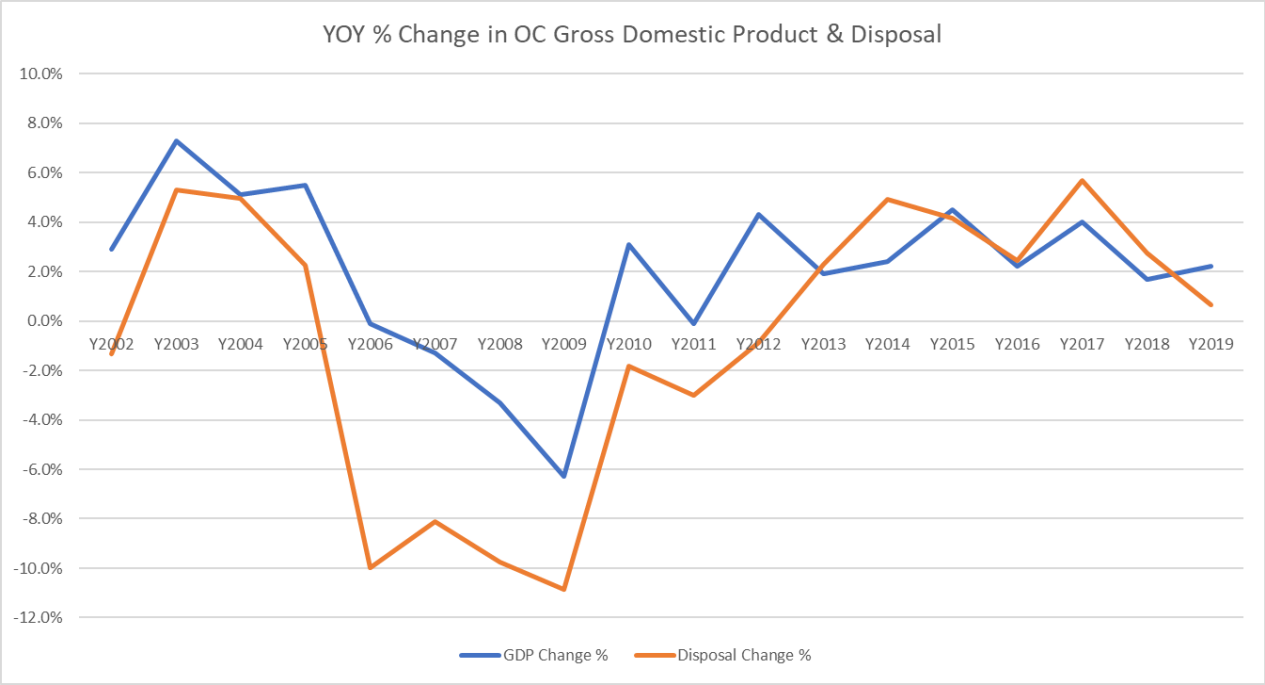
ANATOMY OF A LANDFILL



Funding

OCWR is an Enterprise Fund and not part of the County's General Fund. Revenue sources include **disposal fees** at the landfill, lease agreements, royalties, and other miscellaneous fees. The

disposal fees account for 95 percent of revenue generated. The enterprise fund is a "cost recovery" (versus profit) model. OCWR maintains extremely low disposal rates to benefit the residents and businesses of Orange County. The disposal fee is based on usage, which is based on weight. As waste enters one of the landfill sites, the vehicle is weighed and charged a fee based on the amount of waste brought in. OCWR's general funds cover the cost of operations during the active life cycle of the landfill. A restricted fund covers the series of operational actions required for closure and post closure maintenance once the sites reach full capacity. The restricted funding covers the cost of operations and maintenance of the closed site into perpetuity.



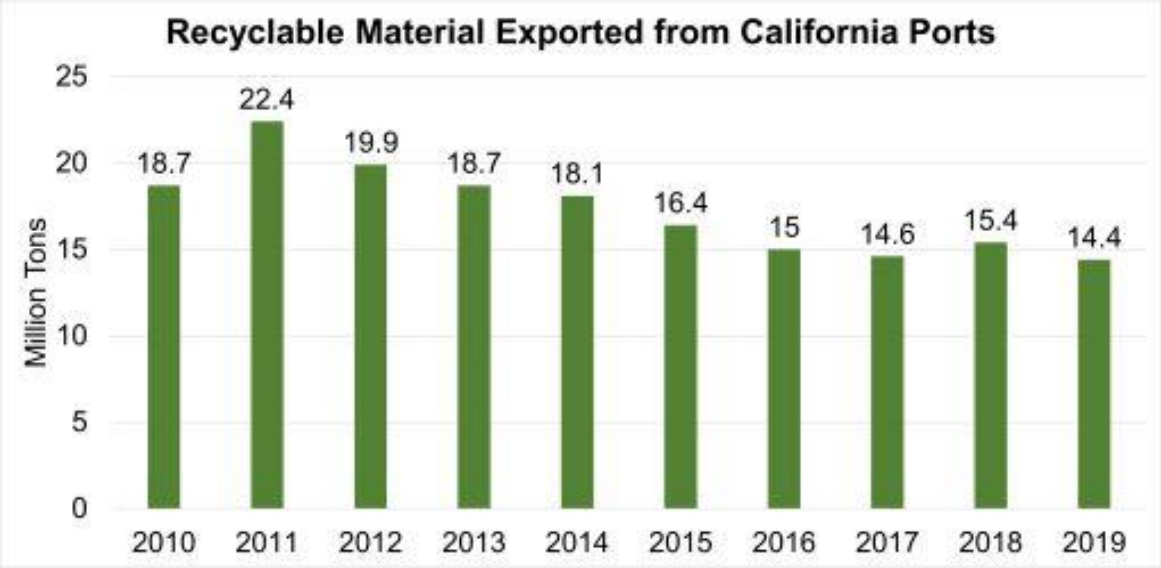
- *Relationship between Gross Domestic Product of Orange County and Disposal in percentage of change year-over-year. 18-year comparison.*
- *Impacts to the percentage of change in disposal related to goods and services in the chart, change may also be related to local recycling efforts and legislation.*

Future Need

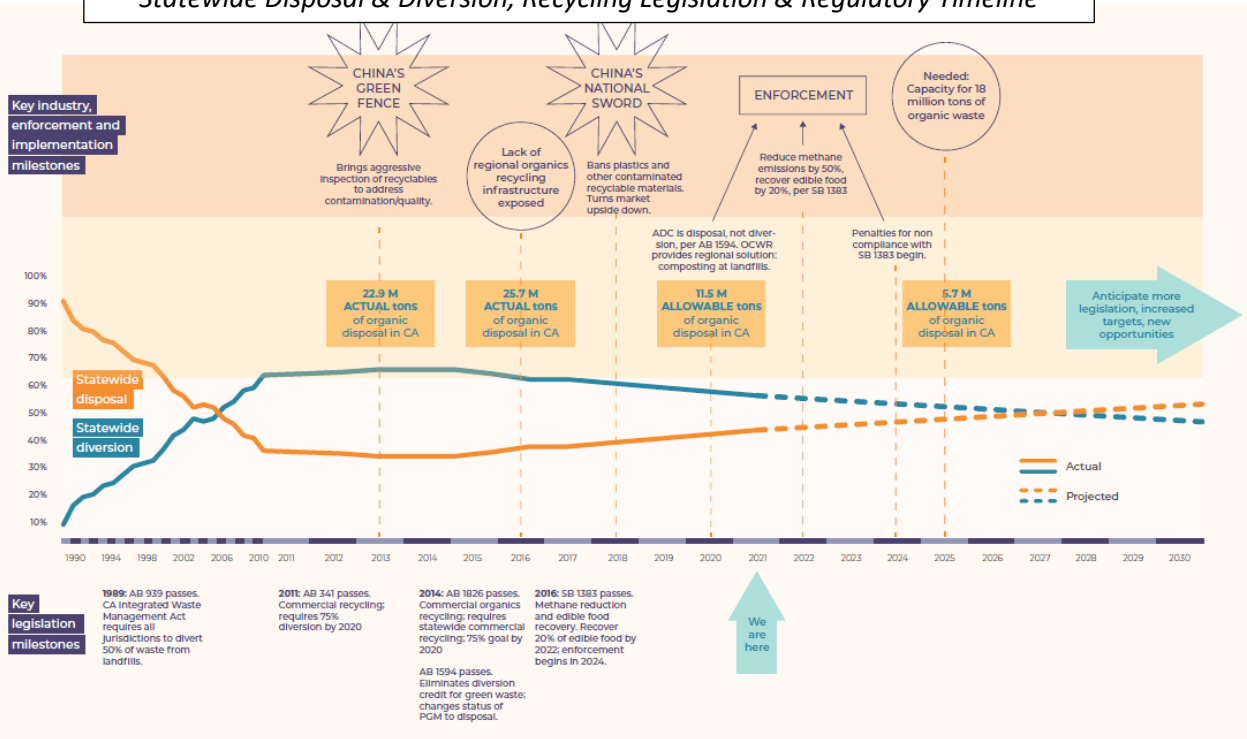
To further preserve natural resources, reduce greenhouse gas emission and prolong the life of landfills, CalRecycle continues to drive **new legislation** and implement mandates that require jurisdictions to divert more material from the landfill system. The **recycling industry and markets** are facing new challenges due to increased quality requirements under China's 2013 Green Fence Initiative and enforcement of China's 2017 **National Sword**. With the increasing demand for cleanliness and purity of recyclable materials, identified in the Green Fence Initiative, jurisdictions and haulers are challenged by these standards as well as the changing markets and lack of recycling infrastructure.

Critical needs include: education, training and outreach to residents and businesses; **increased domestic recycling infrastructure**; and, where possible, local recycling infrastructure and market development. A greater emphasis on domestic recycling infrastructure has risen as foreign recycling infrastructure is currently at a standstill and shows no signs of recovery anytime soon.

Graph form CalRecycle: **Recycling in California**



Statewide Disposal & Diversion, Recycling Legislation & Regulatory Timeline



- *Multiple layers of information: Statewide Disposal & Diversion; recycling market impacts from China Green Fence & National Sword; Recycling Legislation both current and new diversion rates from the landfills statewide. Statewide disposal and recycling projections based on trending data.*
- *Timeline demonstrates the need for additional recycling capacity due to regulatory requirements and highlights lack of sufficient recycling infrastructure for tonnage from landfills.*

Operations and Maintenance

The **landfill life cycle** requires operations and maintenance into perpetuity, involving detailed planning, regulatory approval, engineering, and design. As active sites, each OCWR landfill builds lifts toward estimated dates that each will reach its capacity/allowed elevation, identified in its **Solid Waste Facilities Permit** (SWFP). The closure date estimate is based on the amount of permitted tonnage. As a result of declining tonnage in recent years, those estimated dates are revised into the future. The operations and maintenance continue until final capacity and elevation is met, then closure activities begin. In the post-closure phase, activities such as groundwater and stormwater management, gas collection and air quality monitoring continue, as does reporting to regulators on all such environmental components.

Safety

In 2019 the U.S. Department of Labor's Bureau of Labor **statistics** listed the waste and recycling industry amongst the top-10 highest-hazard industries. The **Solid Waste Association of North America** (SWANA) is the leading association in the waste and recycling industry. SWANA has recognized OCWR for our efforts in landfilling and **safety**. OCWR's core cultural value is the protection of public health and the environment. This starts with the safety of our employees but also the contractors and customers who frequent the landfill system. Our core business is protecting public health and safety by managing waste responsibly to steward air and water quality.

The landfill system operates at full compliance and uses above-industry standards. This is demonstrated in our employee safety culture and compliance-plus efforts at each landfill site. OCWR provides ongoing training for employees on safety, compliance and policy adherence and utilizes an award-winning online system to track training completion. We perform routine and random inspections, which both verify compliance and spotlight new opportunities to increase safety. OCWR requires all contractors, customers, and visitors to follow safety procedures while on the property.

Resilience

Orange County's current waste and recycling infrastructure provides an excellent level of resilience based on the number of private waste haulers, local Material Recovery Facilities (MRFs), and a stable landfill system. The resilience of the infrastructure was tested by the impacts of the COVID-19 pandemic and major damage caused by the Silverado Fire. The **MRF's had to temporarily close** due to COVID-19, as the workforce was minimized. Closed MRFs resulted in an increase of recyclable materials coming to the landfill. The **Silverado Fire** caused a temporary closure of one landfill, however the other two sites were able to accommodate the additional waste. In both cases, OCWR received regulatory approval to operate beyond the permitted capacity to handle the additional waste during the state of emergency. OCWR has proven its capacity to recover quickly from difficulties, and to spring back into shape. OCWR has demonstrated its ability to overcome such challenges from natural disasters, regulatory changes, loss of volume and even a pandemic.

Innovation

OCWR's history of **innovation** reflects broad, forward thinking. The implementation in 1990 of a liner system set new design standards in the landfilling sector. Our partnerships with private energy firms to repurpose landfill gas – a byproduct of waste – continue to provide opportunities for innovation. Each site manages the landfill gas and converts a portion to energy through multiple energy partner contracts.

The need for continuous innovation has never been greater when it comes to the waste and recycling industry to further the recycling infrastructure. OCWR developed a regional response to industry-transforming organic waste management legislation, for which an infrastructure was virtually nonexistent. Starting from scratch, within two years launched pilot composting projects at each landfill site. Currently one is a fully operational, commercial composting facility, and the other two will be operational by 2022. Our compost operation uses preprocessed green waste from the residential waste stream.

The finished product creates a **soil amendment and mulch** to be used locally. Siting the composting operations onsite at the landfills contributes to the shortage of organic processing facilities within the County. Plans are also underway to incorporate food waste recovery into the compost operations.

Composting is one element of a business model pivot OCWR **launched in 2019**. For decades OCWR provided the singular, essential public service of waste disposal. The pivot moves OCWR from landfilling alone to resource recovery. In 2020, OCWR launched mattress and scrap metal recovery programs systemwide. Both programs are in their early infancy but are already making a difference. Based on visual observation of the waste stream and initial salvaging efforts, there is tremendous potential to further recover these items from incoming loads. As these efforts continue, OCWR will be identifying the resources needed to capitalize on these opportunities.

Surface Water Quality

Surface Water Quality Setting

Orange County is known for great weather, safe communities, beautiful parks, open spaces, and plentiful beaches along the coastline. But what if residents and visitors were restricted from enjoying the ocean or recreating in its bays and along its creeks and streams? We may face restrictions in the future if surface water quality is not properly managed.

In Orange County, the quality of stormwater runoff is regulated through the implementation of programs and activities required by a series of permits and regulations. The purpose of these regulations is to protect local receiving water beneficial uses from the impacts of urbanization. A direct correlation exists between continued urbanization and an increased need to protect surface water quality, which helps safeguard the receiving waters' beneficial uses (e.g., swimming, surfing, and fishing). Managing urban runoff presents an ongoing challenge due to its broad nature and potential to degrade receiving waterbody quality. Degradation of our creeks, streams, lakes, and ultimately the ocean can occur from pollutants such as metals, nutrients, bacteria, pesticides, oil and grease, trash, and sediment; all of which are carried into our waterways via stormwater runoff and non-stormwater runoff such as overwatering of lawns.

The following regulations drive the development of surface water quality programs and are issued by state and local regulatory agencies:

- **Santa Ana National Pollutant Discharge Elimination System (NPDES) Permit,**
- **San Diego NPDES Permit,**
- **Phase II Small Municipal Separate Storm Sewer System Permit,**
- **Construction General Permit,**
- **Industrial General Permit, and**
- **Statewide Trash Provisions**

The Orange County Watersheds Program (OC Watersheds) leads implementation of the Santa Ana and San Diego NPDES Permit requirements for the Orange County Public Works Department and municipal permittees within Orange County.

Capacity

The transformation of undeveloped open space into residential, commercial, and industrial areas connected by transportation corridors and supported by utilities is the basis of land development and urbanization. Unfortunately, actions to address the impacts of development on receiving waters were not taken until the past few decades and the necessary space to mitigate these issues was not anticipated in the planning efforts throughout Orange County. As a result, Orange County was largely developed with limited provisions to set aside adequate space to address water quality issues.

Orange County has experienced consistent population growth (**5.5 percent from 2010 to 2020**). As a result of the direct correlation that exists between continued urbanization and an increased need to protect surface water quality, local municipalities have been challenged to find new ways

to treat, store, infiltrate, and/or divert stormwater runoff through enhancements to an existing stormwater conveyance system.

Water quality issues exist during both dry weather and wet weather. Dry weather water quality issues can occur because of overwatering landscaping or rising groundwater due to leaking water pipes, among many other sources. Progress has been made through municipalities working in partnership with local Water and Sanitation Agencies (Orange County Sanitation District, Moulton Niguel Water District, South Coast Water District, South Orange County Wastewater Authority) on their Water Conservation and **Dry Weather Urban Runoff Diversion Programs**; as well as other programs in the county. Recent examples include the **Santa Ana Delhi Channel Diversion Pipeline Project** (estimated capital cost of $1.7 million) and the Smart Watershed Network Project (estimated cost of $412,000). However, more efforts like this are needed throughout Orange County to address water quality issues more effectively.

Managing water quality during wet weather presents a different challenge because of the large volume of water that must be addressed. Although runoff from an entire storm often does not need to be treated, the necessary wet weather treatment capacity to consistently meet the water quality targets does not currently exist.

To meet this demand, municipalities need increased funding and additional or re-purposed space. Thus, it is imperative for regulated communities to continue fostering collaboration to identify, fund, design, and construct multi-benefit water quality projects. Multi-benefit projects stretch available funding and can address both dry and wet weather conditions, along with other needs.

Condition

According to **Heal the Bay's 2019-2020 Beach Report Card**, 20 Orange County beaches were highlighted in the program's *Honor Roll*, out of 42 statewide. The *Honor Roll* beaches were monitored daily and met the specific program requirements during the summer (dry), winter (dry), and wet-weather seasons. Unfortunately, two (2) of the ten (10) California beaches on the *Bummer* list were also in Orange County.

Dry weather conditions during both the summer and winter were very good across Orange County, which indicates the success of dry weather diversion systems. However, 37% of Orange County beaches received a low rating during wet weather due to bacteria exceedances. Other pollutants were not analyzed, although they too impact surface water quality.

Beyond the beaches, water quality conditions in our creeks, streams, and bays have started to improve due to the implementation of stormwater programs (source control, treatment devices, etc.) across Orange County, however additional effort is necessary. Municipalities have made progress as several water bodies from the 2012 list of impaired waters are **no longer impaired** (as seen in red within Figure 1 below). However, many of those impaired waters identified in 2012 remain today and additional waterways were added to the list by regulators during the 2014/2016 update.

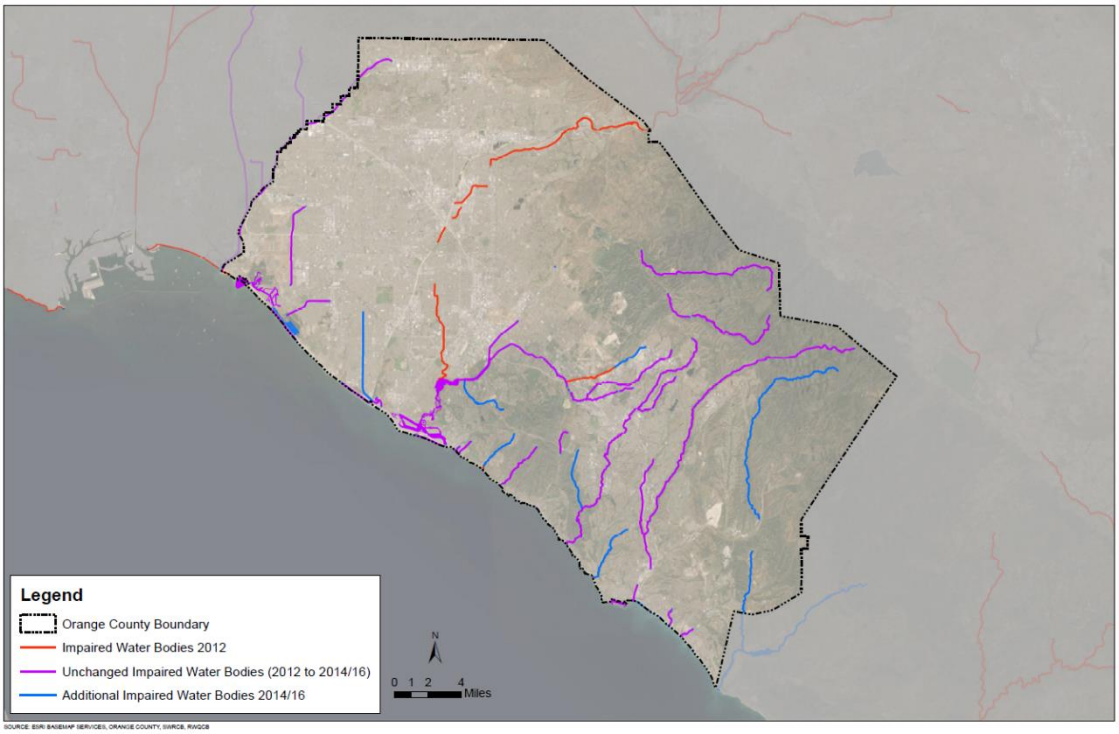


Figure 1: Impaired Water Bodies in Orange County

Funding

Unlike potable water and sanitary sewer utilities, stormwater treatment and conveyance must compete for general fund dollars to complete projects and implement programs. Orange County has an approved budget of **$7.54 billion** for fiscal year (FY) 2020-2021, of which an estimated $17.95 million (0.23%) is for the OC Watersheds. Since FY 2015-2016, expenditures for the Orange County NPDES program have been approximately **$6 million** annually (on average) per the shared cost budget, which supports County-wide common programmatic efforts such as public education, surface water quality monitoring and reporting, and watershed studies and planning efforts. These budgets do not reflect the additional funds spent by individual cities on infrastructure projects to improve water quality or city-specific program efforts.

Consequently, there has been an increasing use of grant programs that encourage collaboration amongst various jurisdictions through integrated regional water management programs. This effort enables an effective use of available funding, while also improving surface water quality, water supply, flood risk, and habitat throughout Orange County.

Preliminary watershed studies in 2015 indicated that it could cost dischargers **up to $2.1 billion** to meet future stormwater quality objectives for bacteria and zinc just for south Orange County. Therefore, generating new funding sources to meet future capital, operations, and maintenance funding needs should simultaneously occur at the local, state, and federal level.

Voters have approved statewide programs that provide grant funding to projects that would improve water quality. Most grants require the development of projects that result in multi-benefit solutions, addressing not only water quality, but flood control, water supply, community

development, and habitat improvement at the same time. Planning for multi-benefit projects requires a collaborative approach to developing infrastructure that not only qualifies for grants, but efficiently leverages limited resources across Orange County.

At a local level, voters will need to consider funding these programs through fees or taxes, as they have with other infrastructure needs in the past. For example, voters in Los Angeles County approved Measure W, the Safe Clean Water Program. The revenue from the parcel tax, estimated at $275 million dollars a year, will increase local water supply, improve water quality, and help make communities greener.

Future Need

Investment in water quality programs is expected to increase due to more rigorous regulations and the need to meet compliance schedules. Urbanization, along with the development of stringent provisions that establish surface water quality objectives for various pollutants, requires coordination among all regulating agencies and dischargers. Prioritizing the improvement of stormwater runoff through multi-benefit projects and source controls (i.e., stopping pollutant generation before it happens) is essential.

Fortunately, these infrastructure investments will help improve water quality and the resiliency of conveyance systems, encourage economic growth, and support the creation of new local jobs for both construction and the long-term development of a work force to operate and maintain these facilities.

Public education about this issue is also part of the solution. True source control is the most cost-effective strategy to address water quality challenges. This includes education on proper use of chemicals (e.g., fertilizers and pesticides), sources of heavy metals (e.g., tires and brake pads), and eliminating dry weather runoff. If potential pollutants are not controlled at the source, then increased funding to manage pollutants downstream will be required. Educating residents and local leaders on the need for increased funding is also necessary to address pollution issues.

Operation and Maintenance

The ongoing effectiveness of stormwater controls is heavily dependent upon regular operation and maintenance (O&M). **Up to 20% of a project's capital cost** can be associated with the annual O&M of its stormwater treatment devices. Most of these treatment facilities, known as Best Management Practices (BMPs), are located on individual parcels, and distributed across Orange County with the owner responsible for O&M. Managing O&M in this manner is inefficient and makes confirming effective operation of the BMPs a challenge.

A shift toward regional stormwater facilities operated by municipalities and paid for by contributing stakeholders is a solution that may, in some circumstances, lower O&M costs. Centralized systems may also **decrease pollutant removal efficiency** when compared to a distributed system and proper optimization of **pollutant removal in a given watershed requires case-by-case analysis.** The restructuring of O&M activities would help reduce O&M costs due to economies of scale and would also help ensure O&M takes place at the required frequencies and by qualified personnel. This approach will require improved funding mechanisms for O&M.

Budget cuts will continue to challenge local municipalities in their ability to maintain infrastructure as funding drives development, NPDES permit compliance and overall infrastructure improvements. Therefore, increased investment over the coming years will be critical to ensure treatment devices are maintained for longevity and effectiveness.

Public Safety

Water quality is a direct public safety issue. Not only do pollutants impact the plants and animals in our receiving waterbodies, but also the Orange County residents who rely on them for recreation. Beach closures are the clearest manifestation of this, but public safety may also be at risk with the consumption of fish or wildlife from our bays, piers, and estuaries. If not properly managed, pollutants can impact ecosystem vitality, cause negative impacts on public health, and ultimately hurt economic well-being.

Resilience

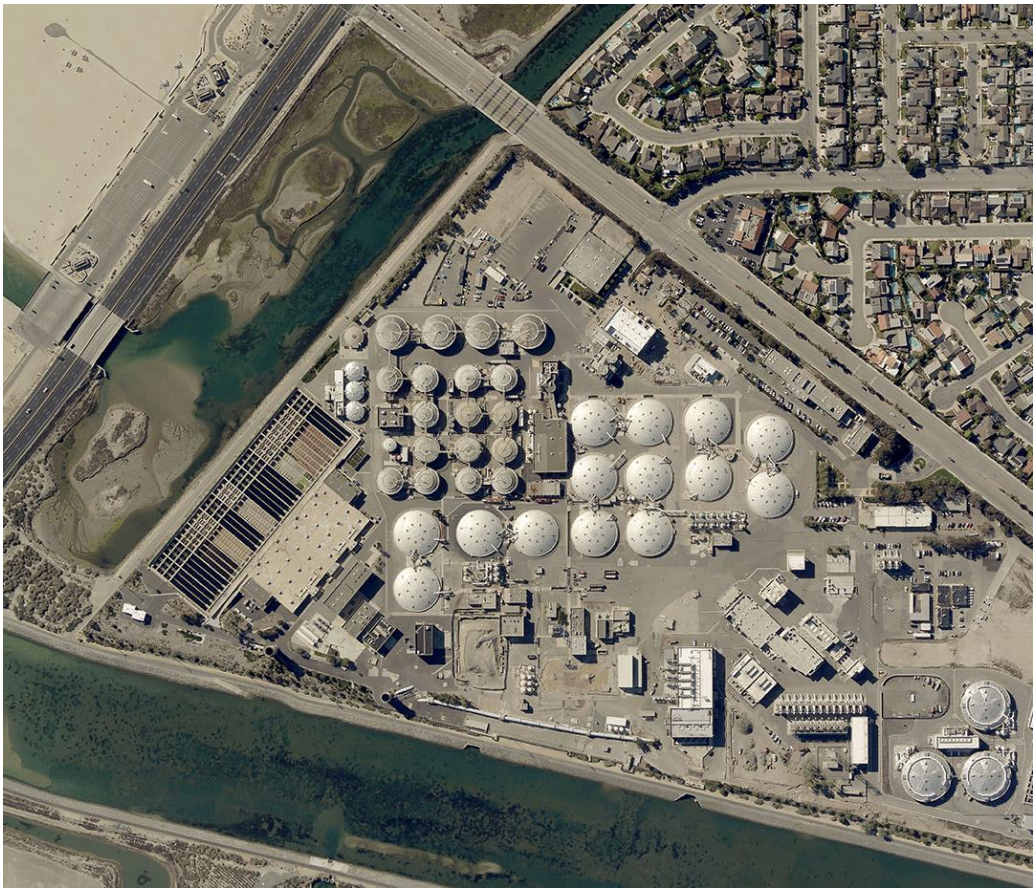
Investment in green infrastructure, low impact development and multi-benefit solutions can help with resilience in a changing climate. Projects that improve water quality might also retain or use runoff, which could help increase water supply, introduce improved habitat that could reduce secondary development effects and bring back native species, or provide storage to extend the life of a now undersized storm drain system. Targeted investment like this will create redundancies in our stormwater systems and help make them more resilient. Fortunately, a transition to this approach is underway and is occurring every day. Accelerating this transition will improve local communities and may increase local sources of clean water.

Innovation

Managing water quality in Orange County will continue to stretch available resources. Consequently, there is a great demand for innovative and cost-efficient treatment solutions. As such, improving Orange County's ability to treat and convey stormwater through investment in research and development, as well as the development of multi-benefit systems, should be of utmost importance to communities and policy makers. As innovative, regional facilities become more common, it may open the door for additional alternative compliance opportunities, such as **water quality trading**, fee-in-lieu programs, stormwater banking, and public private partnerships. These programs are geared towards providing local municipalities a funding source to implement multi-benefit projects.

Imported drinking water is a part of the water portfolio for most cities. Investing in stormwater infrastructure that facilitates the harvest and use of stormwater simultaneously augments the region's water supply and improves water quality. Opportunities for this may exist at a regional and local level. Innovative thinking is also needed regarding how to provide funding for these projects.

Wastewater



OC San Plant No. 2, Huntington Beach, CA

Orange County's (OC) wastewater system comprises thirty-five (35) special districts and cities. **Orange County Sanitation District** (OC San) provides regional wastewater collections, treatment, reuse, and disposal services to central and northwest OC with twenty-one (21) cities, three (3) special districts, and portions of the unincorporated areas of OC. These central and northwest OC cities and special districts provide local wastewater collection services that connect to OC San's facilities.

In south OC, individual cities and special districts provide wastewater collection, treatment, reuse, and disposal through a combination of their own or jointly owned facilities. These cities and special districts are: **El Toro Water District** (ETWD), **Emerald Bay Service District** (EBSD), **Irvine Ranch Water District** (IRWD), **City of Laguna Beach** (CLB), **Moulton Niguel Water District** (MNWD), **City of San Clemente** (CSC), **City of San Juan Capistrano** (CSJC), **Santa Margarita Water District** (SMWD), **South Coast Water District** (SCWD), **South Orange County Wastewater Authority** (SOCWA), and **Trabuco Canyon Water District** (TCWD).

Capacity

There are approximately two-hundred twenty (220) wastewater pump stations and fifteen (15) wastewater treatment and reclamation facilities with total secondary treatment capacity of more than 750 million gallons per day (MGD) in OC. Average daily flows are approximately 230 MGD, with most flows (189 MGD) being conveyed to OC San's facilities. OC wastewater agencies also operate a total of four (4) ocean outfall facilities with total capacity of approximately 745 MGD.

The vast majority of the OC collection systems do not have capacity deficiencies and are not at risk for **sanitary sewer overflows** (SSOs). Despite experiencing more heavily concentrated rain events in recent years, facilities and procedures have been implemented to handle higher peak flows (i.e., flow equalization, flow diversion). Areas with identified capacity deficiencies have future projects to eliminate collection system capacity issues. There are no treatment or outfall capacity issues for any OC wastewater agencies.

Condition

Generally, OC wastewater treatment plants are in good condition and have had ongoing rehabilitation and upgrades to meet stringent State and Federal regulations on effluent water quality and discharge. Most OC wastewater agencies employ dedicated asset management efforts which have helped to extend the useful life of sewers, pumping stations, treatment plants and reduce hours of reactive maintenance (i.e., equipment breakdown, emergency work) over the last five years.

The physical condition of the oldest civil infrastructure in sewer facilities continue to be an area of concern, but system conditions have generally been improving over the last five years through rehabilitation and replacement programs. Many sanitary sewers built in the late 1940s and 1950s have reached their original design life. As their condition deteriorates, these older sewers are more prone to root intrusion, offset joints, debris, and grease build-up, and site-specific failures that can result in sewer spills.

Funding

Although most OC wastewater agency capital outlays are expected to increase over the next several years, current revenues and funding are adequate to support planned expenditures. Funding to design, build, operate, maintain, rehabilitate, and replace the facilities comes primarily from local user fees. All OC wastewater agencies have authority to enact and collect user fees. Most OC wastewater agencies also receive a share of property tax revenue.

When typical revenue sources are inadequate, major capital projects can be funded in a variety of ways. Agencies can issue certificates of participation, or repayment obligations based on a lease or installment sale agreement. However, alternative funding is sometimes needed for the implementation of newer technology and innovative projects. There are state and federal grant low-interest loan programs to help fund major capital projects, especially projects that increase water and energy efficiency. Additionally, increased capacity required for land development is funded by new development bonds.

Future Need

Future needs in the county vary based on geographical area. Areas in south OC are experiencing new development in undeveloped areas, and north and central OC are experiencing redevelopment such as higher density housing or infill projects. In new development areas, new facilities are required to convey and treat wastewater whereas long built-out areas have more project needs based on local wet weather capacity rather than growth. Low flow plumbing has resulted in reduced wastewater generation per capita in all areas.

Reduced wastewater flowrates may result in pipeline and pump station surplus capacity sufficient to serve additional flows from higher density housing redevelopment. Areas without significant industrial flows have been experiencing higher strength wastewater due to lower per capita wastewater flowrates, in most cases still requiring full existing treatment capacity.

Rehabilitation and replacement of facilities is an ongoing and future need. Throughout the county, projects are planned for lift station pump rebuilding and replacements, manhole coating, sewer system repairs, treatment plant repair and maintenance including coating and equipment rehabilitation or replacement. Some projects are technology driven, where equipment replacement is justified by cost savings from energy savings or automation resulting in reduced labor costs.

Increased regulatory requirements, in particular the removal of nutrients (nitrogen and phosphorus) will require upgrades to water reclamation plants. These upgrades will require significant capital expenditures and space for new processes at treatment plants in the future.

Operation and Maintenance

Several factors can have an impact on system operations and maintenance. The use of products advertised as **flushable wipes** continues to be a significant cause of increased operation and maintenance labor and expense. Flushable wipes have caused blockages and damage to pumps in lift stations and in equipment throughout the treatment plants. Agencies are implementing costly capital projects to increase screening of wastewater coming into the collections and treatment facilities to prevent clogging of equipment and other operational issues.

Wastewater flows have decreased because of low flow plumbing fixtures and other water use efficiency efforts. Drought conditions also result in lower wastewater flows as residents reduce water usage which, in turn, reduces wastewater flows. In the sewer system, lower flows result in lower velocity and therefore require more cleaning to prevent settled solids from causing blockages or odors. In areas without significant industrial flows, lower wastewater flows have resulted in higher wastewater strength which has impacted treatment facilities.

Wastewater treatment is a biological process with demand for oxygenation, and physical processes and chemical usage relate to the solid's concentration of the wastewater. While wastewater flows may decrease, the treatment demands remain the same or may become more difficult to control. Potential regulations for more nutrient removal will result in higher operation and maintenance costs.

With lower flows and higher concentrated wastewater, collections infrastructure is more susceptible to an advanced rate of corrosion. Most OC wastewater agencies have employed various

odor control technologies to minimize nuisance odors as well as protect assets from higher corrosion rates. In most areas of OC, odor complaints have been reduced significantly in recent years and response time to odor complaints has also been improved.

Public Safety

OC wastewater agencies have always practiced preventive maintenance to reduce the need for reactive repairs and the frequency of responding to "hot spots", or sections of the sewer collections network which require additional attention. Pipeline closed circuit television (CCTV), manhole CCTV, and in some cases remote monitoring equipment installed on manholes are being used systematically to monitor the condition of sewer collection networks and need for maintenance, repairs, rehabilitation, or capital improvements. The ability to accommodate treatment capacity demands, the established preventive maintenance schedules, CCTV inspections, and continued odor control provide an increased public safety margin for minimizing wastewater spills which have an impact on public health.

Additional public safety measures include security at outlying facilities such as pump stations where cyber locks and CCTV cameras have been installed for surveillance. IT departments are also investing resources into protecting their internal files and servers from any outside attempts to disrupt operations.

Resilience

Resiliency measures are in place in OC wastewater systems through contingency planning, system redundancy, and other factors which provide options to wastewater agencies during potentially catastrophic events. These types of events primarily include earthquakes, significant rainstorms, and wildfires. In the last five years there have been several earthquakes in OC, though none significant enough to affect any wastewater facilities. Seismic evaluations have been performed in recent years to study risks associated with active faults, liquefaction, and lateral sliding to other structures and buildings.

In January 2017, the region experienced a strong rainstorm which pushed many wastewater treatment plants close to capacity limits, but ultimately no incidents of significance were reported. In most rainfall events, OC wastewater agencies can utilize diversion structures to redirect flows and store peak flows prior to treatment. Wildfires can have an indirect effect on wastewater facilities due to emergency power utility shutdowns; however, wastewater facilities that require power tend to be equipped with backup generation systems on-site or generator connections.

At several OC wastewater treatment facilities, gaseous byproducts from the digester process are used as fuel for resilient power generation as well as battery storage systems to reduce peak grid demands. To evaluate long term environmental impacts, some OC wastewater agencies have completed climate resiliency studies evaluating risks associated with various hazards such as wildfires, flooding, extreme temperatures, sea level rise, and tsunamis.

Resilience also calls for contingency planning for equipment failure and other condition-related issues. For example, field crews have established plans to bypass pump stations in the event those pump stations cannot be operated normally due to problems with sewer force mains. These plans

include live drills where crews perform a full bypass of the pump station as practice to be familiar with the needed resources and time.

Innovation

On a limited basis, OC wastewater agencies are installing polymer concrete manholes to eliminate frequent maintenance due to concrete corrosion. OC wastewater agencies are also using locking composite manhole frames and covers in some locations, because of resistance to corrosion, worker safety (lighter lifting), and locking resistance to vandalism.

At specific agencies, OC San has been using centrifuges to thicken sludge and increase digester efficiency as well using food waste and thermophilic digestion to expand methane gas generation. SOCWA has also improved digester gas production through biocatalyst addition and is also studying new technologies for biosolids disposal. SMWD is considering using pasteurization for disinfection, granular sludge for secondary treatment, high combustion temperature thermal sludge processing, and use of battery storage in conjunction with solar panel installations at remote facilities.

Some OC wastewater agencies are using Design-Build for project delivery where appropriate and favorable. Traditional Design-Bid-Build continues to be the dominant project delivery method.

Water Supply

OCWD Reverse Osmosis Array, Fountain Valley, CA

Orange County's (OC) system of water providers comprises thirty-two (32) special districts and cities. For access to imported water from the **State Water Project** (SWP) there are three (3) OC cities – the **City of Anaheim**, **City of Fullerton**, and **City of Santa Ana** – and the **Municipal Water District of Orange County** (MWDOC) are member agencies of **Metropolitan Water District of Southern California** (MWD) and receive water from the SWP and Colorado River Aqueduct in varying quantities. The other twenty-eight (28) special districts and cities in OC are members of MWDOC and are represented by MWDOC at MWD. Additionally, the **Orange County Water District** (OCWD) manages the OC groundwater basin which is under the majority of northern and central county and provides water to several cities in its service area.

Capacity

Approximately two-thirds of OC water supplies are from local sources (i.e., groundwater basin, recycled water, and surface water), with the balance of supplies imported from two main sources previously referenced: (1) the Sacramento and San Joaquin Rivers through the **State Water Project**, and (2) the Colorado River via the **Colorado River Aqueduct**. Water supply sources for areas within OC differ. North and central OC satisfy 75 percent of the water demands from the basin and can also replenish the basin with local and imported water sources, while the majority (~75 percent or higher depending on conditions) of south OC water supplies are imported from the MWD sources (due to a lack of available groundwater).

Current water supplies meet average condition demands, but water supply sources have been stressed during drought years. The **Colorado River Basin** has been in a drought since 2000 and climate change continues to reduce snowpack volume. While MWD storage is generally in good shape state-wide, local storage is limited mainly by a lack of available locations for large-scale storage facilities and the sustainable rate of withdrawing groundwater supply.

Conservation continues to play a significant role in reducing OC water demands. In 2015, 125 gallons per capita per day (GPCD) in total potable water usage was achieved by the Orange County 20x2020 Regional Alliance of water agencies due in large part to drought conservation efforts. In south OC, agencies and cities have invested significantly in the conversion of outdoor and other potable water use to recycled water use and as a result have successfully reduced regional reliance on imported water supplies. In 2020, OC water demands have fallen even further to 109 GPCD.

Condition

The water supply infrastructure (pipelines, reservoirs, pumping stations, etc.) in OC is in generally good and reliable condition. For example, the number and frequency of leaks continue to be lower than industry averages. Several rehabilitation projects for the imported water system have been completed within the past 5 years and system reliability has improved.

OC water agencies have made significant investments in their distribution systems as well, with several capital improvements and rehabilitation projects completed over the last 5 years. These projects have helped to maintain the overall condition of aging city and agency water systems. Each year more infrastructure approaches its original design life, causing rehabilitation needs to generally increase. OC water agencies continue to undergo robust planning and infrastructure replacement efforts to maintain and improve system conditions. Rehabilitation programs have been successful in utilizing available trenchless technologies such as cured-in-place pipe to extend the useful life of pipelines, reduce public impacts, and lower construction costs.

The **Mesa Water District** (Mesa Water®) Pipeline Integrity Program (PiP) successfully addresses the industry-wide issue of renewing and replacing water system pipes in an economical, effective, and timely manner. Through this award-winning, innovative program, Mesa Water uses a condition-based approach to determine a pipe's useful life by conducting non-destructive and destructive testing. Through PiP testing data, Mesa Water has demonstrated that its pipelines' remaining useful life is estimated to be 142 years, which is saving the district and its ratepayers an estimated $230 million dollars over a 30-year timeframe.

Funding

Current revenues and funding are adequate to support planned expenditures for OC water systems. However, imported water rates are currently under review and subject to increase due to recent revenue shortfalls. Funding to design, build, operate, maintain, rehabilitate, and replace facilities comes primarily from local user rates and charges. All OC water agencies have authority to enact and collect rates and user fees. Most OC water agencies also receive a share of property tax revenue.

When typical revenue sources are inadequate major capital projects can be funded in a variety of ways. Some OC water agencies may issue certificates of participation, or repayment obligations

based on a lease or installment sale agreement. However, alternative funding is sometimes needed for the implementation of newer technology and innovative projects. 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. A combination of local revenues and State bonds are expected to be adequate to support OC's planned water system improvements for the next 5 years.

Future Need

North OC is largely developed with only a few areas with available land for further development. However, redeveloping single family neighborhoods and/or industrial land uses to multi-family dwelling units provides space for further population growth. In south OC, major developments are under construction, and more are planned soon. These trends have resulted in the continuous regional population growth of approximately 5 percent over the past 10 years with current projections suggesting similar growth continuing for the next 5 to 10 years. Future per capita water demands are forecasted to be flat or slightly declining given continued conservation efforts and new development requirements.

For many years, **Orange County Water Agencies** have been investing in securing additional water supplies locally to decrease dependence on imported water. Developing additional local water supply sources will remain a focus of OC water agencies over the next 5 years to address future droughts, climate change, and other factors influencing future water supply shortages. Several local water supply projects under consideration in and near OC will increase local potable and recycled water supplies.

Implementing comprehensive asset management programs that include condition assessment of existing infrastructure and prioritization of their rehabilitation and/or replacement remains a priority for OC water agencies over the next 5 years. Most agencies have an annual pipeline replacement program and a list of other infrastructure that need to be replaced or rehabilitated. This kind of system maintenance will continue for years to come.

Operation and Maintenance

One challenge facing water providers with groundwater supplies is the presence and regulation of per- and polyfluoroalkyl substances (**PFAS**) in the groundwater. PFAS are a group of manufactured chemicals found in numerous products, such as non-stick coatings and fire-fighting foams. They are especially resistant to degradation in the environment and have been accumulating in various groundwater basins across the US since the 1940s. There is some evidence of health risks with long term exposure and significant accumulation in the body.

Currently there are fifty-five (55) production wells shut down for eleven (11) OC groundwater producers in response to detected PFAS levels in OC's groundwater basin. In the short term, the affected well supplies are being replaced with additional imported water supplies (at added

costs). OC water agencies are responding and taking steps to operate and maintain their production water wells to deliver PFAS-free potable water to OC residents and businesses and implement treatment systems to restore the original groundwater production.

Public Safety

OC water agencies strive to deliver the best water quality possible by using commercially available water quality sensors to monitor changes and maintain the quality standards. All agencies that responded have dedicated safety officers and strict safety protocols to ensure that the infrastructure is operational, and employees work within all safety regulations.

In recent years, water contamination detection has become a significant public safety concern for water agencies. Newly discovered contaminants such as PFAS have become a substantial threat. Water agencies are taking several steps to ensure public safety including extensive and continuous groundwater testing, investment in research of new treatment methods, and design and construction of treatment facilities to remove contaminant(s).

Another threat to the water supply falls into the broad category of seismic activity. Within the last 5 years, most agencies have taken steps to protect their facilities from earthquakes and other natural disasters. Additionally, OC water agencies recognize wildfires as a serious public safety threat and maintain required water pressure in the distribution system as well as adequate water in reservoirs for fire suppression. Per EPA requirements all agencies must conduct a vulnerability assessment and develop an Emergency Response Plan to address potential disasters, including a bioterrorism attack.

Resilience

OC water agencies continue to increase water system resiliency by investing in new and additional water supply sources, increasing wastewater recycling capabilities, and upgrading existing infrastructure to prevent or protect against significant multi-hazard events. In doing so, OC water agencies increase their ability to recover quickly following an emergency and resume critical services with minimum disruption to public safety, health, the economy, and national security.

The groundwater basin serving north, and central OC is continually replenished with high quality recycled water through Groundwater Replenishment System (GWRS) operated by OCWD. The **GWRS Final Expansion Project** is currently under construction to increase its production from 100 million gallons per day (MGD) to 130 MGD.

Several other local water supply projects are under consideration in or near OC that will contribute to increase resiliency in the region. They include: **Doheny Ocean Water Desalination Project** (2 - 15 MGD); **Poseidon Huntington Beach Ocean Water Desalination Project** (50 MGD); **San Juan Watershed groundwater project** (8 MGD); **MWD Regional Recycled Water Program** (in Carson, CA; up to 150 MGD primarily in Los Angeles County). These projects all offer increased water reliability and reduction in the need for imported supplies.

Additionally, local water agencies have implemented and continue to grow their recycled water production in multiple facilities throughout south OC. For example, the recently constructed **Trampas Canyon Reservoir** will create winter storage for recycled water (when demands are

low) that could be used during dry, hot months (when demands are high) for construction and landscape irrigation. Trampas Canyon Reservoir will capture and store recycled water from the **Chiquita Water Reclamation Plant** and other recycled water supply sources from the **Santa Margarita Water District** (SMWD) and the **City of San Clemente**. Other future upgrades and expansion of recycled water facilities are in the planning stages and will be implemented in the next 5-10 years.

Due to its award-winning **Mesa Water Reliability Facility (MWRF),** Mesa Water provides 100% locally-reliable water supplies to its service area, and is the only Orange County water provider that meets water demand exclusively from local groundwater supplies. The deep-water wells located at the MWRF (pronounced "merph") pump raw water from approximately 1,000 feet underground. The water is soft and meets all water quality standards, but contains an amber tint caused by nature. A state-of-the-art nanofiltration technology treatment process removes the amber tint while sand separators and other filters remove inorganic materials. Chloramines are used to disinfect the water which then moves into the on-site reservoir before being pumped into the Mesa Water distribution system.

Innovation

The GWRS is the world's largest water purification system for indirect potable reuse. The treatment system process train includes the state-of-the-art microfiltration, reverse osmosis, and ultraviolet oxidation/disinfection technologies. Other water treatment innovations in OC include PFAS/PFOS treatment facilities being designed and installed in **Yorba Linda Water District**, Anaheim, and other OC cities.

The City of Anaheim implemented Design-Build to install its PFAS treatment plants as well as to expedite its pipeline replacement program. The City of Anaheim is also conducting pilot programs for advanced metering infrastructure (AMI) and leak detection.

Methodology: 2021 Review of Orange County's Infrastructure

To build widespread infrastructure literacy of the public infrastructure facilities and their impacts on the quality of life and economic vitality in Orange County.

Capacity:

- Review the infrastructure's capacity to meet current and future demands.

Condition:

- Review the infrastructure's existing or near future physical condition.

Funding:

- Review the current level of funding (from all levels of government and the private sector) for the infrastructure category and compare it to the estimated funding need.

Future Need:

- Review the cost to improve the infrastructure and determine if future funding prospects will be able to meet the need.

Operation and Maintenance:

- Review the owners' ability to operate and maintain the infrastructure properly and determine that the infrastructure is following government regulations.

Public Safety:

- Review to what extent the public's safety is jeopardized by the condition of the infrastructure and what the consequences of failure may be.

Resilience:

- Review the infrastructure system's capability to prevent or protect against significant multi-hazard events and the ability to expeditiously recover and resume critical services with minimum disruption to public safety and health, the economy, and national security.

Innovation:

- Review the implementation and strategic use of innovative techniques and delivery methods.

Roster: 2021 Review of Orange County's Infrastructure

Executive Committee:

- Ronald Stein, Executive Chairman of the 2021 O.C. Infrastructure Review Project, **PTS Advance**
- Kevin Haboian, **HNTB**
- Steve Bucknam, **Bucknam & Associates**
- Sunny Jiang, **UCI Civil and Environmental Engineering**
- Susan Barua **CSUF College of Engineering and Computer Science**
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    - Customer Outreach Team provided the approved photo.
    - Director of our Resource Management team provided the investment dollars specific to Orange County.
    - Gas System staff provided safety information.
    - Marketing Team provided our large customer profile (we focused on industries)
    - Customer Service Staff provided information on the number of customers and CCF usage.
    - Tax Department provided the miles of distribution pipe.
    - Transmission Department provided the miles of Transmission pipe running through Orange County.
    - Program Manager for the Mobile Home Park Program provided the mobile home park information.
    - Aspire 2045 information came from our policy team and was proofed by our external communications team.

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