

SUSTAINABLE AND RESILIENT INFRASTRUCTURE


CREATING A BETTER FUTURE FOR BERKELEY

VISION 2050



PRESENTED BY THE
VISION 2050 TASK FORCE
May 2020



A scenic view of a large body of water, likely the ocean, with mountains in the background under a sunset sky. The water is dark blue with white-capped waves. The sky is a mix of orange, yellow, and blue. The mountains are silhouetted against the sky.

Infrastructure investment will be crucial. The world should adopt a simple rule: if big infrastructure projects are not green, they should not be given the green light. Otherwise, we will be locked into bad choices for decades to come.

— UN Secretary General Antonio Guterres, 2017

Forward by Mayor Jesse Arreguin

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Foreword by Mayor Jesse Arreguin

Friends,

We have a complex network of pipes, streets, utility wires, bike-ways, and transportation systems across our city. Berkeley's critical infrastructure services are the lifeblood of our daily lives, economy and public health. Yet, the delivery of these essential services depends on infrastructure systems that are old, and have suffered from historic disinvestment, neglect and poor maintenance. In Berkeley we lean into what makes us great— our values, diversity and brilliant residents. As our infrastructure ages, we need a plan to make sure our streets, sidewalks, sewer systems and buildings are resilient enough to handle a growing population and climate change, including sea-level rise, more flooding and wildfires.

As technological innovations continue to flourish and the condition of our infrastructure declines, it presents an enormous and exciting opportunity to reimagine our streets and public spaces. That is why we called this effort Vision 2050. How do we create a plan to invest and re-envision our city by the year 2050? This effort is not just about fixing our streets, sidewalks and other public infrastructure. It is about building a future for Berkeley that will last for future generations. This report is focused on better coordination, integrated project delivery, utilizing new financing mechanisms, and broad principles and strategies for our infrastructure needs. By 2050, we want to design and create a public realm that is sustainable, resilient and equitable.

I am extremely proud of the collaboration and commitment from our community in this process. Over the last 18 months, residents from a diverse range of backgrounds, professors and directors at UC Berkeley, to engineers, architects, designers, planners, and students

have worked diligently to prepare this report. I am especially grateful for the leadership of Ray Yep, our Chair, and for the steering committee leaders, who guided our working groups from research to recommendations. This has been a remarkable effort, and I want to thank everyone who has engaged with us.



Photo by Noah Berger

However, this is just the start. We know that this report does not have all the answers. Predicting the future is not possible, and a true community vision requires many more voices to be brought into this process. Through Vision 2050, we are hoping to foster a larger discussion about the kind of city we hope to have in the future, and the steps we can take together today to get there. I invite all community members to review this report and join us.

A handwritten signature in blue ink that reads "Jesse Arreguin". The signature is written in a cursive, flowing style.

Executive Summary

Mayor Arreguin launched Vision 2050, an initiative to encourage long-term planning to meet the serious challenges to our infrastructure, including climate change, inequality, population increases, and obsolescence. The Vision 2050 Task Force was formed in Spring 2018 and included over 40 Berkeley community members with technical expertise and in-depth knowledge. The task force was organized into four working groups: quality of life, environment, technology, and finance/management. Our community voiced their support for Vision 2050 with the passage of Measure R in the November 2018 election, which asked Berkeley voters the following:

Shall the measure, advising the Mayor to engage citizens and experts in the development of Vision 2050, a 30-year plan to identify and guide implementation of climate-smart, technologically-advanced, integrated and efficient infrastructure to support a safe, vibrant and resilient future for Berkeley, be adopted?

MEASURE R, Passed November 2018

Infrastructure keeps our city functioning. Some parts of this critical infrastructure are controlled by the City of Berkeley while other important components are controlled by our partners. This report focuses on the infrastructure systems over, on and beneath the public streets and right of ways. We view this area as part of our Public Commons. In addition, the infrastructure needs of our City include our parks and playgrounds, the Marina, public buildings and other facilities. Critical systems that we depend on every day – water, sewers, streets, parks, phone/internet and more – are simply wearing out. Aging infrastructure is not only costly to maintain but it doesn't meet current or future requirements. This leaves the community vulnerable to unplanned failure and service interruptions. For residents, workers, and businesses trying



to go about their daily lives, this can translate to unsafe conditions, unexpected costs, and inequity between neighborhoods.

It was vital to reach out to the broader Berkeley community to both build awareness and provide opportunities for input and engagement. Initial Vision 2050 outreach began early in 2018 with four information nights across Berkeley. This continued with outreach to neighborhood and faith-based groups and community organizations. To support this endeavor, the Mayor's Office partnered with Berkeley's Youth in Government, a group of high school students, who were trained as Vision 2050 ambassadors. Using this model, from September 2018 to July 2019, the Mayor's Office presented at thirteen community organization meetings.

EXECUTIVE SUMMARY

Infrastructure to Enhance Our Community

All decisions made in infrastructure planning should include how they will impact the community's quality of life, today and in the future. To help define this, the Quality of Life work group prepared a set of core

values: equity, public health and safety, strong local economy, and resiliency and sustainability.

CORE VALUES FOR INFRASTRUCTURE DEVELOPMENT



EQUITY

The benefits of improved infrastructure must be distributed equitably throughout the entire community. Equity should mean that disadvantaged citizens with more pressing needs experience benefits sooner than others and receive benefits particularly tailored to their unique needs.



STRONG LOCAL ECONOMY

A strong local economy provides resources to Berkeley citizens and creates an opportunity to build local skills and employment opportunities that support the city's diverse community.



PUBLIC HEALTH AND SAFETY

This core value considers safe and convenient access to greenspaces, public services, clean air, and social support networks, all of which can have a big impact on people's emotional and physical health.



RESILIENCY AND SUSTAINABILITY

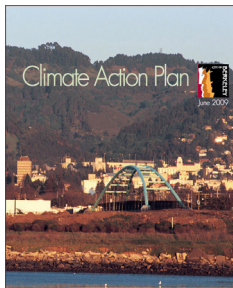
Resilience requires systems and structures that are able to recover quickly from temporary and, sometimes, catastrophic events. Sustainability refers to the ability to minimize our impacts on the environment while still providing core services.

Building on Current Infrastructure Planning

The Vision 2050 Task Force reviewed over 20 of the City’s current infrastructure plans. The plans are the result of lots of hard work by City staff and community members over the years. It is helpful to build on current planning and to learn what has worked well and what hasn’t.

AMONG THE LESSONS LEARNED:

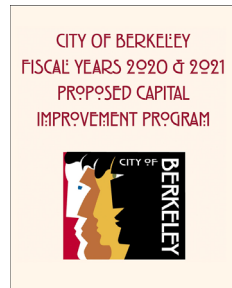
- ▶ Plans do not have a regular schedule to be updated and are sometimes out of date. An ability to have plans be adaptable would be helpful.
- ▶ Plans are prepared for a specific purpose and are often not integrated with related programs.
- ▶ Plans are sometimes aspirational and real funding is not designated.
- ▶ Plans sometimes get off to a good start, but lack follow through, reporting and transparency.



Climate Action Plan (2009)



Resilience Strategy (2014)



Capital Improvement Program

Berkeley prepares a five-year Capital Improvement Plan (CIP) and updates it every two years. As extensive as it is, many infrastructure systems lack planning and have not yet made it into the CIP. Examples of this include improvements recommended in the Watershed Management Plan, implementation of the Green Infrastructure Plan, improvements needed to bring Berkeley’s streets to an acceptable condition and improvements to the Civic Center.

Current funding levels cannot keep up with the rapid decline of our aging infrastructure. Over the last five years, infrastructure needs have well exceeded the available funds to even maintain “status quo”, let alone “modernize” or address emerging needs. Most recently, City management has made positive progress in capturing additional funding for infrastructure improvement.

CITY MANAGEMENT - POSITIVE PROGRESS EXAMPLES:

- ▶ Voter support for passing Measures M and T1 for infrastructure improvements.
- ▶ Benefits of a revenue-funded bond when replacing the Center Street Parking Garage with a climate smart facility.
- ▶ Replacing the aging and destroyed Tuolumne Camp facility, utilizing primarily insurance funds, with a modern facility.
- ▶ Increasing the five-year capital spending budget for FYs2020 – 2024, substantially over what had been spent historically.

EXECUTIVE SUMMARY

Future Challenges for Our Infrastructure

We live in the vibrant Bay Area at an opportune time for regional planning. The Association of Bay Area Governments is currently preparing Plan Bay Area 2050 and the results will provide excellent guidance for Berkeley’s Vision 2050. Plan Bay Area 2050 is a long-range plan charting the course for the future of the nine-county San Francisco Bay Area. The Plan will focus on four key issues – the economy, the environment, housing, and transportation – and will identify a path to make the Bay Area more equitable for all residents and more resilient in the face of unexpected challenges. The Metropolitan Transportation Commission and the Association of Bay Area Governments are expected to adopt Plan Bay Area 2050 in summer 2021.

There are many environmental challenges to planning our future infrastructure. The Environmental work group brought together their extensive expertise and relied on recent publications, such as the 4th California Climate Assessment. The environmental challenges are summarized as follows:

INCREASING HEAT

Berkeley can expect an increase in air temperature. Hotter air leads to droughts or intense rainfall years, drier vegetation and air quality problems that impact people’s health.

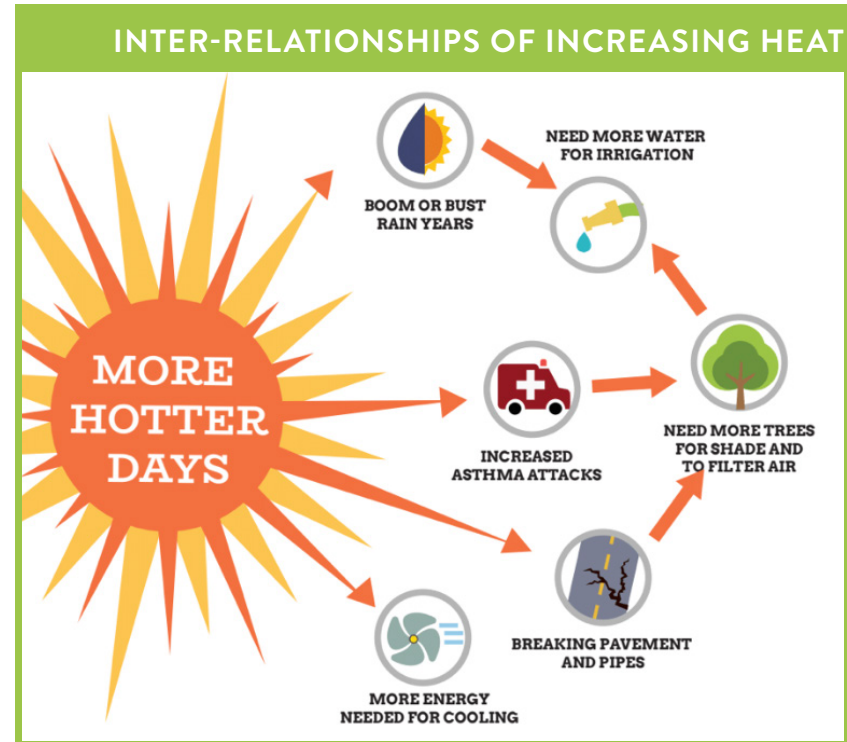
SIGNIFICANT CHANGES IN PRECIPITATION

“Boom and bust” years – both very wet and very dry conditions – are a certainty in the coming decades. Warmer temperatures are also predicted to make a substantial change in the Sierra snowpack, which is the source of the vast proportion of EBMUD’s water supply.

WILDLAND FIRE RISK

Climate change has increased temperatures and drought, which will inevitably lead to even more severe fires and a longer fire season.

Figure 1



SEA LEVEL RISE

Berkeley will see significant sea level changes over the next 20-80 years, and beyond. By 2050, the State has identified a range of likely sea level rises between 1.1 to 2.7 feet. By 2100, many scientists expect an eventual rise in sea level up to 10 feet. We need to consider the expected lifetime of our infrastructure, as well as the rate and timing of sea level change.

EARTHQUAKES AND LANDSLIDES

Berkeley’s Local Hazard Mitigation Plan identifies earthquake and rainfall-triggered landslides as likely hazards with catastrophic severity of impact.

Technology trends provide us opportunities in the way we use Berkeley's infrastructure. While it is impossible to predict what technologies will be available 30 years from now, we can identify general trends and the challenges they pose. Our local partners, including UC Berkeley and Lawrence Berkeley National Laboratory, will be important collaborators.

BUILDINGS

Buildings will increasingly include energy generation and energy storage. We will be seeing more solar panels, microgrids, and batteries. Buildings will also need to move off of natural gas and rely on the increasingly clean electricity grid. Our buildings will also be the site of more distributed water-related services such as storm water and domestic water capture, water treatment, and reuse.

TRANSPORTATION

Transportation networks will have to support everyone, not just cars. "Complete streets" will enable a greater number of pedestrians and a variety of vehicle types, sizes, and speeds to pass safely on public roads and pathways. Private companies providing ride hailing services and micro-mobility solutions will become more prevalent. There will also be increasing demands for

Figure 2

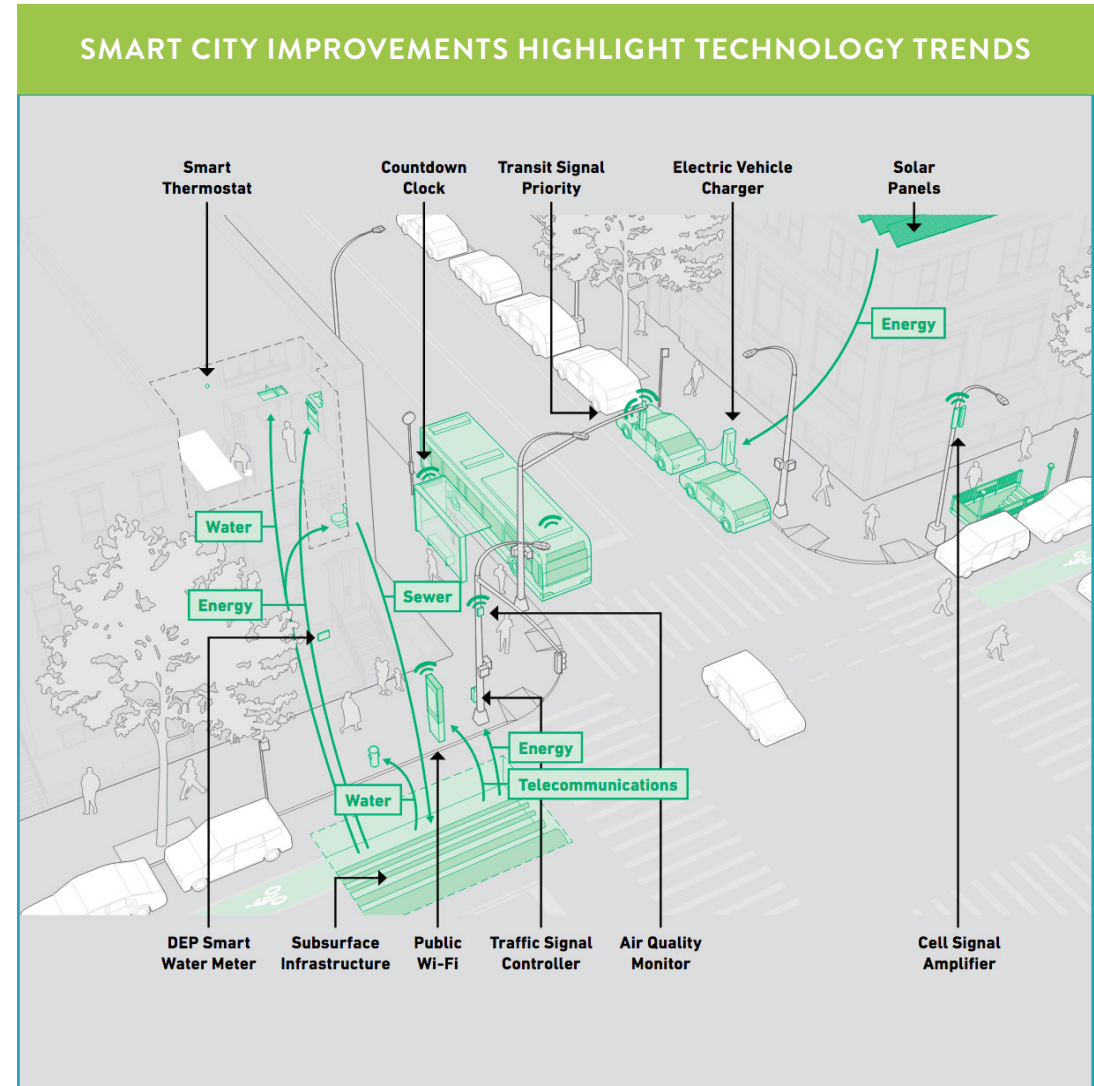


Image: OneNYC 2050

EXECUTIVE SUMMARY

flexible public transportation solutions provided by our regional partners such as AC Transit and BART. To meet climate mitigation targets, transportation will need to become electrified and will require new electric vehicle charging infrastructure.

ENERGY

Berkeley seeks an energy system that, by 2050, delivers carbon-free electricity across a highly distributed system. Multiple and multifaceted changes to existing infrastructure and its uses will be required. In general, these changes can be summarized as: 1) maximize energy efficiency, 2) electrify everything possible, 3) decarbonize and clean up the grid, 4) develop additional wind and solar power sources on public land and 5) phase out use of fossil fuels.

INFORMATION

By 2050, information flows in Berkeley will increase dramatically. Major infrastructure components will gradually incorporate sensing and communication for real-time information. The City must incorporate plans to manage this explosion of information, ensure equal access, and address security risks. Public concerns about harms from electromagnetic spectrums must be addressed with the best evidence available and weighed compared to public benefits.

WATER

The primary technical challenge will be in renewing aging water infrastructure. The East Bay Municipal Utility District has a Pipeline Rehabilitation Program that will repair or replace water pipelines that are nearly a century old. Berkeley's sewer pipelines are currently being

repaired or replaced to reduce the amount of stormwater leaking into the system. New opportunities for storm water management lie with the use of green infrastructure and the use of permeable surfaces.

WASTE

Waste management begins with how and what we consume, and also includes diversion to reuse, recycling, and composting. Berkeley continues to work to reduce the use and disposal of single-use products and also has expanded the range of materials that can be reused, recycled, or composted.

EMERGENCY SERVICES

Fire, police, medical, and mental health assets must be deployed to resolve inevitable conflicts, disasters, and disruptions to city life. Particular care must be taken to ensure that Emergency Services have full access to remote sensing and wireless information transfer and are a carefully considered part of new infrastructure approaches.

Finance for the Future

The City has an extensive portfolio of capital assets and infrastructure, which includes 95 public buildings, 254 miles of public sanitary sewer mains and 130 miles of public sewer laterals, 52 parks, two pools, three camps, and 42 different facilities served by the City’s IT systems. Maintaining these assets is costly and requires significant resources and constant attention. Additionally, Berkeley is an aging city and thus its infrastructure faces challenges that younger cities do not.

THE BAD NEWS is that the City faces significant long-term costs in the areas of capital assets and infrastructure. The FY2020/21 Capital Plan estimates that total capital and maintenance needs are ~\$880 million. Many capital assets have exceeded their useful life and some are failing.

An example is the Berkeley Fishing Pier, which was closed in 2015 due to structural deficiencies (see Figure 3).

THE GOOD NEWS is that Berkeley’s finances are in good shape! In June 2019, Moody’s Rating Agency upgraded the City’s GO bonds from Aa2 to Aa1, which is the second highest for long-term debt. In the last two decades, General Fund revenues have doubled from \$100 million to \$200 million (see Figure 4). The Total City Budget increased by a similar percentage to ~\$457 million in FY2019. Revenues are exceeding expenses and the City’s Investment Portfolio, which holds unspent funds, has increased by 300% over this period.

THE SOLUTION is to double the City’s annual capital spending over the next decade to ~\$80 million/year.

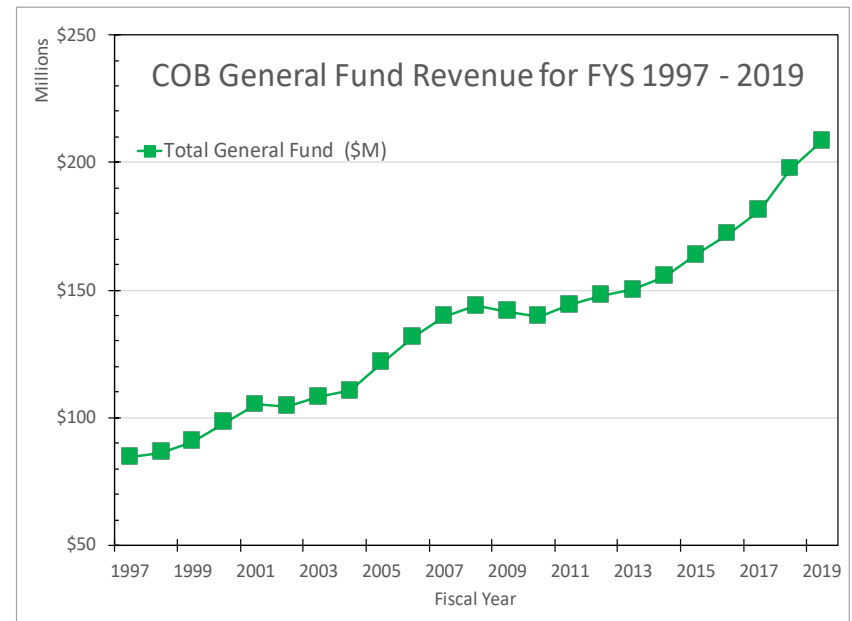
Figure 3



The pier is an example of deteriorated and unsafe infrastructure.

Photo: Dorothy Brown

Figure 4



Our Recommendations

The City of Berkeley has an infrastructure system that has allowed us to thrive and grow for over 100 years.

Now is the time to incorporate new technologies and adapt to meet environmental trends so that our systems can continue to reliably support us for another 100 years.

The Vision 2050 Task Force recommends the following guiding principles, strategies, and actions.

THE VISION 2050 TASK FORCE HAS DEVELOPED THE FOLLOWING GUIDING PRINCIPLES FOR OUR INFRASTRUCTURE DEVELOPMENT



PRINCIPLE ONE
Support Vibrant and Safe Communities



PRINCIPLE TWO
Have Efficient, Inspired and Well Maintained Infrastructure



PRINCIPLE THREE
Facilitate a Green Berkeley and Contribute to Saving Our Planet

THESE PRINCIPLES ARE SUPPORTED BY THE FOLLOWING STRATEGIES AND RECCOMENDATIONS



STRATEGY ONE
Ensure Integrated And Balanced Planning



STRATEGY TWO
Manage Infrastructure from Cradle to Grave



STRATEGY THREE
Adopt Sustainable and Safe Technologies



STRATEGY FOUR
Invest in Our Future



STRATEGY FIVE
Prepare the City's Organization to Implement a Major Capital Program

PRINCIPLES, STRATEGIES, AND RECOMMENDED ACTIONS

PRINCIPLE ONE

SUPPORT VIBRANT AND SAFE COMMUNITIES

Infrastructure shall take equity into account and improve the quality of life of all Berkeley residents, including having green open spaces, safe modes of mobility, and being prepared for fires and earthquakes.

PRINCIPLE TWO

HAVE EFFICIENT, INSPIRED AND WELL MAINTAINED INFRASTRUCTURE

Infrastructure shall be long lasting, use advanced technologies, and be maintained to provide efficient service.

PRINCIPLE THREE

FACILITATE A GREEN BERKELEY AND CONTRIBUTE TO SAVING OUR PLANET

Infrastructure shall accelerate the transition to carbon neutrality and include electrification, develop natural streetscapes using green infrastructure, and prioritize human-powered and public transportation.



STRATEGY ONE: Use Integrated and Balanced Planning

A: Use multi-criteria decision-making

B: Use adaptive planning

C: Prepare and implement a Dig Once policy

STRATEGY TWO: Manage Infrastructure from Cradle to Grave

A: Institute structured master planning

B: Develop an Asset Management Program

STRATEGY THREE: Adopt Sustainable and Safe Technologies

A: Accelerate the transition to clean energy and electrification

B: Implement Complete Streets to provide sustainable and healthy transportation

C: Develop natural streetscapes that provide ecosystem services

D: Use sensors, data, and advanced technologies

E: Prepare a wildfire mitigation and safety plan

STRATEGY FOUR: Invest in Our Future

A: Take advantage of a strong financial position to address infrastructure needs and commit to reducing large unfunded infrastructure liability by doubling capital expenditures

STRATEGY FIVE: Prepare the City's Organization to Implement a Major Capital Program

A: Develop an organization that is integrated and has capacity to deliver

B: Prepare a program approach with management tools

C: Provide independent oversight and reporting

EXECUTIVE SUMMARY

Engaging Our Community

Vision 2050 will continue to engage the community on the future development of Berkeley's infrastructure. Basic infrastructure needs such as street potholes, playgrounds, and bike lanes are well-understood. However, residents are less aware of the age and fragility of the pipes and systems below ground.

Effective community engagement requires setting appropriate goals to ensure that the public's time and input is valued and honored. This includes:

- ▶ **BROADEN THE COMMUNITY UNDERSTANDING OF THE IMPORTANCE OF INFRASTRUCTURE**
- ▶ **SOLICIT COMMUNITY IDEAS ABOUT POSSIBLE PROJECTS AND PROGRAMS**

- ▶ **GATHER INPUT ON PRIORITIZATION**
- ▶ **OFFER WAYS FOR THE COMMUNITY TO HELP IN THE IMPLEMENTATION**
- ▶ **ONGOING COMMUNICATION ON PROGRESS AND ENGAGEMENT**

The Mayor's Office explored and piloted community engagement strategies that can be scaled up as the Vision 2050 initiative and future infrastructure projects are further developed. The lessons and ideas from this work can be categorized in three themes: meet people where they are, leverage the youth, and develop and visualize feedback.



Actions to Move Us Forward

The Task Force recommends the following implementation plan for the next three years, 2020 - 2022.

ACTIONS BY CITY COUNCIL

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Adopt the Vision 2050 Initiative Report 2. Proactively promote findings and vision to constituents and organizations 3. Develop a legislative package based on key recommendations in the Vision 2050 Initiative Report | <ol style="list-style-type: none"> 4. Review funding alternatives to ensure compliance with Vision 2050 goals and timelines 5. Support ongoing further development of Vision 2050 recommendations |
|--|---|

ACTIONS BY CITY MANAGER

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Identify resources to double capital investment 2. Begin process of an updated General Plan and ensure that it addresses all needs raised in the Vision 2050 Initiative Report 3. Create a staff organization and process that promotes integrated and adaptive planning | <ol style="list-style-type: none"> 4. Develop an implementation plan 5. Identify funding resources for budget approval that will begin implementing the Vision 2050 Initiative Report 6. Promote cross departmental networking to address infrastructure innovation |
|---|--|

PROGRAM DISTRIBUTION, COMMUNICATIONS, AND INPUT

1. Present the Vision 2050 Initiative Report to commissions, City Council, City departments, and community organizations
2. Continue to augment the Report for further consideration and incorporation
3. Develop a community engagement program to support ongoing community input
4. Provide timely informational updates to Vision 2050 website
5. Utilize social media to raise awareness and facilitate feedback
6. Engage outside subject-matter experts who can help inform the Initiative
7. Ensure that University of California, Berkeley academic experts are fully engaged and aware of the Initiative

1. The Vision 2050 Initiative

Mayor Arreguin announced in his 2017 State of the City Address his intention to develop Vision 2050, a long-term infrastructure plan to create a city that is resilient and sustainable for future generations. A task force was formed in spring of 2018 that included over 40 people from across our community. It was organized into four work groups: quality of life, environment, technology, and finance/management. Involving the community was very important in the process and that included a series of information sessions in fall of 2018 and community workshops in summer of 2019. Our community voiced their support for Vision 2050 with the November 2018 passage of Measure R, which asked Berkeley voters the following:

Shall the measure, advising the Mayor to engage citizens and experts in the development of Vision 2050, a 30-year plan to identify and guide implementation of climate-smart, technologically-advanced, integrated and efficient infrastructure to support a safe, vibrant and resilient future for Berkeley, be adopted?

Our community's overwhelming response, by 85%, was "YES!"

Vision 2050 extends over 30 years to encourage long-term planning that will begin to meet the serious challenges to our infrastructure, including climate change, inequality, population changes, and aging assets. It is meant to move beyond business-as-usual and accelerate the building of climate-smart, technologically-advanced, integrated, and efficient infrastructure in Berkeley.



What is Infrastructure?

Infrastructure keeps our city functioning. It is beneath our feet, over our heads and all around us. Some parts of this critical infrastructure are controlled by the City of Berkeley while other important components are controlled by our partners such as EBMUD, PG&E, EBCE (East Bay Community Energy), AC Transit, and BART.

SURFACE INFRASTRUCTURE IS MOST FAMILIAR TO EVERYONE

and includes our streets, sidewalks, and bikeways. The quality of these systems is very important for public safety, mobility for all people, and the conduct of our daily lives.

Above the streets are power and streetlight poles that support electric and communications hardware, while trees and plants invite us to slow down and enjoy life, providing a habitat for wildlife, sequestering carbon and water, cooling our streets, protecting pedestrians, and improving the air we breathe. The future may see drones overhead delivering packages.

BENEATH OUR FEET IS AN EXTENSIVE WORLD of cables, pipes, tunnels, and vaults that we rarely think about... until something breaks. This infrastructure delivers water and natural gas to our homes and businesses and takes away storm water and sewage. It also hosts part of the electric and communications grids and Berkeley's underground BART system.

This report focuses on the infrastructure systems over, on, and beneath the public streets and right of ways. Most of our current infrastructure

systems are located here and they provide service to the largest number of people. We view this area as part of our Public Commons (see Figure 5). However, the infrastructure needs of our city include our parks and playgrounds, the Marina, public buildings, and other facilities.

Table 1 summarizes the major infrastructure systems in Berkeley.

Figure 5



Image: Michelle Hook

THE VISION 2050 INITIATIVE

Table 1

MAJOR INFRASTRUCTURE SYSTEMS IN BERKELEY		
Infrastructure System	Controlled by City	Controlled by Others
Streets, sidewalks, paths, bikeways, and tunnels	216 miles of streets 300 miles of sidewalks 50 miles of paths and bikeways	AC Transit buses BART system AMTRAK and trains Taxis, Lyft, Uber and rideshare, ZipCar, Bicycles and Micro-Mobility
Power and communication systems	7,000 street lights	PG&E, EBCE electricity and natural gas delivery systems Private telecommunications and Internet services
Parks, street trees and public plantings	38,000 street trees 52 parks and play grounds	East Bay Regional Parks
Water supply system	11 creek watersheds	EBMUD potable and recycled water
Sanitary sewers	380 miles of sewers	EBMUD sewage treatment
Stormwater system	220 miles of storm sewers 6,000 storm drain facilities	
Solid waste management	7 acre transfer/recycling station Curbside collection services Commercial food waste collection	Alameda County landfill Alameda County household hazardous waste services Alameda County construction & demolition debris services
Public buildings	95 public buildings	BUSD Buildings, UC Berkeley Buildings, Transportation Hubs e.g. Bart Plazas, Berkeley City College
Berkeley marina	Berkeley Marina Municipal pier	State of California

What is the Problem and Our Opportunities?

This report provides a framework to start the discussion about the future of Berkeley’s infrastructure. It is not a strategic plan, a work plan, or a plan that provides answers to all of our infrastructure needs. In essence, it is a call to action.

Additional research and subject matter expertise will be required over time; specific action items and priorities will need to be developed through discussions with City departments; regional, national, and international experts will be engaged; and there will be required input from the community.

It is important to note that the Vision 2050 Task Force recognized that the need for infrastructure has a direct relationship to housing, public safety, economic development, equity, and more. This report focuses only on infrastructure.

THE PROBLEM

Aging Systems

Berkeley, along with many older U.S. cities, is built on infrastructure that was designed and constructed before most of our residents were born. Much of the city’s streets, storm drains, sewers, and water lines date to the early decades of the 20th century.



Photo: EBMUD

Numerous civic facilities were built during the Great Depression to serve this fast-growing population, including Aquatic Park, the Rose Garden, Civic Center, and the Community Theater on the Berkeley High campus. Critical systems that we depend on every day – water, sewers, streets, parks, phone/internet, and more – are simply wearing out.

Recent budgets allocated approximately \$34 million per year for infrastructure capital and maintenance needs, but the total funding need is about \$80 million per year over the next decade. At this level of funding, our infrastructure will deteriorate faster than it can be repaired or replaced.

Aging infrastructure is not only costly to maintain but it doesn’t meet current or future requirements. This leaves the community vulnerable to unplanned failure and service interruptions. For residents, workers, and businesses trying to go about their daily lives, this can translate to unsafe conditions, unexpected costs, and inequity between neighborhoods. If unaddressed, the cascading impacts of various infrastructure failures could eventually overwhelm the City’s ability to respond.

THE VISION 2050 INITIATIVE

Dangerous Unknowns

Now, as we begin to grapple with Berkeley's difficult infrastructure situation, new challenges are emerging. The local impacts of global climate change are a major threat to our aging infrastructure. As outlined in Chapter 4, extreme storm events, wildfires, heatwaves, drought, and sea level rise will challenge streets, pipes, and open spaces that were designed for a more benign environment. And all of this will be happening as we wait and prepare for the next major earthquake. If our city is to survive and thrive, we must confront this challenge.



Firefighters respond to August 2017 fire in the Berkeley-Oakland hills. Photo: Jane Tyska for the East Bay Times



Overhead wires are a safety concern in Berkeley. Photo: Berkeley City Council Report

Our Opportunities

THESE PROBLEMS ARE VERY SERIOUS, BUT THEY ALSO PRESENT OPPORTUNITIES.

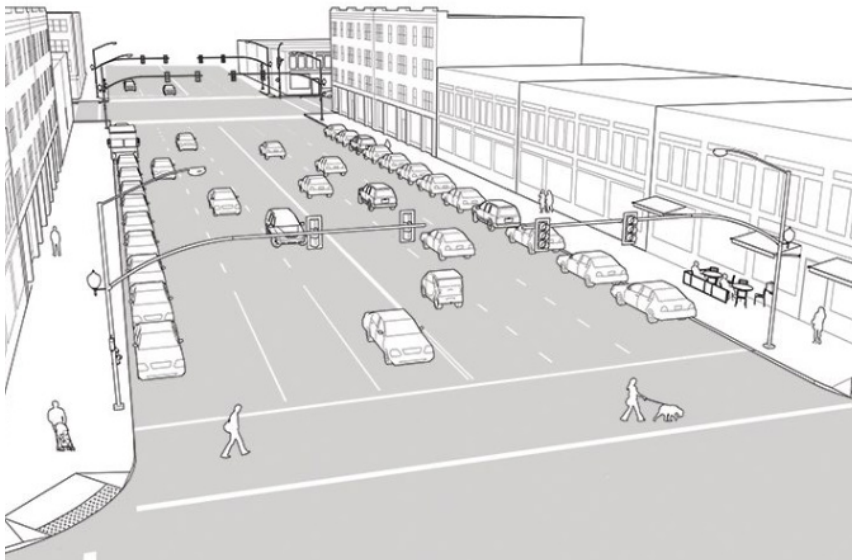
By building upon Berkeley’s historic leadership on tough issues, we can meet the significant environmental and social challenges of the next decades. Berkeley often undertakes sustainable programs and development projects. For example, in 2018 we launched a bike share system, and we are in the early stages of planning affordable, transportation-oriented housing at Ashby and North Berkeley BART stations. Crucially, infrastructure improvement is part of the work Berkeley must do to address the racial and socioeconomic disparities that exist in our community. All residents should have access to welcoming public spaces and well-maintained infrastructure, and negative externalities

from infrastructure development should not fall disproportionately on communities of color.

There are few communities that have such a wealth of knowledge and innovation right at their fingertips. Many of the most innovative new theories, from science to public policy, come out of UC Berkeley. Thought leaders serve on many of our city commissions and task forces. Committing to Vision 2050 can provide us with the opportunity of tapping into that knowledge base, not only to understand current cutting-edge practices from around the globe but, also, innovative ideas for the future. The City of Berkeley could participate in pilot programs that would promote our community’s sustainability while benefiting the world at large.

We know today that the following transformations are possible:

COMMON STREET PROBLEMS



Heavy traffic, unsafe for pedestrians, no bike lane, poor drainage

COMPLETE STREETS



Less automobile traffic, protected sidewalks and bike lanes, green spaces, bioswales

THE VISION 2050 INITIATIVE



Impervious, deteriorating surface



Permeable, long-lasting, and easily maintained surface



Dangerous overhead wires



Undergrounded electrical, supports safe evacuation routes



Pollutants drain to bay



Bioswales filter pollutants

A key component of Vision 2050 must be to ensure that infrastructure serves the entire city, correcting many inequities in the distribution of resources from our past. Infrastructure projects will create good local jobs that can be equitably filled, and can provide excellent training for long-term employment opportunities.

Working together, we can design and build the new, resilient Berkeley that will serve our children and grandchildren for years to come and cost us less in the long run.

Community Engagement During the 2050 Initiative

In early 2018 the Mayor convened a task force in response to community concern about the city’s significant infrastructure needs and the lack of a long-term plan to address them. Approximately 40 citizens – academics, planners, scientists, students, engineers, and teachers – were initially recruited to participate in this citizen-led initiative. While this group is filled with experts including former elected officials and city commissioners, it was vital to reach out to the broader Berkeley community to build awareness and provide opportunities for input and engagement.

Vision 2050 outreach began early in 2018, with four information nights across Berkeley (South, North, Downtown and West). Each night focused on a different issue related to Vision 2050: climate change, transportation, quality of life, and energy. The events had an average attendance of 40 people, and many excellent questions raised by the participants were forwarded to the task force. These questions and comments often informed subsequent research by the working groups and were a direct benefit of sharing the Initiative during the various stages of development. Some attendees became directly involved with the task force after participating in a meeting about the initiative, adding expertise along the way.

The second phase of outreach focused on broadening the reach of Vision 2050. In an effort to reach people where they already congregate, the Mayor’s Office reached out to neighborhood and faith-based groups and community organizations with the offer to share and discuss Vision 2050 during one of their scheduled meetings. To support this endeavor, the Mayor’s Office partnered with Berkeley’s Youth in Government, a group of high school students who participate in the statewide model legislature and court program, to recruit interested youth to become Vision 2050 ambassadors. Ambassadors learned about Vision 2050, practiced giving short introductory presentations, and signed up to help the Mayor’s Office and the task force in sharing the initiative with interested community organizations. Using this model, from September 2018 to July 2019, the Mayor’s Office presented at thirteen community organization meetings in conversations that ranged from intimate (two to three people) to a large audience (100 people). To date, the initiative has been directly shared with over 400 people, with at least one Vision 2050 event held every month from August 2018 to June 2019. Many of these events were video-recorded and materials can be viewed at:

www.jessearreguin.com/Vision-2050





2. Infrastructure to Enhance Our Community

This section highlights the importance of infrastructure in improving the quality of our lives. Too often, infrastructure planning has focused on finding low-cost engineering solutions. We must plan broader and balance the needs of our social, environmental, and technical requirements. The Vision 2050 Task Force recognized this and formed a Quality of Life work group. This section presents their work on developing core values to guide our planning.

Improving the Quality of Our Lives

All decisions made in infrastructure planning must include how they will impact the community's quality of life, today and in the future. There are many things to consider such as adding trees to cool our streets and sidewalks, managing stormwater differently in areas with a higher water table, using alternate paving materials to reduce the heat island effect, creating dry utility tunnels in lower-lying areas, and ensuring the safety of seniors during a heat wave.

In addition, with the projected increase in population, we need transportation systems that can move people more effectively throughout our community while also reducing our greenhouse gas (GHG) emissions. While electric vehicles can help lower carbon emissions, they are not a panacea, partly because of the limited space available and also the issues of battery and vehicle production and disposal. It is also unknown what alternative forms of transportation might emerge and how personal transportation behaviors might change.

It is important to provide more prioritized spaces for transit systems and safe spaces for pedestrians, wheelchair users, cyclists, electric scooter riders, and others. Many of these modes of transportation, such as walking, are proven to increase physical and emotional health

Our infrastructure is critical to our quality of life, including our health and social relationships. Strong, effective, and resilient infrastructure supports a higher quality of life, providing:

- Safe and efficient travel
- Healthy spaces to live, work, play, and study
- Electricity
- Fast internet

while fostering stronger community relations through positive interactions in public spaces. Facilitating green transportation will also reduce automotive traffic for those who may need to use private vehicles. Regardless, infrastructure planning should be adaptive to the greatest extent possible.

If we want to increase the likelihood that our future infrastructure decisions will protect and enhance our quality of life, then we must ensure that quality of life is formally considered alongside other factors. Quality of life should be incorporated as part of a coordinated planning process that is regularly updated as our demographics and behaviors change.

INFRASTRUCTURE TO ENHANCE OUR COMMUNITY

Core Values Guide Our Planning

As we plan for an uncertain and changing future, our infrastructure decisions should be thoughtful and guided by a set of core values. The Quality of Life work group proposes the following core values: equity, public health and safety, strong local economy, and resiliency and sustainability. These are described as follows.

Vision 2050 asks all infrastructure projects to respect our core values and anticipate environmental and socioeconomic impacts. Together, we can prepare for inevitable disasters before they occur, help reduce their impacts, and protect our quality of life. Through this process and guided by the Vision 2050 Initiative Report, we can strengthen equity and inclusion in Berkeley and enhance important determinants of our emotional and physical health.



EQUITY

The equity core value is to ensure that the benefits of improved infrastructure are distributed equitably throughout the entire community. Equity may mean that disadvantaged citizens with more pressing needs experience benefits sooner than others and receive benefits particularly tailored to their unique needs.

For example, equity for street paving might move from equal allocation among Council districts to paving streets of highest needs (bicycle routes, areas of safety concerns, areas of heavy load conditions, etc).



PUBLIC HEALTH AND SAFETY

This core value considers safe and convenient access to greenspaces, public services, clean air, and our social support network, all of which can have a big impact on our emotional and physical health. Well-planned infrastructure that is thoughtfully designed to address the needs of every user plays a critical role in strengthening the health and safety of the community. A good example of this is the Vision Zero program, which will move us from congested and dangerous street travel to safer street intersections and protected bicycle lanes.



STRONG LOCAL ECONOMY

A strong local economy provides resources to our citizens and creates an opportunity to build local skills and employment opportunities that support a diversity of people within Berkeley. Businesses are attracted to areas where there is high-speed internet and other strong, modern infrastructure. Ensuring that Berkeley has the right amount of resources, distributed equally throughout the city, will support its population and can also reduce the amount of carbon-producing travel.



RESILIENCY AND SUSTAINABILITY

“Resilience” refers to systems and structures that are able to recover quickly from temporary and, sometimes, catastrophic events. For example, we must consider what changes we need to make so that Berkeley can recover quickly from a major earthquake, wildland fire, and inevitable sea level rise. “Sustainability” refers to the ability to minimize our impacts on the environment while supporting biodiversity and the survival of other ecosystems. Both resiliency and sustainability are important to maintain our quality of life and our planet over the long-term.

A STREET CORNER VIEW OF BERKELEY IN 2050

Investing in infrastructure is not always an exciting prospect. The systems are not highly visible and the payoff is often long-term. Stories can help us zoom out and overcome our tendency to focus on the needs directly in front of us. The Vision 2050 Task Force used our core values and attempted to transport ourselves into the future and tell a story about Berkeley in 2050. There could be multiple versions of this narrative, and the future we create will depend on the plans and investments we make together in the years to come.

Picture yourself standing on a street corner in Berkeley in 2050. What will our city look like? Will our infrastructure adapt to make our lives safer, more productive, and more



Hi, I'm Maria. It's already a warm morning as I cycle down the bike path, calling out to neighbors who are walking their kids to school and getting ready for work. I continue down the street, thankful for the protected and pothole-free bike lanes. What a difference the safe streets initiative (Vision Zero) has made to bike and pedestrian safety!



I am on my way to the South Berkeley co-op where my great aunt Lizzie lives. She's 85 and asked me if I'd like to join her at a habitat restoration workshop at the updated Berkeley Marina. She wants to learn how to improve the shared open area in her community.



My watch pings to let us know that the accessible shuttle, now celebrating its 20th year of electrified operation, will pick us up in five minutes. After we board, I take a moment to check my phone and see that my home's smart energy system has turned on my dishwasher and washing machine to take advantage of the strong output from our solar panels. It also notifies me that the window shades have been drawn on the sunny south side of the house.



A STREET CORNER VIEW OF BERKELEY IN 2050



As we stroll down the waterfront, we see people coming and going from the bustling ferry terminal. Aunt Lizzie stops for a moment to remember what this area was like before Berkeley restored the wetlands to help protect the waterfront from sea level rise and storm surges. It's

thrilling to see the snowy egrets hunting in the restored, climate-buffering wetlands.

On the way to lunch, we spot solar panels and wind turbines producing a significant portion of the city's power needs, and I particularly enjoy easy access to the strong secure Wi-Fi now available throughout the city. I'm still trying to convince Aunt Lizzie to get an Easy Access watch, but she prefers the old method of text messaging on her phone.

After lunch, I return home and see the Berkeley Fire Department hard at work. They are inspecting homes in the neighborhood to be sure that debris is cleared away from our houses and that we are doing everything we can to prevent an urban wildland fire. It's the time of year that the Diablo winds kick up. We are thankful for the City staff who have undergrounded the overhead wires on Ashby and other evacuation routes.



At around 4 pm, my friend Devin knocks on the door – time for our outdoor concert downtown. Fortunately, the plaza has lots of benches and tables in the shade, or we certainly wouldn't be here! Summer and fall temperatures have been steadily rising in Berkeley over the last few decades.

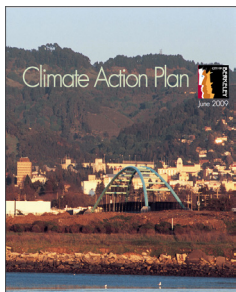
We pick our favorite spot under a leafy oak tree close to the Mist Maker and watch children playing in the interactive fountain. It's all recycled water, so we don't worry about wasting water in this long-lasting drought. After the concert, Devin and I head over to the nearby park for our Tai Chi class. At the corner, we notice a neighbor with his young children pressing the "Extra Time to Walk" button. It's so much safer having a little extra time to cross. After class, we walk to the shuttle stop in the soft down-glow of LED lights, mounted hip-level on the pathway's stanchions. New rain gardens now prevent those flooded intersections and provide a little green oasis at every other corner. Devin and I look forward to the cool evening breezes. As we watch the moon rise over the East Bay hills, we feel fortunate to live in Berkeley, where 30 years ago the city started implementing long-term changes that make such a positive impact to our quality of life. Berkeley is still an amazing and charming city that we are proud to call home.

3. Building on Current Infrastructure Planning

Many City departments have already prepared plans for infrastructure systems and projects. Some of these plans were prepared many years ago and some are more recent. The Vision 2050 Task Force used these existing plans as the starting point to build on what has been done and to add recommendations where needed. This section describes the City's current plans and infrastructure improvement programs.

Building on the City's Planning

The Vision 2050 Task Force reviewed over 20 of the City's current infrastructure plans and created a database. The plans represent lots of hard work by City staff and community members over the years. Some lessons learned from reviewing these plans include the following.



Climate Action Plan (2009)



Resilience Strategy (2014)



Capital Improvement Program

▶ **PLANS NEED TO BE UPDATED AND ADAPTABLE** The Resilience Strategy was prepared in 2014 when the Bay Area was in a major drought and we had not yet experienced the devastating wildfires of 2017 and 2018. In 2014, the high priorities were drought response and seismic upgrade for homes and lower priorities were fire risk reduction and infrastructure improvements to prevent flooding.

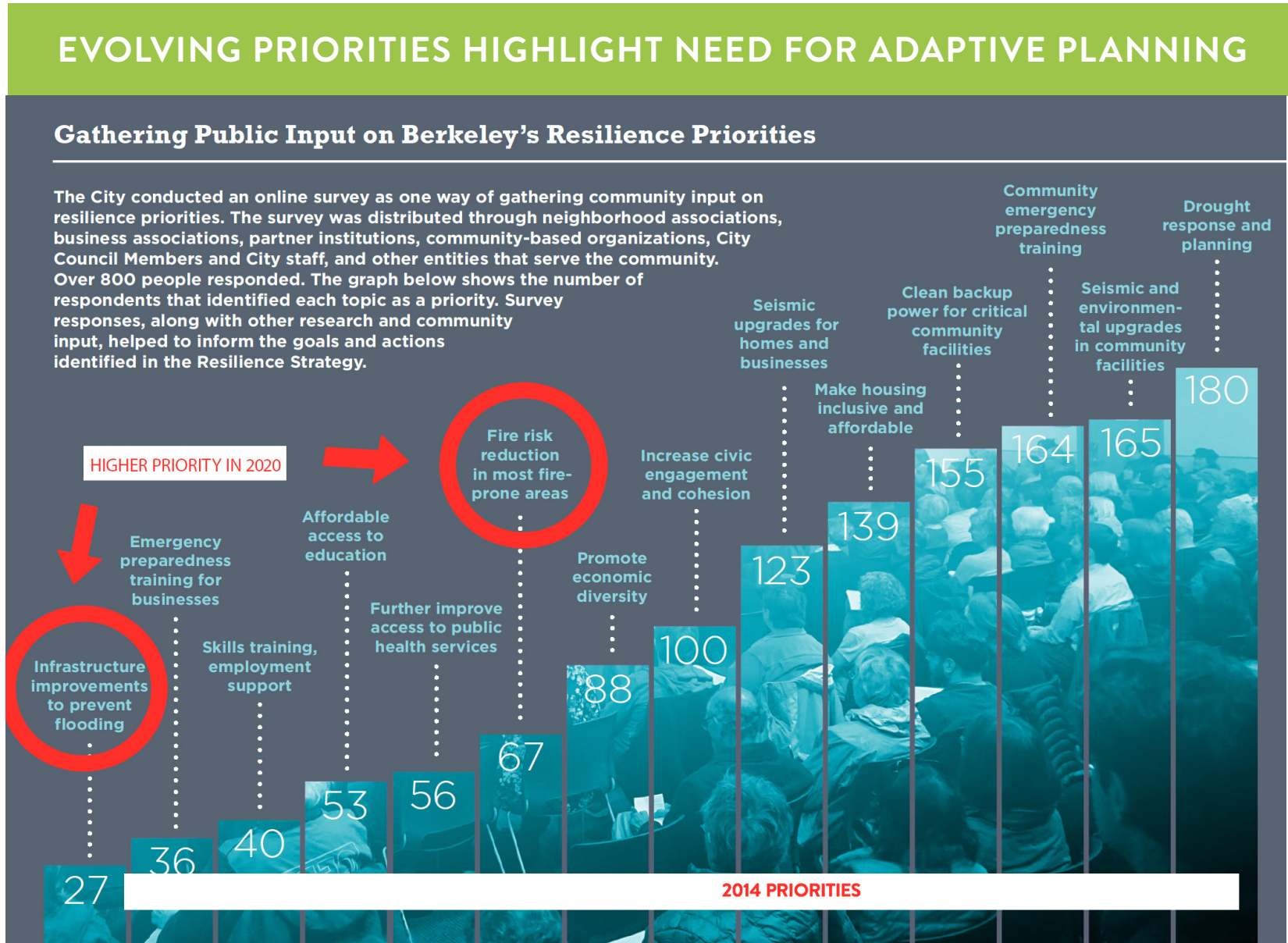
We now know that our risk of an urban wildland fire is very high and potential flooding from sea level rise is increasing. We need our plans to be able to adapt as the scale and impact of these forces shift (see Figure 6).

▶ **PLANS ARE OFTEN NOT INTEGRATED** Plans are often prepared for specific purposes and are not integrated. Examples of this are the street paving, bicycle, and pedestrian plans. These plans involve the use of our streets and sidewalks and have many components that are inter-related. Future planning should find ways to integrate them.

▶ **PLANS ARE ASPIRATIONAL AND ARE NOT FUNDED** The City prepared a Watershed Management Plan in 2011. The plan looked at addressing water quality, flooding, and the preservation of creeks and habitats using multi-objective approaches. The recommended capital funding was \$207 million in 2011. This is an example of a plan that is aspirational and funding was not provided. Another example is the urgent need to improve Berkeley's streets to an acceptable condition.

▶ **PLANS NEED FOLLOW THROUGH AND REPORTING** The Climate Action Plan, the Measure T-1 program, and the Adeline Corridor Plan are good examples of plans with regular reporting. Not all plans do this, and an example is the Measure M street improvement and green infrastructure program. Strong oversight and transparency in how we implement these plans is key to both the success of our plans and the trust we build with community members in delivering them.

Figure 6



This chart shows public input from a 2014 survey of Berkeley's resilience priorities. Today, flood prevention and fire risk reduction are likely higher priorities in light of sea level rise and recent wildfires.

Current Infrastructure Investments

Berkeley prepares a five-year Capital Improvement Plan (CIP) and updates it every two years. The CIP outlines the specific projects, schedule, and the funding needs for the following infrastructure systems: city facilities, information systems, parks and marina, sanitary sewer, storm drains, sidewalk repairs, street repairs, transportation, other infrastructure, and equipment.

Projects shown in the CIP are typically systems that have been studied, are known to be deficient, and require improvements to bring them back to acceptable use. Many infrastructure needs have not yet made it into the CIP. Examples of this include improvements recommended in the Watershed Management Plan, implementation of the Green Infrastructure Plan, improvements needed to bring Berkeley's streets to an acceptable condition, and improvements to the Civic Center.

Current CIP planning is relatively short-term. It does not account for ongoing maintenance nor does it adequately integrate with other infrastructure needs beyond a two to five year horizon.

VOTER-APPROVED FUNDING MEASURES

The CIP is funded by the annual availability of special revenue funds, bonds, enterprise funds, transfer taxes, state and federal funding, and special grants. Several recent actions by voters have provided an important boost to the resources available for meeting these challenges:

Measure T1 This measure authorized the City to sell \$100 million of General Obligation Bonds to repair, renovate, replace, or reconstruct Berkeley's aging infrastructure and facilities, including sidewalks, storm drains, parks, streets, senior and recreation centers, and other important City facilities and buildings.

Measure F This special tax increased the Parks Tax revenues by approximately 16.7% to support parks, playgrounds, city trees and

landscaping operations and maintenance. Measure F provided an additional \$750,000 per year to Berkeley for major maintenance projects, raising annual funding for parks capital and major maintenance projects from \$250,000 to \$1 million.

Measure BB This countywide sales tax implements a 30-year Transportation Expenditure Plan. Berkeley's allocation is approximately \$2.6 million annually and is applied to improving the pavement condition and specific street/transportation improvement projects while increasing funding for local transportation enhancements. Measure BB will benefit the city's streets and roads, including pedestrian and bicycle infrastructure.

Measure M This general obligation bond provided an additional \$30 million which is being used to significantly accelerate the implementation of the 5-Year Street Rehabilitation Plan and install green infrastructure where appropriate. This will improve the condition of city streets and advance green infrastructure projects as defined in the Watershed Master Plan.

BUILDING ON CURRENT INFRASTRUCTURE PLANNING

While these funds are substantial, they cannot keep up with the rapid decline of our aging infrastructure. **Over the last five years, infrastructure needs have well exceeded the available funds to even maintain the status quo, let alone modernize or address emerging needs.** As a result, unfunded liabilities have increased significantly.

Furthermore, from FY2012 to FY2019, the City decreased its annual funding for infrastructure from \$53 million to \$40 million. Additionally, with the exception of vehicles, building maintenance and computers/servers, the City's capital assets do not have reserve funds associated with them. Reserve funds, commonly called sinking funds, are monies that organizations set aside for asset replacement. In addition to the \$19 million reserve funds associated with the aforementioned needs, reserve funds need to be established to replace infrastructure capital assets in anticipation of the end of their useful lifetime.

MOST RECENTLY, CITY MANAGEMENT HAS MADE POSITIVE PROGRESS IN CAPTURING ADDITIONAL FUNDING FOR INFRASTRUCTURE IMPROVEMENT. FUNDING MEASURES INCLUDE:

- ▶ Voter support for passing Measures M and T1 for infrastructure improvements
- ▶ Benefits of a revenue-funded bond when replacing the Center Street Parking Garage with a climate smart facility, using its cash flow from parking fees
- ▶ Replacing the aging and destroyed Tuolumne Camp facility, utilizing primarily insurance funds, with a modern facility
- ▶ Increasing the five-year capital spending budget for FYs2020 – 2024, substantially over what had been spent historically

4. Future Challenges For Our Infrastructure

This section describes the challenges we face in planning our future infrastructure. We begin with the broader context of the Bay Area and the planning work being done by the Association of Bay Area Governments (ABAG). The section then describes the serious environmental challenges facing us. We also present likely future technology trends, which will present challenges as well as opportunities for solutions.

Regional Challenges and Plan Bay Area 2050

We live in the vibrant Bay Area and are at an opportune time for regional planning. ABAG is currently preparing Plan Bay Area 2050 and the results will provide excellent guidance for Berkeley's Vision 2050 Initiative. We are also fortunate to have the coordinated efforts of Jesse Arreguin serving as the Mayor of Berkeley and the President of ABAG at the same time. Strong alignment between this regional effort and our local infrastructure planning will increase access to regional funding and technical support.

SUMMARY OF ABAG EFFORTS

Plan Bay Area 2050 is a long-range plan charting the course for the future of the nine-county San Francisco Bay Area. Plan Bay Area 2050 will focus on four key issues – the economy, the environment, housing, and transportation – and will identify a path to make the Bay Area more equitable for all residents and more resilient in the face of unexpected challenges. This new regional plan will outline strategies for growth and investment through the year 2050, while simultaneously striving to meet and exceed federal and state requirements. The Metropolitan Transportation Commission and the Association of Bay Area Governments are expected to adopt Plan Bay Area 2050 in summer of 2021.

The Plan Bay Area 2050 Blueprint will integrate strategies for all four elements of the Plan to create a more resilient and equitable future for the region. Staff recommends further analysis of 25 strategies, clustered under nine themes, as part of the Draft Blueprint. The themes are:

1. Maintain and optimize existing infrastructure
2. Create healthy and safe streets
3. Enhance regional and local transit
4. Spur housing production and create inclusive communities
5. Protect, preserve, and produce more affordable housing
6. Improve economic mobility
7. Shift the location of jobs
8. Reduce risks from hazards
9. Reduce environmental impacts



FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

Environmental Challenges

In the past we've planned for suitability by trying to match land uses to the capacity of a site. We've planned for resilience by seeking to increase our capacity to recover quickly from events like earthquakes, fires, and temporary flooding. We've begun to plan for sustainability by trying to minimize our impacts on the environment, while supporting biodiversity and other ecosystem services. In our new era of infrastructure planning, planning will have to contend with unforeseen environmental changes.

Our City has declared a Climate Emergency. According to the 4th California Climate Assessment, new climate conditions will lead to: more frequent and severe heatwaves and intense precipitation events; major fires; reduced air quality and regional biodiversity; and gradual flooding of coastal highways, parks, and neighborhoods around the Bay Area. Road systems, sewer systems, new construction, and land use decisions will need to adapt to this changing environment.

Increasing heat, rainfall extremes, wildfires and rising sea levels will affect where people live, public health and will increase maintenance costs. The City needs a vision that reflects how these trends are connected. Our shared public investments, policies and actions must work to mitigate climate impact and adapt to long-term environmental changes, as well as build our resilience to short-term events such as a heat waves and extreme precipitation.

INCREASING HEAT

Hotter air leads to more intense rainfall, drier vegetation, and air quality problems that impact people's health. Research shows the links between increased air temperature and people's health, the health of urban trees that could cool our homes, and the maintenance costs for our infrastructure. More heat means higher maintenance costs and lower performance for conventional "gray" infrastructure. California's 4th Climate Assessment is the best science-based prediction of our future local climate. It states that Berkeley can expect an increase in air temperature along with boom-and-bust rainfall years.

Observations since 1950 show a decrease in the number of foggy days. In dry years, Berkeley has and will experience less fog, less humidity, and more days with reduced air quality. This changing weather may cause an increase in the mortality of trees that cool our homes. This may result in even higher air temperatures and energy demand in buildings. Furthermore, dead and dry vegetation is more dangerous as a fuel for fire in the hills of Berkeley. Increased air temperatures will lead to increased health problems, will impact outdoor recreation, and will harm those who are medically fragile. Additionally, there is evidence that hotter streets need more frequent maintenance and that heat is associated with breaks in underground water pipes.

Figure 1 from page 10

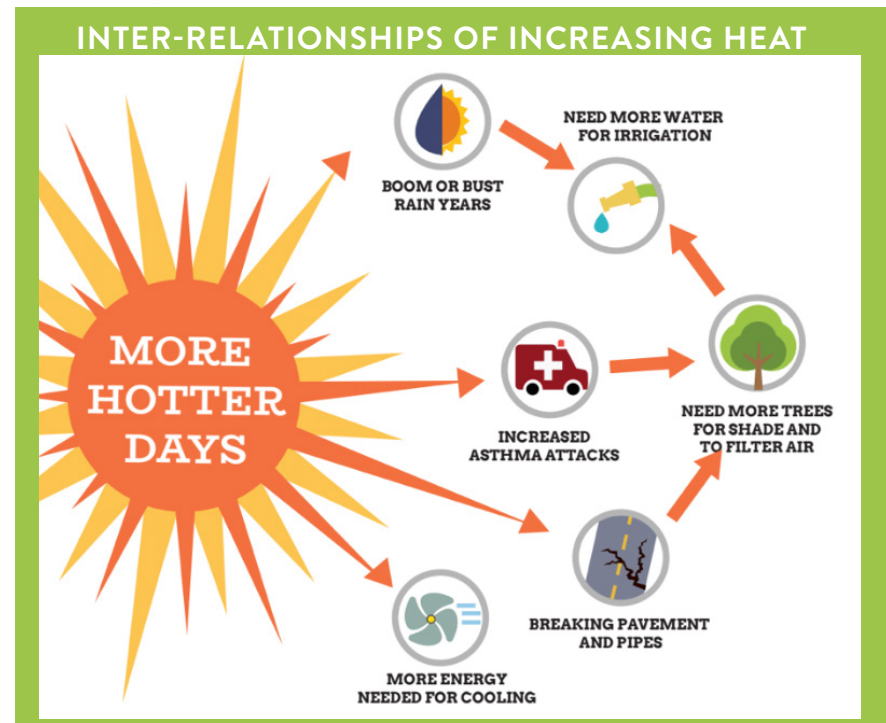


Figure 7

SIGNIFICANT CHANGES IN PRECIPITATION

California’s 4th Climate Assessment projects that the Bay Area will experience more “boom and bust” years – both very wet and very dry conditions – in the coming decades. Our largest winter storms, called “atmospheric rivers,” will likely become more intense, bringing challenges to Berkeley’s stormwater system, leading to more and deeper potholes as well as increased flooding. Longer droughts – like the 2012-16 drought which led to the most severe moisture deficits in the last 1,200 years – will parch our precious parks and open spaces. As rainfall totals decrease, higher temperatures and longer heatwaves will dry out vegetation significantly, increasing fire danger and degrading streetscapes and green areas.

Warmer temperatures are also predicted to make a substantial change in the Sierra snowpack, which is the source of the vast proportion of EBMUD’s water supply (see Figure 7). Under a high emissions scenario in California’s 4th Climate Assessment, the average overall Sierra snowpack will decline by 20% in the next few decades, 30%-60% in mid-century, and over 80% in the late 21st century. Consecutive years of low or no snowpack are especially worrisome. In addition, warmer temperatures are producing a shift to earlier snowmelt in the Sierra, posing storage and supply problems for high water demand periods that occur in hot summers and falls.

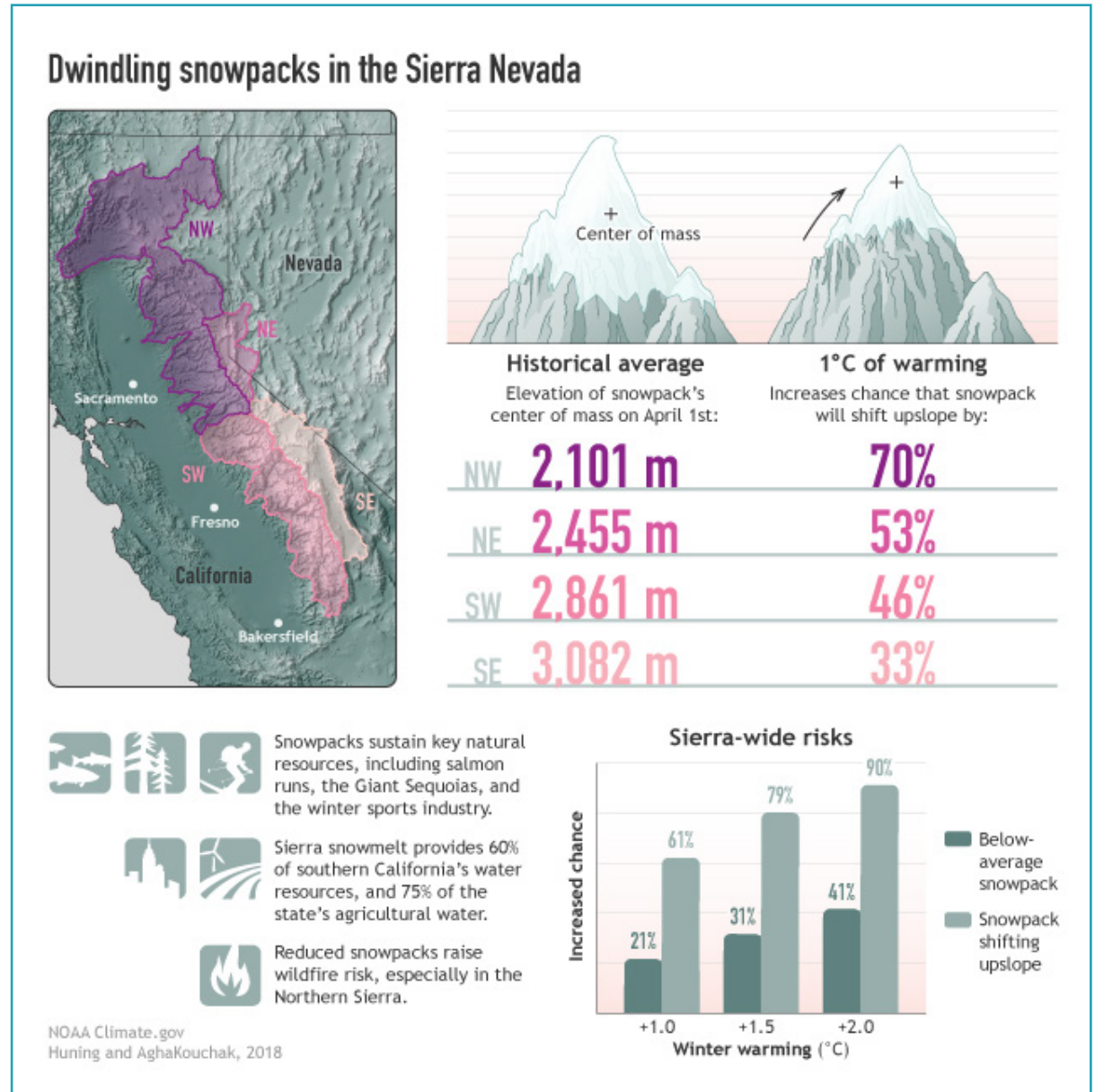


Image: NOAA Climate.gov / Fiona Martin

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

WILDLAND FIRE RISK

2017 was the hottest year on record in California, following five years of drought that killed 129 million trees in California. Five of the most destructive wildfires in the state’s history burned between October and December 2017, and the number of wildfires that year (7,117) almost doubled the historic average of 4,835. The carnage continued in 2018 with 5,847 fires before the traditional fire season even began, destroying over one million acres, razing thousands of homes, and taking dozens of lives. The entire town of Paradise burned to the ground in less than two hours, taking close to 90 lives. The Camp Fire that engulfed Paradise was the most costly natural disaster in the world in 2018. At the same time, the smoke from these fires that were 100 plus miles from Berkeley produced serious air pollution problems for our residents and workers.

Climate change has increased temperatures and drought, which will inevitably lead to even more severe fires and a longer fire season. While Diablo wind-driven fires are nearly impossible to stop, there are a number of steps our city and residents can take to reduce fire and smoke impacts on our infrastructure, health and quality of life. We must adapt to our higher fire risk climate by improving forest management, creating viable escape routes in high hazard areas, expanding pre-fire education and outreach programs, improving emergency warning systems, undergrounding overhead utility wires, creating “smoke-free” community centers during major smoke events, and taking other significant steps to protect our residents.

A critically important action will be to work with PG&E, the California Public Utilities Commission and other agencies to ensure that any Public Safety Power Shutoff activity (PSPS) does not block Berkeley’s emergency services, keep basic infrastructure from functioning, or adversely affect residents who require electric power in their homes for medical support. This work will be essential as Berkeley makes a major transition from natural gas to electricity for buildings and from gasoline-powered cars to electric vehicles.

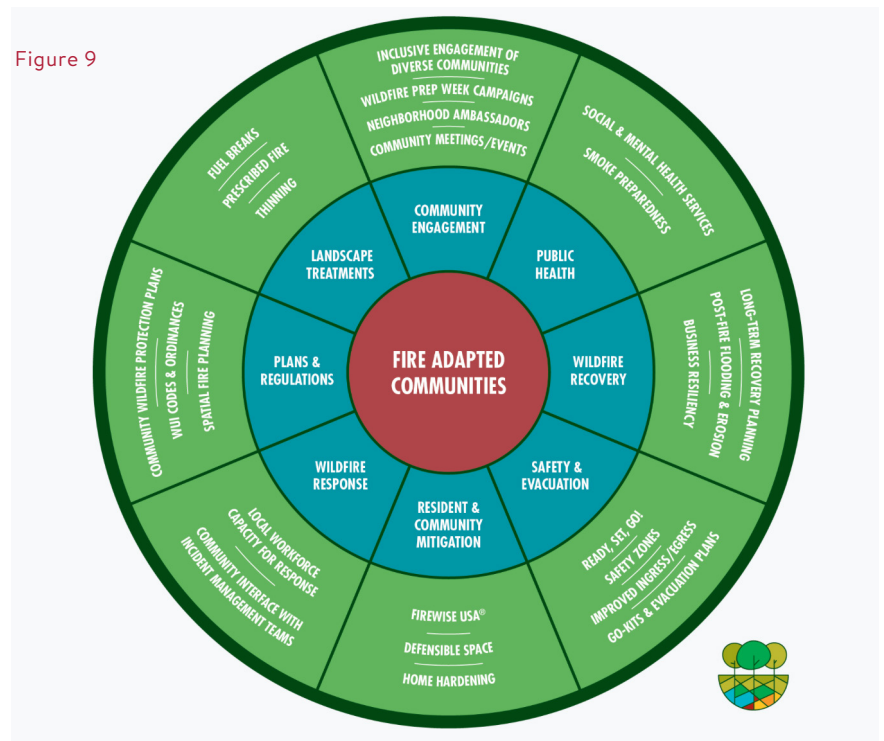
Figure 8



Paradise, CA, during the Camp Fire

Photo: Scott Strazzante for the SF Chronicle

Figure 9



Fire-Adapted Communities Learning Graphic

For more visit: fireadaptednetwork.org

SEA LEVEL RISE

Both California’s 4th Climate Assessment and the State of California’s recent guidance to public agencies on sea level rise tell us that Berkeley can expect to see significant sea level changes over the next 20-80 years and beyond (see Figure 10). Although no one knows exactly how much and how rapidly the Bay will rise, the State has provided a range of estimates to show the low, medium-high, and extreme risk scenarios.

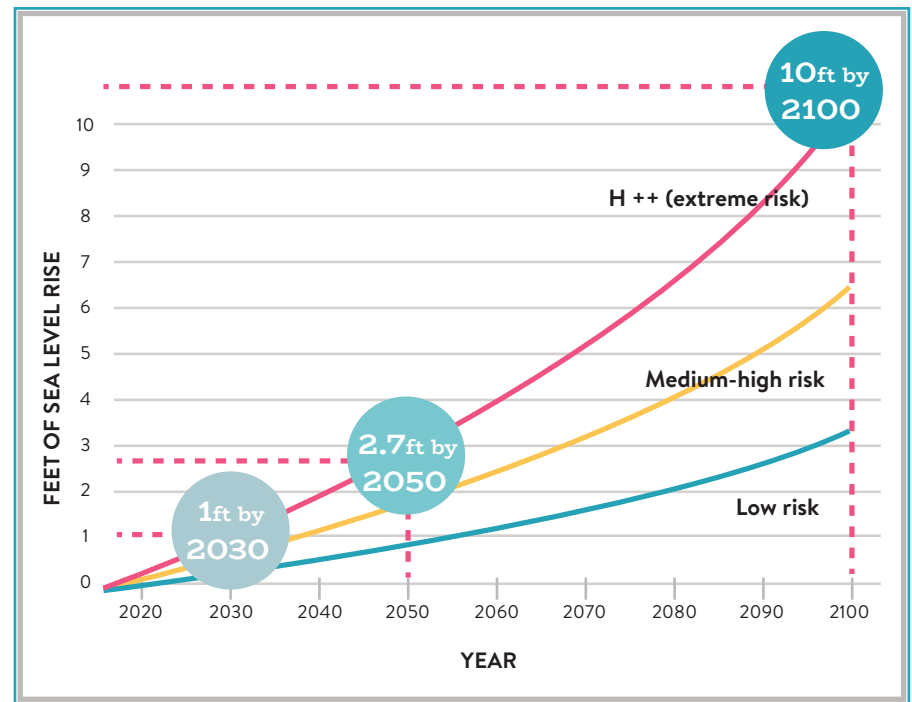
By 2050, the State has identified a range of likely sea level rises between 1.1 to 2.7 feet. Many scientists believe that the amount of carbon and methane in the atmosphere today has committed us to an eventual rise in sea level of up to 10 feet by 2100. As scientists have learned more about the dynamics of ice sheet melting, they have developed scenarios for even greater levels of sea rise until some equilibrium is reached between the elevated levels of CO2 present and the amount of heat trapped in the ocean.

California’s science-based guidance to public agencies recommends that local jurisdictions consider “medium-high risk” predictions when planning long-term facilities (i.e., facilities meant to last 20-50 years). For investments meant to last beyond 50 years, the State recommends that we consider the potential for an extreme sea level rise scenario. Many scientists think that we’ll know a lot more about which sea level trend is actually occurring in the next decade or two.

We need to consider the expected lifetime of our infrastructure as well as the rate and timing of sea level change. It is imperative that longer lived assets can withstand potential extreme sea level rise.

Coastal parks and bike trails will be affected, both by sea level rise directly and by increased erosion from wave action that reaches higher areas of the land. This potential impact will push us to decide where we locate public access (and private facilities that pay fees to the City), and where improvements will be lost or need to be reconfigured. Intertidal wetlands will be lost unless investments are made to raise the

Figure 10



Sea level rise estimates from California State Guidance for public agency planning,

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

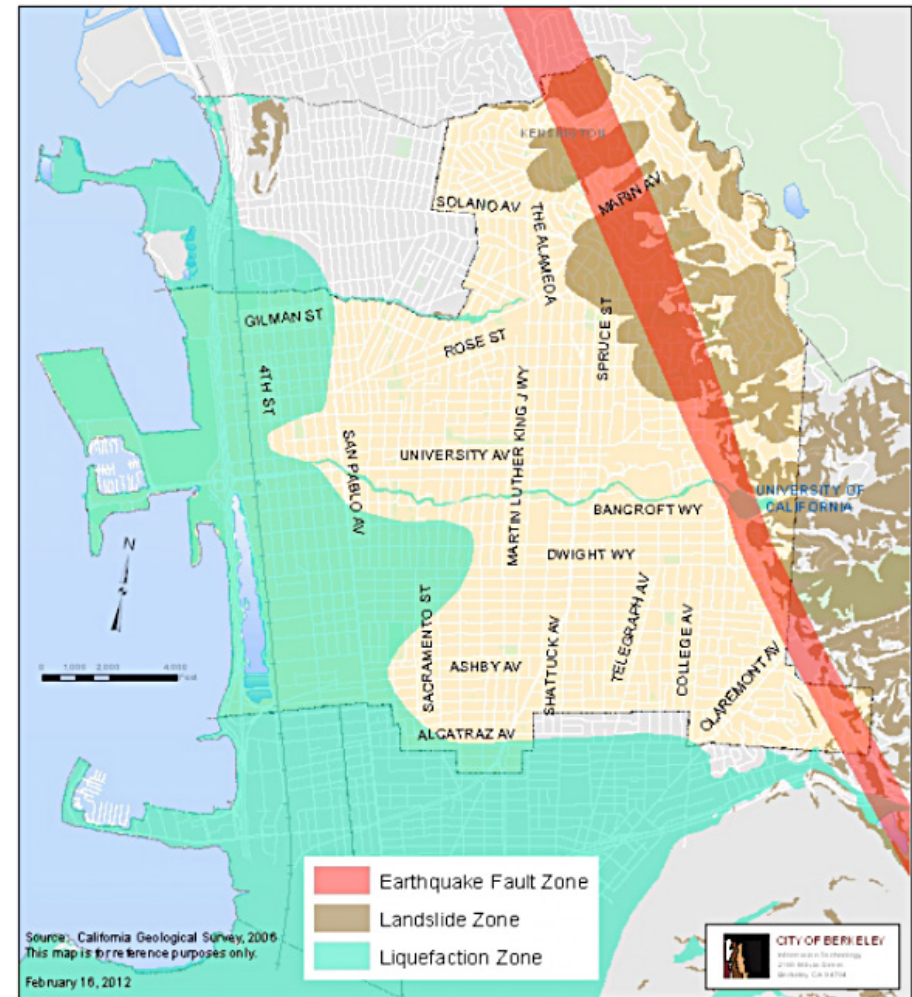
EARTHQUAKES AND LANDSLIDES

Berkeley's Local Hazard Mitigation Plan identifies earthquake and rainfall-triggered landslides as likely hazards with catastrophic severity of impact.

Most of our thinking about acute land changes centers on the destruction of hundreds of building structures. However, the impacts to our infrastructure range from rupture and blockage of water, sewer, and gas pipelines to toppling of power and communication poles and overhead structures. This could result in the loss of power for weeks and the destruction of 5,000 water lines, most of which will not be repaired for months. Street and sidewalk buckling and failure has the potential to impede emergency responders and evacuation routes. Although the earthquake fault runs through the eastern portion of Berkeley and there may be extensive damage from shaking and landslides, most of the seismically vulnerable buildings are in Central, South and West Berkeley. In addition, the gas pipelines and transportation network are centered in Central, South, and West Berkeley.

The reality of such a cataclysmic event will result in hundreds of people that will be forced to move out of town or need to live in shelters. Schools will close. Businesses will fail. Plans must be developed and action taken soon to make the city as resilient as possible in the face of these threats.

Figure 11



The Hayward Earthquake Fault runs through the east of Berkeley but threatens infrastructure throughout the city.

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

COMBINED EFFECTS

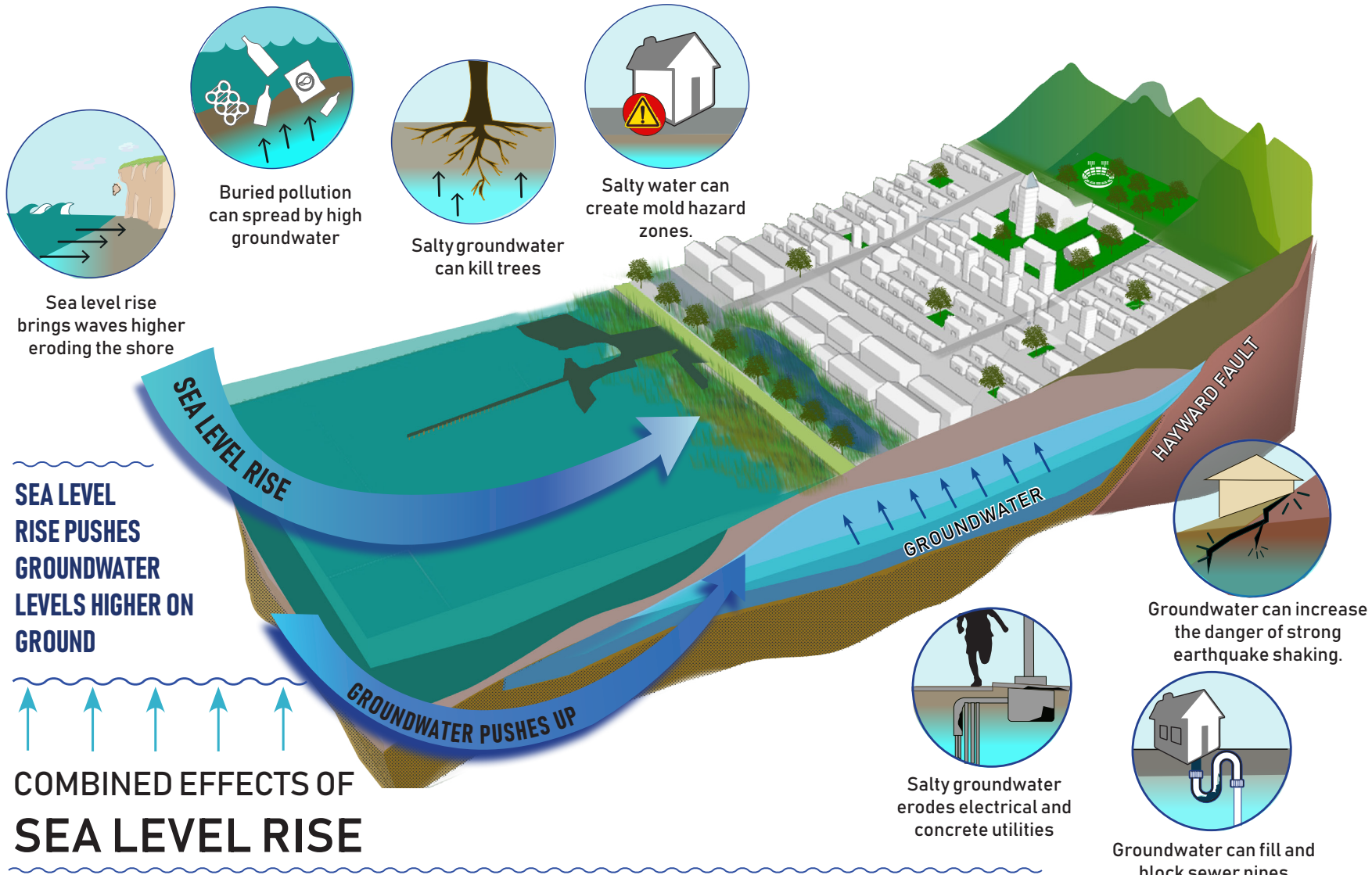
Sea level rise is very likely to produce unexpected impacts through networks of cause-and-effect. The US Geological Survey has shown that rising sea levels will cause groundwater to rise within a few miles of the shoreline. Loss of marshes will devastate biodiversity historically hosted in vegetated bay shores. This change could flood sewer and stormwater lines and basements. It could also move soil and cause the spread of groundwater pollution, creating serious health threats. Sea level rise may lead to corrosion of the pipes that hold underground electrical and communication utilities. Street pavement is more prone to cracking in a high-groundwater environment. High groundwater can also increase the risk of extreme shaking in an earthquake, resulting in greater damage to property and loss of life.

We can adapt to this challenge, but we need to understand the cause-and-effect network connections in order to determine the best investment and design strategies.

While other lower lying communities around the Bay will experience serious impacts from sea level rise before Berkeley, we will all be affected within the life span of many of our infrastructure investments. Our regional wastewater, transportation, refineries, and pipelines will require significant adaptive investment. Many regional facilities will need to be relocated. Our bay shoreline, roadways, and western neighborhoods already suffer flooding impacts of rising sea and groundwater levels when combined with severe storms and king tides. Long-term infrastructure investments should be evaluated frequently against evolving sea level rise data and projections.

Figure 11

COMBINED EFFECTS OF SEA LEVEL RISE



SEA LEVEL RISE PUSHES GROUNDWATER LEVELS HIGHER ON GROUND

COMBINED EFFECTS OF SEA LEVEL RISE

Buried pollution can spread by high groundwater

Salty groundwater can kill trees

Salty water can create mold hazard zones.

Groundwater can increase the danger of strong earthquake shaking.

Salty groundwater erodes electrical and concrete utilities

Groundwater can fill and block sewer pipes

Image: Michelle Hook

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

THERE IS NOT ONE ANSWER FOR BERKELEY

Our infrastructure corridors connect us, providing transportation, water, waste, power and communication networks. Berkeley grew in the 19th century along the shipping corridors on the bay with the pier and the railroads moving goods and people north and south from farms and factories. With the establishment of the university, the center of town shifted east from old Oceanview and Berkeley spread, developing our 20th century grid of water, sewer, gas, telephone and power along the streets from the Bay to the hills.

From an infrastructure and climate point of view, Berkeley has three different “zones,” each with its own unique challenges. These different zones of Berkeley have unique needs. Infrastructure planning and implementation must recognize historic and present inequalities, and avoid using “equality” (i.e., giving everyone the same thing) as a substitute for “equity” (i.e., making sure people have access to what they need).

The Hills have the highest risk of fires, seismic shaking, and landslides. Steep slopes and narrow, winding roads make evacuation difficult. Adaptation will require careful management of vegetation, and finding opportunities to shelter in place when evacuation is impractical. Water pressure needs to be high for firefighting, and electric utilities should be placed underground.

The Flatlands have the highest flooding risks as climate change and development increase runoff from higher elevations. Rising sea levels and groundwater will keep water from seeping into the soil and flowing into the Bay. Poorer air quality impacts neighborhoods along Interstate 880, University, Ashby and San Pablo Avenues due to heavy and increasing traffic. Below surface infrastructure will need to be waterproof, and the risks of extreme shaking may increase as groundwater rises. These neighborhoods have the least amount of tree canopy yet they have the highest traffic impacts. Efforts should be made to increase green infrastructure to absorb the effects of carbon emissions in heavily impacted traffic corridors.

Figure 12



The Berkeley Hills are in need of fire prevention, Downtown and South Berkeley require density planning and environmental health management, and West Berkeley (the Flatlands) has a particular need for air quality control and flood protection.

Downtown and South Berkeley are particularly vulnerable to heat and experience high traffic demand due to population density. Pedestrians and bicycles must have safer streets and sidewalks. Additionally, these neighborhoods need greener infrastructure (trees and rain gardens) to help manage both storm water and air quality. Since they sit at the base of the hills, storm water and groundwater can emerge as springs and flood basements. Infrastructure and sidewalks need to be enlarged and redesigned to handle growth and development, support street-tree canopies, and become more people-friendly.

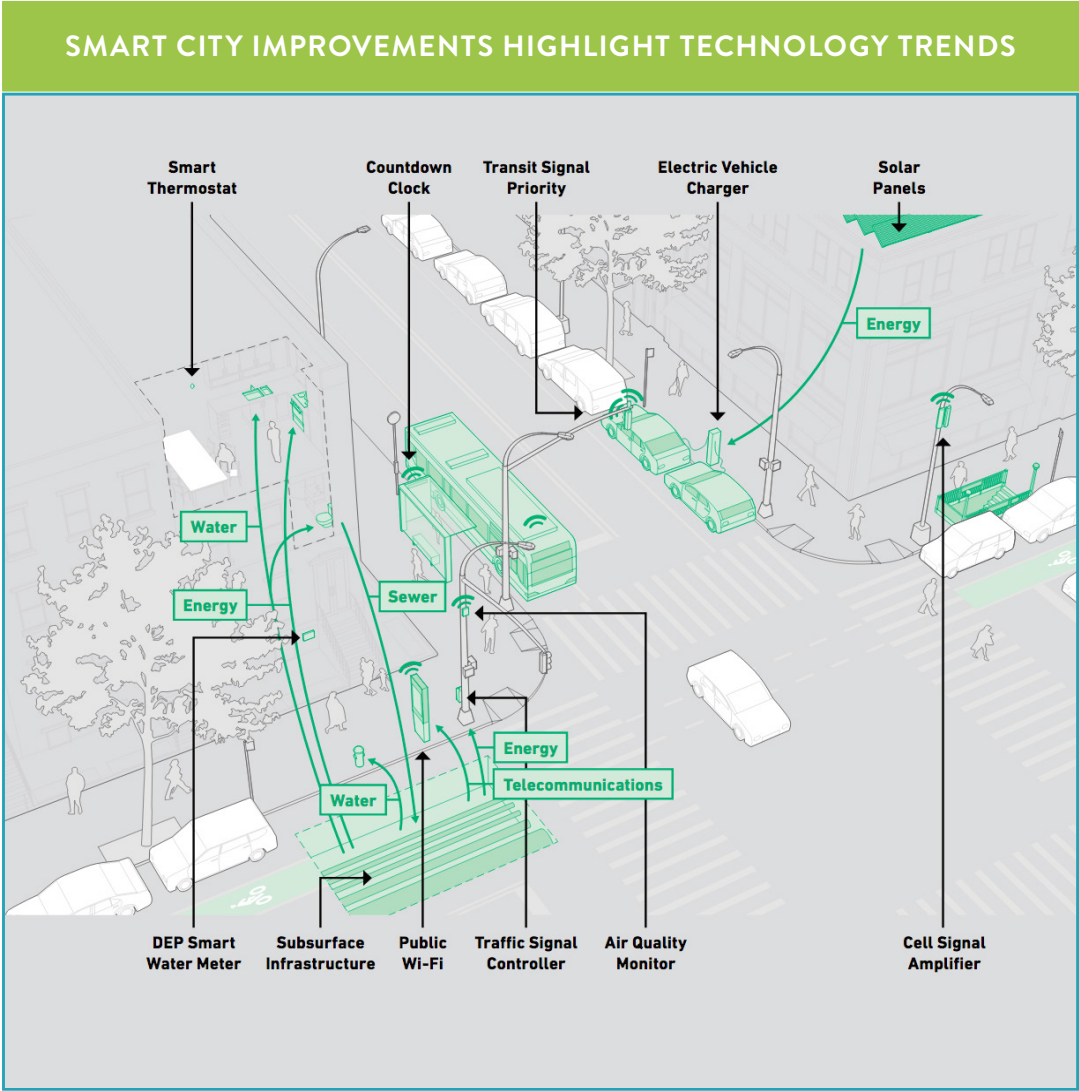
Figure 2 from page 11

Technology Trends

Technology affects the way we use Berkeley’s infrastructure and is challenging the ability of existing infrastructure to meet future needs. While technology offers many opportunities to improve infrastructure, the City will need to work proactively to:

- 1. Understand and incorporate new beneficial technologies
- 2. Take steps to prevent potential negative impacts
- 3. Ensure that benefits of improved technology are shared widely and equitably

We consider seven areas of technology that will affect the services provided by the City: buildings, energy, transportation, information technology, water, waste management, and emergency services. Technology in each of these areas has changed dramatically and will continue changing over the next 30 years. While it is impossible to predict exactly what technologies will be available in five years, let alone 30 years from now, we can identify general trends and the challenges they pose to current infrastructure approaches. Our local partners, including UC Berkeley and Lawrence Berkeley National Laboratory, will be important collaborators in this process to help the City stay abreast of current research, projections, and innovations.



FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

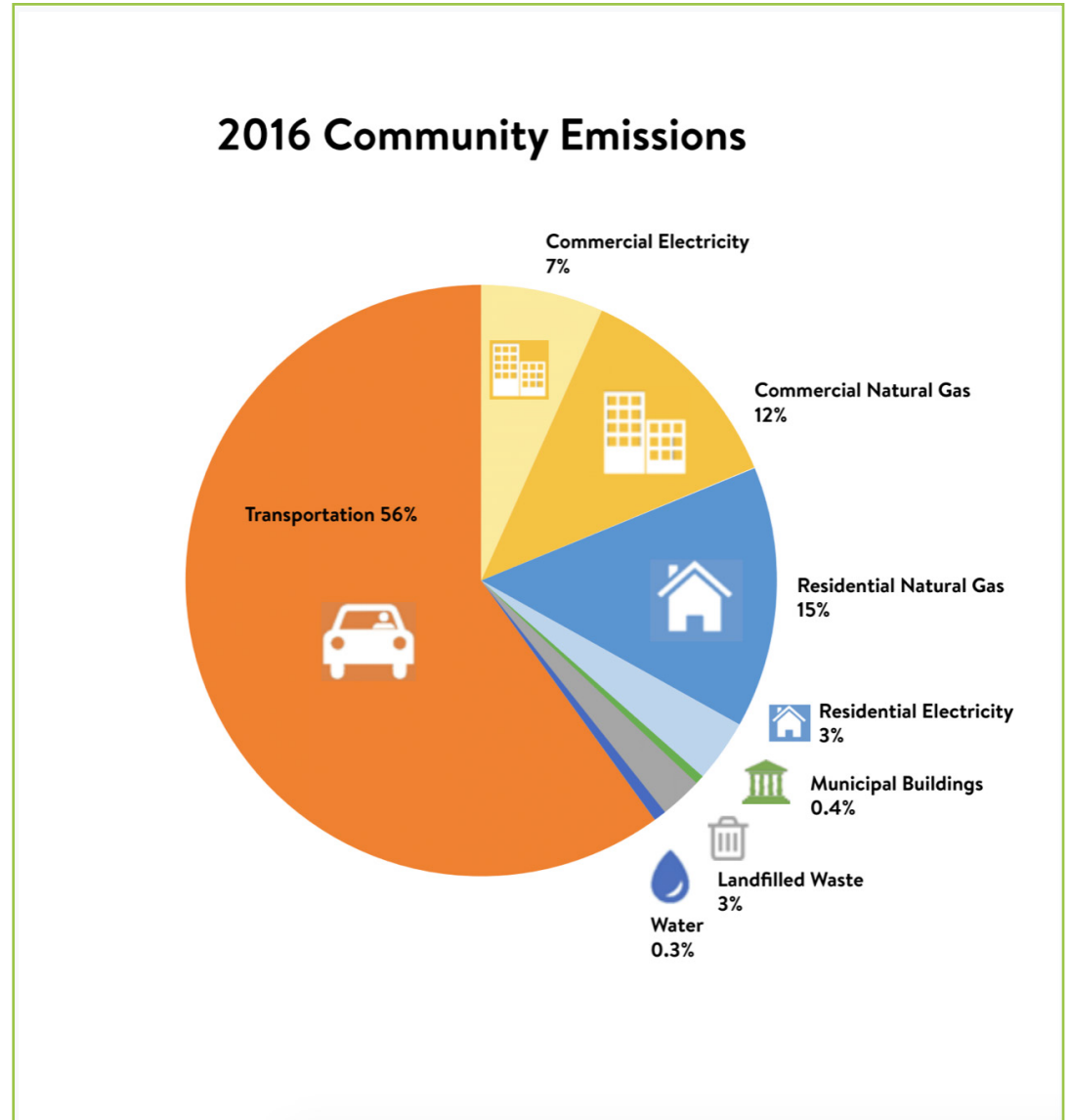
BUILDINGS

Berkeley has approximately 50,000 residences, over 3.4 million square feet of commercial building space, and approximately 100 public buildings within the direct control of the City. Taken together, these buildings account for just under 40% of the GHG emissions in Berkeley.

In order to meet state climate action targets through 2050 (and for the City to meet its Climate Action Plan goals), these buildings will need to become more energy and water efficient. They will also need to move off natural gas and rely on the increasingly clean electricity grid, which the state has committed to make zero carbon by 2045. This electrification effort involves replacing equipment like water heaters and furnaces with heat pump technologies, using electric induction cooktops, and relying on some limited electric resistance heating (e.g. in kitchen ovens). It will also involve taking steps to improve efficiency by adding insulation, sealing up cracks, and upgrading windows. Homeowners, designers, and contractors will need to learn about new products on the market and be part of this transformation in our buildings. In some cases, electrical panels will need to be upgraded to support electrification. The City can help develop a local market of installers for electrified technologies and help streamline permitting processes.

Buildings will increasingly include energy generation and energy storage that have been traditionally taken care of by central utilities. We will be seeing more solar panels, microgrids, and batteries. Our buildings will also be the site of more distributed water-related services such as storm water and domestic water capture, water treatment, and reuse.

Figure 13



This chart breaks down the sources of GHG emissions in Berkeley.

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

TRANSPORTATION

Berkeley's transportation networks — including roadways, sidewalks, bicycle and pedestrian bike paths, public transit systems, fleets, as well as shared and private automobiles — move people, goods and services around the city. These transportation activities account for about 60% of Berkeley's GHG emissions. To meet climate mitigation targets, transportation will need to become electrified (or in some cases moved to alternative, zero-GHG emission fuels). Electrification will require new electric vehicle charging infrastructure distributed among private homes, commercial properties, and within the public rights-of-way.

Rapid changes in transportation technology, usage patterns and services are also likely to reduce the rate of private vehicle ownership and create changing demands for public infrastructure. For example, the proportion of physical space allocated to parking will have to shift.

Transportation networks will have to support everyone — not just cars. “Complete streets” will enable a greater number of pedestrians and a variety of vehicle types, sizes, and speeds to pass safely on the public roads and pathways. Private companies providing ride hailing services and micro-mobility solutions (such as pay-and-go bicycles, scooters, and cars) will become more prevalent. There will also be increasing demands for flexible public transportation solutions provided by our regional partners such as AC transit and BART to meet the diverse needs of the community and manage congestion.

A primary challenge for the City is that transportation technologies are significantly changing, altering the basic design and allocation of space within the public right-of-way. These changes in transportation modes and demands impact congestion and pollution and will require that the City balance the needs of people's quality of life with changes to their mobility.

Figure 14



Complete streets will accommodate varied modes of transportation. Image: OHM Advancing Commu-

ENERGY

Energy demands in the City of Berkeley include the production, distribution, storage, and consumption of energy used to meet residential and commercial needs. This energy consumption accounts for about 40% of our community GHG emissions. As identified in the City's Resilience Strategy and Climate Action Plan, Berkeley seeks an energy system that, by 2050, delivers carbon-free electricity across a highly distributed system. Multiple and multifaceted changes to existing infrastructure and its uses will be required to achieve carbon reduction goals. In general, these changes can be summarized as: 1) maximize energy efficiency, 2) electrify everything possible, 3) decarbonize and clean up the grid, 4) develop additional wind and solar power sources on public land and 5) phase out use of fossil fuels.

While California has established a policy framework that will achieve a carbon-free grid by 2045, Berkeley has the ability to achieve a local carbon-free grid more quickly. The City has significant control and influence over local energy infrastructure and technology choices, particularly for public and city assets. From developing solar canopies over parking spaces in the public right-of-way in the Berkeley Marina to providing incentives for home electrification, including heat pump

FUTURE CHALLENGES FOR OUR INFRASTRUCTURE

technology and induction cooking, there are many opportunities for the City to contribute to a carbon-free future.

As the devastating wildfire seasons of 2018 and 2019 demonstrated, building more self-sufficiency and flexibility is an essential feature of Berkeley's resilient clean energy future. Critical facilities and services are vulnerable to power shutoffs caused by fires or other disasters. Clean energy microgrids, capable of providing electricity even when the larger grid is down, must be prioritized at public health and safety facilities, and encouraged elsewhere in the city. They can work in parallel with the grid, contributing to our state and national GHG reduction goals, but also harness local clean energy resources to provide power during extended outages. There may also be opportunities to underground more of the infrastructure, improving local safety and upgrading switches, relays, transformers, and other essential elements of the grid.

INFORMATION

By 2050, information flows in Berkeley will increase dramatically. Automobiles, trucks, appliances, communication devices, entertainment devices, information infrastructure components, and lighting devices will be able to communicate with each other. Major infrastructure components — road surfaces, structural elements of buildings, load-bearing components of bridges and towers, all piping and pumping infrastructure for water, wastewater, airflow and air conditioning, all cabling and energy transport infrastructure — will gradually incorporate sensing and communication for real-time information. The City must incorporate plans to manage this explosion of information, ensure equal access, and address security risks. Public concerns about harms from electromagnetic spectrums must be addressed with the best evidence available and weighed against public benefits. Related to the undergrounding of electricity infrastructure and a “dig-once” policy, the City must find a way to facilitate more widespread deployment and use of the public right-of-way for fiber-optic conduit or whatever future permutations of the hardwired information grid

require. The City can't rely on the private sector alone to provide bandwidth in a way that ensures broad and equal access.

WATER

Water services encompass the complete hydrological cycle: rain and storm water, surface flows and containment, subsurface groundwater flows, clean water use, and wastewater distribution and treatment. The primary technical challenge will be in renewing aging water infrastructure. The East Bay Municipal Utility District has a Pipeline Rehabilitation Program that will repair or replace water pipelines that are nearly a century old. Berkeley's sewer pipelines are currently being repaired or replaced to reduce the amount of stormwater leaking into the system. This work is using new technologies with “pipe bursting” installation and with using high density polyethylene (HDPE) pipe.

New opportunities for stormwater management lie with the use of green infrastructure (such as bioswales and rain gardens) and the use of permeable surfaces. For example, permeable pavement offers multiple benefits, such as stormwater flow attenuation, trash capture that will improve water quality to the bay, and a longer lasting street surface.

As we study the potential to provide supplemental water to our parks and median strips during drought conditions, there are opportunities to recharge with our groundwater by utilizing large residential and commercial buildings to install on-site wastewater capture and treatment systems.

WASTE

Waste management begins with how and what we consume, and also includes diversion to reuse, recycling, and composting. Berkeley continues to work to reduce the use and disposal of single-use products, and also has expanded the range of materials that can be reused, recycled, or composted. But plastic waste streams are increasing and

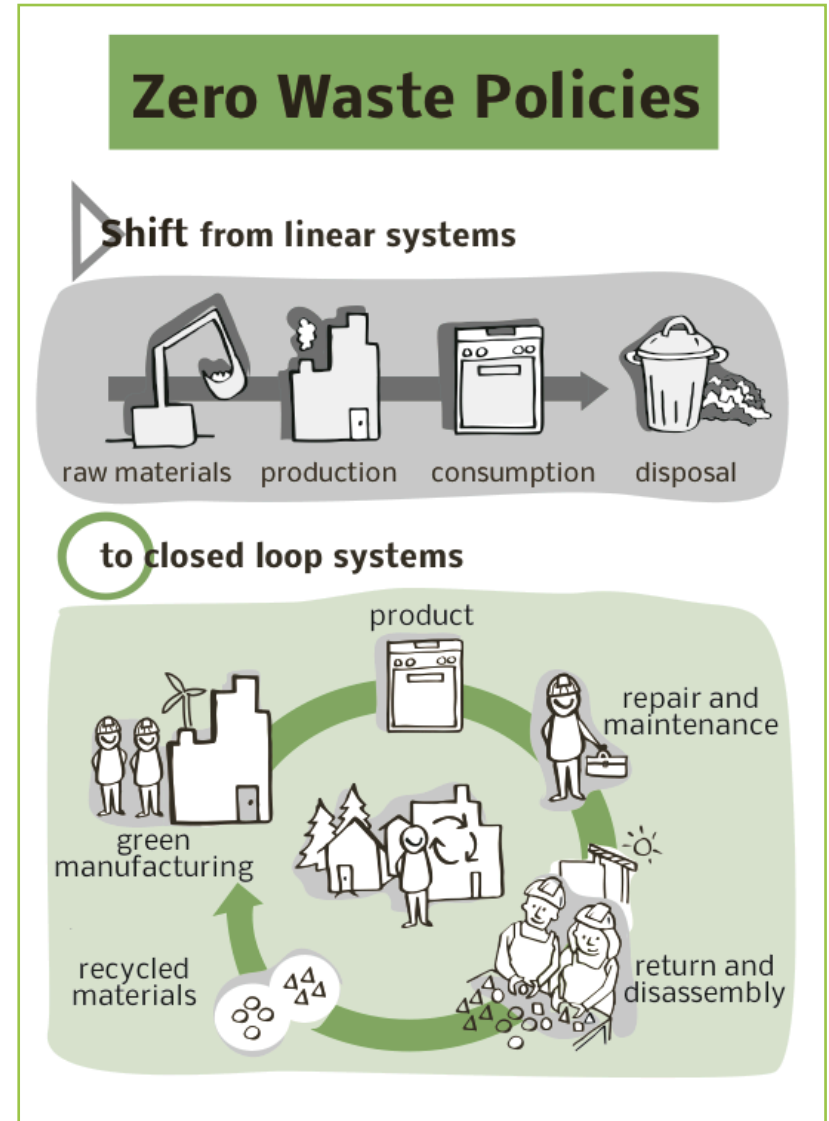
Figure 15

are not effectively recycled. Other waste streams are also increasing such as packaging from delivered goods.

Improvement in waste management requires people to change their behaviors and vendors to make upstream changes in the way products are designed and shipped to facilitate a closed-loop system. Neither behavior nor product design are in the direct control of the City. The markets in which materials have been recycled (involving shipping and treatment in Asia) are breaking down, degrading the success of local recycling efforts. Additionally, the capacity of local composting infrastructure is insufficient to meet even currently legislated requirements to eliminate food waste from the landfill. The challenge for the City will be to continue to evolve waste management facilities and help encourage the development of more local opportunities to impact the amount of waste the City produces and encourage recycling and composting.

EMERGENCY SERVICES

Fire, police, medical and mental health assets must be deployed to resolve inevitable conflicts, disasters and disruptions to city life. Particular care must be taken to ensure that Emergency Services have full access to the flow of information and are a carefully considered part of new infrastructure approaches. The City can help connect the dots – just as the City’s Resilience Strategy recognizes the value of having solar generation technologies that can still be used when the power grid has gone down. A primary challenge is continuing to engage Berkeley’s diverse population so that the community is prepared and empowered in the event of everyday emergencies as well as life-changing ones such as large earthquakes.



5. Finance for the Future

Meeting our challenges requires adequate resources. Vision 2050 proposes to transform Berkeley's core infrastructure, much of it developed during the New Deal, into a 21st century system with local funding sources. While this is no small task, a close look at Berkeley's finances reveals that, with some key policy changes and creativity, the City can make our local dollars go further.

The Bad News

The City of Berkeley has \$837 million of capital assets of which 50% have exceeded their useful life. The City's FY2020/21 Capital Plan calls for spending ~\$57 million/year on capital and maintenance needs. Even at this increased level of funding, Berkeley's infrastructure will deteriorate faster than it is being repaired and replaced, and construction cost escalation (~4%/year) will significantly increase replacement costs. For example, in FY2020, the City proposes to spend \$1.3 million/year maintaining storm drains. After five years, the unfunded liability for the storm drain system is projected to increase from \$241 million to \$259 million.

To modernize these old physical structures with resilient, durable, and climate-smart infrastructure will require substantial new investments. To adequately address the \$882 million in infrastructure unfunded liabilities, the City needs to double its annual capital spending over the next decade to ~\$80 million/year.

The Good News

Berkeley's finances are in good shape! In June 2019, Moody's Rating Agency upgraded the City's GO bonds from Aa2 to Aa1, which is the second highest for long-term debt. In its credit analysis report, Moody's stated that "The City of Berkeley, CA (AA1) has a robust tax base and economy benefiting from its central Bay Area location. The city's assessed valuation (AV) is large and growing, supported by strong resident wealth indicators. The city has a very strong fiscal position, with growing revenues, high available fund balances and strong financial management policies and practices.

In the last two decades, General Fund revenues have doubled from \$100 million to \$200 million. The Total City Budget increased by a similar percentage to ~\$457 million in FY2019. Revenues are exceeding expenses and the City's Investment Portfolio, which holds unspent funds, has increased by 300% over this period. Recently, Berkeley voters have demonstrated that they strongly support increasing infrastructure spending by approving the authorization of \$235 million of new General Obligation bonds (Measure T1 & O) by overwhelming margins.

Capital expenditures are typically funded through a combination of debt financing (pay-as-you use) and cash (pay-as-you-go). Paying in cash avoids the cost of interest, but requires the City to accumulate sufficient cash to fund the project, while construction costs escalate. Using debt to finance capital projects incurs interest expense but allows the project to start earlier, avoiding escalation costs. Finally, there is the option of using both cash and debt to finance infrastructure. An example of this is the Center Street Parking Garage project.

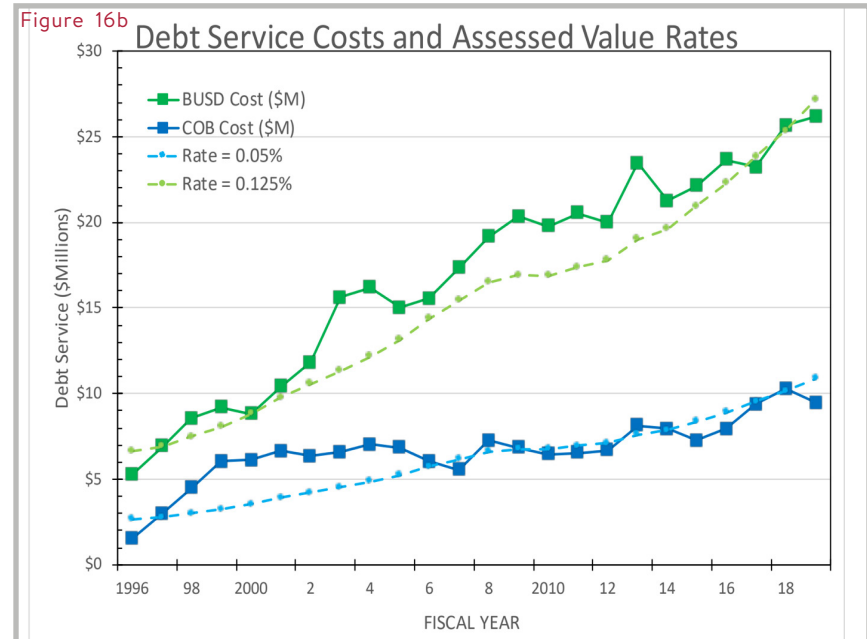
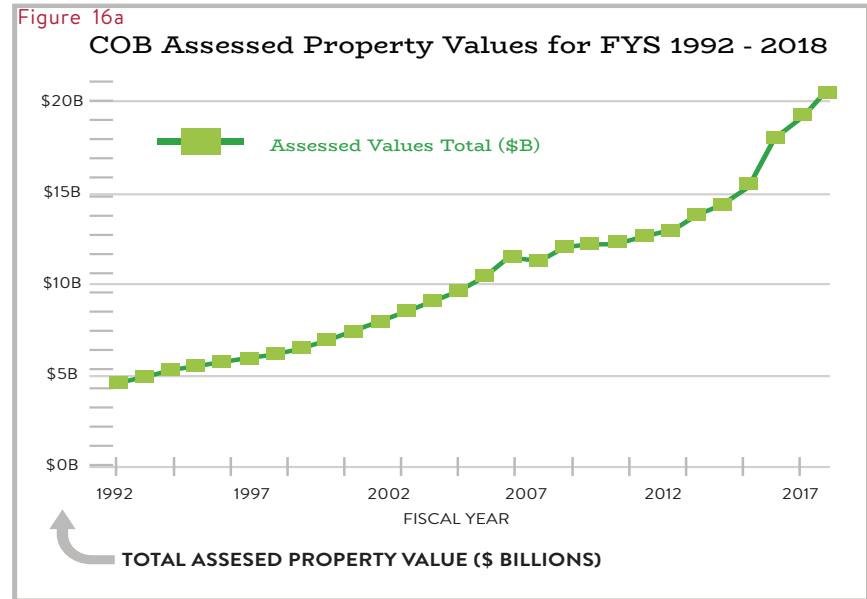
General Obligation Bonds (GO) are backed by the “full faith and credit” of the issuer. Typically, GO bonds are based on the assessed value of the property within the jurisdiction, and require voter approval by a two-thirds majority. Borrowing capital funds depends on the City’s credit rating. In FY2019, Berkeley Unified School District (BUSD), which has annual revenues of ~\$210 million, borrowed \$331 million and received a credit rating on its GO bond debt from Standard & Poor of AA+. The City, which has annual revenues of ~\$457 million, borrowed \$112 million, and also received a credit rating of AA+.

So how does the school district, with less than half of the City’s budget, borrow three times as much?

The amount of debt a municipality can issue depends on the total assessed value of property in the city and its bond rating. Over the last quarter century, Figure 16a shows that the total assessed value of property located in the City has increased from \$5 billion to \$22 billion or over 300%. This strong increase in assessed values allowed the City to increase its debt service revenue from ~\$2 million to \$10 million/year and its GO bonds debt from \$30 million to \$112 million, while keeping its debt service rate on assessed values roughly constant at 0.05% (see COB Actuals in Figure 16b).

Over the same period, Fig. 16b shows that BUSD has kept its debt service tax rate at ~0.125%, which generated ~\$5-\$26 million in debt service revenue. This allowed the school district to borrow almost \$330 million, compared to \$112 million for the City.

If interest rates stay low and property values continue to increase at 5.5%/year and Berkeley increases its debt service rate to 0.125% to match BUSD, the City could service ~\$1 billion in bond debt in 2050.



FINANCE FOR THE FUTURE

Revenue Bonds are defined as municipal bonds that finance projects that have revenue streams to support them. The income generated by the revenue stream pays the interest and principal on the bonds. Recently, the City of Berkeley issued a \$34 million revenue bond backed by Parking Meter revenue with a coverage ratio of 2.55. In contrast to Berkeley, which issues mostly GO bonds, EBMUD issues all of its debt as revenue bonds. With a revenue stream of ~\$100 million, EBMUD's Wastewater (WW) system supports ~\$400 million in bond debt, while maintaining a AAA bond rating from Standard & Poor's.

Berkeley has a number of enterprise funds that provide services that generate revenue streams (~\$105 million) comparable to EBMUD's WW system. If the cash generated by all of the City's enterprise funds could generate a similar coverage ratio to the Center Street Garage, then Berkeley may be able to carry ~\$350 million in revenue bond debt, compared to the current \$60 million.

A Parcel Tax is a pay-as-you go tax. In Berkeley, parcel taxes are based on the square footage of the structures located on the property. A parcel tax is equitable because owners of the same size home pay the same amount regardless of when the property was purchased. Parcel taxes are also progressive, since the owner of a larger structure pays a larger tax than the owner of a smaller structure.

Berkeley has several parcel taxes, such as the Library and the Parks taxes, which in FY2018 generated \$19.4 and \$13.1 million, respectively. Parcel taxes are particularly well-matched for long term programs of construction/maintenance such as street maintenance/repair or undergrounding. Currently, Berkeley has ~78 million square feet of total taxable building space. Thus, a new parcel tax of 10 cents/square foot would generate \$7.8 million/year.

General Fund The majority of San Francisco's ongoing annual capital needs are funded with General Fund (GF) dollars. These are typically smaller investments to maintain facilities and infrastructure in a good state. The two largest categories are Street Resurfacing and Facility Renewal.

San Francisco also supplements its GF capital program with revenue bonds financed with GF monies. San Francisco dedicates 3.25% of GF revenues to finance GF Revenue Bonds. The advantage of this approach is that over time as the GF increases, additional GF Revenue Bonds can be issued, which allows staff to do long-term planning and establish a project queue. Although Berkeley assigns the excess revenue from the Transfer Tax over \$12.5 million to its Capital Improvement Fund, the volatility of the Transfer Tax makes long range planning difficult.

As reported in Moody's recent bond rating upgrade, for the last five years Berkeley's General Fund operating revenues have exceeded expenses by an average of 8%. This annual surplus suggests that the General Fund could make a larger annual contribution to an infrastructure capital reserve fund. For example, if Berkeley were to dedicate 3.25% of its General Fund revenue to such a Reserve Fund, in FY2019, this would have generated ~\$7 million to address ongoing capital needs.

Community Services District During the next quarter century, new development will continue across the city. This will increase the City's tax base, but will also increase the need for infrastructure upgrades. A key equity principle is that if up-zoning is allowed, the public must share in the wealth created. San Francisco has used this principle to impose a Community Services District (CSD) for up-zoned properties and only for the increment of additional density granted. As an example, if the city were to provide further up-zoning in Downtown or in the southside, an additional development envelope should be allowed

only if the property owners agreed to create a districtwide Community Services District. The CSD could then fund additional infrastructure needs or allow other public benefits to accrue to the district. These benefits can include green infrastructure, wider sidewalks, better streetlights, or even new parks. In addition, the district could fund the maintenance of some of these assets, providing a source of both capital and operating funds. The CSD requires a study and nexus of benefits to the district and creates a rate (based on the ad valorem value) of the development subject to the tax.

Berkeley's Catastrophic Reserve was established to sustain General Fund Operations in the event of a public emergency such as a natural disaster. Currently, this reserve fund totals ~\$17 million. Since the City's monthly expenditures are ~\$39 million, \$17 million is clearly inadequate to fund the City's response to a major earthquake or wildfire.

The City does have a large pool of liquid funds in its investment portfolio, which as of December 31, 2018 contained \$446 million in Total Cash and Investments. This fund includes several employee trust funds totaling ~\$45 million. The \$401 million balance consists of unspent fund balances, bond proceeds, additional reserves, and operating cash. Berkeley should not rely exclusively on bond funding to meet its infrastructure unfunded liabilities. To better align the priorities expressed by voters, the City should dedicate more of its existing revenue streams to address this major infrastructure unfunded liability. Failure to provide funding to maintain and modernize existing infrastructure will greatly increase the future cost due to inflation and the increase in construction costs, which is currently running at 5% per year. The City should conduct a study of the options to fund a long-term infrastructure capital program.

6. Our Recommendations

The City of Berkeley has an infrastructure system that has allowed us to thrive and grow for over 100 years. The Vision 2050 team commends the City for the planning it has done and the programs underway to keep our systems working.

Now is the time to comprehensively plan across all City departments, incorporate new technologies and adapt to meet environmental trends so that our systems can continue to reliably support us for another 100 years.

The Vision 2050 task force has developed three guiding principles for our infrastructure development. These principles resulted from reviewing City plans, considering our core values and the evaluation of our challenges ahead.

THE VISION 2050 TASK FORCE HAS DEVELOPED THE FOLLOWING GUIDING PRINCIPLES FOR OUR INFRASTRUCTURE DEVELOPMENT



PRINCIPLE ONE
Support Vibrant and Safe Communities



PRINCIPLE TWO
Have Efficient, Inspired and Well Maintained Infrastructure



PRINCIPLE THREE
Facilitate a Green Berkeley and Contribute to Saving Our Planet

THESE PRINCIPLES ARE SUPPORTED BY THE FOLLOWING STRATEGIES AND RECCOMENDATIONS



STRATEGY ONE
Ensure Integrated And Balanced Planning



STRATEGY TWO
Manage Infrastructure from Cradle to Grave



STRATEGY THREE
Adopt Sustainable and Safe Technologies



STRATEGY FOUR
Invest in Our Future



STRATEGY FIVE
Prepare the City's Organization to Implement a Major Capital Program

PRINCIPLES, STRATEGIES, AND RECOMMENDED ACTIONS

PRINCIPLE ONE

SUPPORT VIBRANT AND SAFE COMMUNITIES

Infrastructure shall take equity into account and improve the quality of life of all Berkeley residents, including having green open spaces, safe modes of mobility, and being prepared for fires and earthquakes.

PRINCIPLE TWO

HAVE EFFICIENT, INSPIRED AND WELL MAINTAINED INFRASTRUCTURE

Infrastructure shall be long lasting, use advanced technologies, and be maintained to provide efficient service.

PRINCIPLE THREE

FACILITATE A GREEN BERKELEY AND CONTRIBUTE TO SAVING OUR PLANET

Infrastructure shall accelerate the transition to carbon neutrality and include electrification, develop natural streetscapes using green infrastructure, and prioritize human-powered and public transportation.

STRATEGY ONE: USE INTEGRATED AND BALANCED PLANNING

A: Use Multi-Criteria Decision-Making

We recommend the use of multi-criteria evaluation for decision-making. An example is the Envision program, organized by the Institute for Sustainable Infrastructure. Envision is an objective framework of criteria designed to help identify ways in which sustainable approaches can be used to plan, design, construct, and operate infrastructure projects. Envision is a framework that includes 64 sustainability and resilience indicators, organized around five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Resilience.

B: Use Adaptive Planning

The new era of urban planning will have to contend with changes in the environments that have seemed relatively stable in the past. In projects that we've planned in the past, we haven't accounted for an environment that is changing so much that it will require us to adapt. "Adaptation" refers to altering our systems and structures to adjust to permanent changes. Adaptation will require strategic investments by multiple generations of Berkeley citizens in order to succeed. All infrastructure planning should address the Climate Action Plan and Resilience Strategy.

C: Prepare a Dig Once Policy

To help with integrated planning, adopt a "dig once" policy to formalize the coordination and to facilitate the expansion of communications and information service in Berkeley. The City coordinates repair and rehabilitation work in the public right-of-way with other agencies. Berkeley has been conducting studies to expand broadband internet service within the city. One issue that many cities are addressing is whether to require the installation of conduits for telecom cables whenever other utility work is constructed. We recommend a "dig once" policy to minimize the cost and impacts of installing conduits to expand communications and information service.

OUR RECOMMENDATIONS

STRATEGY TWO: MANAGE INFRASTRUCTURE FROM CRADLE TO GRAVE

A: Institute Structured Master Planning

Prepare a master plan for each infrastructure system. This process *should* develop long-term plans for infrastructure systems that incorporate the following components:

- Evaluate the condition of the infrastructure assets and their remaining useful life.
- Evaluate the drivers that will affect the future use of the systems, including regulatory requirements, climate change conditions, technology advancements, and other factors.
- Evaluate alternatives for making the improvements.
- Develop a plan for the improvements, including the priority, schedule, and funding requirements.

The plans should project infrastructure needs for 20 or more years and should be updated on an approximately five-year schedule.

B: Develop an Asset Management Program

Implement a life cycle infrastructure management program (i.e. Asset Management Program). Currently, the City has three AMPs for vehicle maintenance and replacement, building maintenance, and computers/servers. Since these programs represent a small fraction of the City's total infrastructure assets, we recommend that an AMP be developed to properly maintain Berkeley's infrastructure systems, to forecast future improvement needs, and to estimate costs. An AMP forecasts maintenance needs to keep systems in proper working order and predicts the timing to perform repairs or replacement. It also forecasts the costs, which helps to plan financing, budgeting, and rate-setting.

STRATEGY THREE: ADOPT SUSTAINABLE AND SAFE TECHNOLOGIES**A: Promote Clean Energy and Electrification**

Increase community understanding of the importance of building and vehicle electrification to meeting greenhouse gas mitigation targets. Support market transformation for electrification. Confirm changes in infrastructure approaches necessary to facilitate a transition from carbon-based fuels. The City can build on its past successes in areas such as electrifying its buildings and fleets, requiring electrification in building retrofit applications, creating micro-grids, expanding the availability of electric vehicle charging infrastructure, and understanding how utilities in the public commons will change over the coming decades.

B: Provide Sustainable And Healthy Transportation

Berkeley's Climate Action Plan calls for public transit, walking, cycling, riding mobility vehicles, scooting, and other such modes to be the primary means of transportation for Berkeley residents and visitors. However, these options are still not viable for a majority of residents because of unsafe infrastructure. The City must rapidly increase the planning for and implementation of safe infrastructure for these modes of transportation to make them viable options and help us meet our Climate Action Plan goals. The City should establish a single, clear transportation mode priority policy by combining and updating existing policies to reflect priorities as set in the Climate Action Plan and Vision Zero.

C: Develop Natural Streetscapes

Provide green streetscapes throughout the city. These streetscapes can improve our health and well-being, control heat island impacts, provide ecosystem services, support biodiversity, and manage precious water resources. Develop permeable streetscapes and integrated water systems to address water variability including drought and flooding impacts and improve the tree canopy.

D: Use Sensors, Data, and Advanced Technologies

Make use of remote sensing technologies, broadband expansion, Geographic Information Systems, management of "big data," and other advanced technologies to develop Berkeley into a smart city.

E: Have an Integrated Approach to Fire Safety

The devastating wildfires in 2017 and 2018 showed that extreme climate conditions are already here. Regional solutions to reduce the risk of a wildland urban interface fire include creating fuel breaks, regional utilities curtailing power supply, and public education. Local solutions include evacuation planning, public notification, inspections and reducing fuel loads, utility undergrounding, and other activities. We recommend that these activities be coordinated, receive a high priority, and that a Wildfire Mitigation and Fire Safety Plan be prepared.

OUR RECOMMENDATIONS

STRATEGY FOUR: INVEST IN OUR FUTURE

A: Address City Infrastructure Needs

Identify critical capital projects through integrated cross-departmental planning.

- Develop a Capital Funding Plan utilizing a comprehensive planning approach.
- Create a ten-year Capital Project Queue with identified financing sources.

B: Adequately Fund Critical Capital Needs

Double annual capital spending through:

- Revenue Bonds: Identify cash generated by all Enterprise and other funds for revenue bond debt potential.
- GO Bonds: Evaluate increasing the GO debt service tax rate to determine additional debt capacity that would not impact AA+ rating.

Fund Infrastructure Reserve Fund with:

- “unclaimed” seismic/resilience Transfer Tax Rebates
- 25% of annual General Fund surplus.

Fund annual street and building maintenance with General Fund dollars.

C: Conduct a Study of the Options to Fund a Long-Term Infrastructure Capital Program

D: Consider New Tax Measures to Fund Climate-Smart Infrastructure

STRATEGY FIVE: PREPARE THE CITY’S ORGANIZATION TO IMPLEMENT A MAJOR CAPITAL PROGRAM

A: Develop an Organization That is Integrated and Has Capacity

We recommend conducting a study of the options to organize the City structure to deliver a major infrastructure program. The study shall include the following:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Integrated planning and decision-making: Evaluate options for the City structure to better integrate its infrastructure planning and decision-making. This evaluation can include creating a new department, adding capability in existing departments, or providing oversight coordination. The goal is for our planning to be comprehensive and not in individual silos and systems. • Training of staff: Evaluate the training needs of the City’s staff to meet our future needs, addressing: a) new technologies, | <ul style="list-style-type: none"> b) adaptive planning, c) Envision program, d) program management. • Staffing needs: Evaluate the number and type of staff needed to meet our infrastructure needs. Include consideration of consultant capabilities, innovation and research to augment City staff. • Capital delivery structure: Evaluate organizational options to deliver a major capital program, including the creation of a new department, adding capability in existing department, use of consultants, and other options. |
|---|--|

B: Prepare a Program Approach with Management Tools

With an infrastructure program that will approach \$1 billion, it will be necessary to prioritize the work into phases. This has begun with the current Measure T1 program. Subsequent phases will depend on the priority of the work, whether planning has started, community input, and the overall capacity to implement the work. We recommend that a Program Plan be developed and open for public comment. The Plan should include the following:

- | | |
|---|---|
| <ul style="list-style-type: none"> • Outcome objectives • Breakdown structure of work activities • Project team and responsibilities | <ul style="list-style-type: none"> • Cost and schedule tracking • Change management and approval process • Reporting |
|---|---|

To effectively carry out the program, the project team will need many tools, including the following:

- | | |
|---|---|
| <ul style="list-style-type: none"> • A cost accounting system to track and report on labor, materials, and consultant costs according to a work breakdown structure • A website to communicate with the public • Document management | <ul style="list-style-type: none"> • Risk management • Cost estimating • Scheduling • Procurement |
|---|---|

C: Provide Independent Oversight and Reporting

Ensure transparency and accountability through independent oversight and reporting. The concept is to appoint a citizen’s oversight committee comprised of people with relevant experience. The committee would prepare an annual report of progress compared to the Program Plan. The concept has been used effectively by the Berkeley Unified School District and other agencies in the Bay Area.

7. Engaging Our Community

Building on Initial Community Engagement

Vision 2050 will continue to engage the community on the future development of Berkeley's infrastructure. Basic infrastructure needs, such as street potholes, playgrounds, and bike lanes are well understood. However, residents are less aware of the age and fragility of the pipes and systems below ground.

Future community engagement should coordinate with the Measure T-1 Phase 2 public input process currently underway, as well as with other critical community planning processes.

Goals for Future Community Engagement

Authentic community engagement requires setting appropriate intentions and goals to ensure that the public's time and input is valued and honored. This includes:

- Raise awareness – broaden the community understanding of the importance of infrastructure, how it works, what the current issues

and needs are and what the related costs could be

- Hear and gather concerns and ideas – solicit community ideas about possible projects and programs
- Gather input on prioritization – prioritize values, criteria, programs, and projects
- Implement together – offer a way to contribute to implementation, such as planting trees or using paint and planters to create safer spaces for pedestrians at busy intersections
- Ongoing communication – check in on progress and engagement when changes need to be made or goals reassessed

The Mayor's Office piloted community engagement strategies that can be scaled up as the Vision 2050 initiative and future infrastructure projects are further developed. The lessons and ideas from this work can be categorized in three themes: meet people where they are, leverage the youth, and develop and visualize feedback.

RAISE AWARENESS

Broaden the community understanding of the importance of infrastructure, how it works, what the current issues and needs are and what the related costs could be;

HEAR & GATHER CONCERNS & IDEAS

Solicit community ideas about possible projects and programs;

GATHER INPUT ON PRIORITIZATION

Prioritize values, criteria, programs and projects;

IMPLEMENT TOGETHER

Offer a way to contribute to implementation, such as planting trees or using paint and planters to create safer spaces for pedestrians at busy intersections

RECOMMENDED ACTIONS TO RAISE INFRASTRUCTURE AWARENESS IN OUR COMMUNITY

MEET PEOPLE WHERE THEY ARE	LEVERAGE THE YOUTH	DEVELOP AND VISUALIZE FEEDBACK
<p>A. Develop a simple presentation and discussion framework that can be shared at existing community organization meetings. Scale up the “train the trainer” approach that was started with Youth In Government to reach more groups by having additional presenters. Expand the opportunity for engagement by including the community events and meetings where people already participate.</p> <p>B. Create a Meeting in a Box “kit” that contains everything needed for a community group to hold their own discussion including instruction sheets for the host/facilitator, a conversation menu of discussion questions, visioning worksheets for participant responses, idea boards, comment maps, and directions for recording and returning responses.</p>	<p>A. Young people are already a major force in the national and international movement on climate change. The Vision 2050 initiative and the future projects that follow it provide a tremendous opportunity for local young people to apply their passion in projects they can see through. Initial engagement with Berkeley High, BCC and UC Berkeley students demonstrated that the interest is there. Work with the Youth Commission to make Vision 2050 one of their core initiatives.</p> <p>B. Replicate Boston’s Youth Lead the Change process to give Berkeley’s young people power over some dollars in the city’s infrastructure capital budget. The process should be informed by the Citizen Lab Participatory Budgeting Project: https://www.participatorybudgeting.org</p>	<p>A. Use art, data visualization, and creative campaigns to nurture a deeper connection between residents and the resources and infrastructure that facilitate urban life.</p> <p>B. Develop an online dashboard that can be featured in public spaces such as public schools, libraries, nonprofits, and city businesses. Use monitoring and display technology to provide feedback.</p> <p>C. Create a #Beneathyourfeet Campaign to educate and engage residents about what types of infrastructure exist in different parts of the city. Many people were amazed to learn that decommissioned pipes are left underground due to cost. What does it look like under the street with pipes new and old snaking around one another? Vinyl illustrations might be developed to place on the ground at farmers markets or during Sunday Streets that would give the impression one is looking through the asphalt to see the energy, water, waste, and telecommunications services beneath our feet.</p>

8. Actions To Move Us Forward

The Vision 2050 Initiative is a start to address our aging infrastructure issues, to move Berkeley beyond business-as-usual, and to accelerate the building of climate-smart, technologically advanced, integrated, and efficient infrastructure. The following actions are proposed for

the next three years, 2020 – 2022. These are conceptual next steps; further details need to be developed through actions by Council, staff and community input.

ACTIONS BY CITY COUNCIL

1. Adopt the Vision 2050 Initiative Report

and recommend that the report be developed into a living document to inform current and future infrastructure planning.

2. Proactively promote Vision 2050 findings and vision to constituents and organizations

and recommend that the report be developed into a living document to inform current and future infrastructure planning.

3. Develop a Vision 2050 legislative package based on key recommendations in this report.

- A. Direct the City Manager to support Vision 2050 Initiative staffing and organizational recommendations and

an integrated and adaptive planning infrastructure approach.

- B. Continue community engagement that will inform a long-term sustainable infrastructure plan.

- C. Develop a Vision 2050 Initiative website that will keep the community informed about the Initiative and progress toward our goals.

4. Review funding alternatives to ensure compliance with Vision 2050 goals and timelines.

5. Support ongoing development of Vision 2050 recommendations.

ACTIONS BY CITY MANAGER

1. Identify resources to double capital investment

2. Begin the process for the development of an updated General Plan and ensure that it addresses all needs raised in the Vision 2050 Initiative Report

3. Create a staff organization and process that promotes integrated and adaptive planning

4. Develop an implementation plan

5. Identify funding resources for budget approval that will:

A. Begin implementing the Vision 2050 Initiative for FY2020/2021 budget

B. Study organizational needs to implement City Council recommendations

C. Evaluate funding options to implement a major infrastructure program, over time.

6. Support and promote cross departmental networking with outside subject matter experts and organizations that address infrastructure innovation

PROGRAM DISTRIBUTION, COMMUNICATIONS AND INPUT

1. Present the Vision 2050 Initiative Report to:

- A. Relevant Commissions
- B. City Council
- C. City Departments
- D. Outside Community Organizations

2. Continue to augment report for further consideration and incorporation

3. Develop a community engagement program to support ongoing community input

4. Provide timely informational updates to Vision 2050 website

5. Utilize social media to raise awareness and facilitate feedback

6. Engage outside subject-matter experts that can help inform the Initiative

7. Ensure that the University of California, Berkeley academic experts are fully engaged and aware of the Initiative.

APPENDICES

Appendix A: Acknowledgments

MAYOR’S OFFICE

Jesse Arreguin, Mayor
Brandi Campbell, Former Chief of Staff
Jacquelyn McCormick, Chief of Staff
Tano Trachtenberg, Legislative Aide

STEERING COMMITTEE

Ray Yep, Task Force Chair
Margo Schueler, Co-Chair
Victoria Legg, Co-Chair
Sachu Constantine, Technology Work Group lead
John Elliott, Technology Work Group co-lead
Kristina Hill, Environment Work Group co-lead
Jim McGrath, Technology Work Group member
Karen Parolek, Quality of Life Work Group lead
Bruce Riordan, Environment Work Group member
Debbie Sanderson, Quality of Life Work Group co-lead
Gordon Wozniak, Finance/Management Work Group lead
 Jenny Lovett, graphic design and layout

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TASK FORCE	
Member	Background
Jesse Arreguin	Mayor of Berkeley
Amanda Bornstein	Port Workspaces
Tony Bruzzone	Transportation Commission, infrastructure planner
Brandi Campbell	Former Chief of Staff, Mayor’s Office
Sachu Constantine	Public Works Commission, former Energy Commission, solar energy specialist
Nate Dahl	Community Development Project Coordinator, City of Berkeley
Paul Degenkolb	Disaster and Fire Safety Commission, IT specialist
Erin Diehm	Parks and Waterfront Commission
John Elliott	Chief Sustainability Officer, Lawrence Berkeley National Laboratory
Scott Ferris	Berkeley Parks, Recreation and Waterfront Director
Bob Flasher	Disaster and Fire Safety Commission
Lucy Flood	Journalist, community builder
Abigail Franklin	Haas Business School, finance specialist
John Gage	Former Sun Microsystems, IT specialist
Ben Gerhardstein	Former Transportation Commission, Walk Bike Berkeley
Max Gomberg	State Water Resources Control Board, water specialist
Kate Harrison	Berkeley Councilmember, District 4

TASK FORCE			
Member	Background	Member	Background
Kristina Hill	U.C. Berkeley professor	Rigel Robinson	Berkeley Councilmember, District 7
Rashi Keserwani	Berkeley Councilmember, District 1	Bruce Riordan	Director at Bay Area Climate Adaptation Network, climate strategist
Cate Leger	Energy Commission, architect	Debbie Sanderson	Former City of Berkeley Planning Department
Victoria Legg	Former Disaster and Fire Safety Commissioner	Margo Schueler	Public Works Commission, Zero Waste Commission, infrastructure specialist
Jaimie Levin	Center for Transportation and Environment, transportation planner	Sophia Skoda	Director of Finance, EBMUD
Jose Lopez	Communities for Better Environment	Kira Stoll	Chief Sustainability Officer, U.C. Berkeley
Monika Mann	Johns Hopkins University, health specialist	Sam Trachtenberg	Brown University student
Emily Marthinsen	U.C. Berkeley Campus Architect	Tano Trachtenberg	Legislative Aide, Mayor's Office
Jim McGrath	Parks and Waterfront Commission, water specialist	Alfred Twu	Zero Waste Commission, Rent Board, local designer and artist
Toni Mester	Former Parks and Waterfront Commissioner	Susan Wengraf	Berkeley Councilmember, District 6
Nicholas Oxley	Former Transportation Commissioner	Anna Whitney	U.C. Berkeley student
Karen Parolek	Transportation Commission, Walk Bike Berkeley, urban planner	Gordon Wozniak	Former Berkeley Councilmember, District 8
Lauren Randall	Sunrun Solar, solar specialist	Ray Yep	Public Works Commission, infrastructure specialist

APPENDICES

Appendix B: Glossary of Terms

TERM	DEFINITION		
ABAG	Association of Bay Area Govern-ments	EBMUD	East Bay Municipal Utilities District
AC Transit	Alameda Contra Costa Transit Dis-trict	GF	General Fund
BART	Bay Area Rapid Transit District	GO bonds	General obligation bonds
BUSD	Berkeley Unified School District	GHG	Greenhouse Gases
CAP	Climate Action Plan	LED lights	Light emitting diode lights
CIP	Capital Improvement Program	Measure R	Berkeley ballot measure in November 2018 that asked: Shall the measure, advising the Mayor to engage citizens and experts in the development of Vision 2050, a 30-year plan to identify and guide im-plementation of climate-smart, technologically-advanced, integrated and efficient infrastructure to support a safe, vibrant and resilient future for Berkeley, be adopted?
City	City of Berkeley	MTC	Metropolitan Transportation Commission
City staff	Employees of the City of Berkeley	PG&E	Pacific Gas & Electric Company
Council	City Council of Berkeley	Public Commons	The area in the public right-of-way encompassing streets, sidewalks and related facilities.
CPUC	California Public Utilities Commis-sion	PSPS	Public Safety Power Shutoff
CSD	Community Services District	Vision Zero	Vision Zero is a data-driven strategy to eliminate all traffic fatalities and severe injuries while increasing safe, healthy, equitable mobility for all.
EBCE	East Bay Community Energy		

Appendix C: Reference Documents

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City of Berkeley. (2011), Watershed Management Plan

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