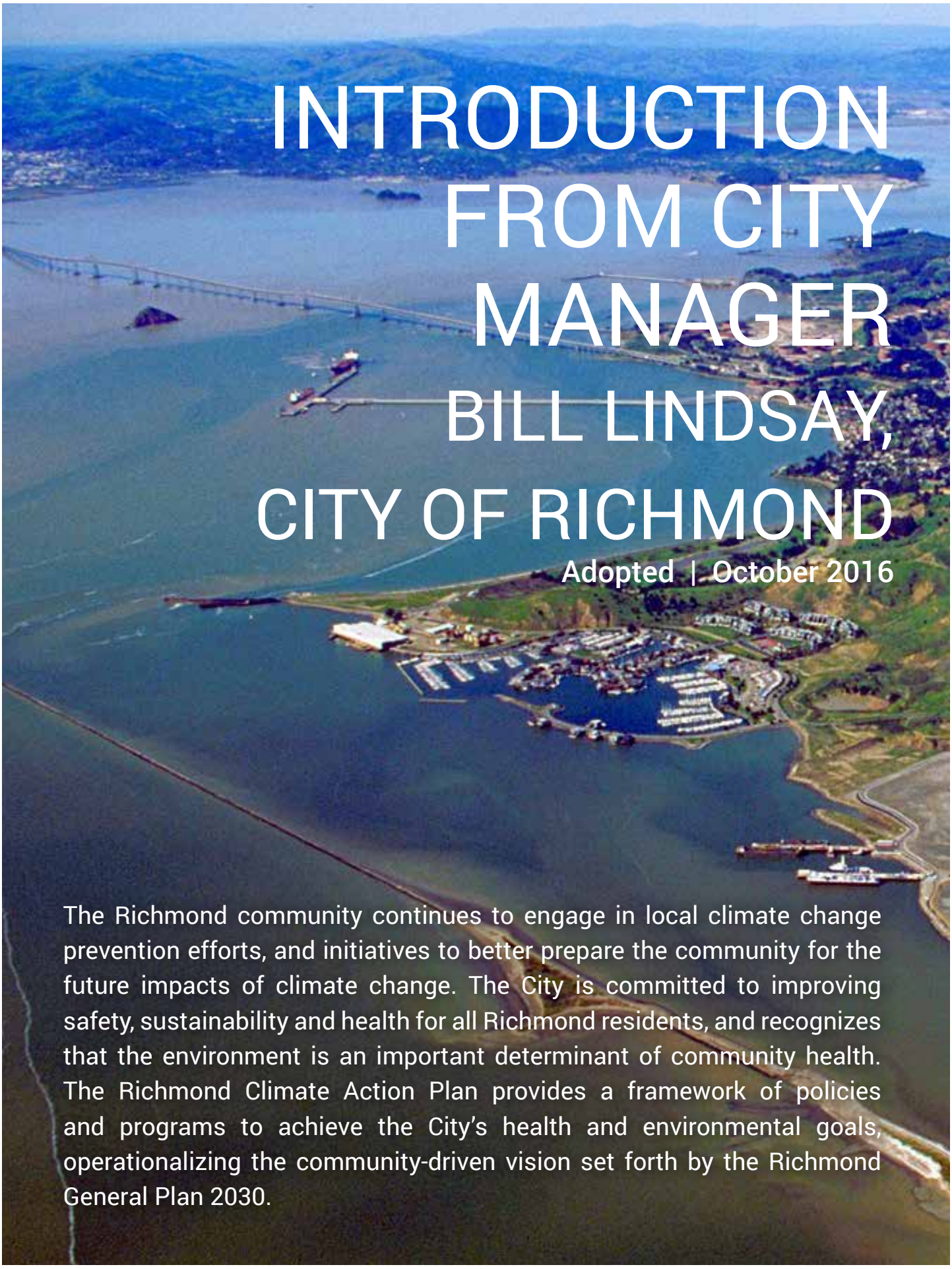
City of Richmond

Climate Action Plan

Adopted | October 2016



INTRODUCTION FROM CITY MANAGER BILL LINDSAY, CITY OF RICHMOND

Adopted | October 2016

The Richmond community continues to engage in local climate change prevention efforts, and initiatives to better prepare the community for the future impacts of climate change. The City is committed to improving safety, sustainability and health for all Richmond residents, and recognizes that the environment is an important determinant of community health. The Richmond Climate Action Plan provides a framework of policies and programs to achieve the City's health and environmental goals, operationalizing the community-driven vision set forth by the Richmond General Plan 2030.

The Richmond Climate Action Plan uses community input and cross sector collaboration to prioritize action and outcomes with the greatest community benefits for the Richmond community. Many people may think of climate action solely as a means to address environmental concerns; Richmond's plan builds on this narrative with a more comprehensive strategy. The Richmond Climate Action Plan continues the mission that the City set forth with its Community Health and Wellness Element and its Health in All Policies Strategy: to create initiatives that improve the equitable delivery of services and improve the overall quality of life in Richmond. This Climate Action Plan strengthens Richmond's commitment to health equity and creates a strategy to serve the interests and well-being of the entire community – the environment, economy, and residents.

Climate change is a global challenge with impacts that we feel locally here in Richmond. When these impacts are approached with thoughtful planning, we create opportunities for a significant amount of positive, local development. Addressing climate change will create a more secure future for Richmond, and presents an opportunity to overcome many challenges that the community faces today. Richmond's health equity lens facilitates a plan with a nontraditional focus that engages all City departments to better serve the public's needs.

There are numerous opportunities for improvement and adaptation identified in the following pages, and this plan will complement the City's ongoing efforts to lead and innovate through local policy. With close collaboration from hundreds of residents, the University of California, Berkeley's, Department of City and Regional Planning and School of Public Health, the Y-PLAN Center for Cities and Schools, the West Contra Costa Unified School District, and local community based organizations, the City co-developed a plan that serves the needs of the Richmond community, and allows us to become an active participant in the global effort to address climate change.

"Climate action and health equity go hand in hand, and are among the City's top priorities."

Bill Lindsay
City Manager

Acknowledgements

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Youth Plan Learn Act Now! (Y-PLAN)

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COMMUNITY PARTNERS

Association of Bay Area Governments (ABAG)

Bay Area Air Quality Management District (BAAQMD)

Bay Area Regional Collaborative (BARC)

Bay Area Rapid Transit (BART)

Chevron

Community Civic Consortium

Community Energy Services Corporation

Contra Costa Health Services

Contra Costa Interfaith Supporting Community Organization (CCISCO)

GRID Alternatives

Groundwork Richmond

East Bay Energy Watch

East Bay Municipal Utility District

Marin Clean Energy (MCE)

Metropolitan Transportation Commission (MTC)

Office of Supervisor John M. Gioia

Pacific Gas and Electric (PG&E)

Republic Services

Rich City Rides

Richmond Trees

Richmond High School Health Academy

Richmond Community Foundation

Rising Sun Energy Center (RYSE) Youth Center

San Francisco Bay Conservation and Development Commission (BCDC)

Solar Richmond

The California Endowment

West Contra Costa Unified School District

YES – Nature to Neighborhoods

City Accomplishments:

Taking Climate Action

1. In 2008, the Richmond City Council adopted a resolution to commit to the GHG emissions target established by AB 32, and the City completed our first GHG Inventory for the baseline year 2005.
2. Created the Richmond Build program in 2007 to provide 'green' job training and employment opportunities for local youth.
3. Installed solar on 175 lower income homes through our partnership with GRID Alternatives.
4. Upgraded all of our streetlights with high efficiency LED fixtures!
5. Adopted our Bicycle Master Plan in 2011, and installed 36 miles of bikeways toward a goal of a 145 mile network of bikeways throughout the City.
6. Updated our General Plan to include a new Energy and Climate, and Community Health and Wellness Elements!
7. Over 80% of our residents and businesses have enrolled in MCE's Light Green program, which supplies 50% of their electricity from renewable sources.
8. Began weekly collection of recycling and green waste for residents in 2014.
9. Adopted the Health in All Policies (HiAP) Strategy and Ordinance in 2014, to ensure the health of Richmond residents comes first!
10. Approved the MCE Solar One project to build a 10.5 MW solar facility at the Chevron Refinery in 2016, which will be the largest municipal solar field in the Bay Area!

MCE Clean Energy
My community. My choice.

Quick Tips:

Top Personal Actions to Support our

Climate Goals,

as Recommended by

Richmond High School Health Academy




1. Walk, bicycle and use public transportation instead of driving.
2. Retrofit buildings with more efficient lighting (e.g., LEDs), improved insulation and windows, and installing solar panels.
3. Take advantage of local programs and rebates to install solar panels, reducing energy costs and our reliance on fossil fuels.
4. Turn off lights and unplug electronics when not in use.
5. Participate in composting and recycling services to save money and reduce the amount of waste sent to the landfill.
6. Conserve water by reducing shower times, skipping flushes, installing cistern displacement devices in toilets, and retrofitting faucets with water-saving fixtures.
7. Replace lawns with drought-tolerant landscaping.
8. Install greywater systems to capture and repurpose (non-toilet) domestic wastewater for irrigation.
9. Install green roofs to diminish heat island effect.
10. Support urban gardens and buy produce at your local farmers markets to increase access to fresh food and reduce the greenhouse gases from transportation.

Y-PLAN CENTER FOR CITIES+SCHOOLS UNIVERSITY OF CALIFORNIA BERKELEY

[1] In 2015, the City of Richmond partnered with the Y-PLAN (Youth – Plan, Learn, Act, Now) program from UC Berkeley's Center for Cities and Schools to engage 265 students in Richmond High's Health Academy to create adaptation and mitigation strategies to inform Climate Change Policy in Richmond. Each grade level focused on a different sector including individual/household, schools, the City, and small businesses. Over 300 guests from the City, community organizations, parents and other stakeholders were in attendance to hear students' findings and recommendations at the Y-PLAN Final Presentations in early May 2015. This event marked the formal launch of this Climate Action Plan.

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Climate Action Plan

CHAPTER 1

Introduction


ONE WAY

INTRODUCTION

In the last decade, cities across the globe have taken the lead in addressing climate change at the local level. Municipal and regional climate action plans are becoming standard operations across the nation, as cities have a responsibility and a unique capacity to tailor and develop programs to reduce community greenhouse gas (GHG) emissions and prepare for the impacts of climate change.

Climate Action Plan Mission

Serve as a roadmap for the City to reduce greenhouse gas emissions, create jobs, and prepare for the impacts of climate change on public health, infrastructure, the economy, ecosystems, and public spaces in our community.

Climate change presents the City of Richmond with complex challenges and tremendous opportunities. The City is committed to creating a healthy, equitable community for all of its residents. The Richmond Climate Action Plan (CAP) is a multi-objective plan that addresses environmental, social and economic issues related to climate change. The CAP builds on the goals and policies in the City's General Plan and the Health in All Policies Strategy (HiAP) to further the City's efforts to build health equity through the reduction of local GHG emissions, and to simultaneously ensure that the community is well prepared for the impacts of climate change. It elevates health equity priorities in the selection of climate action measures, building on the City's existing policy framework to support a healthy, vibrant, and equitable City.

The City of Richmond is committed to developing a coordinated approach to reducing GHG emissions within the community, and the CAP establishes the framework for that process. It provides an inventory of the City's emissions, establishes an emissions reduction target, and identifies feasible City and community actions that cost-effectively reduce GHG emissions and improve community health across all sectors.

In addition to reducing GHG emissions, successful implementation of the CAP will result in numerous co-benefits to the community, and will position the City to obtain grant funding for sustainable development programs such as affordable housing, transit-oriented development, and urban forestry.

1.1 Vision and Mission

The CAP expands and operationalizes the community vision for health equity, sustainability, and climate change established in the Richmond General Plan 2030. The Richmond CAP Community Vision is as follows:

Introduction

Community Vision

The City of Richmond plays a pivotal role in developing climate policy at a local level that, in turn, influences regional, state, and national objectives. The City relies on clean energy sources, waste reduction practices, sustainable buildings and innovative land use planning to reduce energy and climate impacts. These measures have resulted in broad community benefits including dramatic reductions in fossil fuel use, cost savings, emission reductions, improved health equity, water conservation, and an enhanced quality of life. City officials and community members value and protect natural resources and continue to work together to reduce the impacts of a changing climate. A renewed focus on education and local and regional partnerships further supports sustainable practices that will nurture human health and environmental quality for future generations. The City builds resiliency to climate change impacts through actions focused on transitioning to renewable energy, strengthening critical transportation infrastructure, creating safe and affordable housing, enhancing local jobs and wages, creating healthy local food systems, and protecting natural resources and habitat.

Co-benefits of Implementing the City of Richmond Climate Action Plan

- Improve community health and air quality
- Increase investment in homes and buildings
- Complete streets and increased urban tree canopy
- Conserve water and other natural resources
- Increase home and building values
- Create local green jobs
- Reduce utility bills and maintenance costs
- Increase educational and training opportunities
- More resilient infrastructure prepared for climate change impacts

In support of this vision, the mission of the Richmond CAP is to serve as a roadmap for how the City will reduce GHG emissions, create local jobs, and prepare for the impacts of climate change on public health, infrastructure, ecosystems, and public spaces in our community. The CAP supports the community's goals and policies in the City's General Plan 2030, and builds upon other local policies such as the Health in All Policies Strategy. It also enables the City to implement strategies that successfully fulfill the requirements of state initiatives Assembly Bill 32 (AB 32) and Senate Bill 375 (SB 375).

1.2 Goals

The Richmond CAP is founded on four overarching goals that represent the aim or desired result of climate action planning in the City.

1. **GHG Emissions Reduction:** The City is committed to substantially reducing GHG emissions originating from the community and from government operations. The City will contribute to emissions reductions needed to achieve statewide targets and reduce the societal and environmental risks associated with climate change.

2. **Healthy and Resilient Community:** Richmond is committed to sustainable growth that provides a healthy, resilient and equitable environment for all. Richmond will continue to invest resources in residences, businesses, infrastructure, and public spaces to better prepare for the impacts of climate change. Every resident should have access to walkable neighborhoods, and good jobs. Homes should be safe, affordable, and efficient. Urban forestry and green space should be integrated throughout the City's neighborhoods.

3. **Prosperous Local Economy:** The City will work with the local business community to capitalize on emerging clean technology economic opportunities in energy, transportation, land use, and general consumption. Local jobs creation will create more employment options and reduce the need for City residents to commute to distant employment centers.

4. **Engaged Community and Educated Youth:** The City is committed to utilizing culturally and linguistically responsive outreach to engage the community and maximize community participation and benefits. Students, residents, and businesses are essential partners in confronting the climate change challenge. An engaged community is more cohesive and capable of achieving City climate program goals in energy efficiency, waste reduction, water conservation, sustainable transportation, and sustainable resources such as community gardens and healthy food. In Richmond's youth lies its foundation for a sustainable and resilient future. Young people empathize and embrace climate-smart behaviors, and are empowered to take ownership of Richmond's future as active citizens within the local climate change policy decision-making processes.

Assembly Bill 32 (AB 32)

California's Global Warming Solutions Act of 2006, or AB 32, seeks to fight climate change through a comprehensive program reducing GHG emissions from virtually all sources statewide. The landmark law requires the California Air Resources Board (CARB) to develop regulations and market mechanisms that will cut statewide GHG emissions to 1990 levels by 2020.

1.3 CAP Development Process

The Richmond CAP is the culmination of several years of work within the City, and organizes the City's past and future path with that of the growing state and worldwide movement to address the causes of human-induced climate change.

In 2007, the City signed the U.S. Mayors Climate Protection Agreement, a pledge to meet the Kyoto Protocol's goal to reduce GHG emissions to 1990 levels by 2020. In 2009, the City published its 2005 baseline GHG inventory as a first step to understand its sources of GHG emissions across the community. That same year, Richmond became a member of ICLEI: Local Governments for Sustainability, an international network for municipalities dedicated to addressing climate change. In 2008, the City Council adopted Resolution 108-08 committing to the GHG emissions target established by AB 32, and to achieving an 80 percent reduction below 1990 levels by 2050.

Richmond strengthened its commitment to climate action in 2012 with the adoption of an Energy and Climate Element into the City's General Plan 2030 update, which seeks to recognize and responsibly address the impacts of climate change. Developing a CAP is an implementing action of the General Plan 2030.

Preparation of the Richmond Draft CAP began in earnest in 2013, and commenced with a community workshop to discuss the CAP with partners from UC Berkeley. The City collaborated with the UC Berkeley Department of City and Regional Planning and the School of Public Health to develop a 2012 update of the GHG inventory, survey current best practices for the Plan, and evaluate policy synergies with state and federal initiatives. In 2014, the City also sought input on CAP strategies and actions from 250 Richmond High School students via the Youth Plan Learn Act Now (Y-PLAN) Program, sponsored by the UC Berkeley Center for Cities + Schools and the City of Richmond. The Y-PLAN program analyzed what actions residents, businesses, schools, and the City could undertake to reduce greenhouse gas emissions.

In 2015, the City held two additional community workshops and hosted three luncheons with stakeholders representing community-based organizations, businesses, and utilities, franchisees, and industry groups. These events provided ample opportunity for stakeholder input, informed the strategies and actions included in the CAP, and helped identify and strengthen important partnerships for pursuing funding and implementing the CAP.

The City also held meetings with the Bay Area Regional Collaborative (BARC), Bay Area Air Quality Management District (BAAQMD), Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), the Bay Conservation and Development Commission (BCDC), and UC Berkeley's School of Public Health. These meetings were designed to capture important stakeholder concerns regarding the City's climate action planning, to help align the CAP with regional transportation plans, state and regional climate programs, and funding opportunities.

This CAP reflects the vast breadth and depth of input received at these events and through these programs. **Appendix A: Stakeholder Outreach and Education** includes the City's CAP Community Engagement Plan, as well as a summary of input received during community and stakeholder engagement events. **Appendix E: Implementing Actions** provides a timeline of state and local actions to date that address climate change.

1.4 Relationship to Other City Plans

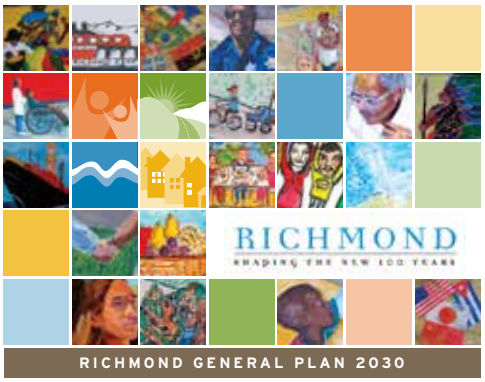
The City of Richmond understands that addressing climate change goes beyond environmental concerns. Efforts to reduce GHG emissions and improve resilience to climate change will improve the local economy, sustainability, health, and well-being of the entire community. The City is continuously working to address climate change through policy, and has adopted numerous plans and strategies that directly or indirectly support climate action. The Richmond CAP was influenced by, and builds upon, these plans and strategies, including the City's General Plan, the Health in All Policies Strategy (HiAP), Draft Urban Greening Master Plan, Parks Master Plan, Richmond Bicycle Master Plan, and Richmond Pedestrian Plan. The CAP not only directly supports policies within these plans, it provides actions that implement requirements of these policies.

1.5 Relationship to State Policies on Climate Change

Many strategies for monitoring and addressing climate change have emerged at the international, national, and state levels. California remains a leader in the effort to reduce GHG emissions through mitigation and adaptation strategies. With AB 32, California became the first state in the U.S. to mandate GHG emissions reductions across its entire economy. To support AB 32, California has been developing policy and passing legislation that seeks to control emissions of gases that contribute to climate change. These have included regulatory approaches such as mandatory reporting for significant sources of GHG emissions and caps on emission levels, as well as market-based mechanisms, such as the state's Cap and Trade program. The state policies and regulations most relevant to the Richmond CAP are briefly described below.

Introduction

Richmond General Plan 2030



On April 25, 2012, the Richmond City Council adopted a new General Plan to guide the City's sustainable growth and development. The General Plan provides a comprehensive framework for developing a healthy city and healthy neighborhoods.

The Energy and Climate Change Element of the General Plan provides Richmond's community vision for energy and climate in 2030. The element examines how the City's land use and transportation network will affect energy consumption and determines what measures can be implemented to reduce greenhouse gas emissions. The element also provides policy direction for protecting energy resources and responding to climate change, and provides goals, policies, and actions to address energy conservation, renewable energy generation and use, sustainable business development, and responsible community revitalization.

The Richmond CAP stems from, and supports implementation of these General Plan goals, policies, and actions. The first goal in the Energy and Climate Change Element is "Leadership in Managing Climate Change" (Goal EC1). General Plan policies supporting this goal include:

- Policy EC1.1 Leadership and Advocacy: Take a leadership role in advocating for local, regional and national solutions to climate change at all levels of government and with the private sector.
- Policy EC1.2 Public Awareness and Support: Provide incentives to encourage residents and businesses to reduce their carbon footprint by raising their awareness about the impacts of climate change and by building support for climate change initiatives in Richmond and the greater region.

Moreover, the structure and content of the CAP meet the directive of General Plan Action EC1A, which calls for development of a CAP for reducing GHG emissions to meet or exceed state reduction targets.

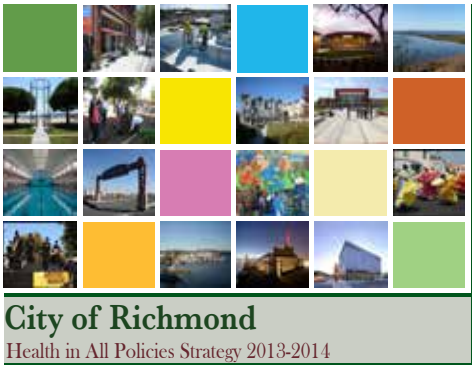
Executive Order S-3-05

Executive Order (EO) S-3-05, signed on June 1, 2005 by Governor Arnold Schwarzenegger, set the stage for multiple legislative actions to reduce GHG emissions in California. EO S-3-05 established the following statewide GHG emissions targets:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

EO-S-3-05 provided the basis for subsequent regulation to reduce GHG emissions, including AB 32 and SB 375 (described below). It also created the California Climate Action Team (CAT), which is tasked with preparing biennial science assessment reports on climate changes and adaptation options for California.

Richmond Health in All Policies Strategy (HiAP)



The City is fully committed to achieving the highest level of health for all Richmond residents. The City's HiAP Strategy reflects this pledge to health equity by integrating health and wellness throughout City policies, programs, and operations. The City defines health equity as attaining the highest level of health for all people, while describing health inequity as differences in health that are unfair, unjust, and preventable. Environmental conditions, socioeconomic conditions, and other root causes contribute to health inequity.

Health Equity is incorporated into the CAP in the following ways:

- **Commitment to Health Equity:** The City's vision for a healthy, climate-resilient City includes a commitment to improving the overall health of all its residents (health equity) by implementing GHG reduction measures that also address unnecessary and unjust health burdens faced by some of its most disadvantaged residents (health inequities).
- **Strategies and Actions:** The CAP includes specific strategies and actions that work towards these goals by:
  - Encouraging physical activity through pedestrian and bicycle infrastructure.
  - Advancing state, regional, and local efforts to reduce GHG emissions, criteria pollutants, and short-lived climate pollutants through enforcement of existing emission regulations.
  - Supporting local agriculture and food production to ensure residents have better access to healthy local foods.
  - Building healthy schools through partnerships to reduce energy and water consumption, and increase solid waste diversion.
  - Developing partnerships with community-based organizations that support workforce development and green jobs.
  - Targeting specific programs such as energy efficient upgrades and solar installation to low-income facilities.
  - Encouraging safe, affordable, and healthy housing.

Assembly Bill 32 – California Global Warming Solutions Act of 2006

AB 32 was approved by the legislature and signed by Governor Schwarzenegger in 2006. The landmark legislation requires the state to reduce GHG emissions to 1990 levels by 2020 and directs the California Air Resources Board (CARB) to develop the plans, programs, and regulations needed to achieve reductions in a technologically feasible and cost-effective manner. Under the legislation, CARB is mandated to:

- Identify early action items that can be quickly implemented to achieve GHG reductions. These early action items were adopted by CARB in 2007 and include regulations affecting landfill operations, motor vehicle fuels, car refrigerants, and port operations, among other regulations.
- Create and adopt regulations that require the state's largest industrial emitters of GHGs to report and verify their emissions on an annual basis.
- Develop and maintain a Climate Change Scoping Plan to identify the most technologically feasible and cost-effective measures to achieve the necessary emissions reductions to reach 1990 levels by 2020. The first Scoping Plan,[1] adopted in 2008, put forth a variety of programs, regulations, incentives, and market-based mechanisms to reduce GHG emissions across the state, including:
  - Expanding and strengthening existing energy efficiency programs;
  - Achieving a statewide renewables energy mix of 33 percent for electricity generation;

[1] CARB 2008 Scoping Plan. Available at http://arb.ca.gov/cc/scopingplan/scopingplan.htm

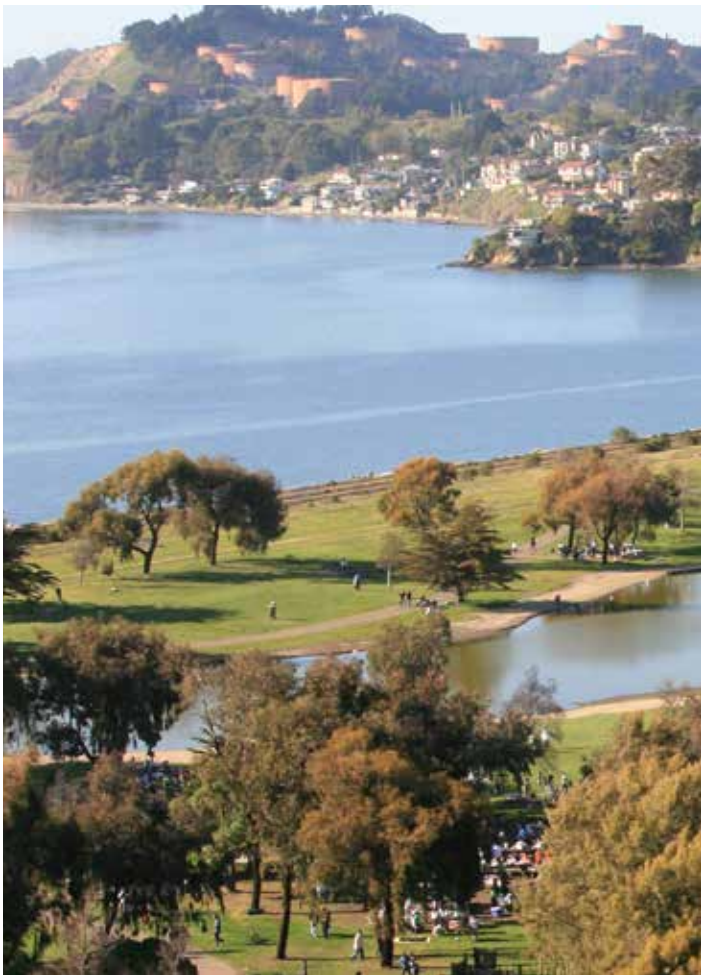
- Developing a California Cap and Trade program affecting major industrial facilities and power plants in the state as well as companies that import power from other states for sale in California;
- Establishing targets for transportation-related GHGs for regions throughout California and pursuing policies and incentives to achieve those targets;
- Adopting measures pursuant to existing laws including clean car standards and low carbon fuel standards;
- Creating targeted fees on high global warming potential gases and a fee to fund the administrative costs of the state's long term commitment to AB 32 implementation; and
- Adopting measures to increase commercial recycling.

CARB's 2014 update to the Climate Change Scoping Plan outlined the challenges to reducing statewide GHG emissions to 80 percent below 1990 levels by 2050, clarified the role of local governments in reducing GHG emissions within their jurisdictions, and highlighted the need for targeted investment, new policy developments, and rapid market uptake of new technologies in transportation, energy, agriculture, water, waste management and land management. The next update to the Scoping Plan, due to be released in late 2016, is expected to include new program and policy details that will demonstrate how the state expects to meet its long-term GHG targets.

Senate Bill 97 – California Environmental Quality Act (CEQA) Guideline Amendments of 2007

Senate Bill (SB) 97 amends the CEQA Guidelines to address GHG emissions. Local governments may now use adopted plans consistent with the amended CEQA Guidelines to assess the cumulative impacts of projects on climate change, if the plan for the reduction of GHG emissions accomplishes the following:

- Quantifies GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
- Establishes a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;



- Identifies and analyzes the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area;
- Specifies measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
- Establishes a mechanism to monitor the plan's progress toward achieving the specified emissions level and to require an amendment if the plan is not achieving it; and
- Is adopted in a public process following environmental review.

SB 375 – Sustainable Communities and Climate Protection Act of 2008

SB 375, also known as the Sustainable Communities and Climate Protection Act of 2008, builds off of AB 32 and aims to reduce GHG emissions by linking transportation funding to land use planning. It requires the state's metropolitan planning organizations (MPOs) to create a sustainable communities strategy (SCS) in their regional transportation plan (RTP) for the purpose of reducing urban sprawl and reliance on automobiles. Under SB 375, CARB established for each MPO a regional target for GHG emissions reductions from passenger vehicle use. The regional GHG reduction targets for the Metropolitan Transportation Commission (MTC) region, which is the MPO with jurisdiction over Richmond, are 7 percent per capita by 2020 and 15 percent per capita by 2035 from 2005 levels.[2]

[2] Association of Bay Area Governments (ABAG) and MTC, 2013. Plan Bay Area 2013: Strategy for a Sustainable Region. July 2013.

Senate Bill 535 – Greenhouse Gas Reduction Fund and Disadvantaged Communities (2012)

SB 535 requires the California Environmental Protection Agency (CalEPA) to identify disadvantaged communities, and requires that 25 percent of all funds allocated pursuant to an investment plan for the use of state moneys collected through a Cap and Trade program be allocated to projects that benefit disadvantaged communities and at least 10 percent of the 25 percent to be spent on projects located in disadvantaged communities.

Senate Bill 350

In October 2015, the California legislature passed the Clean Energy and Pollution Reduction Act of 2015 (SB 350), requiring the State to 1) generate half of its electricity from renewable energy sources; 2) double energy efficiency for both electricity and natural gas end uses in all buildings by 2030; and 3) substantially improve the infrastructure for electric vehicle transportation.

Executive Order B-30-15

On April 29, 2015, Governor Jerry Brown signed Executive Order (EO) B-30-15 to establish an interim GHG emission reduction target to reduce GHG emissions to 40 percent below 1990 levels by 2030. This new target represents the most aggressive goal set by any government in North America to reduce GHG emissions by 2030. The EO also establishes a climate adaptation directive for state investments and agencies, and requires state agencies to "take current and future climate change impacts into account" and consider "full life-cycle cost accounting" when making future planning and investment decisions, particularly as applied to infrastructure planning.

Executive Order B-30-15 calls on CARB to update the AB 32 Climate Change Scoping Plan to incorporate the 2030 statewide target. In June 2016, CARB released a 2030 Draft Scoping Plan Update concept paper describing policy scenarios for achieving the target. The scenarios present the various ways in which industrial emissions could be reduced (e.g., cap & trade, carbon tax, new regulations) and how aggressive the state would need to be in expanding the use of zero emission and plug-in hybrid vehicles by 2030. All scenarios call for enhancing reductions from existing programs (e.g., increase the use of zero emission and plug-in electric vehicles) along with aggressive implementation of existing policies like SB 350 and the state's Proposed Short-Lived Climate Pollutant (SLCP) Reduction Strategy. Although the paper states that local actions are critical for implementation of California's ambitious climate agenda, there is no specific guidance for setting post-2020 reduction targets for local climate action plans. The City is expecting more concrete guidance from the state with the eventual release of the 2030 Scoping Plan Update later in the year.

Senate Bill 379

Beginning January 1, 2017, SB 379 requires California cities and counties, upon the next revision of their local hazard mitigation plan, to include climate adaptation and resiliency strategies in the safety elements of their general plans. The bill requires the safety element update to include a set of goals, policies, and objectives for their communities based on a vulnerability assessment, as well as implementation measures to increase community resilience to climate change. The safety element update can incorporate these components by reference from an adopted local hazard mitigation plan and/or climate adaptation plan.

City of Richmond

Climate Action Plan

CHAPTER 2

Opportunities and Challenges

OPPORTUNITIES AND CHALLENGES

Climate change presents the City with enormous challenges and tremendous opportunities. Taking meaningful action on climate change can mean challenging the status quo and questioning long-held beliefs. But the urgent need to take action provides the City with a unique opportunity to build a thriving community based on sustainable, equitable and resilient systems. This chapter provides a summary of the science behind climate change and the local impacts expected in Richmond. It introduces the City's primary vulnerabilities to climate change, describes the nexus between climate change and public health, and concludes with a discussion of the economic opportunities associated with reducing emissions and increasing community resilience.

2.1 Building a Better Community in the Face of Climate Change

Climate change is happening, as evidenced by larger, more powerful storms, changing precipitation patterns, and rising seas. Climate change is a challenge that demands action in both reducing greenhouse gas (GHG) emissions to minimize future hazards, and investing in resilience and adaptation measures for the impacts we are experiencing now and expect to worsen in the coming decades.

Although climate change presents serious long-term challenges to the City of Richmond, it also presents opportunities. Strong public policy that provides funding for climate change mitigation and adaptation has multiple benefits. For example, strategies to dramatically reduce community-wide GHG will also invest in homes and infrastructure and improve public health. By investing in skilled workers and new low carbon technologies like clean energy, renewable materials, and bio-based fuels, the City can develop new engines for job growth and sustainable economic prosperity. By investing in adaptation strategies, such as flood and tidal defenses, the City can lessen the impact of future natural disasters while simultaneously driving economic growth by strengthening infrastructure. By instituting public health measures to deal with heat waves, and air quality impacts, the City can plan for climate change in a way that protects vulnerable populations and provides an equitable distribution of costs, benefits, and opportunities for all members of the Richmond community.

2.2 Greenhouse Gases and their Impact on Climate

The Greenhouse Effect is a natural phenomenon whereby greenhouse gases trap heat in the atmosphere and regulate the Earth's temperature. This natural effect is responsible for maintaining a habitable climate, but over the last century human activities have greatly increased atmospheric concentrations of greenhouse gases. According to the Intergovernmental Panel on Climate Change (IPCC), it is very likely that this increase of human-generated GHG emissions, which has accelerated since the mid-20th century, is a primary cause of climate change. Atmospheric concentrations of GHG emissions now far exceed the average of the past several thousand years. Land use changes, burning of fossil fuels, and agricultural practices have all contributed to this observed increase. Global climate models clearly show that human activity is having an effect on global temperatures

Figure 2-1: The Greenhouse Effect

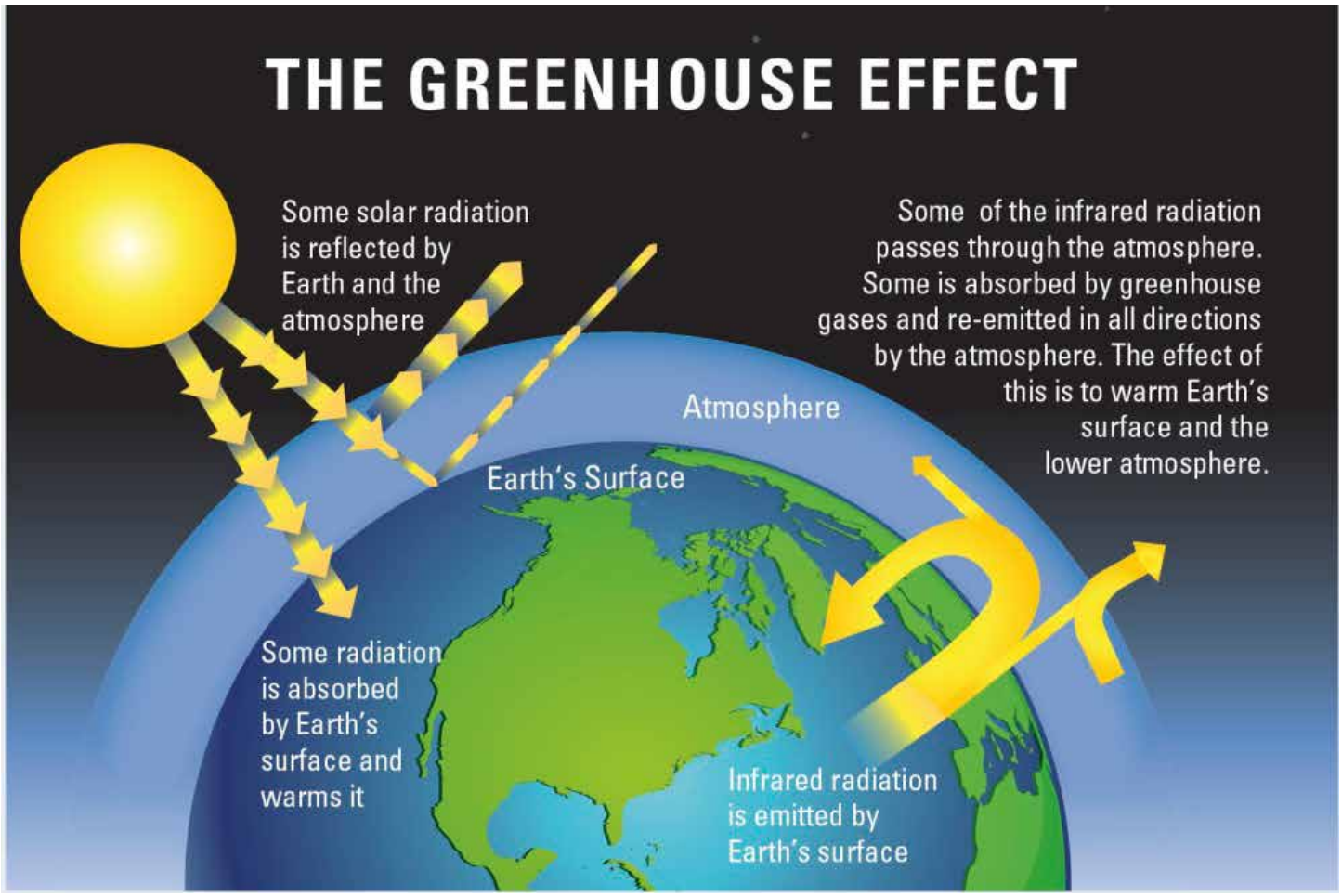
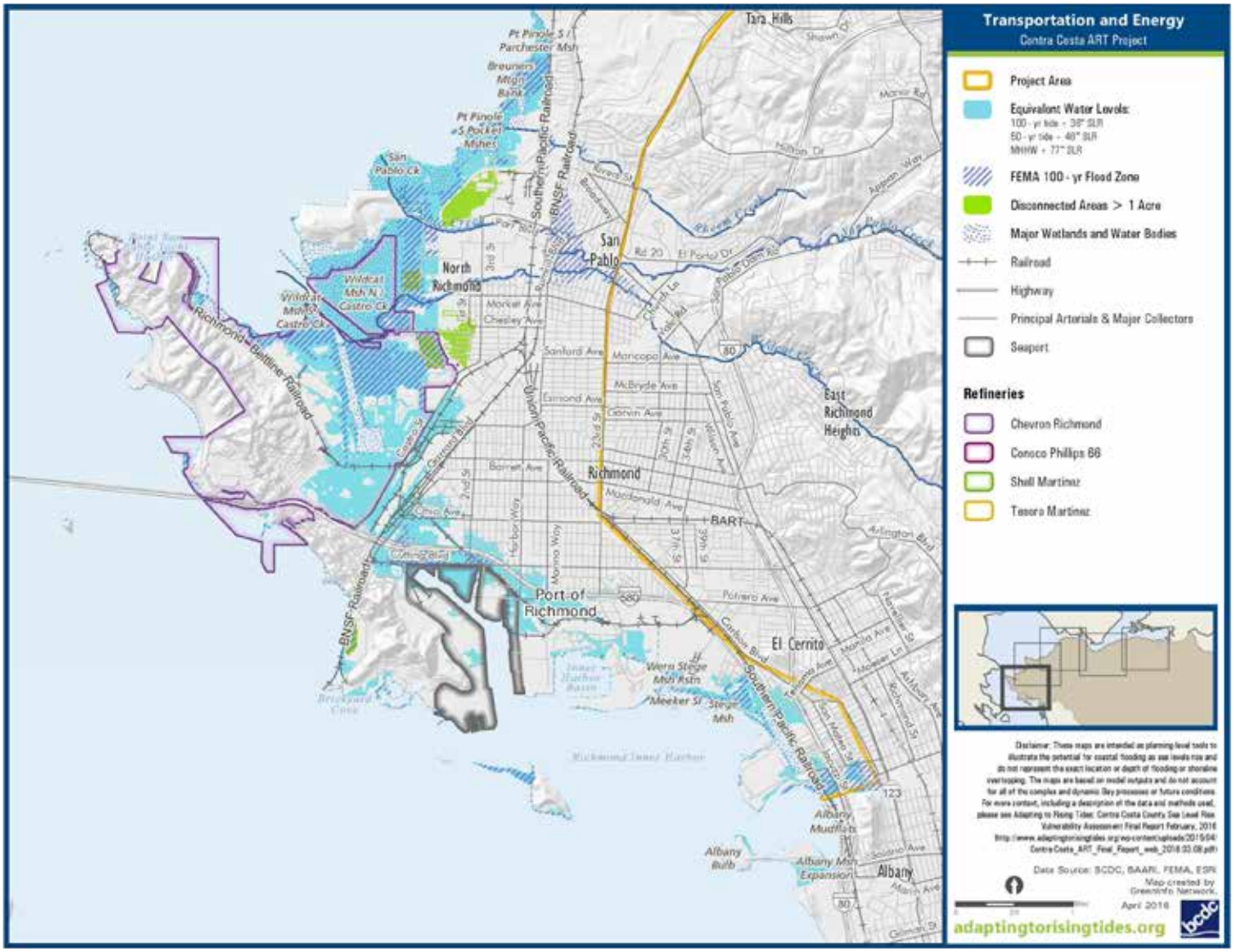


Photo courtesy of The Royal Society;
https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/basics-of-climate-change/

The most prevalent GHGs are carbon dioxide (CO2) and water vapor. Others important GHGs are methane (CH4), nitrous oxide (N2O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). These gases are emitted through a variety of natural processes and human activities, as follows:

- CO2 and N2O are byproducts of fossil fuel combustion;
- N2O is associated with agricultural operations, such as fertilization of crops;
- CH4 is commonly created by off-gassing from agricultural practices (e.g., manure from cows), anaerobic composting, and landfills;
- CFCs were widely used as refrigerants, propellants, and cleaning solvents; their production has been mostly eliminated by international treaty, but past emissions remain in the atmosphere due to their long lifespan;
- HFCs are now used as a substitute for chlorofluorocarbons in refrigeration and cooling; and
- PFCs and SF6 emissions are common byproducts of industries such as aluminum production and semi-conductor manufacturing.

Figure 2-2: Impact of Sea Level Rise on City of Richmond Transportation and Energy Assets



The City of Richmond has also completed its first Climate Change Adaptation Study (see Appendix F) which includes an evaluation of climate change impacts at the local scale and a vulnerability and risk assessment of the City's most important assets to rising temperatures, rising seas, extreme weather events, and more extreme droughts.1 The methodology used to develop the City's Adaptation Study expands on the Adapting to Rising Tides (ART) methodology2 developed by the Bay Conservation and Development Commissions (BCDC) and National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, to evaluate how San Francisco Bay Area communities can adapt to sea level rise and storm event flooding. The findings from the City of Richmond Climate Change Adaptation Study, which incorporate a wide range of analyses done for the Contra Costa County ART Project,[3] are summarized in the following sections.

Rising Seas

Historical records show that sea level in San Francisco Bay has risen more than 7 inches (18 cm) over the past 100 years. Scientists agree that the rate of sea level rise is accelerating, but projections of future sea levels vary considerably. The State of California has adopted sea level rise projections for the San Francisco Bay region from the National Research Council (NRC), which includes an allowance for vertical land motion (tectonic uplift, or subsidence from compaction of sediments). For the Bay Area, the NRC projects 11 inches of sea level rise (measured at Mean Higher High Water, or MHHW) over current levels by 2050 (with a range of 5 to 24 inches) and 36 inches by 2100 (with a range of 17 to 66 inches by 2100). The Contra Costa County ART Project mapped these sea level rise scenarios, as well as higher Bay water elevations ranging from 77 to 108 inches above MHHW. These higher levels are above current predictions for sea level rise likely to occur before 2100, but they illustrate short-term flooding that could occur in that time frame when extreme tides are coupled with sea level rise. For example, 77 inches above MHHW is approximately equal to a 36-inch sea level rise plus 100-year extreme tide

As described in the Adaptation Study, hundreds of Richmond homes are at risk from current or future flooding that will be more frequent or extensive as sea level rises. Critical infrastructure including roads, railways, and wastewater treatment plants are vulnerable to sea level rise and coastal flooding, as are recreational areas at Point Isabel Recreational Shoreline, Miller Knox Regional Shoreline, and Point Pinole Regional Shoreline. Figure 2-2 illustrates the anticipated impact of sea level rise on transportation and energy assets in the City of Richmond, using a projection of 77 inches above MHHW (equivalent to 36-inch sea level rise plus 100-year extreme tide). The Chevron refinery is located in a high risk area for sea level rise, as is the Port of Richmond, and critical stretches of important highways and rail lines.

Rising Temperatures

California in general expects overall hotter conditions for both average and extreme temperatures. An increase in heat waves and wildfires are expected to be among the earliest climate impacts experienced across the state.[4] According to the State's climate adaptation planning tool known as Cal-Adapt, the City of Richmond area can expect to experience a rise in average annual temperature of about 3 to 6 degrees Fahrenheit above the historical average by the end of the century. Urban areas with lots of pavement and few trees will tend to heat up even more. Though extreme heat events in coastal areas like Richmond are not expected to be as severe or as long-lasting as further inland, the residents of these historically cooler areas are less accustomed to hot weather and may not be as well prepared or equipped to deal with it. Air conditioning is far less common, for example. Outdoor workers, elderly populations, and infants are particularly vulnerable to extreme temperatures.[5]

[1] City of Richmond Climate Change Adaptation Study, 2016.

[2] San Francisco Bay Conservation and Development Commission (BCDC) and the NOAA Coastal Services Center, 2011: Adapting to Rising Tides; project information and resources available at http://www.adaptingtorisingtides.org/

[3] Project information available at: http://www.adaptingtorisingtides.org/project/contra-costa-county-adapting-to-rising-tides-project

[4] California Natural Resources Agency, 2014, Safeguarding California: Reducing Climate Risk; An update to the 2009 California Climate Adaptation Strategy, http://resources.ca.gov/climate/safeguarding/

[5] Contra Costa Health Services. Climate Change Vulnerability in Contra Costa County: A Focus on Heat, 2015

Precipitation and Drought

Climate models indicate that the San Francisco Bay Area is likely to continue with its Mediterranean climate of cool wet winters and hot dry summers, but conditions will be drier than the historical average in the second half of the century. While average conditions may be drier, the expectation is that more intense downpours will occur during a somewhat shorter rainy season.[6] Since the City already has an arid climate, it is sensitive to a decrease in annual local precipitation, which can cause local drought, impacting local flora and contributing to wildfire risk. An increase in local precipitation during extreme storms can increase the peak storm runoff, thereby increasing the risk of flooding due to the overtopping of stormwater channels, pipes, pumps, and creeks.

Regional changes in precipitation and temperature patterns present a long-term risk to the City's water supply. Climate models predict reductions in the average annual Sierra snowpack with a shift in snowmelt runoff to earlier in the year, changes in the timing, intensity and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow.[7]

Long-term changes in watershed vegetation and increased incidence of wildfires could affect water quality in local reservoirs. Higher temperatures would also increase evaporation, which in turn would increase irrigation demand.

2.3 Vulnerabilities and Potential Consequences in Richmond

In its recently published update to the California Climate Adaptation Strategy, the California Natural Resources Agency outlines the significant climate change impacts facing the Bay Area, including sea level rise, public health problems arising from more extremely hot days and poorer air quality; longer and more intense wildfire conditions; more frequent droughts with possible disruptions in fresh water supplies; and vastly different natural resource conditions. The report emphasizes the unprecedented levels of leadership and cooperation needed amongst multiple stakeholders to effectively address adaptation.[8]

The local impacts on climate described in the prior section will affect community infrastructure and resources. The City of Richmond Climate Change Adaptation Study assesses vulnerabilities for the following eleven categories of community assets, which include City-owned or operated facilities deemed critical for operations, utility services, and risk management, and other tangible and non-tangible assets that are important to community health, safety, and well-being. Assets are categorized as follows:

1. Community Services and Public Facilities
2. Public Health
3. Housing
4. Water Supply
5. Wastewater Management
6. Stormwater Management
7. Transportation Infrastructure
8. Shoreline Flood Management
9. Energy Security and Infrastructure
10. Solid Waste/Hazardous Materials Management
11. Natural Areas/Ecosystems/Recreation Assets
12. Commercial and Industrial Assets

[6] Cayan, Tyree, and Iacobellis, 2012. Climate Change Scenarios for the San Francisco Region. California Energy Commission Publication No. CEC-500-2012-042.

[7] San Francisco Bay Area Integrated Regional Water Management Plan, September 2013. Available at: http://bairwmp.org/

[8] California Natural Resources Agency, 2014, Safeguarding California: Reducing Climate Risk; An update to the 2009 California Climate Adaptation Strategy, http://resources.ca.gov/climate/safeguarding/

Richmond's greatest risks related to climate change result from the City's shoreline, the inherent sensitivities of its Mediterranean climate, and its dependence on imported water from the distant Sierra Nevada as its primary water supply. Some of the City's most critical assets are located in close proximity to the low-lying shoreline where risk of damage or disruption from sea level rise is significant. These include wastewater treatment facilities, stormwater management infrastructure, residential neighborhoods, historical landmarks, the Chevron Refinery and other industrial areas including the Port of Richmond, highways, rail lines, emergency response facilities, and parks. Climate change is expected to bring hotter and drier summers and winter storms that are predicted to be fewer in number but higher in intensity. These changes can stress natural habitats and public health while posing a potentially serious risk to the long-term reliability of the City's potable water supply. Based on this study, the City-owned and community assets at highest risk from climate change by the year 2100 include the following:

1. Property and infrastructure located in areas along the bay shore prone to coastal flooding. Current levees are not designed to protect these assets from sea level rise;
2. The City's long-term potable water supply, which is largely dependent on runoff from the Sierra Nevada Mountains, especially during dry years;
3. Road transportation assets including streets and highway approaches that are located in flood-prone areas near the bay shore;
4. The health and well-being of the most vulnerable of the City's residential populations, and its natural inhabitants (flora and fauna), which can experience severe stress from extreme heat, drought and extreme precipitation events; and
5. Parks, roads and residential areas in the Richmond Hills that become increasingly high risk zones for wildfires by the year 2100.

Richmond is already engaged in multiple planning efforts that address some or all of these risks. However, the Adaptation Study represents the City's first widely coordinated effort to identify and document vulnerabilities across a broad range of community assets, and assess the risk of climate-related impacts to those assets over near-term (to 2050) and longer-term (to 2100) planning horizons.

2.4 Climate Change and Public Health

Climate change presents a significant risk to community health. More extreme weather events, worsening air quality, and increased transmission of infectious disease may negatively affect human health, health behaviors, and the socio-economic factors that influence health outcomes. Some existing health threats may intensify, while new health threats may emerge. The impacts of climate change will not affect everyone equally. It is expected that already burdened and vulnerable populations, such as the elderly, infants and children, people of color/communities of color, and people living in poverty, will be disproportionally impacted by climate change. Fortunately, many of the actions that address climate change also improve the health and wellbeing of vulnerable communities, helping to address the existing, unequal health burdens faced by some of the City's most disadvantaged residents.

Health Effects and Vulnerable Populations

Climate change, together with other stressors, is expected to impact many facets of public health. For example, extreme heat can cause premature death, cardiovascular stress or failure, and heat-related illness such as heat stroke, heat exhaustion, and kidney stones. Air pollution can cause increased asthma attacks, allergies, chronic obstructive pulmonary disease, and other cardiovascular and respiratory diseases. Any of these stressors can lead to mental health disorders such as depression, anxiety, Post-traumatic Stress Disorder (PSD), substance abuse, and other conditions.

The City's most vulnerable populations (the elderly, low-income families, communities of color, and individuals already suffering from chronic diseases) face significant risk from extreme heat events. These populations will also face higher risk of health problems from worsening air quality and new disease vectors. The City has an important role, in partnership with public agencies and community-based organizations, to educate and engage the public on climate change issues, and to promote community involvement in actions to reduce climate change risks, using linguistically and culturally responsive approaches that are effective to improving resiliency for diverse populations.

Community Resiliency to Climate Change

The driving hypothesis behind the City's HiAP Strategy is recognizing that the cumulative impact of multiple stressors on the body is a key factor in the persistence of health inequities. Toxic stress refers to prolonged and repeated exposure to multiple negative factors that have known physical and mental health impacts that contribute to chronic conditions such as heart disease and diabetes, including poor air quality resulting from GHG emissions. Similarly, the "climate gap" refers to the disproportionate and unequal health and economic impact that climate change has on people of color and low income communities.[9] Together, the City's HiAP Strategy and the CAP focus on reducing toxic stress and the climate gap by focusing on the Social Determinants of Health, the conditions in the environment in which people are born, live, work, play, and age that affect a wide range of health and quality of life outcomes.

Health Co-benefits

Climate change will have significant health impacts and it is important that people are prepared to mitigate and adapt to our changing climate. Many climate change mitigation and adaptation efforts can bring multiple health co-benefits to Richmond residents. For example, reducing vehicle miles traveled by increasing safe and accessible walking and bicycling infrastructure can increase physical activity, reduce air pollution, and decrease injury collisions. Corresponding health co-benefits include reductions in chronic disease, obesity levels, and respiratory diseases, and improvements in mental health.

Promoting local agriculture and food systems can increase access to healthy and fresh foods, reduce upstream energy use, and increase local social cohesion. Urban greening is another strategy that helps reduce energy use, moderate temperature and the urban heat island health effect, reduce air and noise pollution, and enhance safety. Likewise, having access to urban green space can improve physical and mental health.

Finally, climate actions can indirectly improve health. Actions that reduce residential building energy use can reduce household energy cost and promote healthy homes while at the same time creating local green jobs with living wages. Better employment, housing, and other physical environment factors are all factors that affect health and wellbeing.

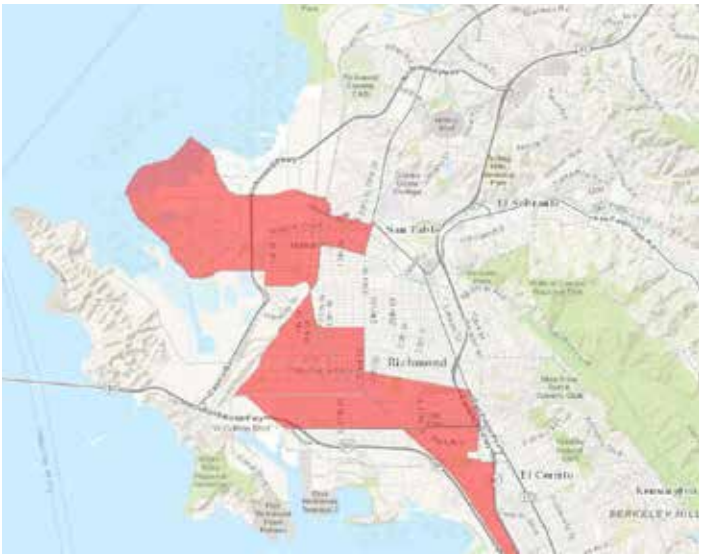
Climate Change and Health Equity

Climate change will act as a stress multiplier for many existing health problems which already disproportionally impact low-income populations and communities of color in Richmond. While climate change is expected to affect environmental conditions such as temperature and air quality, which can result in more illness and injury, it is also expected to impact socio-economic conditions and access to basic goods and services, such as health care, food, and housing, exacerbating existing cumulative stress.

[9] Morello-Frosh, Rachel, Manuel Pastor, James Sadd, and Seth Shonkoff. The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap. May 2009, available at: https://dornsife.usc.edu/pere/climategap/

The map in Figure 2-3 shows the disadvantaged communities in Richmond designated by California Environmental Protection Agency (CalEPA) for the purpose of implementing SB 535, which allocates twenty-five percent of available moneys in the State's Greenhouse Gas Reduction Fund (GGRF) to projects that provide benefits to disadvantaged communities.[10] These areas are disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure or environmental degradation. Their location is determined by CalEnviroScreen 2.0,[11] a screening tool that uses twenty-one indicators to identify communities most burdened by pollution from multiple sources and most vulnerable to its effects, taking into account their socioeconomic characteristics and underlying health status. These areas tend to have high concentrations of people with low income, high unemployment, low levels of home ownership, high rent burden, health sensitivities, or low levels of educational attainment. Communities in North Richmond, Central Richmond, South Richmond, and the Richmond Annex are among those designated by these criteria as disadvantaged communities.

Figure 2-3: Disadvantaged Communities in Richmond



Courtesy Image by; California Environmental Protection Agency
http://www.calepa.ca.gov/EnvJustice/GHGInvest/

Actions focusing on the most burdened and vulnerable communities can help alleviate existing health and social inequities by helping to address some of the upstream root causes of those inequities. As opportunities to build local capacity, engage and empower the community, and implement cross-sector partnerships are integrated into the City's climate change efforts, the CAP will be leveraged to maximize health co-benefits and reduce existing inequities. Furthermore, by strengthening local capacity to respond to natural hazards when they occur, the City can reduce the number and severity of injuries and illnesses when they do happen.

2.5 Economic Opportunities

The City is already home to many prominent, innovative green businesses and clean tech companies, and is poised to be a new center of innovation in the low carbon economy. Studies conducted by CARB and others show that economic growth does not have to be compromised to achieve deep reductions in GHG emissions in line with the state's goal of 80 percent below 1990 levels by 2050.[12] The state is committed to meeting this challenge though innovation and investment that will drive technology development and advance social progress. Recent legislation and policy developments are providing clear signals that the transformation to a low carbon economy is upon us, encouraging businesses to invest in clean technology and develop products and services that do not come at the expense of future generations, but instead, provide even more opportunity for growth in the future.

Achieving GHG reductions of this magnitude requires innovation and investment in energy, transportation, agriculture, water, waste management, and land management. It also requires scaling up the market adoption of new technologies in these sectors. Already, public and private investment in new technologies has reaped broad economic benefits for the state along with significant GHG reductions. Energy policies in particular have enabled the state to emerge

[10] See SB 535 maps at the California Office of Health Hazard Assessment (OEHHA) web site: http://oehha.maps.arcgis.com/apps/Viewer/index.html?appid=dae2fb1e42674c12a04a2b302a080598

[11] CalEnviroScreen is the state's Environmental Health Screening Tool used to help identify California communities that are disproportionately burdened by multiple sources of pollution. CalEPA has used the tool to designate California communities as disadvantaged pursuant to Senate Bill 535. The tool will be updated periodically; CalEnviroScreen 3.0 Draft became available in September 2016.

[12] California Air Resources Board (CARB), 2014: First Update to the Climate Change Scoping Plan, May 2014.

as the national leader in both clean energy jobs and clean energy investment. Title 24 and other energy standards have saved Californians $74 billion in energy costs since 1977. [13] California has the fourth lowest per-capita energy-related GHG emissions in the country and produces on average twice as much economic value for every unit of electricity used. The state's AB 32 Scoping Plan Update references multiple studies that show how businesses in the U.S. could collectively cut energy-related GHG emissions by more than 20 percent by 2020, and generate hundreds of billions of dollars in net savings.[14]

New economic opportunities will continue to emerge as state and regional agencies direct investment, policy and planning towards reducing GHG emissions. Electrification of the transportation and building sectors, decarbonization of electricity supply, and designing new buildings to be net energy producers are just three examples of the transformative developments required for the state to meet its long term GHG targets. Many of the technologies needed to accomplish these outcomes are cost-competitive and available today. As technologies improve and supporting infrastructure becomes available, costs will come down, accelerating market uptake and saving consumers money that will be re-directed elsewhere into the economy.

The City of Richmond recognizes future business growth opportunities in the bioscience and green/clean technology sectors and has set has set a long-term vision to be nationally recognized for business development in these sectors. Richmond has an abundance of marketable assets that position it for growth in the low-carbon economy, including robust transportation and transit networks, proximity and partnerships with world-class universities and urban innovation centers, and relatively affordable real estate.[15]

2.6 The Role of State and Regional Action

The Richmond CAP contains many strategies and actions designed to enhance and leverage existing State policies and programs. Building on the State's existing policies and programs improves the effectiveness of the CAP and increases State funding opportunities.

The State is providing an important leadership role in climate protection through policy development, planning, regulations, research, legislation, and funding programs. California has established a broad framework, across all sectors of the economy, to reduce GHG emissions to 80 percent below 1990 levels by 2050. This framework, outlined by the California Air Resources Board (CARB) in the Climate Change Scoping Plan Update of 2014, identifies the following six sectors that must undergo profound transformation in order for the State to meet its 2050 goal:

1. Energy
2. Transportation (Vehicles/Equipment, Land Use, Fuels, and Infrastructure)
3. Agriculture
4. Water
5. Waste Management
6. Natural and Working Lands

[13] California Air Resources Board (CARB), 2014: First Update to the Climate Change Scoping Plan, May 2014.

[14] City of Richmond Marketing Plan, 2013, by Social Sector Solutions (S3), a project of the UC Berkeley Haas Business School MBA program.

[15] California Energy Commission web site, accessed November 28, 2015: http://www.energy.ca.gov/efficiency/savings.html

California's Scoping Plan measures are designed to reduce state-wide emissions from each of these sectors. State measures include developing new policies, supporting emerging technologies, and growing the markets for those technologies. Market transformation is a recurring theme of the Scoping Plan Update, which acknowledges the role that the State must play in developing infrastructure and commercial markets for low-carbon solutions to grow to the scale required to meet its GHG emissions reduction goal. Convergence of technologies and market objectives is needed across multiple sectors and will require integrated planning among dozens of State agencies as well as closely coordinated efforts with locally-driven GHG reduction efforts, such as the City of Richmond CAP.

Many of the State's transportation measures, including the Advanced Clean Car standards and the Low Carbon Fuel Standard (LCFS), are designed to achieve consistent GHG reductions statewide by increasing vehicle efficiency and reducing the carbon intensity of fuels. These measures have been incorporated into the City's forecasted GHG emissions through the year 2050.

California's energy policies have enabled the State to emerge as the national leader in both clean energy jobs and infrastructure investment. With respect to energy, California has the fourth lowest per-capita emissions in the country and produces on average twice as much economic value for every unit of electricity used. The State adopted SB 350 in 2015 establishing requirements that by the year 2030 the State's buildings increase energy efficiency by 50 percent, and electricity be generated from 50 percent renewable energy sources. The Richmond CAP builds on these policies, facilitates effective implementation within the City, and in some cases goes beyond the State's standards and policy goals to achieve deeper reductions.

As described in CAP Chapter 1, Introduction, the Sustainable Communities and Climate Protection Act of 2008 (SB 375) aims to reduce GHG emissions from cars and light-duty trucks by incentivizing denser development that reduces urban sprawl. Plan Bay Area[16] is the Region's required Sustainable Communities Strategy (SCS), which demonstrates how the Bay Area region will integrate transportation, land-use and housing to reduce GHG emissions. Plan Bay Area concentrates approximately 80 percent of housing growth and 66 percent of job growth in Priority Development Areas (PDAs). A majority of PDAs are infill development areas located near existing or planned public transit, and in communities where there is local commitment to develop more housing.[17] The One Bay Area Grant (OBAG) program associated with Plan Bay Area provides discretionary funds geared toward transit-oriented housing projects and transportation infrastructure that supports growth in the PDAs. These funds can be spent on infrastructure items such as new bicycle lanes and more pedestrian-friendly sidewalks. Transportation and land use strategies in the CAP are geared toward leveraging the OBAG program.

[16] Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC), 2013. Plan Bay Area 2013: Strategy for a Sustainable Region, July 2013

[17] PDAs in Richmond include the Central Richmond and 23rd Street Corridors, South Richmond, and North Richmond. For maps and more information, see the Plan Bay Area web site: http://gis.abag.ca.gov/website/PDAShowcase/

City of Richmond

Climate Action Plan

CHAPTER 3

Emissions Inventories, Forecasts, and Reduction Target

EMISSIONS INVENTORIES, FORECASTS, AND REDUCTION TARGET

The City of Richmond greenhouse gas (GHG) emissions inventory quantifies the annual GHG emissions resulting from activities within the City by residents, businesses, and local government. The community inventory provides an understanding of where GHG emissions are originating and informs development of effective strategies and actions to reduce emissions.

The City's baseline Community GHG Inventory for 2005 forms the basis for setting emissions reduction targets and measuring future progress. In developing the CAP, the City revised its existing 2005 inventory with better transportation and solid waste data, and compiled a 2012 inventory update that allows the City to start assessing emissions trends over time. Detailed information regarding the boundaries of analysis, methods of quantification, data sources, and changes that occurred between the 2005 and 2012 inventories is provided in Appendix B.

The 2005 baseline and 2012 updated inventories account for GHG emissions in metric tons of carbon dioxide equivalent (MTCO2e)[1] from four sectors: energy, transportation, solid waste, and water. The GHG inventories are presented as:

1. Community GHG Inventory: Includes all emission sources within the community with the exception of large industrial sources that are regulated by CARB and are a part of California's Cap and Trade Program per the requirements of Assembly Bill 32 (AB 32). These sources are referred to in this chapter as "AB 32-regulated facilities."
2. Community GHG Inventory with AB 32-Regulated Sources: Includes emissions from all sources located within the City of Richmond including large industrial facilities regulated by the State.[2]

[1] MTCO2e combines the global warming potential (GWP), or extent to which each GHG is able to trap heat, for carbon dioxide (CO2), methane (CH4) and/or nitrous oxide (N2O) into a single unit of measurement for purposes of comparison.

[2] These sources were not regulated per the requirements of AB 32 in 2005, as AB 32 was not signed until 2006.

This approach is consistent with guidance from the BAAQMD, which recommends presenting community GHG inventories with and without large industrial sources that are regulated by the State through CARB. The adjusted inventory approach 1) provides City directives and actions that advance sustainability for community emission sources; and 2) institutionalizes and formalizes City support of State cap-and-trade regulation of large industrial facilities.

3.1 Community Inventory

As shown in Table 3-1, the baseline (2005) Community GHG Inventory for the City of Richmond includes 693, 426 MTCO2e. In 2012, community emissions rose by 0.4% to 696,407 MTCO2e.

If large industrial sources currently regulated by AB 32[3] are added to the Community Inventory, total 2005 emissions from sources within the City of Richmond amount to more than 5.6 million MTCO2e.

Table 3-1: GHG Emissions Inventory Results

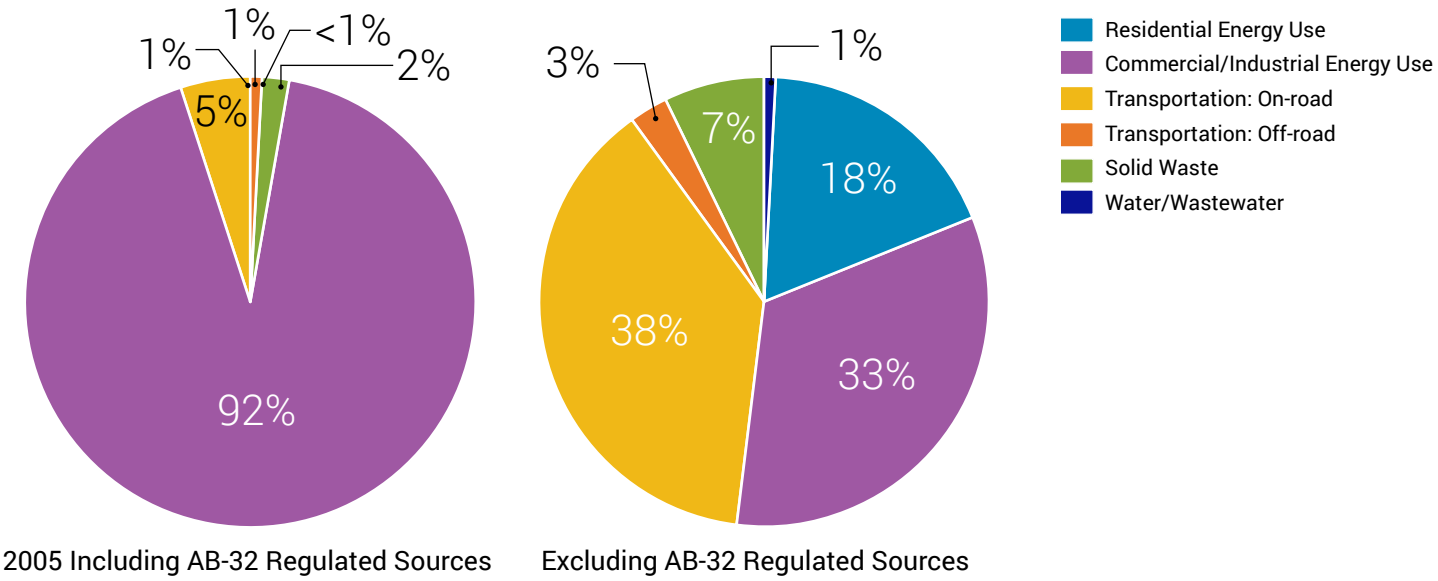
Sector	2005 MTCO2e (baseline)	2012 MTCO2e	Change from 2005 to 2012	
			MTCO2e	Percent
Residential Energy Use	126,118	120,248	-5,870	-4.7
Commercial/Industrial/Municipal Energy Use	226,591	225,736	-855	-0.4
Transportation (On- and Off-road)	287,916	299,701	11,785	4.1
Solid Waste	50,214	48,999	-1,215	-2.4
Wastewater	222	239	17	7.6
Water	2,364	1,484	-880	-37.2
Community GHG Inventory	693,426	696,407	2,982	0.4
Large Industrial Energy Use (Regulated by AB 32)	4,914,982	4,169,879	-745,103	-15.2
Community GHG Inventory with AB 32-Regulated Sources	5,608,407	4,866,206	-742,121	-13.2

Figure 3-1 illustrates the results of the 2005 community inventory, with and without emissions from AB 32-regulated sources. Without the emissions from AB-32 regulated sources, the Richmond Community GHG Inventory resembles that of most other cities in California. Contributing the largest share of emissions to adjusted Community GHG Inventory is On-road Transportation, accounting for approximately 38 percent of total emissions. Commercial/Industrial/Municipal Energy Use (from electricity and natural gas) accounts for around 33 percent of total emissions, while 18 percent is attributed to Residential Energy Use. The remaining emissions are comprised of GHGs from Solid Waste (7 percent), Off-road Transportation (3 percent), Water and Wastewater (1 percent).

In 2012 the City emitted approximately 4.9 million MTCO2e, of which almost 4.2 MTCO2e (82 percent) is attributed to large industrial emissions regulated by AB 32 (see Table 3-1). The 2012 inventory is similar to the 2005 inventory in terms of total emissions and relative contribution by sector. The vast majority of emissions were the result of large industrial sources that are regulated by AB 32, and when those sources are excluded, the biggest contributions are from On-road Transportation (54 percent), followed by Commercial/Industrial/Municipal Energy Use (25 percent), and Residential Energy Use (13 percent).

[3] These sources were not regulated per the requirements of AB 32 in 2005, as AB 32 was not signed until 2006.

Figure 3-1: 2005 Baseline Community GHG Inventory



2005 Including AB-32 Regulated Sources

Excluding AB-32 Regulated Sources

How does the Richmond Cap Consider "AB 32 Regulated" Sources?

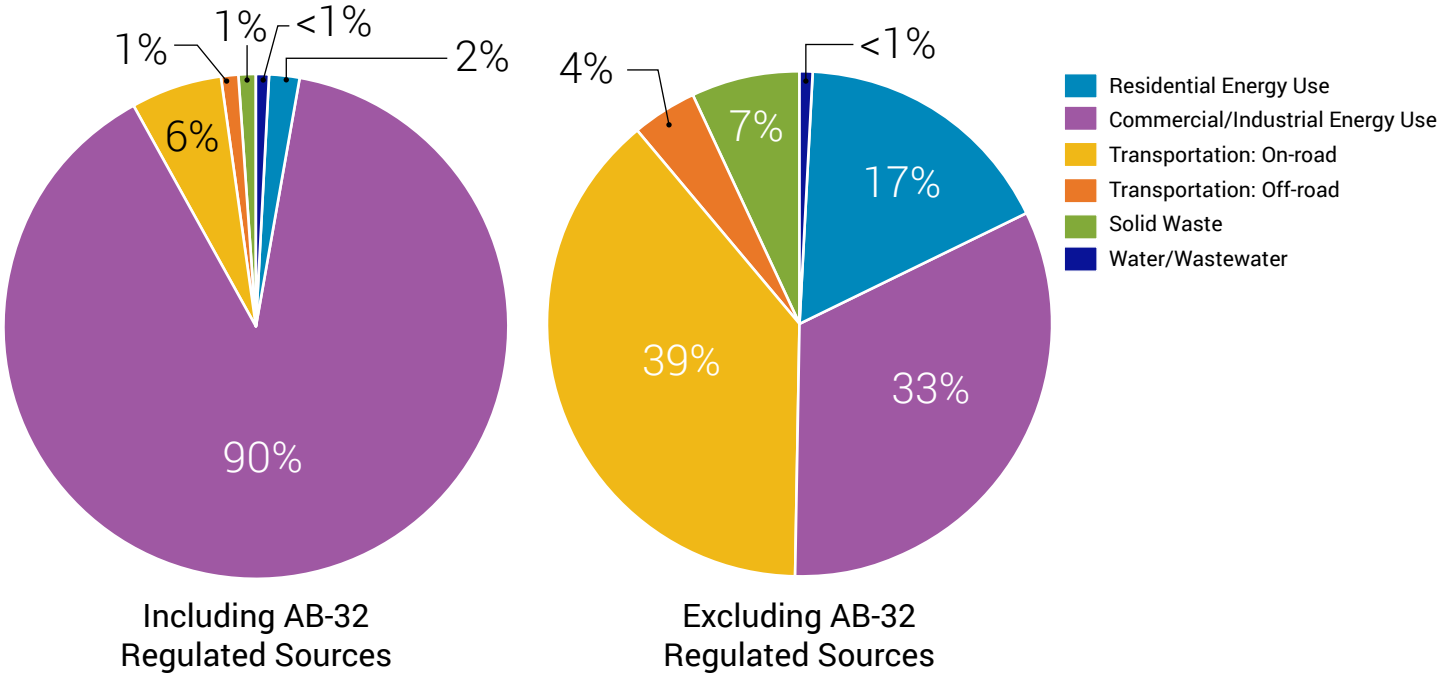
The Richmond CAP is largely focused on GHG emissions sources that the City controls or influences. Consistent with guidance from the BAAQMD and ICLEI's Draft Community-wide Protocol, the City is supporting AB 32 as the primary vehicle and framework to regulate and reduce emissions from large industrial facilities (Chevron, West Contra Costa County Landfill, and New NGC, Inc.) in its community-wide GHG reduction target for the following reasons:

1. These facilities' GHG emissions are regulated by CARB under the state's Cap and Trade program, which requires that power generators, refineries, and other large industrial emitters that emit more than 25,000 metric tons of carbon dioxide equivalent per year (which collectively represent approximately 85 percent of the state's emissions) reduce their emissions over time in line with the California Global Warming Solutions Act of 2006 (AB 32). The Cap and Trade program provides a limit on emissions with the state as the enforcing agency; the City does not have the same jurisdictional authority.

2. These facilities are also regulated through the Federal Energy Regulatory Commission (FERC) and the California Energy Commission (CEC), and are subject to air quality and emissions standards set forth by the Environmental Protection Agency, CARB, and the BAAQMD.

3. Chevron's GHG emissions are currently limited by the Conditional Use Permit the City recently issued for the Chevron Refinery Modernization Project. Mitigation included in the project's Environmental Impact Report (EIR) ensures compliance with AB 32 by requiring the refinery, even operating at full capacity (100% utilization), to maintain no net increase (NNI) in GHG emissions, and include numerous measures to reduce GHG emissions from operations. In addition, the subsequent Environmental and Community Investment Agreement (ECIA) between Chevron and the City identifies a number of Community-based GHG Reduction Programs (CGRPs) designed to mitigate the refinery's operational GHG emissions that fall outside of California's Cap and Trade Program, and allocates funding to those programs and to community programs that overlap those in the CAP, covering the transportation and mobility, energy, solid waste, and biological sequestration sectors.

Figure 3-2: 2012 Community GHG Inventory Update



Comparison of the 2005 and 2012 inventories shows that the City saw a reduction in total GHG emissions, including Large Industrial Energy Use by sources regulated under AB 32, of 742,121 MTCO2e over the seven year period (a 13.2 percent reduction). Excluding sources regulated by AB 32, emissions increased by 0.4 percent (2,982 MTCO2e). As shown in Table 3-1, every sector saw a reduction in emissions with the exception of Transportation and Wastewater, which exhibited increases of 4.1 and 7.6 percent, respectively. The sectors that exhibited the greatest decrease in emissions were Water (37.2 percent) and Large Industrial Energy Use (15.2 percent).

3.2 Municipal Inventory

The GHG emissions associated with municipal facilities and operations, referred to as the Municipal Inventory, are a subset of the community-wide inventory. The Municipal Inventory represents less than one percent of the Community Inventory. Despite this low percentage, the City of Richmond recognizes the importance of providing leadership to the community and is committed to introducing policies and programs to reduce GHG emissions associated with its operations. Table 3-2 shows the municipal emissions for 2005 and 2012, which are estimated to be around 7,845 MTCO2e and 8,175 MTCO2e, respectively. In 2005 municipal energy use for Buildings accounted for the greatest share of emissions at approximately 46 percent, followed by the City's Vehicle Fleet at 18 percent and Streetlights at 17 percent. In 2012, the City's Vehicle Fleet had surpassed energy use as the greatest source of municipal emissions at around 35 percent, followed by Buildings at approximately 33 percent, and Water and Sewerage at 13 percent.

Table 3-2: Municipal Inventory Results

	2005		2012		Percent Change 2005-2012
	MTCO2e	Percent	MTCO2e	Percent	
Buildings	3,599	45.9	2,669	32.6	-26%
Streetlights	1,312	16.7	930	11.4	-29%
Water and Sewerage	1,005	12.8	1,033	12.6	3%
Waste	543	6.9	701	8.6	29%
Vehicle Fleet	1,386*	17.7	2,842	34.8	105%
Total	7,845	100	8,175	100	4%

*2005 data unavailable, 2008 used as proxy year

3.3 Emissions Forecasts and Reduction Targets

Business as Usual Forecast

Business-as-usual (BAU) emissions forecasts for 2020 and 2030 were derived based on demographic growth projections from the City of Richmond General Plan 2030 for future population, jobs, and households. Emissions forecasts for 2040 and 2050 were derived by continuing the average annual growth rates from 2005 to 2030. Excluding sources regulated by AB 32, the City of Richmond's community emissions are expected to increase approximately 11 percent between 2005 (the baseline year) and 2020, from 693,426 to 767,673 MTCO2e; by 2030 emissions would increase approximately 46 percent from baseline conditions to approximately 1,015,000 MTCO2e; by 2050 emissions would increase to nearly 1.3 million MT CO2e.[4] The BAU emissions forecasts are depicted in Figure 3-3. (For additional information on how these forecasts were derived see Appendix B.)

Adjusted Business as Usual Forecast

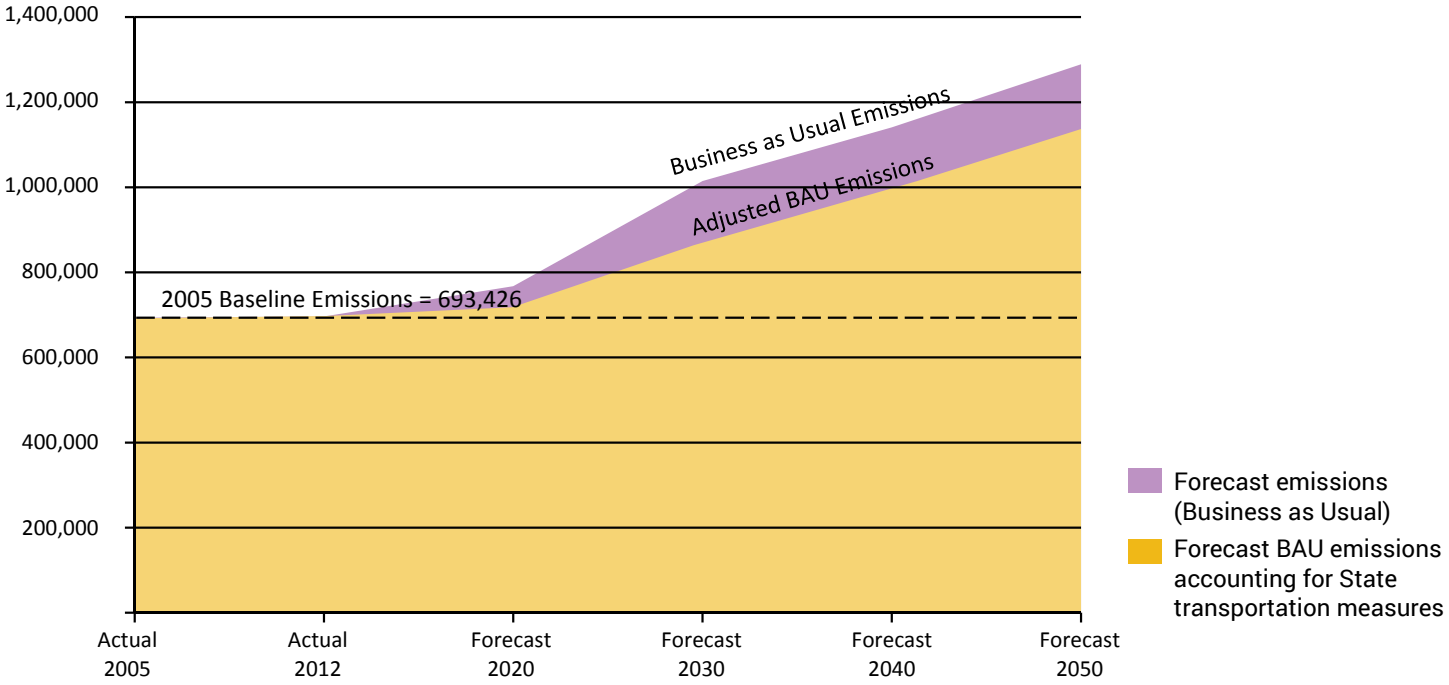
The adjusted business as usual (Adjusted BAU) forecast accounts for the local impact of state measures designed to reduce GHG emissions. Through its Climate Change Scoping Plan Update of 2014, the State of California establishes a broad framework to reduce GHG emissions to 80 percent below 1990 levels by 2050, across all sectors of the economy. Transportation measures in particular are designed to achieve consistent GHG emissions reductions across the state by increasing vehicle efficiency and reducing the carbon intensity of fuels used by the statewide vehicle fleet. These measures include the Pavley II/CAFÉ (Corporate Average Fuel Economy) Vehicle standards (known as the Advanced Clean Car initiative in California), the Low Carbon Fuel Standard (LCFS), the Tire Pressure Program, the Tire Tread Standard, and the Heavy Duty Vehicle Emission Reduction Program. Collectively, these measures are expected to reduce statewide transportation emissions by nearly 35 percent from the 2030 BAU forecast, and by extension should reduce community-wide emissions in the City of Richmond by the same percentage.

The Adjusted Business-As-Usual forecast for the City accounts for these state-level transportation measures.[5] Figure 3-3 shows how the BAU forecast compares to the Adjusted BAU forecast that accounts for state measures.

[4] The BAU forecast takes into consideration emissions reductions resulting from implementation of statewide mandates including the California's Advanced Clean Car Initiative (Pavley II standards) to reduce GHG emissions from passenger vehicles and the Low Carbon Fuel Standard to reduce the carbon intensity of vehicle fuels. For additional information on how future emissions were calculated, see Appendix B.

[5] Note that state measures affecting energy efficiency (e.g., SB 350) and renewable energy (Renewables Portfolio Standard) are not accounted for here.

Figure 3-3: Richmond GHG Emissions Baseline and Forecasts



Reduction Target

On September 6, 2008, the Richmond City Council passed Resolution No. 108-08 establishing a goal of achieving GHG reduction targets consistent with AB 32 and the Governor's 2005 Executive Order S-3-05, which correspond to achieving 1990 emissions levels by 2020 and 80 percent below 1990 levels by 2050, respectively.[6] Consistent with Resolution No. 108-08, the City has established a 2020 GHG reduction target for the CAP of 15 percent below 2005 levels by 2020.[7]

In addition, although executive orders do not have the same status as legislation[8], the City is committed to supporting the state's continued work toward meeting the deeper reductions called for in Executive Orders S-3-05 and B-3-15.[9] Notably, on May 22, 2014, the CARB approved the "First Update to the Climate Change Scoping Plan" describing the state's progress towards achieving AB 32 and broader goals.[10] The update stated that "California is on track to meet the near-term 2020 greenhouse gas limit and is well positioned to maintain and continue reductions beyond 2020 as required by AB 32." Specifically, "if California realizes the expected benefits of existing policy goals (such as 12,000 megawatts [MW] of renewable distributed generation by 2020, net zero energy homes after 2020, existing building retrofits under AB 758, and others) it could reduce emissions by 2030 to levels squarely in line with those needed in the developed world and to stay on track to reduce emissions to 80 percent below 1990 levels by 2050."

[6] Governor Schwarzenegger's Executive Order S-3-05 established a statewide GHG emissions goal of 80 percent below 1990 levels by 2050.

[7] In its Climate Change Scoping Plan of September 2008, and confirmed in the Scoping Plan Update in 2014, CARB recommends that local governments adopt a GHG reduction target consistent with the State's commitment to reach 1990 levels by 2020. This was identified as equivalent to 15% below "current" levels at the time of writing (2008). In its GHG Plan Level Guidance, BAAQMD also recommends using a baseline year of 2008 or earlier.

[8] Under California's constitutional system, the Legislature, not the Governor, is entrusted to make statewide laws. (See Santa Ana Hospital Medical Center v. Belshe (1997) 56 Cal.App.4th 819, 836; see also Cal. Const. Art. 4 § 8(b)). The Legislature did not include EO S-3-05 goals in AB 32, and has not incorporated the EO in any implementing legislation or applicable plans.

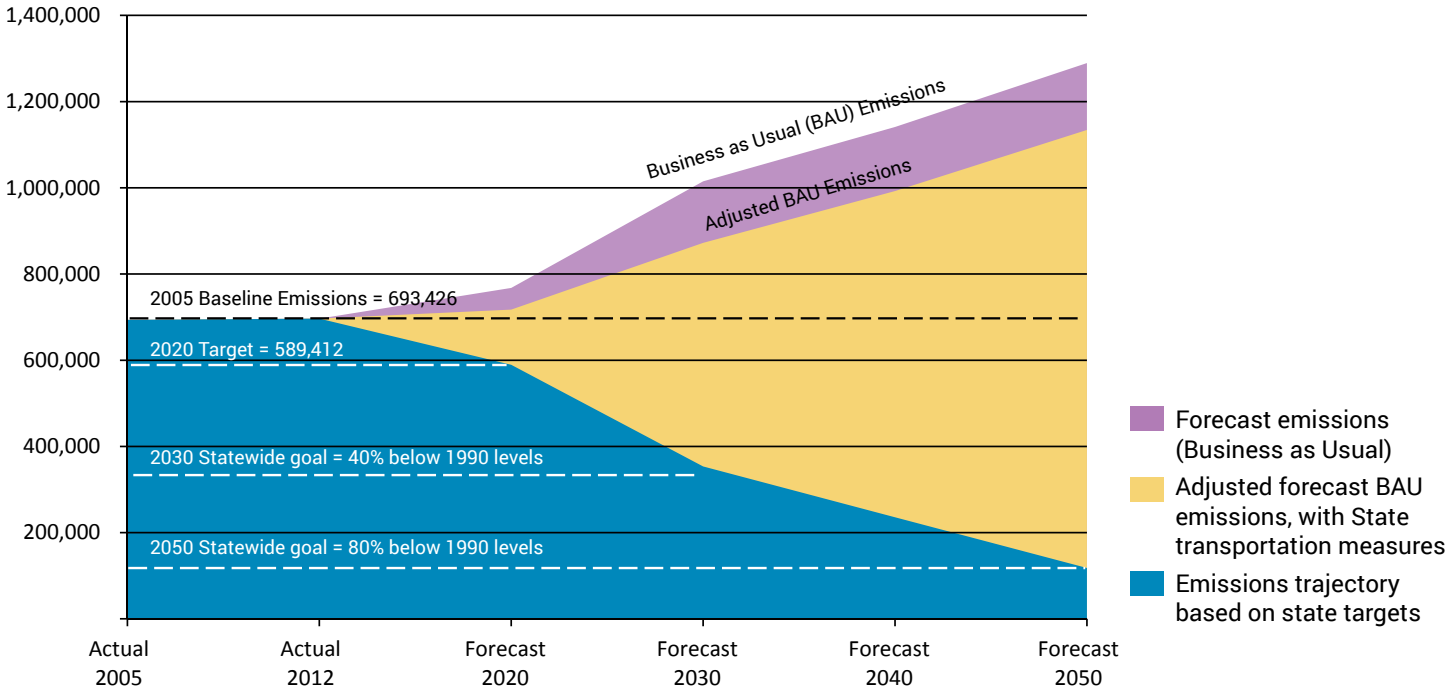
[9] Governor Brown's Executive Order B-3-15 established the statewide interim GHG emission reduction target at 40% below 1990 levels.

[10] Available online at http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf (last accessed 7/11/16).

The City's 2020 GHG emissions target, equivalent to 15 percent below 2005 levels, is 589,412 metric tons CO2e. Figure 3-4 illustrates the 2020 target in relation to deeper reductions needed for the City to maintain an emissions trajectory in line with the longer term statewide goals established by Executive Orders S-3-05 and B-3-15.

As outlined in the next chapter, Objectives and Strategies, the CAP provides a clear roadmap to meeting the 2020 target mandated by AB 32, and includes measures that will enable the City to accomplish much deeper reductions by 2030 and beyond, consistent with City commitments to support the state's progress toward deeper emissions reductions as called for in Executive Orders S-3-05 and B-3-15. As the State enacts new policies and regulations for reducing GHG emissions, the CAP and the City's own GHG reduction targets will be revised accordingly.

Figure 3-4: Richmond GHG Emissions Baseline, Forecasts, and 2020 Target

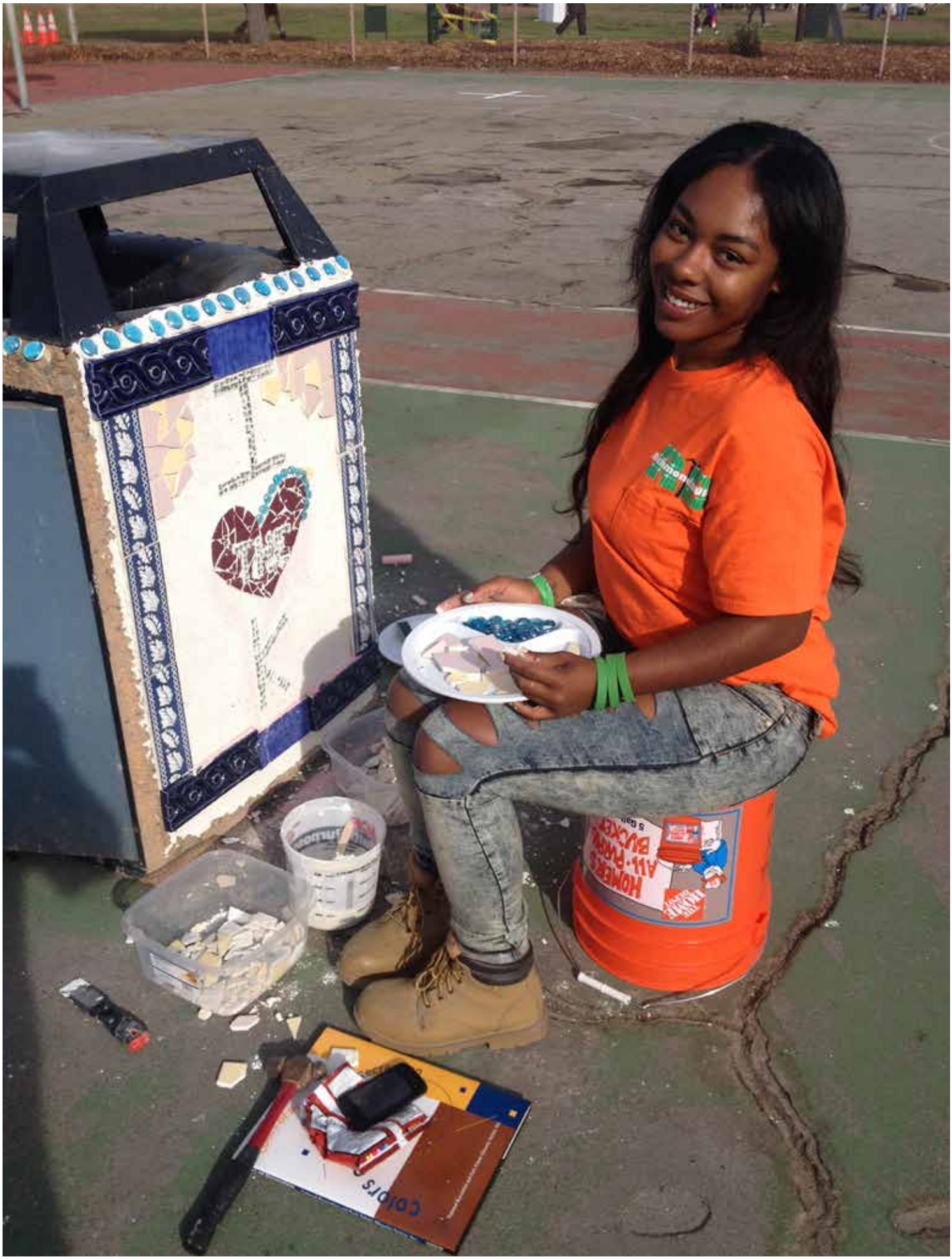


City of Richmond

Climate Action Plan

CHAPTER 4

Objectives and Strategies


HOMER'S
All-Purpose
Bucket
Colors

OBJECTIVES AND STRATEGIES

Climate Action Plan objectives and strategies were co-developed by the City and members of the public during community workshops and meetings, and through consultations with key local community groups and agencies. The eight objectives support the four CAP goals, and the goals, policies, and actions of the City's General Plan 2030 and other adopted City plans and ordinances.

Climate Action Plan Goals

GHG Emissions Reduction

Healthy and Resilient Community

Prosperous Local Economy

Engaged Community and Educated Youth

4.1 Organization of Objectives and Strategies

These four goals are supported by eight CAP objectives, which are derived from one or more Richmond General Plan 2030 policies.

1. Energy Efficient Buildings and Facilities
2. Increase Use and Generation of Renewable Energy
3. Sustainable Transportation and Land Use
4. Zero Waste
5. Water Conservation
6. Green Infrastructure, Urban Forestry and Local Agriculture
7. Green Business and Industry
8. Resiliency to Climate Change

Leadership in Managing Climate Change

All eight CAP objectives are supported by the City's two General Plan policies pertaining to leadership in managing climate change:

- Policy EC1.1 Leadership and Advocacy. Take a leadership role in advocating for local, regional and national solutions to climate change at all levels of government and with the private sector.
- Policy EC1.2 Public Awareness and Support. Provide incentives to encourage residents and businesses to reduce their carbon footprint by raising their awareness about the impacts of climate change and by building support for climate change initiatives in Richmond and the greater region.

The eight objectives provide an organizing framework for the forty CAP strategies presented in the following pages. Table 4-1 summarizes the estimated GHG reductions from each strategy, showing relative contributions toward meeting Richmond's 2020 GHG reduction target and maintaining reductions consistent with the State's longer term target for 2030. Methods of quantifying annual energy and GHG savings are documented in Appendix D. The GHG reduction estimates are based on standard methods and assumptions recommended by State and regional agencies, augmented by data obtained from local organizations and agencies, recent trends, relevant case studies, or reasonable assumptions regarding program participation. Some strategies are difficult to quantify or do not reduce emissions directly, but support other strategies or programs in the CAP. These strategies are identified as "Supporting Actions."

Figure 4-1: Relationship of CAP Components

Table 4-1: Summary of Strategies and GHG Savings

Strategy		2020 MT CO2e	2030 MT CO2e
Objective 1: Increase Energy Efficiency of Buildings and Facilities		**55,197**	**261,728**
Strategy EE1	Leverage Existing Programs and Rebates to Improve Efficiency of Existing Buildings	43,758	145,860
Strategy EE2	Leverage Existing Funding Programs and Financing Tools	supporting	supporting
Strategy EE3	Promote Green Building	11,439	115,867
Strategy EE4	Outreach and Education to Promote Energy Conservation and Renewable Energy	supporting	supporting
Objective 2: Increase Use and Generation of Renewable Energy		**64,719**	**113,520**
Strategy RE1	Increase Local Solar Energy Generation	3,074	8,422
Strategy RE2	Promote and Maximize Utility Clean Energy Offerings	48,602	57,390
Strategy RE3	Promote Conversion From Natural Gas to Clean Electricity	13,043	47,709
Objective 3: Sustainable Transportation and Land Use		**20,481**	**55,059**
Strategy TL1	Promote Smart Growth and Complete Neighborhoods	3,329	6,820
Strategy TL2	Promote "Complete Street" Improvements	741	873
Strategy TL3	Improve Pedestrian and Bicycle Infrastructure	2,419	5,176
Strategy TL4	Improve Signal Timing	supporting	supporting
Strategy TL5	Expand Public Transit Options and Network Connectivity	7,496	10,131
Strategy TL6	Expand Car Sharing, Bike Sharing, and Ride Sharing	1,726	1,638

Table 4-1: Summary of Strategies and GHG Savings

Strategy		2020 MT CO2e	2030 MT CO2e
Strategy TL7	Promote Low-Carbon Vehicles and Fuels	supporting	23,770
Strategy TL8	Support Outreach and Education for Public Transit and Active Transportation	1,973	1,530
Strategy TL9	Support Transportation Demand Management	2,796	5,120
Objective 4: Zero Waste		**27,040**	**52,755**
Strategy SW1	Establish a Zero Waste Framework	27,040	52,755
Strategy SW2	Increase Participation in Recycling Programs and Incentives	supporting	supporting
Strategy SW3	Supportive Garbage Collection Service Rates and Schedules	supporting	supporting
Strategy SW4	Increase Diversion of Construction and Demolition (C&D) Waste	supporting	supporting
Strategy SW5	Promote School Waste Diversion Programs	supporting	supporting
Objective 5: Water Conservation		**349**	**800**
Strategy WA1	Promote EBMUD Outreach and Conservation Programs	349	800
Strategy WA2	Expand School Programs	supporting	supporting
Strategy WA3	Green Building Strategies for Water Conservation	supporting	supporting
Strategy WA4	Support Water Infrastructure Improvements and Expand Water Reclamation and Reuse	supporting	supporting
Objective 6: Green Infrastructure, Urban Forestry and Agriculture		**375**	**1,081**
Strategy GA1	Support Urban Tree-Planting Programs	375	1,081
Strategy GA2	Support Local Agriculture and Food Production	supporting	supporting
Strategy GA3	Support Green Infrastructure and Streetscape Design	supporting	supporting
Objective 7: Green Business and Industry		**1,044**	**2,315**
Strategy GB1	Reduce Industrial Carbon Emissions	supporting	supporting
Strategy GB2	Green Workforce Development	supporting	supporting
Strategy GB3	Support Green/Clean Technology Incubator Programs	supporting	supporting
Strategy GB4	Support Local Energy and Green Business Programs	supporting	supporting
Strategy GB5	Reduce Emissions from Goods Movement	1,044	2,315
Strategy GB6	Reduce Use of Short-Lived Climate Pollutants (SLCPs)	supporting	supporting
Objective 8: Resiliency to Climate Change		**NA**	**NA**
Strategy RC1	Improve Community Preparedness for Climate Emergencies	supporting	supporting
Strategy RC2	Increase Resilience of Local Housing to Climate Change	supporting	supporting
Strategy RC3	Increase Resilience of Critical Infrastructure to Climate Change	supporting	supporting
Strategy RC4	Increase Resilience of Parks & Ecosystems to Climate Change	supporting	supporting

Table 4-1: Summary of Strategies and GHG Savings

Strategy		2020 MT CO2e	2030 MT CO2e
Strategy RC4	Develop a Long-term Shoreline Vision and Protection Plan	supporting	supporting
Strategy RC5	Protect Public Health and Promote Health Equity	supporting	supporting
Total GHG Reductions		**169,214**	**487,257**
GHG Reductions Needed to Reach Target		**128,011**	**NA**

In addition to GHG reductions, each strategy was evaluated using a broad set of criteria, including public health benefits and other co-benefits, including local economic benefits, availability of funding, financial impact to the City, and the ability to track and measure effectiveness. Key evaluation criteria are presented for each strategy in the following pages. The figure below explains the icons used to represent public health and other community co-benefits.

In-depth strategy evaluations, including discussion of relevant existing programs and planned implementing actions, are provided in Appendix E (CAP Implementing Actions). Implementing actions generally include changes in municipal codes, ordinances, and policies, new City programs and initiatives, and establishing or strengthening partnerships with outside organizations. The evaluations in Appendix E consider several criteria for each strategy, including costs, GHG reduction potential, funding sources, implementation responsibility, co-benefits, and potential implementation partners.

Objective 1: Energy Efficient Buildings and Facilities

Support energy conservation by businesses, residents, City government, and schools. Promote efficient use of energy in the design, construction, and operation of public and private facilities, infrastructure, and equipment.

Emissions associated with consumption of electricity and natural gas account for approximately 38 percent of the City's 2012 Community GHG emissions with 25 percent associated with commercial buildings and industrial use, and 13 percent associated with residential buildings. Significant opportunities exist to leverage existing programs to reduce energy demand, and maximize energy efficiency, as well as develop new programs and strategies. Richmond's strategies and implementing actions are consistent with California's clean energy policy, which prioritizes energy efficiency in the state's quest to meet energy demand.[1]

[1] As determined by the energy resource loading order adopted in the state's 2003 Energy Action Plan, and established by California's principal energy agencies: the California Energy Commission, the California Public Utilities Commission, and the California Consumer Power and Conservation Financing Authority.

Senate Bill 350 (SB 350) requires California to 1) generate half of its electricity from renewable energy sources; 2) double energy efficiency for both electricity and natural gas end uses in all buildings by 2030; and 3) substantially improve the infrastructure for electric vehicle transportation. Richmond is already on track to exceed SB 350's renewables portfolio requirement, through its participation in Marin Clean Energy's (MCE's) green electricity programs. The City can also expect to make rapid progress toward SB 350's energy efficiency goal for existing buildings, with a wealth of funding sources, incentives, and financing tools currently available for local improvement projects, and a reasonable expectation that additional State programs and funding sources will continue to develop. The City intends to lead by example, using utility rebates and incentives to retrofit existing municipal buildings, and prioritizing investment in community centers and public housing located in disadvantaged communities.

Commercial and industrial building stock represents an important opportunity for energy efficiency and conservation programs, as 4.7 percent of City land use is for commercial activities, and 21.7 percent is for industrial and port activities.[2] Richmond has approximately 2.6 million square feet of office space, and the City estimates that substantially more space will be required in the near future. By 2035, current job projections suggest demand for as much as 1.0 million to 1.3 million square feet of office space; even if current vacancies absorb some of this demand, these estimates still represent a significant addition of new space. The City houses approximately 11.3 million square feet of warehouse and manufacturing space, which is also projected to grow by 2035.[3]

Single family homes make up more than half (57 percent) of the local housing stock in Richmond. Housing units are equally split between the number of renters and homeowners, with 52 percent of homes owner-occupied and 48 percent of homes renter-occupied.[4] Seventy percent of the City's homes were built before 1980.[5] Older homes are typically less efficient, resulting in both higher energy bills and higher GHG emissions. These are all homes built prior to when California building energy efficiency standards went into effect, which ensure new and existing buildings maximize energy efficiency and preserve outdoor and indoor environmental quality. Even making small changes in homes can provide significant contributions in reducing GHG emissions and will save money. Actions such as switching to LED light bulbs, replacing old and inefficient appliances, and repairing leaky faucets and drafty doors and windows are some of the most effective ways to save energy. Such measures reduce energy costs, increase home values, and improve indoor air quality for residents.

Energy Upgrade California is a statewide program that offers up to $6,500 in incentives to homeowners, including those of multifamily properties, who complete energy efficiency home improvements. Homeowners can receive additional financing through an energy efficiency loan from MCE or utilize Property Accessed Clean Energy loans to pay for the cost of the upgrades that are not covered by the incentive payments. Energy Upgrade California offers assistance in understanding this program and finding contractors who can assess and complete projects that are funding-eligible.

[2] City Facts, City of Richmond. September 3, 2015.

[3] City of Richmond 2030 General Plan, Economic Development Element. Adopted April 25, 2012.

[4] City Facts, City of Richmond. September 3, 2015.

[5] American Community Survey. (2013). Table DP04. Selected housing characteristics.

PACE Programs

Property Assessed Clean Energy (PACE) programs provide financing for energy and water efficiency improvements and renewable energy systems. The repayment of the loan is collected on the property owner's tax bills over the course of several years, and the loan remains with the property if it is sold. Since the loan is tied to the property, it provides less risk to property owners to undertake energy efficiency measures with a longer term payback. There are currently three PACE programs available to businesses and residents in Richmond: HERO Financing, California First Efficiency Financing, and Figtree Financing. The City has adopted an open marketplace policy and will add additional PACE programs as they become available.

Compared with the greater Bay Area, many Richmond residents have less disposable income, making them more vulnerable to rising energy costs. An asset of the Richmond community is its multicultural and linguistic diversity; if rebate and assistance programs do not take this into account with their outreach strategies, many people can be excluded. Richmond has a high percentage of households that are low income, renter occupied, and housing cost burdened. Nearly half (48 percent) of all renters in Richmond are housing cost burdened.[6] These are families that pay more than 30 percent of their income on housing, meaning they have limited disposable income, making it difficult to make energy retrofit and climate ready upgrades. Lower-income residents also tend to live in older, less efficient buildings. These homes are less likely to have energy-efficient features and appliances, and it is more challenging for these households to invest in longer-term cost saving energy efficiency upgrades.[7] These same residents are also the most vulnerable to housing and cost of living increases across the Bay Area. Targeting energy upgrades to low-income residents living in older homes is one of the most cost-effective strategies to improve energy efficiency while providing multiple co-benefits to the community. Energy efficiency upgrades reduce utility bills and increase financial stability thereby freeing up funds for essential needs such as healthy food and health care.

Assistance for Low-Income Households

The Low Income Home Energy Assistance Program (LiHEAP), administered by Contra Costa County Community Services Bureau, provides income qualified homes with building envelope improvements, appliance upgrades, and other cost-effective improvements that improve energy efficiency. Lower income households can spend four times more of their income on energy costs than higher income households. Weatherization services can reduce this cost burden by lowering their energy consumption by up to 35 percent, saving an average of $400 on a household's heating and cooling bills in the first year alone.

Promoting energy efficient building and facilities will provide many health and equity co-benefits to residents, business owners, faculty, students, and staff in Richmond. Enhanced indoor air quality and healthier homes can be achieved by improving ventilation and duct systems, sealing drafty leaks to crawl spaces and attics, and testing of carbon monoxide sources caused by appliances. These improvements can also control moisture, reducing mold and other indoor allergens that contribute to and exacerbate asthma, while lessening noise pollution by sealing the building. Efficient buildings tend to have more natural light, which is associated with improved productivity. All of these outcomes can lead to enhanced personal health, fewer sick days, and higher performing students and employees.

[6] American Community Survey. (2013). Table B25106. Tenure by Housing Costs.

[7] http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/ahr2013_05-affordability.pdf

Several energy efficiency programs are available to Richmond's low-income populations including the County's Low Income Home Energy Assistance Program (LiHEAP) (see inset) and the Richmond Distressed Housing Rehabilitation Program, administered by the Richmond Community Foundation, which leverages social impact bonds to restore blighted homes (including energy and water upgrades) and sell to first time home buyers, including those participating in the SparkPoint Contra Costa program. Rising Sun Energy Center's California Youth Energy Services (CYES) Program hires youths ages 15 to 22 during the summer to provide green house calls for residents to identify and install energy and water efficiency home improvements, at no cost to the resident. The program focuses on non-English speaking households, renters, moderate income households, and seniors.

General 2030 Plan Alignment

CAP Objective 1 supports the following General Plan 2030 policies:

- **Policy EC3.2 Energy Efficiency and Conservation.** Promote efficient use of energy and conservation of available resources in the design, construction, maintenance and operation of public and private facilities, infrastructure and equipment.
- **Policy EC3.5 City Government Operation.** Promote climate-friendly standards, practices, technologies and products in all City facilities and operations.
- **Policy EC4.3 Green Buildings and Landscaping.** Require energy and resource efficient buildings and landscaping in all public and private development projects.
- **Policy HW10.1 Citywide Energy Footprint.** Work towards reducing the overall energy footprint from residential, industrial, transportation and City operations.

Strategies to Increase Energy Efficiency of Buildings and Facilities

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
261,728 MT CO2e by 2030	Improved indoor air quality & comfort, reduced mold, reduced noise pollution, improved lighting	

Strategy EE1: Leverage Existing Programs and Rebates to Improve Efficiency of Existing Buildings.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Improve the energy efficiency of all existing buildings (residential, commercial, and industrial) by 50 percent by 2030.	Ongoing	Electricity and natural gas use (total and per capita). Number of buildings retrofitted.	145,860 MT CO2e

Strategy EE2: Leverage Existing Funding Programs and Financing Tools.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase energy program participation rates.	Ongoing	Electricity and natural gas use (total and per capita). Number of buildings retrofitted.	Supports EE1

Strategy EE3: Promote Green Building.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
All new buildings meet or exceed Title 24 standards at time of construction; by 2020 all new residential buildings will be ZNE; by 2030 all new commercial buildings will be ZNE.	Ongoing	Square footage of new construction meeting/exceeding Title 24 Square footage of new construction achieving ZNE	115,867 MT CO2e

Strategy EE4: Outreach and Education to Promote Energy Conservation and Renewable Energy.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Support Strategies EE1 through EE3.	Ongoing	City energy outreach budget Program participation rates	Supports EE1

Objective 2: Increase Use and Generation of Renewable Energy

Promote the generation, transmission, and use of a range of renewable energy sources, such as solar, wind power and waste energy to meet current and future demand. Encourage new development and redevelopment projects to generate a portion of their energy needs through renewable sources.

The City is committed to promoting renewable and alternative energy generation in its own operations and throughout the community. Renewable energy sources include solar, wind and alternative fuels that aim to replace energy generated by conventional fossil fuels. Renewable energy systems should be combined with cost-effective efficiency and conservation measures to maximize cost savings and community co-benefits.

Through a series of legislation that began in 2002, California has placed requirements on electric utilities to procure a portion of their energy from renewable sources. The standard, known as the **Renewables Portfolio Standard (RPS)**, applies to investor-owned utilities, publicly-owned utilities, electricity service providers, and community choice electricity aggregators. To comply with the legislation, utilities in California must procure a minimum of 25 percent of its retail electricity sales from qualifying renewable sources by 2016, 33 percent by 2020, and 40 percent by 2035. As of 2015, Pacific Gas and Electric (PG&E) sourced 27 percent of its retail sales from renewable sources, surpassing the standard for 2016.

Solar One

Rendering of MCE's Solar One Project

In 2017, Richmond will be home to MCE's Solar One, a 10.5 MW ground mount solar farm. One of the largest solar projects in the Bay Area, Solar One is being constructed on a 49-acre parcel at a former Chevron Richmond Refinery brownfield site. MCE has teamed with RichmondBUILD to train and hire employees for the Solar One Project. The project will create 344 local jobs and will generate enough power for nearly 3,000 homes per year.

The City of Richmond is already well beyond compliance with the RPS. In 2013 the City joined **Marin Clean Energy (MCE)** to increase renewable energy choices for local businesses and residents. A "Community Choice Aggregation" program, MCE procures electricity from renewable sources – solar, wind, bioenergy, geothermal, and small hydro – and then partners with PG&E to deliver electricity to homes and businesses. As of 2015, over 80 percent of Richmond's electrical customers have enrolled in MCE; of these, 99 percent are enrolled in the Light Green option that sources 56 percent of its energy supply from renewable energy sources, and less than 1 percent were enrolled in the Deep Green option, which provides a 100 percent renewable energy option.

The City is investigating the feasibility of enrolling all of its buildings in MCE's Deep Green program, and will help residents and ratepayers understand their choice and promote enrollment in the MCE Light Green, Deep Green, and Local Sol (100 percent locally generated solar energy) programs. The City will continue to work with both PG&E and MCE to increase the percent of electricity that is sourced from renewable systems. Specifically, the City will support MCE in achieving their goal of providing 100 percent of its electricity from renewable sources by 2025.

Richmond's industrial base and its large concentration of warehouses provide significant potential for increasing solar production throughout the City. West Contra Costa Unified School District (WCCUSD) is currently installing solar on the roofs of all of its schools and administration buildings in Richmond, which will produce the equivalent of enough electricity to power more than 2,700 homes, saving more than 1,300 MT CO2e annually.[8]

Catahoula Coffee Company: Deep Green Champion

MCE offers businesses in Richmond the opportunity to choose 50 to 100 percent renewable energy at highly competitive rates. Businesses that voluntarily "opt-UP" to MCE's Deep Green 100% renewable energy service--and effectively eliminate the carbon pollution associated with their electricity usage--are entitled to complimentary marketing benefits by joining MCE's Deep Green Champions (http://mcecleanenergy.org/deep-green-champions/). These include free publicity on MCE's webpage and social media platforms; printed advertisements and outreach material; and a variety of co-branding opportunities. The Catahoula Coffee Company, for example, has appeared in MCE's public service announcements, and features a customized "100% Renewable" logo on all of its coffee bags. By partnering together, MCE and Richmond's business community are providing dynamic examples of how the twin goals of earning a profit and protecting the planet can be mutually reinforcing.

[8] Solar America Showcase Report, Solar Master Plan, WCCUSD. http://www.heliosproject.net/files/managed/Document/90/WCCUSD%20-%20Benchmarking%20and%20Assessments.pdf

Generating large quantities of energy within Richmond reduces dependency on fossil fuels and benefits the community by creating local green jobs, improving health, and increasing community resilience. Generating electricity from renewable sources also reduces harmful air pollutants and benefits public health, especially for people living and working near power plants. Replacing fossil fuels with renewable energy improves air quality and can result in direct health benefits such as decreased respiratory ailments, lost workdays, and overall healthcare costs, and indirect health benefits such as local, green jobs creation that supports Richmond residents.

Renewable Energy for Low-Income Households

Programs that target lower-income households can have a positive economic impact on those communities. Supporting lower-income residents and small businesses through income-qualified programs to install solar panels reduces utility bills, which frees up scarce financial resources for healthier food, preventative healthcare, or higher employee wages. Solar panels can also increase property values and enhance the energy security of communities.

Renewable energy can also make Richmond more resilient to power outages. Distributed energy systems spread throughout the community are more able to withstand equipment system failure during earthquakes, extreme heat events, localized flooding, or other natural disasters.

Investments in renewable energy will ensure that a broad range of Richmond residents have access to the improvements. The equity benefits and impacts of these programs can be addressed through measures that target low-income qualified populations (e.g. the Single- family Affordable Solar Homes [SASH] program), workforce development for green jobs (e.g., RichmondBUILD), and partnerships with local community-based organizations.

Natural gas is used extensively throughout Richmond for residential, commercial, and industrial energy applications, accounting for 31 percent of the baseline Community GHG Inventory. A good portion of natural gas emissions can be reduced by efficiency improvements outlined in the energy efficiency strategies in the previous section; however, the City recognizes that to meet its GHG reduction goals, it must promote conversion of natural gas systems to solar thermal systems or electric systems that are powered with renewable electricity.

General Plan 2030 Alignment

CAP Objective 2 supports the following General Plan 2030 policies:

- **Policy EC3.1 Renewable Energy.** Promote the generation, transmission and use of a range of renewable energy sources such as solar, wind power and waste energy to meet current and future demand and encourage new development and redevelopment projects to generate a portion of their energy needs through renewable sources.
- **Policy HW10.1 Citywide Energy Footprint.** Work towards reducing the overall energy footprint from residential, industrial, transportation and City operations.

Strategies to Increase Use and Generation of Renewable Energy

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
113,520 MT CO2e by 2030	Improved air quality, reduced premature mortality	

Strategy RE1: Increase Local Solar Energy Generation

The City will promote the installation of distributed, small-scale solar photovoltaic systems (solar PV), as well as other renewable energy generation systems, in existing buildings and new construction, prioritizing investments in municipal buildings, schools, and public housing developments. Richmond is leading local solar development in the Bay Area through innovative policy decisions that create competition and marketplaces for local renewable energy development.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 1,010 new residential solar installations averaging 4 kW per system; 69 new commercial solar installations averaging 174 kW per system.	Ongoing	Number of homes and businesses solarized Total local solar generation capacity; quantity installed per year	8,422 MT CO2e

Strategy RE2: Promote and Maximize Utility Clean Energy Offerings

The City will promote renewable and alternative energy generation in its own operations and throughout the community.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
In partnership with MCE supply at least 87 percent of community electricity from sources that are 95 percent renewable, by 2025; PG&E will supply the remainder of community electricity from sources that are at least 50 percent renewable by 2030.	Ongoing	Enrollment in MCE Green Energy programs Average CO2e content of PG&E and MCE electricity	57,390 MT CO2e

Strategy RE3: Promote Conversion From Natural Gas to Clean Electricity

The City will promote conversion of residential and commercial natural gas systems to electric systems powered by renewable energy or solar thermal systems.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Residential: Convert 1,328 water heaters annually from natural gas to electric in Richmond homes by 2030. Commercial: 6 percent of currently forecasted natural gas use is electrified by 2020, and 17 percent by 2030.	Ongoing	Number of natural gas systems electrified Therms reduced by electrification per year	42,486 MT CO2e

Objective 3: Sustainable Transportation and Land Use

Encourage the use of low-emission and renewable fuel vehicles by residents and businesses, schools, public agencies, and City government. Support and promote enhanced and expanded public transit; walkability and bicycling; mixed-use urban streets; and creation of an urban landscape that reduces reliance on private automobiles. Promote the safe and efficient movement of goods by truck, rail and ship to support port operations and industrial uses.

The transportation sector accounts for the largest source of emissions in the City. In 2012, GHG emissions associated with transportation and land use patterns represented approximately 43 percent of the Community Inventory. The majority of transportation emissions were generated by vehicles travelling on state highways and City streets. The remainder was generated by vehicles engaged in off-road activities, like construction, agricultural production, and recreation.

Land use patterns and transportation are fundamentally related and together can determine community reliance on automobiles or proclivity to use public transportation. Existing development patterns and the inclusion of transportation infrastructure are critical factors in supporting sustainable transportation options. The strategies and actions in the Richmond CAP help the City shift from an auto-dependent culture that relies on personal motor vehicle trips to one that relies more on walking, biking, and public transit, and build on the City's existing transportation policies, such as those in the Richmond General Plan, **Bicycle Master Plan**, and **Pedestrian Plan.** The resulting reductions in vehicle miles traveled (VMT), in conjunction with state and regional policies and programs mandating more fuel efficient vehicles and lower carbon fuels, are expected to result in significant GHG savings, decreased smog and toxic air pollutants, and reduced automobile engine oil runoff into local ecosystems.

Richmond Bay Specific Plan

The Richmond Bay Specific Plan (RBSP) proposes to develop a sustainable shoreline district designed to capitalize on the development of UC Berkeley's Richmond Field Station, with a high density, mixed- use district that includes an extensive transit, bicycle, pedestrian, and open space connectivity network, reduced parking standards for vehicles, and requirements for bicycle and pedestrian amenities to reduce vehicle trips and encourage active transportation.

The City will use **smart growth** strategies, which accompany a range of development and conservation strategies that support economic growth, environmental health, and GHG reductions. Smart growth is primarily a land use strategy, which places higher density, mixed-use developments near or within existing development, and near transit services. Infill development, or the redevelopment of underutilized sites within existing developed areas, is a key smart growth approach that increases the land use intensity and resulting social and economic activity within the existing urban footprint. Smart growth encourages mixed-use neighborhoods that offer a variety of housing types within close proximity to various commercial and retail services, as well as schools and parks. Smart growth strategies thereby direct new growth towards existing urban areas, and help concentrate City investments to reach more residents and preserve existing open space and critical habitat areas for enjoyment by future residents of Richmond.

The City has already begun weaving smart growth strategies into planning strategies. The City developed the **Richmond Livable Corridors Form-Based Code** (FBC) as a means of guiding the revitalization of three major commercial corridors in the City. The FBC describes development standards for various zones within each corridor, and incorporates principles of smart growth into the plan for these areas. The City may supplant existing zoning regulations in other areas in the City with similar form-based codes in the future as a means of continuing to implement and expand smart growth development. Areas that have already been identified as candidates for smart growth prioritization include downtown Richmond, the City's existing and future mixed-use corridors, areas surrounding key traffic intersections, future designated pedestrian priority districts, and multi-use trails that connect high-density areas of the City to parks and open space.

Did you know?

A San Francisco Bay Area study found that increasing bicycling and walking from 4 to 24 minutes a day on average would reduce cardiovascular disease and diabetes by 14% and decrease greenhouse gas emissions by 14%.[9]

The City is committed to using **complete street** principles and design to improve safety, amenities and access for all types of transportation including walking, bicycling, driving, and transit. Complete streets improvements are recommended as part of an overarching smart growth strategy in dense urban areas with a mix of uses to encourage people to safely walk, bicycle, utilize public transit, and accommodate motorists. Complete street designs incorporate amenities and design features for pedestrian, bicycle, and transit users, including street trees, landscape strips, trash cans, outdoor furniture, shade structures, bus shelters, and public art installations. The City recently completed a study to identify and implement complete streets improvements to the Rumrill Boulevard/13th Street corridor, between Harbour Way and Contra Costa College. The City plans to continue these efforts in the future, with a similar study for San Pablo Avenue in the works.

Expanding public transit options and improving multi-modal network connectivity is a key component of achieving the Sustainable Transportation objective. Residents and employees in the City of Richmond have multiple transit options that provide connections throughout the Bay Area and greater Northern California region. The **Amtrak Capitol Corridor** line originates in Sacramento and runs south through Richmond, ending in San Jose and providing connections to most cities in between. The **Richmond-Fremont Bay Area Rapid Transit (BART)** line originates near Downtown Richmond and extends through San Francisco to Millbrae, northeast to the Pittsburg/Bay Point area or southeast to the Dublin/Pleasanton area, and south to Fremont. The **Richmond Circular Shuttle** service provides a connection between Amtrak and BART. Bus service is provided by the **Alameda Contra Costa Transit District (AC Transit)** and **Western Contra Costa Transit Authority (WestCAT)**, with local and regional connecting lines. Richmond Paratransit and East Bay Paratransit are also available to residents. In addition, a new ferry line is proposed that would provide a direct connection from a new terminal at the Ford Peninsula (1.5 miles from Downtown Richmond) to San Francisco as early as 2018. Extending and increasing transit service will be essential as the City grows in the future and new employment opportunities in the City and the greater Bay Area increase the number of commuters traveling to or passing through Richmond.

Zero-emission vehicles (ZEVs) and charging stations are becoming increasingly common in the Bay Area. ZEVs include plug-in battery electric vehicles (PEVs) and hydrogen fuel cell electric vehicles (FCEVs). The availability of new vehicle

[9] Maizlish N, Woodcock J, Co S, Ostro B, Fanai A, Fairley D., 2015, Health Cobenefits and Transportation-Related Reductions in Greenhouse Gas Emissions in the San Francisco Bay Area. Am. J. Public Health 2013;103(4):703–709.

models, improved battery storage, increased availability of charging infrastructure and vehicle range coupled with incentives such as carpool lane access stickers, federal tax credits, and state and air district rebates have contributed to an expanding market for PEVs. The Chevron ECIA specifies that funding is available to expand PEV infrastructure and use in Richmond. Funding from the ECIA can be used for programs and actions that support the adoption and use of PEVs and expansion of PEV charging stations.

The Yellow Brick Road

In a 2008 summer youth program, a group of teenagers from Richmond, California's Iron Triangle neighborhood were asked to think of a project that would improve their neighborhood. They came up with a brilliantly simple idea: the Yellow Brick Road. They envisioned Iron Triangle residents identifying key community assets (e.g., schools, parks, churches, community centers, transportation hubs, etc.). Then they would connect those assets via the Yellow Brick Road — a network of "safe, green, and clean" (their words) walking and biking paths designated by brightly colored yellow bricks, stenciled on sidewalks and roads. The City of Richmond and its partners, the Local Government Commission and Pogo Park, received an Environmental Justice Transportation Planning Grant for the Yellow Brick Road from Caltrans in 2012 to further develop this neighborhood vision into what would become the Yellow Brick Road Iron Triangle Walkable Neighborhood Plan. The plan was adopted in 2015 as an appendix to the Pedestrian Plan, and the City is currently seeking funding to implement the plan.

Transportation demand management (TDM) describes strategies to reduce demand for roadway travel, particularly in single-occupancy vehicles, or to redistribute this demand in space or in time. TDM strategies can aim to change travel behavior patterns through either voluntary incentives or requirements. The nine-county **Bay Area Commuter Benefits Program**, the largest TDM program in the country, is based on successful ordinances in San Francisco, Richmond, Berkeley and at San Francisco International Airport. In San Francisco alone, the local commuter benefits ordinance has helped reduce GHG emissions by as much as 286,547 metric tons annually. **Richmond's Commuter Benefits Ordinance**, contained in Chapter 9.62 of the City's Municipal Code, requires all businesses with ten or more employees, who work an average of 10 or more hours per week, to offer a pre-tax election program, an employer-paid transit benefit, or employer provided transit options.

Health Co-Benefits of Active Travel

Active travel promotes numerous health co-benefits, such as reduced chronic disease and obesity rates and reduced traffic injuries and fatalities. Strategies to reduce GHG from transportation benefit respiratory and cardiovascular health due to changes in air pollution.

In addition to reducing GHG emissions, improving the City's transportation and land use systems has significant benefits to public health, equity and community resilience. The design of neighborhoods, streets, and homes can determine whether children can safely play outside and walk to school, whether

families can easily access basic goods and services, and whether neighbors are familiar and supportive of one another. Supporting complete neighborhoods, transit supportive development, and a variety of housing types can increase access to jobs, parks, healthy food, health and social services and encourage healthier active transportation options such as walking, biking, and utilizing public transit.

The returns on investment associated with active modes of travel are also significant. Residents who choose active transportation directly save on costs from purchasing a motor vehicle, insurance and maintenance, and may indirectly reduce healthcare costs. Lower rates of car ownership can free up parking space for wider sidewalks, "parklets," and other beneficial uses of urban property. Having fewer cars on the road also reduces air pollution and noise, and alleviates traffic jams.[10]

General 2030 Plan Alignment

CAP Objective 3 supports the following General Plan 2030 policies:

- **Policy EC2.1 Climate-Friendly Vehicles and Equipment.** Encourage the use of available climate-friendlier vehicles and equipment to reduce energy use and carbon emissions and support the use of low-emission or renewable fuel vehicles by residents and businesses, public agencies and City government.
- **Policy EC2.2 Climate-Friendly Fuel.** Support production and distribution of climate-friendlier fuels (when and if any are identified) and identify appropriate locations for fuel storage and distribution.
- **Policy EC2.3 Expanded and Affordable Public Transit.** Coordinate with regional transportation agencies and support enhanced and expanded public transit to improve mobility options for residents and visitors.
- **Policy EC2.4 Safe and Convenient Walking and Bicycling.** Promote walking and bicycling as a safe and convenient mode of transportation.
- **Policy LU6.1 Pedestrian and Transit-Oriented Urban Environment.** Promote walkability and public transit by encouraging mixed-use, higher-density development close to community amenities.
- **Policy LU6.2 Complete Streets.** Promote mixed-use urban streets that balance public transit, walking and bicycling with other modes of travel.
- **Policy EC2.5 Regional Passenger Rail.** Support efforts by transit agencies to provide regional and long-distance passenger rail service.
- **Policy EC2.6 Private Automobile Use.** Work toward creation of an urban landscape that will reduce reliance on private automobiles through land use planning and by providing amenities and infrastructure that encourage safe and convenient use of public transit, walking and bicycling.
- **Policy EC2.7 Climate-Friendly Goods Movement.** Promote the safe and efficient movement of goods by truck, rail and ship to support port operations and industrial uses.
- **Policy EC4.2 Compact Walkable Neighborhoods and Livable Streets.** Promote safe and walkable neighborhoods and inter-connected streets through the design of streetscapes, public gathering places and all types of physical development.
- **Policy LU6.4 Long-Term Environmental Sustainability.** Promote development standards and land use patterns that encourage long-term sustainability.

[10] N, Maizlish, Woodcock J, Co S, Ostro B, Fanai A, and Fairley D. "Health Cobenefits and Transportation-related Reductions in Greenhouse Gas Emissions in the San Francisco Bay Area." Pubmed.gov. California Department of Public Health, 14 Feb. 2013. Web. 13 Apr. 2015.

Strategies for Sustainable Transportation and Land Use

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
55,059 MT CO2e by 2030	Improved air quality, increased physical activity, decreased obesity, illness, and reduced premature mortality	

Strategy TL1: Promote Smart Growth and Complete Neighborhoods

The City will promote a range of development and conservation strategies that support economic growth, environmental health, and GHG reductions, including but not limited to placing higher density, mixed-use developments near or within existing development, and near transit services.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, increase residential and employment density by 15% as compared to BAU.	Ongoing	Percent density increase in PDAs and citywide	4,768 MT CO2e

Strategy TL2: Complete Streets

The City will design its streets so that they enable safe access to goods and services for all pedestrians, bicyclists, motorists, and transit users. Complete streets in dense urban areas will encourage people to walk, bicycle, or take transit rather than drive.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, make vehicle calming and speed reduction enhancements to intersections and roadways that carry 25 percent of the City's traffic.	Ongoing	Percent of total intersections and roadways retrofitted	668 MT CO2e

Strategy TL3: Improve Bicycle and Pedestrian Infrastructure

The City will maintain and accelerate implementation of Richmond's Bicycle and Pedestrian Master Plans, and provide additional actions that support pedestrian and bicyclist safety and comfort, expand the bicycle and pedestrian network, and increase amenities throughout the City.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase 50% of Master Plan implemented by 2030 with 300% increase in bicycle trips (commute and non-commute).	Ongoing	Percent of Master Plan improvements completed Percent increase in bicycle trips (commute and non-commute)	4,150 MT CO2e

Strategy TL4: Improve Signal Timing

The City will time groups of traffic signals along priority arterials to provide smooth movement of traffic with minimal stops.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase number of coordinated traffic signals.	One-time; ongoing coordination	Percentage of total signals coordinated	Supporting strategy

Strategy TL5: Expand Public Transit Options and Improve Multi-Modal Network Connectivity

The City will improve the efficiency of public transit services by coordinating transit schedules and ensuring all parts of Richmond are provided access to transit options. The City may also improve amenities at existing transit stops and stations to improve rider comfort and safety.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
30 percent increase in transit network coverage, 30 percent reduction in headways, and conversation of 50 percent of routes to BRT by 2030; Ferry service provides 400 commute trips daily by 2030.	Ongoing	Transit ridership rates	9,427 MT CO2e

Strategy TL6: Expand Car Sharing, Bike Sharing and Ride Sharing

The City will expand existing and promote new car sharing, bike sharing, and ride sharing programs within Richmond and the Bay Area.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
75 percent of City residents and employees are within half a mile of a car share pod by 2030.	Ongoing	Percent of residents within half-mile of bike share station and/or car sharing pod Program participation rates	1,433 MT CO2e

Strategy TL7: Promote Low-Carbon Vehicles and Fuels

The City will act to increase adoption of zero-emission vehicles (ZEVs) including plug-in battery electric vehicles (PEVs) and hydrogen fuel cell electric vehicles through actions including but not limited to supporting the expansion of PEV charging stations, creating a program that offers rental income for unused EVs, offering PEV car rentals, providing longer range PEV vehicles for rent to reduce range anxiety, sharing the City's underused EVs with other residents, providing subsidies for residential developers to provide EV car share stations and subsidies for sales/leases, and developing a robust educational campaign.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 17% of vehicles used by residents and businesses are Plug-in electric vehicles (PEVs) or other zero emission vehicles (ZEVs).	Ongoing	ZEV vehicle penetration (percent of total fleet) Number of ZEV stations installed	21,549 MT CO2e

Strategy TL8: Outreach and Education to Support Public Transit and Active Transportation

The City will partner with local agencies, schools, and community groups to engage students, residents, and businesses in confronting the climate change challenge. Together, we will continue identify and implement opportunities for school and community improvements related to active transportation (i.e., walking and biking) and public transportation.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase number of residents knowledgeable about transportation options by 20 percent.	Ongoing	Number of residents who report using transit or active transportation	1,530 MT CO2e

Strategy TL9: Support Transportation Demand Management

The City will support transportation demand management (TDM) programs within private businesses by continuing to employ a staff member responsible for enforcement of the Bay Area and Richmond Commute Benefits Ordinances. This staff member will continue to help businesses comply with these ordinances, and will also promote additional TDM strategies, particularly for larger businesses where these strategies are the most effective. The City will also consider new ways to incentivize TDM strategy implementation alongside basic compliance.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
10 percent increase in participation and number of employees provided transit subsidies and a doubling of employees able to work from home (from 5 percent to 10 percent) at least one day a week.	Ongoing	Percent participation in TDM programs Percent of employees able to work from home one day per week	3,097 MT CO2e

Objective 4: Zero Waste

Reduce the City's overall waste stream by reducing the City's consumption of goods and materials, and by adopting a zero-waste philosophy. Promote waste reduction and recycling to minimize materials that are processed in landfills.

Solid waste that decomposes in landfills generates methane gas (CH4), a GHG that is at approximately 25 times more potent than carbon dioxide (CO2) over a 100-year time frame, and even more potent over shorter time spans (see inset). GHG emissions resulting from the decomposition of solid waste account for approximately five percent of the 2012 Community Inventory. In addition, the collection, transportation, and handling of waste cause emissions from trucks and facility operations. Waste reduction and diversion programs prevent materials from ending up in landfills, and recycling reduces GHG emissions associated with the energy embodied in material goods and their packaging.

The City, through its franchise agreement with Republic Services, currently offers garbage collection, recycling, and food-scrap composting collection services to residents and businesses within Richmond. Garbage, recyclables and green waste are picked up weekly for residential customers. Customers pay for garbage collection services, while recycling and composting services and materials are offered free of charge. Richmond has implemented a volume-based fee structure for garbage collection services, or Pay-As-You-Throw (PAYT) collection, that charges customers based on the volume of the garbage container service subscription, and the frequency of pickup. Customers who use smaller containers for garbage are charged less money, thus creating a financial incentive to increase composting and recycling. Meanwhile, the City has made great strides in reducing illegal dumping in its neighborhoods with the Bulky Item and On-Call Cleanup programs.

The Importance of Methane Reduction

The State of California is actively working to reduce methane emissions as part of broader efforts to reduce "Short-Lived Climate Pollutants" (SLCPs). Methane is a powerful greenhouse gas that remains in the atmosphere for a much shorter period of time than carbon dioxide (CO2). However, its relative potency, when measured in terms of how it heats the atmosphere, is at least 25 times greater than that of CO2 over a 100-year time frame, and more than 80 times more potent than CO2 over a 20-year span. Reducing methane emissions can make an immediate beneficial impact on climate change.

California's 2014 Climate Change Scoping Plan Update contains actions to reduce SLCPs, including methane, and SB 605 (Lara, Chapter 523, Statutes of 2014) directs ARB to develop a comprehensive SLCP strategy by January 1, 2016. California has taken, and will continue to take, steps to reduce methane emissions from the agricultural, waste treatment, and oil and gas sectors.

For more information on methane's impact on climate change and reduction strategies, see the California Air Resources Board website at http://www.arb.ca.gov/cc/shortlived/shortlived.htm.

The City will continue to encourage waste diversion from landfills by promoting recycling, composting, and the appropriate disposal of hazardous waste. Republic Services provides educational materials through bill inserts, quarterly newsletters, and on its website to help customers properly dispose of their waste. RecycleMore, the regional recycling agency, is tasked with ensuring Richmond and its neighboring cities achieve the solid waste diversion goals established by the State. RecycleMore has several programs aimed at helping residents, businesses, and institutions achieve zero waste by promoting backyard composting, construction and demolition (C&D) diversion, the adoption of reusable bag ordinances, and proper hazardous waste disposal. RecycleMore also offers free workshops, field trips, and classroom presentations to schools in Contra Costa County. **Contra Costa County Green Business Program**, as part of the Bay Area Green Business Program, provides certifications to businesses that demonstrate compliance with certain environmental regulations and that implement certain practices and procedures that are considered environmentally sustainable. Some of these practices include waste diversion through enhanced recycling and composting, environmentally preferable purchasing policies, best practices in source reduction (i.e., double sided printing, reduced printing, and/or reduced junk mail) and reuse of waste materials where possible.

The City will work with its franchise haulers to increase commercial and multi-family recycling and organics diversion by setting service rates that incentivize diversion. In addition, the City will work with RecycleMore to adopt a **Zero Waste Ordinance** that sets a goal to achieve maximum waste diversion by 2030. The City will also develop a **Zero Waste Strategic Plan** to outline a path to achieving the target established in the ordinance. The Strategic Plan would include: strategies to expand existing recycling and composting facilities; various regulations and incentives to reduce total waste disposed by residents, businesses, and institutions; programs to educate the public on zero waste strategies and promote the participation of community members; and policies to advocate for manufacturer responsibility for product waste.

Composting at Schools: It's the Law

Current California law requires schools and school districts that generate four cubic yards or more of waste per week to recycle, and requirements commenced on April 1, 2016:

- April 1, 2016: Schools that generate eight cubic yards of organic waste per week shall arrange for organic waste recycling services.
- January 1, 2017: Schools that generate four cubic yards of organic waste per week shall arrange for organic waste recycling services.
- January 1, 2019: Schools that generate four cubic yards or more of commercial solid waste per week shall arrange for organic waste recycling services.

The City will work with RecycleMore and WCCUSD to develop programs at Richmond schools, and work with WCCUSD staff to ensure they have the resources needed to increase solid waste diversion at each school facility. Specifically, the City will support WCCUSD in implementing a District-wide three-bin collection system for trash, recycling, and compost. School programs will develop educational activities for students, faculty, and parents to increase awareness of recycling best practices.

As of July 1, 2014, CALGreen, the State's Green Building Standards Code, requires jurisdictions to divert a minimum of 50 percent of the nonhazardous construction and demolition (C&D) waste from landfills. C&D debris typically includes materials such as lumber, drywall, metals, masonry, carpet, plastic, and other building materials. Richmond will promote the deconstruction of buildings, rather than demolition, in which buildings are carefully disassembled and component parts are recycled or locally repurposed and reused. When buildings are demolished, workers, neighbors and the environment can be exposed to toxic chemicals. The deconstruction of buildings requires that developers plan how to manage materials after the building is deconstructed, and in doing so identify hazards or potentially dangerous waste.

Did You Know?

Richmond is one of the only cities in the Bay Area that has a closed loop composting program whereby the food scraps are composted within the City – actually on top of the old, capped landfill. The compost is then given back to community groups, schools and residents for use in gardens, and sold to farms and wineries.

Recycling and waste reduction results in numerous co-benefits for residents and business owners. Diverting waste from landfills reduces the City's reliance on landfills, which can be costly to permit and locate in or near an urbanized area. Fewer waste collection vehicles results in less traffic, better roads and air quality. Minimizing solid waste in landfills can improve community health by reducing exposures to methane gas and toxic stormwater runoff that can contaminate groundwater and surface water.

Another benefit to minimizing waste includes empowering the community to be more environmentally conscious with everyday, tangible decisions. As the community works towards zero-waste, residents and businesses may become more conscious consumers. The zero-waste approach to food preparation can result in healthier, less processed, and more affordable food. Additionally, community members may save money by reducing trash bills or repairing existing material possessions instead of purchasing new ones.

General Plan 2030 Alignment

CAP Objective 4 supports following General Plan 2030 policy:

- **Policy EC3.3 Solid Waste Reduction and Recycling.** Promote waste reduction and recycling to minimize materials that are processed in landfills.

The General Plan includes Goal EC3 (Sustainable and Efficient Energy Systems) that includes reducing the City's overall waste stream by reducing the City's consumption of goods and materials, and adopting a zero-waste philosophy.

Strategies for Solid Waste

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
52,755 MT CO2e by 2030	Improved air quality, reduced exposure to toxic materials, reduced potential for ground water and surface water contamination	

Strategy SW1: Establish a Zero Waste Framework

The City will implement Zero Waste strategies aimed to prevent waste, and increase recycling, reuse, and composting of waste materials so that fewer materials are sent to landfills. Strategies will include, but not be limited to, developing a Zero Waste Ordinance and a Zero Waste Strategic Plan.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 90 percent of all solid waste is diverted from landfills.	Ongoing; Adopt Zero Waste Ordinance by 2017	Citywide solid waste generation Percent solid waste diverted from landfill	48,421 MT CO2e (this accounts for Strategies SW1 through SW5)

Strategy SW2: Increase Participation in Recycling Programs and Incentives

The City will work with local waste haulers and agencies to increase recycling and composting, and ensure appropriate disposal of hazardous waste.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 90 percent of all solid waste is diverted from landfills.	Ongoing	Annual tonnages of recyclables and organics diverted from landfill	Accounted for in Strategy SW1

Strategy SW3: Establish and Support Garbage Collection Service Rates and Schedules that Maximize Participation in Composting and Recycling Programs

The City will work with its franchise haulers to increase commercial and multi-family recycling and organics diversion by setting garbage service rates (i.e., costs) and schedules that incentivize diversion.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 90 percent of all solid waste is diverted from landfills.	Ongoing	Citywide solid waste generation Annual tonnages of recyclables and organics diverted from landfill	Accounted for in Strategy SW1

Strategy SW4: Increase Diversion of Construction and Demolition (C&D) Waste

The City will promote the deconstruction of buildings, rather than demolition, in which buildings are carefully disassembled and component parts are recycled or locally repurposed and reused.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 90 percent of C&D waste is diverted from landfills.	Ongoing	Annual tonnage of processed (recycled) C&D materials Annual tonnage of C&D waste sent to landfill	Accounted for in Strategy SW1

Strategy SW5: Promote School Waste Diversion Programs

The City will support communitywide implementation of the Zero Waste Framework (Strategy SW1) by expanding recycling outreach and education programs in schools.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2030, 100 percent of all schools will have "three-bin" recycling programs (garbage, recycling, and compost).	Ongoing	Percentage of Richmond schools with "three-bin" recycling programs	Supports Strategy SW1

Objective 5: Water Conservation

Promote the use of existing incentives and develop new incentives to encourage schools, government facilities, residences, commercial businesses, and industrial users to reduce water consumption and increase the use of graywater and recycled water. Promote water efficient features and landscaping in all new development.

While GHG emissions associated with the energy needed for pumping and conveyance of water represent less than 1 percent of the Community Inventory, strategies to reduce water consumption have important co-benefits to the local water supply and they are outlined here to support water conservation goals established by the State and by East Bay Municipal Utilities District's (EBMUD's) Urban Water Management Plan (UWMP).

Maintaining a safe and plentiful water supply is a basic necessity for individuals and communities. Promoting conservation programs and supporting water infrastructure improvements helps to maintain the quality and reliability of tap water and prevents consumers from having to purchase bottled water. Water conservation can offer financial savings allowing families to spend more money on healthy food, health care, housing, or other necessities. Identifying and fixing leaking pipes can reduce or prevent the unhealthy growth of indoor molds and mildews which can improve indoor air quality, reduce allergens, and improve respiratory health. Replacing lawns with drought tolerant native plants and trees can expand the City's urban forest and provide a shade and a cooling effect for residents, especially for those in homes without air conditioning. Incentive programs can target low-income and communities of color to ensure an equitable distribution of resources.

A wide range of outreach and conservation programs are available to Richmond residents and businesses. EBMUD, the water provider for the City of Richmond, offers a variety of incentives to encourage customers to reduce indoor and outdoor water consumption during normal and dry years. EBMUD's **WaterSmart Calculator** helps households calculate their water use and identify areas where efficiency improvements may conserve water and save money. Residents

may sign up for **My Water Report** for bi-monthly statistics on their water use compared to similar households. The **Home Survey Kit** can help a household identify leaking toilets, high-flow fixtures, and irrigation components that may be resolved through simple fixes or replacements. Alternatively, residential customers may opt for an **On-Site Home Water Survey** completed by EBMUD. On its web site, EBMUD also offers simple tips and advice for saving water. Rebates are provided for: toilet replacement, clothes washer upgrades, and installation of graywater systems. EBMUD also offers free low flow showerheads, faucet aerators, hose nozzles, shower diverters, and dye tablets (for detecting toilet leaks).

EBMUD's **WaterSmart Gardener** program provides incentives, outreach, and education for outdoor water conservation, including: rebates for converting lawn space to water efficient landscaping; information on installing drip irrigation; irrigation surveys; landscape water budgets; rebates for graywater system installation; grants for creating community gardens; and a multitude of resources for designing and installing water efficient landscapes.

Are Property Assessed Clean Energy (PACE) Programs for Water Too?

Yes! PACE programs provide financing for water efficiency and conservation improvements such as solar thermal, low flow bathroom fixtures, high efficiency toilets, lawn replacements, and more. The repayment of the loan is collected on the property owner's tax bills over the course of several years, and the loan remains with the property if it is sold. Since the loan is tied to the property, it provides less risk to property owners to undertake water efficiency measures with a longer term payback.

There are currently three PACE programs available to businesses and residents in Richmond: HERO Financing, California First Efficiency Financing, and Figtree Financing. The City has adopted an open marketplace policy and will add additional PACE programs as they become available.

EBMUD offers similar resources and incentives for business customers, including **Water Surveys** and **Water Budgets**, a variety of rebates for indoor and outdoor efficiency upgrades, and a **WaterSmart Guidebook** with information on water saving technologies for new design and retrofits. The **EBMUD WaterSmart Business Certification Program** works with customers to identify and implement water saving measures.

In addition, EBMUD offers a wide variety of resources and programs to support water conservation education in the West Contra Costa Unified School District (WCCUSD). EBMUD offers **free water conservation workbooks** and water pollution prevention materials to all public and private schools in its service area. EBMUD deploys ranger-naturalists in an outdoor classroom setting to promote watershed stewardship through teaching students about creek restoration, reforestation, and other natural history programs. At Contra Costa County science fairs, EBMUD offers an **Excellence in Water and Wastewater Research Awards** that recognize water related projects and provide cash prizes. Through the **Drought Education Theater Program**, EBMUD partnered with three theater groups to provide 20-minute educational theater shows teaching the importance of water conservation, each using a unique approach.

EBMUD offers **WaterSmart garden grants** that can be used to fund the design and construction of community gardens or urban farm projects that demonstrate water conservation principles. In partnership with Water Education for Teachers and the Water Education Foundation, EBMUD provides periodic training sessions to teachers through the **Project WET Teacher Training** program, which covers various water topics that teachers can use to enhance their curriculum in line with Common Core and Next Generation Science Standards.

Reclaiming Water in Richmond

Water reclamation is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a ground water basin (referred to as ground water recharge).

EBMUD operates two water reclamation facilities in Richmond, the North Richmond Water Reclamation Plant and the Richmond Advanced Recycled Expansion (RARE) Water Project, that combined can produce up to 8.9 million gallons a day (mgd) of recycled water.

In addition, the City of Richmond owns and operates the Richmond Municipal Sewer District, which provides service to an area that encompasses 13.5 square miles in the City. The District's wastewater treatment plant located in Point Richmond treats the wastewater collected by the District. The City will work with the District to begin evaluating reclamation projects within the Port of Richmond and nearby commercial areas.

The City will further support green building strategies for water conservation, by ensuring the successful implementation of the **California Green Building Standards (CalGREEN) Code**, which requires new construction and major remodels to use high efficiency plumbing fixtures, including toilets, urinals, showerheads, and faucet fixtures. For outdoor water use, CalGREEN maintains that irrigation controllers shall be weather- or soil-moisture based, and shall automatically account for rainfall, or be attached to a rainfall sensor. The City may also offer incentives to comply with the water efficiency requirements of the **GreenPoint Rated** system and/or the U.S. Green Building Council's **Leadership in Energy and Environmental Design (LEED) Standards**.

In addition, the City is committed to improving and expanding the water supply, water reclamation (recycling), and water reuse infrastructure in Richmond. The City will support EBMUD's efforts to expand recycled water use to serve its City of Richmond customers, and support the use of graywater and rainwater catchment systems by local residents and businesses. The City will support EBMUD's efforts to maintain and upgrade water infrastructure and conveyance systems to minimize leaks and prevent waste.

General Plan 2030 Alignment

CAP Objective 5 supports the following General Plan 2030 policies

- **Policy EC3.4 Water Conservation and Reuse.** Promote water conservation and recycled water use.
- **Policy EC3.5 City Government Operation.** Promote climate-friendly standards, practices, technologies and products in all City facilities and operations.
- **Policy EC4.3 Green Buildings and Landscaping.** Require energy and resource efficient buildings and landscaping in all public and private development projects.
- **Policy EC4.4 Green Infrastructure.** Develop green infrastructure standards that rely on natural processes for stormwater drainage, groundwater recharge and flood management.

Strategies for Water Conservation

GHG Reduction:	Health Co-benefits:	Other Co-Benefits (Symbols)
800 MT CO2e by 2030	Reduced mold, reduced illness, increased indoor comfort, reduced incidents of heat-related illness	

Strategy WA1: Promote East Bay Municipal Utilities District (EBMUD) Outreach and Conservation Programs

The City will promote programs EBMUD outreach and conservation programs (WaterSmart Calculator, water surveys, WaterSmart Gardener, WaterSmart Business Certification, etc.), as well as Property Assessed Clean Energy (PACE) programs that provide financing for water efficiency and conservation improvements.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
By 2020, 20 percent per capita reduction in water consumption from 2012 levels (per Senate Bill 7x); by 2030, 30 percent per capita reduction.	Ongoing	Gallons saved per year Citywide	800 MT CO2e

Strategy WA2: Expand School Programs

The City will expand upon existing water conservation efforts in schools in the West Contra Costa Unified School District (WCCUSD) to further engage students through water usage assessments, water reduction targets, and tracking programs of school facilities to teach students how to perform a water audit, with a follow up assignment to apply these auditing, target setting, and tracking skills at home.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
25 percent of WCCUSD schools participating in water conservation programs by 2020; 100 percent participating by 2030.	Ongoing	Percent of schools participating in EBMUD programs	N/A (Supporting action)

Strategy WA3: Green Building Strategies for Water Conservation

The City will employ a variety of strategies to reduce water use via green building techniques, such as ensuring that all projects demonstrate compliance with, at minimum, the 2013 CalGREEN standards; offering incentives for certification through GreenPoint Rated, LEED, or other green building rating systems; considering adopting a retrofit-on sale ordinance in conjunction with a Building Energy Saving Ordinance (BESO); and providing information to developers, homeowners, and businesses on water efficiency and green building rating systems.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
100 percent compliance with CalGREEN Code or more stringent water standards.	Ongoing	CalGREEN compliance Number of GreenPoint rated or LEED certified buildings	N/A (Supporting action)

Strategy WA4: Support Water Infrastructure Improvements and Expand Water Reclamation and Reuse

The City will support EBMUD's efforts to expand recycled water use to serve its City of Richmond customers, and support the use of graywater and rainwater catchment systems by local residents and businesses. The City will support EBMUD's efforts to maintain and upgrade water infrastructure and conveyance systems to minimize leaks and prevent waste.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Annual increases in the number of graywater and rainwater catchment permits issued; increase in capacity of purple pipe installed and volume of reclaimed water provided to City by Richmond Municipal Sewer District.	Ongoing	Number of graywater and rainwater catchment permits issued	N/A (Supporting action)

Objective 6: Green Infrastructure, Urban Forestry and Agriculture

Restore and protect the natural environment to sequester GHG emissions and mitigate impacts of climate change, while updating Richmond's built environment to allow the City to adapt to potential climate change impacts such as sea- level rise and flooding. Promote development standards and land use patterns that encourage long-term sustainability, such as supporting the restoration of natural features and ecological systems to support the natural functions of soil, water, tree canopies, creeks, open space and other natural resources. Protect neighborhoods, infrastructure, buildings, and other facilities from the impacts of climate change such as sea level rise, and flooding. Collaborate with local urban agriculture and tree planting organizations to identify sites with urban forestry and/or agriculture potential.

Green infrastructure uses vegetation, soils, and natural processes to manage water and improve the overall health of urban environments. Traditionally, stormwater runoff travels from rooftops, streets, and parking lots into the City's sewer or storm drainage system, which directs discharged water into nearby water bodies, including the San Francisco and San Pablo bays. As runoff travels across impervious surfaces, it collects garbage, bacteria, heavy metals, oil, and other pollutants from the urban environment that are released along with the runoff, degrading the quality of the receiving waters. In addition, runoff travels more rapidly through urban environments, resulting in erosion and flooding that may damage habitat, property, and infrastructure. By partially retaining runoff onsite, green infrastructure systems reduce the quantity of stormwater sent to the City drainage system, which in turn reduces the amount of pollutants being discharged in nearby water bodies, and physical damage resulting from flooding and erosion. Instead, stormwater runoff permeates the soil, reducing the need for irrigation, and recharges groundwater. Green infrastructure benefits flood control, water supply, pollution reduction, recreational open space, urban agriculture, and urban wildlife habitat.

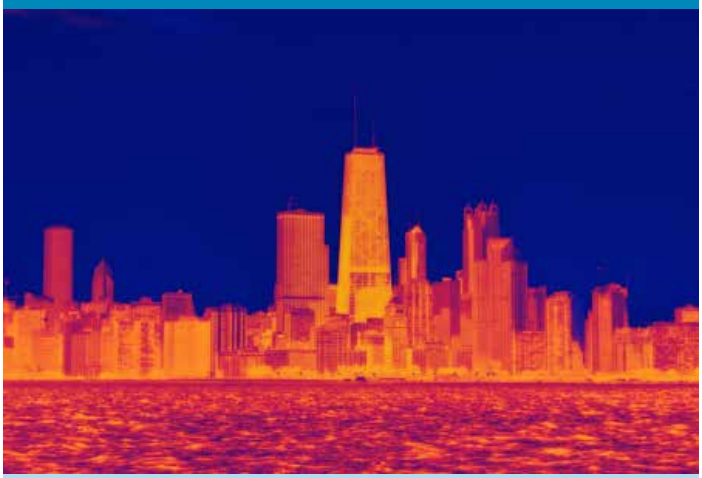
Green infrastructure, urban forestry, and local agriculture all work in concert with Richmond's natural environment to make local landscapes more productive and provide benefits to local residents and ecosystems. The natural environment is important both for sequestering GHG emissions and for mitigating the impacts of climate change. By better integrating Richmond's built environment with the natural environment, the City will reduce its contribution to climate change while simultaneously preparing for impacts such as sea-level rise and flooding.

Richmond's Urban Forest

In support of General Plan Action EC6.E to develop an urban forestry management plan, the City conducted a city-wide inventory of publicly-owned trees, and identified existing species and opportunities for future plantings. The Citywide Tree Inventory, completed in July 2013, identified a total of 22,051 City-maintained trees and over 13,000 planting areas available for new trees.

In 2015, in partnership with Pogo Park and several CBOs, the City of Richmond received a $497,292 grant from the CalFire Urban and Community Forestry Program to plant more than 500 trees in Richmond over a two year period. The Chevron ECIA agreement also allocates funding to expand the urban forest throughout Richmond.

Urban Heat Island Effect



The term "heat island" describes built up areas that are hotter than nearby rural areas. On a hot, sunny summer day, roof and pavement surface temperatures can sometimes reach temperatures 50 to 90 degrees hotter than the air, while shaded or moist surfaces (often in more rural surroundings) remain close to air temperatures.

Heat islands can affect Richmond's environment and quality of life, particularly during the summer. The heat island effect can increase summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and can have impacts to water quality.

Source: Climate Central, 2015. http://www.climatecentral.org/news/urbanization-global-warming-could-send-city-temps-soaring-14806

Urban trees provide aesthetic, environmental, and economic benefits including cleaner air, arboreal habitats, and increased property values. The State of California recognizes the key role that forests, including urbans forests, and all natural and working lands must play in meeting the state's GHG emission reduction goals, by providing a carbon sink that removes CO2 from the atmosphere.[11] Urban trees also help lower peak-load energy demands during the hottest months, providing shade for parking lots and other paved areas, reducing the urban heat island effect. Properly selected and located shade trees can help reduce air conditioner use and associated energy costs. Forested parks and tree-lined streets mitigate the impact of the urban heat island effect by cooling and cleaning the air. Public parks and green spaces allow people to congregate, socialize, and be more physically active. Making parks and green spaces available and accessible to all residents is an important City priority. Parks and green spaces are also associated with better mental health outcomes, better academic for children, improving social integration, and reducing community violence.

Several volunteer organizations support the expansion of Richmond's urban forestry through canvassing and planting trees, providing ongoing tree care, organizing community events, education, and sharing best practices. The City will continue to collaborate with community-based organizations (e.g., Richmond Trees, Groundwork Richmond) to organize plantings of shade trees along public right-of-ways. The City will also work with community-based organizations to continue to promote the **Adopt-A-Tree program**, and will distribute existing resources providing tree care tips.

[11] California Air Resources Board (CARB), 2014: First Update to the Climate Change Scoping Plan, May 2014.

Richmond's current zoning locates agricultural uses primarily on the eastern edge of the City, adjacent to Wildcat Canyon Regional Park. Despite Richmond's close proximity to major agricultural hubs such as the Napa Valley, Sonoma County, and the Central Valley, some economically disadvantaged areas within the City are considered "food deserts" where access to fresh and affordable foods is disproportionately lower than in other areas. To confront this challenge, the City helps support a local food system by promoting urban agriculture and connecting local farmers with Richmond residents through farmers markets and community programs. In addition, resident gardening and urban agriculture incorporate food production into the City's green infrastructure and culture. The Richmond Urban Agriculture Assessment has identified opportunity sites for urban agriculture on underutilized parcels, roof tops, within courtyards, and other public areas. Distributed urban agriculture sites increase access to food and reduce the GHG emissions associated with transporting food over long distances to reach consumers.

Richmond Grows Seed Lending Library

The Richmond Grows Seed Lending Library is open to all residents of the greater Richmond area and provides free seeds, as well as free education about growing and saving seeds and organic gardening. Richmond Grows celebrates biodiversity through the time-honored traditionof seed saving, nurtures locally-adapted plant varieties, and fosters community resilience, self-reliance, and a culture of sharing.

All of these actions can improve access to healthy foods and better nutrition, which in turn helps prevent obesity and type 2 diabetes. Low-income residents are particularly affected by diet-related diseases and will benefit from improved healthy food access. Local agriculture also benefits GHG emissions reduction by reducing the transportation needed to supply food to local residents.

General Plan 2030 Alignment

CAP Objective 6 supports the following General Plan 2030 policies:

- **Policy EC4.4 Green Infrastructure.** Develop green infrastructure standards that rely on natural processes for stormwater drainage, groundwater recharge and flood management.
- **Policy LU6.4 Long-Term Environmental Sustainability.** Promote development standards and land use patterns that encourage long-term sustainability.
- **Policy EC4.5 Local Food System (Urban Agriculture).** Collaborate with local urban agriculture advocates to identify sites with urban agriculture potential.
- **Policy EC6.1 Habitat and Biological Resource Protection and Restoration.** Natural habitat is essential to ensuring biodiversity and protecting sensitive biological resources.
- **Policy EC6.2 Low-Lying Areas in Richmond.** Protect and manage low-lying areas that are likely to be affected by sea level rise and storm surges.
- **Policy EC6.3 Adapting to Climate Change.** Prepare for and adapt to future impacts of changing weather patterns and sea level fluctuations.

Strategies for Green Infrastructure, Urban Forestry and Agriculture

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
1,081 MT CO2e by 2030	Reduced heat related illness, improved air quality, lower energy costs, improved nutrition, decreased obesity, decreased illness and premature mortality	

Strategy GA1: Support Urban Tree-Planting Programs

The City will continue to collaborate with community-based organizations to organize plantings of shade trees along public right-of-ways, promote the Adopt-A-Tree program, and distribute existing resources providing tree care tips. The City will consider developing a shade tree incentive program that provides a rebate or covers the full cost of the tree.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
5 percent of all new and existing homes in Richmond will plant a shade tree by 2030.	Ongoing	Annual trees planted by residents Number of homes and businesses participating in tree planting program	1,081 MT CO2e

Strategy GA2: Support Local Agriculture and Food Production

The City will promote urban agriculture to increase access to healthy food; continue to promote its weekly farmers markets; partner with schools and other community organizations to bring urban agriculture to neighborhoods, schools, and parks; and use its purchasing power to advance locally-produced and health eating options.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Double the acreage of urban gardens in Richmond from baseline conditions by 2030.	Ongoing	Number of urban and school gardens Acreage of urban gardens Number of weekly farmer's markets	Not calculated; supporting action

Strategy GA3: Support Green Infrastructure and Streetscape Design

The City will encourage property owners and developers to incorporate green infrastructure (e.g., bioswales, permeable pavement, rainwater catchment, planter strips, etc.) into existing and new developments, continue to utilize the same green infrastructure design principles in City-owned property as outlined in the City's Parks Master Plan, incorporate green infrastructure into new City developments, and retrofit existing City facilities with green infrastructure as funding becomes available.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase green infrastructure projects Citywide by 2030.	Ongoing	Number of green infrastructure projects completed annually	N/A (Supporting action)

Objective 7: Green Business and Industry

Reduce and mitigate carbon dioxide and other GHG emissions from large commercial and industrial sources. Promote "green" industries while providing jobs and training to Richmond residents. Encourage existing businesses and industries to become environmentally advanced and continue making positive contributions to the community. Work with businesses and industry, residents, and regulatory agencies to reduce the impact of direct, indirect, and cumulative impacts of pollution from industry, the Port, railroads, diesel trucks, and busy roadways.

Commercial businesses and industrial facilities in Richmond use large quantities of natural gas and electricity for lighting, heating, cooling, ventilation, computers, electronics, refrigeration and other office equipment and processes. Many also emit significant quantities of short-lived climate pollutants (SLCPs) that have an outsized impact on atmospheric warming, including industrial refrigerants like hydrofluorocarbons (HFCs). The strategies under this objective will help reduce emissions of GHGs, SLCPs, and criteria pollutants, leading to cleaner air and better public health..

California's **Cap and Trade program** is the cornerstone of the State's strategy to reduce GHG emissions from electric power plants, oil and gas producers, and large industrial plants. Regulated facilities under the program generate approximately 85 percent of the State's total GHG emissions. Starting January 1, 2012, an overall limit on GHG emissions from capped sectors was established and facilities subject to the cap are now issued trade permits (allowances) to emit GHGs, through a mix of free allocation and quarterly auctions. Regulated entities can purchase or sell allowances in the carbon market as needed to meet their emissions obligation. The quantity of allowances declines approximately 3 percent each year, thereby increasing industry incentive to invest in clean technologies. The quantity of allowances under California's program is flexible and can be reduced at an accelerated rate if the State's other measures to reduce GHG emissions have less impact than anticipated. The Cap and Trade program therefore acts as a backstop to ensure that the State's overall GHG target is met.

Richmond is also committed to reducing industrial carbon emissions through promotion of other existing programs. **PG&E's Permanent Load Shift – Thermal Energy Storage Program** offers financial incentives for their commercial/industrial electricity customers to implement technologies that permanently shift electric load by storing thermal cooling capacity during off-peak hours (e.g., by chilling water or making ice) in order to meet cooling load during subsequent peak hours. **California Public Utilities Commission's (CPUC) Self-Generation Incentive Program (SGIP)**, administered through PG&E provides incentives to businesses to support existing, new, and emerging distributed energy resources, including energy storage systems and efficient combined heat and power systems. In addition, local public agencies and equipment owners involved in the movement of freight can apply for grants from CARB's **Goods Movement Emission Reduction Program**, administered through BAAQMD, which provides funding for equipment that reduces air pollution emissions and health risks from freight movement along California's trade corridors. The program currently provides funding for truck replacements, truck engine repowering, truck charging/fueling infrastructure and truck stop electrification projects.

Large Industrial Sources in Richmond

There are three entities operating in Richmond that are subject to the California Cap and Trade program: the Chevron Richmond Refinery, the West Contra Costa County Landfill, and New NGC, Inc. (National Gypsum). The Chevron Refinery alone accounts for the vast majority of the City's total emissions, as demonstrated in Chapter 3. Chevron's GHG emissions are also regulated by the Conditional Use Permit the City recently issued for the Chevron Refinery Modernization Project. The City will continue to partner with capped entities, CARB, and BAAQMD to support compliance with AB 32 Cap and Trade emissions reduction targets for regulated industries, and to support the BAAQMD requirement that requires the installation of best-available control technology for businesses and industry during the entitlement process.

UC Berkeley Richmond Field Station

The development of UC Berkeley's Richmond Field Station is expected to bring broad economic and social benefits to the Richmond community. The site represents a tremendous opportunity for the City to partner with UC Berkeley to advance CAP objectives related to improving infrastructure resiliency, enhancing community connectivity, and providing local employment opportunities.

Other strategies in this section focus on supporting green businesses that help reduce community GHG emissions, and attracting businesses in the "cleantech" industry that are developing the innovative solutions needed to achieve deep GHG reductions across the state (and global) economy. With an abundance of marketable assets, including robust transportation and transit networks, proximity to world-class universities and urban innovation centers, and relatively affordable real estate, Richmond is well-positioned to attract economic growth in the bioscience and green/clean technology sectors, and has set a long-term vision to be nationally recognized for business development in these sectors.[12] There is tremendous entrepreneurial opportunity in developing and marketing new technologies and services that are geared toward reducing the GHG footprint of energy, transportation, agriculture, water, materials, waste management, and land management.

Richmond Green Business Highlight: Hero Arts

Hero Arts is a Certified Green Business that designs and manufactures art supplies in Richmond. Hero Arts is committed to reducing their carbon footprint. In 2005, they pledged to reduce packaging, waste, and energy consumption, and to reduce carbon emissions by 90% over 10 years. Today, their Richmond warehouse is lined with windows and glass rolling doors to let in sunlight and act as a natural heat sink, eliminating the need for heat and lighting, and in side rooms, sensors now turn off lights when rooms are not in use. They have also eliminated all toxics chemicals and solvents in all manufacturing processes and products, and require all suppliers to sign a green pledge to do the same. Through these efforts, in 5 years they reduced their GHG emissions by 240 tons and electricity usage by 15%, saving the company an estimated $6,000.

Source: Hero Arts, 2016.

[12] City of Richmond Marketing Plan: Strategies for the City of Richmond to attract new businesses and support economic growth; 2013. Social Sector Solutions (S3). Available at: http://www.ci.richmond.ca.us/DocumentCenter/View/27689

The City is already home to many prominent, innovative green businesses and clean tech companies, including Sunpower and Heliodyne, and is poised to become a new center of innovation in the low carbon economy. There are multiple programs in the private sector that provide incubator services to businesses in the Bay Area. The **East Bay Economic Development Alliance (EDA)** provides services, analysis and cross sector partnerships, and has created a guide to help grow small and medium sized businesses and develop industries throughout the Bay Area. EDA is particularly dedicated to growing the region's international economic focus by providing assistance to companies interested in importing and exporting products, trading with foreign companies, and working with local maritime ports. Other organizations include: **AnewAmerica Community Corporation**, which offers a three-year program of support for micro- business incubation, asset building, and social responsibility; and **Communications Technology Cluster (CTC)** which is a business acceleration center providing strategic consulting, business and financial services.

RichmondBUILD

RichmondBUILD is a public private partnership aimed at providing job training and hands-on experience in solar installations and green industry businesses. This unique training opportunity delivers a triple benefit: participants experience effective, real-world training in solar installation; homeowners receive a solar system financed by a low-interest loan that immediately reduces their energy bills; and the planet benefits from a reduction in carbon emissions.

All of RichmondBUILD students are low-income and most are young people of color, including those with a history with the justice system. Since 2007, more than 200 participants have graduated receiving an average wage of $18.33 an hour, while maintaining a robust job retention rate of 85 percent.

The growing green economy is attracting new industry while helping the City achieve its GHG reduction goals. Investing in renewable energy creates living-wage, green collar jobs, generates local business revenue, and spurs economic growth. The City will promote growth of its green business and industry sectors and support training and development of a local workforce that has the skills to support the City's economic future. Focusing workforce development program opportunities within underemployed and low-income communities will ensure that all of the City's youth and communities are included in the transition to a cleaner, more sustainable economy.

Health Co-Benefits of Green Businesses

Promoting the growth of green businesses and industry provides many health co-benefits to business owners and the community in Richmond. Residential neighborhoods located near industrial zones typically have higher proportions of lower income and residents of color than other neighborhoods. As large industries in Richmond reduce their carbon emissions, these residents benefit from reduced pollution levels Employees, too, benefit when businesses commit to sustainability and reducing emissions. Buildings with good environmental quality can enhance worker performance and reduce the rate of respiratory disease, allergy, asthma, and sick building symptoms. By taking steps to ensure compliance with environmental regulations, businesses are protecting the health of their employees.

Since 2007, the **RichmondBUILD program** has offered training to 35 low- income and at-risk youth in the construction and renewable energy fields each year. Participants complete the core Carpentry Pre-Apprenticeship track, and 80 percent of graduates are placed in jobs paying an average of $18.33 an hour utilizing the skills they were taught. The **Rising Sun Energy Center's Green House Calls** program offers summer job training for youth ages 15-22 in outreach, customer service, and energy efficiency. Participants work in teams to perform energy efficiency audits for customers, install simple energy efficiency upgrades, and provide advice to residents on ways to further increase their energy savings. The City's **YouthWORKS** program provides case-managed services to at-risk and in-risk youth ages 16 to 21. The program provides pre-employment training and life skills, among other services.

General Plan 2030 Alignment

CAP Objective 7 supports the following General Plan 2030 policies:

- **Policy EC5.1 Green Businesses and Jobs.** Promote "green" industries to provide goods and services to fill the growing need for clean and sustainable technologies, fuels, vehicles and equipment, while providing jobs and training to Richmond residents.
- **Policy EC5.2 Environmentally Progressive Businesses and Industries.** Encourage existing businesses and industries to become increasingly environmentally progressive and continue making positive contributions to the community.
- **Policy EC5.3 Air Quality.** Support regional policies and efforts that improve air quality to protect human and environmental health and minimize disproportionate impacts on sensitive population groups.
- **Policy HW6.1 Local Employment Base.** Expand and diversify the local employment base to provide quality jobs for all Richmond residents, especially those that face barriers to employment such as youth, seniors, the formerly incarcerated, and residents with limited English proficiency.
- **Policy HW6.2 Workforce Training and Recruitment.** Support and enhance jobs-skills training and recruitment programs and services.
- **Policy HW6.3 Local Small Businesses.** Promote and support locally owned and cooperative enterprises and businesses, particularly along major corridors, to maximize economic and community benefits for Richmond residents.

Strategies for Green Business and Industry

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
2,315 MT CO2e by 2030	Improved air quality & comfort, reduced mold, reduced noise pollution reduced illness and premature mortality	

Strategy GB1: Reduce Industrial Carbon Emissions

The City will partner with local industries, the Bay Area Air Quality Management District (BAAQMD) and the California Air Resources Board (CARB) to ensure compliance with AB32 Cap and Trade emissions reduction targets for regulated industries and local carbon emission limits for industries that are not regulated by AB 32.

Performance Goal	Timeframe	Tracking Metrics	Total GHGs Reduced - 2030
GHG reduction by local regulated (capped) facilities.	Ongoing	GHG reductions by local regulated (capped) facilities	N/A (Supporting action)

Strategy GB2: Green Workforce Development

The City will continue to support and expand workforce development programs for the City's residents and youth through actions such as working with WCCUSD to incorporate green technology education and job training into the curriculum of area high schools; considering partnering with WCCUSD, UC Berkeley, and local industries and businesses to host an annual green tech career fair; and pursuing other technical training programs that could be provided to residents in Richmond.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase number of individuals trained for green jobs.	Ongoing	Number of individuals trained, total training hours by discipline or program	N/A (Supporting action)

Strategy GB3: Support Green/Clean Technology Incubator Programs

The City will promote networking and training organizations in the Bay Area, and will promote the various sources of financial assistance available throughout the Bay Area.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Promote networking and training organizations and raise awareness of financial assistance sources available to entrepreneurs.	Ongoing	Number of local businesses participating in local energy and green business programs	N/A (Supporting action)

Strategy GB4: Support Participation in Local Energy and Green Business Programs

The City will work with PG&E and MCE to develop an outreach and education plan that targets businesses and industries with the greatest potential for GHG reduction opportunities; cross-promote transportation demand management programs that go beyond the requirements of the Bay Area Commuter Benefits ordinance; educate businesses regarding fuel switching and electrification, reducing reliance on diesel fuel, and reducing hydrofluorocarbons (HFCs); provide supportive guidance to companies interested in reducing their carbon footprint, and identify ways to promote their accomplishments in the community and throughout the greater Bay Area.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Maximize participation in local energy and green business programs.	Ongoing	Number of businesses locating in Richmond and enrolling in support programs	N/A (Supporting action)

Strategy GB5: Reduce Emissions from Goods Movement

The City will reduce diesel fuel emissions through measures to address goods movement, or the transportation of imported and exported goods through or within the City of Richmond.

Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Reduce Port of Richmond GHG emissions by 20%.below 2005 baseline by 2030.	Ongoing	Port's MTC02e emissions reduced below 2005 baseline	2,315 MT CO2e

Strategy GB6: Reduce Use of Short-Lived Climate Pollutants (SLCPs)

The City will work with the CARB, BAAQMD, the Department of Toxic Substance Control, and other agencies to assist local business and industry in choosing or shifting to alternative refrigerants that don't use hydrofluorocarbons (HFCs). Where feasible, the City shall encourage new development and redevelopments to eliminate the use of HFCs in building construction by using alternative methods of heating and refrigeration.

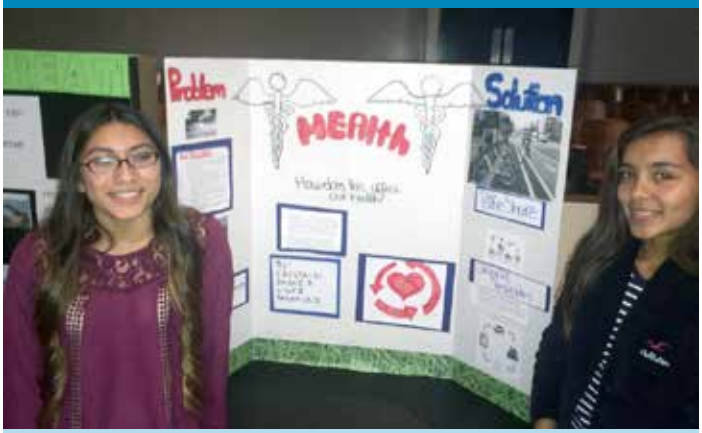
Performance Goal	Timeframe	Tracking Metrics	GHGs Reduced - 2030
Increase diversion of organics from landfill, and work with local industry to reduce use of refrigerants and SLCP emissions	Ongoing	SLCP emissions levels, as measured by CARB or BAAQMD	N/A (Supporting action)

patterns, sea level rise, prolonged periods of heat exposure, poor air quality, and associated health impacts. Ensure that community members have access to resources and programs that protect public health. Ensure affordable, safe, and climate-resilient housing, and access to local food and agriculture.

A resilient community is one that is prepared and ready to withstand social and environmental challenges, and can recover equitably from disasters and disruptions. As climate change impacts become more frequent and significant, the City must ensure that the community is resilient in terms of basic survival needs like shelter, food, water, and medical care, but is also prepared for long-term impacts to infrastructure and natural systems that support public health and provide important services to the local economy and the well-being of its residents. In turn, these improvements will enhance community disaster preparedness and make Richmond less susceptible to a changing climate.

Chapter 2 introduced the primary climate change vulnerabilities faced by the City of Richmond and the risks that they pose to community assets. The information presented

Youth and Climate Adaptation



In 2014, the City sought input on CAP strategies and actions from 250 Richmond High School students via the Youth Plan Learn Act Now (Y-PLAN) Program, sponsored by the UC Berkeley Center for Cities + Schools and the City of Richmond. Youth engagement is a key component of creating a healthy and resilient City. By integrating climate change considerations into the school curriculum and their daily environment, students, teachers and school administrators can all play a role in raising awareness about climate change impacts. Engaging students in understanding both the risks to the community and actions that the City government and community-members can undertake provides a key opportunity to enrich Richmond youth in energy, and environmental science and policy, and will make our future generations more climate conscious citizens.

here draws from the comprehensive City of Richmond Climate Change Adaptation Study (see Appendix F) which analyzes vulnerability of the City's assets, identifying risks from higher temperatures, sea level rise, riverine flooding, and extreme precipitation. The Adaptation Study provides a compendium of current plans, studies, policies, and actions that are relevant to the City's adaptation planning efforts, and provides a framework for making informed decisions on how to best focus resources going forward to increase the City's resilience to an uncertain future. Many of the findings in the Adaptation Study are derived from the county-wide **Adapting to Rising Tides project**[13] led by the Bay Conservation and Development Commission (BCDC).

Climate change presents a significant opportunity and risk to community health in Richmond, threatening to exacerbate existing inequities. Climate change may lead to more extreme weather events, worsened air quality, and increased transmission of infectious disease that could negatively affect community health. The impacts of climate change will not affect everyone equally. It is expected that already burdened and vulnerable populations, such as the elderly, infants and children, communities of color/people of color, and people living in poverty, may be disproportionally impacted by climate change. As such, the strategies included in this section encompass actions identified in the Richmond Adaptation Study that will increase Richmond's social, physical, environmental and economic resilience to climate change hazards. Increasing resiliency to climate change means increasing the capacity of the City's residents, infrastructure, response systems, and natural systems to absorb the impacts of climate change. It also means identifying the human populations that are most vulnerable to those impacts, and focusing on social agents that can yield positive change in support of overall resiliency. Effective resilience-building requires strong governance and a well-developed network of social, political, economic and financial institutions that can take on the work of identifying and addressing the risks posed by climate change.

Many strategies under other CAP objectives also bolster community resilience, including those that support local agriculture, green infrastructure, water conservation, and renewable energy. The strategies under "Resiliency to Climate Change" focus on the aspects of resilience that are not covered under those objectives, including safe and resilient housing, emergency response capabilities, flood management, healthy natural systems, and a local community that is prepared for climate shocks.

Improving community preparedness for climate emergencies is of paramount importance to the City of Richmond. The City will focus on raising community awareness of climate

[13] San Francisco Bay Conservation and Development Commission (BCDC) and the NOAA Coastal Services Center, 2011: Adapting to Rising Tides; project information and resources available at http://www.adaptingtorisingtides.org

change impacts, vulnerabilities, and risks, and working with government agencies, CBOs, and the community, to increase neighborhood and city-wide resilience. This includes strengthening social networks and emergency response systems to support communities in times of climate emergencies, ranging from floods, extreme heat events, droughts, wildfires, and the cascading impacts that can result from such events.

As part of such efforts, the City will prioritize the health and well-being of its most vulnerable populations (elderly, low-income, and health-compromised residents) who face significant risk from extreme heat events by 2100. These populations will also face higher risk of health problems from worsening air quality and new disease vectors (see Strategy RC6 for actions focused on public health and health equity). The City has an important role, in partnership with public agencies and community based organizations, to educate and engage the public on climate change issues, and to promote community involvement in actions to reduce climate change risks, using linguistically and culturally responsive approaches that are effective for diverse populations.

As part of its adaptation efforts, the City will develop a comprehensive vision for its extensive shoreline that addresses climate change impacts to private property, commercial and industrial assets, public infrastructure, water quality, ecological protection, public access, public health and recreation. This strategy complements General Plan Action EC6.G, which calls for the City to develop a shoreline protection system that is initially built to accommodate a mid-term rise in sea level of 16 inches,[14] along with an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels of sea level rise. The City will engage stakeholders in a discussion on shoreline resiliency that considers multiple objectives, which could lead to more effective capital improvement plans, better access to different financial and material resources, and approaches that provide co-benefits to issues beyond climate change.

In addition, the City will take immediate, short-term steps to reduce risk to climate change exposures and increase local preparedness efforts. Many actions focus on integrating climate change into existing planning and preparedness processes to better understand the vulnerabilities of specific populations to climate change, and to target programs, capacity building, and resources in those areas in culturally- and linguistically-appropriate ways.

Protecting Richmond's Natural Shoreline

Richmond's natural shorelines provide an array of recreational, flood protection, and ecosystem service benefits. Natural shorelines help reduce incoming wave heights, protecting shoreline structures from wind waves and tidal energy. Their loss can place shoreline communities at greater risk of flooding by increasing the likelihood that structural shoreline protection is overtopped or fails, and can increase the cost of maintaining, repairing and upgrading these already expensive structural protection assets. Scientific results from regional water quality monitoring programs and ecosystem restoration activities are suggesting the need to adjust priorities for the management of wastewater, sediment and flooding while continuing to protect the Bay's ecological resources.

The City recognizes the critical role it plays in increasing resilience of local housing and critical infrastructure to climate change. The following sections provide brief summaries of the climate change vulnerabilities and associated risks faced by housing and infrastructure, as presented in the City of

[14] This is based on a 2012 study by the National Research Council (NRC), Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, which projects 11 inches of sea level rise in the San Francisco Bay by 2050 (with a range of 5 to 24 inches) and 36 inches by 2100 (with a range of 17 to 66 inches).

Richmond Climate Change Adaptation Study (Appendix F). Public infrastructure at risk includes ground transportation networks, energy infrastructure such as power lines and natural gas distribution networks, water supply infrastructure, wastewater management facilities, and stormwater management infrastructure.

LOCAL HOUSING

Within the City of Richmond, hundreds of single-family residential parcels are at risk from either current or future flooding that will be more frequent and/or extensive due to sea level rise. Many parcels in Brickyard Cove and Point Richmond are at risk from less than 3 feet of sea level rise, which is also the same water level that could occur during a 50-year return period coastal storm event. Excessively dry periods will increase the risk of wildfires at the urban-wild interface along the eastern portion of the City, endangering nearby homes and property.

GROUND TRANSPORTATION

Stronger Housing, Safer Communities

The Association of Bay Area Governments (ABAG) and BCDC recently completed a study, **Stronger Housing, Safer Communities** (2015) that looked at vulnerability and resilience of housing in the Bay Area to flooding from sea level rise, seismic shaking, and liquefaction. The project includes a focused community profile for the Richmond Inner Harbor area, which includes all or part of eight neighborhoods: Atchison Village, Iron Triangle, Santa Fe, City Center, Coronado, Cortez, Marina Bay and Southwest Annex. It also includes all of the City's Richmond Bay Specific Plan area, the Ford Peninsula major activity center in Marina Bay, and two Districts, Regatta/Marina Bay and Southern Gateway. Much of this area is within the current 100-year flood plain and is susceptible to future flooding as sea level rises. There are also pockets of Bay fill that are susceptible to liquefaction. Many residents in the profile area are very low income and are burdened by housing and transportation costs. Neighborhoods are ethnically diverse with many areas having a high percentage of non-English speaking households. Established residents in the profile may not have the resources to invest in housing resilience, and are more likely to be displaced if their homes are damaged.

The ground transportation infrastructure in Richmond includes railways, state and federal highways, local arterials and access roads, and bridge approaches that are vulnerable to sea level rise and localized flooding. At risk are a number of roads the City of Richmond owns and manages in the Point Richmond, Marina Bay, and Iron Triangle neighborhoods. This includes segments of Richmond Parkway/Castro Street and Central Avenue, which are major truck and transit routes and important arterials for commuters and emergency service vehicles. Current levees are not likely to adequately protect these assets from sea level rise; as an intermediate measure, the City may develop contingency plans for temporary loss of these assets.

Portions of Interstate I-80 (approach to the Carquinez Bridge and San Pablo Avenue interchange) and I-580 (from the Castro Street Interchange to the Contra Costa County line) are also at risk of future flooding and storm events. Even temporary damage or partial closures of these highways could impact traffic at a regional scale. There are limited alternatives to re-routing goods movement, and loss of these segments would have significant impacts on worker access to local and regional jobs, and would greatly affect access to local and regional shoreline recreation.

The rail lines that run through Richmond are critically important, and support important inter- and intra-region goods and commuter movement. Goods moved by rail in Richmond include rail carload commodities (e.g., motorized vehicles and petroleum products other than gasoline or fuel oils) and intermodal rail shipments (shipping containers that can be moved by container ship, rail or truck). The rail lines are also used for passenger drains and freight trains daily. The Union Pacific (UP) rail line in particular is primarily located adjacent to the shoreline and crosses many tidal creeks and channels as well as coastal floodplains. The rail line serves as ad-hoc flood protection in many locations, with tidal marshes and mudflats on the bayside of the rail track that help reduce wind, wave and tidal energy. However, these marshes and mudflats that protect the rail line from erosion and flood damage are themselves vulnerable to sea level rise.

Given the interconnected nature of rail, and lack of redundancy,

a disruption of any segment, either within or outside of Richmond, could have significant impacts. Collaboration between private rail owners (UP and BNSF), local agencies that own or manage adjacent lands, and those that rely on rail either for providing service or for flood protection will be necessary to find and implement appropriate, multi-benefit solutions to address flood risks.

Many roads in the Richmond Hills are in high risk zones for wildfires by the year 2100. The vulnerability of these assets should be better defined, along with consequences of failure and contingency plans in the event they become damaged or inaccessible.

ENERGY INFRASTRUCTURE

Numerous studies by the California Energy Commission[15] (CEC) and others have highlighted the impact of climate change on California's energy infrastructure, which in turn impacts power availability to the City. Potential negative impacts on the energy grid system include higher temperatures stressing power plant capacity, electricity generation, transmission lines, substation capacity, and peak electricity demand; increased wildfire frequency or severity and the resulting impacts near transmission lines; and sea level encroachment upon power plants, substations, and natural gas facilities.

A potential climate risk to the City's natural gas infrastructure is inundation of pipelines and pumping stations due to temporary flooding or sea level rise. Buried pipelines are directly and indirectly sensitive to higher groundwater table and salinity intrusion. Exposure to salt water can corrode pipelines that are not protected as specified in federal and state regulations. Rising groundwater levels could increase liquefaction potential leading to additional damage during a seismic event. In the event of flooding, pipelines that are not weighted or anchored may float and become exposed, particularly during prolonged flooding and in marshy or sandy soils. PG&E's natural gas distribution network includes mains and service lines that which connect customers with the service mains. The location of mains and service lines is restricted information, and is beyond the scope of the City of Richmond Adaptation Study.

WATER SUPPLY

The City's current water supply is highly vulnerable to drought, but the risk of failure is uncertain. The City is dependent on the East Bay Municipal Utility District (EBMUD) for its long-term water supply. EBMUD sources its water from the Mokelumne River Basin which collects snowmelt and runoff from the Sierra Nevada Mountains. California's current long-term drought is putting added emphasis on long-term water security and forcing public agencies to redouble conservation efforts and expand contingency planning. Both EBMUD and the City of Richmond are increasing efforts to improve conservation, upgrade storage and delivery systems, and diversify local water supplies.

EBMUD delivers water to the East Bay through a large and complex conveyance system that includes aqueducts, reservoirs, water treatment plants, pumps, water mains and other infrastructure. Some of this infrastructure is at risk from climate change. None of EBMUD's reservoirs or treatment plants in Contra Costa County are at risk of flooding; however, EBMUD relies on the three Mokelumne Aqueducts that could be exposed to flooding as a result of Delta levee failure. These aqueducts provide built-in redundancy but if all three failed, EBMUD would rely on water from a local terminal reservoir that could provide 4-6 months of service. EBMUD has documented reliability risks for all major infrastructures from various hazards, including flooding. Redundancies in the water system that address seismic hazard vulnerabilities could also help avoid service disruption during a flood event.

Sea level rise could have its greatest impact on local water service by increasing salinity in the Sacramento-San Joaquin Delta, impacting EBMUD's water quality. Additionally, increased liquefaction potential during seismic events, storm event flooding, and rising sea levels will increase the potential for failure of Delta levees. Failure of the levees could result in damage to the Mokelumne Aqueducts and disruption of water supply to the entire region. To ensure water supply reliability EBMUD has built redundancy into their distribution and treatment systems. However, as a growing city in the fastest growing county in the Bay Area, with an expected population growth of 27 percent between 2010 and 2040, Richmond

[15] CEC, 2012, Estimating Risk To California Energy Infrastructure From Projected Climate Change, Report #CEC-500-2012-057.

will need to find new opportunities to improve water supply resilience to both accommodate growth and adapt to a changing climate.

WASTEWATER MANAGEMENT

The City has three sanitary sewer districts: Richmond Municipal Sewer District, managed by the City of Richmond; West County Wastewater District (WCWD); and Stege Sanitary District (SSD), managed by East Bay Municipal Utility District (EBMUD). Richmond maintains about half of the sewer lines within the City's boundaries. Many of the residents living in the northern half of Richmond are served by WCWD. Residents in the southern section of the Richmond Annex are serviced by Stege Sanitation District.

Richmond's wastewater treatment infrastructure is subject to multiple physical and functional vulnerabilities related to sea level rise, as outlined by the Contra Costa County ART Project and summarized in the City of Richmond Climate Change Adaptation Study. The consequences of system disruption or failure would be far ranging:

- A wastewater system disruption could potentially have wide-ranging consequences in the communities serviced by the wastewater treatment plants. Cumulative impacts on commercial and industrial businesses and the associated employment, goods, and services they provide could also be significant. Operations and maintenance cost, as well as capital improvement costs could increase with storm events and sea level rise flooding.
- Wastewater treatment facilities provide a critical public health and safety function. If storm events or sea level rise overwhelm and compromise the system, it could affect a plant's ability to treat and discharge wastewater. Shutdown of the plant would require directing its wastewater to another treatment plant, and/or sewer backups could occur in Richmond, causing residents to be out of their homes at least temporarily and businesses to close.
- If storm events or sea level rise overwhelm and compromise wastewater system assets, untreated sewage could overflow into the environment. Toxic substances and excessive nutrients degrade water quality and harm fish and other aquatic organisms.

STORMWATER MANAGEMENT

City stormwater assets that are directly exposed to flooding, or have their lowest elevation below future high tides, are vulnerable to sea level rise. Assets that are not directly exposed but rely on gravity drainage or have insufficient capacity to store and convey both stormwater and Bay water are also vulnerable. Because of their inherent function and location, large pipes, culverts, outfalls, storm gates, weirs, pump stations and force mains are especially at risk. For example, pipes and culverts are larger and carry more flow the closer they are to the receiving waters, and pump stations and their attached force mains are typically located in low-lying areas, such as road underpasses or roads that are below grade. The City has very limited resources to conduct studies to better understand the current condition of the stormwater system and the changes that are needed to reduce its future vulnerability to sea level rise.

The City of Richmond recently conducted an assessment to determine which components of the storm system assets are at risk from 6 feet of sea level rise plus mean higher high water (MHHW) or have their lowest point (invert elevations) below 6 feet of sea level rise. For more information see the City of Richmond Climate Change Adaptation Study (Appendix F), which summarizes key findings from the Contra Costa County ART Project, including a map of affected assets and a table listing the number of collection devices by category, those with invert elevation below 6 feet SLR, and the percent at risk.

Outfalls are the first line of defense against sea level rise in the

City's stormwater system. An exposure analysis conducted by the City indicates that 79 outfalls would be inundated at high tide with 6 feet of sea level rise. As these outfalls do not have storm gates to prevent Bay water from entering the stormwater system, where upstream pipe capacity is insufficient to store both stormwater and Bay water, there could be street and basement flooding during extreme tides or even the daily high tide. This is already a problem in many low-lying areas along the Richmond shoreline where historic marshes were filled for development. Higher water tables associated with sea level rise could also infiltrate the stormwater system and further reduce pipe capacity, and pipes and other infrastructure that were not constructed for saline conditions may be vulnerable to corrosion. Although some of the City outfalls have storm gates, these are often inaccessible to City staff and there is no plan in place to repair and maintain over time.

Stormwater Vulnerabilities Now

The Richmond Annex neighborhood already experiences "sunny day flooding" when stormwater does not drain during high tide and backs up into people's homes. Higher water tables associated with sea level rise could also infiltrate the stormwater system and further reduce pipe capacity, and pipes and other infrastructure that was not constructed for saline conditions may be vulnerable to corrosion.

General Plan 2030 Alignment

CAP Objective 8 supports the following General Plan 2030 policies:

- **Policy EC6.2 Low-Lying Areas in Richmond.** Protect and manage low-lying areas that are likely to be affected by sea level rise and storm surges.
- **Policy EC6.3 Adapting to Climate Change.** Prepare for and adapt to future impacts of changing weather patterns and sea level fluctuations.
- **Policy EC5.31 Air Quality.** Support regional policies and efforts that improve air quality to protect human and environmental health and minimize disproportionate impacts on sensitive population groups.

Strategies for Resiliency to Climate Change

GHG Reduction:	Health Co-benefits:	Other Co-Benefits
NA	Improved health equity, better disaster preparedness, lower emotional stress, reduced heat island effect and associated heat-related illness, decreased exposure to infectious diseases	

Strategy RC1: Improve Community Preparedness for Climate Emergencies

The City will raise community awareness of climate change impacts, vulnerabilities, and risks, and will work with government agencies, community-based organizations, and the community to increase neighborhood and city-wide resilience.

Performance Goal	Timeframe	Tracking Metrics
Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate sea level rise and other climate change hazards	Ongoing	Adoption of updated plans and building codes

Strategy RC2: Increase Resilience of Local Housing to Climate Change

The City will increase the resilience of local housing such that physical structures can withstand anticipated climate hazards including sea-level rise and flooding.

Performance Goal	Timeframe	Tracking Metrics
Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate sea level rise and other climate change hazards.	Ongoing	Adoption of updated plans and building codes

Strategy RC3: Increase Resilience of Critical Infrastructure to Climate Change

The City will increase the resilience of critical infrastructure (both existing and planned) such that physical structures can withstand anticipated climate hazards including sea-level rise and flooding.

Performance Goal	Timeframe	Tracking Metrics
Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate sea level rise and other climate change hazards.	Ongoing	Adoption of updated plans and building codes

Strategy RC4: Increase Resilience of Parks and Ecosystems to Climate Change

The City will protect parks, natural areas and ecosystems that provide recreational and aesthetic value, are critical to local flora and fauna, and provide ecosystem services that are valuable to the community.

Performance Goal	Timeframe	Tracking Metrics
Update the City's Parks Master Plan to incorporate sea level rise and other anticipated climate change impacts; protect vulnerable local and regional park assets. Update the City's approved street tree list to include species that will thrive under the future climate conditions anticipated for Richmond.	2018	Adoption of updated parks Plan and approved street tree list

Strategy RC5: Develop a Long-term Shoreline Development Vision and Protection Plan

The City will develop a comprehensive vision for its extensive shoreline that addresses climate change impacts to private property, commercial and industrial assets, public infrastructure, water quality, ecological protection, public access, public health and recreation.

Performance Goal	Timeframe	Tracking Metrics
Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G).	2018	Adoption of Adaptive Management Plan

Strategy RC6: Support Programs and Adaptation Responses that Protect Public Health and Promote Health Equity

The City will take initial, short-term actions to reduce risk to climate change exposures and increase local preparedness efforts, including but not limited to integrating climate change into existing planning and preparedness processes to better understand the vulnerabilities of specific populations to climate change, and to target programs, capacity building, and resources in those areas in culturally- and linguistically-appropriate ways.

Performance Goal	Timeframe	Tracking Metrics
Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate public health impacts of climate change.	Ongoing	Adoption of updated plans and building codes

City of Richmond

Climate Action Plan

CHAPTER 5

Implemention and Monitoring

IMPLEMENTATION AND MONITORING

5.1 Overview

For Richmond to advance toward meeting its CAP Goals and Objectives, the CAP strategies and actions must be implemented in a timely and efficient manner. The City will monitor each strategy to assess whether performance objectives are being met, and to inform what adjustments may be needed to keep performance on track. This chapter describes who is responsible for implementing the CAP strategies; how funding opportunities will be used to implement the strategies; and which metrics will be used for monitoring.

5.2 Responsibility and Outreach Channels

Successful implementation of the CAP strategies will require commitment and coordination from staff throughout the City. The City Manager will work with department heads to assign staff members to serve on the Promote Health and Sustainable Communities Chapter of the 5-year Business Plan to oversee the successful implementation and tracking of the CAP. The Sustainable Communities Team will directly report to the City Manager and is responsible for working within municipal departments and local entities to gather data, report on progress, track completed projects, and ensure that scheduling and funding of upcoming projects are discussed at key meetings. The Sustainable Communities Team may also advise in development review processes for new projects, determining whether development projects are consistent with the CAP.

The City is responsible for initiating the local actions to reduce emissions, but success for many measures will ultimately depend on state and regional actions as well as public participation. Community involvement is an essential component of the CAP implementation process, as many strategies depend on active participation by residents, businesses, community-based organizations (CBOs), regional organizations, or other government agencies. Coordination between City departments and these entities will be needed to ensure that existing state, regional, and community efforts are leveraged, and that CAP actions are well-managed and cost-effective.

The City will continue to use its existing community outreach channels to communicate in multiple languages and mediums with all sectors of the Richmond community, including traditionally underrepresented or underserved groups. The primary means of communicating news and progress regarding CAP implementation and soliciting feedback from the community and other stakeholders include:

1. Richmond Neighborhood Coordinating Councils;
2. Richmond City website (www.ci.Richmond.ca.us), and CAP website (www.RichmondClimateAction.org);
3. Email blasts including to the listserves for the Environmental Health List, City Manager Weekly Report, and Richmond City Councilmembers;
4. Regulations/discretionary review processes such as permitting, inspections, and environmental compliance (e.g., California Environmental Quality Act);
5. Utility bills, such as energy, trash, and water bills.

6. Community stakeholder outreach through collaborations with community based organizations;
7. NextDoor and other online neighborhood forums; and
8. Social media programs, including the City's Facebook page and Twitter account.

5.3 Key Implementation Considerations

The majority of the CAP strategies are already being implemented to some degree, and the specific actions identified in Appendix E provide support for and/or augment existing efforts. However, the way in which the City prioritizes specific strategies and actions will depend on a variety of factors, including availability of funding and City staff time, the need for new or updated city codes and ordinances, community priorities, evolving state regulations, and changing environmental demands. For each CAP strategy, **Table 5-1** summarizes the City department(s) responsible for implementation, along identified funding streams and anticipated need for code and/or policy changes.

Cost-benefit Analysis

The strategy descriptions in Appendix E assess at a high level the financial impact of program development and execution. For some strategies, detailed cost estimates or program designs will be necessary to assess the cost-effectiveness of various implementation options and to identify City budget and staffing needs. Cost-benefit analysis should be based on a variety of participation and per-unit factors, and other assumptions. As programs are developed, cost estimates should be refined and updated over time with more precise implementation-level data. Certain capital improvements, particularly those identified in the Sustainable Transportation and Land Use strategies, will need to be added to the City's Capital Improvement Plan and/or facility master plan programs used by City departments or the implementing agency.

Implementation Responsibility

Table 5-1 identifies the City department(s) tasked with implementation of each CAP strategy. Staff from the identified department(s) will work with the Sustainable Communities Team, other Richmond City departments, local agencies, and community groups, as appropriate, to implement actions under each strategy. Responsible staff will also monitor and measure the City's progress in meeting its GHG reduction targets.

City Ordinance and Code Updates

As shown in Table 5-1, some strategies recommend modifications to existing codes or ordinances, while others propose new codes or ordinances. The City will review model general plan, zoning, and building code amendments and other programs, as appropriate, to develop or modify codes and ordinances. Issue areas will include, but not be limited to, those related to energy, water, land use, transportation, storm water management, building reuse, and waste reduction.

Financial Impact to the City

The strategies in Chapter 4 were formulated with an understanding that the City has finite staff and financial resources to implement CAP strategies and actions. The costs for implementation include the creation or promotion of voluntary programs, continuing administration of those programs, and coordination and outreach with other government agencies and businesses. A few strategies require up-front capital expenditures by local agencies. The City will use a combination of staff time, existing and future grant funding opportunities, direct spending, and collaboration with other agencies and organizations to achieve CAP goals. However, the City will prioritize strategies that are supported by existing funding sources, including the Chevron ECIA, GHG Reduction Fund (GGRF), grants, utility/agency incentives, and other sources. Table 5-1 identifies the major funding streams available for each strategy. Details on specific funding programs are provided in the next section.

Table 5-1: CAP Strategy Implementation: Responsible Departments, Funding Sources, and Code/Policy Changes

Strategy	Title	Responsible Department(s)/ Division(s)	Funding Sources					Code or Policy Change
			Chevron ECIA	GHG Reduction Fund	Grants	Utility/ Agency Incentives	Other	
EE1	Leverage Energy Utility Programs, Rebates, and Incentives to Improve Efficiency of Existing Buildings	City Manager's Office, DIMO (Public Works), Housing and Community Development				●		
EE2	Leverage Other (Non-Utility) Third-Party Programs and Financing Sources to Improve Efficiency of Existing Buildings	Finance, City Manager's Office, Housing and Community Development	●	●	●			
EE3	Promote Innovative Design and Enforce Green Building Codes	Planning and Building Services, Code Enforcement, City Manager's Office				●		●
EE4	Outreach and Education to Promote Energy Conservation and Renewable Energy	City Manager's Office, Library and Cultural Services	●		●			●
RE1	Increase Local Solar Energy Generation	City Manager's Office, Planning and Building Services, DIMO (Public Works), Engineering	●	●	●			●
RE2	Promote and Maximize Utility Clean Energy Offerings	City Manager's Office, Planning and Building Services	●	●			●	
RE3	Promote Switching From Natural Gas to Clean Electricity	City Manager's Office, Planning and Building Services, DIMO (Public Works)		●				●

Table 5-1: CAP Strategy Implementation: Responsible Departments, Funding Sources, and Code/Policy Changes

Strategy	Title	Responsible Department(s)/ Division(s)	Funding Sources					Code or Policy Change
			Chevron ECIA	GHG Reduction Fund	Grants	Utility/ Agency Incentives	Other	
TL1	Promote Smart Growth and Complete Neighborhoods	Planning and Building Services, Engineering	●	●	●			●
TL2	Complete Streets	Engineering, Planning and Building Services	●	●	●			●
TL3	Improve Bicycle and Pedestrian Infrastructure	DIMO (Public Works), Engineering, Planning and Building Services, Transportation and Transit Services	●	●	●			●
TL4	Improve Signal Timing	Engineering, DIMO (Public Works)			●			●
TL5	Expand Public Transit Options and Improve Multi-Modal Network Connectivity	Planning and Building Services, Transportation and Transit Services	●	●	●			●
TL6	Promote Car Sharing, Bike Sharing, and Ride Sharing	Engineering, City Manager's Office, Transportation and Transit Services	●		●			
TL7	Promote Low-Carbon Vehicles and Fuels	DIMO (Public Works), City Manager's Office, Transportation and Transit Services	●		●	●		●
TL8	Outreach and Education to Support Public Transit and Active Transportation	City Manager's Office, Transportation and Transit Services, Library and Cultural Services	●		●			●

Table 5-1: CAP Strategy Implementation: Responsible Departments, Funding Sources, and Code/Policy Changes

Strategy	Title	Responsible Department(s)/ Division(s)	Funding Sources					Code or Policy Change
			Chevron ECIA	GHG Reduction Fund	Grants	Utility/ Agency Incentives	Other	
TL9	Support Transportation Demand Management	Planning and Building Services, City Manager's Office, Transportation and Transit Services			●			●
SW1	Establish a Zero Waste Framework	City Manager's Office, Planning and Building Services	●			●		●
SW2	Leverage Existing Programs and Incentives	City Manager's Office, Planning and Building Services						
SW3	Support Waste Collection Services, Rates and Schedules that Maximize Participation in Composting and Recycling Programs	City Manager's Office, DIMO (Public Works)						
SW4	Increase Diversion of Construction and Demolition (C&D) Waste	Building and Planning Services, City Manager's Office	●					●
SW5	Promote School Waste Diversion Programs	City Manager's Office	●					
WA1	Promote EBMUD Outreach and Conservation Programs	Department of Water Resource Recovery, City Manager's Office						
WA2	Expand School Programs	Department of Water Resource Recovery, City Manager's Office						
WA3	Green Building Strategies for Water Conservation	Department of Water Resource Recovery, Planning and Building Services						●

Table 5-1: CAP Strategy Implementation: Responsible Departments, Funding Sources, and Code/Policy Changes

Strategy	Title	Responsible Department(s)/ Division(s)	Funding Sources					Code or Policy Change
			Chevron ECIA	GHG Reduction Fund	Grants	Utility/ Agency Incentives	Other	
WA4	Support Water Infrastructure Improvements and Expand Water Reuse and Recycling	Department of Water Resource Recovery						●
GA1	Support Urban Tree-Planting Programs	DIMO (Public Works), Planning and Building Services	●	●	●			●
GA2	Support Local Agriculture and Food Production	DIMO (Public Works), Library and Cultural Services, Planning and Building Services	●					
GA3	Support Green Infrastructure and Streetscape Design	Engineering, Planning and Building Services			●			●
GB1	Reduce Industrial Carbon Emissions	Planning and Building Services, City Manager's Office	●					
GB2	Green Workforce Development	Department of Employment and Training, Library and Cultural Services	●					
GB3	Support Green/Clean Technology Incubator Programs	City Manager's Office	●				●	
GB4	Outreach and Incentives to Support Local Participation in Energy Efficiency Technical Assistance and Green Business Programs	City Manager's Office	●					
GB5	Reduce Emissions from Goods Movement	Planning and Building Services, Port Operations, City Manager's Office						●

Table 5-1: CAP Strategy Implementation: Responsible Departments, Funding Sources, and Code/Policy Changes

Strategy	Title	Responsible Department(s)/ Division(s)	Funding Sources					Code or Policy Change
			Chevron ECIA	GHG Reduction Fund	Grants	Utility/ Agency Incentives	Other	
GB6	Reduce Use of Short-Lived Climate Pollutants (SLCPs)	Planning and Building Services, City Manager's Office						
RC1	Improve Community Preparedness for Climate Emergencies	Police and Fire Departments						
RC2	Increase Resilience of Local Housing to Climate Change	Planning and Building Services, City Manager's Office, Housing and Community Development			●			●
RC3	Increase Resilience of Critical Infrastructure to Climate Change	DIMO (Public Works), Engineering, Department of Water Resource Recovery			●			●
RC4	Increase Resilience of Parks and Ecosystems to Climate Change	DIMO (Public Works), Engineering, Recreation Department	●		●			
RC5	Develop a Long-term Shoreline Vision and Protection Plan	Planning and Building Services, DIMO (Public Works)			●			●
RC6	Protect Public Health and Promote Health Equity	City Manager's Office, Richmond Emergency Services, Planning and Building Services	●		●			●

5.4 Tracking Performance and Co-benefits

Monitoring of the CAP's performance involves tracking the performance of individual strategies and estimating the GHG emissions reductions resulting from their implementation. The performance metrics identified for each strategy will be tracked using readily accessible data that is useful for estimating emissions reductions. Periodic re-inventorying of local government and community-wide emissions will also be needed to validate overall progress toward the City's GHG reduction targets.

Many of the CAP's GHG reduction strategies have the added benefit of improving Richmond's urban environment and creating greater health equity among City residents. CAP strategies may also create new social and economic opportunities for Richmond residents. For example, some strategies will improve public health outcomes by encouraging walking and biking or reducing air pollution; others offer economic benefits such as job creation, or financial benefits such as energy retrofits that lower utility bills.

Monitoring Progress toward CAP Targets

Regular monitoring provides concrete data to document the City's progress in reducing GHG emissions to reach its 2020 and 2030 reduction targets. The Richmond CAP Coordinator will present an annual memorandum or report card to the City Manager summarizing progress implementation of CAP measures. The report will evaluate the successes and challenges in meeting the City's GHG reduction targets (as they become known or apparent), provide the status of implementing actions for each reduction strategy in the CAP (e.g., initiated, ongoing, completed), assess the effectiveness of each strategy, and recommend adjustments to programs or actions as needed. The annual report will also assess whether the City's actual growth and development is consistent with the forecasts and assumptions in the CAP. The annual report will be presented to City Council, Planning Commission, and other stakeholders as needed.

GHG Inventory Updates

The City plans to update of the GHG inventory biennially (every other year) at minimum. If appropriate, the City shall modify the geographic scope of the inventory, along with emissions baseline and targets as necessary. Inventory updates will encompass all inventory sectors (residential energy, commercial/industrial/municipal energy, large industrial energy, on- and off-road transportation, solid waste, wastewater, and water), and include a comparison to baseline GHG emissions (2005) and analysis of trends over time.

CAP Revisions

A comprehensive revision of the CAP should occur at least every five years to monitor progress of GHG reductions against the 2020 and 2030 targets, to account for the impact of new legislation and state programs on GHG targets and emissions reductions, and to adjust strategies and actions as needed to reach the targets. With the Governor's recent Executive Order B-30-15 to cut state-wide GHG emissions to 40 percent below 1990 levels by 2030, it is widely expected that the state will soon codify post-2020 GHG reduction targets and enact new laws and programs to ensure those targets are met. Targeted investment and state supported infrastructure will be needed to establish commercial markets for low-carbon solutions to grow to the scale required. These developments will greatly enhance the ability of the City of Richmond to meet its long-term GHG reduction goals.

Tracking Implementation of Local Measures

City staff will report CAP implementation progress using tracking metrics that serve to gauge degree of implementation and associated GHG reductions. Table 5-2 lists the tracking metrics used to estimate the GHG reduction impacts of each CAP strategy, which consists of a mix of system level metrics (e.g., energy usage by community), program level metrics (e.g., percent of homes and businesses participating in Marin Clean Energy), and milestones/status metrics (e.g., compliance with Title 24 regulations). Each metric serves multiple functions, such as:

- Indicates whether the City is on path to achieve the goals set in the CAP, including GHG reduction as well as improvements in overall health outcomes, health equity, local jobs, cost savings, community resilience and other important co benefits attributed to CAP implementation;
- Measures the effectiveness of individual CAP strategies in achieving their objectives;
- Supports CAP monitoring and public reporting needs including the ability to be easily tracked over time;
- Supports the pursuit of grants for CAP implementation, and grant reporting;
- Relies on accessible, high quality data;
- Is easily understood by the public and other stakeholders; and
- Is consistent with and supports existing plans, policies, and strategies such as the Richmond General Plan, Richmond Livable Corridors Sustainability Guidelines, and the Health in All Policies (HiAP) Strategy and Ordinance.

Table 5-2 also describes the data sources for the tracking metrics, and the scale at which data will be tracked. A monitoring tool is being developed by the City to track implementation milestones and to annually estimate the GHG reductions associated with implementation.

Table 5-2: CAP Performance Tracking Metrics

Strategy	Title	GHG Reduction Tracking Metrics	Data Source(s)	Scale
EE1	Leverage Energy Utility Programs, Rebates, and Incentives to Improve Efficiency of Existing Buildings	Electricity and natural gas use (total and per capita) Number of buildings retrofitted	PG&E, MCE	City, Sector
EE2	Leverage Other (Non-Utility) Third-Party Programs and Financing Sources to Improve Efficiency of Existing Buildings	Electricity and natural gas use (total and per capita) Number of buildings retrofitted	PACE programs, East Bay Energy Watch	City, Sector
EE3	Promote Innovative Design and Enforce Green Building Codes	Square footage of new construction meeting/ exceeding Title 24 Square footage of new construction achieving ZNE	PG&E, MCE, City permit data	City, Sector
EE4	Outreach and Education to Promote Energy Conservation and Renewable Energy	City energy outreach budget Program participation rates	City data	City
RE1	Increase Local Solar Energy Generation	Number of homes and businesses solarized Total local solar generation capacity; quantity installed per year	CA Solar Initiatives, PG&E, City permit data	City

Table 5-2: CAP Performance Tracking Metrics

Strategy	Title	GHG Reduction Tracking Metrics	Data Source(s)	Scale
RE2	Promote and Maximize Utility Clean Energy Offerings	Enrollment in MCE Green Energy programs Average CO2e content of PG&E and MCE electricity	MCE, PG&E	City
RE3	Support Fuel Switching and Electrification to Reduce Carbon Emissions	Number of natural gas systems electrified Therms reduced by electrification per year	PG&E, CEC	City
TL1	Promote Smart Growth and Complete Neighborhoods	Percent density increase in PDAs and citywide	City planning data on residential and employment density	Neighborhood, zip code, City
TL2	Complete Streets	Percent of total intersections and roadways retrofitted	City planning data	Neighborhood, zip code, City
TL3	Improve Bicycle and Pedestrian Infrastructure	Miles and Percent of Master Plan improvements completed Percent increase in bicycle trips (commute and non-commute)	City planning data	Neighborhood, zip code, City
TL4	Improve Signal Timing	Percentage of total signals coordinated	City planning data	Neighborhood, zip code, City
TL5	Expand Public Transit Options and Improve Multi-Modal Network Connectivity	Transit ridership rates	AC Transit, City planning data	Neighborhood, zip code, City; Bus line/stop
TL6	Promote Car Sharing, Bike Sharing, and Ride Sharing	Percent of residents within half-mile of bike share station and/ or car sharing pod Program participation rates	City permit data, Assessor data, Car-share / bike-share websites	Point data, City
TL7	Promote Low-Carbon Vehicles and Fuels	ZEV vehicle penetration (percent of total fleet) Number of ZEV stations installed	City permit data	City

Table 5-2: CAP Performance Tracking Metrics

Strategy	Title	GHG Reduction Tracking Metrics	Data Source(s)	Scale
TL8	Outreach and Education to Support Public Transit and Active Transportation	Number of residents who report using transit or active transportation	American Community Survey, Richmond Community Survey	Neighborhood, zip code, City
TL9	Support Transportation Demand Management	Percent participation in TDM programs Percent of employees able to work from home one day per week	Richmond Community Survey, WCCUSD	Neighborhood, zip code, City
SW1	Establish a Zero Waste Framework	Citywide solid waste generation Percent solid waste diverted from landfill	City data, City hauler, Recyclemore	City
SW2	Increase Participation in Recycling Programs and Incentives	Annual tonnages of recyclables and organics diverted from landfill	City hauler, Recyclemore	City
SW3	Support Waste Collection Services, Rates and Schedules that Maximize Participation in Composting and Recycling Programs	Citywide solid waste generation Annual tonnages of recyclables and organics diverted from landfill	City hauler, Recyclemore	City
SW4	Increase Diversion of Construction and Demolition (C&D) Waste	Annual tonnage of processed (recycled) C&D materials Annual tonnage of C&D waste sent to landfill	City hauler, Recyclemore	City
SW5	Promote School Waste Diversion Programs	Percentage of Richmond schools with “three-bin” recycling programs	WCCUSD	City
WA1	Promote EBMUD Outreach and Conservation Programs	Gallons saved per year Citywide	EBMUD	City
WA2	Expand School Programs	Percent of schools participating in EBMUD programs	EBMUD, WCCUSD	City
WA3	Green Building Strategies for Water Conservation	CalGREEN compliance Number of GreenPoint rated or LEED certified buildings	City permit data	City

Table 5-2: CAP Performance Tracking Metrics

Strategy	Title	GHG Reduction Tracking Metrics	Data Source(s)	Scale
WA4	Support Water Infrastructure Improvements and Expand Water Reuse and Recycling	Number of graywater and rainwater catchment permits issued	City permit data	City
GA1	Support Urban Tree-Planting Programs	Annual trees planted by residents Number of homes and businesses participating in tree-planting programs	City data, CBO data	City
GA2	Support Local Agriculture and Food Production	Number of urban and school gardens Acreage of urban gardens Number of weekly farmer's markets	City permit data, assessor data, CBO data	City
GA3	Support Green Infrastructure and Streetscape Design	Number of green infrastructure projects completed annually	City permit data	N/A
GB1	Reduce Industrial Carbon Emissions	GHG reductions by local regulated (capped) facilities	CARB	City
GB2	Workforce Development	Number of individuals trained, total training hours by discipline or program	Department of Employment and Training	City, industry sector
GB3	Support Green/Clean Technology Incubator Programs	Number of businesses locating in Richmond and enrolling in support programs	Richmond Office of Economic Development	City, industry sector
GB4	Outreach and Incentives to Support Local Participation in Energy Efficiency Technical Assistance and Green Business Programs	Number of local businesses participating in local Green Business Program	Richmond Office of Economic Development	City
GB5	Reduce Emissions from Goods Movement	Port's MTC02e emissions reduced below 2005 baseline	Port of Richmond, CARB	City
GB6	Reduce Use of Short-Lived Climate Pollutants (SLCPs)	TBD	BAAQMD, CARB	City
RC1	Increase Local Awareness of Climate Change Hazards	Adoption of updated plans and building codes	City data	City

Table 5-2: CAP Performance Tracking Metrics

Strategy	Title	GHG Reduction Tracking Metrics	Data Source(s)	Scale
RC2	Increase Resilience of Local Housing & Infrastructure to Climate Change	Adoption of updated plans and building codes	City data	City
RC3	Improve Community Preparedness for Climate Emergencies	Adoption of updated plans and building codes	City data	City
RC4	Increase Resilience of Parks and Ecosystems to Climate Change	Adoption of updated parks Plan and approved street tree list	City data	City
RC5	Develop Long-term Plan for Sea Level Rise with a Comprehensive Shoreline Vision	Adoption of Adaptive Management Plan	City data	City
RC6	Support Programs to Protect Public Health and Health Equity	Adoption of updated plans and building codes	City data	City

Tracking Progress of State and Regional Measures

While successful implementation of the CAP relies to a large extent on local actions, the City is ultimately dependent on state and regional programs to close the gap between projected business-as-usual (BAU) emissions and its reduction goals. Close monitoring of the real gains being achieved by state programs will inform the City whether adjustments to locally implemented measures are needed in order to achieve GHG reduction targets. The City will work with regional agencies and organizations to track the success of actions included in the Richmond CAP that are being led by, or are heavily influenced by, state and regional efforts, such as advances in Title 24 Energy Efficiency Standards, the state's Advanced Clean Vehicle standards, the Low Carbon Fuel Standard, and goods movement programs.

Tracking Health Equity and Resilience

The effects of CAP implementation on health equity and resilience will be tracked using the indicators shown in Figure 5-1. These indicators were selected based on their correlation with GHG emissions reductions, community resilience improvements, and other co-benefit outcomes expected with implementing the strategies and actions in the CAP. For example, CAP strategies to improve pedestrian and bicycle infrastructure may increase physical activity, reduce collisions with cyclists and pedestrians, and reduce rates of mortality for certain diseases. These indicators can be used to track health outcomes and guide policy and programmatic initiatives that are consistent with, or linked to, existing health indicators projects in the City of Richmond, such as the Community Health and Wellness Element and the City's Health in All Policies strategy. Linking health indicators to the implementation of CAP strategies can provide supporting information for grant applications and other opportunities that fund health initiatives at a range of scales.

Figure 5-1: Alignment of CAP Objectives with Health Equity and Resilience Indicators

CAP	Indicator: Air quality	Adult physical activity	Asthma dianosed in children	Asthma hospitalizations	Collisions with pedestrian and cyclist	Health status (self reported)	Heat Related illness	Human Development Index (HDI)	Low birth weight babies	Overweight and obesity rate - adult	Overweight and obesity rate - childhood	Toxic releases from facilities
Energy Efficient Buildings and Facilities	●		●	●		●			●			
Increase Use and Generation of Renewable Energy	●		●	●		●			●			
Sustainable Transportation and Land Use	●	●	●	●	●	●		●	●	●	●	
Zero Waste	●					●						
Water Conservation	●					●	●					
Green Infrastructure, Urban Forestry and Agriculture	●	●	●	●		●	●	●	●	●	●	●
Green Business and Industry	●		●	●		●		●	●	●	●	●
Resiliency to Climate Change	●	●	●	●		●	●	●	●	●	●	●

Some indicators, such as Air Quality, are highly correlated with CAP actions (e.g., transit oriented development to reduce vehicle trips) and with health outcomes (fewer vehicle trips produce fewer emissions of criteria air pollutants and GHG emissions). Other indicators, such as physical activity, obesity, and collision data, are affected by CAP measures that influence land use and transportation such as complete streets, or improvements to pedestrian and bicycle infrastructure. [1, 2, 3]

Table 5-3 describes the metrics underlying each health equity and resilience indicator and the data source(s) used for quantification. As indicated in Table 5-1, eight of the ten metrics are already being tracked by the City as part of HiAP implementation. For most metrics, data is available at multiple scales (e.g., County, City, zip code, census tract). Even with high resolution data, however, it is difficult to attribute specific health outcomes or resiliency trends to individual GHG reduction strategies since many implementing actions are occurring simultaneously, and because of the complex interplay of so many social and environmental factors not related to CAP implementation. Accordingly, the indicators selected are most relevant to overall CAP implementation and how it is affecting health equity and resilience across the community. Even so, normalizing performance metrics against a second variable, such as population, service population (jobs + residents), or a particular demographic or economic sector, can provide additional insights into program effectiveness. For example, normalizing per capita electricity use against income and/or race can evaluate how well energy efficiency programs are helping different socio-economic groups.

[1] Morello-Frosch, Rachel, and Manuel Pastor, James Sadd, and Seth B. Shonkoff, The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap, 2013. Available on California DPH web stie: https://www.cdph.ca.gov/programs/Documents/The_Climate_Gap_Full_Report_FINAL.pdf

[2] Centers for Disease Control and Prevention. Environmental Health Tracking Program, Assessing Health Vulnerability to Climate Change: A Guide for Health Departments, U.S. Climate Resilience Toolkit. Available at: http://www.cdc.gov/climateandhealth/pubs/AssessingHealthVulnerabilitytoClimateChange.pdf

[3] California Department of Public Health, Climate Action for Health: Integrating Public Health into Climate Action Planning, February 2012. Available at: https://www.cdph.ca.gov/programs/Pages/ClimateChange.aspx

Table 5-3: Health Equity and Resilience Indicators and Metrics for City of Richmond Climate Action Plan

Indicator	Metric	Source	Data Scale	HiAP Strategy Indicator
Air Quality	Ozone, PM 2.5, and NOx Concentrations; diesel PM Emissions; toxic air contaminants (TACS) Self-reported air quality	CalEnviroScreen, ARB, BAAQMD, Richmond Community Air Monitoring Program, Richmond Community Survey	County, City. census tract	●
Adult physical activity	Percentage of adults who meet federal physical activity guidelines	California Health Interview Survey (CHIS), Contra Costa Health Services	County, City, zip code	●
Asthma diagnosed in children	Percentage of children diagnosed with asthma	(CHIS), Contra Costa Health Service	County, City, zip code	●
Asthma hospitalizations	Hospitalization rate for patients where asthma was the condition established to be the chief cause of the admission of the patient to the facility for care, per 100,000 people	California Office of Statewide Health Planning and Development (OSHPD), Contra Costa Health Services	County, City, zip code	●
Collisions with pedestrians and cyclists	Rate (and total number) of motor vehicle collisions with pedestrians and cyclists per 10,000	California Highway Patrol Statewide Integrated Traffic Records System	Point data, City, zip code, tract	
Health status (self-reported)	Reported as excellent, good, fair or poor	Richmond's NCS	City	●
Heat related illness	Emergency Department visits for heat stress	California Department of Public Health (DPH)	City	
Human Development Index	California Human Development Index is comprised of four indicators: life expectancy, school enrollment, educational degree attainment, and median personal earnings	Measure of America	County, City, neighborhood	
Low birth weight babies	Percent of births below 2,500 grams (5 lbs 8 oz.)	CalEnviroScreen, California DPH, Contra Costa Health Services	County, zip code, census tract	●

Table 5-3: Health Equity and Resilience Indicators and Metrics for City of Richmond Climate Action Plan

Indicator	Metric	Source	Data Scale	HiAP Strategy Indicator
Overweight and obesity rates – adult	Percentage of adult population that is overweight or obese (Body Mass Index)	CHIS, Contra Costa Health Services	County, City, zip code	●
Overweight and obesity rates – childhood	Percentage of childhood population that is overweight or obese; Percentage of 5th, 7th, and 9th graders in the healthy fitness zone (HFZ)	CHIS, California Department of Education, Contra Costa Health Services	County, City, zip code	●
Toxic releases from facilities	Pounds of toxic released as reported in the Toxic Release Inventory (TRI) database,	CalEnviroScreen, Risk Screening Environmental Indicators (RSEI), Contra Costa Health Services	City, census tract	

5.5 Aligning with Funding Opportunities

A number of existing and anticipated funding opportunities will be leveraged to implement the Richmond CAP strategies. The primary funding sources referenced in Table 5-1 and in Appendix E are described below.

1. **Chevron Refinery Modernization Project Environmental and Community Investment Agreement (ECIA).** On July 29, 2014 the Richmond City Council approved the Environmental and Community Investment Agreement (ECIA) as part of the Chevron Modernization Project. The ECIA will provide $90 million dollars to the Richmond community over a period of ten years. Committed uses of these funds include investments in community-based GHG reduction programs, and a photovoltaic solar farm, a community scholarship program, public safety, job-training, and competitive community grants.

2. **Greenhouse Gas Reduction Fund (GGRF).** Funds generated by California's cap-and-trade program are deposited into the State's Greenhouse Gas Reduction Fund (GGRF). The GGRF is created by the California Global Warming Solutions Act of 2006 (AB 32), which designates the Cap-and-Trade program as one of several strategies that California uses to reduce GHG emissions that cause climate change. The funds are administered by State and local agencies to further the goals and actions outlined in the Scoping Plan and other State climate and energy plans, through a variety of GHG reducing programs for energy efficiency, public transit, low-carbon transportation and affordable housing. Short-Lived Climate Pollutants (SLCPs) including methane, black carbon (soot) and fluorinated gases are also targeted for reductions. Per the requirements of Senate Bill 535 (2012, De León) a quarter of the proceeds from the GGRF must also go to projects that provide a benefit to disadvantaged communities. A large portion of the City of Richmond is classified as a disadvantaged community and is eligible for this funding (see Figure 2-3 in Chapter 2, Opportunities and Challenges). The Draft Cap-and-Trade Second Investment Plan[4] for fiscal years

[4] CARB's Draft Second Investment Plan available: http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/auctionproceeds.htm

2016/17 and 2017/18 recommends that a portion of the total GGRF proceeds be allocated to "integrated projects" that support energy and transportation solutions, smart growth, urban forestry, and more funding for disadvantaged communities. GGRF funding streams that are important to CAP implementation include the following:

a. The State's **Affordable Housing and Sustainable Communities (AHSC) Program** is designed to distribute GGRF funds to disadvantaged communities. Eligible projects for AHSC funding include those providing affordable housing, transit-oriented development (TOD), transit, complete streets, and active transportation projects that reduce GHG emissions and vehicle miles travelled (VMT). Project scoring criteria consider the anticipated economic, environmental, and public health benefits. Approximately $320 million dollars was available through the AHSC program for fiscal year 2015-16 funding.

b. The GGRF contributes to the **CalFire Urban and Community Forestry Program.** The Program supports a number of urban tree planting projects, including jurisdiction wide tree inventory and urban forest mapping, analysis, and long term management planning; urban wood and biomass utilization projects; projects to assist local entities purchase and improve unused lots; and projects for urban green infrastructure.

c. The GGRF supports energy efficiency and renewable energy projects for single and multifamily low-income housing units within disadvantaged communities, supplementing the federal Low-Income **Weatherization Assistance Program** administered by the California Community Services and Development (CSD) Department. The City has successfully leveraged the low-income solar program to solarize a number of households in Richmond and plans to solarize an additional 130 homes from 2015 through 2018.

d. CARB's **Low Carbon Transportation program** supports the transition to low carbon freight and passenger transportation and prioritizes funding for disadvantaged communities. This investment from the GGRF will also support the Brown Administration's goal to deploy 1.5 million zero emission vehicles in California by 2025. CARB currently administers programs that provide rebates for zero emission cars and vouchers for hybrid and zero emission trucks and buses. Incentives will also be provided for the pre commercial demonstration of advanced freight technology to move cargo in California, which will benefit communities near freight hubs. The **Clean Vehicle Rebate Project (CVRP)** is designed to promote the purchase of battery electric, plug-in hybrid electric, and fuel cell vehicles. Rebates of up to $6,500 per light-duty vehicle are available for individuals, nonprofits, government entities, and business owners who purchase or lease an eligible vehicle. The Center for Sustainable Energy (CSE) administers the both the CVRP and the CVRP public fleet pilot project, where agencies operating in California's most vulnerable and pollution-burdened areas can get up to $15,000 in rebates for the purchase of new, eligible zero-emission and plug-in hybrid light-duty vehicles. BAAQMD has similar funding available for public agencies. Notably, the CVRP and BAAQMD incentives are not mutually exclusive

e. Through the GGRF's **Transit and Intercity Rail Capital Program (TIRCP)** the city may be eligible for funding that encourages capital investments in transportation infrastructure. In addition, cities have applied for innovative transit-oriented development funding through the GGRF's **Low Carbon Transit Operations (LCTO)** program, which supports transit agency programs to reduce greenhouse gas emission and improve mobility, with an emphasis on benefitting disadvantaged communities.

f. With GGRF funding, CalRecycle established the **GHG Reduction Grant and Loan Program** to provide financial incentives for capital investments in composting/digestion infrastructure and recycling manufacturing facilities that will result in reduced GHG emissions.

3. **One Bay Area Grant (OBAG) Program.** The OBAG program supports implementation of Plan Bay Area, providing discretionary funds for many transit-oriented housing projects and transportation infrastructure improvements in PDAs, such as safe bicycle lanes and more pedestrian-friendly sidewalks. OBAG established program commitments and policies for investing roughly $800 million over a four-year period (fiscal years 2012-13 through 2015-16), funded by federal funds authorized by Congress in Moving Ahead for Progress in the 21st Century (MAP 21).

4. **CalTrans Grant Programs:** The California Department of Transportation (CalTrans) administers several grant programs available to the City that benefit sustainable transportation systems:

   a. **Strategic Partnerships Grants** fund planning projects that: encourage regional agencies to partner with Caltrans to identify and address statewide/interregional transportation deficiencies in the state highway system; strengthen government-to-government relationships; and, result in programmed system improvements. An estimated $1.5 million will be available for the FY 2016-2017 grant cycle. The program requires a 20% non-federal local match. Grants are available in amounts ranging from a minimum of $100,000 to a maximum of $500,000. CAP-relevant example eligible projects include corridor studies, transportation demand management plans, and system investment prioritization plans.

   b. **Sustainable Communities Grants** fund transportation planning projects that: identify and address mobility deficiencies in the multimodal transportation system. Eligible projects are those that identify specific mobility needs of disadvantaged communities, encourage stakeholder collaboration, involve active public engagement, integrate Smart Mobility concepts, and ultimately result in programmed system improvements. The program's overarching objectives include sustainability, preservation, mobility, safety, innovation, economic development, health, and equity. Eligible projects include community efforts to reduce transportation-related GHG emissions.

5. **Transformative Climate Communities (TCC) Program:** Assembly Bill 2722, signed into law in September 2016, directs the Strategic Growth Council to fund implementation of new or existing neighborhood level plans that include innovative multi-objective projects to address climate change in ways that deliver multiple benefits in disadvantaged communities. TCC will encourage integrated community-wide approaches to sustainable development that locate affordable housing near transit and increase energy savings and clean transportation.

6. **Multifamily Affordable Housing Solar Roofs Program:** Assembly Bill 693, signed into law in October 2015, allows low-income tenants of multifamily affordable housing projects to benefit from on-site solar installations, with the goal to distribute $100 million per year over ten years, and install 300 megawatts of rooftop solar through 2030. Low-income renters can receive a portion of the energy produced on the roof of their apartment complex, which reduces their monthly utility bills and allows the money to be spent on other basic needs.

7. **Bay Area Air Quality Management District (BAAQMD):** administers several grant programs for public agencies, private businesses, and Bay Area residents that help reduce pollutants and greenhouse gases from mobile sources. Over $13 million is available for all electric vehicle (EV)-related programs for the fiscal year ending in 2016, distributed through a number of programs, including:

    a. **Shuttle and Rideshare Program:** Aims to reduce air pollution in the Bay Area by funding existing shuttle/feeder bus services and regional rideshare projects. Funding is awarded on a competitive basis.

    b. **Transportation Fund for Clean Air (TFCA):** Funds are available for bicycle facility and infrastructure projects including secure bicycle parking, bike racks, bike paths and bikeways.

    c. Funding to support plug-in electric vehicle (PEV) infrastructure and adoption, including the **Plug-in Electric Vehicle Rebate Program** for residents, businesses, and public agencies, and the **Charge! Program** for the installation of PEV charging stations at Bay Area transportation corridors, workplaces, multi-family dwelling units and trip destination locations.

    d. **Light-Duty Zero- and Partial-Zero-Emissions Vehicle Program:** Grant funding is available for plug-in hybrid-electric, plug-in electric, and fuel cell vehicles certified by the CARB as meeting super-ultra low emission vehicle (SULEV) or zero-emission vehicle (ZEV) standard. Eligible recipients include all public and private entities within the boundaries of the District.

    e. **Heavy Duty Electric Vehicle (EV) Program:** Grant funding is available for zero- and partial-zero-emissions medium, heavy-duty vehicles and Urban Buses in fleets. Eligible vehicle types include zero-emissions (electric and fuel cell technologies) vehicles that are certified by the CARB. Eligible recipients include all public and private entities within the boundaries of the District.

    f. **Goods Movement Emission Reduction Program:** Grant funding is available from this CARB program for local public agencies and equipment owners involved in the movement of freight.

8. **Prop 39 Grants:** The California Clean Energy Jobs Act (Proposition 39) funds eligible local educational agencies — including county offices of education, school districts, charter schools and state special schools — for energy efficiency and clean energy projects. It also funds related energy planning, energy training, energy management, and energy projects with related non-energy benefits. The Proposition 39 award program is scheduled to continue through fiscal year 2017/18. Up to $550 million annually is available for appropriation by the Legislature for eligible projects in K-12 schools.

9. **Energy and Water Provider Programs:** A wide variety of financial incentives and assistance programs are offered to customers of the energy and water utilities (PG&E and EBMUD) and the Community Choice Aggregation entity (MCE) serving the City of Richmond. Programs to promote energy efficiency, water conservation, and clean energy projects include rebates, retrofit incentives, on-bill financing, free audits, and design assistance, some of which are targeted to low-income customers. These include ratepayer-funded energy efficiency programs that are administered by PG&E and MCE within a framework developed by the CPUC.

10. **The Partnership for Sustainable Communities:** This multiagency partnership between U.S. Department of Housing and Urban Development (HUD), U.S. Department of Transportation (DOT), and the U.S. Environmental Protection Agency (USEPA) offers grant funding to help communities realize their own visions for building more livable, walkable, and environmentally sustainable regions.

11. **Proposition 1 Grants:** The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) authorizes $7.5 billion in general obligation bonds to fund ecosystems and watershed protection and restoration, water supply infrastructure projects, including surface and groundwater storage, and drinking water protection. $725 million is aimed at water recycling and reuse. Proposition 1 allocates funding to various state and regional agencies to administer grant programs that emphasize a shift to an integrated water management approach that relies on green infrastructure at the local level. These include:

    a. $100.5 million to the State Coastal Conservancy for competitive grants for multi-benefit ecosystem and watershed protection and restoration projects. The Conservancy expects to grant approximately $10 million each year for about ten years.

    b. $200 million to the State Water Resources Control Board for stormwater and green infrastructure projects.

12. **The California Endowment** supports healthy, livable communities through grants and other assistance that enable local governments to take a "health in all policies" approach to land use planning, Richmond is part of The California Endowment's Building Healthy Communities (BHC) program, a ten-year, comprehensive community initiative that is challenging the way Californians think about and support health in their communities.[5]

[5] More information on Healthy Richmond available at: http://healthyrichmond.net/about/mission-vision-history/

GLOSSARY OF TERMS AND ACRONYMS

AB 32

Assembly Bill 32, the California Global Warming Solutions Act of 2006. Establishes a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases for the state of California.

ABAG

Association of Bay Area Governments, an agency that provides planning and research resources related to land use, housing, environmental and water resource protection, disaster resilience, energy efficiency and hazardous waste mitigation, risk management, financial services and staff training to local cities, and towns in the Bay Area.

AC Transit

Alameda Contra Costa Transit District is the public transportation agency serving both Alameda and Contra Costa Counties.

Adjusted BAU

An adjusted "business as usual" emissions forecast that includes the effects of state-wide emissions reductions measures such as updates to building energy standards and implementation of programs to decrease emissions from on-road vehicles

AHSC

Affordable Housing and Sustainable Communities Program, a state program that funds land-use, housing, transportation, and land preservation projects to support infill and compact development that reduce greenhouse gas emissions.

ART

Adapting to Rising Tides, a collaborative project created by the San Francisco Bay Conservation and Development Commission and the National Oceanic and Atmospheric Administration's Office for Coastal Management to identify how current and future flooding along the shoreline will affect communities, infrastructure, ecosystems, and the economy, and to implement appropriate federal, state, regional, and local adaptation responses.

ATP

Active Transportation Program, a suite of legislative actions signed by Governor Brown on September 26th, 2013 that is intended to encourage the increased use of active modes of transportation (i.e., walking and biking).

BAAQMD

Bay Area Air Quality Management District, the regional air pollution control agency for the Bay Area.

BARC

Bay Area Regional Collaborative, coordinates the climate change planning efforts of the Association of Bay Area Governments, the Bay Area Air Quality Management District, the Bay Conservation and Development Commission, and the Metropolitan Transportation Commission.

BART

Bay Area Rapid Transit is the high speed rapid rail network that serves the Bay Area.

Baseline Inventory

An assessment of greenhouse gases in a base year by which future trends in emissions can be compared.

BAU

Business as Usual is a scenario that assumes that no new actions will be taken to reduce greenhouse gas emissions from current and future residents and businesses within the City.

BCDC

San Francisco Bay Conservation and Development Commission is a California state planning and regulatory agency with regional authority over the San Francisco Bay, the Bay's shoreline band, and the Suisun Marsh.

BESO

Building Energy Savings Ordinance, an ordinance that requires building owners to complete energy efficiency assessments and publicly report their building's energy efficiency information with the goal of helping building owners save energy and motivate them to participate in whole-building energy efficiency retrofits.

BHC

Building Healthy Communities, a ten-year, comprehensive community initiative spearheaded by The California Endowment.

C&D

Construction and demolition debris is waste that is generated during construction activities.

CAFÉ

Corporate Average Fuel Economy, federal fuel efficiency standards enacted in 1975 to improve the average fuel economy of cars and light trucks produced for sale in the United States.

CalEPA

California Environmental Protection Agency, the state agency charged with developing, implementing and enforcing California's environmental protection laws.

CALGreen

Refers to the CALGreen component of the California Building Code. See California Building Code.

California Building Code

California Code of Regulations Title 24, also known as the California Building Standards Code. Title 24, Part 6 sets forth California's energy efficiency standards for residential and nonresidential buildings.

CalTrans

California Department of Transportation, the agency that manages the state highway system and other public transportation systems controlled by the State.

CAP

Climate Action Plan, a plan that is prepared by an entity to reduce greenhouse gas emissions.

CAPCOA

California Air Pollution Control Officers Association, an association of air pollution control officers that represents all thirty-five local air quality control agencies in California.

CARB

California Air Resources Board, the agency in charge of air quality regulation for California.

CAT

Climate Action Team, a group created as part of AB 32 that is tasked with preparing biennial science assessment reports on climate change and adaptation options for California.

CBO

Community-Based Organization is any local organization that provides services to residents and businesses within a community.

CBTP

Community-Based Transportation Planning, programs that promote a balanced, comprehensive, and multi-modal transportation system

CCA

Community Choice Aggregation, a type of energy supply program that allows cities and counties to aggregate the buying power of individual customers within a jurisdiction to secure alternative energy supplies.

CCISCO

Contra Costa Interfaith Supporting Community Organization, a community-based organization.

CEC

California Energy Commission, the State's primary energy policy and planning agency focused on energy costs and environmental impacts of energy use

CEQA

California Environmental Quality Act (California Public Resources Code § 21000 et seq.,) is a state statute adopted in 1970 that requires state and local agencies to analyze and disclose the environmental impacts of proposed projects.

CFCs

Chlorofluorocarbons are greenhouse gases.

CH4

Methane is a greenhouse gas.

CO2

Carbon dioxide is a greenhouse gas.

CO2e

Carbon dioxide equivalent, a measurement used to compare the emissions of various greenhouse gases based upon a common metric for global warming potential (GWP).

Community-wide

Refers to activities that occur within a community or city's geographic boundary.

CPUC

California Public Utilities Commission, the agency that regulates public utilities in California.

CSD

Community Services Department, the state agency that partners with a network of private, non-profit and local government community service providers dedicated to helping low-income families achieve and maintain self-sufficiency, meet their home energy needs and reside in housing free from the dangers of lead hazards.

CYES

California Youth Energy Services, a community-based organization, oversees a youth employment and empowerment program, that addresses climate change and provides valuable no-cost services to local residents each year.

Demand Response

Mechanism for managing end-user electricity consumption in response to energy supply conditions, especially during summer periods when electricity demand on the California power grid is high.

Direct Access

Direct access service is when customers elect to purchase electricity and other services from an electric service provider (ESP), instead of from a public or private utility company.

DOE

United States Department of Energy, a Cabinet-level department of the United States Government concerned with the United States' policies regarding energy and safety in handling nuclear material.

DOF

California Department of Finance prepares, explains and administers California's annual financial plan, the California Budget. Also conducts demographic research.

DOT

U.S. Department of Transportation, the federal Cabinet department of the U.S. government concerned with transportation.

EBMUD

East Bay Municipal Utilities District, a public water agency serving Alameda and parts of Contra Costa counties.

ECIA

Environmental and Community Investment Agreement, refers to the agreement that the City entered into with Chevron to provide funding for community programs for a period of ten years.

EDA

East Bay Economic Development Alliance, a community based organization focused on economic development.

EIR

Environmental Impact Report, a report created for a project that discloses the potential environmental impacts of a project to the public.

EJ

Environmental Justice refers to the equitable distribution of environmental benefits and burdens.

ESA

Environmental Science Associates, a consulting firm.

EV

Electric Vehicle is a vehicle that uses an electric battery to operate.

FBC

Form-Based Code is a means of regulating land development to achieve a specific urban form.

FCEV

Fuel Cell Electric Vehicle, a vehicle that is powered by hydrogen fuel cell technology.

FERC

Federal Energy Regulatory Commission, a regulatory commission monitoring interstate aspects of the utilities industries, including: electrical power, natural gas, oil pipeline, and hydroelectric.

FY

Fiscal Year, a year as reckoned for taxing or accounting purposes.

GGRF

Greenhouse Gas Reduction Fund, an account established by the State of California to receive Cap-and-Trade auction proceeds to support programs that reduce greenhouse gas emissions.

GHG

Greenhouse Gas is a type of gas that causes heat to be trapped in the atmosphere, resulting in warming effects for the Earth.

Green Building

Sustainable or "green" building is a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.

Greenhouse Gas Inventory

A greenhouse gas inventory provides estimates of the amount of greenhouse gases emitted to and removed from the atmosphere by human activities.

GWh

Gigawatt hour is a unit of electricity.

GWP

Global warming potential is a relative measure of how much heat a greenhouse gas traps in the atmosphere.

HFCs

Hydrofluorocarbons are greenhouse gases.

HiAP

Health in All Policies, a document adopted by the City of Richmond to prioritize public health outcomes and promote health equity through City services, programs, and initiatives.

HUD

U.S. Department of Housing and Urban Development, a Cabinet department in the Executive branch of the United States federal government that was founded in 1965 as part of the "Great Society" program of President Lyndon Johnson to develop and execute policies on housing and metropolises.

HVAC

Heating, ventilation and cooling, provides interior climate conditioning within buildings.

ICLEI

International Council for Local Environmental Initiatives is an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development.

IPCC

Intergovernmental Panel on Climate Change is a scientific intergovernmental body under the auspices of the United Nations.

kWh

Kilowatt-hour, a unit of electricity equivalent to one kilowatt (kW) of energy used for an hour.

LCFS

Low carbon fuel standard requires transportation fuel providers in California to decrease lifecycle fuel carbon intensity by 2020.

LEED

Leadership in Energy and Environmental Design is an internationally recognized green building certification program, which provides third party verification that a building or community was designed and built using sustainable approaches, with particular regard to energy savings, water efficiency, CO2 emissions reductions, and improved indoor environmental quality, among other criteria.

LiHEAP

Low Income Home Energy Assistance Program, a state program that provides assistance with energy costs to families in California.

MAP

Moving Ahead for Progress, a two-year federal law governing transportation that was adopted in 2012.

MCE

Marin Clean Energy, a community choice aggregation program.

MGD

Million Gallons per Day is a large-scale unit of water or wastewater flow.

MHHW

Mean Higher High Water is the average of all the high water levels observed over a period of several years.

mpg

Miles Per Gallon, provides a comparison of the fuel economy or efficiency of various transportation fuels.

MPO

Metropolitan Planning Organization, a federally mandated and funded transportation policy-making organization that is made up of representatives from local government and governmental transportation authorities.

MT CO2e

Metric tons of carbon dioxide equivalent, a unit of measurement for greenhouse gases (one metric ton equates to approximately 2,204 lbs).

MTC

Metropolitan Transportation Commission, a transportation planning, financing, and coordinating agency for the San Francisco Bay Area.

Municipal

Refers to energy use and greenhouse gas emissions from City-owned and operated facilities and equipment.

N2O

Nitrous oxide is a greenhouse gas.

NOAA

National Oceanic and Atmospheric Administration, a scientific agency within the United States Department of Commerce focused on the conditions of the oceans and the atmosphere.

NRC

National Research Council, a private, nonprofit institution in the United States founded in 1916, which produces reports that shape policies, inform public opinion, and advance the pursuit of science, engineering, and medicine.

OBAG

One Bay Area Grant, a funding approach that aligns the Metropolitan Transportation Commission's investments with support for focused growth

OED

Office of Economic Development, which serves as California's single point of contact for economic development and job creation efforts.

OEHHA

Office of Health Hazard Assessment, a specialized department within the cabinet-level California Environmental Protection Agency with responsibility for evaluating health risks from environmental chemical contaminants.

PACE

Property-Assessed Clean Energy, a form of long-term financing that creates municipal finance districts to provide loans to homeowners and businesses for energy-efficient retrofits and renewable energy system installations. Loans are repaid through an annual surcharge on property tax assessments.

PAYT

Pay-As-You-Throw is a type of waste disposal program.

PDA

Priority Development Areas are locally identified infill development opportunity areas located near transit.

PEV

Plug-in Battery Electric Vehicle is a type of electric vehicle.

PFCs

Perfluorocarbons are greenhouse gases.

PG&E

Pacific Gas and Electric is an investor-owned energy utility.

POU

Publically owned utility, a utility company that is owned by a public agency.

ppm

Parts per million, a measurement unit of concentration.

PV

Photovoltaic refers to method of converting solar energy into direct current electricity using semiconducting materials.

RARE

Richmond Advanced Recycled Expansion, water recycling project in Richmond.

RBSP

Richmond Bay Specific Plan, a specific plan describing land uses along the City's south shoreline.

Rebate

Offered by the state, utility, or local government to promote the installation of renewables and energy efficiency projects.

Renewable Energy

Energy from sources that regenerate and are less damaging to the environment, such as solar, wind, biomass, and small-scale hydroelectric power.

RPS

California's Renewables Portfolio Standard requires utility providers to increase the portion of generated energy that comes from renewable sources to 20 percent by 2010 and to 33 percent by 2020.

RTP

Regional Transportation Plan, a plan that identifies transportation projects to serve entire regions.

RTPA

Regional Transportation Planning Agency, a public agency in California that is tasked with transportation planning at the regional level.

SASH

Single-Family Affordable Solar Homes, a ratepayer-funded program through the California Public Utilities Commission that provides up-front rebates to help low-income homeowners access the benefits of solar power.

SB 350

Senate Bill 350 requires California to: 1) generate half of its electricity from renewable energy sources; 2) double energy efficiency for both electricity and natural gas end uses in all buildings by 2030; and 3) substantially improve the infrastructure for electric vehicle transportation.

SB 375

Senate Bill 375 enhances California's ability to reach its AB 32 goals by planning more transportation-efficient communities.

SB 97

Senate Bill 97 requires the Governor's Office of Planning and Research (OPR) to develop and adopt CEQA guidelines for the mitigation of GHG emissions.

SCS

Sustainable Community Strategy, a comprehensive land use and regional growth strategy that serves as a companion document to a regional transportation plan.

SEEC

California State-wide Energy Efficiency Collaborative, provides no-cost resources to support the climate and energy initiatives of California local governments.

SF6

Sulfur Hexafloride is a greenhouse gas.

SGIP

Self-Generation Incentive Program, an incentive program provided by the Pacific Gas and Electric Company.

SLCP

Short-Lived Climate Pollutants, greenhouse gases that persist for a relatively short time in the atmosphere.

SOVs

Single occupancy vehicles, a vehicle driven by a single person.

SSD

Stege Sanitary District is one of three sanitary districts in the City of Richmond.

SULEV

Super ultra-low emission vehicle is a type of vehicle.

TDM

Transportation demand management is the application of strategies and policies to reduce travel demand.

TFCA

Transportation Fund for Clean Air, a grant program funded by a $4 surcharge on motor vehicles registered in the Bay Area.

Title 24

California Code of Regulations, Title 24, also known as the California Building Standards Code (composed of 12 parts). Title 24, Part 6 established California's energy efficiency standards for residential and nonresidential buildings. See also California Building Standards.

TOD

Transit-Oriented Development, a mixed-use residential and commercial area designed to maximize access to public transport, and often incorporates features to encourage transit ridership.

USEPA

United States Environmental Protection Agency, an agency of the U.S. federal government which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.

UWMP

Urban Water Management Plan, a plan prepared by California's urban water suppliers to support their long-term resource planning, and ensure adequate water supplies are available to meet existing and future water demands.

VMT

Vehicle miles traveled is a measurement of vehicle travel.

WCCUSD

West Contra Costa Unified School District.

WCWD

West County Wastewater District is a utility that provides sewage conveyance and treatment in the City of Richmond.

WestCAT

Western Contra Costa Transit Authority is a transit agency serving City of Richmond.

WWTP

Waste water treatment plant is a facility that treats sewage.

YES

YES Nature to Neighborhoods (formerly Youth Enrichment Strategies) is a community-based organization that provides youth, adults and families living in Richmond and surrounding West Contra Costa County access to experiences in the natural environment.

Y-PLAN

Youth Plan Learn Act Now is a University of California Berkeley program offering project-based civic learning experiences for youth.

Zero Net Energy

For buildings, use of no more energy over the course of a year than can be generated onsite through renewable resources such as solar, wind, or geothermal power.

ZEV

Zero-emission vehicle is a type of vehicle.








RICHMOND



City of Richmond

Stakeholder Outreach and Education

APPENDIX A

Richmond Climate Action Plan

Community Engagement Plan
Revised: July 1, 2015

The Richmond Climate Action Plan (CAP) is a roadmap for how the City will reduce energy consumption and greenhouse gas (GHG) emissions to meet state GHG reduction targets. The plan will also help the City to prepare for the potential impacts of climate change on public health, infrastructure, ecosystems, and public spaces. The CAP will inventory the City's emissions, establish an emissions reduction target, and identify City and community actions to reduce emissions. The CAP will provide a policy vision for green businesses, healthy homes, sustainable schools, active transportation, and community resilience. The CAP will elevate health and equity as a priority in the selection of climate action measures, establishing a policy framework to support a healthy, vibrant, and equitable City.

The intent of the Community Engagement Plan is to summarize the approach and key outreach activities. The Engagement Plan will be revised based on comments from the City to ensure the outreach is effectively carried out to the meet the community needs and desires.

Goals of the Process

- To gather meaningful input and feedback from various local stakeholder groups and sectors, and from the community about the CAP.
- To build capacity in the community and in community-based organizations (CBOs) so that they can guide and support implementation of the CAP for the next generation of Richmond residents.
- To engage the public at-large in this planning process to ensure the entire community has an opportunity to be heard and involved in the planning process.
- To develop easily understood informational materials that are language and culturally appropriate.

Audience / Targeted Stakeholders

A primary goal of the community engagement is to involve as diverse a group of residents and stakeholders as possible. To assist in this effort, City staff will develop a master list of CBOs and other key stakeholder groups to ensure the consultant team and/or City communicates with the organization during the process. This list will be updated throughout the planning process. A longer list of CBOs, businesses, and other organizations has been collected by the City for the stakeholder luncheons (see below).

- Residents
- Property and business owners
- City Council and City Commissioners
- CBOs
- Businesses and health care providers
- Utilities, franchisees, industry groups and representatives
- Youth organizations and schools
- City staff

- Bay Air Quality Management District
- UC Berkeley
- Faith-based organizations

Outreach Activities

The project team is planning for an interactive, tailored approach to outreach that will ensure we have involvement from the entire community. To meet the public outreach goals stated above, the project team will reach out to targeted stakeholder groups throughout the City using a variety of activities to engage and inform the entire community. Meetings and activities for which the consultant team is responsible for will take place when most people are available, such as in the evening on weeknights. When needed, there will be language translation available at the various workshops. These activities are described below:

Agency Meetings

The team will participate in three small group meetings with key regional agencies and public institutions. The purpose of these meetings will vary by agency. However, each of these meetings will be use to engage in conversation with agencies/institutions to receive feedback on key issues in the GHG inventory and CAP planning process. Agency meetings will include the Bay Air Quality Management District and the University of California at Berkeley (public health focused), and may include either the Contra Costa County Health Services Department, East Bay Regional Parks, the Bay Conservation and Development Commission, or other regional agency. Meetings will be held between June and August, 2015.

Stakeholder Luncheons

The team will facilitate three stakeholder luncheons. The purpose of the stakeholder luncheons will be to promote the Richmond CAP, seek input that will help refine draft CAP objectives and actions, and identify partnerships for CAP implementation. The team will also discuss ways to publicize community workshops and engage the community in climate planning. The luncheons will be organized into the following stakeholder groups:

- **Community Based Organization (June 29**): CBE, APEN, Solar Richmond, Pogo Park, CCISCO, ACCE, YES, Watershed Project, Richmond Trees, GroundWorks Richmond, Urban Tilth, Richmond-City Rides, LifeLong, Latina Center, RYSE, Grid Alternatives, Richmond and Kennedy High School clubs, West County Toxics Coalition, Richmond Neighborhood Councils, Richmond Progressive Alliance, Y-Plan, WCCUSD School Community Outreach Workers.
- **Businesses and Health Care Providers (July, Date TBD)**: Nutiva, Sun Power, Advanced Home Energy, Esko, Whole Foods Distribution, Restoration Hardware Distribution, Kaiser, Richmond Chamber of Commerce, West Contra Costa County Council of Industries, Richmond Main Street, 23rd Street Merchants.
- **Utilities, Franchisees, Industry Groups and Representatives (August, Date TBD)**: PG&E, Richmond Sanitary Service, Marin Clean Energy, Chevron, BNSF, Union Pacific, BART, AC Transit, and EBMUD, CCTA, WCCTAC, RecycleMORE.

Draft Agenda

The following outlines the agenda for the three luncheons..

1. Welcome and Introductions (10 minutes)
2. Presentation (20 mins)
    A. Project overview and update
    B. Challenges and opportunities related to climate change in Richmond
    C. Local Policy Framework to Address Climate
    D. Questions?
3. Luncheon Engagement Exercises (30 mins)
    A. Exercise: Draft Objectives (20 mins)
        - *Purpose*:
            - High-level review of draft objectives.
            - Gain familiarity with the scope, level of detail, and content of the draft objectives.
            - Identify key gaps in the objectives, and identify potential new objectives.
            - Identify potential implementation partners for individual CAP objectives.
        - *Format*: Facilitated, small-group discussions. Table handouts include: list of objectives from the Draft CAP.
        - *Exercise:* Facilitator provides participants with a brief overview of the objectives. Each participant prioritizes each objective (low to high), identifies gaps in the objectives, and identifies partnership opportunities. Then the facilitator leads a group discussion around the objectives.
    B. Exercise: Report Back (10 mins)
        - What were the most important ideas your table discussed?
        - What opportunities do you see for partnerships in implementing CAP objectives?
4. Community Engagement Discussion (15 mins)
    A. *Purpose*: Provide an overview of upcoming Community Workshop #1 or #2 (depending on when the luncheon occurs). Solicit feedback on how to publicize and get people to the event.
    B. *Format*: Presenter provides participants with an overview of Community Workshop #1 or #2 (content and format), and then facilitates a large group discussion around the workshop, and partnering with the organizations to publicize the workshop.
5. Wrap-up (5 mins)

Event Logistics and Responsibilities

CATEGORY	TASK	RESPONSIBILITY	ADDITIONAL ASSUMPTIONS
VENUE LOGISTICS	Lunch	City	
	Venue	City	
	Projector/Screen	City	
	Laptop	ESA	
PREPARATION / MATERIALS	PowerPoint presentation	ESA; R+A	City will review / approve PPT
	Sign-in sheet	R+A	
	Handouts		City will review / approve all handouts
	• Agenda	R+A	
	• Exercise worksheet	ESA; R+A	
	• Project factsheet	R+A	Bilingual sheet provided
	• Community Workshop fliers	R+A	Bilingual flyer provided
	Policy / objective boards	R+A; ESA	
	Markers	R+A	
	Name tags	R+A	
	Sticky dots	R+A	
	Easels	City	
	Flip charts	City	
OUTREACH	Email to organizations / phone call follow-up as necessary	City	
DAY-OF LOGISTICS	Lunch and refreshment	City	
POST LUNCHEON FOLLOW-UP	Thank you email	City	
	Summary document	ESA/R+A	

Community Workshops

The consultant team, with support from the City, will organize and facilitate two community workshops to inform the community about key CAP issues in order to build local knowledge and capacity, and to solicit feedback and direction on a variety of climate action planning issues.

Schedule / Logistics

- Workshop #1
    - Date: July 30, 2015
    - Location: City Council Chambers
    - Time: 6-7:30pm, doors open at 5:30
- Workshop #2
    - Date: TBD

- Anticipated Location: City Council Chambers
- Anticipated Time: 6-7:30pm, doors open at 5:30

Draft Workshop #1 Agenda

- Doors open (5:30pm)
  - Registration
  - Light refreshments
  - Y-Plan posters
- Presentations (6pm – 6:30pm)
  - Official welcome
  - Project overview
  - Summary of Y-Plan and Y-Plan event
  - Purpose and overview of workshop exercises
- Workshop exercises (6:30pm – 7:15pm)
- Workshop report back and next steps (7:15pm – 7:30pm)
- Adjourn (7:30pm)

Topics for Discussion

The topics for workshop discussion are TBD. The following summarizes potential topics from the scope, project kickoff meeting, and initial brainstorming. Topics and related exercises will be developed by the City and team.

- **Public Workshop #1**: Overview of climate change and its nexus with health and economic equity, environmental justice, and overall sustainability in Richmond; presentation of initial GHG assessment and the CAP's vision, goals and objectives; work with participants to define how health equity and climate change should be integrated into the CAP, and to gauge community support for CAP's draft objectives and strategies.
  - Notes from the kick-off meeting:
    - City has already had a few public meetings on the CAP (most recent was December 2013).
      - Demonstrate progress has been made,and leave open to input.
      - Include Y-Plan summary, and have some students and teacher (Claire) present.
    - Don't be overly focused on presenting information; focus on the areas where community input can really help (e.g., gauge support, prioritization, etc.)
    - Show that this isn't an esoteric exercise and that the CAP will result in real actions. GHG mitigation funding coming from Chevron; have City staff develop a slide, talk about SB 535 funding, etc.
    - Incorporate policies from General Plan; frame discussion as a program to be implemented as part of the General Plan.
  - Questions generated during an internal team meeting.

        - Does the vision adequately capture the breadth of issues in the City? Should it be adjusted?
        - What CAP goals and objectives are most important? Least important? What could be added?
        - What are the key challenges/opportunities for implementing the CAP?
        - How could health equity and climate change be defined and integrated into the CAP?

- **Public Workshop #2**: Discuss and prioritize the draft CAP objectives, policies, programs, and supporting actions. Help the community understand the health and sustainability co-benefits and trade-offs of different proposed implementation actions; seek feedback on prioritizing actions.
    - Ideas generated during an internal team meeting:
        - Mind the gap between the target and the City's emissions trajectory.
            - Show the quantification of programs.
            - Propose additional programs to meet City targets.
        - Identify first steps for the City.
        - Present adaptation framework and strategies.

Publicize events

- **Eventbrite**: Eventbrite will be used to send out meeting announcements, publicize the event, and collect RSVPs.
- **Listservs**: The team will work with the City to send out email blasts through the existing Environmental Health List, City Manager weekly report, and Tom Butt e-forum. If possible, an email blast will be sent to Y-Plan participants.
- **CBO outreach**: The team will work with the City to send personalized emails to specific CBOs encouraging their participation in the workshops, as well as working through their networks to engage community participation. Examples from the CBO luncheon include:
    - Richmond Trees newsletter / social media
    - Sunflower Alliance newsletter
    - Rich City Rides newsletter
- **Faith-based organization announcements**: The team will work with the City to send personalized notes to specific faith-based organizations in Richmond. The City will provide a list of organizations and mailing or email addresses to the team.
- **Social media**: The City will post information about events to social media such as Twitter and Facebook in conjunction with flyer and announcements, as well as one week prior to related events, two days before, day of, and during the event to gain support and attendees. Postings will be time appropriate and include links to flyers, or event information as appropriate.

- **Press release**: Working with the City, the team will prepare and send out press releases for the public workshops. The team will use the City's PR web subscription. Release will be coordinated with Mike (City of Richmond). Note: we do not have Mike's last name.
- **Newspapers**: Newspaper advertising will be purchased to publicize community workshops. These newspapers include the Richmond Pulse, Richmond Confidential, West County Times, and The Richmond Post.
- **Direct email/phone calls: The City and/or the team will have c**heck-in calls to follow-up with community stakeholders, CBOs, institutions, etc. regarding outreach opportunities.
- **Participation in other community events:** Working with the City, the team may help prepare materials for community events. Opportunities may include:
    - Rich City Rides bike repair workshops on (Fridays)
    - Rally on rail emissions (July 11)
    - Youth Action Exchange (July 16)
    - Summer of Our Power (August 22nd)
    - Walk to Nature (August 29th)
    - North Shoreline Fest (October)
- **City kiosk**: Working with the City, the team will advertise the workshop in the City's kiosk.
- **City's TV channel KCRT**: The City will send the flyer and press release to the City.
- **Alternative advertisement techniques:** If resources are available, the City and team may consider additional outreach techniques including the following:
    - **Mural announcing the workshop**. Groundwork Richmond paints murals in the City. This idea was well-liked during the CBO luncheon.
    - **YouTube video**. City has a YouTube channel.

Day-of Logistics

- Printed handouts / materials
- PowerPoint Presentation
- Flyer for workshop #2
- Sign in sheets and Eventbrite RSVP print outs
- Refreshments
- A facilitator's guide to the workshop exercise and/or a mini training for facilitators
- Name tags
- Projector(s) and screen(s)
- Laptop
- Flip charts
- Markers
- Easels
- Camera

Post workshop follow-up

- Write workshop summary.

- Post workshop summary, PPT, agenda and handouts on CAP website.
- Workshop activity questions posted on MySidewalk.
- Send follow up "thank you" email with summary, materials to attendees, Workshop #2 flyer, save the date and Eventbrite invite.

Multi-Lingual materials and workshops.
The team will provide multilingual materials and translation for the workshops. The following key questions need to be answered by the City:

- Which languages, besides Spanish?
- Who should we hire for translation and interpretation?
- Does the City have headsets we can use?

Public Information and Communication

As discussed above, the City and project team identified a variety of ways to communicate with the public throughout the project with traditional public information methods such as flyers and announcements, as well as more contemporary electronic media. Whenever possible information will be available in a bilingual (Spanish/ English) format. The primary methods of communication are described below.

Email

The team will work with the City to communicate using the City's Environmental Health List, the City Manager weekly report, and the Tom Butt e-forum. The team will not develop a new database of interested residents, businesses, and other stakeholders. Throughout the project, we will communicate with these lists about project activities, including upcoming events.

Project Fact Sheet

A project fact sheet will provide information to the community regarding the planning process. It will also help the community understand the purpose of the CAP, and the ways that the community can participate in the process.

Social Media (Facebook, Twitter, etc.)

When feasible, the team will use social media to post information about upcoming meetings and release documents. The team will use the existing Twitter and Facebook accounts. As appropriate, the team will coordinate with Mike, the Public Information Officer on social media outreach.

Project Website

A project website will be used to provide information about the CAP, ways to get involved, and key related documents. The web address is: www.richmondclimateaction.org. The website will use have information in Spanish.

MySidewalk

The team will develop and manage a MySidewalk community engagement site for the duration of the CAP process. MySidewalk is an online survey tool that will be used to collect community input and ideas on health and climate topics throughout the process. At a minimum, the team will publish topics/questions from the public workshop in order to engage a broader set of Richmond residents.

The City may be granted access to the site in order to post additional topics. In addition to open-ended questions, the team may utilize the polling function as well as idea/image submission functions of the site to focus the community's input into a format that can readily inform the CAP. R+A will provide raw input and results to the City. The web address is:
https://mysidewalk.com/organizations/289632/richmond-climate-action-plan.

Newspapers

Newspaper advertising will be purchased to publicize community workshops. These newspapers include the Richmond Pulse, Richmond Confidential, West County Times, and The Richmond Post.

Richmond Climate Action Plan

Community Workshop #1
August 18, 2015

On Tuesday, August 18, 2015 the City of Richmond (City) hosted a community workshop about the Richmond Climate Action Plan (CAP). Approximately eighty residents, businesses owners, and representatives from community-based organizations (CBOs), utilities, and faith-based organizations attended the event. The workshop offered an opportunity for the public to learn more about the CAP and provide input on it. Led by the City of Richmond Environmental team, ESA, and Raimi + Associates, workshop participants provided important comments on the CAP vision and high-level goals for the plan, as well as draft objectives and supporting strategies.

A second community workshop will be held on September 16, 2015 at 6pm. Workshop participants will hear about how their comments from workshop #1 will be integrated into the CAP, identify barriers to participating in key programs, and learn more about strategies to build a climate resilient community. Please RSVP for the event at http://richmondcapworkshop2.eventbrite.com. For more information on the project, please visit www.richmondclimateaction.org.

Purpose and Overview

The Richmond CAP Workshop #1 took place on Tuesday, August 18, 2015 from 6:00pm-7:30pm at the Richmond Memorial Auditorium. The objectives of the workshop were to:

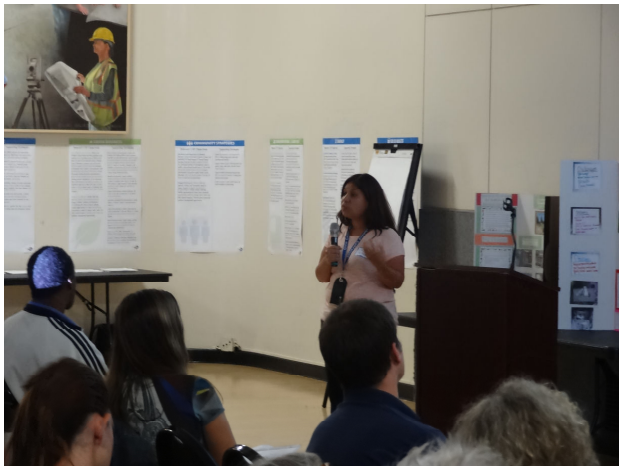
- Educate the community about climate change, the Richmond CAP, Y-Plan, and steps community members can take to reduce greenhouse gas (GHG) emissions.
- Engage the community to generate ideas, enthusiasm, and support for the CAP process.
- Socialize and make climate action planning fun!

Meeting materials were provided in English and Spanish.

Presentation

The workshop began with opening remarks from Richmond's City Manager Bill Lindsay. He discussed institutionalizing climate change and greenhouse reduction strategies into City decision-making, and specific actions the City has already taken to reduce emissions while improving public health and supporting local businesses. Example actions included replacing streetlights, garbage collection rates, and the local PACE programs. Mayor Tom Butt reiterated that the CAP is a high priority for the City. He described the City's decision to join Marin Clean Energy and the Solar 1 project.

The City's Environmental Manager Adam Lenz then described CAP progress to date, including collaboration with UC Berkeley and the Y-Plan program, and described the purpose of the workshop. Rich Seeber, 9th grade English teacher at Richmond High School, discussed Y-Plan and the data-driven process to inform the CAP. Richmond Senior Planner Lina Velasco provided background on the existing City plans and policy documents related to the CAP, the Association of Bay Area Government's Priority Development Areas, and cap-and-trade funding.



Jeff Caton of ESA presented background information on the project and the draft CAP to ensure workshop participants had the knowledge necessary to provide meaningful input for the draft CAP, including funding/grant opportunities and the community-wide GHG inventory. Next, Eric Yurkovich of Raimi + Associates explained the purpose of each workshop station and initiated the participatory exercises.

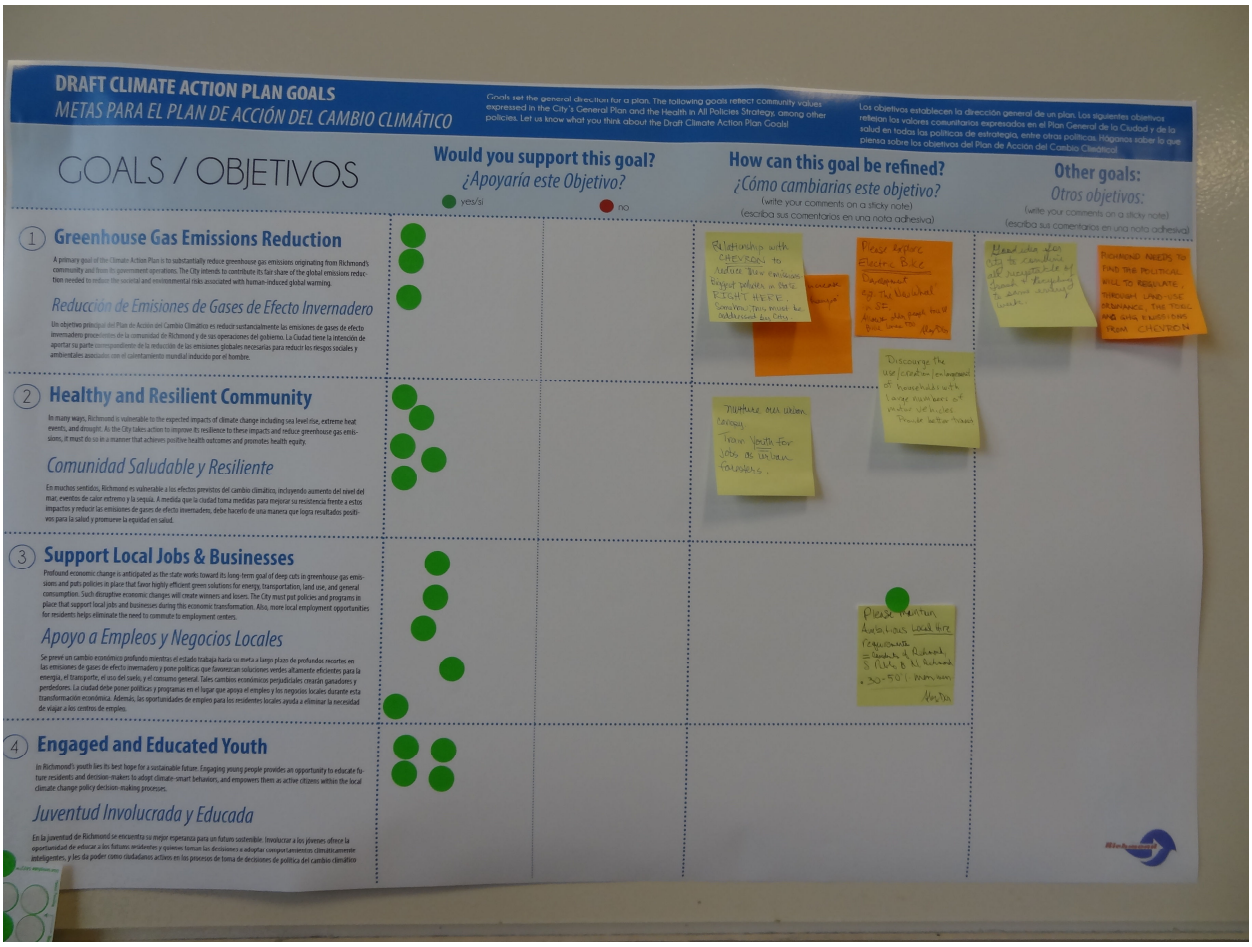
Workshop Stations

After the presentation, workshop participants circulated through six educational and interactive workshop stations. The stations included:

1. What is a Climate Action Plan?
2. Draft Climate Action Plan Goals
3. "Climate Action for Richmond is: _____" Photo Booth
4. Draft Objectives and Supporting Strategies
5. Calculate Your Carbon Footprint!
6. Richmond Can!

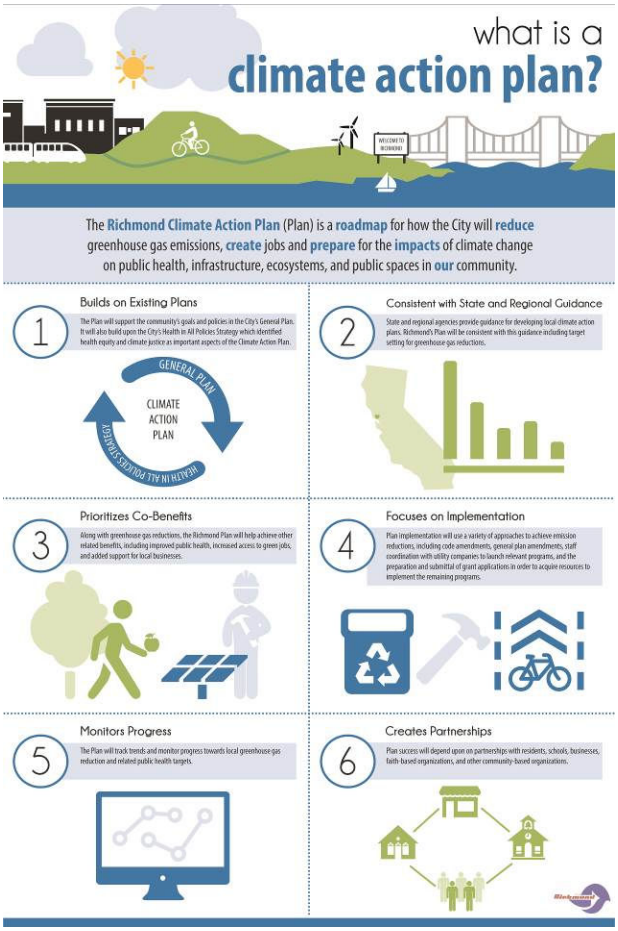
One or two project staffers provided guidance and answered questions at each station. Participants were encouraged to comment on each topic area with additional thoughts, either on large flipchart paper on the wall or on the individual feedback forms provided at the meeting.

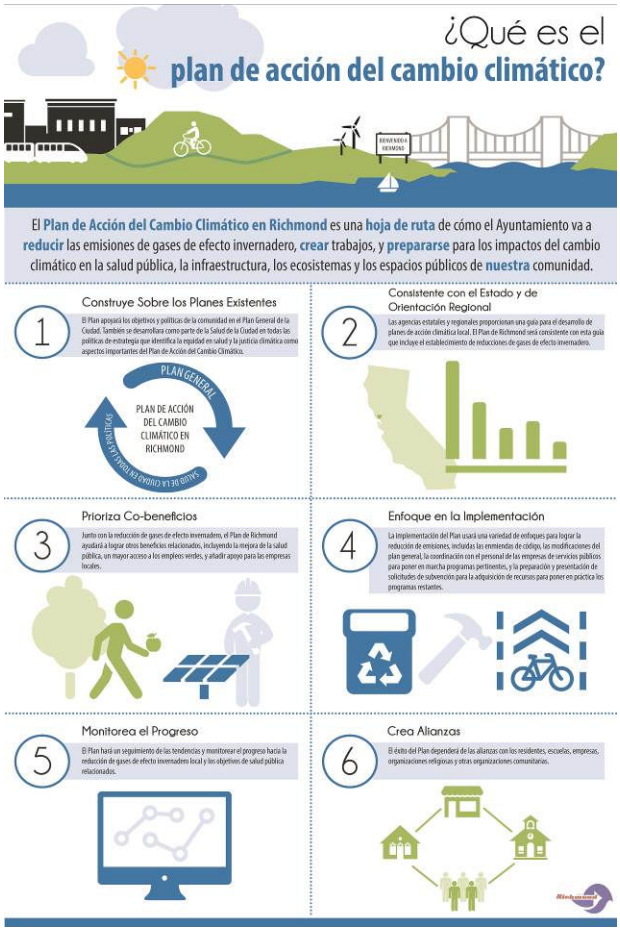
Below are descriptions of each station, images of the poster(s) at each station, and a summary of the community input. Comments that were received in Spanish were translated and are included in the summaries.



What is a Climate Action Plan?

This educational poster provides project details and describes how the Richmond CAP will play a role in reducing GHG emissions, creating jobs, and preparing the City for the impacts of climate change. The poster was provided in English and Spanish.





Draft Climate Action Plan Goals

This interactive workshop station allowed participants to comment on the draft CAP goals. The poster asked participants whether they supported the goal, how the goal could be refined, and whether there were other high-level goals the City should consider.

Participants were supportive of all four draft CAP goals. They provided details on recommended strategies and actions to the support the goals, and other potential goals. The following table summarizes the breadth of comments on the draft goals.

1. Greenhouse Gas Emissions Reduction	Green	Red
Comments received on this goal include: • Reduce coal burning in city, state, county, and world. • Alternative maritime power and clean truck programs for Port. • Adopt measurable GHG reduction goals that go beyond AB 32; no local cap and trade. • Focus on industrial and commercial businesses. • GHG reduction goals for refineries and dirty energy. • Expand transit, paratransit, rideshare (provide incentives and set targets for use). • Replace City vehicle fleet. • Conduct city-wide car use survey for baseline. • Land use – discourage households with need for many vehicles. • Electric bike services targeted towards the elderly. • Hire local. • More edible and drought-tolerant trees. • Building maintenance; energy and water upgrades. • Green space development. • Promote new systems (i.e., HVAC, forklifts, grants and financing).	21	0

2. Healthy and Resilient Communities	Green	Red
Comments received on this goal include: • Promote local health care access, full service hospital with ER in Richmond (like Doctor's Hospital). • Jobs need to pay enough for workers to afford rent in Richmond. • Increase preventative medical services. • More food stores in poor neighborhoods. • Offer free, hands-on workshops at community centers, churches, and parks about green solutions and healthy strategies. • Encourage active transportation. • Consider sea level rise impact on shoreline liquefaction and future access to shoreline. • Place parkland along shoreline to buffer for sea level rise. • Use natural methods of pest control. • Use water recycling for industrial and commercial processes. • Collaboration of people with power.	18	0

3. Support Local Jobs & Businesses	Green	Red
Comments received on this goal include: • Urban forestry jobs for the youth. • Locally-owned and distributed renewable energy. • Incentivize business energy efficiency. • Support local hiring goals over Euro-American building trade unions. • Consider if Chevron will continue to be located in Richmond in future and impact on jobs. • Enhance requirements for water in building codes. • Provide more local shopping. • Reasonable solar permitting fees (reduce). • Funding for entrepreneurs. • Support union training programs and provide education on new and current equipment; technical training through schools. • Maintain ambitious local hire requirements.	19	0

4. Engaged and Educated Youth	Green	Red
Comments received on this goal include: • Fund youth apprenticeships at community based gardens, solar project, etc. • Engage all high schools in Richmond. • Link open space and shoreline together. • Develop science and ecology programs for Richmond schools. • Provide career days at schools focused on environmental management, trades, IT.	21	0

Other Goals

Comments received include:

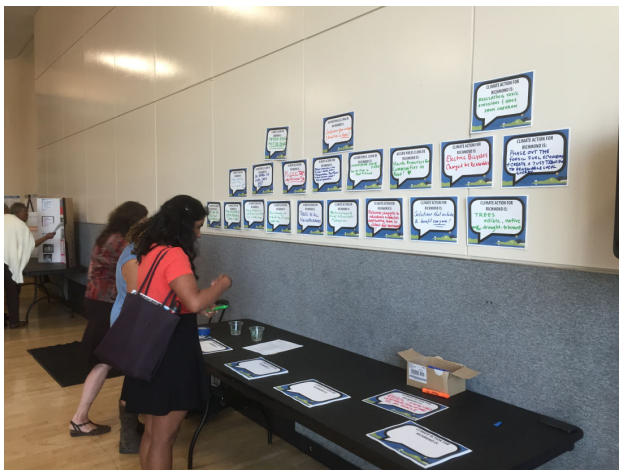
- Inform residents on how Chevron is being regulated by BAAQMD.
- Disenfranchised neighborhoods that rely heavily on public transportation need repaired side-walks and designated bike lanes.
- Halt all waterfront commercial development.
- Adopt ordinance to require all ships in port to hook up to onshore electricity powered by local solar.
- Massive jobs program to restore wetland and dikes to mitigation sea level rise.
- Create a universal pre-school with a pipeline through high school to college for local tech careers.
- More co-op development and businesses.
- Limit parking spaces on all commercial development.
- Bike share program.
- Consider commute patterns across Richmond Bridge (is mass transit solution feasible?).
- Bird safe glass.
- RECO to upgrade homes; EV in every garage; more transit; divest from CalPERS, join Sunshares! Build Solar; add Ygrene to your list of PACE.
- Plant trees.
- Continue weekly trash and recycling pick-ups.

Climate Action for Richmond is:

This photo booth allowed participants to articulate their vision for climate action in Richmond. Participants were encouraged to draw or write their vision and many were photographed with their vision.

Participants said “Climate Action for Richmond is:”

- Acting now and not waiting for a crisis.
- Empowering community members to direct and take action (2).
- Economic, social and environmental responsibility.
- Planting trees, including edible, native, and/or drought tolerant, and other native species (7).
- Training youth as urban foresters.
- Transitioning to a renewable energy economy (2).
- Creating solutions that include and benefit everyone (2).
- Improving health by reducing pollution and emissions and providing health resources for communities in need (2).
- Increasing recycling (2)
- Bikes for all; electric bikes (2).
- Walkable and bikeable.
- Reducing emissions from Chevron and other large employees (3).
- Creating a climate smart, zero-waste West Contra Costa Unified School District.
- Creating a North Shore State Park.
- Better transit and paratransit.
- Implementing a residential energy and water conservation ordinance.
- Providing opportunities to ex-convicts in sustainable food production, churches, and other community organizations.




CLIMATE ACTION FOR RICHMOND IS: BIKES for ALL
CLIMATE ACTION FOR RICHMOND IS: Relevant changes to individuals + families empowering them to effect their environment!
ACCIÓN POR EL CLIMA DE RICHMOND ES: UN ARBOL EN CADA CASA
CLIMATE ACTION FOR RICHMOND IS: Being economically, socially, and environmentally responsible!
CLIMATE ACTION FOR RICHMOND IS: More Solar + More Recycling!
CLIMATE ACTION FOR RICHMOND IS: Walkable/ Bikable
CLIMATE ACTION FOR RICHMOND IS: 15,000 TREES
ACCIÓN POR EL CLIMA DE RICHMOND ES: Health Resources for Communities in Need!
CLIMATE ACTION FOR RICHMOND IS: RECYCLING to public housing
CLIMATE ACTION FOR RICHMOND IS: CHEVRON EMISSI MUST BE REDUCE
CLIMATE ACTION FOR RICHMOND IS: Replacing lawns with drought-tolerant plants. Planting trees.
CLIMATE ACTION FOR RICHMOND IS: TREES edible, native drought-tolerant
CLIMATE ACTION FOR RICHMOND IS: PHASE OUT THE FOSSIL FUEL ECONOMY + CREATE A JUST TRANSITION TO RENEWABLE LOCAL ENERGY

Draft CAP Objectives and Strategies

This workshop station presented draft CAP objectives and supporting strategies for seven topic areas: energy, water, solid waste, transportation and land use, community strategies, green businesses, and green infrastructure and resiliency. The station provided a poster for each topic area and handout with a comment card. Participants were asked to review the draft CAP objectives and supporting strategies, and then provide feedback on the handout.

Participants had the following comments, organized by topic.

Energy

- Work with Chevron to transition to clean energy production.
- Increase solar energy.
- Explore how to catalyze small- to medium-scale wind energy.
- Physical limitations to rooftop solar and PACE programs.

Transportation and Land Use

- Explore how to integrate electric bikes into the CAP (charged with renewable energy to reduce dependence on fossil fuels).
- Small public charging stations for electric bikes.
- Promote emission controls on boats.
- Promote electric car charging stations.
- Place park-and-ride lot at foot of bridge.
- Work with Caltrans to convert a mixed-flow Richmond Bridge lane into an HOV lane.
- Improve bus service on MacDonald.
- Consider light rail service on MacDonald, Cutting, and San Pablo.
- Increase dedicated bike lanes (2).
- Encourage bicyclists and pedestrians to obey all laws.
- BART paths should be better signed.
- Emphasize zero-emission vehicles and affordable charging.
- Create bike approach to the Richmond Bridge.
- Fix roads to reduce maintenance and emissions.

Water

- Provide rebates on greywater systems (2), water smart systems, and on drought-tolerant landscaping set-up (not just removal of lawns).
- At sale/transfer of property, require that

property meets watersmart recommendations.
- For new buildings, require watersmart features, installation of greywater systems (if feasible), and drought-tolerant landscape.
- Provide recycled water to residents and urban farmers in the City, similar to Martinez.
- Promote green roofs.

Solid Waste

- Ensure multifamily housing, including public housing, has access to recycling bins.

Green Infrastructure

- Support urban tree care programs.
- Control dredging emissions. Use sediments to mitigate rising sea levels.

Green Business

- Promote recycled materials for manufacturing, and provide grants for small businesses to create products.

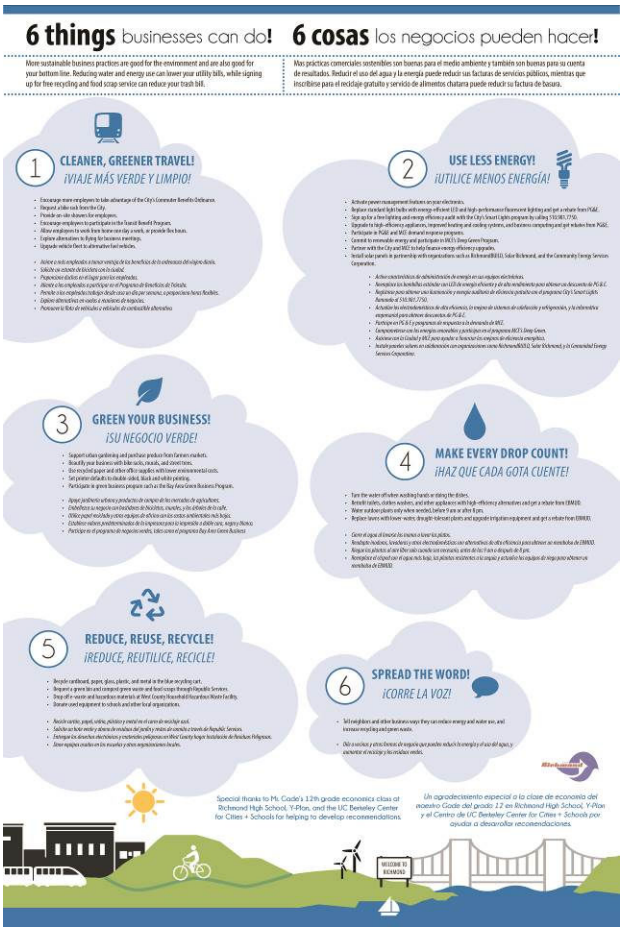
Community Strategies

- Make the City safer, schools better; reason for people to remain in Richmond.
- Live in Richmond, work in Richmond, kids go to school in Richmond = less commuting.
- Incorporate trees and urban forestry into these strategies.
- Initiate a competition among residents to conserve resources.
- Promote community gardens.
- Work with corner stores to offer programs and support for healthy food.

Calculate Your Carbon Footprint!

Adjacent to the Bermuda Room, an educational station allowed participants to calculate their carbon footprint (e.g. the amount of GHG emissions generated by their energy consumption, transportation, and solid waste) using the United States Environmental Protection Agency's Carbon Footprint Calculator. For more information on the calculator, visit http://www3.epa.gov/carbon-footprint-calculator/.

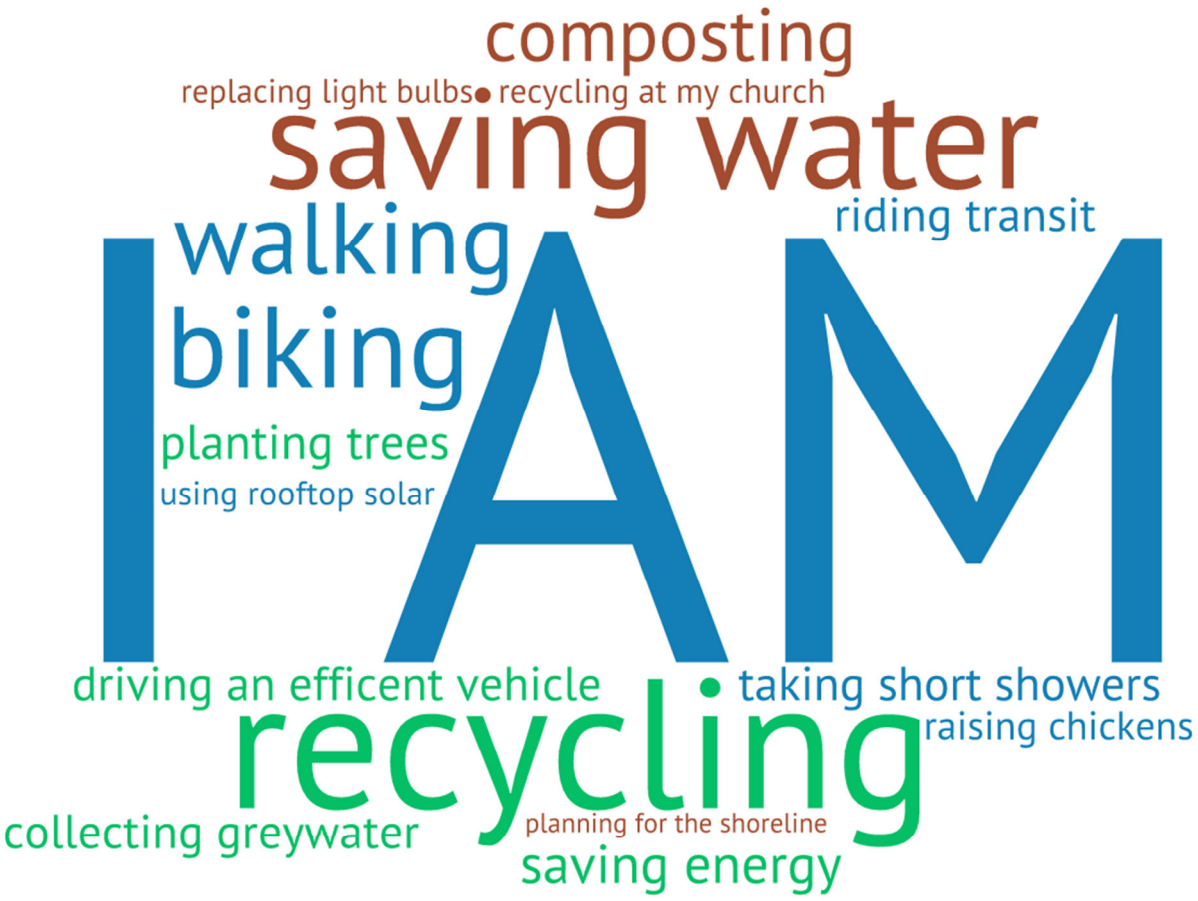
After calculating their emissions, participants could view two educational posters highlighting activities they could do to reduce their emissions, and things businesses could do to reduce their emissions. Posters highlighted local programs offered by the City of Richmond, Republic Services, East Bay Municipal Utility District, PG&E, and others.



Richmond Can!

At the Richmond Can! station, participants were asked to write one thing s/he is currently doing to be more environmentally sustainable and to write one thing s/he will do to be more environmentally sustainable. Participants wrote responses on *Rosie the Riveter* stickers and stuck them on the board.

Results were compiled in word clouds. As the number of responses increases, the relative text size increases for the response.




consider an electric vehicle
recycle more
install low-flow water fixtures
compost
install drip irrigation
combine more trips
work to build complete streets
ride transit
use less water
I WILL
buy local
eat organic food
replace my lawn
plant native species
reduce paper use
spread the word
plant trees
replace light bulbs
walk
bike
consider solar energy
use less energy

Other Public Comments

Workshop participants also made the following comments.

- Focus on two biggest GHG emitters: transportation and industry. The largest emissions savings would come from these sectors.
- Incorporate smart planning to achieve a triple bottom line.
- Richmond should participate in the kilowatt-hour (kWh) challenge with other Contra Costa County cities.
- Lead by adopting a RECO to upgrade existing homes.
- Get creative on reducing VMTs, get EVs, and increase rideshares.
- Have Mayor Butt do a "Kilowatt Crackdown" challenging all 19 Contra Costa County cities to reduce energy use.
- Send a resolution and ask CalPERs to divest from fossil fuels.
- Join a sunshares program for bulk solar purchasing.
- Add Ygrene to list of PACE options.
- Why has the solar building permit increased from $100 in 2010 to $500 today to > $600 proposed? This discourages solar implementation.
- Provide more information when it's available, including a copy of the priority development areas in street view.
- "Scientific evidence indicates that the planet is in catastrophic climate change. This evidence is sufficient for the City Council to declare a public emergency for the purpose of immediately shutting down the Richmond Chevron Oil Refinery. The urgency to end fossil fuel production is sufficient legal basis for declaring an emergency."
- Failing to include GHG emissions beyond AB32 will be a major political problem for the plan.

Richmond Climate Action Plan

Community Workshop #2 Summary
September 16, 2015

On Wednesday, September 16, 2015 the City of Richmond (City) hosted a community workshop about the Richmond Climate Action Plan (CAP). Approximately fifty residents, businesses owners, and representatives from community-based organizations (CBOs), utilities, and faith-based organizations attended the event. The workshop offered an opportunity for the public to learn more about the CAP and the Bay Area Conservation and Development Commission's (BCDC) Adapting to Rising Tides project, and to provide input on key energy, water, solid waste, transportation, and resiliency programs.

Purpose and Overview

The Richmond CAP Workshop #2 took place on Wednesday, September 16, 2015 from 6:00pm-7:30pm at the Richmond City Council Chambers. The objectives of the workshop were to:

- Highlight key feedback received during Community Workshop #1 and describe how it will be integrated into the CAP.
- Better understand challenges and participation barriers to implementing and expanding key programs.
- Discuss specific actions or solutions the City (or another partner) can take to help overcome these challenges.
- Educate the community about climate change impacts, adaptation, and resiliency.
- Continue to engage the community to generate ideas, enthusiasm, and support for the CAP process.

Presentation

The workshop began with opening remarks from Richmond's Environmental Manager Adam Lenz. Mr. Lenz described CAP progress to date, including collaboration with UC Berkeley and the Y-Plan program, and described the purpose of the workshop, and opportunities for community transformation through the CAP.

Jeff Caton of ESA reviewed the purpose, key outcomes, and feedback from Community Workshop #1. Mr. Caton provided a high-level overview of climate change adaptation and resilience and potential climate change impacts and vulnerabilities.

Wendy Goodfriend of BCDC talked about the Adapting to Rising Tides (ART) project. Ms. Goodfriend described the expected project outcomes from the Contra Costa County project, the project timeline, and the ART portfolio. Next, workshop attendees engaged in a full-group question and answer session. Finally Eric Yurkovich of Raimi + Associates explained the purpose of each workshop breakout group and initiated the interactive exercises.

Question and Answer Period

The following summarizes the question and answer period from Workshop #2:

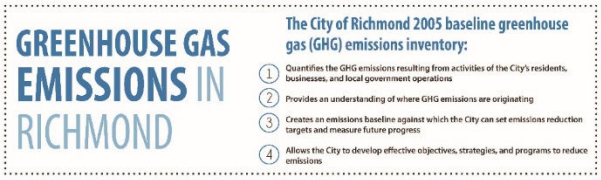
- Where will the workshop materials be posted?
  - richmondclimateaction.org
- Who is ESA?
  - ESA is an environmental science and planning firm of more than 350 professionals in 12 offices across the Western United States and Florida. ESA specializes in all aspects of project planning, environmental analysis and assessment, and regulatory compliance, including climate action plans.
- How is the Richmond Climate Action Plan funded?
  - The Chevron Refinery Modernization Project Environmental and Community Investment Agreement between the City of Richmond and Chevron provided funding for the project.
- How is the City spreading the word about the project?
  - The City posts information on the City Manager's Weekly Report, Mayor Butt's Forum, the Environmental Health Listserv, and the City's social media. The project team has also coordinated with community-based organizations.
- Where can residents get literature about climate change and the CAP?
  - richmondclimateaction.org
- What types of actions will the CAP recommend?

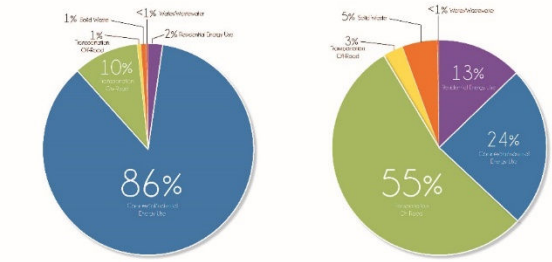
    - The CAP will include actions to reduce greenhouse gases (mitigations) and to prepare for the likely impacts of climate change (adaptations).
- Who will implement the CAP?
    - All City departments will be charged with implementing the CAP. Plan implementation will require collaboration with local businesses, community-based organizations, utilities, and residents, among others.
- Is the CAP part of the Richmond Mayor's branding and marketing campaign?
    - No. The CAP is a separate effort from the Mayor's campaign.
- What is the project timeline? Is the project behind schedule?
    - The project began in May 2015, and the Draft Plan is expected in Dec 2015. City Staff made the choice to slow down the project to align with other regional planning efforts by the Bay Area Air Quality Management District and BCDC. City Council is expected to hold a CAP adoption hearing in Quarter 1 2016.

Breakout Sessions

After the presentations and Q&A, workshop participants had the opportunity to participate in two of four breakout sessions. These sessions focused on:

1. Transportation
2. Energy
3. Water and Solid Waste
4. Adaptation and Resilience





The purpose of the breakout session was to get feedback from attendees on challenges and barriers to participation to a selection of key programs that would result in reduced greenhouse gas emissions in Richmond. Two facilitators staffed each breakout session. Facilitators asked two primary questions:

- **Challenges**: What challenges or barriers do you anticipate in implementing or expanding participation in specific programs?
- **Solutions**: What specific actions or solutions do you think the City (or other partner) can take to help overcome these challenges and leverage existing opportunities in Richmond? How can these efforts address current health conditions and inequities in the community?

Energy Breakout Group

The energy breakout group allowed participants to comment on the key programs, such as the Marin Clean Energy Renewable Energy Option, Income-qualified weatherization programs, and the Smart Lights Program. The following table summarizes the challenges and solutions discussed by the groups.

ENERGY

KEY PROGRAMS

Marin Clean Energy (MCE) Renewable Energy Options
MCE offers commercial, residential, and municipal customers the choice of having 56% (Light Green option) to 100% (Deep Green and Local Sol options) of their electricity supplied from clean, renewable sources.

Property Assessed Clean Energy
PACE programs help residential and commercial property owners finance the cost of energy and water efficiency improvements and renewable energy systems, which is paid back on the owner's property tax bills over several years.

Energy Upgrade California
Energy Upgrade California is a statewide program that offers single-family homeowners incentives to address home energy efficiency needs as a system rather than focusing on individual improvements.

Income-Qualified Weatherization Programs
PG&E and Contra Costa County programs offer no-cost solutions to income-qualified renters and homeowners to help make homes more energy efficient, safe and comfortable through improvements, such as weatherproofing, minor home repairs, and select appliance replacement.

Single-family Affordable Solar Homes (SASH) Program
The SASH program offers incentives to help low-income homeowners access solar technologies.

SmartLights Program
The SmartLights Program offers businesses, small institutions, and common areas of multifamily buildings no-cost start-to-finish technical assistance and cash rebates to help defray the cost of installing energy-efficient lighting and limited refrigeration products.

CHALLENGES
What challenges or barriers do you anticipate in implementing or expanding participation in these energy programs?

SOLUTIONS
What specific actions or solutions do you think the City (or other partner) can take to help overcome these challenges and leverage existing opportunities in Richmond? How can these efforts address current health conditions and inequities in the community?

Solutions	Barriers
General	
Tools to monitor homes (e.g. Smart home)	Cost to monitor
Discuss energy in less wonky manner	Classify actions/options in more manner that is more accessible to the general public.
City-led sign up events with contractors and energy service providers	
Increase utilization and inputs for MCE's and PG&E's My Energy Tool • Competitions for tool sign up • Pilot programs to pay homeowners to enroll in the program and track energy consumption over time	
• City can provide quick, well organized access to info • Make starting point easy for people new to issue	Lack of time
Simplification of process with one City website and coordinator	
Develop interactive tool • Person-specific info → Specific programs • Promote existing utility tools that do this	
Present emissions info in more comprehensible units during outreach (e.g., equivalent to taking 5,000 cars off the road)	
Make sure utilities understand the City's priority programs	
Integrate smart tools into school curriculum • Utilize youth to incentive smart tool participation. • Look at goals	
Use community leaders to spread info	
Leverage Richmond's community involvement	
Have local stores change policies on what they sell and promote. Stock more LEDs.	
City support of state initiatives	
Highlight MCE "Deep Green" program	
Show recommendations "for a homeowner"	
Renewable Energy	
Homeowners/businesses need to be able to sell electricity back.	Not a cost-effective investment
Need stronger incentives for lower energy households to have financial case to install solar	Renewable energy cost
	Housing stock issues, e.g., can't do solar installs on roof
Battery storage and potential for homes to off-grid power systems	
Energy Efficiency	
Electrification of home appliances to shift homes away from natural gas consumption	
Promote weatherization and ducting	
	Energy upgrade. California focuses on expensive top-of-the-line upgrades
	Outdoor gas heating

Transportation

At the land use and transportation breakout group, workshop participants commented on programs related to transit use, active transportation, electric vehicles, and land use development. The following table summarizes the challenges and solutions discussed by the groups.

In addition, the land use and transportation breakout group had the opportunity to identify potential bike rack locations throughout the City. The City collected this input for its next application to the Bay Area Air Quality Management District's Bicycle Rack Voucher Program.

TRANSPORTATION + LAND USE

KEY PROGRAMS

Commuter Benefits Program
The City's Commuter Benefits Program requires business with ten or more full-time employees to offer employees options, such as excluding transit or vanpool costs from taxable income, subsidizing employee transportation costs, providing shuttles, vans or buses, or similar to decrease the number of single-occupant motor vehicle trips to worksites.

Safe Routes to School Program
The Safe Routes to School program leverages State and federal grants to fund pedestrian infrastructure, such as sidewalks, bulb-outs, and in-pavement flashers around Richmond schools.

Bicycle and Pedestrian Master Plan
The City's Bicycle and Pedestrian Master Plans establish a blueprint for the completion of a 145-mile system of bikeways and support facilities, and to improve the safety, convenience and appeal of walking throughout the city.

Bay Area Air Quality Management District's
Residents and businesses may send bike rack requests to the City to include in future Bicycle Rack Voucher Program applications for installation of bike racks along City streets.

Transit Benefit Program
The City's Transit Benefit Program allows residents and employees to redeem transit benefit checks at retail locations across City for BART, AC Transit, and Amtrak tickets, providing savings on transit passes.

Safe Routes to Transit Program
The Safe Routes to Transit program leverages State and federal grants to fund bike and pedestrian transit-related projects. The City of Richmond used allocated funds to stripe buffered bike lanes on Carlson Boulevard.

One Bay Area Grants
The One Bay Area Grants program supports California's climate law requiring all metropolitan regions in California to complete a Sustainable Communities Strategy. Contra Coasta County has been awarded $46 million to fund bicycle, pedestrian, and street improvements and planning activities.

Active transportation program grants
This Statewide program encourages increased use of active modes of transportation, such as walking and biking, by funding infrastructure projects, planning, and other related educational and safety programs.

Environmental and Community Investment Agreement (ECIA)
The ECIA encourages increased use of electric vehicles and active modes of transportation by providing funding for the design and construction of new segment(s) of the Bay Trail, and for other transportation programs that may include a City bike-share program, EV charging stations, transit vouchers, and vehicle fleet upgrade, among others.

CHALLENGES
What challenges or barriers do you anticipate in implementing or expanding participation in these transportation programs?

SOLUTIONS
What specific actions or solutions do you think the City (or other partner) can take to help overcome these challenges and leverage existing opportunities in Richmond? How can these efforts address current health conditions and inequities in the community?

Solutions	Barriers
Driving	
• Employer based incentives for EV, transit, etc. • Casual carpooling spot • Ride sharing aps	Driving is too cheap
• Reduced parking requirements • Residential parking permit program	• Free parking • Residential developments over parked
EV Charging, more EV infrastructure, city vehicle fleet	Available grants
Transit	
• Bus schedules synced with BART • Better scheduling and communication of delays • Express buses	Reliability of transit
• Express buses to job centers (rapid bus not that rapid) • More frequent transit on San Rafael bridge	Transit travel time to/from destination too long
School security at bus stops	Crime, personal safety waiting for bus, working
	Some residents do not work close to transit
	Working class community – strategies for other types of workers regional coordination
	Jurisdictional coordination
Active Transportation (Walking and Biking)	
More bike paths, better connections between trails and street facilities	Some bikeways not safe
	Safe routes to school
	Street lighting
	Street maintenance
	Walking is not pleasant, palaces not in close walking distance
Land Use	
Groceries closer to home	
	Overcome fear of increased density

WATER SOLID WASTE

KEY PROGRAMS

WATER

Lawn Conversion & Irrigation Upgrade Rebates

EBMUD offers property owners rebates for converting lawn to a sustainable landscape and upgrading to high-efficiency irrigation equipment helps to conserve water.

High-Efficiency Toilets and Clothes Washer Rebates

EBMUD customers may receive a combined water and energy rebate after purchasing and installing a qualifying Energy Star washing machine or receive a water rebate for replacing an old toilet.

Free Conservation Items

Residential and business property owners may request free water-conserving faucets, aerators, showerheads, and hose nozzles from EBMUD.

SOLID WASTE

Weekly Residential Recycling and Composting

Residents may subscribe to free weekly recycling and green waste programs for commingled recyclables and to compost food scraps, food soiled paper, and yard waste.

Business Recycling and Food Scrap Collection

These free programs provide commercial customers the ability to reduce trash costs by recycling glass, aluminum, metal and plastic containers, paper, and cardboard, and to compost restaurant food scraps.

Bulky Item Trash Pickup

This program allows residential customers a free option for disposing of oversized household items, such as home furnishings, mattresses and box springs, carpet, appliances and other household items too large to fit in the trash container.

Household Hazardous Waste

The Household Hazardous Waste programs allows Richmond residents to dispose of household hazardous waste conveniently and for free at the West County Household Hazardous Waste Facility in Richmond.

CHALLENGES

What challenges or barriers do you anticipate in implementing or expanding participation in these solid waste and water programs?

SOLUTIONS

What specific actions or solutions do you think the City (or other partner) can take to help overcome these challenges and leverage existing opportunities in Richmond? How can these efforts address current health conditions and inequities in the community?

Water and Solid Waste

This breakout group provided input on key water and solid waste programs. The following table summarizes the challenges and solutions discussed by the groups.

Solutions	Challenges
Water	
Water conservation	
• Recycled water • Permit city's plant to give recycled/cleaned water to residents for irrigation)	
	How can residents share water conservation tips with each other
Use city resources to get information out to residents at events, picnics, festivals, churches	
Education through social media (Facebook, Twitter, Radio stations, Pandora, Spotify, television).	
Build a campaign with billboards etc.	
School districts need to work with EBMUD • Educate teachers about water/ waste • Teach kids at schools. They bring information to parents.	Water at school needs to be assessed
	Need to more information about well water • Is it beneficial? • Is it contaminated?
	Old clay sewage pipes are cracking and leaking into groundwater
	Issue with seater intrusion
	How to clean water in emergency
Rain water catchment	
Solid Waste	
	Getting people to participate is a challenge
Locks are offered for $20	Poaching recycle materials. This is a health + safety issue (people going through dumpsters).
City resources used to pick them up	Poachers pick up bulky items on street
Teach kids to recycle at elementary schools such as Green academy at West Contra Costa	
Ban Styrofoam at restaurants	
• Shared information between Kaiser and City • Kaiser and City collaboration in resources	Better recycling at Kaiser

Adaptation and Resiliency

The purpose of the adaptation and reslience breakout group was primarily educational, and an opportunity for particpants to ask questions and raise concerns about climate impacts and resiliency. Wendy Goodfriend of the BCDC demonstrated the Adapting to Rising Tides tool for viewing sea level rise impacts in Contra Costa County. Workshop participants were very interested in this tool and asked that key maps relating to CIty of Richmond be made available in public forums, including the CIty web site and the City's public libraries in order to raise community awareness. Additional comments and questions raised by the participants are summarized below.

- There is a real need to educate the community on sea level rise, extreme heat emergencies, and climate change resilience in general. For example, do residents know if they live in a high risk flood zone? Does the City know which populations in the city are most vulnerable to climate change hazards and are there emergency response plans in place for dealing with them?
- With Doctor's hospital closing, what are the implications for health emergencies? How will care be coordinated in an emergency? What can the City learn from the recent toxic release from the Chevron refinery where Kaiser, as a private corporation, voluntarily took on an important role in setting up an ad hoc triage system (tents, staff, etc.) for dealing with impacted residents?
- Planning for resilience should focus on the neighborhood level to build a sense of community that could kick-in during an emergency: community gardens, book-drop kiosks, playgrounds, walking paths, and produce exchanges.

- Is groundwater a potential asset for residents as water supply becomes more critical? Specifically, one participant asked how they could get a well on their property. This person is in an older neighborhood (Richmond Annex) with an abundance of underground spring water and knows many of the houses around her have wells. She is interested in the potential of utilizing groundwater for her fruit trees which have really suffered in the drought.
- In general, agencies could use better data on the health outcomes of climate events.

Richmond Climate Action Plan

Community-Based Organization (CBO) Luncheon
June 29, 2015

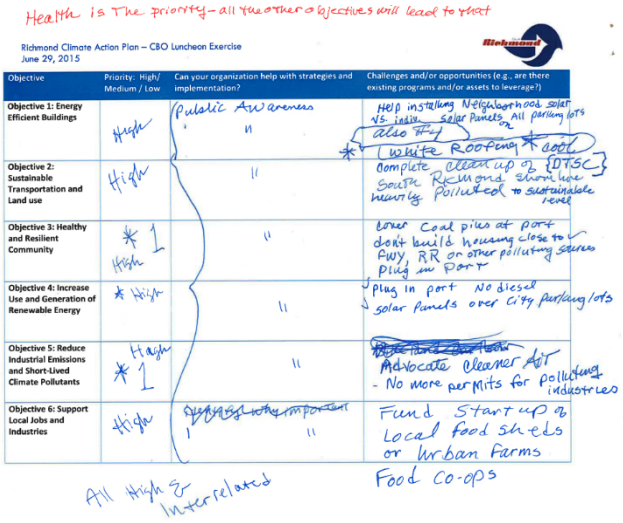
On Monday, June 29th the City of Richmond hosted a luncheon with local Community-Based Organizations (CBOs) regarding development of the Richmond Climate Action Plan (CAP). Twenty-five representatives attended, representing fifteen organizations. The luncheon provided an opportunity for CBOs to hear a status update on development of the CAP, discuss key challenges and opportunities related to climate change in Richmond, and learn about the relationships between the CAP and existing Richmond policy and strategy documents.

The luncheon also provided the opportunity to share draft CAP objectives, and get feedback from CBOs on what objectives should be top priority, and what objectives are missing. Through break-out group discussions and a larger group discussion, CBOs identified opportunities to partner with the City to help implement specific CAP actions, and ways in which they can help publicize the upcoming Community Workshop on the Climate Action Plan.

Key Takeaways

The CBO luncheon yielded a wide-ranging discussion on the CAP, community engagement, and opportunities and challenges within the City. The following summarizes a number of key takeaways examined by participants.

- The Healthy and Resilient Communities objective was identified as the highest priority. There was also extensive discussion around emphasizing public health co-benefits in all of the objectives.
- The objectives with the fewest high priority votes included Reduce Industrial Emissions that Contribute to Global Warming, Water Conservation, and Zero Waste. Participants also identified the fewest partnership opportunities for these objectives.
- Participants identified a number of gaps in the draft CAP objectives. Multiple participants identified urban forestry and tree planting, and community and family engagment as missing. During the group report back, participants showed strong support for adding these objectives.
- Participants identified a range of activities from community engagement and awareness building to specific implementation programs as opportunities to partner with the City and residents to implement the CAP.



Presentation

The luncheon began with opening remarks from Richmond's Environmental Manager Adam Lenz. He discussed CAP progress to date, including collaboration with UC Berkeley and the Y-Plan program, and described the purpose of the luncheon. Jeff Caton, ESA, presented background information on the project and the CAP to ensure luncheon participants had the knowledge necessary to provide meaningful input on the draft CAP. Jeff presented information on the local policy framework to address climate change, funding/grant opportunities, and the community-wide greenhouse gas inventory. Next, Beth Altshuler, Raimi + Associates, outlined the luncheon exercise on draft CAP objectives initiating the individual and group exercises.

Objective Priorities and Gaps

To understand participant priorities for the CAP, the team asked each participant to prioritize nine draft CAP objectives and to identify gaps in the existing objectives. Participants ranked their priorities from high to low as summarized in Table 1 (on the following page). Twenty participants completed their worksheets. About half of the participants (11) ranked all objectives; however, some participants only ranked their highest priorities. The majority of participants identified Healthy and Resilient Communities as the highest priority (19), followed by Sustainable Transportation and Land Use (16), Support Local Jobs and Industries (15), and Youth Engagement (14). The objectives with the fewest high priority votes included Reduce Industrial Emissions that Contribute to Global Warming, Water Conservation, and Zero Waste. Each objective received 10 high priority votes.

Participants identified the following gaps in the draft objectives:

- Urban forestry / tree planting (5)
- Community engagement / family engagement and education (7)
- Health-related (3)
    - Decrease health disparities
    - Health education
    - Access to health care to mitigation and manage health consequences of climate change on population
- Marketing and communications strategies (2)
- Local organization collaboration
- Urban agriculture and local food development
- Heat island
- Vehicle charging infrastructure
- Residential renters / access to alternative energy programs

Table 1: Objective Prioritization

Objective	High	Medium	Low
1. Energy Efficient Buildings. Support energy conservation by businesses, residents, City government, and schools. Promote efficient use of energy in the design, construction, and operation of public and private facilities, infrastructure, and equipment.	12	2	1
2. Increase Use and Generation of Renewable Energy. Promote the generation, transmission, and use of a range of renewable energy sources, such as solar, wind power and waste energy to meet current and future demand. Encourage new development and redevelopment projects to generate a portion of their energy needs through renewable sources.	12	1	2
3. Sustainable Transportation and Land use. Encourage the use of low-emission and renewable fuel vehicles by residents and businesses, schools, public agencies, and City government. Support and promote enhanced and expanded public transit; walkability and bicycling; mixed-use urban streets; and creation of an urban landscape that reduces reliance on private automobiles. Promote the safe and efficient movement of goods by truck, rail and ship to support port operations and industrial uses.	16	2	
4. Healthy and Resilient Community. Prepare for and adapt to future impacts of climate change, including changing weather patterns and sea level rise. Support affordable, safe, and climate-resilient housing. Promote development standards and land use patterns that encourage long-term sustainability, such as supporting the restoration of natural features, including creeks and wetlands in urban areas; promoting landscaping that incorporates drought-tolerant plants; and providing trees and green infrastructure to reduce storm water runoff. Collaborate with local urban agriculture advocates to identify sites with urban agriculture potential.	19		
5. Reduce Industrial Emissions that Contribute to Global Warming. Reduce and mitigate carbon dioxide and other greenhouse gas emissions (e.g., hydrofluorocarbon) from large commercial and industrial sources. Work with businesses and industry, residents, and regulatory agencies to reduce the impact of direct, indirect, and cumulative impacts of pollution from industry, the Port, railroads, diesel trucks, and busy roadways.	10	3	1
6. Support Local Jobs and Industries. Promote "green" industries to provide goods and services to fill the growing need for clean and sustainable technologies, fuels, vehicles, and equipment, while providing jobs and training to Richmond residents. Encourage existing businesses and industries to become environmentally progressive and continue making positive contributions to the community.	15	2	
7. Water Conservation. Promote the use of existing and develop new incentives to encourage schools, government facilities, residences, commercial businesses, and industrial users to reduce water consumption and increase the use of recycled water. Promote water efficient features and landscaping in all new development.	10		2
8. Youth Engagement. Partner with local agencies, schools, and community groups to engage students in confronting the climate change challenge. Identify opportunities for school and community improvements related to energy, waste, water, and other natural resources. Promote green careers.	14		1
9. Zero Waste. Reduce the City's overall waste stream by reducing the City's consumption of goods and materials, and by adopting a zero-waste philosophy. Promote waste reduction and recycling to minimize materials that are processed in landfills.	10	3	1

Participants also commented on the draft CAP objective descriptions. Comments varied in their level of details, with some participants recommending new actions, such as passing an ordinance to ban the sale of plastic bags and Styrofoam, and others new strategies, such as developing complete communities. Table 2 summarizes these comments.

Table 2: Comments on the Objectives

Objective	Additional Comments on the Objective
1. Energy Efficient Buildings	• Implement through developer mandates or incentives. • Include school buildings.
2. Increase Use and Generation of Renewable Energy.	• Include rooftop solar.
3. Sustainable Transportation and Land use.	• Access to charging stations.
4. Healthy and Resilient Community.	• Heat island effect. • Complete communities (2). • Jobs/housing balance. • Reference carbon sequestration.
5. Reduce Industrial Emissions that Contribute to Global Warming.	• Reduce health impact. • Plant trees.
6. Support Local Jobs and Industries.	• Training provided supports the needs of community services • Internships for students. • Urban forestry = jobs, youth engagement.
7. Water Conservation.	• Planting palettes. • Consider treating water for recycled water use. • Renovate public restrooms with low-flow/modern fixtures.
8. Youth Engagement.	• Rename objective: Youth and School Education Engagement. • Rename objective: Youth and Community Engagement. • Opportunity to partner with Health Academy.
9. Zero Waste.	• Sale of compostable bags/paper; ban Styrofoam.

Partnership Opportunities

To identify partnership opportunities with the City, each participant was asked whether and how their organization could support the implementation of the CAP. Participants identified a range of activities from community engagement and awareness building to specific implementation programs such as SMARTSOLAR. These partnership opportunities are organized by draft CAP objective and are summarized in Table 3.

Table 3: Partnership Opportunities

Objective	Community-Based Organization	Partnership Opportunity
1. Energy Efficient Buildings	Richmond Progressive Alliance	Public awareness.
	Rising Sun	Youth and adult training/programs focused on energy efficiency.
	CESC	PG&E, MCE funded SmartLights program offers TA and incentives to become more efficient.
	CBE	Residential education/outreach.
	Richmond Community Foundation	Social Impact Bonds to rehab houses that are green / affordable.
2. Increase Use and Generation of Renewable Energy.	Richmond Progressive Alliance	Public awareness.
	Rising Sun	Trains low-income adults in solar installation. Youth program provides basic solar assessment to residents.
	CESC	Free solar advising program (SMART SOLAR)
	CBE	MCE/CCA development.
	Solar Richmond	Installs solar panels on residential homes and commercial businesses.
3. Sustainable Transportation and Land use.	CCIS/Y-Plan	Yes.
	Richmond Progressive Alliance	Public awareness.
	Richmond Trees	Yes.
	CBE	Priority development and job creation.
	Rich City Rides	Promotes cycling. The RBPAC advocates for infrastructure and to make cycling fun.
4. Healthy and Resilient Community.	Groundwork Richmond	Youth workforce Green Team who can help disseminate information.
	CCIS/Y-Plan	Youth/school engagement centered on this.
	Richmond Progressive Alliance	Yes with public awareness.
	Richmond Trees	Tree planting.
	CESC	Richmond/Chevron CDBG-funded home repair program, home safety retrofits, and asthma trigger remediation.
	West Contra Costa USD	Partner on community education.
	CBE	Community education and awareness. Adaptation.
	Rising Sun	Helps reduce harmful gases to improve health.
	Rich City Rides	Promotes riding is healthy and cost-effective. Makes communities more resilient, while supporting local businesses and creating jobs.
	Richmond Community Foundation	Social Impact Bonds to rehab houses that are green / affordable.
	Community Clinic Consortium	Yes.
5. Reduce Industrial Emissions that Contribute to Global Warming.	Richmond Progressive Alliance	Yes with public awareness.
	Richmond Trees	Yes.
	CBE	Yes.
6. Support Local Jobs and Industries.	Groundwork Richmond	Work on a City nursery to plant trees (teach/train for green jobs).
	Richmond Progressive Alliance	Yes with public awareness.
	Richmond Trees	Yes, with careers in urban forestry, develop tree nursery.
	Rising Sun	Yes through programs that train and employ youth and adults in green career pathways.

Objective	Community-Based Organization	Partnership Opportunity
	CESC	Job training of "green jobs".
	Rich City Rides	Creating two bike shops and working to create other bike-related businesses.
	Solar Richmond	Workforce development (entry/advanced solar installation training).
7. Water Conservation.	Rising Sun	Youth program installs water efficient measures in local homes and provides conservation tips. Potential opportunity for adult training program.
	Richmond Trees	Yes.
8. Youth Engagement.	Groundwork Richmond	Utilizes a youth group in urban greening activities.
	CCIS/Y-Plan	Yes… is there an opportunity to have students design community outreach/workshop materials?
	Richmond Trees	Engages youth to plan and care for trees.
	Rising Sun	Hires local youth to provide energy and water efficiency services to the community.
	CBE	Supports climate, adaptation, clean energy, and awareness workshop for AFA, Latino residents.
	Rich City Riders	Hosts a youth earn a bike program.
9. Zero Waste.	Rising Sun	Remove e-waste from home. Potential to work on other waste streams.
	CBE	Education for residents.
	Rich City Rides	Refurbishes used bikes and trains youth/adults to repair bikes.

Opportunities and Challenges to Objective Implementation

Luncheon participants were asked to identify key opportunities and challenges to achieving specific objectives. These were recorded in their worksheets and are organized by objective.

Energy Efficient Buildings

- Opportunities
  - City should help residents install cool roofs (2).
  - Help install neighborhood solar vs. individual homes/businesses.
  - Partner with Richmond Environmental Justice Coalition.
  - Already regulations for this issue.
  - Put solar panels on all City lots, and solar in neighborhoods (2). However, fix building efficiency before doing solar, create free light bulb replacement program.
  - Rising Sun and CESC programs offer free or low cost installs; Year-round program for Rising Sun would increase impact (currently only a summer program).
- Challenges
  - Cost to certify to Rising Sun, LEED, LESC.

Increase Use and Generation of Renewable Energy

- Opportunities
  - Grid Alternatives provide low-income communities with solar.
  - Plug in Port; reduce diesel use; place solar panels over City parking lots.
  - SmartSolar program.
  - Solar Richmond, Rising Sun programs.

Sustainable Transportation and Land Use

- Opportunities
  - Complete cleanup of South Richmond Shoreline.
  - Richmond City Bikes, RBPAC Policy Infrastructure, and the Greenway.
  - Funding: Chevron should provide funding since they are the #1 greenhouse gas emitter.
  - Explore vehicle charging station and affordable access.
  - Add more trees.
- Challenges
  - Lack of reliability of transit system (2).
  - Walkability/transportation connected to public safety.
  - Education, behavior change, and SRTCP access to money.

Healthy and Resilient Community

- Opportunities
  - California King Tides Initiative interested in partnering with Y-Plan; use social media to do education on King Tides, TCE BHC.
  - Contra Costa CARES proposal is being considered by BOS to expand access to healthcare for remaining uninsured.
  - Richmond home repair, energy savings assistance program, and family sustainability project (through Chevron).
  - Richmond Trees model for outreach can be expanded.
  - Provide free assessments and environmental solutions.
- Challenges
  - Funding to plant trees and care for them.
  - Community education and changing the mindset of residents.
  - Cover coal piles at Port; plug in Port.
  - Do not build houses close to freeway and other polluting sources (2).
  - Funding and financing sources.

Reduce Industrial Emissions and Short-Lived Climate Pollutants

- Opportunities
  - City should advocate for cleaner air, stricter air quality regulations (2).
  - Do not issue more permits for polluting industries.

Support Local Jobs and Industries

- Opportunities
  - Build local hire policies into CAP, promote program and connect to employers.
  - Entry and advance solar installation training, e.g. Solar Richmond - Training Rising Sun.
  - Fund startup of local food sheds or urban farms, food co-ops.
  - Involve our youth in STEM education and workforce development.
  - Rising Sun/Solar Richmond, Richmond Build.
- Challenges
  - Funding and financing mechanisms.

Water Conservation

- Opportunities
  - Recycled water (2).
  - Drought-tolerant landscaping.
  - Grey water systems (3).
  - Rainwater harvesting.
  - More efficient plumbing fixtures.

Youth Engagement

- Opportunities
  - Include more schools and youth (2). Outreach in school, local competitions, and through advocacy groups.
  - Pay youth to do work, such as public awareness campaigns, community gardening, green team interns, e.g. Richmond Trees pays them.
  - Other programs: Rising Sun, WCCUSD Youth, Elizabeth Carmody Dir. Community Engagement, Health Academy Build HiAP into curriculum.

Additional Opportunities and Challenges

- Opportunities
  - 25,000 tree planting opportunities including parks, schools, and low-income neighborhoods.
  - Address Chevron's impact beyond Cap and Trade, looking at health related issues.
  - Connect existing community-based groups with funding, promotion, etc.

    - Fund startup or local urban farms, Food Co-Op.
    - Make existing programs easier for residents to research and access; promote low- and no-cost programs.
    - Better communication via media, social media, websites, transit, community meetings, schools, faith-based organizations (2).
- Challenges
    - Existing jobs to housing balance.
    - Multi-lingual outreach including Lao, Spanish, Chinese.
    - Make sure training provide supports needs of community services.
    - Maximize health care access to mitigate Climate Change health impacts.
    - Not yet a Plug in Port, "cold ironing".
    - Piles of coal at port should be covered.

Report Back

After small group discussion related to the draft CAP objectives, each group was given a few minutes to report back their most important, interesting, and unique conversation at their table. Participants highlighted the following ideas:

- Missing objectives included: tree planting / forestry; community and family engagement; and education and communication around the CAP.
- Chevron, and Chevron's emissions, is both a significant challenge and opportunity for the City.
- Recommended bringing health into all objectives.
- Recommended engaging students and schools in climate science and actions.
- Recommended including strategies for complete neighborhoods and jobs-housing balance in the Smart Land Use and Transportation objective.
- Recommended against placing new residential development near transportation pollution sources.

Community Engagement

After completing the draft CAP objectives exercises, Beth Altshuler presented the CAP engagement activities and the specific community workshop outreach techniques. She then facilitated a large group discussion around the following two questions:

- What other ideas or actions do you recommend for publicizing the community workshops?
- How best can we collaborate with you to publicize the Climate Action Plan and the community?

Participants shared the following ideas:

- Work with CBOs through their existing communication networks to encourage residents to participate in the CAP process and workshops. Suggestions included:
    - Richmond Trees newsletter / social media
    - Sunflower Alliance newsletter
    - Rich City Rides newsletter
- Participants also recommended a variety of community events where the team/City may distribute CAP materials and engage residents. Opportunities may include:
    - Stop Crude by Rail (July 11)
    - Youth Action Exchange (July 16)
    - Summer of Our Power (August 22nd)
    - Walk to Nature (August 29th)
    - North Shoreline Fest (October)
    - Rich City Rides bike repair workshops on (Fridays)
- Participants also showed strong support for creating a mural in Richmond publicizing the CAP and upcoming workshops.

Richmond Climate Action Plan

Utilities, Franchisees, Industry Groups and Representatives Luncheon
July 23, 2015

On Thursday, July 23rd the City of Richmond hosted a luncheon with utilities, franchisees, industry groups and representatives regarding development of the Richmond Climate Action Plan (CAP). Eighteen representatives attended, representing thirteen organizations. The luncheon provided an opportunity for these organizations to hear a status update on development of the CAP, discuss key challenges and opportunities related to climate change in Richmond, and learn about the relationships between the CAP and existing Richmond policy and strategy documents.

The purpose of this luncheon was to identify the key programs and policies each organization is implementing to reduce greenhouse gas (GHG) emissions; to discuss what actions the City can take that would help you improve the effectiveness of the GHG reduction efforts; to better understand existing state, regional, and local policies/programs guiding GHG reduction efforts; and to review the relevant draft Richmond Climate Action Plan (CAP) objectives and supporting actions.

Presentation

The luncheon began with opening remarks from Richmond's Environmental Manager Adam Lenz. He discussed CAP progress to date, including collaboration with UC Berkeley and the Y-Plan program, and described the purpose of the luncheon. Jeff Caton, ESA, presented background information on the project and the CAP to ensure luncheon participants had the knowledge necessary to provide meaningful input on the draft CAP. Jeff presented information on the local policy framework to address climate change, funding/grant opportunities, and the community-wide greenhouse gas inventory. Next, Eric Yurkovich, Raimi + Associates, outlined the luncheon exercise on draft CAP objectives initiating the individual and group exercises.

Programs & Policies

Each participant was asked to identify the key programs and policies their organization is implementing to reduce GHG emissions (both within their organization and across the Richmond community), and the important programs and policies going forward. Each group was provided a list of policies and programs, and then they were asked to add to the list.

Energy

Participants were provided the following programs and policies that address energy efficiency and renewable energy:

- Renewable Portfolio Standard (RPS)
- Energy efficiency programs (incentives, rebates, audits, technical support and assistance programs, and outreach and education)
- Energy Upgrade CA, Property Assessed Clean Energy (PACE), and other financing programs
- Solar incentives; feed-in tariffs
- Title 24 energy standards
- Energy Watch Partnership
- Demand response programs
- Local green business program

Participants identified the following activities:

- East Bay Energy Watch (EBEW). Business incentive energy efficiency program (share implementation with MCE).
- MCE Clean Energy. Business incentive energy efficiency program (share implementation with EBEW); commercial Demand Response program; residential Demand Response program currently being rolled out.
- PG&E. Demand Response commercial program; Green Button Connect My Data API.

Transportation and Land Use

Participants were provided the following programs and policies that address land use and transportation:

- Outreach and education to promote benefits of transit and active transportation
- SB 375 - Priority Development Areas and other transit-oriented development (TOD) incentives
- Planning partnerships with local and regional government agencies
- Local land use, parking, and bike/pedestrian strategies to improve intermodal connectivity
- Incentives and passes to promote transit
- Incentives and strategies to accelerate electric vehicle (EV) deployment (federal, state and regional), including funding for DC fast chargers along regional transportation corridors
- Local green business program
- Internal sustainability initiatives
- Transportation Demand Management programs

Participants identified the following activities:

- BART: Developing an internal sustainability strategy; purchase green energy from the NCPA; will set a target for GHG emissions; outreach and education to promote benefits of public transit and active transportation; incentives and passes to promote transit; local sustainability initiatives; piloting EV charging stations at BART extensions.
- PG&E: Incentives and strategies to accelerate electric vehicle (EV) deployment; local sustainability initiatives; education and outreach around EV charging stations.

Water

Participants were provided the following programs and policies that address water:

- Outreach and education programs
- Utility-led conservation incentives and rebates (e.g., WaterSmart, lawn replacements)
- State government conservation mandates and building codes; drought emergency measures
- Local landscaping ordinance & irrigation
- Local support for grey water systems
- Bay Area Regional Desalination Project
- Aggressive local conservation goals; Urban Water Management Plan, 20x2020 goals
- Water audits, leak detection, and repair programs
- Pricing strategies (i.e., tiered rates to incentivize conservation)
- Large-scale recycled water planning and projects
- Regional planning efforts (e.g., Bay Area Integrated Regional Water Management Plan)

Participants identified the following activities:

- Veolia Water: Outreach and education programs; audits; large-scale recycled water planning and projects
- EBMUD: Local green business program; Smart Water program; must plan for recycled water; local support for grey water systems
- Haley & Aldrich: Water consulting; outreach and education programs; audits; recycled water planning and projects

Solid Waste

Participants were provided the following programs and policies that address solid waste:

- Outreach and education programs
- Local compositing facilities
- Residential organics collection (green waste and food waste)
- Local green business program
- Local franchise agreement
- Waste prevention and source reduction programs
- State's Green Building Standards (CalGreen)
- Universal waste recycling programs
- Mandatory recycling laws
- Commercial food waste collection
- Support for multi-family recycling and organics collection
- Local zero waste ordinance
- Pay- as-you-throw program (variable-rate pricing)
- Material exchanges and other private material reuse and waste reduction enterprises
- Zero waste planning for special events

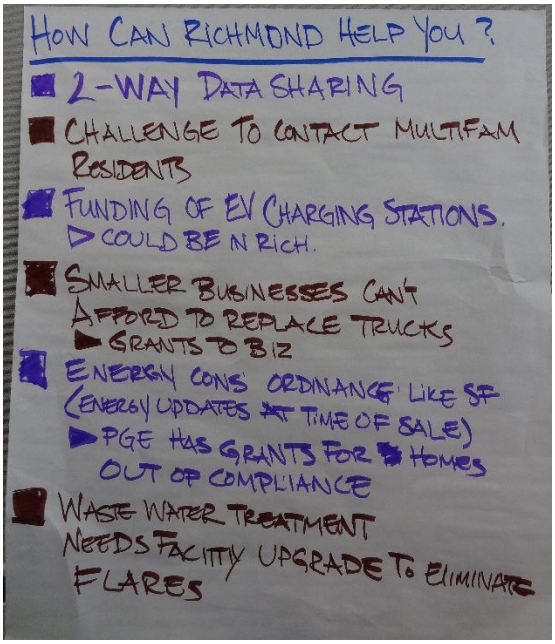
Participants identified the following activities:

- Composting; trucking waste to Pittsburgh landfill; pulling hazardous waste material; public outreach

Table 1: Programs & Policies to Reduce Greenhouse Gas Emissions

City Support

To identify ways in which the City could support organizations' CAP-related policies and programs, each participant was asked what actions the City could take to improve the effectiveness of organizations' greenhouse reduction efforts. Participants identified a range of activities from community engagement and awareness building to data sharing. These support opportunities are organized by industry and are summarized in Table 2.



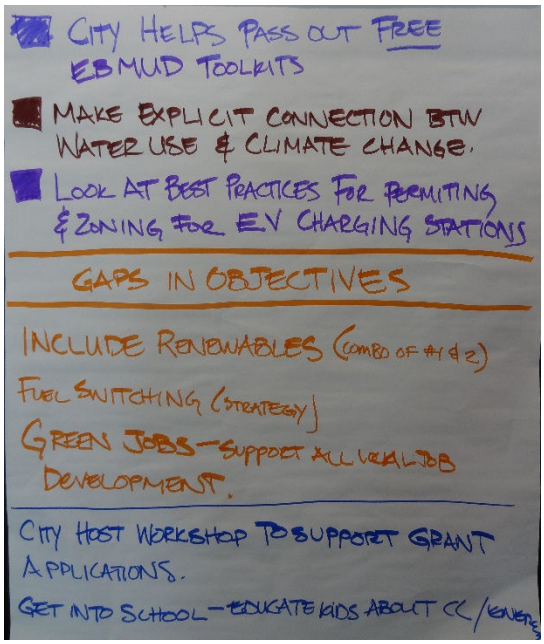


Table 2: Desired City Actions to Support Organizations' Greenhouse Gas Reduction Efforts

Industry	Organization	Desired City Actions
1. Energy	East Bay Energy Watch	Better access to data on program participation and other program data; community outreach around normalizing energy efficiency as a good business decision; City Council support as an energy champion.
	MCE Clean Energy	Financial incentives/access and community engagement to encourage adoption of Deep Green program.
	PG&E	Local renewables promotion.
2. Transportation and Land Use	BART	Get Cap and Trade funds for disadvantaged communities.
	PG&E	Make EV a component of the CAP- PG&E has identified local governments that have CAPs with EV as a component and gives those jurisdictions preference for projects; Make the City EV-ready by looking at zoning policies and building ordinances, making it easy to install charging stations by attaching a toolkit to the existing permitting application and making the permitting process more streamlined (energycenter.org and evcollaborative.org have examples), and making sure City staff are familiar with the permitting process; Take advantage of opportunities to leverage state funding.
3. Local Industry	Chevron	
	Sims Metal Management	
4. Water	Veolia Water	Infrastructure upgrades; 5 year master plan for the waste treatment facility plan needs a response/mitigation plan for sea level rise; comprehensive plan (or component of general plan) to establish, fund and implement reduction goals for all city facilities and operations.
	EBMUD	Fund and implement water reduction goals, including water treatment plant emissions.
	Haley & Aldrich	Energy and water benchmarking and data sharing for large users (like NYC and Seattle)
	Recycle More	Recycle more goals for food waste- help get access to multifamily units; public education and outreach; mandatory recycling/composting bin; Bay ban on plastic bags
5. Solid Waste		

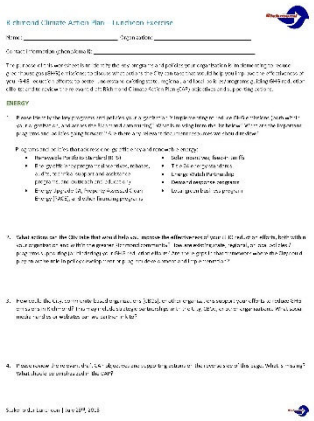
Partnership Opportunities

Participants were asked about strategic partnerships with the City, CBOs, or other organizations. They proposed the following:

- Data sharing between cities and other organizations.
- Connect all CBOs working on environmental sustainability and social justice issues to better serve residents and businesses with programs.
- Community outreach and awareness building; helping gain access to landlords.
- Collaborations with business sectors and schools to address behavior change.
- East Bay Energy Watch has funding for innovative ideas.
- The City can act as an organizer between industry and local organizations to communicate community needs to industry.
- EBMUD- Hand out drought kits/tools from EBMUD at community centers and city offices; take EBMUD drought pledge (Sept. 22); business community engagement.

- Mandatory zero waste programs.
- Community relations manager.

Objective Priorities and Gaps



To understand participant priorities for the CAP, the team asked each group to review relevant draft CAP objectives and supporting actions, and to identify gaps in the existing objectives. Participants identified the following gaps in the draft objectives and/or supporting actions:

- Include renewables
- Fuel switching (strategy)
- Support all job development, not only "green" jobs
- Bill financing
- Identify concreate tasks and projects for engagement, no matter how small, to give the community an outlet to take action
- Move away from incentives, instead build a culture of energy efficiency/water efficiency, etc.
- Leverage third-party programs and connect the dots between programs
- Empower the community and youth to be the source of innovative ideas
- Promote dashboard technology and home automation controls
- Port-related actions such as cold ironing and electrifying small good movement (e.g. electric forklifts, cranes, etc.)
- Make explicit connection between water and climate change/greenhouse gas emissions (drought is a result of climate change, and water use contributes to it)
- Set up benchmarking to see how much water businesses are using (NYC and Seattle have examples)
- Conservation competition (Berkeley example)
- 2 designated Richmond Works Operator in training program positions
- Municipal water/wastewater reclamation
- Schools outreach
- City events for composting/waste system, etc.
- Do a better job of separating municipal solid waste/organics at events
- Waste dropping/illegal dumping, bulky items

Richmond Climate Action Plan

Business Stakeholder Breakfast
October 15, 2015

On Thursday, October 15th the City of Richmond hosted a breakfast with local business, utilities, and local agency stakeholders regarding development of the Richmond Climate Action Plan (CAP). Nineteen representatives attended, representing fourteen organizations. The breakfast provided an opportunity for participants to hear a status update on development of the CAP, discuss key challenges and opportunities related to climate change in Richmond, discuss how the CAP can benefit local businesses, and to provide input on key strategies and programs.

Presentation

The breakfast began with opening remarks from Richmond's Environmental Manager Adam Lenz. He discussed CAP progress to date, including collaboration with UC Berkeley and the Y-Plan program, and described the purpose of the meeting. Jeff Caton, ESA, presented background information on the project and the CAP to ensure participants had the knowledge necessary to provide meaningful input on the draft CAP and its key programs. Jeff presented information on the local policy framework to address climate change, funding/grant opportunities, and the community-wide greenhouse gas inventory.

Large Group Discussion

Next, Eric Yurkovich, Raimi + Associates, described the purpose of the large group input session and then facilitated a group discussion focused on the following three questions:

1. How can the CAP improve the local business climate?
2. What challenges or barriers do you anticipate in implementing or expanding participation in key programs? What specific actions or solutions do you think the City (or other partner) can take to help overcome these challenges and leverage existing opportunities in Richmond?
3. What job creation and partnership opportunities exist?

The following summarizes the information by question.

How can the CAP improve the local business climate?

Participants were asked to discuss how the CAP through new and expanded opportunities, City policies and partnerships, and other cost reductions and efficiencies could improve the business climate. Comments and questions raised by the participants are summarized below.

- **Existing buildings**: There is a lot legislation around new homes, but there are opportunities to improve existing building stock in the City, including better heating and cooling systems, new roofing, and removal of turf.
    - Much of the existing housing stock was built in the 1940s and 1950s and was intended to be temporary. Window and door sealing strategies will be very effective for this era of housing.
- **New markets**: The LEED and Net Zero construction markets are growing. The City needs to identify ways to capture construction and construction jobs.
    - Need better outreach with contractors and construction workers.
- **Example**: WRCOG has been very successful at PACE implementation. HERO has a property advisors program.
- **City opportunities**: Opportunities for the City to incentive and encourage program implementation include:
    - Fast track permitting
    - Marketing through newspapers, property tax bills, and direct mail.
    - Education that addresses investment now for future ROI.
- **Multifamily incentives**: Multifamily incentives have had less success than single family incentives. However significant and popular incentives exist for multifamily, e.g. MCE, BayREN.
- **Triggers**: What types of triggers can the City use to get more businesses and residents enrolled and participating in these programs?
    - Example Berkeley: energy efficient requirements
        - RECO/CECO at point of sale.
        - Required energy audit and upgrades.
        - Used an outside assessment/audit.
        - Tied to national standards.
    - There may be a potential backlash to green program requirements, e.g. EBMUD's sewer lateral requirement at sale.

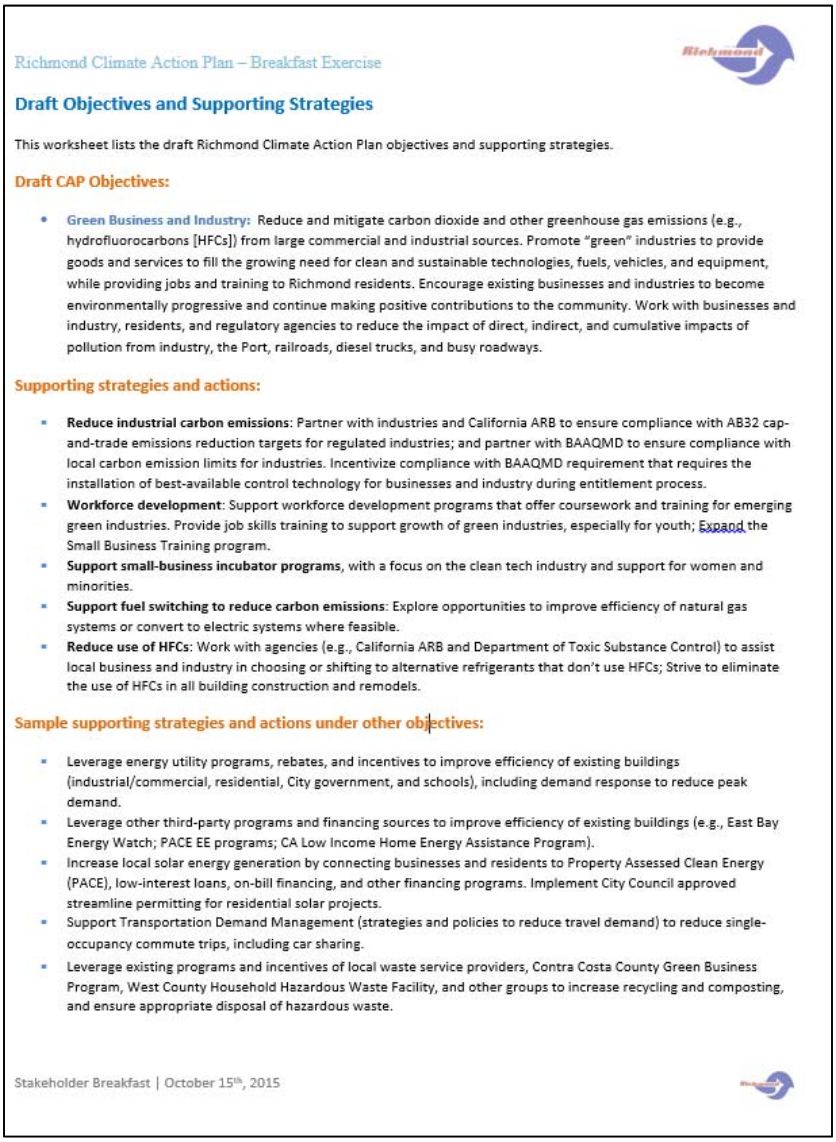
    - If a similar approach was taken to Berkeley's RECO/CECO ordinance, the City could package audits with incentives and financing mechanisms to help residents and businesses implement improvements.
    - Need trigger to get people to do the improvements, not just conduct the audit.
    - Post office welcome packets or realtors could tell people about the financing programs for water and energy efficiency.
    - Example: San Francisco benchmarking program for commercial
- **City leadership**: City should also be held accountable for these improvements, including City facilities and public housing.
- **Potential backlash**: There may be a backlash from employers about new requirements from the CAP.
    - Some businesses feel like there are too many requirements, inspections already, and by adding new regulations, businesses may choose to move or not locate in Richmond.
    - Example: Blue Apron.

Key Programs

Participants were then asked to provide feedback on key programs. They were asked what has worked well and what hasn't; challenges or barriers to implementing or expanding participation in key programs; and actions the City (or other partner) can take to help overcome these challenges. They were asked specifically about the following programs:

- Green Business Program
- Workforce Development
- Commuter Benefits Program
- Property Assessed Clean Energy
- Recycling and Food Scrap Collection
- SmartLights Program
- Lawn Conversion & Irrigation Upgrade Rebates
- High-Efficiency Toilets and Clothes Washer Rebates

The notes from that conversation are summarized below.



Richmond Climate Action Plan – Breakfast Exercise

Draft Objectives and Supporting Strategies

This worksheet lists the draft Richmond Climate Action Plan objectives and supporting strategies.

Draft CAP Objectives:

- **Green Business and Industry:** Reduce and mitigate carbon dioxide and other greenhouse gas emissions (e.g., hydrofluorocarbons [HFCs]) from large commercial and industrial sources. Promote "green" industries to provide goods and services to fill the growing need for clean and sustainable technologies, fuels, vehicles, and equipment, while providing jobs and training to Richmond residents. Encourage existing businesses and industries to become environmentally progressive and continue making positive contributions to the community. Work with businesses and industry, residents, and regulatory agencies to reduce the impact of direct, indirect, and cumulative impacts of pollution from industry, the Port, railroads, diesel trucks, and busy roadways.

Supporting strategies and actions:

- **Reduce industrial carbon emissions**: Partner with industries and California ARB to ensure compliance with AB32 cap-and-trade emissions reduction targets for regulated industries; and partner with BAAQMD to ensure compliance with local carbon emission limits for industries. Incentivize compliance with BAAQMD requirement that requires the installation of best-available control technology for businesses and industry during entitlement process.
- **Workforce development**: Support workforce development programs that offer coursework and training for emerging green industries. Provide job skills training to support growth of green industries, especially for youth; Expand the Small Business Training program.
- **Support small-business incubator programs**, with a focus on the clean tech industry and support for women and minorities.
- **Support fuel switching to reduce carbon emissions**: Explore opportunities to improve efficiency of natural gas systems or convert to electric systems where feasible.
- **Reduce use of HFCs**: Work with agencies (e.g., California ARB and Department of Toxic Substance Control) to assist local business and industry in choosing or shifting to alternative refrigerants that don't use HFCs; Strive to eliminate the use of HFCs in all building construction and remodels.

Sample supporting strategies and actions under other objectives:

- Leverage energy utility programs, rebates, and incentives to improve efficiency of existing buildings (industrial/commercial, residential, City government, and schools), including demand response to reduce peak demand.
- Leverage other third-party programs and financing sources to improve efficiency of existing buildings (e.g., East Bay Energy Watch; PACE EE programs; CA Low Income Home Energy Assistance Program).
- Increase local solar energy generation by connecting businesses and residents to Property Assessed Clean Energy (PACE), low-interest loans, on-bill financing, and other financing programs. Implement City Council approved streamline permitting for residential solar projects.
- Support Transportation Demand Management (strategies and policies to reduce travel demand) to reduce single-occupancy commute trips, including car sharing.
- Leverage existing programs and incentives of local waste service providers, Contra Costa County Green Business Program, West County Household Hazardous Waste Facility, and other groups to increase recycling and composting, and ensure appropriate disposal of hazardous waste.

Stakeholder Breakfast | October 15th, 2015

Green Business Program

- Business may not know about the program.

- The City could let businesses know about the program when they receive their business license.

Commuter Benefit Ordinance

- Businesses could consult with WCCTAC about the commuter benefits program to ensure they select effective strategies to reduce VMT, not just the least costly.
- There needs to be better employer outreach about the commuter benefit program.

Workforce Development

- RichmondBUILD is a public-private partnership that focuses on developing talent and skill in the high growth, high wage construction and renewable energy fields.
- A key issue in the future is solar maintenance and they would like to create an extension for service and repair of solar panels.
- Workforce development programs need more support from City.
    - CAP needs to address this support
    - Award programs to business with Richmond BUILD
- Programs are creative and opportunistic, funded by grant programs, ECIA, and other outside sources
    - Street light upgrades
    - Solar 1
- The program is always looking for a skills match with employers in order to offer other services and training to expand employment opportunities.

Job Creation and Partnership Opportunities

Participants were also asked about the key benefits from the CAP, and they identified the following:

- Healthy working environment
- Commuter benefits, such as transit use, walking and biking
- Energy savings
- Environmental impact
- Business growth
- Interconnectivity of prosperity
- Job creation

Richmond Climate Action Plan

Stakeholder Meeting: Bay Area Air Quality Management District (BAAQMD)
June 24, 2015

Attendees

- Lina Velasco, City of Richmond Senior Planner
- Adam Lenz, City of Richmond Environmental Manager
- Dave Vintz, BAAQMD
- Abby Young, BAAQMD
- Geraldina Grunbaum, BAAQMD
- Jeff Caton, ESA

Meeting Notes

ESA and the City of Richmond met with BAAQMD to Richmond CAP in context of BAAQMD's broader climate protection efforts and 2015 Clean Air Plan update; Richmond's unique challenges to developing a CAP that is sufficient for CEQA tiering (Guidelines section 15183.5), and strategies for deep GHG reductions in a heavily industrialized city.

- Discussed methodology of greenhouse gas (GHG) inventory and the purpose of the CAP. BAAQMD confirmed that we should report Chevron emissions alongside the rest of City's emissions, and not include Chevron it the CAP baseline.
- Dave: We are in a different post-2020 world with respect to GHG emissions and CEQA; with the state's climate stabilization goal (80% below 1990 GHG levels by 2050), Current method of tiering off CAPs is obsolete and 2020 thresholds no longer valid; moving towards a "best practices" approach as to what they will want to see in development projects. They don't have those articulated yet but we can look to the 2014 CARB Scoping Plan to get an indication of what they will be (sector strategies). Can expect zero net energy will be a goal, or close. Offsets will be part of the solution. May take a sector-by-sector approach.
- Climate stabilization threshold: are we doing everything possible? For new development, use BACT, best practices if feasible.
- Richmond CAP will be one of the first to address post-2020 targets; we should stay in close contact with BAAQMD; they are happy to review drafts, etc.
- BAAQMD is still the state's foremost air district in terms of developing GHG policy and guidance; currently working on new GHG thresholds in line with 2050 target, looking at an economic sector approach
- BAAQMD currently working on update to Clean Air Plan, with ARB, looking at 9 economic sectors: Agriculture, electricity, transportation, water, solid waste, Working Lands, SLCPs, fuels/stationary sources. Expect public workshops in September.

- Simultaneously, District is developing a regional GHG inventory, and assessing 58 local gov't CAPs: to identify regulatory, policy, and partnering opportunities.
- BAAQMD looking to partner with local governments to provide guidance and best practices, funnel grant $ and financial incentives, and support outreach and education on climate change.
- Check in with Lauren Casey (Sonoma County) as they are facing similar post-2020 issues and a similar time line.

Richmond Climate Action Plan

Stakeholder Meeting: Rachel Frosh, PhD, MPH, UC Berkeley Professor, Environmental Science, Policy and Management

June 28, 2015

Attendees

- Rachel Frosh
- Adam Lenz, City of Richmond Environmental Manager
- Jeff Caton, ESA
- Eric Yurkovich, Raimi + Associates
- Beth Altshuler, Raimi & Associates

Meeting Notes

Discussed community engagement on EJ & Land Use Planning issues, examples where EL is well articulated and supported by strong actions or implementation programs :

- LA's Clean Up Green Up campaign. Demonstration project; used screening tool; porcess was effective; worked with Liberty Hill Foundation and Planning Commission; combination of carrots and sticks; Rachel has more. Contact Michelle Richards at Liberty Hill Foundation.

Metrics; linking the HiAP strategy to the CAP…Are there specific health indicators or goals from the HiAP Strategy we should incorporate into the monitoring tool / health co-benefits assessment of the CAP?

- Indicators are good, but better at large scale;
- Birth outcome data good at assessing underlying community health (is included in CalEnviroScreen)
- CA Dept of Public Health can geocode with address data at the neighborhood scale
- USC doing some work on relationship between exposures and impact
- Ideas for indicators:
    - Proportion of incarcerated (or institutionalized) people
    - Male to female ratios by race, in under 50 population

CalEnviroScreen:

- Good on socioeconomic indicators (AG forced them to remove race variables)
- data at level then EJ advocates care about
- will improve over time (in perpetual beta mode)
- Rachel favors regional scoring over statewide scoring

Health co-benefits:

- More challenging; Look for upstream indicators

- EPA's risk screening enviro database
- ARB is developing a facilities database; not public yet – David H (former student)
- EPA's Nat'l Air Toxics database should be updated soon (air toxics; source apportionment; off-road and on-road mobile emissions)
- Green infrastructure; heat island risk (Adam has local tree count data). See NLCD data on impervious surfaces and tree canopy – problem is that method changed between older data and 2012 results; NBDI also has data (greenspace)
- ARB interpolates 2.5 data & ozone exceedances, geointerpolated based on monitoring results
- Fresno – Bay Area paper: Looked at disparities by race and income

UC Collaboration

- Lots of eager students; Her PhD student Solange Gould could have some good insights.
- Climate Readiness Institute
- Rachel looking at the suburbanization of poverty

Communication:

- See Dave Roberts TED talk and Grist
- Brenton Mock on social justice

Richmond Climate Action Plan

Stakeholder Meeting: Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC)

September 14, 2015

Attendees

- Lina Velasco, City of Richmond Senior Planner
- Adam Lenz, City of Richmond Environmental Manager
- Therese Trivedi, MTC, Senior Transportation/Land Use Planner
- Vinita Goyal, ABAG Regional Planner
- Alison Brooks, Bay Area Regional Collaborative, Executive Director.
- Jeff Caton, ESA
- Claire Myers, ESA
- Kathrin Tellez, Fehr & Peers

Meeting Notes

- Therese works with cities on supplying planning grants so that cities can adopt specific plans in PDAs. Overseeing climate initiative program. Through that – grant program, new aspect of regional plan. Lots of innovative strategies. Wants to learn more about how they can integrate what we're doing into MTC activities.
- Alison works with air district, MTC, ABAG, and BCDC. Focusing efforts on CC adaptation and mitigation. Working on how to integrate activities among agencies. Works with other regional adaptation collaboratives across the state. Used to do a lot of work with Richmond.
- Discussed methodology of greenhouse gas (GHG) inventory and the purpose of the CAP. ESA described how the Bay Area Air Quality Management District (BAAQMD) is steering away from tiering off CAPs and moving towards a "best practices" approach. The City described how there is significant funding directed at reducing GHGs through transportation and land use, and how the CAP will provide data to support grant applications (e.g., Cap and Trade). In addition, Richmond will receive funds through the Chevron Richmond Refinery Modernization Environmental and Community Investment Agreement (ECIA). Described upcoming Zoning update, South Shoreline Specific plan, and complete neighborhood plan that will support CAP.
- Discussed how the Richmond CAP can best integrate with and support Plan Bay Area through land use, especially in priority development areas (PDAs) with South Shoreline Plan and Downtown Plan, in which CAP policies can be integrated. Discussed other City initiatives currently underway and variety of pilot programs that have been implemented, including transportation demand management (TDM).
- Discussed housing displacement issues and rent control, and CAP objective to develop affordable housing in resilient communities.
- Discussed various TDM programs, carshare, rideshare, and bikeshare programs, and other programs that reduce single-occupancy vehicle use.

- Discussed things the City can do the help MTC and ABAG reach their goals, which included: parking regulations, continued TDM ordinance implementation, improve freeway on/off ramps, reducing idling at rail road crossings, and other ideas.
- Discussed land use initiatives and next round of Plan Bay Area. Next update is 2017. PDAs staying roughly the same… 1 or 2 that went out. Currently looking at forecast to see how it's changed. PDAs will remain primary framework for the plan. Industrial priority zones – they are not sure how these play into GHG reductions. Contra Costa - northern waterfront identified. Jobs, greener economy manufacturing area. Preservation of industrial land, don't lose opportunities for job growth but balance that with GHG goals and housing. Build jobs around transit, not just housing. Balancing act. No one way - different communities need different strategies.

Funding discussion

- Discussed various sources the City could pursue, and where larger reductions may come from. Discussed adaptation at State level and potential for funding. Framework for OBAG 2 is right now. Going back to commission in the fall (Oct/Nov). released in June. OBAG 2 will be less money than last cycle because federally-funded cycle. Very competitive. Look at other sources - e.g., county sales tax measures.
- Therese: Look into "Common Initiatives" program (Innovation grants) - $22M for climate program - 19 projects. $6M now for parking and TDM.
- Cap and Trade funding – opportunity for green alleys, park-work, stormwater management, alternative links from walking perspective. Technical support available, if we have a project that is eligible for SGC grant – there are organizations that can support/help.
- MTC funding perspective: how do you create co-benefits for all these projects that are helping you meet CAP goals? TOA funds. Come up with something in downtown that is connected to your station that would go a long way in meeting…tie into other funding opportuties. Strategic Growth Council. SF got $10M grant. Annual, getting bigger, Richmond very well positioned.
- Active Transportation Grants (CalTrans?). Submit projects there. Not sure about Safe Routes to Transit. Richmond is a perfect place for this. Not a huge city, flat, very bikeable.
- Bike share programs from MTC, ABAG? Big shift in how bike share funding is rolling out. Through private company called Motivate. Oakland, Berkeley, Emeryville. 8,000 bikes, whole plan for how it'll roll out. Some funding ready next year for other cities not part of that. Might be open to the region. Job centers, new campus could play a role. Also, Bay trail.
- Electric vehicle initiatives and programs: VBAAQMD funds a lot of programs. Regional strategy? ABAG Ready Set Charge – best practices and recommendations, permitting recommendations, funding recommendations. Many cities hesitant to go full-speed ahead with chargers.

City of Richmond

GHG Emissions Inventory 2005 Baseline and 2012 Update

APPENDIX B

2005 Baseline Emissions Inventory and 2012 Update

Overview

This document is a revision to the 2005 City of Richmond (City) greenhouse gas (GHG) inventory and a 2012 Inventory update. It quantifies the GHG emissions resulting from activities taking place throughout the City of Richmond and caused by the City's residents, businesses, and local government (i.e., Community Inventory), as well as emissions attributed to local government operations only (i.e., Municipal Inventory). The inventory provides an understanding of where GHG emissions are originating, and creates an emissions baseline against which the City can set emissions reduction targets and measure future progress. The inventory further allows the City to develop effective strategies, programs, and actions to reduce emissions.

The City previously developed and published a GHG inventory for calendar year 2005 that provides a breakdown of GHG emissions by sector to illustrate the contribution of various sources in the community and in municipal operations. The 2005 inventory was developed using ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions for assessing emissions from the community and from municipal operations. As part of the Richmond Climate Action Plan (CAP) development process, the 2005 inventory was revised to reflect new or more accurate information that has since become available, and to include additional sources that were included in the 2012 update. The original 2005 inventory is provided as Appendix B.2.

In addition, this document provides an updated estimate of community-wide and municipal emissions for calendar year 2012. This document provides a description of the emissions sources included in each inventory, as well as those sources that were excluded and the rationale for doing so. The boundaries of analysis, along with the methodology and assumptions used to develop Richmond's GHG inventories are also included. The technical report on transportation modeling of base year and future conditions in Richmond, provided by Fehr & Peers, is included in Appendix C.

Inventory Boundaries

The community inventory encompasses the GHG emissions resulting from activities taking place within the City's boundaries, where the local government has jurisdictional authority. In addition, GHGs attributed to activities taking place outside the City boundaries that support activities in the jurisdiction are also quantified, such as solid waste sent to landfills outside the City.

This inventory includes emissions from four sectors: energy, transportation, solid waste, and water. These sectors represent the largest sources of GHGs, and are prioritized because of the City's ability to influence these sectors and to measure progress in reducing emissions over time. Large industrial emissions, or point source emissions, are included in the energy sector and account for GHG emissions generated on-site at industrial facilities by combustion or other processes. Consistent with BAAQMD guidance, the community inventory is presented using two different perspectives: one including very large energy intensive industrial

facilities that are regulated by the state under AB 32 (there are three such facilities in Richmond, including the Chevron refinery), and one excluding those facilities. With this approach, all emissions in the jurisdiction are accounted for in one inventory, while the alternative perspective provides more comprehensive policy relevance since the results are not highly skewed toward one dominating emissions source.

GHG Emissions Sources

Table 1 provides a summary of the GHG emissions sources quantified in the CAP, providing information for each of the four sectors that are quantified. The table provides a description of the sources that contributed to the GHG emissions for each sector, the type of activity data that was collected for each source, and the entity that provided that data.

GHG Emissions Sources Not Quantified

Emissions from the following sources are omitted due to unavailable or unreliable data, or because they are beyond the scope or influence of the local jurisdiction. While these sources are not included in the community inventory, they are still addressed to some extent in the City's CAP policies and actions. In conjunction with implementing the CAP, the City will work with relevant responsible agencies to encourage emissions reductions from these sources.

GHG emissions sources that were not quantified in this inventory include:

- **Agriculture –** Energy use for water pumping direct methane, N_2O emissions from fertilizer use, enteric fermentation and manure management is excluded as there are few agricultural land uses within Richmond.
- **Consumption of goods produced outside the City** – Manufactured goods produced outside the City, including food and other goods and services, are omitted due to a lack of reliable data.
- **Refrigerants** – Chemical leakage from the installation and disposal of air conditioning and refrigeration units, fire protection units and other industrial process are excluded because of the difficulty in capturing and calculating this information at the community scale.

Table 1. GHG Emissions Sources

Sector	Source	Activity Data (Unit of Measurement)	Description	Data Source(s)
Energy	Electricity	kiloWatt hours (kWh)	Electricity generated and used by residents and businesses	Pacific Gas and Electric (PG&E)
	Natural Gas	therms	Emissions from the combustion of natural gas for use by residents and businesses	PG&E
	Direct Access	kWh	Electricity generated by sources other than PG&E	PG&E
	Point Source Emissions	metric tons carbon dioxide equivalent (CO_2e)	Energy produced from large industrial facility onsite stationary combustion	California Air Resources Board (CARB), Bay Area Air Quality Management District (BAAQMD), Chevron, Republic Services
Transportation	On-road	Vehicle Miles Traveled (VMT)	Vehicle miles driven from trips entirely or partially within Richmond	Contra Costa Transportation Authority (CCTA)
	Off-road	VMT	Percent share of county emissions based on service population estimates	BAAQMD
Solid Waste	Collected Solid Waste	tons of waste	Generation of solid waste picked up from residents and businesses	West Contra Costa Integrated Waste Management Authority (WCCIWMA)
	Self-Haul Waste	tons of waste	Generation of solid waste delivered independently to the landfill	CalRecycle
	Plant Debris	tons of waste	Decomposition of plant debris in landfills	Contra Costa County Community Development Department
Water	Water Consumption	gallons	Energy associated with the use of water in the community	East Bay Municipal Utility District (EBMUD)
	Wastewater Treatment	population	Energy associated with the treatment and conveyance of wastewater	Richmond General Plan, West County Waste Water District

2005 Inventory Revision

Revisions were made to the 2005 inventory for a variety of reasons. In several cases the City had access to previously unavailable data, or more accurate data, for an emissions source. In other cases the methodology used to calculate emissions was updated to be consistent with the 2012 inventory. In all cases, these updates strengthened the accuracy of the 2005 inventory, and facilitate comparison between the 2005 and 2012 inventories.

The 2005 inventory was updated as follows:

- **Commercial/Industrial Natural Gas:** Natural gas attributed to sources regulated by the CARB Cap-and-Trade program were removed from this sector, and added to a new sector, "Emissions Regulated by AB 32."
- **BAAQMD Monitored Point Source Emissions:** Data were disaggregated into emissions regulated by AB 32 and emissions not regulated by AB 32.
- **Transportation – On-road:** Fehr and Peers updated traffic data (vehicle miles traveled) using the Contra Costa Transit Authority (CCTA) model, which is newer and more accurate than the previously used methodology.
- **Transportation – Off-road:** Added emissions from off-road transportation using data from BAAQMD.
- **Solid Waste - Residential and Commercial/Industrial:** Updated 2005 landfill waste data using the City's IRRF report, which is the same source used in the 2012 inventory. Updated the GHG emissions calculations methodology to use the SEEC tool, which is also consistent with the 2012 inventory.
- **Solid Waste – Self Haul:** Added emissions from self-haul waste by looking at 2012 emissions and back-casting 2005 emissions using population.
- **Water:** Added emissions from the treatment, conveyance, and distribution of waster using new data obtained from EBMUD (gallons used and kWh/gallons used for potable water).
- **Water – Wastewater:** Added emissions from wastewater treatment based on population.

Table 2 shows the results of the revised 2005 Community Inventory, including the estimated emissions in metric tons of equivalent carbon dioxide ($MTCO_2e$)[1].

The table also shows the percent contribution of each sector to the City's total emissions with both the inclusion and exclusion of large industrial sources. In 2005, the City of Richmond emitted over 5.6 million $MTCO_2e$, of which approximately 4.9 million $MTCO_2e$ (or 87.6 percent) is attributed to large industrial sources regulated by the California Air Resources Board (CARB) Cap-and-Trade program mandated by Assembly Bill (AB) 32, while the remaining approximately 693,000 $MTCO_2e$ (12.4 percent) is attributed to other activities in the community.

Once large industrial sources regulated by the CARB Cap and Trade program are removed, the Richmond community inventory resembles that of most other cities in California, where energy use and transportation

[1] MT CO_2e combines the global warming potential (GWP), or extent to which each GHG is able to trap heat, for carbon dioxide (CO_2), methane (CH4), and/or nitrous oxide (N_2O) into a single unit of measurement for purposes of comparison.

comprise the vast majority of all emissions and the solid waste, wastewater, and water sectors are responsible for a smaller percentage of total emissions.

Excluding large industrial sources, energy use accounts for approximately half (50.9 percent) of the City's emissions. Approximately 126,118 $MTCO_2e$ (18.2 percent) is attributed to residential energy use, while 226,591 $MTCO_2e$ (32.7 percent) is the result of commercial energy use. As shown in Table 2, these totals reflect the GHG emissions associated with the generation and distribution electricity, and burning of natural gas.

The transportation sector contributed around 287,916 $MTCO_2e$ or 41.5 percent of the inventory (with AB 32-regulated sources removed). Of these emissions, the majority (92 percent) comes from vehicle miles traveled along local roads and state highways (i.e., on-road emissions). GHG emissions associated with trains and other off-road vehicles and equipment in Richmond comprise the other 8 percent of transportation emissions.

Of the total emissions from solid waste (50,214 $MTCO_2e$ and 7.2 percent of the inventory), self-haul waste generated the majority of emissions at 30,829 $MTCO_2e$, followed by commercial and industrial waste at 11,759 $MTCO_2e$, and residential waste at 6,822 $MTCO_2e$. Emissions associated with plant debris were comparatively small at 804 $MTCO_2e$, or less than one percent of the total community inventory. Emissions generated from conveyance, treatment, and distribution of water, and from treatment of wastewater comprise less than one percent of the total community inventory, amounting to around 2,586 $MTCO_2e$ total.

Figure 1 shows the percent of emissions that each sector contributes to the total emissions for the City with large industrial sources included, and **Figure 2** shows community emissions without large industrial sources.

Table 2. 2005 Emissions Inventory Results

Sector	MTCO2e	Percent of Total Including Large Industrial Sources	Percent of Total Excluding Large Industrial Sources
Residential Energy Use	**126,118**	**2.2**	**18.2**
Electricity	39,447	0.7	5.7
Natural Gas	86,671	1.5	12.5
Commercial/Industrial Energy Use	**5,141,573**	**91.7**	**32.7**
"District" Direct Access Electricity	28	0.0	0.0
Commercial/Industrial PG&E Electricity	79,392	1.4	11.4
*Commercial/Industrial PG&E Natural Gas**	118,642	2.1	17.1
Other Direct Access Electricity	13,154	0.2	1.9
Other Direct Access Natural Gas	8,907	0.2	1.3
*BAAQMD Monitored Point Source Emissions Not Regulated by AB 32**	6,468	0.1	0.9
*Emissions Regulated by AB 32**	4,914,982	87.6	0.0
Transportation	**287,916**	**5.1**	**41.5**
*On-road - Local Roads and Highways**	265,705	4.7	38.3
*Off-road - Vehicles and Equipment**	22,212	0.4	3.2
Solid Waste	**50,214**	**0.9**	**7.2**
Plant Debris	804	0.0	0.1
*Residential**	6,822	0.1	1.0
*Commercial and Industrial**	11,759	0.2	1.7
*Self Haul**	30,829	0.5	4.4
Water	**2,586**	**0.0**	**0.4**
*Water**	2,364	0.0	0.3
*Wastewater**	222	0.0	0.0
Total Emissions Including Large Industrial Sources	5,608,408	100	-
Total Excluding Large Industrial Sources	693,426	12.4	100

*** Indicates a revision was made to the calculation data or methodology, and subsequent GHG emissions estimate, since 2005 inventory was initially published.**

Figure 1. 2005 Community Inventory Including AB 32-Regulated Sources

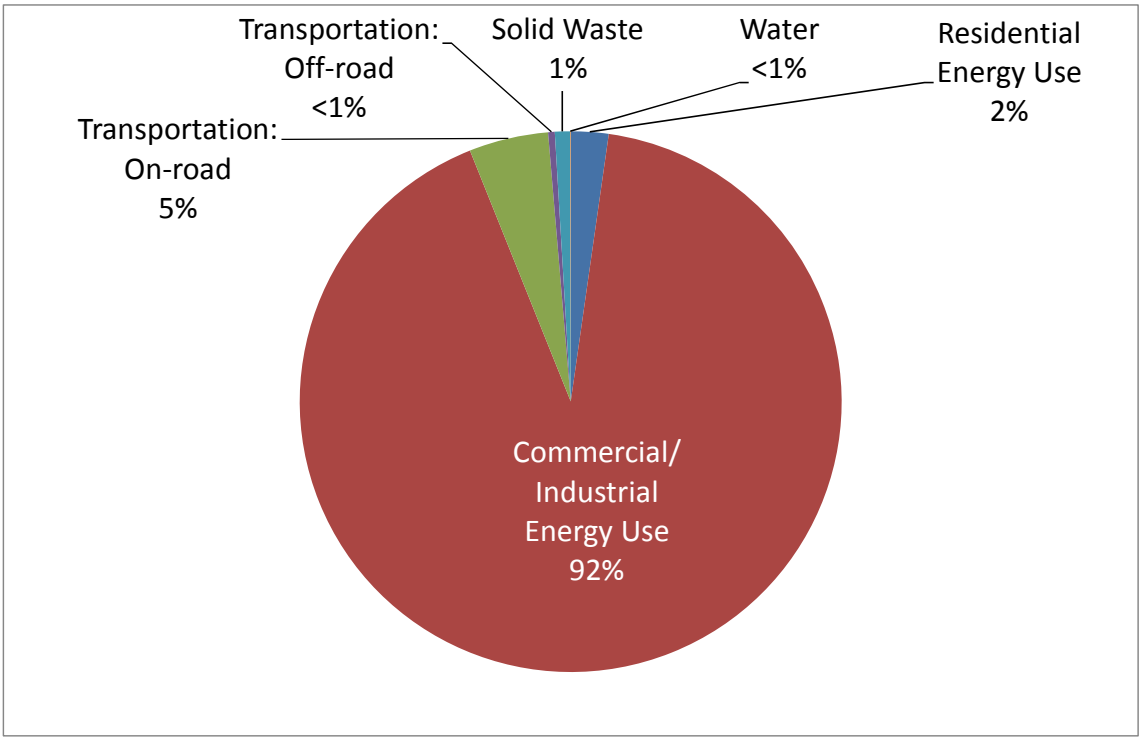
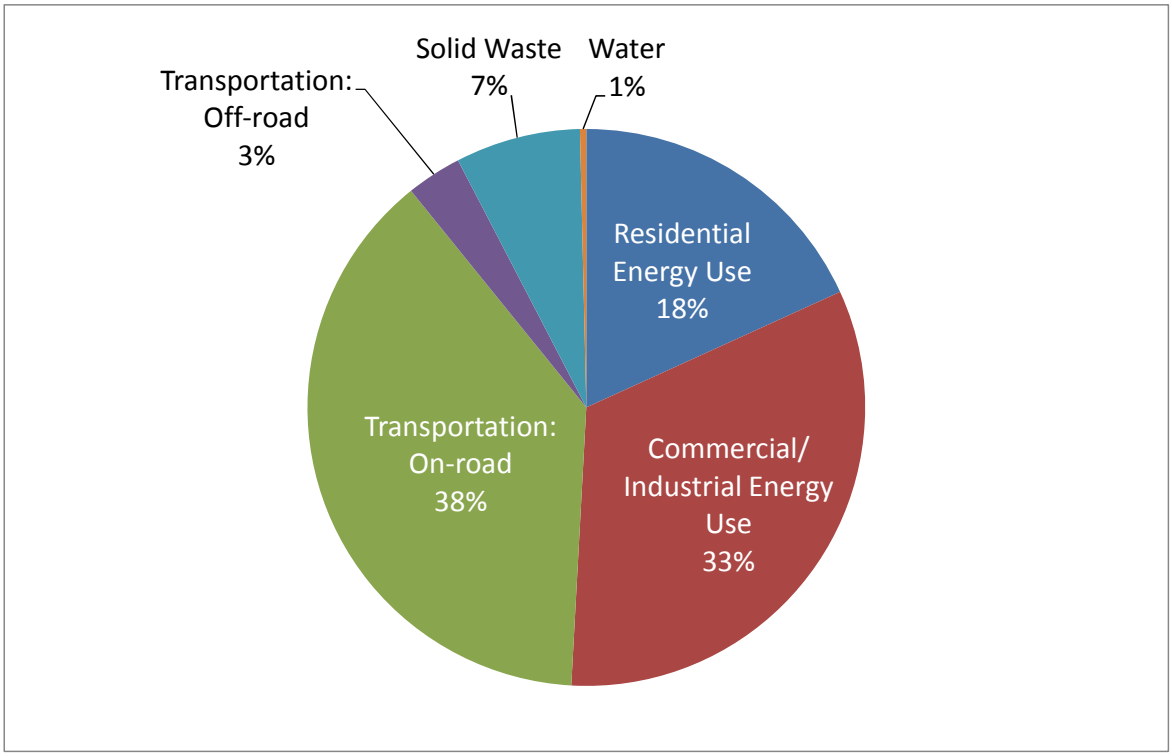


Figure 2. 2005 Community Inventory Excluding AB 32-Regulated Sources



2012 Inventory Results

Table 3 shows the results of the 2012 community inventory, including the estimated emissions with and without large industrial sources regulated the CARB, and the percentage change in emissions from the 2005 community inventory. In 2012, emissions in the City of Richmond totaled almost 4.87 million $MTCO_2e$, approximately 13.2 percent less than in 2005. Emissions from large industrial sources decreased approximately 15.2 percent, from 4.91 to 4.17 million $MTCO_2e$.

With large industrial sources excluded, emissions in the City totaled just over 696,400 $MTCO_2e$, a 0.4 percent increase over 2005. With the exception of transportation, all sectors saw a decrease in emissions between 2005 and 2010. Transportation emissions overall increased by 4.1 percent, with a 2.3 percent increase in on-road emissions, and a 25.2 percent increase in off-road emissions.

Excluding large industrial sources, energy use accounted for around 345,984 $MTCO_2e$ (50 percent of total emissions), of which 120,248 $MTCO_2e$ (17 percent of total) is attributed to residential energy use and 234,643 $MTCO_2e$ (33 percent of total) is attributed to commercial and industrial energy use. Emissions from energy use dropped 6,725 $MTCO_2e$ from 2005 to 2012.

The transportation sector contributed 299,701 $MTCO_2e$ (43 percent of the inventory with AB 32-regulated sources removed). Of these emissions, on-road vehicle miles traveled increased by 6,186 $MTCO_2e$ (approximately 2.3 percent) and off-road vehicle and equipment use increased by 5,599 $MTCO_2e$ (25.2 percent).

Solid Waste emissions also saw an overall reduction to around 49,238 $MTCO_2e$ (a 2.4 percent reduction), mostly attributed to a reduction in emissions from commercial and industrial solid waste (17.1 percent reduction). Emissions from residential waste, self-haul, and wastewater each increased slightly, but not enough to offset the reduction in commercial emissions.

Figure 3 shows the percent of 2012 emissions that each sector contributes to the total emissions for the City with large industrial sources included, and **Figure 4** shows 2012 community emissions without large industrial sources.

Table 3. 2012 Emissions Inventory Results

Sector	MTCO2e	Percent of total Including Large Industrial Sources	Percent of total Excluding Large Industrial Sources	Percent change since 2005
Residential Energy Use	**120,248**	**2.5**	**17.3**	**(4.7)**
Electricity	34,962	0.7	5.0	(11.4)
Natural Gas	85,286	1.8	12.2	(1.6)
Commercial/Industrial Energy Use	**4,395,615**	**90.3**	**32.4**	**(14.5)**
"District" Direct Access Electricity	19	0.0	0.0	(32.1)
Commercial/Industrial PG&E Electricity	74,347	1.5	10.7	(6.4)
Commercial/Industrial PG&E Natural Gas	92,136	1.9	13.2	(22.3)
Other Direct Access Electricity	10,568	0.2	1.5	(19.7)
Other Direct Access Natural Gas	-	0.0	0.0	(100.0)
BAAQMD Monitored Point Source Emissions Not Regulated by AB 32	48,666	1.0	7.0	652.4
Emissions Regulated by AB 32	**4,169,879**	**85.7**	**0.0**	**(15.2)**
Transportation	**299,701**	**6.2**	**43.0**	**4.1**
On-road - Local Roads and Highways	271,891	5.6	39.0	2.3
Off-road - Vehicles and Equipment	27,810	0.6	4.0	25.2
Solid Waste	**48,999**	**1.0**	**7.0**	**(2.4)**
Plant Debris	-	0.0	0.0	(100.0)
Residential	7,256	0.1	1.0	6.4
Commercial and Industrial	9,750	0.2	1.4	(17.1)
Self Haul	31,993	0.7	4.6	3.8
Water	**1,723**	**0.0**	**0.2**	**(33.4)**
Water	1,484	0.0	0.2	**(37.2)**
Wastewater	239	0.0	0.0	7.6
Total Emissions with Large Industrial Sources	**4,866,286**	**100.0**	**-**	**(13.2)**
Total without Large Industrial Sources	**696,407**	**14.3**	**100.0**	**0.4**

Figure 3. 2012 Community Inventory Including AB 32-Regulated Sources

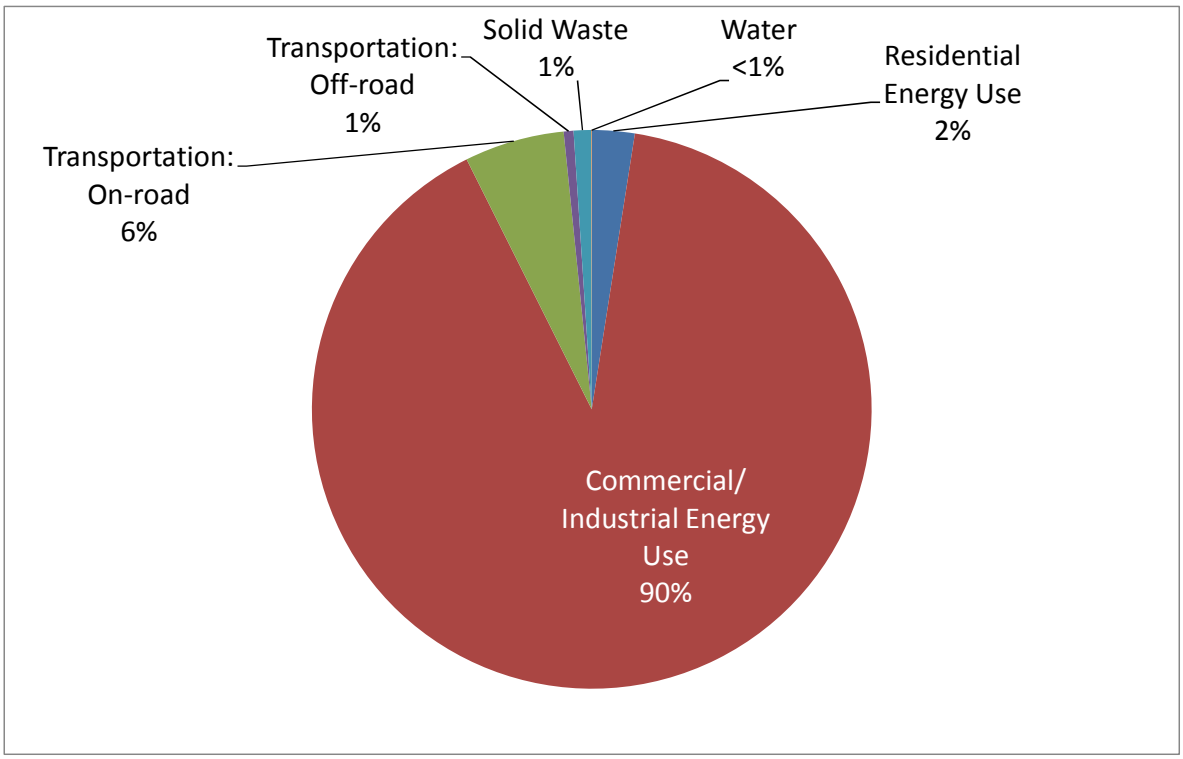


Figure 3. 2012 Community Inventory Excluding AB 32-Regulated Sources

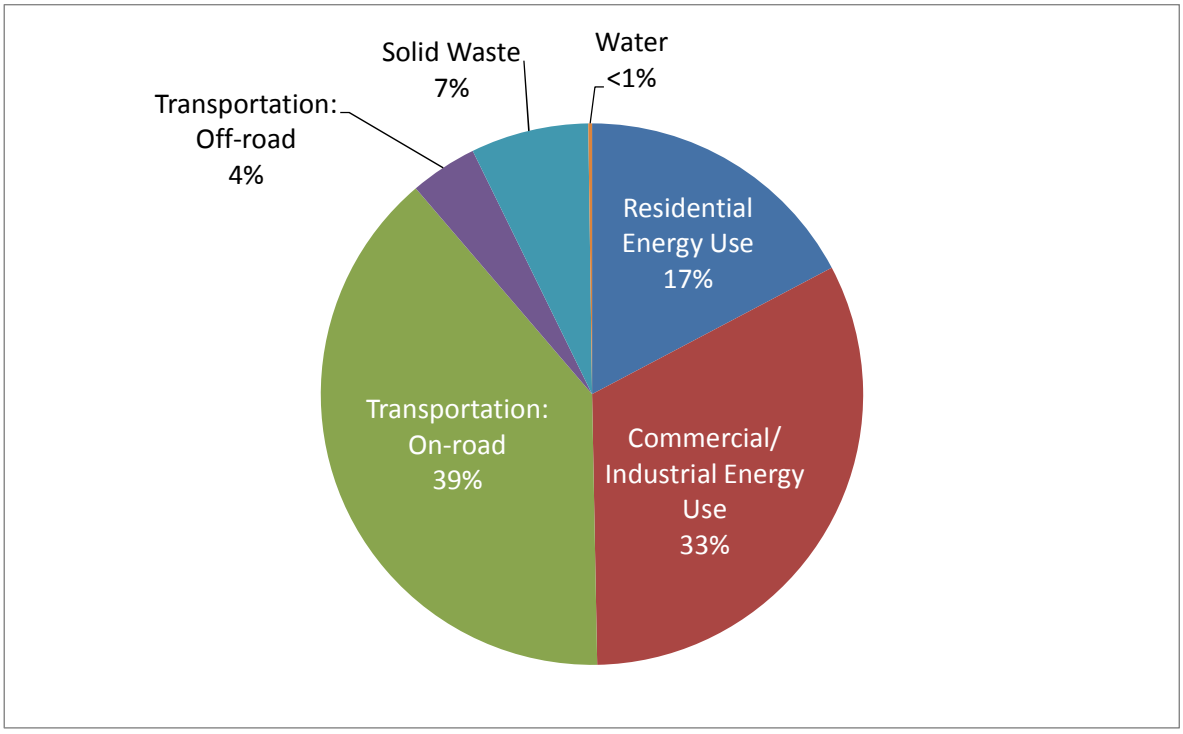
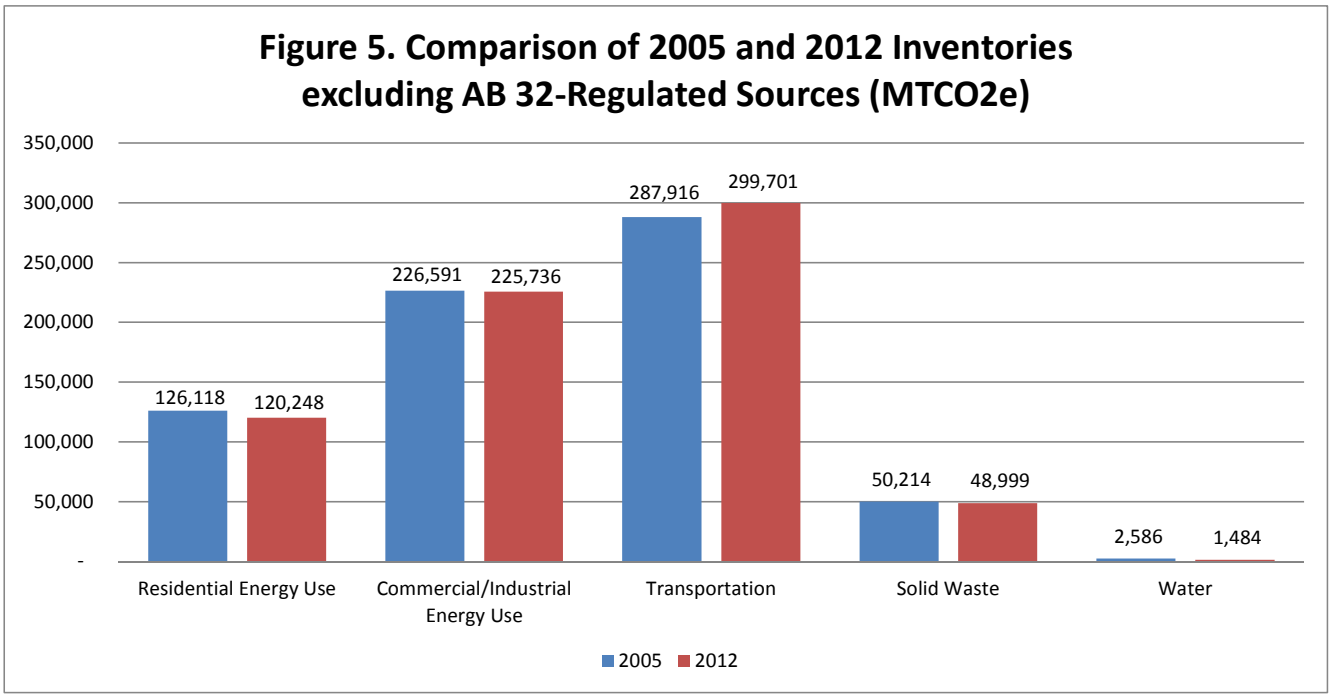


Figure 5 provides a comparison between the two inventory years (excluding AB 32-regulated sources) to further illustrate the change in the City of Richmond's emissions.



2005 and 2012 Municipal Inventories

Emissions from city operations account for less than one percent of community-wide emissions. Despite this low percentage, the City of Richmond recognizes the importance of providing a positive example to the community and is committed to introducing policies and programs to reduce its GHG emissions. Additionally, climate policies meant to reduce emissions have other important benefits for the City to take advantage of such as the cost savings achieved through energy and water efficiency upgrades. The City's municipal inventory includes emissions from: buildings and facilities, streetlights, fleet vehicles, water conveyance and wastewater treatment, solid waste, and fleet vehicles.

In 2005, the municipal emissions resulted in 7,845 $MTCO_2e$ and by 2012, municipal emissions had increased to 8,175 metric tons of CO_2e. In 2005 municipal energy use accounted for the greatest share of emissions at around 46 percent, with the City's vehicle fleet accounting for around 18 percent. In 2012, the City's vehicle fleet had surpassed energy use as the greatest source of municipal emissions at around 35 percent, with energy use accounting for around 33 percent. This was due to an increase in policing activity and the expansion of the police vehicle fleet to meet this need. Emissions from municipal streetlights decreased from 2005 to 2012 as the City began converting to light-emitting diode (LED) streetlights, which use considerably less energy than the typical high pressure sodium (HPS) fixtures that have historically been used.

Table 4. 2005 and 2012 Municipal Inventory Results

	2005		2012		Percent Change 2005-2012
	$MTCO_2e$	Percent	$MTCO_2e$	Percent	
Building	3,599	45.9	2,669	32.6	-26%
Streetlights	1,312	16.7	930	11.4	-29%
Water Sewage	1,005	12.8	1,033	12.6	3%
Waste	543	6.9	701	8.6	29%
Vehicle Fleet	1,386*	17.7	2,842	34.8	105%
Total	**7,845**	**100**	**8,175**	**100**	**4%**

*2005 data unavailable, 2008 used as proxy year

Emissions Forecasts

Using demographic growth projections from the City of Richmond General Plan 2030 for future population, employment, and households, Richmond's business-as-usual (BAU) GHG emissions were forecast for 2020, 2030, 2040, and 2050. Table 5 shows the population, households, and employment estimates used to forecast growth rates for the various emissions sectors in the City of Richmond Community GHG Inventory. The basis for the growth rate for each emissions sector is shown in the far right column of Table 6, under Growth Proxy. In some cases the service population (population plus employment) was used, to more accurately reflect the drivers of sector growth. These growth factors are consistent with growth factors used in the Richmond General Plan 2030, but updated to account for the partial buildout of the Richmond Bay development.

Table 5. Travel Demand Model Growth Estimates

Sector	2005	2012	2020	2030	2040
Population	101,670	105,509	112,530	128,000	140,351
Households	35,750	36,987	39,651	46,460	51,594
Employment	37,780	35,778	40,410	61,220	74,258

Table 6. Adjusted Business-As-Usual Projections

Sector	Actual 2005 MTCO2e	Actual 2012 MTCO2e	Projected 2020 MTCO2e	Projected 2030 MTCO2e	Projected 2040 MTCO2e	Projected 2050 MTCO2e	Growth Proxy
Residential Energy Use	126,118	120,248	128,579	148,442	163,803	180,754	Population and Households
Commercial/Industrial Energy Use	226,591	225,736	254,0961	386,259	468,523	568,308	Employment
Large Industrial (regulated by AB 32)	4,914,982	4,169,879	4,177,735	2,506,641	1,671,094	835,547	AB 32-mandated reductions
On-road Transportation	265,705	271,891	246,587	221,463	230,955	240,855	Service Population
Off-road Transportation	22,212	27,810	31,411	47,586	57,721	70,014	Employment
Solid Waste	50,214	48,999	53,040	65,622	68,435	71,369	Service Population
Water	2,586	1,723	2,845	2,979	2,995	3,013	Service Population
Total BAU Emissions including AB 32-regulated sources	**5,608,408**	**4,866,286**	**4,895,158**	**3,378,992**	**2,663,527**	**1,969,859**	
Total BAU Emissions excluding AB 32-regulated sources	**693,426**	**696,407**	**767,673**	**1,014,851**	**1,141,042**	**1,289,291**	
Total Adjusted BAU Emissions excluding AB 32-regulated sources	**693,426**	**696,407**	**717,423**	**872,351**	**992,433**	**1,134,312**	

Table 6 shows baseline and projected emissions in Richmond through 2050. The first line of forecasts shows projected "business-as-usual" (BAU) emissions based on growth estimates, including AB-32 regulated ((i.e., "large industrial") sources. AB-32 regulated sources are capped at their existing level and decrease over time to comply with the state's Cap-and-Trade legislation. For these sources, emissions in 2020 must be at 1990 levels (equivalent to 15 percent below 2005 levels), and 80 percent below 1990 levels by 2050.

The second line of forecasts in Table 6 shows projected BAU emissions based on growth estimates, excluding AB-32 regulated sources. The third line of forecasts shows projected BAU emissions, excluding AB-32 regulated sources, adjusted for the local impact of state measures designed to reduce GHG emissions. Through its Climate Change Scoping Plan Update of 2014, the State of California establishes a broad framework to reduce GHG emissions to 80 percent below 1990 levels by 2050, across all sectors of the economy. Transportation measures in particular are designed to achieve consistent GHG emissions across the state by increasing vehicle efficiency and reducing the carbon intensity of fuels used by the statewide vehicle fleet. These measures include California's Advanced Clean Car Initiative (Pavley II standards), the Low Carbon Fuel Standard (LCFS), the Tire Pressure Program, the Tire Tread Standard, and the Heavy Duty Vehicle Emission Reduction Program.

Excluding sources regulated by AB 32 and accounting for state measures, community emissions are expected to increase approximately 3 percent between 2005 (the baseline year) and 2020, under business as usual conditions, from 693,426 MTCO2e to 717,423 MTCO2e. This reflects minor increases in emissions in the energy, waste, and water sectors, but a moderate decrease in emissions from transportation despite the state measures described above. Under business as usual conditions, emissions would continue to increase through 2030, 2040, and 2050 to approximately 26 percent, 43 percent, and 64 percent above the 2005 baseline, respectively.

City of Richmond

Fehr & Peers Memorandum

APPENDIX C

- Richmond Climate Action Plan Transportation Baseline
- Future Year VMT Estimates
- VMT Reductions for Transportation Strategies

FEHR PEERS

MEMORANDUM

Date: January 12, 2016

To: Jeff Caton and Claire Myers, ESA

From: Kathrin Tellez, Fehr & Peers

Subject: City of Richmond CAP – Reduction Strategy Quantification

OK15-0059

This memorandum documents the potential reduction in vehicle miles of travel (VMT) that are expected to occur with implementation of the City of Richmond Climate Action Plan (CAP) by 2020 and 2030. Existing and projected future conditions under the future Business as Usual (BAU) scenarios were documented in a memorandum dated August 19, 2015. Since that time, the 2030 scenario was updated to reflect employment and population growth consistent with Contra Costa County Transportation Authority (CCTA) projections, including scenarios without and with development of the South Shoreline Specific Plan Area. Transportation related CAP strategies were identified in consultation with the project team, and includes a variety of measures, including transit enhancements, bicycle and pedestrian infrastructure, and increased participation in transportation demand management programs.

CONCLUSIONS

The CAP transportation measures would reduce overall daily VMT in 2020 by 124,450 VMT per day (an 8 percent reduction), and in 2030 by 182,700 VMT per day (a 12 percent reduction) as compared to the BAU scenarios. VMT per capita, considering both residential and employment population, would be reduced from 9.8 to 9.0 in 2020 and from 9.5 to 8.9 in 2030. With development in the South Shoreline Specific Plan Area (SSSPA), additional housing and employment opportunities would be provided in Richmond by 2030. This development would increase overall VMT, but considering implementation of the CAP strategies, would result in a VMT per capita of 9.1 in 2030.

REDUCTION CALCULATION METHODOLOGY

Some of the measures identified for evaluation were quantified using the Contra Costa County Transportation Authority (CCTA) Travel Demand Model, while others were quantified using off-model

tools and factors. For many of the strategies that are not quantifiable in the regional model, we used the *Quantifying Greenhouse Mitigation Measures* report authored by the California Air Pollution Control Officers Association (CAPCOA), ENVIRON, and Fehr & Peers. This report serves as a statewide benchmark on the quantification of reductions to VMT and GHG from mitigation measures such as the ones evaluated for this CAP.

Many of the measures required additional assumptions to allow for meaningful quantification. Discussions with City staff and the project team, in addition to review of published City documents, led to the assumptions used in the following analysis.

CLIMATE ACTION PLAN VMT CALCULATIONS

The draft strategies and their expected VMT reductions are summarized in **Table 1**. Separate calculations are provided for the 2020 and 2030 conditions. **Table 2** presents the daily VMT and VMT normalized by households and per capita for the analysis scenarios. The results show that VMT is expected to increase between scenario years, with the CAP measures reducing VMT by approximately 8 percent by 2020, and up to 15 percent by 2030 with development of the SSSPA, as compared to the business as usual scenarios.

For the 2030 horizon year, two conditions were evaluated, one with development of the South Shoreline Area consistent with CCTA projections and one assuming build-out of land uses in that area consistent with the draft Specific Plan. The Specific Plan, as currently envisioned, would result in a net-increase in housing units in the plan area of approximately 3,600 and development of approximately 6,400,000 square feet, resulting in a net-increase of up to 23,000 new jobs. As more employment opportunities would be added than households, some new employees would come from outside the City of Richmond, increasing overall VMT and VMT per capita. However, with the implementation of CAP strategies in conjunction with the proposed design and mixture of land uses within the SSSPA, and likely Transportation Demand Management conditions of approval, VMT per household and per capita would be similar to conditions without development in the SSSPA.

Attachment 1 contains additional information for each strategy and the assumptions used to estimate the VMT reduction.

This completes our assessment of the VMT reductions that are likely to occur with implementation of the City of Richmond CAP.

TABLE 1
TRANSPORTATION RELATED POTENTIAL GHG REDUCTION STRATEGIES

Strategy	VMT reduction per day		
	2020	2030	South Shoreline Increment
T1 - Promote Smart Growth and Complete Neighborhoods	20,230	31,460	30,930
T2 - Complete Streets	4,500	4,720	3,090
T3 - Improve Bicycle and Pedestrian Infrastructure	14,700	30,250	15,460
T4 - Improve Signal Timing	--	--	--
T5 - Expand Public Transit Options and improve Connectivity	45,550	74,840	10,610
T6 - Carsharing and Bike Sharing	10,490	11,010	3,090
T7 - Low Carbon Vehicles and Fuels	--	--	--
T8 - Education and Outreach	11,990	12,580	--
T9 - Transportation Demand Management	16,990	17,840	30,480
Total	***124,450***	***182,700***	***93,660***

Source: Fehr & Peers, 2016.

TABLE 2
RICHMOND VMT CALCULATIONS – SHARED ACCOUNTING METHOD

Analysis Scenario	Population	Households	Employment	Daily VMT[6]	VMT / HH	VMT per Capita (Pop + Emp)
2005[1]	101,670	35,750	37,780	1,348,917	37.7	9.7
2012[1]	105,509	36,987	35,778	1,366,033	36.9	9.7
2020 BAU[1]	112,530	39,651	40,410	1,498,344	37.8	9.8
2020 CAP[2]	112,530	39,651	40,410	1,373,894	34.6	9.0
2030 BAU[3]	123,310	42,993	42,808	1,573,074	36.6	9.5
2030 CAP[2]	123,310	42,993	42,808	1,390,374	32.3	8.9
2030 With South Shoreline BAU[4]	130,562	46,621	65,787	1,882,352	40.4	9.6
2030 with South Shoreline + CAP	130,562	46,621	65,787	1,605,992	34.4	9.1

Note:
1. Household, population and employment based on model land uses; VMT based on model.
2. Reflects implementation of the CAP strategies listed in Table 1.
3. Household, population and employment based on 2030 CCTA Model Projections; VMT based on Model
4. Assumes development on the South Shoreline Specific Plan Area consistent with the draft Specific Plan, but no additional CAP measures.
5. Assumes development on the South Shoreline Specific Plan Area consistent with the draft Specific Plan, but with the implementation of additional CAP measures.
6. Does not include through travel; reflects the sum of all internal trips within Richmond and half the trip length for trips with an origin or destination within the City.

Source: CCTA Travel Demand Model, and Fehr & Peers.

ATTACHMENT 1
ASSUMPTIONS BY MEASURE

Measure	Areas and Trip Types Affected	Trip Reduction Assumptions	Applicable VMT Percentage	Percent Reduction	2020 VMT Reduction	2030 VMT Reduction	2030 South Shoreline Increment
T1 - Promote Smart Growth and Complete Neighborhoods Increase Density, Diversity and Decrease Distance to Transit	All Trip Types in Downtown, major Corridors, South Shoreline PDA	Increased residential and employment density by 10% as compared to BAU by 2020 and 15% by 2030; City-wide development would not increase. Approximately 25 percent of SSSPA trips are expected to remain internal to the development area; CCTA model does not fully capture interactions between the variety of land uses; reflects a 10% VMT reduction from the model results for all trips.	50%	2.7% (2020) 4.0 (2030)	20,230	31,460	30,930
T2 - Complete Streets Provides corridor and intersection enhancements to make walking, biking and transit more attractive travel modes.	Affects all trip types, primarily along corridors where implemented.	Assumes enhancements are made to intersections and roadway segments to calm vehicle traffic to decrease vehicle speeds and enhance safety, affecting roadways that carry 25 percent of the City's traffic. Assumes all streets/intersections within SSSPA area designed to accommodate all modes.	100%	0.3% (2020 + 2030) 1.0% (SSSPA Trips)	4,500	4,720	3,090
T3 - Improve Bicycle and Pedestrian Infrastructure Complete portions of the City's bicycle master plan	Commute Trips	Bike plan indicates that bicycle commute trips would increase from 3,566 to 10,698; assume 1,700 new commute trips at an average of 5 mile each way in 2020 and 3,566 new bicycle commute trips in 2030 assuming implementation of 25 percent of plan by 2020 and 50 percent of plan by 2030.	--	--	8,500	17,830	--
	All other trips	Non-commute bike trips would increase from 6,205 to 18,615; Assume 3,100 non-work trips to bicycle share by 2020 at an average length of 2 miles and 6,210 in 2030.	--	--	6,200	12,420	

ATTACHMENT 1
ASSUMPTIONS BY MEASURE

Measure	Areas and Trip Types Affected	Trip Reduction Assumptions	Applicable VMT Percentage	Percent Reduction	2020 VMT Reduction	2030 VMT Reduction	2030 South Shoreline Increment
	SSSPA Trips	Within the SSSPA, assume 5 percent of VMT would be walk/bike trips to/from external locations due to walk/bike infrastructure included as part of the development; absolute number of trips may be a higher percentage, but walk/bike trips tend to replace shorter trips.	--	--			15,460
T4 - Improve Signal Timing	All trip types	Better arterial progression smooths out speed profiles, but does not reduce VMT			--	--	--
T5 - Expand Public Transit Options and Improve Connectivity New Ferry Service; BRT expansion; increased network coverage; decreased headways; new rail station.	All trip types	Assumes ferry service would replace 200 vehicle trips from Richmond Residents to SF at 18 miles each way (18*2*100) by 2020, 400 trips by 2030, and an additional 100 trips with SSSPA development. VMT reduction assumes half the trip length per the CAP accounting metrics.			3,600	7,200	1,800
		20 percent increase in transit network coverage, 20 percent reduction in headways; and conversation of 30 percent of routes to BRT; new commuter rail station at Carlson Boulevard by 2020.	100%	2.8%	41,950	--	--
		30 percent increase in transit network coverage, 30 percent reduction in headways; and conversation of 50 percent of routes to BRT by 2030	100%	4.3%	--	67,640	--

ATTACHMENT 1
ASSUMPTIONS BY MEASURE

Measure	Areas and Trip Types Affected	Trip Reduction Assumptions	Applicable VMT Percentage	Percent Reduction	2020 VMT Reduction	2030 VMT Reduction	2030 South Shoreline Increment
		Transit reductions for SSSPA based Employee Trips accounted for in T-9; reflects trips made for other purposes and residents of SSSPA	100%	4.3%	--	--	8,810
T6 - Carsharing and Bike Sharing Promote the siting of carshare and bike share facilities in Richmond	All-trip types city wide; Bike share supporting measure for T3	Car Share pods located throughout the city such that 75 percent of residents and employees are within half a mile of a car share pod. Allows residents to not own cars, shifting some trips to other modes.	100%	0.7%	10,490	11,010	--
	SSSPA	Within SSSPA, reduction potential increases due to other supporting transit and ped/bike infrastructure.	100% (SSSPA Only)	1.0%			3,090
T7 - Low Carbon Vehicles and Fuels	Affects all trip types city wide	Promote use of PEVs and ZEVs; would not reduce VMT.	--	--	--	--	--
T8 - Education and Outreach	Affects all trip types city wide	Assumes number of residents knowledgeable about transportation options increases by 20 percent; reductions for SSSPA calculated separately as part of TDM measure.	100%	0.8%	11,990	12,580	--
T9 - Transportation Demand Management	Work Trips City-Wide	Assumes a 10 percent increase in participation and number of employees provided transit subsidies and a doubling of employees able to work from home (from 5 percent to 10 percent) at least one day a week.	45%	2.1%	14,160	14,870	--
	School Trips city-wide	Assumes new safe routes to school programs are implemented in at least 25 percent of schools	7%	2.7%	2,830	2,970	

ATTACHMENT 1
ASSUMPTIONS BY MEASURE

Measure	Areas and Trip Types Affected	Trip Reduction Assumptions	Applicable VMT Percentage	Percent Reduction	2020 VMT Reduction	2030 VMT Reduction	2030 South Shoreline Increment
	SSSPA Area	Assumed 100 percent of employees within SSSPA are eligible to participate, with maximum available transit subsidy, parking cash-out, robust marketing, 10 percent of employees with 9/80 alternative work schedules, van pool, shuttle to transit, and ride share program matching.	100% (SSSPA Only)	21.9%	--	--	30,480
Total VMT Reduction					***124,450***	***182,700***	***93,660***
Percent VMT Reduction as compared to Business as Usual					***8.3%***	***11.6%***	***14.7%***

Sources:

1. California Air Pollution Control Officers Association (CAPCOA), *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*, August 2010.
2. *City of Richmond Bicycle Master Plan*, 2011.
3. *Yellow Brick Road Iron Triangle Walkable Neighborhood Plan,* February 2015
4. *South Richmond Transportation Connectivity Plan*, July 2015
5. *South Shoreline Specific Plan, Draft in Progress*
6. *Rumrill Boulevard/13th Street Draft Complete Streets Study*, September 2015

Fehr & Peers, 2016.

City of Richmond

GHG Emissions Reduction Strategies: Quantification

APPENDIX D

CAP Measure Quantification: Common Factors

Metric	#	Unit
Basic Unit Factors		
Hours in a year	8,760	
Hours of daylight in a year	2,920	
Pounds per Metric Ton	2,204.6	
Kwh per Mwh	1,000	
lbs of CO2 emissions from 1 therm of natural gas	11.70	
GHG Emission Factors		
2012 TID Electricity emission factor (lbs/kWh)	0.4890	lbs CO_2/kWh
2012 TID Emission Factor (MT/MWh)	0.2218	MT CO_2/MWh
2012 TID Electricity emission factor (lbs/MWh)	0.0290	lbs CH_4/MWh
2012 TID Electricity emission factor (lbs/MWh)	0.0110	lbs N_2O/MWh
2012 Natural Gas emission factor (kg/MMBtu)	53.0595	kg CO2/MMBtu
2012 Natural Gas emission factor (kg/MMBtu)	11.7000	lbs CO2e/Therm
2012 Natural Gas emission factor (kg/MMBtu)	0.0050	kg CH4/MMBTU
2012 Natural Gas emission factor (kg/MMBtu)	0.0001	kg N2O/MMBTu
Projected City Growth Factors		
2005 Total population	101,670	
2012 Total population	105,509	
2020 Total population	112,530	
2030 Total population	128,000	
2040 Total population	140,351	
2005 Total jobs	37,780	
2012 Total jobs	35,778	
2020 Total jobs	40,410	
2030 Total jobs	61,220	
2040 Total jobs	74,258	100 % SS buildout
2005 Service Population	139,450	population + jobs
2012 Service Population	141,287	population + jobs
2020 Service Population	152,940	population + jobs
2030 Service Population	189,220	population + jobs
2040 Service Population	214,610	population + jobs
2005 Total # of housing units in the City	35,750	Base Housing Units - from CCTA travel model
2012 Total # of housing units in the City	36,987	Base Housing Units - from CCTA travel model
2015 Total # of housing units in the City	37,986	interpolation
2020 Total # of housing units in the City	39,651	Base Housing Units - from CCTA travel model
2030 Total # of housing units in the City	46,460	Base Housing Units - from CCTA travel model
2040 Total # of housing units in the City	51,594	Base Housing Units - from CCTA travel model
City Square Mileage	30.1	sq. mile
City Sphere-of-Influence (SOI) Square Mileage	30.1	sq. mile
City of Richmond Acres in 2005	19,244	Acres
City of Richmond Acres in 2020	19,244	Acres
City of Richmond Acres in 2030	19,244	Acres
Housing Units per Acre in 2005	1.86	units per acre
Housing Units per Acre in 2020	2.06	units per acre
Housing Units per Acre in 2030	2.41	units per acre
Cost Factors		
BLS U.S. Department of Labor: Average Contra Costa	$ 61,932.00	Salary
BLS U.S. Department of Labor: Average Contra Costa	$ 29.78	Hourly Rate

Summary of Richmond CAP GHG Reductions			
ID #	Strategy	MT CO2e by 2020	MT CO2e by 2030
Energy Efficiency Strategies		**55,197**	**261,728**
EE.1	Leverage Existing Programs, Rebates, and Incentives to Improve Efficiency of Existing Buildings	43,758	145,860
EE.2	Leverage Existing Funding Programs and Financing Tools	NA	NA
EE.3	Promote Innovative Design and Enforce Green Building Codes	11,439	115,867
Renewable Energy Strategies		**64,727**	**113,520**
RE.1	Increase Local Solar Energy Generation	3,074	8,422
RE.2	Promote and maximize utility clean energy offerings	48,610	57,390
RE.3	Electrification and Fuel Switching (non-transportation)	13,043	47,709
Transportation and Land Use Strategies		20,481	55,059
TL.1	Promote Smart Growth and Complete Neighborhoods	3,329	6,820
TL.2	"Complete Streets" Designs	741	873
TL.3	Improve Bicycle and Pedestrian Infrastructure	2,419	5,176
TL.5	Expand Public Transit Options and Improve Multi-modal Network Connectivity.	7,496	10,131
TL.6	Promote Car and Bicycle Sharing.	1,726	1,638
TL.7	Promote Low-Carbon Vehicles and Fuels	0	23,770
TL.8	Outreach and Education	1,973	1,530
TL.9	Support Transportation Demand Management	2,796	5,120
**Additional Strategies (Solid Waste, Water, Green Infrastructure and Local Agriculture, (		**28,808**	**56,950**
SW.1	Establish a Zero Waste Framework	27,040	52,755
WA.1	Promote EBMUD Outreach and Conservation Programs	349	800
GA.1	Support Urban Tree-Planting Programs and Local Food and Agriculture Programs	375	1,081
GB.5	Reduce Emissions from Goods Movement	1,044	2,315
Total Emissions Reduced through CAP Actions		**169,214**	**487,257**

STRATEGY EE.1 - Leverage Existing Programs, Rebates, and Incentives to Improve Efficiency of Existing Buildings

Overview

Description	Leverage Existing Programs, Rebates, and Incentives to Improve Efficiency of Existing Buildings
Methodology	Quantification assumes the actions under strategy, in conjunction with the financing tools in EE.2, will enable the City improve the energy efficiency of all (existing) buildings by 50% by 2030 (consistent with SB 350 goal), and an interim result of 15% efficiency performance by 2020. Strategy E3 accounts for Title 24 impact on new construction. Notes: RE strategies account for impact of renewable on future sales after accounting for efficiency gains). Energy savings are "negawatts" that reduce emissions from the BAU curve (Not affected by change in utility EF; Renewable strategy RE2 accounts for utility energy sales after efficiency gains
Supporting Data	PG&E Green Communities, Energy Overview, Savings 2005-2013; MCE Integrated Resource Plan; MCE Implementation Plan. From MCE's 2015 Integrated Resource Plan: MCE has set a goal to reduce annual energy and capacity requirements by 2% through energy efficiency and an additional 5% through demand response programs.

Assumptions and Quantification

Table below assumes 15% reduction in energy use by 2020 and 50% reduction by 2030 (per SB 350)

Table EE.1-3 Utility Energy Efficiency Program Reduction Quantification

Energy Provider	Year	Existing 2015 Energy Use	Estimated kWh Reduced	Estimated Therms Reduced	BAU lbs CO2 per kWh or Therm	Reductions MT CO2e/yr
PG&E Electricity	2020	105,473,280	15,820,992	-	0.445000	3,193
	2030	105,473,280	52,736,640	-	0.445000	10,645
MCE Electricity	2020	449,649,247	67,447,387	-	0.445000	13,614
	2030	449,649,247	224,824,623	-	0.445000	45,381
PG&E Natural Gas	2020	33,854,524	-	5,078,179	11.700000	26,950
	2030	33,854,524	-	16,927,262	11.700000	89,834
TOTAL	**2020**		**83,268,379**			**43,758**
	2030		**277,561,263**			**145,860**

STRATEGY EE.2 - Leverage Existing Funding Programs and Financing Tools	
Overview	
Description	Third party funding programs and financing tools
Methodology	Reductions accounted for in EE1: energy savings attributed to third party energy conservation programs in 2020 and 2030. HERO Residential PACE was rolled out in Richmond in the summer of 2015; For illustration of third party program effectiveness, future participation and energy savings were estimated by averaging participation and savings data for Walnut Creek, Brentwood, Antioch, and Concord which are also located in Contra Costa County (includes kWh reduced through solar photovoltaics).
Data Sources	Data for historic program participation and energy savings was provided by individual program administrators. Oak Ridge National Laboratory, Weatherization Assistance Program Technical Memorandum Background Data and Statistics, March 2010. California Department of Community Services & Development, Statewide Weatherized Homes Breakout. Accessed at: http://www.csd.ca.gov/NewsRoom/NewsReleases/October30,2012/StatewideWeatherizedHomesBreakout.aspx, on August 7, 2015.
No Quantification associated with this strategy	

STRATEGY EE.3 - Promote Green Building

Overview

Description	Quantifies the energy saved through implementation of the CalGreen Building Code (Title 24).
Methodology	Residential assumes Title 24 standards follow linear progression towards Zero Net Energy by 2020. Commercial and Industrial assumes Title 24 standards follow linear progression towards Zero Net Energy by 2030. Energy savings are "negawatts" that reduce emissions from the BAU curve (Not affected by change in utility EF; Renewable strategy RE2 accounts for utility energy sales only after efficiency gains)
Key assumption	If Title 24 does not establish requirements for requiring ZNE for residential buildings by 2020 and ZNE for commercial buildings by 2030, the City will pass a green ordinance establishing similar requirements
Data Sources	Richmond 2005 and 2012 GHG inventory; City of Richmond, Richmond General Plan 2030, Housing Element Update, 2015.

Assumptions and Supporting Calculations

Table EE.3-1 Existing and Projected Households in Richmond

Data	2012	2015	2020	2030
Households	36,987	37,986	39,651	46,460
Residential Electricity Use	171,774,454	176,144,106	183,675,267	212,050,262
Residential Natural Gas Use	16,038,780	16,446,779	17,149,973	19,799,379

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2012	kWh	Therms	Notes
Energy Use per Home in 2012	4,644	434	
Efficiency New Homes to 2015	3,483	325	2013 title 24 is 25% more effriciency than 2008 standard
Efficiency New Homes to 2020	2,508	234	Assumes 2016 title 24 is 28% more efficient than 2013
Annual Saving by 2015	1,159,885	108,300	
Annual savings by 2020	**2,783,724**	**259,920**	2015 savings plus 1,665 new Title 24 (2016 version) new homes by 2020
Annual savings by 2030	**34,405,977**	**3,212,526**	2020 savings +4,249 new net zero households by 2030

Table EE.3-3 Commercial and Industrial Energy associated with New Construction

Sector	Metric	2012	2020	2025	2030	Cumulative 2012 - 2030
Commercial and Industrial Electricity	**BAU Total Energy Use (kWh)**	362,065,534	408,940,361	503,340,891	619,533,009	
	BAU increase for segment		46,874,827	94,400,530	116,192,118	257,467,475
	Average % Energy Savings (5-year period)		40%	70%	100%	78%
	kWh reduced (annual)	-	**18,749,931**	66,080,371	116,192,118	201,022,420
Commercial and Industrial Natural Gas	**BAU Natural Gas Use**	16,630,879	18,783,996	23,120,128	28,457,220	
	BAU Therms increased		2,153,117	4,336,132	5,337,092	11,826,341
	Avg % Energy Savings (period)		50%	75%	100%	82%
	Therms reduced (annual)	-	**1,076,559**	3,252,099	5,337,092	9,665,749

Greenhouse Gas Reduction Quantification

Table EE.3-4 GHG Reduction from Title 24 Imlementation toward Net Zero Energy

Energy Provider	Year	kWh Reduced	Therms Reduced	BAU EF (lbs CO2e/kWh or therm)	Horizon Year EF (lbs CO2e/kWh or therm)	Reductions: Adjusted EF (MT CO2e/yr)
PG&E Electricity	2020	3,660,721	-	0.445000	0.290	739
	2030	30,605,692	-	0.445000	0.242	6,178
MCE Electricity	2020	17,872,934	-	0.445000	0.227	3,608
	2030	204,822,705	-	0.445000	0.047	41,344
PG&E Natural Gas	2020	-	1,336,478	11.700000	12	7,093
	2030	-	12,878,275.28	11.700000	12	68,346
TOTAL	**2020**	**21,533,655**	**1,336,478**	-	-	**11,439**
	2030	**235,428,397**	**12,878,275**	-	-	**115,867**

STRATEGY RE.1 - Increase Local Solar Energy Generation

Overview

Description	Quantifies the energy saved from installing solar photovoltaic (PV) systems through California Solar Initiative Program.
Methodology	Energy Savings (kWh)=Average System Size x # New Systems x Hours of Daylight per Year x Performance Ratio x RPS Adjustment Factor; Savings are "negawatts" that reduce emissions from the BAU curve (Not affected by change in utility EF; Renewable strategy RE2 accounts for energy sales only after efficiency gains)
Data Sources	California Solar Initiative, Working Data Set for City of Richmond; California Solar Initiative Average Solar Installation Size: http://www.pge.com/includes/docs/pdfs/myhome/saveenergymoney/solarenergy/solar_consumer_guide.pdf (pg. 8); Solar capacity factor http://en.wikipedia.org/wiki/Solar_power_in_California. Solar insolation chart: http://www.solarpanelsplus.com/industry-professionals/insolation-charts/

Assumptions and Supporting Calculations

Table RE.1-1 Solar PV System Generation Assumptions

Description	Residential	Commercial		Unit
Average solar installation size	4	174		kW/system
Number of New Solar PV Systems by 2020	644	40		systems
Number of New Solar PV Systems by 2030	1,010	69		systems
Average (over year) solar insolation (full sun hours) per day - Zone 3	5	5		hours per day
Hours of daylight in a year	1,935	1,935		hrs/yr
Performance Ratio	80%	80%		Percent
Total Solar PV electricity generated by 2020	3,984,141	10,740,800		kWh/yr
Total Solar PV electricity generated by 2030	6,255,134	18,412,799		kWh/yr

Table RE.1-2 HERO Residential Solar Installations

Program/Sector	kWh generated
HERO Solar PG&E by 2020	118,952
HERO Solar PG&E by 2030	304,996
HERO Solar MCE by 2020	580,767
HERO Solar MCE by 2030	2,041,124

Greenhouse Gas Reduction Quantification

Table RE.1-3 GHG Reductions from Solar Energy Generation

Energy Provider	Year	Annual kWh generated	2012 EF (lbs CO2e/kWh or therm)	Horizon Year Utility EF (lbs CO2e/kWh or therm)	EF of Installed PV systems	Reductions from BAU (MT CO2e/yr)
PG&E Electricity	2020	2,523,462	0.445000	0.290	0.0	510
	2030	3,246,481	0.445000	0.242	0.0	655
MCE Electricity	2020	12,703,738	0.445000	0.227	0.0	2,565
	2030	23,236,880	0.445000	0.047	0.0	4,692
TOTAL	**2020**	**15,227,200**	-	-		**3,074**
	2030	**26,483,360**	-	-		**8,422**

STRATEGY RE.2 - Promote and Maximize Utility Clean Energy Offerings.

Overview

Description	By 2030, by partnering with the City, MCE will be supplying approximately 87% of the City's purchased electricity from sources that MCE is committing to be 95% zero carbon (by 2025), while PG&E will be supplying electricity the remainder from sources that are at least 50% zero carbon to be in compliance with the state RPS.
Methodology	Quantifies the GHG emissions difference in supplying electricity with a 2012 carbon content with the lower carbon electricity expected in MCE's and PG&E's supply for the horizon years 2020 and 2030 due to higher percentages of renewables. Note that we are accounting for impact of renewables on future sales after accounting for efficiency gains; annual electricity sales go down between 2020 and 2030 as the effect of efficiency measures outpaces growth of energy use.
Data Sources	MCE's 2015 Integrated Resource Plan MCE, Understanding MCE GHG Emissions Factor, 2013. MCE, Revised Implemenatation Plan, 2013. Email correspondance with Alice Stover from MCE, dated 9-17-15. MCE, Integrated Resource Plan, 2014. California Climate Action Registry The Climate Registry GHG Emission Factors: Guidance for PG&E Customers, November 2015 RPS Quarterly Report; Q1 2013

Assumptions and Greenhouse Gas Reduction Quantification

Table RE.2-1 GHG Reductions From Increasing Renewables in Utility Portfolio

Utility	Year	kWh sales	RPS	Carbon Free	EF (lbs/kWh)	MT CO2e Reduced	MT CO2e footprint	Notes
PG&E	2005	507,101,675	19%		0.489			PG&E
	2012	533,839,988	19%		0.445			PG&E
	2020	80,277,237	33%		0.290	5,644	10,563	state mandate (RPS); published PG&E EF forecast
	2025	58,662,706	40%		0.270	4,665	7,178	state mandate RPS (SB 350); published PG&E EF forecast
	2030	37,836,500	50%		0.242	3,490	4,149	state mandate RPS (SB 350); published PG&E EF forecast
MCE	2005	-	NA		0.489	-		
	2012		NA		0.445	-		
	2013		50%	60%	0.364	-		RPS and EFnumbers from MCE reports
	2015	449,649,247	54%	60%	0.337	22,036	68,745	RPS and EF from MCE reports & email correspondence on 11/19/15 and 11/20/15
	2020	391,941,806	63%	76%	0.227	38,835	40,290	RPS and EF from MCE reports & email correspondence on 11/19/15 and 11/20/15
	2025	319,478,878	80%	95%	0.047	57,647	6,842	
	2030	253,213,499	80%	95%	0.047	45,690	5,423	RPS and EF from MCE reports & email correspondence on 11/19/15 and 11/20/15
Direct Acess	2005							
	2012	52,021,290	19%		0.445	-		
	2020	58,756,228	33%		0.290	4,131	7,731	
	2030	89,014,013	50%		0.242	8,210	9,760	
Total	**2020**	456,991,844	-		-	**48,610**		
	2030	264,566,639	-		-	**57,390**		

STRATEGY RE.3 - Promote Switching From Natural Gas to Clean Electricity

Overview

Description	Quantifies the impact of converting residential and commercial natural gas systems to electric systems powered by renewable energy or solar thermal systems.
Methodology	Assumes reductions are not double-counted in EE1 (50% energy efficiency improvement in buildings by 2030) as this strategy is about fuel switching, not efficiency. Residential: assumes 6.3 percent of existing homes replace natural gas water heaters each year, and 57% of replacements are electric models, consistent with NEEA Report. Commercial: assumes 6 percent of total natural gas use is electrified by 2020, and 13% by 2030, supporting a study by Wei et al that concludes that by 2050 electrification of 39 percent of commercial and industrial gas use is needed to meet the State's 2050 GHG reduction target.
Data Sources	CEC, Statewide Appliance Saturation Survey, 2009; Northwest Energy Efficiency Alliance (NEEA), 2011. Water Heater Market Update, January 16, 2012; PG&E Energy Use Data; Wei, et all. Deep carbon reductions in California require electrification and integration across economic sectors, 12 March, 2013.

Assumptions

Table RE.3-1 Projected Energy Savings from Residential Electrification

Data	Activity Data	Total Use (therms)	Therms for Water Heating
State Average Natural Gas Consumption (therms)	-	354	173
Richmond Natural Gas Consumption (therms)	-	434	212
Richmond Total Households	36,987	16,038,780	7,859,002
Annual # of households replacing water heater	2,330	1,010,443	495,117
Annual # of households installing electric model	1,328	-	282,217
2020	6,641	-	1,411,084
2030	19,923	-	4,233,252

Table RE.3-2 Projected Energy Savings from Commercial and Industrial Electrification

Data	2012	2020	2030
Commercial and Industrial Natural Gas	16,630,879	18,783,996	28,457,220
Percent NG Use remaining	-	**0.94**	**0.83**
Natural Gas Use after Electrification	-	17,737,459	23,700,799
Natural Gas Savings (delta from BAU 2012)	-	1,046,537	4,756,421

Greenhouse Gas Reduction Quantification

RE.3-3 Electrification and Fuel Switching Reduction Quantification

Sector and Year	Therms Reduced	EF (lbs CO2e/therm)	Reductions (MT CO2e/yr)
Residential Natural Gas Reduced 2020	1,411,084	11.7	7,489
Residential Natural Gas Reduced 2030	4,233,252	11.7	22,466
Commercial Natural Gas Reduced 2020	1,046,537	11.7	5,554
Commercial Natural Gas Reduced 2030	4,756,421	11.7	25,243
Total Natural Gas Reduced 2020	2,457,621	11.7	**13,043**
Total Natural Gas Reduced 2030	8,989,673	11.7	**47,709**

Transportation and Land Use Strategies TL.1-TL.9

Overvie

Description	Quantifies the reduction in vehicle emissions attributed to reductions in vehicle miles traveled for seven different VMT reduction strategies
Methodology	Shared accounting method for VMT using Contra Costa County Transportation Authority (CCTA) Travel Demand Model; VMT reduction estimates converted to GHG based on EMFAC 2014 results for annual MT CO2e per daily VMT ; For Low Carbon Vehicle uptake: Assumes 2020-2025 EV population increase trend continues after 2025 through 2030
Data Sources	See Fehr and Peers memos of 8/19/15 (RICHMOND VMT CALCULATIONS – SHARED ACCOUNTING METHOD) Table 2, and 1/12/16 (City of Richmond CAP – Reduction Strategy Quantification) Table 4; EMFAC2014 Web Database, Contra Costa County, 2005, 2012, 2020 and 2030 Calendar Years, http://www.arb.ca.gov/emfac/2014/; USEPA, Greenhouse Gas Emissions from a Typical Passenger Vehicle, February 2005. For the strategies that are not quantifiable in the regional model, used the Quantifying Greenhouse Mitigation Measures report authored by the California Air Pollution Control Officers Association (CAPCOA), ENVIRON, and Fehr & Peers

Assumptions

Table TL.2-1 Emissions Factor for VMT Reductions

Year	Source	Daily VMT	Daily MTCO2	Daily MTCO2e	Annual MTCO2	Annual MTCO2e			Annual MT CO2e/ daily VMT
2012	EMFAC 2014	1,366,033	725	768	256,501	271,891			**0.199**
2020	EMFAC 2014	1,498,344	657	697	232,629	246,587			**0.165**
2030	EMFAC 2014	1,820,496	590	626	208,927	221,463			**0.122**

Greenhouse Gas Reduction Quantification

Table TL.2-2 Projected GHG Reductions from Transportation Emissions

ID #	Strategy	Reductions in 2020		Reductions in 2030 - CCTA Projection		Reductions in 2030 from South Shoreline Increment (100%)		Total Reductions in 2030 = CCTA + South Shoreline Increment (80%)	
		daily VMT	Annual MT CO2e	daily VMT	Annual MT CO2e	daily VMT	Annual MT CO2e	daily VMT	Annual MT CO2e
TL.1	Promote Smart Growth and Complete Neighborhoods	20,230	3,329	31,460	3,827	30,930	3,763	56,064	6,820
TL.2	Complete Streets	4,500	741	4,720	574	3,090	376	7,178	873
TL.3	Bicycle and Pedestrian Infrastructure	14,700	2,419	30,250	3,680	15,460	1,881	42,548	5,176
TL.4	Improve Signal Timing	-	-	-	-	-	-	-	-
TL.5	Expand Public Transit Options and Improve Connectivity	45,550	7,496	74,840	9,104	10,610	1,291	83,280	10,131
TL.6	Expand Car and Bicycle Sharing	10,490	1,726	11,010	1,339	3,090	376	13,468	1,638
TL.7	Promote Low-Carbon Vehicles and Fuels	-	-	195,399	23,770	-	-	195,399	23,770
TL.8	Outreach and Education	11,990	1,973	12,580	1,530	-	-	12,580	1,530
TL.9	Transportation Demand Management	16,990	2,796	17,840	2,170	30,480	3,708	42,086	5,120
Total		**124,450**	**20,481**	**378,099**	**45,996**	**93,660**	**11,394**	**452,603**	**55,059**

STRATEGIES TL7: Promote Low-Carbon Vehicles and Fuels - effective VMT reduction calculations

Description	Richmond is committed to supporting the proliferation of plug-in electric vehicles(PEVs) and other zero emissions vehicles (ZEVs), and is actively seeking funding to expand programs for supporting and expanding PEV infrastructure , and incenting the purchase and and sharing of PEVs. Potential sources of funding inlcude the Chevron ECIA and CEC grants.
Methodology	The EMFAC2014 model accounts for the GHG emissions standards in future years that will reduce emissions as cleaner vehicles increase their penetration rates into the fleet. The Pavley standard determines the fleet average fuel economy of vehicles sold in California. The penetration of ZEV vehicles is one of many ways in which these standards may be met. Assumptions of ZEV penetration are built in to EMFAC 2014 at the county level. Currently the assumption in EMFAC is that ZEV sales as percent of total vehicles sold remain constant after 2025. Quantifcation for this measure is based on the assumption that EV sales continue to accellerate after 2025 esitmates built into EMFAC, but assumes the 2020-2025 EV population increase rate in Contra Costa County continues through 2030, and in Richmond the EV population is 25% higher than the County average by 2030. On March 23, 2012, Governor Brown issued Executive Order B-16-20124 to encourage ZEVs in California and set a long term goal of reaching 1.5 million ZEVs on California's roadways by 2025. The Executive Order established milestones for three periods: 2015, 2020, and 2025. Infrastructure goals include by 2015, California's major metropolitan areas will be able to accommodate ZEVs through infrastructure plans; by 2020, California's ZEV infrastructure will be able to support up to 1 million vehicles; and by 2025, 1.5 million ZEVs will be on California's roadways with easy access to infrastructure. The metropolitan areas of Los Angeles, San Diego region, and the San Francisco Bay Area lead the State in PEV sales.
Data Sources	EV data source: EMFAC2014 Web Database (http://www.arb.ca.gov/emfac/2014/) EMFAC2014 Volume III - Technical Documentation

EV Population Summary by County

Jurisdiction	Year	EV Population	Total Population	% EV	EV Sales in year as % of total	Estimated % EVs in CC County	Estimated % EVs in CIty of Richmond	% EVs in CIty of Richmond based on Gov Order
Contra Costa County	2020	7,614	673,154	1.1%	4.9%	1.1%	1.1%	1.1%
	2025	27,455	716,328	3.8%	9.7%	3.8%	3.8%	5.3%
	2030	50,645	774,137	6.5%	9.7%	13.8%	17.3%	9.0%
	2035	68,763	829,972	8.3%	9.7%			
	2040	80,920	883,028	9.2%	9.7%			
Alameda County	2020	11,188	1,086,299	1.0%	4.9%			
	2025	38,863	1,124,923	3.5%	9.6%			
	2030	70,709	1,191,939	5.9%	9.6%			
	2035	95,839	1,253,982	7.6%	9.6%			
	2040	111,729	1,306,189	8.6%	9.6%			
Statewide	2020	307,181	27,165,384	1.1%	4.9%			
Governor's order	2025	1,500,000	28,500,000	5.3%		from EMFAC 2014 tech documentation - vol III		
	2030	2,829,868	31,500,000	9.0%		from EMFAC 2014 tech documentation - vol III		
	2040	3,133,990	36,804,693	8.5%	9.6%			

City of Richmond Estimates	No.	Units
2020 EV population - EMFAC 2014 estimate	793	EVs
2025 EV Population - City of Richmond	-	EVs
2030 EV Population - City of Richmond	14,132	EVs
2020 Richmond total vehicles	70,075	
2020 BAU Daily Richmond VMT	1,498,344	miles
2020 miles/vehicle/day	21.38	miles/vehicle
2020 City VMT from EVs	16,948	EV daily VMT
2020 City VMT from EVs (EMFAC baseline)	16,948	EV daily VMT
Reduction = 2020 VMT from EVs over EMFAC	-	**daily VMT**
2030 Richmond total vehicles	81,806	
2030 BAU Richmond Daily VMT	1,820,496	miles
2030 miles/vehicle/day	22.25	miles/vehicle
2030 City VMT from EVs with increased sales assumption	314,498	daily VMT
2030 City VMT from EVs (EMFAC baseline)	119,099	daily VMT
Reduction - 2030 VMT from EVs over EMFAC	195,399	**daily VMT**

STRATEGY SW.1 - Establish a Zero Waste Framework

Overview	
Description	Reduction in emissions from landfill methane due to reduction of waste sent to landfill with adoption of Zero Waste Ordinance and achieving 75% diversion by 2020, and 90% diversion by 2030. Baseline diversion rate for 2005 = 49%.
Methodology	Top down quanitficaiton method assumes methane production from unit waste volume remains constant as diversion rate increases
Data Sources	CalRecycle Jurisdiction Diversion/Disposal Progress Report for West Contra Integrated Waste Management Authority, 2005 report available at: http://www.calrecycle.ca.gov/lgcentral/Reports/jurisdiction/diversiondisposal.aspx (accessed March 2016)

Assumptions and GHG Reduction Quantifiation

Table SW.1 Solid Waste GHG Reductions

Year	MT CO2e	Diversion Rate Percentage
	53,040	2020 BAU landfill emissions from waste (49% diversion)
	65,622	2030 BAU landfill emissions from waste (49% diversion)
	26,000	2020 CAP Landfil Emissions (25% going to landfill instead of 51%)
	12,867	2030 CAP landfill Emissions (10% going to landfill instead of 51%)
2020	**27,040**	2020 Reduction from BAU
2030	**52,755**	2030 Reduction from BAU

STRATEGY WW.1 - Promote EBMUD Outreach and Conservation Programs

Overview

Description	Assumes compliance with State's SB 7x Regulation to reduce percapita water consumption by 20 percent. Assumes 30% reduction in water consumption by 2030.
Methodology	Percent reduction in emissions from reduced treatment and delivery.
Data Sources	Richmond GHG Inventory

Assumptions

Table WW.1-1 Assumptions for SB 7x Reductions

Description		Data	Unit
Water	Total GHG Emissions in 2012	1,484.0	MT CO2e
	Total GHG Emissions in 2020	1,616.0	MT CO2e
	Total GHG Emissions 2030	2,295.0	MT CO2e
	Percent Reduction in Water Consumption 2020	20%	%
	Percent Reduction in Water Consumption 2030	30%	%
Wastewater	Total GHG Emissions in 2012	239.2	MT CO2e
	Total GHG Emissions in 2020	260.0	MT CO2e
	Total GHG Emissions 2030	370.0	MT CO2e
	Percent Reduction in Water Consumption 2020	20%	%
	Percent Reduction in Water Consumption 2030	30%	%

Greenhouse Gas Reduction Quantification

Table WW.1-2 GHG Reductions from Water Strategies

Water	Total GHG Savings by 2020	297	MT CO2e
	Total GHG Savings by 2030	689	MT CO2e
Wastewater	Total GHG Savings by 2020	52	MT CO2e
	Total GHG Savings by 2030	111	MT CO2e
Combined	**Total GHG Savings by 2020**	**349**	**MT CO2e**
	Total GHG Savings by 2030	**800**	**MT CO2e**

STRATEGY GA.1 - Support Urban Tree Planting Programs

Overview

Description	Quantifies the energy savings associated with planting shade trees on residential properties.
Methodology	For household energy savings calculations (shade trees), assumes 4% of households plant a tree by 2020 and 10% by 2030; emission reductions associated with sequestration and with local food and agriculture are not quantified
Data Sources	McPherson, E. G., Simpson, J. R., Xiao, Q. F. and Wu, C. X. (2011) Million Trees Los Angeles canopy cover and benefit assessment. Landscape and Urban Planning 99, 1, 40–50. Rosenfeld, A.H., Romm, J.J., Akbari, H., Pomerantz, M., 1998. Cool communities: strategies for heat island mitigation and smog reduction. Energy and Building 28, 51–62 Nowak et al - Carbon storage and sequestration by trees in urban and community areas of the United States SMUD Shade Tree Benefit Calculator https://usage.smud.org/treebenefit/iDefault.aspx; EPA http://www.epa.gov/heatisland/resources/pdf/toronto_energysavings.pdf Carbon Dioxide Sequestration, Storage, and Offsets by Gainesville's Urban Forest - https://edis.ifas.ufl.edu/fr272;

Assumptions

Table GA1-1 Assumptions for Shade Tree Planting

Description	#	Unit
Carbon sequestration rate (McPherson et al, and Resenfeld, et al)	18	kg CO2e per tree annually
Projected Residential Electricity Use in 2020	183,675,267	kwh/year
Projected Residential Natural Gas Use in 2020	17,149,973	therms/year
Number of Housing Units in 2020	41,303	housing units
Number of Housing Units participating in program by 2020 (4%)	**1,652**	**housing units**
5% Reduction in energy use for residences	0.050	
Projected Residential Electricity Use in 2030	212,050,262	kwh/year
Projected Residential Natural Gas Use in 2030	19,799,379	therms/year
Number of Housing Units in 2030	46,460	housing units
Number of Housing Units participating in program by 2030 (10%)	**4,646**	**housing units**
Number of trees in Richmond counted in 2013 Urban Tree Inventory	22,051	trees
Number of additional tree planting sites identified in 2013 Urban Tree Inventory	13,000	sites
Avg Annual tree planting target over 14 years	**332**	**trees**
2020 tree planting target	**1,652**	**trees**
2030 tree planting target	**4,646**	**trees**
2012 Electricity emission factor (PG&E)	0.445	Metric Tons/MWh
2020 Electricity EF (aggregate PG&E and MCE)	0.237	Metric Tons/MWh
2030 Electricity EF (aggregate PG&E and MCE)	0.072	Metric Tons/MWh
Natural Gas emission factor (kg CO2/MMBtu)	53	kg CO2/MMBtu
# of trees planted per year	332	

Greenhouse Gas Reduction Quantification

Table GA1-2 GHG Reductions from Shade Tree Planting

Description	#	Unit
Sequestration by 2020	30	metric tons CO2
Sequestration by 2030	84	metric tons CO2
Total residential electricity savings by 2020	367,351	kwh/year
Total residential natural gas savings by 2020	34,300	therms/year
Total residential electricity savings by 2030	1,060,251	kwh/year
Total residential natural gas savings by 2030	98,997	therms/year
Total GHG Emissions Savings by 2020	**375**	metric tons CO2
Total GHG Emissions Savings by 2030	**1,081**	metric tons CO2

STRATEGY GB.5 - Reduce Emissions from Goods Movement

Overview

Description and Methodology	Reduces industrial emissions, beyond those emissions reduced by other measures in the CAP. This measure accounts for reductions in carbon emissions by 2020 estimated for the Port of Richmond Clean Air Action Plan (CAAP), and assumes the Port will reduce its emissions to 20 percent by 2030, consistent with similar efforts by Ports of Long Beach and Los Angeles.
Data Sources	Port of Richmond Clean Air Action Plan (2010), Port of Long Beach Emissions Inventory (2014), and Port of Long Beach Emissions Inventory (2014).

Assumptions and GHG Reduction Quantifiation

Year	Year	MT CO2e	Percent	Notes
Reduce Port Emissions	2010	11,573	-	Baseline Emissions (BAU)
	2020	1,044	9%	= Emissions reduced from implementation of CAAP (Port of Richmond Clean Air Action Plan (2010) Table 5, Page 20. Assumes scenario with "implementation of 0.1 [or 0.5] percent sulfur fuel requriements along with [vessel speed reduction] program and truck program.")
	2030	2,315	20%	= Emissions reduced from continued implementation of CAAP. Assumes Port of Richmond achieves up to 20 percent reduction in emissions, or double the estimated emissions savings, similar to that achieved by the Port of Long Beach by 2014 (see Emissions Factcard and Emissions Inventory 2014) and the Port of Los Angeles [see Port of Los Angeles Air Emissions Inventory (2010) Table ES.6 on page ES-11].

APPENDIX E. Implementing Actions

As described in Chapter 4, *Goals, Objectives and Strategies*, the CAP includes 40 strategies organized under eight objectives. Implementation of each strategy is prioritized according to several evaluation criteria, and summarized with relevant existing programs that support strategy implementation, an overarching implementation strategy, and specific implementing actions.

Figure E.1: Relationship of CAP Components

The CAP is the culmination of several years of work, and organizes the City's past and future path with that of the growing state and worldwide movement to address the causes of human-induced climate change. The strategies in the CAP were developed to complement these existing efforts, and support the implementation of future state legislation and local initiatives that are anticipated to occur by 2030. **Figure E.2** provides a timeline of the past and current state and local actions that are paving the way for climate change action in the future.

Each strategy is prioritized for implementation using the 11 criteria indicated below. These criteria were developed with input from the public to capture the most important features of each strategy, including but not limited to the costs, benefits, potential funding sources, implementation responsibility, and other key features of each strategy. **Table E.1** lists and describes each of the11 criteria.

PARTNERSHIPS AND COMMUNITY ENGAGEMENT

Each strategy identifies relevant existing and potential implementation partnerships with outside agencies, utilities, stakeholder groups, community-based organizations, and others, and describes specific opportunities for leveraging funding and other resources, existing programs, and outreach. One of the CAP's four main goals is an Engaged Community and Educated Youth. Sustained community outreach, participation, and education activities are critical to CAP support and implementation, and the City will rely on partnerships to accomplish the level of community interaction needed.

Figure E.2: Past and Current Climate Actions at the State, Regional, ad Local Level

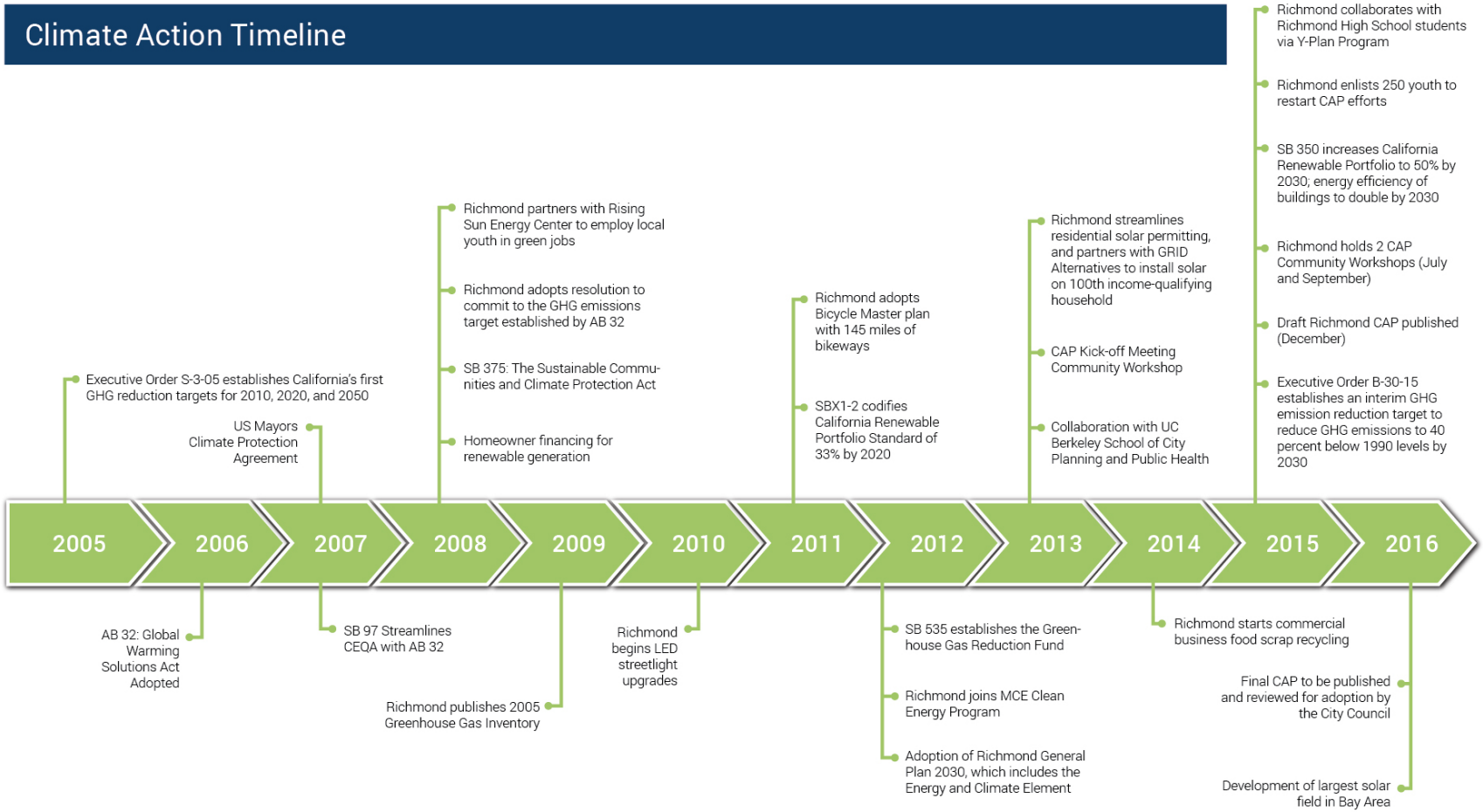

Table E.1: Strategy Evaluation Criteria

Criteria	Description
Performance Goal	Describes the desired impact that strategy implementation will have by 2030 (e.g., improve the energy efficiency of all existing buildings by 50%).
GHG Savings by 2030	Measures approximate GHG savings by the target year 2030 that would result from strategy implementation
Financial Impact to City	Lists the financial costs related to implementing the strategy (e.g., staff time, promotional materials) as well as potential revenue opportunities (e.g., building permits, reduced utility bills)
Potential Source(s) of Funding	Identifies existing and potential funding sources that may be utilized or leveraged to implement the strategy
Implementation	States whether the implementation of the strategy would occur one-time or if implementation would be ongoing
Responsibility	Assigns a City of Richmond department to be responsible for implementing the strategy
Co-Benefits	Lists the co-benefits associated with implementing the strategy, including: community connectivity, job creation, support for local business and industry, reduced fuel or energy costs, and resource savings. Also lists the public health co-benefits associated with implementing the strategy, such as better air quality, reduction of urban heat islands, increased levels of physical fitness, etc.
Tracking Metrics	Identifies the metrics the City will use to track strategy performance
Implementation Partners	Listing of outside agencies, utilities, stakeholder groups and community based organizations (CBOs) who are key to strategy implementation, community engagement, and education

Methods of quantifying annual energy and GHG savings are documented in Appendix D. In many cases, GHG reduction estimates are based on standard methods and assumptions recommended by State and regional agencies; however, in some cases, estimates are based on data obtained from local organizations and agencies, recent trends, relevant case studies, or reasonable assumptions regarding program participation. Some strategies are difficult to quantify, or do not reduce emissions directly, but support other strategies or programs in the CAP. These strategies are identified as "Supporting Actions" in the *Performance Goal* and *Equivalent GHG Savings by 2030* criteria.

Implementing actions for each strategy are organized by category:

- City Initiatives, Policies and Infrastructure: Actions that:
  - Support or expand existing programs, or develop new programs;
  - Promote existing or adopt new codes and policies that support the strategy;
  - Improve and expand existing facilities or infrastructure, or directives for the development of new facilities and infrastructure.
- Partnerships: Actions that develop or strengthen the City's relationships with outside organizations to develop, improve, fund, or promote programs or other implementing actions.
- Outreach and Education: Actions to improve or expand public outreach and education efforts, including actions oriented to Richmond's youth.

Energy Efficient Buildings and Facilities

Strategy EE1: Leverage Existing Programs and Rebates to Improve Efficiency of Existing Buildings

Performance Goal:	Improve the energy efficiency of all existing buildings (residential, commercial, and industrial) by 50 percent by 2030, consistent with SB 350 goal
GHG Savings by 2030:	145,860 MT CO2e (TBD% of total reductions)
Financial Impact to City:	Staff time and promotional materials; long-term revenue opportunities from building permits; reduced utility bills for municipal facilities
Potential source(s) of funding:	East Bay Energy Watch Local Government Partnership, Energy Upgrade California, Cap-and-Trade Funding, PG&E and MCE rebates and retrofit incentives
Implementation:	Ongoing
Responsibility:	City Manager's Office, Housing and Community Development
Co-Benefits:	Reduced utility bills and maintenance costs, increased community energy awareness, increased property values Health: Improved indoor air quality, increased indoor comfort, reduced mold, reduced noise pollution, improved lighting, reduced asthma
Tracking Metrics	Electricity and natural gas use (total and per capita); number of buildings retrofitted
Implementation Partners:	MCE, PG&E, EBEW, Contra Costa County, RichmondBUILD, BayREN, WCCUSD

Description: The City will enhance is multi-departmental coordination and outreach to inform residential, commercial and industrial building owners of opportunities to leverage efficiency incentive programs. These include rebates and incentives for existing building upgrades and direct installation programs. The City will also maximize participation in relevant programs for City owned and/or operated facilities, schools, and public housing developments.

Energy Upgrade California is a statewide program that offers up to $6,500 in incentives to homeowners, including those of multifamily properties, who complete energy efficiency home improvements. Homeowners can receive additional financing through an energy efficiency loan to pay for the cost of the upgrades that are not covered by the incentive payments. MCE and EBEW both offer assistance in understanding this program and finding contractors who can assess and complete projects that are funding-eligible. In addition, the **Bay Area Regional Energy Network** (BayREN), a collaboration of the 9 counties that make up the San Francisco Bay Area, provides single-family

homeowners and multifamily property owners with free energy consulting and assists with obtaining rebates for energy efficiency improvements.

PG&E and MCE offer **online Energy Assessment tools** to single-family residential, multi-family residential, and commercial customers to identify energy efficiency improvements. MCE's **My Energy Tool** also helps property owners identify energy savings improvements. Funding for such improvements is provided through MCE's **Green Business Loans** and **Green Property Loans**. PG&E's **Energy Savings Assistance Program** offers income-qualified renters and homeowners no-cost solutions to improve energy efficiency, including weatherproofing, building envelope repairs, and appliance replacements. PG&E also offers customized incentives for **business energy efficiency projects** involving the installation of high-efficiency equipment or systems.

Information on MCE and PG&E energy efficiency programs is provided on each utility's website, including **PG&E's Home Money Saver** application, **Energy Incentive Packages**, and **Buyer's Guides**. Both MCE and PG&E offer the highly successful, **SmartLights Program** to businesses, nonprofits, and multifamily developments, providing free energy-efficiency assessments, rebates, and technical assistance. PG&E's **SmartRate™** provides discounts for conserving energy when demand is highest, which provides the greatest cost savings to customers.

The **Low Income Home Energy Assistance Program** (**LiHEAP) Weatherization**, administered by Contra Costa County Community Services Bureau, provides income qualified homes with building envelope improvements, appliance upgrades, and other cost-effective improvements that improve energy efficiency. Lower income households can spend four times more of their income on energy costs than higher income households. Weatherization services can reduce this cost burden by lowering their energy consumption by up to 35 percent, saving an average of $400 on a household's heating and cooling bills in the first year alone.[1]

The Richmond Community Foundation administers the **Richmond Distressed Housing Rehabilitation Program**, which leverages social impact bonds to restore blighted homes (including energy and water upgrades) and sell to first time home buyers, including those participating in the SparkPoint Contra Costa program. Rising Sun Center's **California Youth Energy Services (CYES) Program** hires youths ages 15 to 22 during the summer to provide **Green House Calls** for residents to identify and install energy and water efficiency home improvements, at no cost to the resident. The program focuses on non-English speaking households, renters, moderate income households, and seniors. **EBEW** supports implementation of the CYES program, and provides additional outreach and promotion for energy efficiency programs. Bay Area Climate Collaborative's (BACC) **Small and Medium Building Efficiency Toolkit** and Community Demonstration program is a web-based toolkit that identifies optimal energy saving retrofits and operations improvements for small businesses.

[1] California Department of Community Services, 2015. California Recovery Act Program Makes Nearly 60,000 Low-Income Homes More Energy Efficient: *State Program Celebrates Significant Milestone on National Weatherization Day.* Accessed at: http://www.csd.ca.gov/NewsRoom/NewsReleases/October30,2012.aspx, on September 3, 2015.

EE1 Implementing Actions

City Initiatives, Policies and Infrastructure	• EE1.1. Ensure Title 24 compliance for major renovations • EE1.2. Streamline permitting process for projects to increase efficiency of existing buildings. • EE1.3. Update rental inspection checklist to require efficiency measures. • EE1.4. Utilize utility rebates and incentives to retrofit municipal buildings, WCCUSD school facilities, and the City's public housing developments with energy efficient fixtures and energy saving technologies. • EE1.5. Collaborate with WCCUSD to secure funding through California Clean Energy Jobs Act (Prop. 39) to create more energy efficient schools. • EE1.6. Continue to develop City-sponsored programs utilizing ECIA funding that leverages state and regional rebates. • EE1.7. Integrate promotional materials and referrals into rental inspection checklist, business license application, and residential mailers. • EE1.8. Continue energy efficiency workforce training. • EE1.9. Update the Residential Rental Inspection Program (RRIP) to include basic energy efficiency standards and enhanced life-safety provisions.
Partnerships	• EE1.10. Collaborate with **PG&E and MCE** to: improve data sharing with energy disclosure City ordinance to better enable targeted outreach; identify opportunities to improve the efficiency of natural gas systems and promote conversion to electric systems; and identify large demand customers and opportunities to increase enrollment in demand response programs. • EE1.11. Collaborate with **PG&E** to identify opportunities for customized business energy efficiency retrofit projects. • EE1.12. Collaborate with **PG&E, MCE, EBEW, and BayREN** to promote the Energy Upgrade California Home Upgrade Program and encourage homeowners to employ contractors through **RichmondBUILD**. • EE1.13. Work with **BACC to** bring the Small and Medium Building Efficiency Toolkit and Community Demonstration program to the City of Richmond. • EE1.14. Collaborate with **Contra Costa County, CYES, and Richmond Distressed Housing Rehabilitation Program** to provide targeted weatherization services to the City's oldest housing stock. • EE1.15. Partner with **Contra Costa County** and **PG&E** to promote weatherization and Energy Savings Assistance Programs.
Outreach and Education	• EE1.16. Partner with **BayREN** and **Contra Costa County** to host sign-up and enrollment events for homeowners interested in participating in energy efficiency programs. • EE1.17. Review and update the City website on a semi-annual basis with links to energy rebates, incentives, and financing programs for PG&E and MCE customers. • EE1.18. Disseminate information on energy efficiency programs through the City's newsletters, email blasts, social media outlets, and marketing campaigns. • EE1.19. Work with owners of multi-unit buildings and single family homeowners and renters to increase efficiency and reduce operating costs available through the California LIHEAP weatherization program.

Strategy EE2: Leverage Existing Funding Programs and Financing Tools

Performance Goal:	Improve the energy efficiency of all existing buildings (residential, commercial, and industrial) by 50 percent by 2030, consistent with SB 350 goal
GHG Savings by 2030:	Reductions accounted for in Strategy EE1
Financial Impact to City:	Staff time, promotional materials; long-term revenue opportunities from building permits; reduced utility bills for municipal facilities
Potential source(s) of funding:	Chevron ECIA, GGRF, PACE programs, CA Low Income Home Energy Assistance Program, Proposition 39 (California Clean Energy Jobs Act) Funding, CEC's Energy Conservation Assistance Act (ECAA) Program Loans for municipal facilities, MCE Green Loans for homes and businesses, on-bill financing
Implementation:	Ongoing
Responsibility:	City Manager's Office, Housing and Community Development
Co-Benefits:	Reduced utility bills and maintenance costs, increased community energy awareness, increased property values Health: Improved indoor air quality, increased indoor comfort, reduced mold, reduced noise pollution, reduced asthma
Tracking Metrics:	Electricity and natural gas use (total and per capita); number of buildings retrofitted
Implementation Partners:	MCE, PG&E, PACE Providers, California Energy Commission, Realtor Association

Description: The City will increase its education and outreach efforts to residential, commercial and industrial building owners to increase awareness of financing tools and funding opportunities for energy efficiency upgrades.

Property Assessed Clean Energy (PACE) programs provide financing for energy and water efficiency improvements and renewable energy systems. The repayment of the loan is collected on the property owner's tax bills over the course of several years, and the loan remains with the property if it is sold. Since the loan is tied to the property, it provides less risk to property owners to undertake energy efficiency measures with a longer term payback. There are currently three PACE programs available to businesses and residents in Richmond: HERO Financing, California First Efficiency Financing, and Figtree Financing. The City has adopted an open marketplace policy and will add additional PACE programs as they become available.

Low-interest financing for improving the energy efficiency of municipal facilities, including streetlights, can be obtained through CEC's **Energy Conservation Assistance Act (ECAA) Program Loans**. The City of Richmond has utilized these loans in the past to upgrade energy-inefficient streetlights to more efficient LED streetlights.

PG&E's On-Bill Financing (OBF) Program, also known as the Energy Efficiency Retrofit Loan Program, is funded by California utility customers and administered by PG&E under the direction of the California Public Utilities Commission (CPUC). OBF provides qualified, non-residential PG&E customers with a means to finance energy-efficiency rebate and incentive programs implemented under select PG&E energy efficiency programs. The loans issued under OBF are interest-free. Business customer may qualify for loans between $5,000 and $100,000 per service address, with loan periods of up to 60 months. Government agencies may qualify for loans between $5,000 and $250,000 per service address, with loan periods of up to 120 months.

MCE also offers **On-Bill Repayment Loans** for multifamily commercial properties and small. Loans of $10,000 to $265,000 are subject to a 5 percent interest rate, and a 5 to 10 year term. Loan payments are made on a customer's PG&E bill. For residential customers, **MCE's Finance Finder** allows customers and contractors to search for a variety of financing options, and is sortable by city and zip code. Financing options presented included PACE financing, secured and unsecured loans, and solar-specific options.

EE2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• EE2.1. Perform staff and legal review of potential additional PACE programs with recommendations presented to City Council for consideration to authorize additional programs. • EE2.2. Leverage existing financing opportunities to upgrade the energy efficiency of Richmond municipal facilities. • EE2.3. Continue to promote energy efficiency funding and financing tools to Richmond residents and businesses. • EE2.4. All new traffic lights and all replaced traffic lights shall consist of LED lights.
Partnerships	• EE2.5. Work with local **PACE programs** to promote efficiency financing through property tax assessments. • EE2.6. In partnership with local PACE programs, encourage **local realtors** to up-sell energy efficiency upgrades and distribute information on available financing programs to new homeowners. • EE2.7. Work with **MCE and PG&E** to promote participation in on-bill financing programs.
Outreach and Education	• EE2.8. Review and update the City website on a semi-annual basis with links to third party-provided energy funding financing programs. • EE2.9. Disseminate information on energy financing and funding programs through citywide marketing campaigns using the City's newsletters, email blasts, social media outlets, local newspaper ads, direct mail, and by sending flyers along with property tax bills.

Strategy EE3: Promote Green Building

Performance Goal:	All new buildings meet or exceed Title 24 standards at time of construction; by 2020 all new residential buildings will be ZNE; by 2030 all new commercial buildings will be ZNE
GHG Savings by 2030:	115,867 MT CO_2e
Financial Impact to City:	Staff time; increased revenues from building permits
Potential source(s) of funding:	PG&E's Savings By Design Program
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services
Co-Benefits:	Lower energy costs, reduced maintenance costs, increased community energy awareness, increased property values Health: Improved indoor air quality, increased indoor comfort, reduced mold, reduced noise pollution, reduced asthma
Tracking Metrics:	Square footage of new construction meeting/exceeding Title 24; Square footage of new construction achieving ZNE
Implementation Partners:	PG&E

Description: The State of **California Green Building Standards Code (CALGreen Code)** specifies minimum energy performance under Title 24, Part 6 (Building Energy Efficiency Standards). With Title 24 becoming more stringent with every code update (approximately every 3 years), just keeping pace with the energy requirements of new buildings is a major challenge for developers, builders, and city building departments. The 2013 update to Title 24 is designed to reduce energy consumption for residential buildings by 25 percent and nonresidential buildings by 30 percent over the 2008 Energy Standards. The standards apply to lighting, space heating and cooling, ventilation, and water heating. Although the current standards add approximately $2,000 to the cost of constructing a new residential building, the estimated energy savings for homeowners is more than $6,000 over 30 years.[2]

The **2013 Title 24** update was the first since CPUC's Long Term Energy Efficiency Strategic Plan put forth a **Zero-Net Energy (ZNE)** goal for all new residential buildings by 2020 and new nonresidential buildings by 2030. The 2016 and 2019 Building Energy Efficiency Standards will move the state even closer to the Zero-Net Energy goal.[3]

[2] California Energy Commission, 2014. New Title 24 Standards Will Cut Residential Energy Use by 25 Percent, Save Water, and Reduce Greenhouse Gas Emissions, webpage. Accessed at: http://www.energy.ca.gov/releases/2014_releases/2014-07-01_new_title24_standards_nr.html, on September 22, 2015.

[3] Ibid.

The City will ensure effective enforcement of Title 24 building energy standards, and consider incentives such as permit streamlining for new residential and commercial construction projects that incorporate energy efficiency improvements beyond minimum Title 24 standards. The City will encourage developers to design buildings that incorporate innovative and sustainable building techniques whenever possible. The City will promote participation in PG&E's **Savings By Design** program, which provides property owners with resources for designing energy efficient buildings and incentives for qualifying projects of up to $150,000. The City will lead by example by incorporating innovative building design measures into all new municipal facilities, and major renovations of existing facilities.

EE3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• EE3.1. The City will continue to evaluate enhancing the California Building Code with "reach codes" that consider deeper green building practices, zero net energy design, and water savings opportunities. • EE3.2. Work with the building department to increase compliance of all building construction, additions, and renovations with the state's Green Building Standards (CALGreen Code), including Title 24, Part 6 energy standards. • EE3.3. Incorporate green building measures into new City-owned buildings and redevelopment projects. • EE3.4. Establish LEED or Energy Star performance criteria for new municipal buildings and obtain Energy Star certification of existing City-owned buildings • EE3.5. Update the Residential Rental Inspection Program (RRIP) to include basic energy efficiency standards and enhanced life-safety provisions. • EE3.6. Provide expedited permitting for new construction and renovations that include specified energy efficiency upgrades and green building measures.
Partnerships	• EE3.7. Promote participation in **PG&E**'s Savings By Design program among property owners seeking to renovate existing properties or developers planning new properties.
Outreach and Education	• EE3.78. Promote innovative design (e.g., ZNE buildings) and the incorporation of green building best practices in new residential and commercial development and major renovations by providing information on green building techniques at the permitting counter and on the City's website. • EE3.9. Ensure staff fluency with Title 24 energy code updates and provide user-friendly guidance and assistance to local builders and homeowners. • EE3.10. Develop a community recognition award for exemplary energy performance.

Strategy EE4: Outreach and Education to Promote Energy Conservation and Renewable Energy

Performance Goal:	Increase energy program participation rates
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time, promotional materials; long-term revenue opportunities from building permits
Potential source(s) of funding:	Chevron ECIA, Proposition 39 (California Clean Energy Jobs Act) Funding, PG&E and MCE rebates
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Increased community energy awareness, youth education, promote green jobs and careers Health: Improved indoor and outdoor air quality, increased indoor comfort, reduced mold, reduced noise pollution, reduced asthma
Tracking Metrics:	City energy outreach budget; program participation rates
Implementation Partners:	PG&E, MCE, EBEW, RichmondBUILD Academy, WCCUSD, Rising Sun Energy Center, Center for Cities + School, Y-PLAN, Community-based Organizations

Description: The City will partner with local agencies, schools, and community groups to engage students, residents, and businesses in confronting the climate change challenge. This strategy expands on the specific outreach and education actions identified in Strategies EE1 through EE3. By providing outreach assistance to PG&E, MCE, and third party energy efficiency programs, the City lends the programs increased credibility and improves uptake by residents and businesses.

The City will continue to develop programs that result in behavior changes to conserve energy, such as the PG&E **Sustainability Circles Program** which uses a peer-learning format to develop customized Sustainability Action Plans for local businesses, and MCE's **O-Power Model** which allows customers to compare their energy use to their neighbor.

Even making small changes in homes can provide significant contributions in reducing GHG emissions and will save money. Actions such as switching to LED light bulbs, replacing old and inefficient appliances, and repairing leaky faucets and drafty doors and windows are some of the most effective ways to save energy. Such measures reduce energy costs, increase home values, and improve indoor air quality for residents.

EE4 Implementing Actions

City Initiatives, Policies and Infrastructure	• EE4.1. Develop a Building Energy Saving Ordinance (BESO) requiring energy efficiency assessments and disclosure of energy usage at point-of-sale for all residential and commercial buildings. • EE4.2. Work with Contra Costa County Health Services to adopt guidelines for energy efficiency upgrades to reduce and mitigate impacts of indoor air quality for all residential buildings. • EE4.3. Explore model tenant-landlord agreement incentive programs that engage landlords and renters in rental home energy retrofits so that all parties equitably share the costs and benefits of energy efficiency. • EE4.4. Pursue Proposition 39 (California Clean Energy Jobs Act) Funding to support the RichmondBUILD program.
Partnerships	• EE4.5. Engage students at **WCCUSD** in conducting energy assessments and audits, creating energy benchmarking and GHG inventories, and conducting ongoing monitoring to identify areas to maximize emissions reductions and track progress in their schools over time. Create a district-wide school energy reduction competition. • EE4.6. Partner with **MCE and PG&E to** conduct multilingual outreach and education to promote energy efficient homes and cost saving solutions. • EE4.7. Work with **EBEW** to identify opportunities for leveraging strategic energy planning and funding services to expand energy efficiency outreach and education efforts. • EE4.8. Partner with **Community-based Organizations** to advocate for energy efficiency and renewable energy program financing and engage residents in energy efficiency programs. • EE4.9. Coordinate with **Summer Youth Employment Program and Rising Sun Energy Center** to increase energy efficiency offerings to participants in the CYES program and ensure homeowners are made aware of all available energy efficiency programs. • EE4.10. Work with **Center for Cities + Schools/Y-Plan** to expand on city planning and policy making exercises in Richmond that involve energy efficiency and climate change planning.
Outreach and Education	• EE4.11. Distribute a “Welcome Package” to new homeowners biannually, upon receipt of change of home ownership data from the County Assessor, which describes the services, programs, and resources available to Richmond residents that support the goals of the CAP. • EE4.12. Create an inter-neighborhood energy reduction competition to reduce residential GHGs, and promote neighborhood cohesion and information sharing. • EE4.13. Hold enrollment workshops for low-income residents to participate in free weatherization programs. • EE4.14. Hold workshops for local residents to share information about energy efficiency services, regulations, financing programs, and incentives. • EE4.15. Hold workshops for local businesses and contractors to share information about energy efficiency services, regulations, financing programs, and incentives.

Increase Use and Generation of Renewable Energy

Strategy RE1: Increase Local Solar Energy Generation

Performance Goal:	By 2030, 1,010 new residential solar installations averaging 4 kW per system; 69 new commercial solar installations averaging 174 kW per system
GHG Savings by 2030:	8,422 MT CO_2e
Financial Impact to City:	Staff time, promotional materials; long-term revenue opportunities from building permits; increased revenue from more local jobs and local business activity; reduced energy bills at municipal facilities
Potential source(s) of funding:	Chevron ECIA, PACE programs, MCE, PG&E, Single-Family Affordable Solar Homes (SASH) program, Solar Leases, Proposition 39 (California Clean Energy Jobs Act) Funding
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services
Co-Benefits:	Lower energy bills, increased local jobs, increased local business activity, increased community energy awareness, reduced lost work and school days Health: Improved air quality, reduced illness
Tracking Metrics:	Number of homes and businesses solarized; total local solar generation capacity and quantity installed per year
Implementation Partners:	PG&E, MCE, RichmondBUILD, WCCUSD, GRID Alternatives, Contra Costa Community College, Community-based Organizations

Description: The City will promote the installation of distributed, small-scale solar photovoltaic systems (solar PV), as well as other renewable energy generation systems, in existing buildings and new construction. Richmond is leading local solar development in the Bay Area through innovative policy decisions that create competition and marketplaces for local renewable energy development.

In 2016 Richmond will be home to **MCE's Solar One**, a 10.5 MW ground mount solar farm. One of the largest solar projects in the Bay Area, Solar One is being constructed on a 49-acre parcel on at a former Chevron Richmond Refinery brownfield site. MCE has teamed with RichmondBUILD to train and hire employees for the Solar One Project. The project will create 344 local jobs and will generate enough power for nearly 3,000 homes per year. (Note – the GHG reduction impact of Solar One is accounted for in Strategy RE2)

With the passage of **Assembly Bill (AB) 2188** in 2014, cities throughout California are required to adopt an ordinance to streamline the permitting and installation of solar PV systems. In addition, the new CalGreen building code requires all new buildings to be "solar ready" and include the necessary infrastructure to install solar PV systems. In existing buildings the initial cost of installing a solar PV system can deter some residents and business owners form installing the technology. As with energy efficiency improvements, discussed under Strategies EE1 and EE2, there are a variety of ways to finance these systems, including: **PACE programs**, **on-bill financing**, or **private low interest loans**. Alternatively, **solar leases** allow customers to lease a system that is owned and maintained by a private company, while **power purchase agreements (PPAs)** allow customers to purchase the energy that is generated by the system, which is also owned and maintained by a private company. If a property owner would like to switch to solar energy without having to install a system on their property, they may participate in **MCE's Local Sol program**. Local Sol supplies 100 percent solar energy from a local solar farm located in MCE's service area. In addition to providing renewable energy to residents and businesses who cannot install solar panels on their own buildings, Local Sol supports local renewable development and creates economic benefits like solar construction jobs.

Both MCE and PG&E offer rebates for installing solar PV systems, which are funded through the **California Solar Initiative.** MCE and PG&E offer a **Net Energy Metering** program, whereby customers are provided with credits on their energy bill in exchange for the use of excess solar energy that is generated by their rooftop system. MCE's standard-offer contract, called a Feed-In Tariff, is available to anyone in Richmond wishing to sell the power output from small-scale renewable energy projects (up to 1 MW) over a 20-year term, ensuring a stable power supply for MCE customers.

The Community Energy Services Corporation's **SmartSolar Program and Marketplace** provides users with an estimate of the potential system size, generation, and cost for installing a solar PV system on their property. **GRID Alternatives** has partnered with Richmond and other local governments, equipment manufacturers, and other organizations to provide no- to very-low-cost solar for families living with limited or fixed incomes, while making renewable energy technology and job training accessible to underserved communities.

The WCCUSD, which has plans to install rooftop solar at 32 of its campuses, completed a study showing solar installations on the roofs of all of its schools and administration buildings in Richmond would produce the equivalent of enough electricity to power more than 2,700 homes, saving more than 1,300 MT CO2e annually.[4]

The City will continue to support using the burgeoning solar energy market to provide job training and green business ownership opportunities for low income and under-employed residents in Richmond. Since 2007, the **RichmondBUILD** public private partnership has been training residents from low income households for careers in the high growth, high wage construction and renewable energy fields. Contra Costa Community College District manages the **Clean Energy Workforce Training Program (CEWTP)**. Students receive training for careers in "green collar" jobs such as a solar photovoltaic installer, solar thermal, technician; solar installation manager, and others.

[4] Solar America Showcase Report, Solar Master Plan, WCCUSD. http://www.heliosproject.net/files/managed/Document/90/WCCUSD%20-%20Benchmarking%20and%20Assessments.pdf

Home builders in California that integrate PV systems and high energy-efficiency standards throughout their developments are eligible to participate and receive financial incentives from the state's New Solar Homes Partnership. In addition, the Chevron ECIA identified projects that generate renewable energy as a priority for funding.

RE1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RE1.1. Continue to work with the building department to ensure a solar permit streamlining program is in place, and that new buildings include "solar ready" measures, as required by CalGreen, to enable easier installation of photovoltaic panels. • RE1.2. Identify opportunities and funding to install solar on Richmond municipal facilities, schools, and public housing developments. • RE1.3. Research the feasibility and cost effectiveness of installing small-scale wind turbine systems to support business and industry. • RE 1.4. Install solar panels over parking areas at the Port of Richmond. • RE1.5. Explore opportunities for the City to support residential and commercial group solar purchasing programs.
Partnerships	• RE1.6. Work with **PG&E and MCE** to**:** incentivize large retailers, warehouses, and industrial facilities to install solar panels on building and parking lot roofs and other underutilized spaces; and explore opportunities for efficient battery storage to enhance local production, storage, and use of renewable energy. • RE1.7. Work with **PG&E** to promote their Solar Thermal Hot Water Heating rebates for residential and commercial customers (California Solar Initiative) • RE1.8. Work with **WCCUSD** to leverage Prop 39 funds to finance renewable energy system installations. • RE1.9. Collaborate with **RichmondBUILD** and **Contra Costa Community College District** to support solar job training and green business ownership opportunities for low income and under-employed residents in Richmond • RE1.10. Promote solar financing programs offered by **local PACE programs** such as HERO, Fig Tree and CaliforniaFIRST. • RE1.11. Work with **Summer Youth Employment Program and California Youth Energy Services** to increase awareness of solar financing, purchasing, and technical assistance programs with each Green House Call visit. • RE1.12. Partner with **Community-based Organizations** to advocate at the regional and state level to create additional incentives and tariffs that support local renewable energy generation.
Outreach and Education	• RE1.13. Provide resources on the City's website to connect home and business owners with solar financing programs, group solar programs, technical assistance programs, and federal and state tax incentives. • RE1.14. Connect low-income residents with California's Single-Family Affordable Solar Homes (SASH) program and other programs that help low-income residents invest in renewable energy.

Strategy RE2: Promote and Maximize Utility Clean Energy Offerings

Performance Goal:	In partnership with MCE supply at least 87 percent of community electricity from sources that are 95 percent renewable, by 2025; PG&E will supply the remainder of community electricity from sources that are at least 50 percent renewable by 2030.
GHG Savings by 2030:	57,390 MT CO_2e
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	Chevron ECIA, Feed-In Tariff, GGRF
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Increased community energy awareness, reduced lost work and school days, increased local jobs. Health: Improved air quality, reduced asthma
Tracking Metrics:	Enrollment in MCE Green Energy programs; average CO2e content of PG&E and MCE electricity
Implementation Partners:	PG&E, MCE, CYES, CBE, WCCUSD, Community-based Organizations

Description: Through a series of increasingly stringent bills first enacted in 2002, California has placed requirements on electric utilities to procure a portion of their energy from renewable sources. The standard, known as the **Renewables Portfolio Standard (RPS)**, applies to investor-owned utilities, publicly-owned utilities, electricity service providers, and community choice aggregators. To comply with the legislation, utilities in California must procure a minimum of 25 percent of its retail electricity sales from renewable sources by 2016, 33 percent from renewable sources by 2020, and 40 percent from renewable sources by 2035. As of 2015 PG&E sourced 27 percent of its retail sales from renewable sources, surpassing the standard for 2016.

In 2013, the City of Richmond joined Marin Clean Energy (MCE) to increase renewable energy choices for local businesses and residents. A "Community Choice Aggregation" program, MCE procures electricity from renewable sources – solar, wind, bioenergy, geothermal, and small hydro – and then partners with PG&E to deliver electricity to homes and businesses. As of 2015, over 80 percent of Richmond's electrical customers have enrolled in MCE; of these, 99 percent are enrolled in the **Light Green** Option that sources 50 percent of its energy supply from renewable energy sources, and less that 1 percent were enrolled in the **Deep Green** option, which sources all of the energy purchased from renewable sources. The City will help MCE promote enrollment in their Light Green, Deep Green, and **Local Sol** (100 percent locally generated solar energy) programs. The City will continue to work with both entities to increase the percent of electricity that is sourced from renewable systems. Specifically, the City will support MCE in achieving their goal of providing 80 percent of its electricity from renewable sources by 2025, and 95 percent from renewable sources by 2030.

RE2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RE2.1. Support MCE by identifying underutilized sights within the City that are appropriate for solar development. • RE2.2. Identify strategies to recover methane as energy source from the City's wastewater treatment and solid waste management processes. • RE2.3. Enroll all City accounts in MCE Deep Green program. • RE2.4. Assist WCCUSD with enrolling in MCE's Deep Green and Local Sol options.
Partnerships	• RE2.5. Partner with **MCE** and **Community-based Organizations** to promote enrollment in MCE's Light Green, Deep Green, and Local Sol programs among businesses and residents. • RE2.6. Work with **local businesses,** such as local food processors and manufacturers, to use participation in MCE's Deep Green program as an advertising opportunity to demonstrate products were made with 100% renewable electricity. • RE2.7. **Engage with PG&E** to promote enrollment in their Solar Choice program upon its launch
Outreach and Education	• RE2.8. Increase MCE enrollment among Richmond businesses and residences, and encourage participation in their Light Green, Deep Green and Local Sol programs.

Strategy RE3: Promote Switching From Natural Gas to Clean Electricity

Performance Goals:	Residential: By 2030, Replace 54 percent of existing natural gas water heaters in homes each year with electric models Commercial: 6 percent of currently forecasted natural gas use is electrified by 2020, and 17% by 2030
GHG Savings by 2030:	47,709 MT CO_2e
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	PACE programs, MCE, PG&E
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services
Co-Benefits:	Lower energy bills, increased community energy awareness, reduced lost work and school days, increased local jobs Health: Improved air quality, reduced asthma
Tracking Metrics:	Number of natural gas systems electrified; therms reduced by electrification per year
Implementation Partners:	PG&E, MCE, CBO's, WCCUSD, Community-based Organizations

Description: This strategy supports the switch from natural gas to low-carbon electricity or solar thermal energy as an energy source. Natural gas is used extensively throughout Richmond for residential, commercial, and industrial energy applications, such as for heating, cooking, and to power industrial and manufacturing processes. In Richmond, natural gas consumption accounts for 71 percent of residential GHG emissions from energy, and 41 percent of commercial/industrial GHG emissions from energy (excluding sources regulated by AB 32). Certain natural gas emissions can be reduced by efficiency improvements such as home energy upgrades or boiler retrofits; however, the City recognizes that in order to meet its GHG reduction goals, it must promote conversion of natural gas systems to electric systems or solar thermal systems.[5] Electrification will increase the use of electricity generated from renewable energy. This complements Strategies RE1 and RE2 for decarbonizing the City's electricity supply, making electricity the City's least emissions-intensive energy source.

Rising energy prices and the drive for low carbon fuels are making fuel switching increasingly desirable to end-users while also enhancing energy security, under some market conditions. Fuel switching often results in long term energy cost-savings, as projects often finance themselves over time, and performance improvements with lower operational and maintenance costs for end-users. The initial cost of fuel switching can be financed with simple paybacks typically lasting 2.5 to 4 years, on average. These projects are also becoming more favorable as national regulations, tariffs, and subsidies support the switch to a cleaner fuel, creating new sources of funding and incentives for businesses and

[5] A recent Electricity and Natural Gas Working Paper by CARB concludes that solar thermal provides a better option for serving heating needs, but acknowledges that many technology advancements are needed to make such systems affordable and scalable. Available at: www.arb.ca.gov/cc/scopingplan/2013_update/energy.pdf

industries. For example, financing environmentally-friendly fuel switching can earn reputational capital with policy makers, investors and consumers due to the positive impact projects have on reducing carbon emissions.

This measure focuses on encouraging natural gas users to switch to electric or solar thermal systems upon routine equipment replacement, or as a part of a larger energy efficiency and GHG reduction scheme. In line with the other energy efficiency and renewable energy measures in the CAP, the City will promote electrification by connecting residents, businesses, and owners of multi-unit residential buildings to **rebates and incentives** through PG&E and MCE. The City will also streamline the permitting process for **solar water heaters**, which use onsite solar PV systems in lieu of natural gas, to reduce regulatory barriers to electrifying appliances; permit streamlining for solar water heaters is particularly important, because when businesses and residents replace water heaters they frequently must do so quickly. The City will conduct targeted outreach to industrial and manufacturing entities to identify opportunities to electrify systems and provide information on available rebates.

RE3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RE3.1. Consider implementing a citywide ordinance to require commercial and industrial natural gas users to evaluate replacing natural gas systems with electrical systems during routine replacement. • RE3.2. Consider adopting an ordinance for new construction requiring the installation of all electric appliances and heating systems, and encouraging Zero Net Energy Buildings. • RE3.3. Research the feasibility and cost effectiveness of installing various electric alternatives to natural gas appliances, engines, and heating systems. Identify and reduce regulatory barriers for innovative and new technology. • RE3.4. Work with the building department to ensure a solar water heater permit streamlining program is in place.
Partnerships	• RE3.5. Partner with **PG&E** to incentivize large retailers, warehouses, and industrial facilities to electrify existing natural gas appliances, engines, and heating systems. Promote PG&E's Solar Thermal Hot Water Heating rebates for residential and commercial customers (California Solar Initiative), including special set asides for low-income single-family and multifamily residences. • RE3.6. Assist **WCCUSD** in leveraging Prop 39 funds to finance electrification projects at school facilities. • RE3.7. Work with **Summer Youth Employment Program** and **California Youth Energy Services** to encourage home owners to convert to solar water heater and other electrified systems upon routine system replacement, with each Green House Call visit. • RE3.8. Partner with **Community Based Organizations** to advocate at the regional and state level to create additional incentives and tariffs that support local electrification programs.
Outreach and Education	• RE3.9. Provide resources on the City's website to connect residents, businesses, and industrial entities with electrification resources, incentives, and benefits. • RE3.10. Conduct targeted outreach to encourage homeowners to install electric appliances upon routine replacement of natural gas appliances and water heaters. • RE3.11. Targeted outreach to commercial, industrial, and manufacturing entities, including owners of multi-unit residential buildings, to electrify existing natural gas systems upon routine replacement.

Sustainable Transportation and Land Use

Strategy TL1: Promote Smart Growth and Complete Neighborhoods

Performance Goal:	By 2030, increase residential and employment density by 15% as compared to BAU
GHG Savings by 2030:	6,820 MT CO_2e
Financial Impact to City:	Staff time, promotional materials
Potential source(s) of funding:	Chevron ECIA, AHSC Program (GGRF), OBAG Program, CalTrans ATP, Caltrans Sustainable Communities grants, Caltrans EJ planning grants
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services
Co-Benefits:	Bicycle and pedestrian connectivity and comfort, enhanced community aesthetic and sense of place, attracts businesses, provides "eyes on the street", supports high quality development, attracts mix of uses, encourages biking and walking, attracts patrons from other cities Health: Improved air quality, increased physical activity, decreased obesity and illness
Tracking Metrics:	Percent density increase in priority development areas (PDAs) and citywide
Implementation Partners:	CCIS/Y-Plan, Community-based Organizations

Description: Smart growth accompanies a range of development and conservation strategies that support economic growth, environmental health, and GHG reductions. Smart growth is primarily a land use strategy, which places higher density, mixed-use developments near or within existing development, and near transit services. Infill development, or the redevelopment of underutilized sites within existing developed areas, is a key smart growth approach that increases the land use intensity and resulting social and economic activity within the existing urban footprint. Smart growth encourages heterogeneous neighborhoods that offer a variety of housing types within close proximity to various commercial and retail services, as well as schools and parks. As a result of directing new growth towards existing urban areas, smart growth strategies help preserve existing open space, farm land, and critical habitat areas for enjoyment by future residents of Richmond.

The City developed the **Richmond Livable Corridors Form-Based Code (FBC)** as a means of guiding the revitalization of three major commercial corridors in the City. The FBC describes development standards for various zones within each corridor, and incorporates principles of smart growth into the plan for these areas. The City may supplant existing zoning regulations in other areas in the City with similar form based codes in the future as a means of continuing to implement and expand smart growth development. The City may conduct community and stakeholder outreach to identify other opportunities

to adopt a form based code, as well as areas where smart growth principles may be easily integrated into the existing urban fabric. Areas that have already been identified as candidates for smart growth prioritization include downtown Richmond, the City's existing and future mixed-use corridors, areas surrounding key traffic intersections, future designated pedestrian priority districts, and multi-use trails that connect high-density areas of the City to parks and open space.

The **Richmond Bay Specific Plan (RBSP)** proposes to develop a sustainable shoreline district designed to capitalize on the planned Berkeley Global Campus at Richmond Bay. The RBSP plan area is fully located within a priority development area (PDA), as identified by the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) in **Plan Bay Area**, and is designed incorporate smart growth and complete neighborhoods concepts into future development. At full buildout, RBSP would accommodate over 5.6 million square feet of research and development uses, 720,000 square feet of retail and services, over 4,000 housing units, and 145 acres of public and natural open space. RBSP utilizes a form based code approach to describe allowable building types, dimensions, and amenities. RBSP proposes a high density, mixed-use district that includes an extensive transit, bicycle, pedestrian, and open space connectivity network, reduced parking standards for vehicles, and requirements for bicycle and pedestrian amenities to reduce vehicle trips and encourage active transportation.

Smart growth development touches on many of the other strategies in the transportation sector that are discussed in detail in this section, including: complete streets, pedestrian and bicycle connectivity, and enhanced transit services.

TL1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL1.1. Develop a noise mitigation plan as part of the building ordinance that prioritizes mitigation for urban infill development. • TL1.2. Expand Richmond Livable Corridors Form-Based Code to other areas in the City and adopt parking maximums for commercial businesses and multi-family buildings.
Partnerships	• TL1.3. **CCIS/Y-Plan:** engage in visioning exercise to prioritize implementing smart growth strategies in targeted areas. • TL1.4. Work with **Community-based Organizations** to identify and prioritize smart growth strategies that improve environmental justice. • TL1.5. Work with **Community-based Organizations** to increase public awareness of smart growth and enhance public perception of denser development.
Outreach and Education	• TL1.6. Continue to hold community workshops to identify additional areas for smart growth prioritization.

Strategy TL2: Complete Streets

Performance Goal:	By 2030, make vehicle calming and speed reduction enhancements to intersections and roadways that carry 25 percent of the City's traffic
GHG Savings by 2030:	873 MT CO_2e
Financial Impact to City:	Staff time to complete grant applications; potentially high cost of construction and/or maintenance
Potential source(s) of funding:	Chevron ECIA, AHSC Program (GGRF), City Capital Improvements Fund, Development Impact Fees, Chevron ECIA, OBAG Program, CalTrans ATP, Caltrans Sustainable Communities grants, Caltrans EJ planning grants
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services
Co-Benefits:	Bicycle and pedestrian comfort and safety, encourages walking and biking, enhanced community aesthetic Health: Improved air quality, increased physical activity, decreased obesity and illness
Tracking Metrics:	Percent of total intersections and roadways retrofitted
Implementation Partners:	CCIS/Y-Plan, Community-based Organizations

Description: Complete streets are designed to enable safe access to goods and services for all pedestrians, bicyclists, motorists, and transit users. A complete street responds to its surrounding context, including traffic calming and safety features such as: sidewalks, protected bike lanes, reduced speed limits, wide paved shoulders, designated bus lanes, comfortable and accessible public transportation stops, frequent and safe crossing opportunities, median islands, accessible pedestrian signals, curb extensions, narrower travel lanes, and roundabouts. Such improvements may be prioritized on streets that have high occurrences of speeding, automobile accidents, and cut-through traffic to reduce such events.

Complete streets improvements are recommended as part of an overarching Smart Growth strategy in dense urban areas with a mix of uses to encourage people to walk, bicycle, or take transit rather than drive, resulting in fewer GHG emissions per trip. Amenities for pedestrian, bicycle, and transit users are often provided in such areas, and may include: street trees, landscape strips, trash cans, outdoor furniture, shade structures, bus shelters, and public art installations, among other things. By enhancing the safety, comfort, and enjoyment of the experience for all users, complete streets contribute to an overall sense of "place" that can attract residents, new businesses, and visitors to the area, thereby stimulating new investments and economic growth.

The City recently completed a study to identify and implement complete streets improvements to the Rumrill Boulevard/13th Street corridor, between Harbour Way and Contra Costa College. The City plans to continue these efforts in the future, with similar study for San Pablo Avenue in the works. The Rumrill

Boulevard Specific Plan design standards require complete streets development along key routes in the plan area.

TL2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL2.1. Update the City's development impact fee program to provide funding for future circulation improvements including pedestrian, bicycle, and public transit facilities and amenities. • TL2.2. Continue to explore the potential to designate streets around schools, parks, and public gathering places as safety zones where the vehicular speed limit may be lowered to 20 miles per hour or where vehicles are banned completely. • TL2.3. Continue to implement streetscape improvements to enhance access, lighting, safety, and experience for pedestrians, bicyclists, transit users, and motorists. Focus improvements in areas with the highest need such as the downtown, mixed-use corridors, key intersections, designated pedestrian priority districts, and multi-use trails that connect high-density areas of the City to parks and open space. • TL2.4. Develop strategies to calm traffic on streets that experience speeding or cut-through traffic. Measures should consider emergency vehicle access as well as pedestrian and bicycle circulation and may include traffic circles, curb extensions, stop signs, narrow travel lanes, fewer travel lanes, landscaping, and plantings. • TL2.5. Connect residential neighborhoods to commercial centers with protected bike lanes and paths (linked to Land Use). • TL2.6. Integrate schools and youth facilities into pedestrian priority districts and implement Safe Routes to Schools projects to improve pedestrian connections to schools, transit, and neighborhood business districts.
Partnerships	• TL2.7. **CCIS/Y-Plan** and **Community-based Organizations:** engage in community outreach and visioning activity to identify opportunities for complete streets improvements.
Outreach and Education	• TL2.8. Host community and neighborhood workshops to identify streets and corridors that would benefit from traffic calming and complete streets improvement measures.

Strategy TL3: Improve Bicycle and Pedestrian Infrastructure

Performance Goal:	Increase 50% of Master Plan implemented by 2030 with 300% increase in bicycle trips (commute and non-commute)
GHG Savings by 2030:	5,176 MT CO_2e
Financial Impact to City:	Staff time to complete grant applications; potentially high cost of construction and/or maintenance
Potential source(s) of funding:	Chevron ECIA, AHSC Program (GGRF), CalTrans ATP, Caltrans Sustainable Communities grants, Caltrans EJ planning grants, CalTrans CBTP grants, Capital Improvements Fund, Development Impact Fees, BAAQMD grants for bicycle paths and facilities
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services, Transportation and Transit Services
Co-Benefits:	Bicycle and pedestrian comfort and safety, encourages walking and biking, enhanced community aesthetic Health: Improved air quality, increased physical activity, decreased obesity and illness
Tracking Metrics:	Percent of Master Plan improvements completed; percent increase in bicycle trips (commute and non-commute)
Implementation Partners:	CalTrans, Community-based Organizations, Rich City Rides, Richmond Bicycle/Pedestrian Advisory Committee, Contra Costa Health Services, Richmond Spokes, Safe Routes to School, East Bay Bicycle Coalition, and WCCUSD

Description: This strategy maintains and accelerates implementation of the City's Bicycle and Pedestrian Master Plans, and provides additional actions that support pedestrian and bicyclist safety and comfort, expand the bicycle and pedestrian network, and increase amenities throughout the City.

The City's **Bicycle Master Plan** (2011) identifies a 145-mile system of existing and planned bikeways, and supportive amenities. It builds upon the existing system of on-street and off-street bicycle facilities and focuses on connections between neighborhoods, safe routes to schools, and access to major destinations such as employment centers, stores and shops, parks, trails and open space areas. The Plan also includes criteria for defining different types of bicycle facilities, a listing of priority projects, recommendations for increasing the supply of bicycle parking, design standards, and education and safety programs.

The City's **Pedestrian Master Plan** (2011) identifies improvements to the street network to increase pedestrian route connectivity and safety within central Richmond. The Plan identifies existing physical barriers between neighborhoods, such as wide roadways, freeways, railroad tracks, and street closures that create challenges for pedestrians and bicyclists, as well as recommendations to reduce such challenges. The Plan recommends adoption of a complete streets policy, provides standards for complete street design, and prioritizes improvements for specific sites. The Plan includes a goal to

reduce the number of bicycle fatalities and injuries by 25 percent (even as the number of bicyclists increases) through bicycle safety programs.

The GHG savings associated with this strategy assume that 25 percent of the improvements identified in the Bicycle Master Plan are completed by 2020 and that 50 percent are completed by 2030. The City will continue to update these plans to identify new improvement projects in the future. The Richmond Livable Corridors FBC includes requirements for bicycle parking for each land use type, and other standards that benefit bicyclists and pedestrians. The RBSP would develop an inter-connected bicyclist and pedestrian network, that would include separated bike lanes, protected bike lanes, and recreational trails. The City will continue to integrate requirements for bicycle and pedestrian amenities in future planning efforts.

The Caltrans **Active Transportation Program** (ATP) funds a variety of planning and infrastructure projects that increase biking and walking mode share. Application scoring criteria include safety and mobility, GHG reduction potential, public health benefits, and benefits to disadvantaged communities. 88 percent of funds from the 2015 cycle of the statewide program went to projects that directly benefit disadvantaged communities, including the **Yellow Brick Road Project** in Richmond's Iron Triangle Neighborhood, which is expected to receive $6.2 million. In 2012, the City adopted the Iron Triangle Yellow Brick Road (YBR) Walkable Neighborhood Plan as an amendment to the Richmond Pedestrian Plan (2011) to create a walkable, pedestrian oriented neighborhood in the City's Iron Triangle.

TL3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL3.1. Develop standards for bicycle, pedestrian, and trail improvements and amenities in new development and redevelopment projects. Include requirements for adequate, safe, and accessible bicycle parking, drinking fountains, public restrooms, benches, landscaping and lighting. Consider weather and low-light conditions when mapping routes and designing bicycle paths. • TL3.2. Explore the potential to designate pedestrian priority areas near and within downtown, recreation destinations, commercial and mixed-use areas, transit stations, and schools. • TL3.3. Require owners of property along the shoreline to ensure maximum feasible public access and to complete the Bay Trail as part of any project approval process. • TL3.4. Per the Pedestrian and Bicycle Master Plans, increase the number of bikeway miles by 50 percent by 2030. The City currently has 32 miles of bicycle paths and must complete a total of 48 miles. • TL3.5. In future updates of the Bicycle and Pedestrian Master Plan provide additional connections between bicycle and pedestrian routes and regional trails. • TL3.6. Install "Share the Road" signs along all bicycle routes in the City to heighten driver awareness of bicyclists. • TL3.7. Create citywide signage plan for bicyclists and pedestrians at buildings, transit stops, and major intersections showing the distance, time, route and calories burned along routes. • TL3.8. Install secure bike parking at all school facilities. • TL3.9. Provide resources and incentives for businesses to provide amenities that promote active transportation such as secured bicycle parking, showers and lockers.
Partnerships	• TL3.10. Continue to work with **Community-based Organizations** and local organizations to secure funding for and increase promotion of biking and walking. Coordinate the City's efforts with ongoing bicycle and pedestrian community initiatives. • TL3.11. Partner with **WCCUSD to** identify strategies that increase bicycle ridership to schools.
Outreach and Education	• TL3.12. Create a forum for residents to request bike racks and lanes, and identify potholes and other bicycling barriers.

Strategy TL4: Improve Signal Timing

Performance Goal:	Increase number of coordinated traffic signals
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time; high (cost of construction, development of citywide traffic management center)
Potential source(s) of funding:	MTC's Program for Arterial System Synchronization (PASS)
Implementation:	One-time, with ongoing coordination duties
Responsibility:	Public Works, Transportation and Transit Services
Co-Benefits:	Improved vehicle fuel efficiency, reduced vehicle fuel cost, reduced traffic congestion Health: Improved air quality, decreased illness
Tracking Metrics:	Percentage of total signals coordinated
Implementation Partners:	MTC

Description: Traffic signal coordination describes a method of timing groups of traffic signals along an arterial to provide smooth movement of traffic with minimal stops. This technique reduces motorist stops and delays. This lowers the amount of fuel need to move a certain distance, lessens congestion, and reduces tail pipe emissions, all of which reduce GHG emissions and improve air quality.

Retrofitting an existing corridor to accommodate signal coordination can sometimes require excavating work, installing conduit, repairing sidewalks, and installing items like cameras and traffic signal controllers. Given the work required, large scale signal coordination projects create opportunities for local contractors to bid on the work, which would directly benefit the City economy and its residents.

To implement this strategy, the City will need to pursue funding to develop a citywide traffic management center, from which to control the City's traffic signal system. The City will also develop a list of priority arterials that are candidates for signal coordination, as part of the grant seeking process.

MTC administers the **Program for Arterial System Synchronization (PASS)**, which provides technical assistance to Bay Area agencies to improve the safety and efficiency of arterials in the region. Since its inception in Fiscal Year 2010-11, PASS has successfully re-timed approximately 2,000 traffic signals to improve signal coordination across jurisdictions and provide priority signal timing for transit vehicles. Highest priority is given to projects where an arterial serves as a reliever route to nearby freeway(s), serves transit lines with high ridership, or is located within a city that is projected to experience a substantial growth in housing and/or jobs between 2010 and 2040.

TL4 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL4.1. Explore developing requirements for traffic signal timing in local traffic engineering design standards. • TL4.2. Pursue funding to develop a citywide traffic management center. • TL4.3. Develop list of priority arterials for signal coordination. • TL4.4. Coordinate signal timing on roads to ensure more efficient traffic flow for motorists and bicyclists.
Partnerships	• TL4.5. **MTC**: Identify candidate projects for signal timing that can receive assistance under the PASS program

Strategy TL5: Expand Public Transit Options and Improve Multi-Modal Network Connectivity

Performance Goals:	30 percent increase in transit network coverage, 30 percent reduction in headways, and conversation of 50 percent of routes to BRT by 2030; ferry service provides 400 commute trips daily by 2030
GHG Savings by 2030:	10,131 MT CO_2e
Financial Impact to City:	Staff time to complete grant applications; potentially high cost of construction and/or maintenance
Potential source(s) of funding:	Chevron ECIA, AHSC Program (GGRF), CalTrans ATP, Caltrans Sustainable Communities grants, Caltrans EJ planning grants, CalTrans CBTP grants, BAAQMD Shuttle and Rideshare program
Implementation:	Ongoing
Responsibility:	City Manager's Office, Transportation and Transit Services
Co-Benefits:	Reduced traffic congestion, enhanced transit connectivity Health: Improved air quality, decreased illness
Tracking Metrics:	Transit ridership rates
Implementation Partners:	BAAQMD, MTC, AC Transit, BART, Port of Richmond, San Francisco Bay Ferry, large employers

Description: Residents and employees in the City of Richmond have multiple transit options that provide connections throughout the Bay Area and greater Northern California region. The **Amtrak Capitol Corridor** line originates in Sacramento and runs south through Richmond, ending in San Jose and providing connections to most cities in between. The Richmond-Fremont **Bay Area Rapid Transit (BART)** line originates near Downtown Richmond and extends through San Francisco to Millbrae, northeast to the Pittsburg/Bay Point area or southeast to the Dublin/Pleasanton area, and south to Fremont. The Richmond Circular Shuttle service provides a connection between Amtrak and BART. Bus service is provided by **the Alameda Contra Costa Transit District (AC Transit)** and **Western Contra Costa Transit Authority (WestCAT)**, with local and regional connecting lines. Richmond Paratransit and East Bay Paratransit are also available to residents. In addition, a **new ferry line** is proposed that would provide a direct connection from a new terminal at the Ford Peninsula (1.5 miles from Downtown Richmond) to San Francisco as early as 2018.

Extending and increasing transit service will be essential as the City grows in the future and new employment opportunities in the City and the greater Bay Area increase the number of commuters traveling to or passing through Richmond. To improve the efficiency of these services, the City will coordinate transit schedules and ensure all parts of Richmond are provided access to transit options. The City may also improve amenities at existing transit stops and stations to improve rider comfort and safety.

TL5 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL5.1. Update the City's development impact fee program to provide funding for improvements to public transit facilities and amenities. • TL5.2. Work with AC Transit to enhance public transit rider experience by installing shelters and improved lighting at heavily trafficked bus stops. • TL5.3. Support expansion of night and weekend service to make public transit more reliable and accessible to seniors, youth, and low-income households. • TL5.4. Facilitate dialogue between transit agencies to ensure schedule coordination. Schedule coordination will increase public transit usage by reducing overall travel times and making public transit more competitive with other modes of transportation. • TL5.5. Work with WCCUSD to evaluate school bus routes to ensure efficient routing. • TL5.6. Expand "Guaranteed Ride Home Program" and transition to new Contra Costa County guidelines for subsidies and enrollment.
Partnerships	• TL5.7. **BAAQMD, MTC,** other regional partners and **large employers:** improve Richmond Circular Shuttle services linking **BART** and **Amtrak** stations to commuter destinations, and extend service to the planned ferry terminal and other nearby transit hubs. Seek funding through BAAQMD Shuttle and Rideshare program. • TL5.8. **Port of Richmond:** begin free shuttle service between the Port of Richmond and the BART station for port employees and Richmond residents.
Outreach and Education	• TL5.9. Encourage transit use by distributing information on the various transit routes and options through the City's newsletters, email blasts, social media outlets, and marketing campaigns.

Strategy TL6: Expand Car Sharing, Bike Sharing and Ride Sharing

Performance Goal:	75 percent of City residents and employees are within half a mile of a car share pod by 2030
GHG Savings by 2030:	1,638 MT CO_2e
Financial Impact to City:	Staff time to develop public-private partnerships; promotional materials
Potential source(s) of funding:	Chevron ECIA, Bay Area Bike Share program, BAAQMD Shuttle and Rideshare program
Implementation:	Ongoing
Responsibility:	City Manager's Office, Transportation and Transit Services
Co-Benefits:	Reduced or eliminated cost of car ownership Health: Improved air quality, increased physical activity, decreased obesity and illness
Tracking Metrics:	Percent of residents within half-mile of bike share station and/or car sharing pod; program participation rates
Implementation Partners:	MTC, BAAQMD, car sharing companies, BACC, neighborhood groups and associations

Description: Car sharing allows people to rent cars for one trip, or one day, rather than the multi-day rental services traditional rental cars provide. The **Chevron ECIA agreement** specifies that funding is available to expand car sharing and to increase its use, through the following actions: 1) trip planning services; 2) private car-sharing using greener vehicles; 3) provide low-cost alternative fuel and EV sport utility vehicle rentals; 4) provide subsidies to encourage developers to incorporate car sharing into new residential developments; and 5) continue to subsidize existing programs during the startup phase.

The City also has an opportunity to expand car sharing by working with the **Bay Area Climate Collaborative (BACC),** which is partnering with the Contra Costa Transit Administration and City CarShare on a MTC grant to bring EV car sharing to the East Bay. Richmond is being considered as a potential site for the program. The City will also work with other car sharing services in the Bay Area, like **Zip Car**, to increase their presence within the City.

The City will explore the benefits of promoting ride sharing services such as **Uber** and **Lyft**, as well as "**casual carpools**" for commuting into San Francisco. Casual carpools are formed between at least two riders and one driver (carpools of three or more are eligible for reduced tolls and use of highway express lanes) at the pickup locations in the East Bay during carpool lane hours (5:00am-10:00am). Because both riders and drivers can form a carpool almost immediately when they arrive, it can be faster than relying on a traditional carpool and is almost always faster than driving individually or taking BART. A casual carpool community emerged in the Bay Area in the 1970s and has since grown to be a reliable means of commuting to San Francisco from the East Bay.

The **Bay Area Bike Share** program allows users to rent bicycles for use on a temporary basis, after which the users return the bicycle to either the same location or another designated location. The

program offers rentals based on the hour or day, or else a one year membership which provides unlimited rides. The program is currently operating in San Francisco, Redwood City, Palo Alto, Mountain View, and San Jose with service extending into Berkeley, Emeryville, and Oakland by 2017. Bike Share stations are generally located in high density areas and near transit stations to provide the "final mile" between transit stops and riders' final destination. Potential locations for car sharing and bike sharing stations include the Transit Station, Downtown Richmond, and the future ferry terminal.

TL6 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL6.1. Create incentive program to encourage developers to incorporate car sharing into new development and redevelopment projects. • TL6.2. Explore feasibility of developing a student bike share program at Richmond schools. • TL6.3. Consider implementing a program that provides rental income in exchange for allowing other residents in the City to borrow unused EVs when they are available (i.e., private car share program).
Partnerships	• TL6.4. **Car sharing companies:** support expansion and increase usage by providing trip planning services and additional rental options. • TL6.5. **MTC and BAAQMD:** bring Bay Area Bike Share program to Richmond. • TL6.6. **BAAQMD:** pursue funding from Shuttle and Rideshare Program. • TL6.7. **BACC:** implement pilot EV car sharing program in Richmond. • TL6.8. **Neighborhood groups:** identify opportunities for installing car-sharing portals.
Outreach and Education	• TL6.9. Promote the use of car sharing, ride sharing, and bike sharing among residents in Richmond through City's newsletters, email blasts, social media outlets, and a citywide marketing campaign.

Strategy TL7: Promote Low-Carbon Vehicles and Fuels

Performance Goal:	By 2030, 17% of vehicles used by residents and businesses are Plug-in electric vehicles (PEVs) or other zero emission vehicles (ZEVs)
GHG Savings by 2030:	23,770 MT CO_2e
Financial Impact to City:	Staff time; promotional materials
Potential source(s) of funding:	Chevron ECIA, BAAQMD *Charge!* Program, BAAQMD PEV Rebate Program, PEV charging program with CPUC and PG&E, pilot program with BART
Implementation:	Short-term; ongoing maintenance and expansion of programs
Responsibility:	City Manager's Office, Transportation and Transit Services
Co-Benefits:	Reduced reliance on petroleum, significant fuel savings to drivers, benefits to the local economy Health: Improved air quality, decreased illness
Metrics:	ZEV vehicle penetration (percent of total fleet) Number of ZEV stations installed
Implementation Partners:	BAAQMD, Contra Costa Transit Administration, City CarShare, MTC, BACC, PG&E, BART

Description: Zero-emission vehicles (ZEVs) are an increasingly common sight along California roads. ZEVs include plug-in battery electric vehicles (PEVs) and hydrogen fuel cell electric vehicles (FCEVs). The availability of new vehicle models, greater driving range from improved battery technology, increased availability of charging infrastructure, along with incentives such as carpool lane access stickers, federal tax credits, and state and air district rebates have contributed to an expanding market for PEVs. In addition to the GHG savings and co-benefits listed above, consumers are beginning to realize that PEVs are fun to drive and can satisfy a large percentage of their daily transportation needs.

On March 23, 2012, Governor Brown issued Executive Order (EO) B-16-20122 to encourage ZEVs in California and set a long term goal of reaching 1.5 million ZEVs on California's roadways by 2025. Interim goals established by the EO are as follows: by 2015, California's major metropolitan areas will be able to accommodate ZEVs through infrastructure plans; by 2020, California's ZEV infrastructure will be able to support up to 1 million vehicles; and by 2025, 1.5 million ZEVs will be on California's roadways with easy access to infrastructure. The State's 2013 ZEV Action Plan and Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) are tasked with identifying funding for the installation of PEV charging stations, advanced technology zero-emission and low-emission medium- and heavy-duty truck demonstrations and deployment, and providing seed funding for start-ups and small manufacturers of advanced technology vehicles, components, and batteries to expand their plants and assembly lines.

According to the Bay Area Plug-In Electric Vehicle Readiness Plan, the region's goal for EV deployment is 110,000 EVs by 2020 and 247,000 EVs by 2025. The Plan, co-developed by BAAQMD and Metropolitan Transportation Commission (MTC), includes strategies for rapidly increasing PEV adoption, by expanding PEV charging infrastructure, offering financial and other incentives to help grow the PEV

market, expanding consumer education and outreach, assisting local governments with PEV friendly policies, ordinances, zoning and permitting practices, and integrating with the Sustainable Communities Strategy (Plan Bay Area).

In support of the PEV readiness plan, BAAQMD offer grant funding through its ***Charge!*** program for the installation of PEV charging stations at Bay Area transportation corridors, workplaces, multi-family dwelling units and trip destination locations. The Bay Area Climate Collaborative (BACC) is also working to support broader statewide goals by connecting cities with transportation technology companies, such as Vision Fleet which helps organizations deploy PEV and hybrid electric vehicle fleets through financing innovations and program support. In addition, Richmond is evaluating the feasibility of participating in PEV funding programs that are in the early stages of development, such as pilot with Bay Area Rapid Transit (BART) to install PEV charging stations at BART extensions, and a program that PG&E is proposing with the California Public Utilities Commission (CPUC) to fund charging stations throughout its territory, including disadvantaged communities.

The Chevron ECIA specifies that funding is available to expand PEV infrastructure and use in Richmond. Funding from the ECIA can be used for programs and actions such as: 1) support the expansion of PEV charging stations, 2) create a program that offers rental income for unused EVs, 3) offer PEV car rentals, 4) provide longer range PEV vehicles for rent to reduce range anxiety, 5) share the City's underused EVs with other residents, 6) provide subsidies for residential developers to provide EV car share stations, 7) subsidies for sales/leases, and 8) a robust educational campaign.

TL7 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL7.1. Develop a City of Richmond ZEV implementation strategy. • TL7.2. Update parking standards in the Zoning Code and future form-based codes to include EV charging stations. • TL7.3. Streamline the permitting process to install charging stations. • TL7.4. Expand EV charging stations in Richmond on City properties, in downtown, and high traffic retail and commercial areas. • TL7.5. Update the City's purchasing policy to include procurement goals for ZEVs • TL7.6. Seek funding to replace municipal fleet vehicles with low-carbon alternatives. • TL7.7. Explore use of low-emission vehicles at the Port of Richmond. • TL7.8. Provide long-range EVs for rental to reduce range anxiety. • TL7.9. Provide subsidies to low-income residents for the sale or lease of ZEVs.
Partnerships	• TL7.10. **BACC:** identify a funding and implementation strategy for converting the City's vehicle fleet to EVs. Consider using Vision Fleet's services service, or a similar service; continue to identify new transportation and public transit service startups and systems (i.e., start-ups) that could be offered in Richmond. • TL7.11. Explore opportunity to install EV charging stations at Richmond BART station. • TL7.12 **PG&E:** explore opportunities to fund charging stations throughout the City, focusing on disadvantaged communities.
Outreach and Education	• TL7.13. Connect businesses with funding opportunities and services to convert company fleets to zero- and low-emission vehicles and to install EV charging stations. • TL7.14. Connect residents with subsidies and financial incentives to purchase low-emission or renewable fuel vehicles, including Community Housing Development Corporation's Ways to Work car loan program. • TL7.15. Encourage ride and drive events to provide local residents with direct ZEV experience.

Strategy TL8: Outreach and Education to Support Public Transit and Active Transportation

Performance Goal:	Increase number of residents knowledgeable about transportation options by 20 percent
GHG Savings by 2030:	1,530 MT CO_2e
Financial Impact to City:	Staff time, promotional materials
Potential source(s) of funding:	Chevron ECIA, CalTrans CBTP grants, CalTrans ATP
Implementation:	Ongoing
Responsibility:	City Manager's Office, Transportation and Transit Services
Co-Benefits:	Increased transit ridership funds, reduced traffic congestion, reduced or eliminated cost of car ownership Health: Improved air quality, increased physical activity, decreased obesity and illness
Metrics:	Number of residents who report using transit or active transportation
Implementation Partners:	MTC, AC Transit, BART, San Francisco Bay Ferry, WCCUSD, Port of Oakland, Communities for a Better Environment, Rich City Rides, Richmond Bicycle/Pedestrian Advisory Committee, Contra Costa Health Services, Richmond Spokes, Safe Routes to School, East Bay Bicycle Coalition, neighborhood groups, and large employers

Description: The City will partner with local agencies, schools, and community groups to engage students, residents, and businesses in confronting the climate change challenge. Together, we will continue identify and implement opportunities for school and community improvements related to active transportation (i.e., walking and biking) and public transportation. The City will promote public transit and active transportation as an attractive and preferable means of traveling, and will engage local businesses in encouraging employees to take advantage of public transit and active transportation options available to them.

TL8 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL8.1. Promote safe and accessible active transportation through long-range planning documents, including California Transportation Plan 2040 and Regional Transportation Plans. • TL8.2. Explore opportunities to create "walking school bus" programs where parents can share the responsibility of escorting children to and from school by foot or bicycle.
Partnerships	• TL8.3. Identify and implement opportunities for school and community improvements related to active transportation (i.e., walking and biking) and public transportation. • TL8.4. Partner with **WCCUSD** to engage students, parents, and transit providers to continue to implement and expand the Safe Routes to School program. (GP Action EC2.G)
Outreach and Education	• TL8.5. Conduct outreach to inform residents about access to and benefits of alternative and active modes of transportation, including walking, biking, car sharing, and public transit. • TL8.6. Collect, develop, and disseminate tools and guidelines that promote safe, active transportation. • TL8.7. Maintain the City's commitment to the Bike-to-Work awareness month and campaign. • TL8.8. Engage students in designing and implementing competitions and incentive programs for students who walk, bike, carpool or take public transportation to school. • TL8.9. Consider adding local bicycle skills parks to promote local cycling

Strategy TL9: Support Transportation Demand Management

Performance Goal:	By 2030, achieve 10 percent increase in participation and number of employees provided transit subsidies and a doubling of employees able to work from home (from 5 percent to 10 percent) at least one day a week.
GHG Savings by 2030:	5,120 MT CO_2e
Financial Impact to City:	Staff time, promotional materials
Potential source(s) of funding:	MTC's Parking Management and TDM Grant Program
Implementation:	Ongoing
Responsibility:	City Manager's Office, Transportation and Transit Services, Planning and Building Services
Co-Benefits:	Improved air quality, increased transit ridership funds, reduced traffic congestion, promotes biking and walking, reduced or eliminated cost of car ownership Health: Improved air quality, increased physical activity, decreased obesity and illness
Tracking Metrics:	Percent participation in TDM programs; percent of employees able to work from home one day per week
Implementation Partners:	AC Transit, MTC, WCCUSD, 511, local businesses, building management companies

Description: Transportation demand management (TDM) describes strategies to reduce demand for roadway travel, particularly in single-occupancy vehicles. TDM strategies can aim to change travel behavior patterns through either voluntary incentives or requirements. Specific examples include: preferential parking for carpoolers, parking pricing, parking "cash out" programs, and allowing telecommuting or flexible schedules.

The nine-county **Bay Area Commuter Benefits Program**, the largest TDM program in the country, is based on successful ordinances in San Francisco, Richmond, Berkeley and at San Francisco International Airport. In San Francisco alone, the local commuter benefits ordinance has helped reduce GHG emissions by as much as 286,547 metric tons annually[6]. Richmond's **Commuter Benefits Ordinance**, contained in Chapter 9.62 of the City's Municipal Code, requires all businesses with ten or more employees, who work an average of 10 or more hours per week, to offer a pre-tax election program, an employer-paid transit benefit, or employer provided transit options.

This strategy focuses on City actions that support TDM programs within private businesses. The City will continue to employ a staff member responsible for enforcement of the Bay Area and Richmond Commute Benefits Ordinances. This staff member will continue to help businesses comply with these ordinances, and will also promote additional TDM strategies, particularly for larger businesses where

[6] http://www.spur.org/blog/2014-11-25/how-commuter-benefits-can-shift-bay-area-more-sustainable-future

these strategies are the most effective. The City will also consider new ways to incentivize TDM strategy implementation alongside basic compliance.

The Metropolitan Transportation Commission's (MTC's) **Climate Initiatives Parking Management and Transportation Demand Management (TDM) Grant Program** provides $6 million to support parking management strategies with additional opportunities to fund first / last-mile transportation strategies in areas currently underserved by other alternatives. The Grant Program is part of the MTC's Climate Program, a critical component of the region's long-range Regional Transportation Plan/Sustainable Communities Strategy, Plan Bay Area.

TL9 Implementing Actions	
City Initiatives, Policies and Infrastructure	• TL9.1. Continue to implement Richmond's Commuter Benefit Ordinance requiring businesses to offer and encourage employees to take alternative modes of transportation. • TL9.2. Provide tax and development incentives for employers with more than 100 employees within the City to establish a trip reduction plan that would incorporate annual employee commute surveys, marketing of commute alternatives, ride matching assistance, and transit information. • TL9.3. Explore the potential to support a Parking Cash-Out policy that requires certain employers to provide cash in-lieu of a parking space. This policy "unbundles" parking from employees' benefits. • TL9.4. Explore the potential to support fare-free transit zones in major commercial areas, free or very low-cost bus passes for target groups, • TL9.5. Explore the potential for a streetcar system that connects the Downtown with the planned ferry terminal in the South Shoreline Area • TL9.6. Develop online tools that provide real time information to transit riders. • TL9.7. Develop a sample TDM program for businesses in the City that encourages use of public transit through transit subsidies and incentive programs.
Partnerships	• TL9.8. Encourage **local businesses** and building management companies in the same area to collaborate on joint trip reduction plans. • TL9.9. **511's free RideMatch Service:** encourage participation to alleviate stress of commuting to other cities for Richmond residents. • TL9.10. **AC Transit:** to explore opportunities to expand subsidized public transit for low-income residents. • TL9.11. **AC Transit** and **WCCUSD:** connect Richmond high school students who participate in the free and reduced lunch program with free monthly AC Transit Youth Passes program, and identify funding to provide AC Transit passes to all high school students in Richmond.
Outreach and Education	• TL9.12. Create online forum for rideshare customers in Richmond. • TL9.13. Facilitate casual carpool for residents commuting to work outside of the City by identifying popular routes and establishing meeting points and drop-off locations.

Solid Waste

Strategy SW1: Establish a Zero Waste Framework

Performance Goal:	By 2030, 90 percent of all solid waste is diverted from landfills
GHG Savings by 2030:	52,755 MT CO_2e (this accounts for Strategies SW1 through SW5)
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	CalRecycle, RecycleMore, Republic Services
Implementation:	Ongoing; Adopt Zero Waste Ordinance by 2017
Responsibility:	City Manager's Office
Co-Benefits:	Reduced waste, lower energy demand, improved traffic, public education, potential cost savings for ratepayers Health: Improved local air quality, reduced worker exposure to toxic materials, reduced potential for ground water contamination
Tracking Metrics:	Citywide solid waste generation; percent solid waste diverted from landfill
Implementation Partners:	WCCUSD, RecycleMore, Republic Services, Reuse Centers, Community-based Organizations dedicated to urban gardening

Description: Zero Waste encourages the redesign of products and waste service streams with a goal that every resource is eventually reused. As it relates to solid waste collection, Zero Waste strategies aim to prevent waste, and increase recycling, reuse, and composting of waste materials so that fewer materials are sent to landfills. As a result, Zero Waste strategies extend the useful life of landfills while reducing methane emissions associated with the decomposition or organic matter in landfills.

Cities throughout the country have adopted Zero Waste ordinances, which typically aim to achieve around 90 percent waste diversion through a combination of enhanced diversion programming, pricing incentives, public education and outreach, and waste regulations. To implement this measure, the City will work with the regional recycling agency, RecycleMore, and adopt a Zero Waste Ordinance that sets a goal to achieve 90 percent waste diversion by 2030.

The City will also develop a Zero Waste Strategic Plan to outline a path to achieving the target established in the ordinance. The Strategic Plan would include: strategies to expand existing recycling and composting facilities or create new facilities; various regulations and incentives to reduce total waste disposed by residents, businesses, and institutions; programs to educate the public on Zero Waste strategies and promote the participation of community members; and policies to advocate for manufacturer responsibility for product waste.

SW1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• SW1.1. Develop a Zero Waste ordinance to provide the framework for a Zero Waste Richmond by 2030 (equivalent to 90% diversion rate). • SW1.2. Implement the State's 75% Diversion Initiative (AB 341) within the Richmond Municipal Code such as a Commercial Recycling Law for all Richmond Businesses. • SW1.3. Continue to require upgrades to Republic's recycling, construction and demolition debris, and green waste sorting and processing infrastructure as new technologies become available. • SW1.4. Periodically review sorting and processing infrastructure used in other Bay Area jurisdictions, to identify emerging methods and technologies that could increase Richmond's waste diversion. • SW1.5. Install recycling bins throughout the City along public right-of-ways, parks, and transit stops. • SW1.6. Develop a Zero Waste Strategic Plan. • SW1.7. Provide resources and technical assistance to businesses to help maximize waste diversion rates, reduce packaging, and provide more sustainable products. • SW1.8. Launch programs to connect commercial kitchens with local donations centers to reduce food waste.
Partnerships	• SW1.9. Engage residents in designing and implementing an inter-neighborhood waste reduction and neighborhood cleanup competition.
Outreach and Education	• SW1.10. Conduct outreach and education to businesses and schools (see Strategy SW5) on waste reduction tips, and encourage use of complimentary recycling and composting pickup services. • SW1.11. Conduct outreach and education to residential neighborhoods on waste reduction tips and neighborhood cleanups, and encourage use of complimentary recycling and composting pickup services. • SW1.12. Promote the use of material re-use centers.

Strategy SW2: Increase Participation in Existing Recycling Programs and Incentives

Performance Goal:	By 2030, 90 percent of all solid waste is diverted from landfills
GHG Savings by 2030:	Accounted for in Strategy SW1
Financial Impact to City:	Staff time and promotional materials.
Potential source(s) of funding:	CalRecycle, RecycleMore and Republic Services
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Reduced waste, improved traffic, public education Health: Improved air quality, reduced worker exposure to toxic materials, reduced potential for ground water contamination
Tracking Metrics:	Annual tonnages of recyclables and organics diverted from landfill
Implementation Partners:	Republic Services, RecycleMore, Contra Costa County Green Business Program

Description: This measure encourages the City to work with local waste haulers and agencies to increase recycling and composting, and ensure appropriate disposal of hazardous waste. **Republic Services**, the City's franchise waste hauler, provides educational materials on its website to help customers properly dispose of their waste. **RecycleMore** is tasked with ensuring Richmond and its neighboring cities achieve the solid waste diversion goals established by the State. RecycleMore has several programs aimed at helping residents, businesses, and institutions achieve Zero Waste by promoting backyard composting, construction and demolition (C&D) diversion, the adoption of reusable bag ordinances, and proper hazardous waste disposal. RecycleMore also offers free workshops, field trips, and classroom presentations to schools in Contra Costa County.

In 2014, the State banned disposal of organic materials at landfills, which has the potential to significantly reduce methane emissions from landfills over time, once existing organic "waste-in-place" has decomposed.

Contra Costa County Green Business Program, as part of the Bay Area Green Business Program, provides certifications to businesses who demonstrate compliance with certain environmental regulations and that implement certain practices and procedures that are considered environmentally sustainable. Some of these practices include waste diversion through enhanced recycling and composting, environmentally preferable purchasing policies, best practices in source reduction (i.e., double sided printing, reduced printing, and/or reduced junk mail) and reuse of waste materials where possible.

SW2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• SW2.1. Ensure that the City's Building Code supports waste diversion best management practices. (See SW1.1 and SW1.2) • SW2.2. Ensure that all city-owned and operated facilities contain disposal containers for recycling and composting, and appropriate signage. • SW2.3. Continue to expand and build commercial recycling program offerings, in partnership with RecycleMore and the City's franchisee Republic Services, to provide recycling and composting bins, and multilingual technical assistance for waste reduction programs for businesses, apartment buildings, schools and non-profit organizations. • SW2.4. Develop "dry route recycling" program to divert paper, cardboard and other non-putrescible materials from the discards generated by larger Richmond businesses that are not taking full advantage of other diversion and waste reduction methods.
Partnerships	• SW2.5. Work with **Contra Costa Green Business Program** to increase participation in the Green Business Program to maximize practices that reduce wastes sent to landfills and supports the City's Zero Waste Ordinance. • SW2.6. Partner with **RecycleMore** to maximize participation in residential and commercial recycling and composting programs.
Outreach and Education	• SW2.7. Conduct educational outreach to connect residents and businesses with the West County Household Hazardous Waste (HHW) Facility, and promote proper disposal of hazardous materials from households and small businesses. • SW2.8. Conduct outreach and education to single- and multi-family dwellings on waste reduction, and encourage use of recycling and composting services. Ensure that linguistic and cultural communication barriers are addressed. • SW2.9. Provide outreach to encourage compliance with the Reusable Bag Ordinance. • SW2.10. Provide outreach on proper disposal of bulky items (e.g., mattresses) including curbside pick-up services.

Strategy SW3: Establish and Support Garbage Collection Service Rates and Schedules that Maximize Participation in Composting and Recycling Programs

Performance Goal:	By 2030, 90 percent of all solid waste is diverted from landfills
GHG Savings by 2030:	Accounted for in Strategy SW1
Financial Impact to City:	Staff time and promotional materials; potential need for outside technical study
Potential source(s) of funding:	RecycleMore
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Reduced waste, lower energy demand, public education Health: Improved air quality
Tracking Metrics:	Citywide solid waste generation; annual tonnages of recyclables and organics diverted from landfill
Implementation Partners:	RecycleMore, Republic Services

Description: The City, through its franchise agreement with Republic Services, currently offers garbage, recycling, and food-scrap composting services to residents and businesses within Richmond. Garbage, recyclables and green waste are picked up weekly. Customers pay for garbage collection services, while recycling and composting services and materials are offered free of charge. Common practices for reducing waste collected by franchise haulers include converting to larger recycling containers and smaller garbage bins, and increasing recycling and composting collection service while decreasing garbage collection service. Richmond has implemented a volume-based waste collection for garbage services, or Pay-As-You-Throw (PAYT) collection, that charges customers for garbage collection based on the amount of garbage they generate. Rates are determined by the size of the waste container, and the frequency of pickup. Customers who generate less garbage are charged less money, thus creating a financial incentive to increase composting and recycling.

The City will work with its franchise haulers to increase commercial and multi-family recycling and organics diversion by setting garbage service rates (i.e., costs) and schedules that incentivize diversion.

SW3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• SW3.1. Regulate industrial collection rates and incentivize recycling for large industrial customers. • SW3.2. Evaluate including incentives, in addition to bill savings, for more customer engagement. • SW3.3. Evaluate and consider reducing the mandatory weekly pickup frequency of trash included in the Richmond Municipal Code. • SW3.4. Consider the development of mandatory residential composting and recycling ordinance. • SW3.5. Continue to provide weekly residential curbside recycling and compost collection services, and evaluate expanding materials accepted by Republic Services. • SW3.6. Develop a pilot program to explore reducing residential garbage collection to every other week with neighborhoods and customers actively participating in recycling programs.
Partnerships	• SW3.7. Work with multifamily buildings to develop green teams, provide access to curbside recycling and composting services, and encourage onsite composting for community gardens when possible. • SW3.8. Continue to evaluate rate adjustments with **Republic Services** and **RecycleMore** that incentivize waste diversion.
Outreach and Education	• SW3.9. Educate Richmond businesses about cost-savings achieved by participating in the City's no-cost curbside recycling and compost program.

Strategy SW4: Increase Diversion of Construction and Demolition (C&D) Waste

Performance Goal:	By 2030, 90 percent of C&D waste is diverted from landfills
GHG Savings by 2030:	Accounted for in Strategy SW1
Financial Impact to City:	Staff time and promotional materials; potential contract negotiation costs
Potential source(s) of funding:	Franchise Agreements
Implementation:	Develop a C&D Strategy
Responsibility:	City Manager's Office, Building and Planning Services Department
Co-Benefits:	Reduced waste, reduced costs of disposal, reduced production of new materials, reduced illegal dumping Health: Reduced worker exposure to toxic materials, reduced potential for ground water contamination, improved air quality
Tracking Metrics:	Annual tonnage of processed (recycled) C&D materials; annual tonnage of C&D waste sent to landfill
Implementation Partners:	RecycleMore, RichmondBUILD

Description: As of July 1, 2014, CALGreen, the State's Green Building Standards Code, requires jurisdictions to divert a minimum of 50 percent of the nonhazardous construction and demolition (C&D) waste from landfills. C&D debris typically includes materials such as lumber, drywall, metals, masonry, carpet, plastic, and other building materials. This measure also promotes the deconstruction of buildings, rather than demolition, in which buildings are carefully disassembled and component parts are recycled or locally repurposed and reused. When buildings are demolished, workers, neighbors and the environment can be exposed to toxic chemicals. The deconstruction of buildings requires that developers plan how to manage materials after the building is deconstructed, and in doing so - identify hazards or potentially dangerous waste.

Deconstructing buildings and diverting C&D waste supports green building construction by reducing the need to harvest and transport new raw construction materials. This measure reduces GHG's by reducing landfill methane emissions from the decomposition of organic components contained in the C&D debris.

SW4 Implementing Actions	
City Initiatives, Policies and Infrastructure	• SW4.1. Work with the RecycleMore to ensure city policies comply with CalRecycle requirements for C&D waste. • SW4.2. Continue to update the City's Building Code based on the state's Green Building Standards (CalGreen Code) requiring a minimum 50 percent of debris be recycled or repurposed. • SW4.3. Require new development projects to provide a construction plan prior to permit approval that demonstrates how activities will reduce waste to achieve the required diversion rate. Require disposal receipts during the building permit process to confirm proper recycling and disposal, and prevent illegal dumping. • SW4.4 Continue ongoing review and monitoring of the Republic's Condition Use Permit and ensure that best practice technologies are installed at the C&D sorting facility. • SW4.5. Evaluate opportunities to franchise C&D waste stream and improve C&D services to customers.
Partnerships	• SW4.6. Work with **RecycleMore** to develop a C&D strategy to implement best practices for capture of C&D materials including C&D rate analysis, necessary capital improvements, and financing options. • SW4.7. Work with **RichmondBUILD**, developers, community-based organizations, and others to promote practices that reduce C&D waste sent to landfills, and support the City's C&D diversion requirements.
Outreach and Education	• SW4.8. Work with building department to provide outreach to contractors and ensure the limited use and proper disposal of all hazardous and non-reusable C&D waste materials.

Strategy SW5: Promote School Waste Diversion Programs

Performance Goal:	By 2030, 100 percent of all schools will have "three-bin" recycling programs (garbage, recycling, and compost)
GHG Savings by 2030:	Accounted for in SW1
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	RecycleMore, CalRecycle, California Recycling Challenge program
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Reduced waste, engaged youth, public education Health: Reduced exposure to toxic materials by using compost instead of chemically-based fertilizers
Tracking Metrics:	Percentage of Richmond schools with "three-bin" recycling programs (i.e., bins for garbage, recycling, and compost)
Implementation Partners:	RecycleMore, West Contra Costa Unified School District (WCCUSD)

Description: This measure supports communitywide implementation of the Zero Waste Framework (Strategy SW1) by expanding recycling outreach and education programs in schools. Current California law requires schools and school districts that generate four cubic yards or more of waste per week to recycle, and mandatory organics recycling requirements will commence on April 1, 2016[7]:

- April 1, 2016: Schools that generate eight cubic yards of organic waste per week shall arrange for organic waste recycling services.
- January 1, 2017: Schools that generate four cubic yards of organic waste per week shall arrange for organic waste recycling services.
- January 1, 2019: Schools that generate four cubic yards or more of commercial solid waste per week shall arrange for organic waste recycling services.

The City will work with RecycleMore and WCCUSD to develop programs at Richmond schools, and work with WCCUSD staff to ensure they have the resources needed to increase solid waste diversion at each school facility. Specifically, the City will support WCCUSD in implementing a District-wide three bin collection system to enable students to properly sort their waste destined for the landfill, to be composted, or to be recycled.

As a means of supporting implementation of a Zero Waste Plan for WCCUSD, the City will partner with RecycleMore to engage and assist WCCUSD with the development of educational activities for students, faculty, and parents to increase awareness and understanding of recycling best practices. Educational

[7] CalRecycle, School Waste Reduction. Available at http://www.calrecycle.ca.gov/reducewaste/schools/#California. Accessed November 24, 2015.

school programs may be competitive or incentive-based and will increase awareness of existing residential and business programs. These programs will introduce all students to three-bin recycling systems, promote backyard composting at school and home gardens, encourage the use of reusable bags, provide examples of hazardous waste, and discuss proper disposal of such items. By implementing three-bin recycling systems at schools, students may provide guidance on best practices in source reduction for District purchasing policies, and later transfer this knowledge to develop at-home environmentally preferable purchasing practices to reduce household waste.

SW5 Implementing Actions	
City Initiatives, Policies and Infrastructure	• SW5.1. Ensure that Richmond codes and policies are consistent with and support California State requirements for school recycling and organics waste diversion. • SW5.2. Partner with RecycleMore and WCCUSD to establish a standardized district-wide three bin compost, recycling, and garbage system. • SW5.3. Work with WCCUSD to develop and implement a Zero Waste 2030 program in support of the City's Zero Waste Ordinance. • SW5.4. Support WCCUSD to establish a new contract and service agreement with their waste hauler consistent with the citywide waste diversion plans, including food scrap composting and weekly compost and recycling service. • SW5.5. Develop educational programs to engage students, teachers, staff, and parents in waste diversion efforts, including school waste assessments and tracking. • SW5.6. Engage students in designing and implementing a school waste reduction competition.
Partnerships	• SW5.7. Continue partnership with RecycleMore and WCCUSD to provide technical assistance and training to students, teachers, and staff for composting and other waste reduction programs. • SW5.8. Work with WCCUSD Food Service Department programs to connect school cafeteria kitchens and food-service contractors with local donation centers and implement environmentally preferable purchasing.
Outreach and Education	• SW5.9. Work with **RecycleMore** to expand existing solid waste education and outreach programs. • SW5.10. Help **WCCUSD** organize school field trips to the City of Richmond landfill and compost facility. • SW5.11. Provide students with at-home environmentally preferable waste purchasing guidelines to encourage source reduction.

Water Conservation

Strategy WA1: Promote Water Conservation Programs

Performance Goal:	By 2020, 20% per capita reduction in water consumption from 2012 levels (per Senate Bill 7x); by 2030, 30% per capita reduction
GHG Savings by 2030:	800 MT CO_2e
Financial Impact to City:	Low to moderate cost of upgrading municipal facilities, staff time, and promotional materials; cost savings from reductions in water use
Potential source(s) of funding:	EBMUD programs
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Energy savings, improved water supply resiliency and security, reduced lost work and school days Health: Reduced mold, reduced illness, increased indoor comfort, reduced heat island effect
Tracking Metrics:	Gallons saved per year Citywide
Implementation Partners:	EBMUD

Description: East Bay Municipal Utilities District (EBMUD) is the primary water provider for the City of Richmond. EBMUD offers a variety of incentives to encourage customers to reduce indoor and outdoor water consumption during normal and dry years. EBMUD's **WaterSmart Calculator** helps households calculate their water use and identify areas where efficiency improvements may conserve water and save money. Residents may sign up for **My Water Report** for bi-monthly statistics on their water use compared to other similar households. The **Home Survey Kit** can help a household identify leaking toilets, high-flow fixtures, and irrigation components that may be resolved through simple fixes or replacements. Alternatively, residential customers may opt for an **On-Site Home Water Survey** completed by EBMUD. EBMUD also offers a list of tips and tricks on its website with simple water saving advice. Rebates are provided for: toilet replacement, clothes washer upgrades, and installation of graywater systems. EBMUD also offers free low flow showerheads, faucet aerators, hose nozzles, shower diverters, and dye tablets (for detecting toilet leaks).

EBMUD's **WaterSmart Gardener** provides incentives, outreach, and education for outdoor water conservation, including: rebates for converting lawn space to water efficient landscaping, information on installing drip irrigation, irrigation surveys, landscape water budgets, rebates for graywater system installation, grants for creating community gardens, and a multitude of resources for designing and installing water efficient landscapes.

EBMUD offers similar resources and incentives for business customers, including **Water Surveys** and **Water Budgets**, a variety of rebates for indoor and outdoor efficiency upgrades, and a **WaterSmart Guidebook** with information on water saving technologies for new design and retrofits. As a means of promoting a business' efforts to conserve water, the EBMUD **WaterSmart Business Certification Program** works with customers to identify and implement water saving measures.

Property Assessed Clean Energy (PACE) programs provide financing for water efficiency and conservation improvements such as solar thermal, low flow bathroom fixtures, high efficiency toilets, lawn replacements, and more. The repayment of the loan is collected on the property owner's tax bills over the course of several years, and the loan remains with the property if it is sold. Since the loan is tied to the property, it provides less risk to property owners to undertake water efficiency measures with a longer term payback. There are currently three PACE programs available to businesses and residents in Richmond: HERO Financing, California First Efficiency Financing, and Figtree Financing. The City has adopted an open marketplace policy and will add additional PACE programs as they become available.

WA1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• WA1.1. Ensure CALGreen compliance with water-related codes for projects within existing buildings and for new construction. • WA1.2. Work with EBMUD to install water-smart approaches to landscaping, irrigation, and the use of native drought-tolerant vegetation in all City facilities. • WA1.3. Work with EBMUD to install water-smart features within City owned and/or operated facilities. • WA1.4. Work with EBMUD to create a tiered billing structure to incentivize water conservation. • WA1.5. Work with EBMUD to consider transforming wastewater billing system to a pay as flush billing structure. • WA1.6. Continue to offer PACE financing programs for water efficiency and lawn conversion improvements.
Partnerships	• WA1.7. Work with **EBMUD** to identify largest business and industrial water consumers and to better direct reduction outreach efforts. • WA1.8. Collaborate with EBMUD to understand high water consumption among multi- and single-family residences, and improve residential reduction outreach efforts. • WA1.9. Work with EBMUD to encourage businesses to participate in their WaterSmart Business Certification Program. • WA1.10. Connect businesses with EBMUD WaterSmart commercial irrigation programs and rebates. • WA1.11. Encourage businesses to take free EBMUD Water Survey to identify leaks and identify water efficiency improvements. • WA1.12. Encourage residents and property owners to take advantage of EBMUD's free WaterSmart Home Survey to identify leaks and identify water efficiency improvements. • WA1.13. Connect residents with EBMUD's Lawn Conversion & Irrigation Upgrade Rebates.
Outreach and Education	• WA1.14. Share information on water conservation programs through the City's newsletters, email blasts, social media outlets, and marketing campaigns. • WA1.15. Increase multilingual outreach and education efforts targeting single family residences. • WA1.16. Connect residents and businesses with EBMUD incentives and rebates encourage water efficiency upgrades and conservation.

Strategy WA2: Expand School Programs

Performance Goals:	25 percent of WCCUSD schools participating in water conservation programs by 2020; 100 percent participating by 2030.
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	EBMUD programs, EBMUD's WaterSmart garden grants
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Energy savings, improved water supply resiliency and security, educational value, engaged youth Health: Increased indoor comfort, reduced heat island effect
Tracking Metrics:	Number of schools participating in EBMUD water conservation programs
Implementation Partners:	WCCUSD, EBMUD

Description: This strategy expands upon existing water conservation efforts in schools in the West Contra Costa Unified School District (WCCUSD). EBMUD offers a wide variety of resources and programs to support water conservation education in schools. EBMUD offers **free water conservation workbooks** and **water pollution prevention materials** to all public and private schools in its service area. EBMUD deploys ranger-naturalists in an outdoor classroom setting to **promote watershed stewardship** through teaching students about creek restoration, reforestation, and other natural history programs. At Contra Costa County **science fairs**, EBMUD offers an "Excellence in Water and Wastewater Research Awards" that recognize water related projects and provide cash prizes. Through the **drought education theater program**, EBMUD partnered with three theater groups to provide 20-minute educational theater shows teaching the importance of water conservation, each using a unique approach.

EBMUD offers **WaterSmart garden grants** that can be used to fund the design and construction of community gardens or urban farm projects that demonstrate water conservation principles. In partnership with Water Education for Teachers and the Water Education Foundation, EBMUD provides periodic training sessions to teachers through the **Project WET Teacher Training** program, which covers various water topics that teachers can use to enhance their curriculum in line with Common Core and Next Generation Science Standards.

This strategy expands on these efforts to further engage students through water usage assessments, water reduction targets, and tracking programs of school facilities to teach students how to perform a water audit, with a follow up assignment to apply these auditing, target setting, and tracking skills at home.

The City will also work with WCCUSD to identify school facility landscaping that would be considered water intensive, and develop a plan to gradually convert these landscapes to native and drought tolerant vegetation with drip irrigation and weather based control systems to conserve water. WCCUSD may work with EBMUD to earn grant funding to convert a portion of these landscapes to educational community gardens. Such gardens could be focused on native plants with information about their taxonomy and ecological function, or could support rainwater harvesting or an on-site graywater irrigation system. WCCUSD may also use this funding to create urban farms on school campuses.

WA2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• WA2.1. Promote water-smart approaches to landscaping, irrigation, and the use of native drought-tolerant vegetation in all school landscaping. • WA2.2. Engage students in school facility water usage assessments, and develop water reduction targets and tracking programs. Provide students with an at-home water usage assessment workbook to practice the skills they learned and reduce their water usage at home. • WA2.3. Explore opportunities for graywater use and rainwater harvesting programs in WCCUSD facilities. • WA2.4. Pursue grant funding through EBMUD's WaterSmart garden grants to construct education water efficient gardens at school campuses.
Partnerships	• WA2.5. Facilitate communication between **EMBUD** and **WCCUSD** as appropriate.
Outreach and Education	• WA2.6. Connect educators with EBMUD School Programs to expand educational programs that raise awareness among students, teachers, and staff about water conservation efforts.

Strategy WA3: Green Building Strategies for Water Conservation

Performance Goal:	100 percent compliance with CALGreen Code or more stringent water standards
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Low cost associated with development of incentive program, staff time and promotional materials
Potential source(s) of funding:	PACE Programs (e.g., HERO), EBMUD's WaterSmart garden grants
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services Department, Utilities Department
Co-Benefits:	Energy savings, improved water supply resiliency and security, educational value, reduced lost work and school days Health: Reduced mold, reduced illness, increased indoor comfort, reduced heat island effect & incidents of heat-related illness
Tracking Metrics:	CALGreen compliance; number of GreenPoint rated or LEED certified buildings
Implementation Partners:	Bay Area Green Business Program

Description: The City will ensure the successful implementation of the 2013 update to the **California Green Building Standards (CALGreen)** Code, which requires a 20 percent reduction of indoor water use over the previous standard, through the use of high efficiency plumbing fixtures, including toilets, urinals, showerheads, and all faucet fixtures. For outdoor water use, CALGreen maintains that irrigation controllers shall be weather- or soil-moisture based, and shall automatically account for rainfall, or else be attached to a rainfall sensor.

The **GreenPoint Rated** system provides a competitive edge for new residents and renovations, offering a flexible path to certification and affordable certification fee. To achieve this rating, a project must earn a minimum of 50 points for incorporating various green building measures, of which six points may be earned for water conserving measures. Water conserving measures may include: installing water efficient fixtures; installing pre-plumbing for graywater systems or an operational system; grouping plants by water need, known as hydrozoning; adding mulch and compost to planting beds to retain soil moisture; using plant species appropriate for the site location, including native, drought tolerant, and Mediterranean species; reducing and avoiding turf planting; installing rainwater harvesting systems; demonstrating compliance with a water budget; and installing irrigation system meters.

New developments and renovations may also apply for certification with the U.S. Green Building Council offers the Leadership in Energy Efficiency Design or **LEED Standards**. LEED encourages similar water saving techniques as CALGreen and the GreenPoint Rated system, applied to one of the following categories: building design and construction, interior design and construction, building operations and maintenance, neighborhood development, and homes.

The City will ensure that all projects demonstrate compliance with, at minimum, the 2013 CALGreen standards, prior to approval of any building permits. The City will consider offering incentives for certification through GreenPoint Rated, LEED, or other green building rating system, such as streamlined permitting or reduced permitting costs. The City will consider adopting a retrofit-on sale ordinance in conjunction with the proposed Building Energy Saving Ordinance (BESO) implementing action (see EE4). The city will continue to provide information to developers, homeowners, and businesses on water efficiency and the abovementioned green building rating systems.

Along with energy efficiency improvements, water conservation improvements for existing homes and businesses can be funded through Property Assessed Clean Energy (PACE) programs that are currently offered in Richmond, including those offered by HERO[8], CaliforniaFIRST[9], and FigTree[10].

WA3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• WA3.1. Ensure all new buildings and renovations comply with CALGreen Green Building Standards Code water efficiency and conservation measures. • WA3.2. Update the City's Landscape Design and Development Guidelines to require water efficient landscaping in all development projects. • WA3.3. Explore the feasibility of a retrofit-on-resale ordinance, in conjunction with the proposed BESO Ordinance (see Strategy EE4), requiring the buyer or seller of a building to update any inefficient fixtures and plumbing to present federal plumbing standards. • WA3.4. Collaborate with EBMUD to identify funding for the installation of low-flow fixtures and replace old appliances in all City facilities. • WA3.5. Develop an incentive program to encourage new buildings and renovations to exceed CALGreen Green Building Standards Code for water efficiency and conservation measures. Such a program could offer development entitlement streamlining features, reduced permitting costs, or other incentives.
Partnerships	• WA3.6. Partner with the **Bay Area Green Business Program** to promote certification of green businesses, which includes water conservation strategies.
Outreach and Education	• WA3.7. Continue to provide information to developers, homeowners, and businesses on water efficiency and the abovementioned green building rating systems through the City's newsletters, email blasts, social media outlets, and marketing campaigns. • WA3.8. Provide pamphlets with information on water efficient appliances, fixtures, and landscaping at the permitting counter.

[8] https://www.heroprogram.com/
[9] https://californiafirst.org/
[10] http://www.figtreefinancing.com/

Strategy WA4: Support Water Infrastructure Improvements and Expand Water Reclamation and Reuse

Performance Goal:	Annual increases in the number of graywater and rainwater catchment permits issued; increase in capacity of purple pipe installed and volume of reclaimed water provided to City by Richmond Municipal Sewer District
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	EBMUD programs
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Energy savings, improved water supply resiliency and security, educational value
Tracking Metrics:	Number of graywater and rainwater catchment permits issued
Implementation Partners:	EBMUD, Community-based Organizations

Description: This strategy is concerned with improving and expanding the water supply, water reclamation (recycling), and water reuse infrastructure in Richmond. The City will support EBMUD's efforts to expand recycled water use to serve its City of Richmond customers, and support the use of graywater and rainwater catchment systems by local residents and businesses. The City will support EBMUD's efforts to maintain and upgrade water infrastructure and conveyance systems to minimize leaks and prevent waste.

Water reclamation is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a ground water basin (referred to as ground water recharge). EBMUD operates two water reclamation facilities in Richmond, the North Richmond Water Reclamation Plant and the Richmond Advanced Recycled Expansion (RARE) Water Project, that combined can produce up to 8.9 million gallons a day (mgd) of recycled water. Much of this water is used for various processes at the Chevron Richmond Refinery. On average, Chevron fulfills around 7.5 mgd of its needs with reclaimed water, sparing enough potable water for the daily indoor and outdoor water needs of around 83,000 EBMUD customers. EBMUD has also provided reclaimed water to the Richmond County Club since 1984 for irrigation purposes. Long-term, EBMUD anticipates expanding existing reclaimed water projects to include more users and establishing new partnerships with industries and neighboring wastewater agencies. EBMUD also anticipates the development of small satellite projects to meet the irrigation needs of large water users like parks, golf courses and cemeteries. The City will work with EBMUD to continue to identify such opportunities, particularly to expand reclaimed water use in industrial manufacturing processes and for irrigation purposes throughout Richmond.

In addition, the City of Richmond owns and operates the Richmond Municipal Sewer District, which provides service to an area that encompasses 13.5 square miles in the City. The wastewater treatment plant located in Point Richmond treats the wastewater collected by the District. The City will work with the District to begin evaluating reclamation projects within the Port of Richmond and nearby commercial areas.

Gray water is reusable wastewater from residential, commercial and industrial bathroom sinks, bathtubs, showers, and clothes washing equipment drains that is treated onsite, and then reused, typically for landscape irrigation. EBMUD offers a rebate for the purchase of a three-way diverter valve for a graywater system. Rainwater catchment systems collect runoff from roofs or other non-permeable surfaces, which is then redirected to a containment mechanism. Rainwater gardens may also be constructed that direct rainwater into a deep pit or larger reservoir with percolation, or it can be collected from dew or fog with nets or other tools. Rainwater can then be used for gardens, livestock, irrigation, or domestic use with proper treatment, and indoor heating for houses.

The City can support the use of graywater and rainwater catchment systems by reviewing the permitting process to look for opportunities for streamlining, offering rebates and incentives for installation of these systems, and by providing information at the permitting counter for developers, business owners, and homeowners.

WA4 Implementing Actions	
City Initiatives, Policies and Infrastructure	• WA4.1. Require the installation of recycled water pipes and connections with all new development. • WA4.2. Streamline the permitting process for graywater and rainwater catchment systems for businesses and residents. • WA4.3. Support expansion of recycled water infrastructure to serve existing municipal parks and facilities (e.g., golf courses), as well as multi-family, commercial, and industrial development and redevelopment projects. • WA4.4. Work with the Richmond Municipal Sewer District to begin evaluating reclamation and recycling projects within the Port of Richmond and nearby commercial areas. • WA4.5. Work with EBMUD to identify customers that would benefit from recycled water use, and develop an implementation plan to connect these customers with recycled water from EBMUD, neighboring wastewater agencies, or provide information on local water recycling systems, as applicable. • WA4.6. Develop a new City program that provides free rain barrels, rain barrel conversion kits, or rain barrel rebates to residents and businesses.
Partnerships	• WA4.7. Establish partnerships with **EBMUD** and local **Community-based Organizations** to support education about graywater and rainwater catchment systems.
Outreach and Education	• WA4.8. Provide pamphlets at the permitting counter to encourage the use of graywater and rainwater catchment systems in commercial and industrial buildings

Green Infrastructure, Urban Trees and Local Agriculture

Strategy GA1: Support Urban Tree-Planting Programs

Performance Goal:	1,652 households (4%) plant a tree by 2020 and 4,646 households (10%) plant a tree by 2030
GHG Savings by 2030:	1,081 MT CO_2e
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	Chevron ECIA, Strategic Growth Council Urban Greening Planning Grant, CalFire Urban and Community Forestry program
Implementation:	Ongoing
Responsibility:	Public Works, Planning and Building Services
Co-Benefits:	Pedestrian comfort, improves community aesthetics, carbon sequestration, reduced energy bills Health: Reduced heat island effect, improved air quality, lower energy costs, decreased illness
Tracking Metrics:	Annual trees planted by residents; number of homes and businesses participating in tree
Implementation Partners:	Urban Forest Advisory Committee, Community-Based Organizations, West Contra Costa Unified School District (WCCUSD)

Description: The urban forest provides a number of benefits for a community, such as increasing comfort for pedestrians, enhancing the overall visual aesthetic, and providing habitat for urban dwelling animal species. Trees naturally capture carbon, removing it from the air and storing it within the trunk, branches, and leaves. A healthy urban forest lessens the urban heat island effect by increasing shaded areas along roads and within parking lots. Trees can be strategically planted near buildings to help control the interior temperature of a home or building, and reduce the consumption of energy for heating and cooling, particularly during peak hours.

In support of General Plan Action EC6.E to develop an urban forestry management plan, the City conducted a city-wide tree inventory of publicly-owned trees, and identified existing species and opportunities for future plantings. The Citywide Tree Inventory, completed in July 2013, identified a total of 22,051 City-maintained trees and over 13,000 planting areas available for new trees.

Several volunteer organizations support the expansion of Richmond's urban forestry through canvassing, planting, ongoing tree care, organizing community events, education, and sharing best practices. The City will continue to collaborate with community-based organizations (e.g., Richmond Trees, Groundwork Richmond) to organize plantings of shade trees along public right-of-ways. The City

will work with community-based organizations to continue to promote the Adopt-A-Tree program, and will distribute existing resources providing tree care tips. The City will consider developing a shade tree incentive program that provides a rebate or covers the full cost of the tree.

In 2015, in partnership with Pogo Park and several CBOs, the City of Richmond received a $497,292 grant from the CalFire Urban and Community Forestry Program to plant more than 500 trees in Richmond over a two year period. The Chevron ECIA agreement also allocates funding to expand the urban forest throughout Richmond.

GA1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GA1.1. Update the City's design guidelines to require shade trees. • GA1.2. Update the City tree ordinance to protect and promote native, heritage and other significant trees. • GA1.3. Leverage Chevron ECIA funding to expand the urban forest. • GA1.4. Remove pavement along public right-of-ways in to facilitate tree plantings. • GA1.5. Continue to promote Richmond's Adopt-A-Tree Program to increase the number of trees in the City.
Partnerships	• GA1.6. Collaborate with local **Community-based Organizations** (e.g., Richmond Trees) on outreach and education efforts to spread awareness of the benefits of street trees, encourage home and business owners to plant shade trees, and distribute resources including but not limited to the City's "Tree Care Tips." • GA1.7. Work with existing youth programs and **WCCUSD** to plant more shade trees. • GA1.8. Coordinate with Richmond's Love Your Block Program and Cities of Service Program to include tree planting in revitalizing and beautifying local neighborhoods.
Outreach and Education	• GA1.9. Conduct an outreach campaign to spread awareness of the energy savings associated with planting shade trees and connect home and business owners with available resources and the proposed rebate.

Strategy GA2: Support Local Agriculture and Food Production

Performance Goal:	Double the acreage of urban gardens in Richmond from baseline conditions by 2030
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	Chevron ECIA, West County DIGS (school gardens), California Department of Food and Agriculture (CDFA) Specialty Crop Block Grant Program
Implementation:	Ongoing
Responsibility:	Public Works, Planning and Building Services
Co-Benefits:	Improved access to foods, urban greening benefits, public education, increased local jobs Health: Improved nutrition, decreased obesity and illness
Tracking Metrics:	Number of urban and school gardens; acreage of urban gardens; number of weekly farmer's markets
Implementation Partners:	WCCUSD, Community-based Organizations

Description: Globally, one-third of GHG emissions result from the food system, when accounting for importation, refrigeration, deforestation, and other food system processes.[11] Although the City of Richmond's inventory does not directly account for emissions from agricultural activities, choosing more sustainably produced food yields benefits for individuals and the community at large. Eating locally-produced, fresh food, and choosing vegetarian options, has the dual benefit of lowering GHG emissions associated with food production while improving community health.

Richmond's current zoning locates agricultural uses primarily on the eastern edge of the City, adjacent to Wildcat Canyon Regional Park. Despite Richmond's close proximity to major agricultural hubs such as the Napa Valley, Sonoma County, and the Central Valley, some economically disadvantaged areas within the City are considered "food deserts" where access to fresh and affordable foods is disproportionately lower than in other areas. To confront this challenge, the City promotes urban agriculture to increase access to healthy food. The Urban Agriculture Assessment has identified opportunity sites for urban agriculture on underutilized parcels, roof tops, within courtyards, and other public areas within such neighborhoods. Distributed urban agriculture sites increase access to food and reduce the GHG emissions associated with transporting food over long distances to reach consumers.

The **Richmond Grows Seed Lending Library** is open to all residents of the greater Richmond area and provides free seeds, as well as free education about growing and saving seeds and organic gardening.

[11] Nature.com, 2012. One-third of our greenhouse gas emissions come from agriculture. Available at: http://www.nature.com/news/one-third-of-our-greenhouse-gas-emissions-come-from-agriculture-1.11708. Published October 31, 2013, accessed November 30, 2015.

Richmond Grows celebrates biodiversity through the time-honored tradition of seed saving, nurtures locally-adapted plant varieties, and fosters community resilience, self-reliance, and a culture of sharing.

The City will continue to promote its weekly farmers markets, which offer locally produced goods from around the Bay Area. The City will partner with schools and other community organizations to bring urban agriculture to neighborhoods, schools, and parks where it is accessible to all residents. The City can use its purchasing power to advance locally-produced and health eating options by prioritizing municipal purchasing of vegetarian products, and procuring from local gardens.

GA2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GA2.1. Update the zoning ordinance to permit urban agriculture on rooftops, underutilized parcels, in community open spaces, and on residential properties. • GA2.2. Continue engaging community groups and subject matter experts to create an Urban Agriculture Ordinance that reflects municipal design and operations requirements while supporting urban agriculture activities. • GA2.3. As part of the Urban Agriculture Ordinance, maintain a publicly-accessible database of existing urban agriculture farms and gardens in the City. • GA2.4. Use the results of the 2011 Urban Agricultural Assessment, which identified rooftops, underutilized parcels, and community open spaces that could support urban agriculture, to prioritize locations to implement urban agriculture projects. • GA2.5. Update the City's inventory of potential urban agriculture sites. • GA2.6. Work with WCCUSD and CBOs to expand educational vegetable gardens at school campuses in Richmond; use Richmond High School as an example. • GA2.7. Consider leveraging the Chevron ECIA funding to support urban agriculture sites or to provide tool, soil and/or seed giveaways to existing urban agriculture sites. • GA2.8. Continue to support the Richmond Food Policy Council (RFPC) through providing resources such as access to conference rooms and encouraging attendance at RFPC meetings and events. • GA2.9. Expand number and frequency City-sponsored compost giveaways that improves local yield of gardens and promotes closed loop system. • GA2.10. Review and revise municipal procurement policies to encourage the purchase of local foods, and reduce the purchase of meat, when possible. • GA2.11. Support WCCUSD Food Service Department in applying for funding to create a local procurement program that purchases food from local producers for food banks, school meals and after-school programs. • GA2.12. Work with WCCUSD to consider implementing meatless Mondays in school cafeterias. • GA2.13. Support the inclusion of nutrition, cooking and gardening in primary and secondary school curricula to make connections between the benefits of healthy food choices, locally grown produce, and energy conservation.
Partnerships	• GA2.14. Work with the **Richmond Food Policy Council** to ensure that community events such as Food Day are recurring. • GA2.15. Collaborate with the **WCCUSD** to support the development and expansion of school gardens by providing resources, advocacy, and networking opportunities. • GA2.16. Work with **Community-based Organizations** and UC Master Gardeners of Contra Costa County to support and expand school gardens, small urban farms, and community gardens to provide educational and employment opportunities. • GA2.17. Partner with Community-based Organizations to increase opportunities for community members to visit and learn about urban agriculture. • GA2.18. Work with Community-based Organizations to encourage large institutions and businesses to purchase food from local producers.

GA2 Implementing Actions	
Outreach and Education	• GA2.19. Connect students and residents in Richmond with organizations that provide information, instruction, and education about local and organic farming, such as local farms, Community-based Organizations like Richmond Grows Seed Lending Library, and UC Master Gardeners of Contra Costa County. • GA2.20. Continue to promote the weekly farmer's market to bring local goods to Richmond residents. • GA2.21. Increase opportunities for community members to visit and learn about urban agriculture by encouraging urban farms and community gardens to host "open hours," where community members can engage with urban gardeners, learn about their practices, and volunteer. • GA2.22. Promote food-related community events.

Strategy GA3: Support Green Infrastructure and Streetscape Design

Performance Goal:	Increase green infrastructure projects Citywide by 2030
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time and promotional materials
Potential source(s) of funding:	Chevron ECIA, Prop 1 grants, Measure AA funds, GGRF (Wetlands and Watershed Restoration)
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services, Utilities Department
Co-Benefits:	Improved water quality, reduced property damage from flooding and erosion, improved public safety, reduced water consumption, lower energy costs Health: Reduced heat island effect & incidents of heat-related illness, improved air quality
Tracking Metrics:	Number of green infrastructure projects completed annually
Implementation Partners:	WCCUSD, Community-based Organizations committed to park rebuilding, water quality, and urban forestry

Description: Green infrastructure and streetscapes include pervious surfaces that allow natural ground absorption of rainfall, replenishing groundwater tables and reducing the amount of storm-water runoff. Contaminant runoff into water bodies is reduced and prevents exposure to oils, lead, and other toxins for residents swimming or fishing in the water. There are multiple methods of collecting stormwater onsite, which can be used independently or combined for a multi-faceted approach. Large development projects may incorporate retention or detention basins that direct water to an area onsite for permanent or temporary storage. On a smaller scale, runoff can be directed into bioswales for temporary storage during storms and to capture excess irrigation runoff. Planter strips along roads and parking lots are excellent opportunities for utilizing bioswales to reduce runoff. Rain gardens capture runoff and filter water before excess runoff accesses the stormwater drainage system. Rain water can be directed to catchment barrels or basins onsite and then used for irrigation systems.

To implement this measure, the City will encourage property owners and developers to incorporate green infrastructure into existing and new developments, and continue to utilize the same green infrastructure design principles in City-owned property as outlined in the City's Parks Master Plan. The City may develop a program that provides incentives or discounted rainwater collection devices, from the City's stormwater programs and enables property owners to retain rainwater onsite for irrigation. The City will also incorporate green infrastructure into new City developments, and retrofit existing City facilities with green infrastructure as funding becomes available.

GA3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GA3.1. Review the City's development code to ensure green infrastructure systems can be easily incorporated into new developments and existing properties. • GA3.2. Collaborate with community-based organizations to develop an urban agricultural ordinance • GA3.3. Explore the potential for incorporating green street elements into streetscape design such as bioswales, rain gardens, planter strips, and permeable pavement. • GA3.4. Incorporate green infrastructure into existing and new City buildings to more effectively manage stormwater runoff. • GA3.5. Develop a "Downspout Disconnection" program that enables property owners to retain rainwater onsite for irrigation. • GA3.6. Incorporate green infrastructure elements into projects to rebuild local parks. • GA3.7. Continue to organize an annual Richmond Coastal Cleanup event.
Partnerships	• GA3.8. Collaborate with **Community-based Organizations** to promote green infrastructure systems among property owners in Richmond, including providing describing the benefits of green infrastructure, methods of retaining runoff onsite, and assistance to property owners interested in participating in the proposed "Downspout Disconnection" program. • GA3.9. Continue to partner with Community-based Organizations to incorporate green infrastructure into neighborhood revitalization projects, including but not limited to the **Cities of Service Love Your Block Initiative**, and park rehabilitation projects with **The Trust for Public Land**.
Outreach and Education	• GA3.10. Conduct an outreach campaign to promote participation in the proposed "Downspout Disconnection" program. • GA3.11. Disseminate information on green infrastructure benefits and projects through citywide marketing campaigns using the City's newsletters, email blasts, social media outlets, local newspaper ads, direct mail, and by sending flyers along with property tax bills.

Green Business and Industry

Strategy GB1: Reduce Industrial Carbon Emissions

Performance Goal:	GHG reduction by local regulated (capped) facilities
GHG Savings by 2030:	Supporting strategy)
Financial Impact to City:	Staff time; outreach materials
Potential source(s) of funding:	BAAQMD, CARB, CPUC, USEPA
Implementation:	Ongoing
Responsibility:	City Manager's Office, Planning and Building Services
Co-Benefits:	Decreased lost work and school days Health: Improved air quality, reduced illness and premature mortality
Tracking Metrics:	GHG reductions by local regulated (capped) facilities
Implementation Partners:	BAAQMD, PG&E, USEPA

Description: The City will partner with local industries, the Bay Area Air Quality Management District (BAAQMD) and the California Air Resources Board (ARB) to ensure compliance with AB32 Cap and Trade emissions reduction targets for regulated industries and local carbon emission limits for industries that are not regulated by AB 32.

California's **Cap and Trade program** is the cornerstone of the state's strategy to reduce GHG emissions from electric power plants, oil and gas producers, and large industrial plants. Regulated facilities under the program generate approximately 85 percent of the state's total GHG emissions. Starting January 1, 2012, an overall limit on GHG emissions from capped sectors was established and facilities subject to the cap are now issued trade permits (allowances) to emit GHGs, through a mix of free allocation and quarterly auctions. Regulated entities can purchase or sell allowances in the carbon market as needed to meet their emissions obligation. The cap declines approximately 3 percent each year to further incentivize investments in clean technologies. The cap under California's program is flexible and can be tightened if the state's other measures to reduce GHG emissions have less impact than anticipated. The Cap and Trade program therefore acts as a backstop to ensure that the state's overall GHG target is met.

There are three entities operating in Richmond that are subject to the California Cap and Trade program: the Chevron Richmond Refinery, the West Contra Costa County Landfill, and New NGC, Inc. (National Gypsum). The Chevron Refinery alone accounts for the vast majority of the City's total emissions, as demonstrated in Chapter 3. Chevron's GHG emissions are also regulated by the Conditional Use Permit the City recently issued for the Chevron Refinery Modernization Project, as described in Chapter 3. The City will continue to partner with capped entities, the California ARB, and BAAQMD to support compliance with AB 32 Cap and Trade emissions reduction targets for regulated industries, and to

support the BAAQMD requirement that requires the installation of best-available control technology for businesses and industry during the entitlement process.

PG&E's **Permanent Load Shift – Thermal Energy Storage Program** offers financial incentives for their commercial/industrial electricity customers to implement technologies that permanently shift electric load by storing thermal cooling capacity during off-peak hours (e.g., by chilling water or making ice) in order to meet cooling load during subsequent peak hours.

CPUC's **Self-Generation Incentive Program (SGIP),** administered through PG&E provides incentives to businesses to support existing, new, and emerging distributed energy resources, including energy storage systems and efficient combined heat and power systems. The SGIP provides rebates for qualifying distributed energy systems installed on the customer's side of the utility meter. Qualifying technologies include wind turbines, waste heat to power technologies, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems.

GB1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GB1.1. Maintain the City's commitment to reducing and mitigating emissions and impacts from all commercial and industrial facilities. • GB1.2. Work with regional partners to apply CARB's Air Quality and Land Use Handbook regulations for large stationary sources and small stationary sources. • GB1.3. Implement more stringent limits for carbon emissions for heavy industry in the City. • GB1.4. Incentivize compliance with BAAQMD requirement that requires the installation of best-available control technology (BACT) for businesses and industry during the entitlement process. • GB1.5. Enforce more stringent limits on smog-forming pollutants for heavy industry in Richmond. • GB1.6. Install best-available carbon-capture technology for heavily-polluting industry.
Partnerships	• GB1.7. **BAAQMD:** develop a program to fund diesel engine retrofitting or replacement in existing automobiles, trucks, rail, and equipment (GP Action EC2.K). • GB1.8. **PG&E:** Promote participation in their Permanent Load Shift – Thermal Energy Storage Program and CPUC's Self-Generation Incentive Program • GB1.9. **USEPA:** Promote industrial participation in their Combined Heat and Power Partnership and Energy Innovations Small Grant Program

Strategy GB2: Workforce Development

Performance Goal:	Increase number of individuals trained for green jobs
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time, outreach and promotional materials
Potential source(s) of funding:	ECIA, EPA, Department of Labor
Implementation:	Ongoing
Responsibility:	Department of Employment and Training
Co-Benefits:	Increased local jobs & lower unemployment, less crime, increased economic stability Health: Reduced illness
Tracking Metrics:	Number of individuals trained, total training hours by discipline or program
Implementation Partners:	RichmondBUILD, Labor Unions, WCCUSD, UC Berkeley, local industries and businesses

Description: Through implementation of this strategy, the City will continue to support and expand workforce development programs for the City's residents and youth. Since 2007, the **RichmondBUILD** program has offered 35 low-income and at-risk youth training in the construction and renewable energy fields each year. Participants complete the core Carpentry Pre-Apprenticeship track, and 80 percent of graduates are placed in jobs paying an average of $18.33 an hour that utilize the skills they were taught. The **Rising Sun Energy Center's Green House Calls** program offers summer job training for youth ages 15-22 in outreach, customer service, and energy efficiency. Participants work in teams to perform energy efficiency audits for customers, install simple energy efficiency upgrades, and provide advice to residents on ways to further increase their energy savings. The City's **YouthWORKS** program provides case-managed services to at-risk and in-risk youth ages 16 to 21. The program provides pre-employment training and life skills, among other services.

The City will also work with WCCUSD to incorporate green technology education and job training into the curriculum of area high schools. The City will consider partnering with WCCUSD, UC Berkeley, and local industries and businesses to host an annual green tech career fair that introduces students and residents to the range of job opportunities in this field. The City will pursue other technical training programs that could be provided to residents in Richmond.

GB2 Implementing Actions

City Initiatives, Policies and Infrastructure	• GB2.1. Continue to implement Richmond's local hire and living wage ordinances (Richmond Municipal Code Chapters 2.56 and 2.60). • GB2.2. Work with UC Berkeley and other partners to develop strategies to ensure sufficient housing is available at rates affordable to low income residents that can support the City's growing workforce. • GB2.3. Create linkages between industries and local, work-ready, and talented workforce. • GB2.4. Work with WCCUSD to create programs that offer coursework and training oriented toward emerging green industries. • GB2.5. Continue YouthWORKS summer internship program to include a green industry track. • GB2.6. Partner with lenders to establish a mortgage assistance program for the workforce in Richmond aimed at low and moderate income homebuyers. • GB2.7. Continue to support and expand workforce development programs, such as RichmondBUILD and YouthWORKS. • GB2.8. Pursue grant funding to expand RichmondBUILD workshops to include training on the repair, and maintenance of solar PV systems, and other building systems.
Partnerships	• GB2.9. **Labor Unions:** increase pathways to more unionized jobs. • GB2.10. **WCCUSD, UC Berkeley, RichmondBUILD, local industries and businesses:** establish an annual clean tech job fair for students and residents of Richmond. • GB2.11. Partner with utilities and public agencies (e.g., PG&E, MCE, EBMUD) to train and connect local residents with local job opportunities in outreach and implementation of local programs.
Outreach and Education	• GB2.12. Provide a list of local "green" contractors, construction companies, and retailers to applicants at the building permit counter. • GB2.13. Continue to support training and intervention strategies for populations that face barriers to employment including youth, the formerly incarcerated, and residents with limited English proficiency. • GB2.14. Explore the feasibility of developing a green career technical track in Richmond high schools. • GB2.15. Encourage and support businesses and industries that hire locally and provide a safe work environment, living wages and benefits, and opportunities for skill development and advancement.

Strategy GB3: Support Green/Clean Technology Incubator Programs

Performance Goal:	Promote networking and training organizations and raise awareness of financial assistance sources available to entrepreneurs
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time, promotional materials
Potential source(s) of funding:	ECIA, Incubator programs, private investors
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Attracts green businesses, increased tax revenue, creates local jobs Health: Reduced illness
Tracking Metrics:	Number of businesses locating in Richmond and enrolling in support programs
Implementation Partners:	UC Berkeley, Richmond Works, ProspectSV, BACC, SBDC, EDA, CTC, other local business support agencies and community stakeholders

Description: Green/clean technology (cleantech) is generally described as products, processes, or services that reduce waste, conserve energy, and require as few non-renewable resources as possible. The cleantech sector advances important innovations in green building, transportation, clean energy and carbon management that enable economy-wide GHG reductions. California and the Bay Area in particular lead the nation in cleantech investment and development.[12]

One of the defining characteristics of the East Bay is the diversity of its economic base, which includes a mix of industries contributing to job creation, research and development, local investment, and business growth. The U.S. Business Administration requires cities to provide Small Business Development Centers (SBDC). In addition, there are a multitude of business incubators in the Bay Area that support the growth of small start-up companies by providing them with supportive services and facilities during their crucial early development phases. The Bay Area is also host to research and technology parks that house incubator programs alongside larger-scale businesses, institutions, and projects. Serving as the City's designated SBDC, Richmond's Office of Economic Development (OED) in the City Manager's Office offers programs for businesses to help entrepreneurs and investors to locate developing businesses in Richmond and facilitate business-to-business transactions.

[12] 2015 U.S. Clean Tech Leadership Metro Index, available at: http://cleanedge.com/indexes/u.s.-clean-tech-leadership-index

There are multiple programs in the private sector that provide incubator services to businesses in the Bay Area. The **East Bay Economic Development Alliance (EDA)** provide services, analysis and cross sector partnerships, and have created a guide to help grow small and medium sized businesses and develop industries throughout the Bay Area. EDA is particularly dedicated to growing the region's international economic focus by providing assistance to companies interested in importing and exporting products, trading with foreign nationals, and working with local maritime ports. Other organizations include: **AnewAmerica Community Corporation**, which offers a three-year program of support for micro-business incubation, asset building, and social responsibility; and **Communications Technology Cluster (CTC)** which is a business acceleration center providing strategic consulting, business and financial services.

Some incubator programs in the region are focused on the cleantech sector. The **Siemens Technology-To-Business Center** in Berkeley supports promising innovators, incubates their ideas, and launches spin-in products and start-up companies. **Prospect Silicon Valley** (ProspectSV) provides support services to development and transportation related business startups that specialize in clean technology. The **Bay Area Climate Collaborative** (BACC) is a ProspectSV program whose mission is to scale the clean energy economy and drive down the deployment cost of clean energy so that economic benefits accelerate adoption. BACC is engaged in several initiatives that are accelerating electric vehicle (EV) fleet deployments, EV charging station installations, LED streetlight conversions, and building energy efficiency initiatives.

The Governor's Office of Business and Economic Development (GO-Biz) offers a range of services that have potential value to green business owners including: attraction, retention and expansion services, site selection, permit streamlining, clearing of regulatory hurdles, small business assistance, international trade development, assistance with state government, and more. GO-Biz offers a potential source of green business funding with its **California Competes Tax Credit**, which has been used by zero-emission vehicle (ZEV) manufacturers Faraday Future and Tesla Motors to secure millions of dollars in benefits.

The planned UC Berkeley Global Campus at Richmond Bay is expected to bring broad economic and social benefits to the Richmond community. The Global Campus will host an international coalition of leading academic institutions and private sector and community partners to collaborate on addressing some of the world's most pressing social and environmental challenges. It represents a tremendous opportunity for the City to partner with UC to promote local cleantech industry spinoffs that develop commercial applications based on the institution's research and development activities.

The City will promote networking and training organizations in the Bay Area, including: the African Network, Astia (formerly Women's Technology Cluster), SCORE East Bay, Renaissance Entrepreneurship Center, the Small Business Development Center (SBDC) Technology Adoption Program, San Francisco Small Business Development Center, the Indus Entrepreneurs (TiE), Silicon Valley Entrepreneurs Club, and the Forum for Women Entrepreneurs & Executives. The City will also promote the various sources of financial assistance available throughout the Bay Area, including: Y Combinator, Silicon Valley Association of Startup Entrepreneurs, the Silicon Valley Association of Startup Entrepreneurs (SVASE), Silicon Valley Microfinance Network (SVMN), and various Angel Investors.

GB3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GB3.1. Support local businesses and entrepreneurs by offering incentives and necessary infrastructure, and providing a range of locations and office sizes. • GB3.2. Continue to expand jobs-skills training and recruitment programs and services for residents to enter into the green-industry workforce. • GB3.3. Expand offerings of Richmond Works program to include resources on business incubation and startup services. • GB3.4. Expand the Small Business Training program and grow other small-business incubator programs, with support for women and minorities.
Partnerships	• GB3.5. **UC Berkeley and ProspectSV:** create a business incubation center at the Berkeley Global Campus, or elsewhere in the City, that promotes local programs for growing businesses and provides incentives for locating businesses in Richmond. • GB3.6. **EDA, Anew America Community Corporation, CTC, Seimens Technology-To-Business Center, and ProspectSV:** collaborate with incubator programs to promote their services and attract green technology startups to Richmond. • GB3.7. **BACC:** Partner on EV and building energy efficiency initiatives. • GB3.8. **Local business support agencies and community stakeholders:** to develop a strategic plan to retain, attract, and support innovative "green" companies, consistent with City Council Resolution 45-07.
Outreach and Education	• GB3.9. Develop a comprehensive guide to business incubator, networking, and financing tools in the Bay Area to distribute to entrepreneurs and new businesses in Richmond.

Strategy GB4: Support Participation in Local Energy and Green Business Programs

Performance Goal:	Maximize participation in local energy and green business programs
GHG Savings by 2030:	Supporting strategy
Financial Impact to City	Staff time, promotional materials, and incentives
Potential source(s) of funding:	Utility rebate programs
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Increased local jobs, reduced energy and water bills, improved building comfort, energy efficiency awareness Health: Improved indoor air quality, increased indoor comfort, reduced mold, reduced noise pollution
Tracking Metrics:	Number of local businesses participating in local energy and green business programs
Implementation Partners:	CCC Green Business Program, PG&E, MCE, local business owners

Description: Local energy utilities offer multiple programs to their residential and commercial customers for improving energy efficiency, purchasing renewable energy, and installing solar PV systems (see EE and RE strategies). To maximize participation in these programs, the City will work with PG&E and MCE to develop an outreach and education plan that targets businesses and industries with the greatest potential for GHG reduction opportunities. To maximize promotional efforts, the City may create a comprehensive guide for distribution to these businesses that describes the full range of programs and opportunities available to reduce energy and fuel use. The City will leverage these efforts to cross-promote transportation demand management programs that go beyond the requirements of the Bay Area Commuter Benefits ordinance, and the use of active transportation, car sharing, bike sharing, and transit use. The City will also educate businesses regarding fuel switching and electrification, reducing reliance on diesel fuel, and reducing hydrofluorocarbons (HFCs).

The City will provide supportive guidance to these companies interested in reducing their carbon footprint, and identify ways to promote their accomplishments in the community and throughout the greater Bay Area. The City will help establish a green business network in Richmond by encouraging participation in the Contra Costa County (CCC) Green Business Program, which partners with government agencies and utilities to help local businesses comply with environmental regulations and take additional actions to conserve resources, prevent pollution, minimize waste, and reduce their carbon footprint. Currently, more than 350 businesses in Contra Costa are certified green businesses in the program.

GB4 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GB4.1. Develop incentives for participation in Bay Area/Contra Costa Green Business Program.
Partnerships	• GB4.2. **Local business owners:** establish a city-supported green business network that enables information sharing and cross-communication between Richmond's business owners and industry leaders.
Outreach and Education	• GB4.3. Create an outreach plan that targets businesses and industries that would benefit from programs that reduce GHG emissions and contribute to the goals of the CAP, while saving money and improving business operations. • GB4.4. Develop a comprehensive guide showcasing programs that promote increasing energy efficiency, fuel switching and electrification, and alternative transportation use, as well as other programs that support the goals of the CAP, for distribution to existing businesses and industries in the community. • GB4.5. Provide a "Welcome Package" to new businesses in Richmond that provides information on the various programs, ordinances, and resources in Richmond that support the goals of the CAP. • GB4.6. Leverage the services of the City's Economic Development Office to cross-promote programs in the CAP. • GB4.7. Develop a recognition program for local businesses that support the goals of the CAP by hiring local workers, employing sustainable operations, undergoing energy and water efficiency upgrades, and implementing a comprehensive transportation demand management program, among other measures.

Strategy GB5: Reduce Emissions from Goods Movement

Performance Goal:	Reduce Port of Richmond GHG emissions by 20% below 2005 baseline by 2030.
GHG Savings by 2030:	2,315 MT CO_2e
Financial Impact to City:	Staff time to pursue grant funding and coordinate with the Port
Potential source(s) of funding:	Goods Movement Emission Reduction Program (CARB)
Implementation:	Ongoing
Responsibility:	City Manager's Office, Port Operations
Co-Benefits:	Noise reduction, traffic improvement, decreased lost work and school days Health: Improved air quality, reduced illness
Tracking Metrics:	Port's MTC02e emissions reduced below 2005 baseline
Implementation Partners:	BAAQMD, CARB, Port of Richmond

Description: This strategy reduces diesel fuel emissions through measures to address **goods movement**, or the transportation of imported and exported goods through or within the City of Richmond. At the state level, more standards are being implemented to increase vehicle efficiencies, and regional efforts such as Plan Bay Area and BAAQMD are supporting greater penetration of low-emission trucks in the region. While goods will continue to be moved to support local and regional economies, electrification and other low-emission technologies installed in vehicles can reduce the GHG emissions of goods movement.

The **Port of Richmond Clean Air Action Plan (CAAP)** provides the framework for strategies and programs to reduce carbon and pollutant emissions from the Port, which are primarily the result of the operation of ocean-going vessels. The CAAP includes both voluntary and regulatory programs to reduce the Port's emissions, including vessel speed reduction, use of exhaust treatment devices for ships, on-site renewable energy generation, heavy-duty truck replacement and shore power. The CAAP estimates that the Port's current emissions would be reduced from approximately 11,600 MT CO_2e to 10,500 MT CO_2e by implementing these programs. The Port is considering the feasibility of becoming the first Port in the world to provide 100 percent of its energy needs from on-site renewable energy generation, which would reduce emissions by an additional 205 MT CO_2e per year. The City will align future iterations of the CAAP with the goals, objectives, and actions in this CAP.

Local public agencies and equipment owners involved in the movement of freight can apply for grants from CARB's **Goods Movement Emission Reduction Program**, administered through BAAQMD, which provides funding for equipment that reduces air pollution emissions and health risk from freight movement along California's trade corridors. The program currently provides funding for truck replacements, truck engine repowering, truck charging/fueling infrastructure and truck stop electrification projects. Future solicitations will include projects for transportation refrigeration units, cargo handling equipment, shore power and locomotive & railyard projects.

GB 5 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GB5.1. Require trucks to reduce idling by mandating that a driver cannot idle the primary engine for more than five minutes unless the idling is a result of a traffic condition. • GB5.2. Require diesel trucks and buses that run in the state to make upgrades. This includes installing particulate matter filters and replacing old vehicles with cleaner engine trucks to reduce emissions by 2023. • GB5.3. Continue to explore the use of shore power, low-emission vehicles, short-sea shipping service, "cold ironing" and other strategies to reduce emissions (supported by GP Action EC2.J and Port of Richmond CAAP). • GB5.4. Initiate a Green Flag Program that mirrors the Port of Long Beach's program for vessels entering and departing the Port of Richmond. • GB5.5. Implement off-peak delivery by beginning peak-period pricing for port access.
Partnerships	• GB5.6. **BAAQMD:** develop a program to fund diesel engine retrofitting or replacement in existing ships and port equipment (GP Action EC2.K). • GB5.7. **BAAQMD:** Promote local business & industry participation in CARB's Goods Movement Emission Reduction Program • GB5.8. **Port of Richmond:** continue to identify ways of reduce carbon emissions from Port activities.
Outreach and Education	• GB5.9. Outreach to local trucking companies to raise awareness of CARB grant funding for equipment replacement

Strategy GB6: Reduce Use of Short-Lived Climate Pollutants (SLCPs)

Performance Goals:	Increase diversion of organics from landfill, and work with local industry to reduce use of refrigerants and SLCP emissions
GHG Savings by 2030:	Supporting strategy
Financial Impact to City:	Staff time
Potential source(s) of funding:	BAAQMD
Implementation:	Ongoing
Responsibility:	City Manager's Office
Co-Benefits:	Fewer lost workdays
	Health: Improved air quality, decreased illness
Tracking Metrics:	SLCP emissions levels, as measured by BARB or BAAQMD
Implementation Partners:	BAAQMD, CARB, DTSC

Description: Short-Lived Climate Pollutants (SLCPs), which include methane, fluorinated gases (F-gases), black carbon, and tropospheric ozone, are among the most harmful to both human health and global climate. Like CO2, SLCPs are heat trapping, but only last in the atmosphere for a few days to a few years. However, they are much more powerful than CO2 when measured in terms of how they heat the atmosphere. SLCPs may be responsible for about 40 percent or more of global warming experienced to date. F-gases, which include hydrofluorocarbons (HFCs), are the fastest growing source of GHG emissions in California and globally. Cutting emissions of SLCPs can immediately slow global warming and reduce the impacts of climate change. [13]

CARB, in coordination with other state agencies and local air districts, has published a draft Short-Lived Climate Pollutant Reduction Strategy, due to be finalized by the end of 2015 and be incorporated into the 2016 Scoping Plan update. Meanwhile, state agencies will continue to develop policies and programs targeting SLCP reductions, and coordinate with local air districts and other agencies on implementation and enforcement.

Many of the benefits of cutting SLCP emissions in California will accrue in the most disadvantaged parts of the State, where pollution levels and their health impacts are often highest, and where further economic development may be most needed. For example, cutting black carbon emissions from the transportation sector and building a sustainable freight system would have health and economic benefits for areas of Richmond along freight corridors and near the Port and railyards where diesel particulate matter concentrations are high.[14]

Many commercial and industrial operations in Richmond require the use of refrigerants, or fluids used in the heat pump and refrigeration cycle. HFCs are commonly used refrigerants that have a global warming

[13] IGSD (2013) Primer on Short-Lived Climate Pollutants, Institute for Governance and Sustainable Development, February 2013. http://igsd.org/documents/PrimeronShort-LivedClimatePollutantsFeb192013.pdf

[14] DRAFT Short-Lived Climate Pollutant Reduction Strategy, CARB, September 2015

potential that is thousands of times greater than carbon dioxide, so while they are released in much smaller quantities they are still considered a significant contributor to climate change.

There are other refrigerants that can be used, or are being developed, that have a less substantial impact on the environment and the climate. The City will work with the California ARB, BAAQMD, the Department of Toxic Substance Control, and other agencies to assist local business and industry in choosing or shifting to alternative refrigerants that don't use HFCs. Where feasible, the City shall encourage new development and redevelopments to eliminate the use of HFCs in building construction by using alternative methods of heating and refrigeration.

GB 6 Implementing Actions	
City Initiatives, Policies and Infrastructure	• GB6.1. Support the phasing out of organics disposal in landfills (See Solid Waste strategies) • GB6.2. Encourage local oil and gas operations to monitor and minimize sources of fugitive methane emissions, and support CARB's regulatory processes to monitor and reduce those emissions • GB6.3. Support the capture of organics at local WWTP facilities, and their use for energy generation or agricultural biosolids • GB6.4. Monitor the community air quality and health impacts of SLCPs along freight corridors and in the vicinity of large industrial emitters • GB6.5. Coordinate with state efforts to install low-GWP refrigeration equipment in new commercial facilities or convert existing high-GWP systems to lower-GWP options
Partnerships	• GB6.6. **CARB, BAAQMD**, and **DTSC**: assist local business and industry in choosing or shifting to alternative refrigerants that don't use HFCs • GB6.7. Coordinate with BAAQMD in enforcing new rules regarding SLCPs
Outreach and Education	• GB6.8. Educate local business and industry on the benefits of reducing SLCPs and potential funding sources for reduction programs

Resiliency to Climate Change

Strategy RC1: Improve Community Preparedness for Climate Emergencies

Performance Goal:	Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate sea level rise and other climate change hazards
Financial Impact to City:	Staff time; outreach materials
Potential source(s) of funding:	FEMA, Philanthropic Foundations, California Energy Commission, Measure AA funds (parcel tax for SF Bay restoration projects)
Implementation:	Ongoing
Responsibility:	City Manager's Office, Police and Fire Departments
Co-Benefits:	Improved health equity, better disaster preparedness Health: Lower stress levels, reduced heat island effect, decreased illness
Tracking Metrics:	Adoption of updated plans and building codes
Implementation Partners:	Community-based Organizations, local businesses and residents

Description: This strategy focuses on raising community awareness of climate change impacts, vulnerabilities, and risks, and working with government agencies, CBOs, and the community, to increase neighborhood and city-wide resilience. This includes strengthening social networks and emergency response systems to support communities in times of climate emergencies, ranging from floods, extreme heat events, extreme droughts, wildfires, and the cascading impacts that can result from such events.

Many public-serving facilities that are critical in times of emergencies and natural disasters can themselves be impacted by such events. These include hospitals and medical facilities, police and fire stations, telecommunications infrastructure, cooling centers, emergency operations centers and evacuation shelters, and other public resources such as libraries and public transit systems. In Richmond, higher sea levels in the future will lead to higher tide elevations and storm surges, more extensive inland flooding, and increased erosion. Extreme heat events can strain the ability of current services and facilities to accommodate the needs of vulnerable populations. If more frequent or severe natural disasters occur, existing emergency response and communications services may not be adequate to deal with the consequences. Higher sea levels and extreme heat events combined with drought may also strain emergency response systems.

In its resilience planning, the City will prioritize the health and well-being of its most vulnerable populations (elderly, low-income, and health-compromised residents) who face significant risk from extreme heat events by 2100. These populations will also face higher risk of health problems from worsening air quality and new disease vectors (see Strategy RC5 for actions focused on public health

and health equity). The City has an important role, in partnership with public agencies and community based organizations, to educate and engage the public on climate change issues, and to promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations.

The City will concurrently increase local awareness about the need to protect its natural inhabitants (flora and fauna), which can experience severe stress from extreme heat, drought and extreme precipitation events.

Youth engagement is a key component of creating a healthy and resilient City. By integrating climate change considerations into the school curriculum and their daily environment, students, teachers and school administrators can all play a role in raising awareness about climate change impacts. Finding ways to engage students in understanding both the risks to the community and actions that the City government and community-members can undertake provide a key opportunity to enrich Richmond youth in energy, and environmental science and policy, and will make our future generations more climate conscious citizens.

RC1 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RC1.1. Update Local Hazard Mitigation Plan (LHMP) to incorporate sea level rise, flood risk, extreme heat events and other climate change hazards. • RC1.2. Survey all public-serving facilities and infrastructure in Richmond and determine whether emergency response systems are in place. • RC1.3. As City owned or operated emergency response facilities and infrastructure are upgraded or constructed, require that improvements mitigate anticipated climate change impacts. • RC1.4. Identify or develop a network of emergency shelters and cooling centers to be used by each City neighborhood in times of flooding and other climate-related emergencies. • RC1.5. Provide incentives or require that public buildings vulnerable to sea level rise be retrofitted using waterproof shutters, shields or doors and salt-resistant materials to reduce flood damage, with a particular focus on retrofitting critical community facilities. • RC1.6. Assist managers of public-serving facilities and infrastructure with development of emergency response systems. • RC1.7. Work with neighborhood council groups to develop emergency response plans that include strategies to address flooding, extreme heat, and other climate-related events; consider ramifications of access routes and transportation modes being disrupted. • RC1.8. Develop and adopt plans for future relocation of people, uses, and services that are at risk of becoming isolated where sole or limited access ways cannot be improved or protected, and where no other alternative means of access is feasible. • RC1.9. Build new community gardens and edible landscapes on City-owned parcels.
Partnerships	• RC1.10. **WCCSD**: Integrate climate-related education into school curricula and after school learning programs; engage students in identifying opportunities for school resiliency improvements and provide peer-to-peer education. • RC1.11. Partner with one or more Richmond-based **Community-based Organizations** to pursue grant funding for building the resilience of the City's vulnerable populations. • RC1.12 Facilitate coordination between **emergency service providers, utilities and transportation agencies** to develop contingency plans for maintaining operations when roads are damaged or impassable due to flooding, if power is lost for long periods of time, or if telecommunication services are interrupted.

RC1 Implementing Actions

Outreach and Education	• RC1.13. Work with neighborhood council groups to develop emergency response plans that include strategies to address flooding, extreme heat, and other climate-related events. • RC1.14. Engage with community organizers, businesses, and residents throughout the City to bridge community capacity building with government decision-making to ensure broad participation in local actions and benefits are accrued by all individuals in Richmond. • RC1.15. Engage the public and promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations. • RC1.16. Partner with WCCSD to integrate climate-related education into school curricula and after school learning programs; engage students in identifying opportunities for school resiliency improvements and provide peer-to-peer education. • RC1.17. Promote youth engagement, and integrate climate change considerations into the school curriculum, so that students, teachers and school administrators can all play a role in raising awareness about climate change impacts. • RC1.18. Increase local awareness about the need to protect Richmond's natural inhabitants (flora and fauna), which can experience severe stress from extreme heat, drought and extreme precipitation events. • RC1.19. Make sea level rise maps and other climate change hazards information available in public forums including the City web site and the City's public libraries. • RC1.20. Provide expanded Community Emergency Response Team (CERT) trainings, refresher classes, and annual exercises that include future flood events.

Strategy RC2: Increase Resilience of Local Housing to Climate Change

Performance Goal:	Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate sea level rise and other climate change hazards.
Financial Impact to City:	Staff time; outreach materials
Potential source(s) of funding:	FEMA, Measure AA funds
Implementation:	Ongoing
Responsibility:	City Manager's Office, Housing and Community Development
Co-Benefits:	Better disaster preparation, property asset protection Health: Decreased illness
Tracking Metrics:	Adoption of updated plans and building codes
Implementation Partners:	ABAG, UC Berkeley, Distressed Housing Rehabilitation Program, Richmond Trees, RichmondBUILD, Rising Sun Energy Center, other Community-based Organizations

Description: This strategy focuses on increasing the resilience of local housing such that physical structures can withstand anticipated climate hazards including sea-level rise, flooding, and increased risk of wildfire. The *City of Richmond Climate Change Adaptation Study* (Appendix F) examines the vulnerability of local housing to sea level and flooding in detail, drawing from the extensive information provided in the **Contra Costa County Adapting to Rising Tides** project, which found that hundreds of single-family residential parcels are at risk from either current or future flooding that will be more frequent and/or extensive in the future due to sea level rise. Many parcels in Brickyard Cove and Point Richmond are at risk from less than 3 feet of sea level rise, which is also the same water level that could occur during a 50-year return period coastal storm event.

The Association of Bay Area Governments (ABAG) and BCDC recently completed a study, ***Stronger Housing, Safer Communities*** (2015) that looked at vulnerability and resilience of housing in the Bay Area to flooding from sea level rise, seismic shaking, and liquefaction. The project includes a focused community profile[15] for the Richmond Inner Harbor area, which includes all or part of eight neighborhoods: Atchison Village, Iron Triangle, Santa Fe, City Center, Coronado, Cortez, Marina Bay and Southwest Annex. It also includes all of the City's South Shoreline Specific Plan area, the Ford Peninsula major activity center in Marina Bay, and two Districts, Regatta/Marina Bay and Southern Gateway. Much of this area is within the current 100-year flood plain and is susceptible to future flooding as sea level rises. There are also pockets of Bay fill that are susceptible to liquefaction. Many residents in the profile area are very low income and are burdened by housing and transportation costs. Neighborhoods are ethnically diverse with many areas having a high percentage of non-English speaking households. Established residents in the profile area are likely limited in their ability or resources to invest in housing resilience, and are more likely to be displaced if their homes are damaged.

[15] ABAG, BCDC, *Stronger Housing, Safer Communities: Strategies for Seismic & Flood Risks*, March 2015

Excessively dry periods will increase the risk of wildfires at the urban-wild interface along the eastern portion of the City, endangering nearby homes and property. The City of Richmond Annex to the Contra Costa County Hazardous Mitigation Plan Update[16] (May 2011), identifies areas of highest wildfire hazard occurring in the vicinity of Wildcat Canyon Regional Park and in the El Sobrante Hills neighborhoods along Castro Ranch Road. The City can expect these areas to become even more prone to wildfire hazard as the local climate changes, along with increased risk to other areas, including Point Molate at the western edge of the City.

RC2 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RC2.1. Amend the City's Flood Damage Prevention Ordinance to meet current FEMA requirements for constructing in special flood hazard zones and areas vulnerable to sea level rise and liquefaction. These requirements may include policies related to flood-proofing of structures located adjacent to special Flood Hazard Zones. • RC2.2. Enhance minimum design requirements for new small-scale residential building foundations in liquefaction zones. • RC2.3. Consider ordinance requiring flood hazard disclosure to renters • RC2.4. Leverage Cap and Trade funds to support the development of climate resilient affordable housing. • RC2.5. Provide incentives or require that structures vulnerable to sea level rise be retrofitted using waterproof shutters, shields or doors and salt-resistant materials to reduce flood damage. • RC2.6. Leverage existing weatherization and energy efficiency programs (see Strategy EE2) to improve building heating and cooling comfort for low-come and vulnerable populations. • RC2.7 Increase efforts to reduce hazards for homes in high wildfire hazard areas through improving engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on defensible space mitigation strategies. (Identified as a high priority initiative in the City's Local Hazard Mitigation Plan). • RC2.8. Leverage Cap and Trade funds to support the development of climate resilient affordable housing. • RC2.9. Participate in and seek to qualify for the highest possible rating of the Community Rating System of the National Flood Insurance Program to reduce flood risks and private property insurance costs.
Partnerships	• RC2.10. Work with **UC Berkeley**, the **Richmond Distressed Housing Rehabilitation Program**, lenders, neighborhood groups, and other local partners to promote affordable, climate change-resistant, healthy, and energy-efficient housing and neighborhoods. • RC2.11. **Community-based Organizations:** Partner with one or more Richmond-based CBOs to pursue grant funding for building the resilience of the City's vulnerable populations. • RC2.12. Engage with and seek support from **ABAG** community resilience programs; in particular their multiple hazard risk assessment and study of housing resilience in the face of natural disasters.
Outreach and Education	• RC2.13. Work with neighborhood council groups to provide resources to residents on all climate-ready home programs, and provide a platform to get ongoing feedback on the function and accessibility of programs. • RC2.14. Make sea level rise maps and other climate change hazards information available in public forums including the City web site and the City's public libraries. Ensure that linguistic and cultural communication barriers are addressed.

[16] Contra Costa County (2011), Hazard Mitigation Plan Volume 2: Planning Partner Annexes, May 2011.

Strategy RC3: Increase Resilience of Critical Infrastructure to Climate Change

Performance Goal:	Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate sea level rise and other climate change hazards.
Financial Impact to City:	Staff time, capital improvement budget
Potential source(s) of funding:	Chevron ECIA, Caltrans Sustainable Transportation Planning Grant Program
Implementation:	Ongoing
Responsibility:	City Manager's Office, Department of Public Works, Utilities Department
Co-Benefits:	Property asset protection Health: Decreased illness
Tracking Metrics:	Adoption of updated plans and building codes
Implementation Partners:	Distressed Housing Rehabilitation Program, Richmond Trees, RichmondBUILD, Rising Sun Center, other Community-based Organizations

Description: This strategy focuses on increasing the resilience of critical infrastructure (both existing and planned) such that physical structures can withstand anticipated climate hazards including sea-level rise and flooding. The *City of Richmond Climate Change Adaptation Study* (Appendix F) makes extensive use of the findings in the ***Contra Costa Adapting to Rising Tides Project***, which examines in detail the vulnerability of transportation, energy, water supply, wastewater management, and stormwater management infrastructure.

RC3 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RC3.1. Require that development of all new City codes and policies include consideration of anticipated climate change impacts. • RC3.2. Require new developments and redevelopments to reduce and manage stormwater through on-site capture and retention, low impact development (LID), green infrastructure, and other means. • RC3.3. Enforce creek protection, stormwater management, and discharge control ordinances, and follow the RWQCB Best Management Practices (BMPs) to keep watercourses free of obstructions and protect drainage facilities • RC3.4. Consider increased risk to infrastructure assets from climate change exposures (sea level rise, flooding and associated higher risk of liquefaction) and potential cascading impacts in emergency response and contingency plans, including the Local Hazard Mitigation Plan. • RC3.5. As City owned or operated facilities and infrastructure are upgraded or constructed, require that improvements mitigate anticipated climate change impacts. • RC3.6. Construct buildings and vital transportation infrastructure at elevations that would not be exceeded by flood waters.

RC3 Implementing Actions	
	• RC3.7. Enhance infiltration of stormwater on City-owned properties through use of pervious pavement and bioswales, revegetating areas, adding trees, and increasing green spaces. • RC3.8. Explore the use of potential alternative water supplies, including recycled water and use of local groundwater sources. • RC3.9. Ensure that WCWD's infrastructure upgrade includes improvements that mitigate anticipated sea level rise impacts. Sea level rise and high tide storm events could exacerbate any outfall capacity issues in particular. • RC3.10. Ensure that emergency response systems are in place at all local wastewater treatment plants and that electrical and mechanical components are either located above grade or are waterproofed or salt-resistant to lower risk of failure when flooded. • RC3.11. Assess communication towers in the East Bay hills for their vulnerability to wildfire including their criticality in the overall system, the consequences of failure. Emergency preparedness plans should be updated accordingly. • RC3.12. Enhance emergency response and contingency plans for the City of Richmond household hazardous waste facility for a flood event that causes temporary shutdown or prevents access to the facility. • RC3.13. Develop contingency plan for temporary shutdown or prevention of access to the Golden Bear Transfer Station in the event of flooding, which could impact community garbage collection services. • RC3.14. Work with PG&E to better understand the vulnerabilities of Richmond's electricity and natural gas infrastructure and the consequences of failure or disruption. • RC3.15. Conduct City-wide watershed analyses to identify opportunity sites for green infrastructure or low impact development (LID) techniques to improve stormwater and flood control system capacity to accommodate sea level and groundwater rise. • RC3.16. Conduct studies to better understand the current condition of the stormwater system and changes that are needed to reduce its future vulnerability to sea level rise
Partnerships	• RC3.17. Work with **EBMUD** to improve effectiveness of water conservation programs, upgrade storage and delivery systems, and diversify local water supplies. • RC3.18. Continue as an active participant in the ongoing development of the Bay Area Integrated Regional Water Management Plan (IRWMP) and other regional water planning efforts, to improve water supply resilience in the face of population growth and climate change. • RC3.19. Seek collaboration between private rail owners (**UP** and **BNSF**), local agencies that own or manage adjacent lands, and those that rely on rail either for providing service or for flood protection, to find and implement appropriate, multi-benefit solutions to address flood risks. • RC3.20. Work with **PG&E** and **MCE** to better understand the vulnerability of the electrical grid, power plants, substations, and natural gas facilities (including pipelines) to climate change impacts. • RC3.21. Work with **CalTrans** and other stakeholders and business operators to develop contingency plans for temporary loss of roadway assets due to flooding; Work with business operators and other stakeholders to develop a plan to re-route diesel trucks away from neighborhood streets and sensitive uses such as homes, schools, parks and playgrounds to minimize impacts from emissions and traffic conflicts.
Outreach and Education	• RC3.22. Work with EBMUD to promote local water conservation programs and awareness of drought conditions as the "new normal" for California water users. • RC3.23. Conduct public outreach to educate property owners about the importance of stormwater management and flood control so they support bond initiatives and increases in assessments for infrastructure repair and improvement • RC3.24. Consider implementing Adopt-a-Drain programs in neighborhoods with current flooding

Strategy RC4: Increase Resilience of Parks and Ecosystems to Climate Change

Performance Goals:	Update the City's Parks Master Plan to incorporate sea level rise and other anticipated climate change impacts; protect vulnerable local and regional park assets; Update the City's approved street tree list to include species that will thrive under the future climate conditions anticipated for Richmond.
Financial Impact to City:	Staff time
Potential source(s) of funding:	Strategic Growth Council, CalFire, Chevron ECIA, Prop 1 grants
Implementation:	2018
Responsibility:	Department of Public Works, Recreation Department
Co-Benefits:	Protect ecosystems and ecosystem services; protect local economy and property assets Health: Recreation and fitness, lower emotional stress, reduced heat island effect and associated heat-related illness
Tracking Metrics:	Adoption of updated parks Plan and approved street tree list
Implementation Partners:	ABAG, BCDC, EBRPD, CCC Flood Control District

Description: This strategy focuses on protecting parks, natural areas and ecosystems that provide recreational and aesthetic value, are critical to local flora and fauna, and provide ecosystem services that are valuable to the community.

Richmond's natural shorelines provide an array of recreational, flood protection, and ecosystem service benefits. Natural shorelines help reduce incoming wave heights, protecting shoreline structures from wind waves and tidal energy. Their loss can place shoreline communities at greater risk of flooding by increasing the likelihood that structural shoreline protection is overtopped or fails, and can increase the cost of maintaining, repairing and upgrading these already expensive structural protection assets. Much of the shoreline infrastructure, including levees, flood control facilities, and a waste water treatment plant is more than 50 years old, built in the Clean Water Act era when federal and state grants covered most costs. When clean water regulations, flood control specifications, and Bay fill policies were written 20-50 years ago, conditions were quite different than they are today or what they are projected to be in the future. More recently, scientific results from regional water quality monitoring programs and ecosystem restoration activities are suggesting the need to adjust priorities for the management of wastewater, sediment and flooding while continuing to protect the Bay's ecological resources.

Shoreline parks in Richmond, including four regional shoreline parks owned and managed by East Bay Regional Park District (EBRPD), are typically comprised of marsh habitat, wetlands, bluffs and other natural areas that bring communities in direct contact with the Bay and its natural resources. These areas provide a wide variety of services and activities to the public, including scenic views; walking, running, and biking on paths and trails; nature viewing; interpretive displays; swimming; paddleboating; sailboarding; motorboating; picnicking; playgrounds; family/group event areas and facilities; dog recreation; historic or cultural activities; and sport facilities. In addition, Richmond's shoreline parks

provide a variety of environmental, health, and economic benefits, such as critical wildlife habitat for aquatic, terrestrial, and avian species, reduced flood risks to inland communities, and improved public health. These valuable services may be lost as these natural shorelines face increased wave and tidal energy, and in some locations, longer duration periods of flooding or permanent flooding as sea level rises.

The City of Richmond contains 32 miles of Bay Trail that traverses the southern, central, and northeastern portions of the City, with large sections located on erodible shoreline such as levees, bluffs, and natural shorelines. The Bay Trail will potentially be exposed to shoreline erosion and flooding of low-lying portions, which may damage trails and lead to closures and costly repairs. The Bay Trail relies on connectivity in its function as a regional network, as even small sections of damage can disrupt the use of large segments. In addition, the Bay Trail is managed and funded by many different agencies so adaptation will require extensive coordination to maintain trail alignments and connectivity.

RC4 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RC4.1. Update the City's Parks Master Plan to incorporate sea level rise and other anticipated climate change impacts; protect vulnerable local and regional park assets or limit their use during extreme storms and King Tides. • RC4.2. Update the City's approved street tree list to include species that will thrive under the future climate conditions anticipated for Richmond. • RC4.3. Protect regional park assets or limit their use during extreme storms and King Tides. Point Isabel Recreational Shoreline, Miller Knox Regional Shoreline, Point Pinole Regional Shoreline, and sections of the Bay Trail face moderate risk from sea level rise by 2050 and significant risk from sea level rise by 2100.
Partnerships	• RC4.4. Partner with **EBRPD** in updating the City's Park's Master Plan to incorporate sea level rise and other anticipated climate change impacts, as described above.
Outreach and Education	• RC4.5. Increase local awareness about the need to protect Richmond's natural inhabitants (flora and fauna), which can experience severe stress from extreme heat, drought and extreme precipitation events.

Strategy RC5: Develop a Long-term Shoreline Development Vision and Shoreline Protection Plan

Performance Goal:	Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G)
Financial Impact to City:	Staff time; consultant fees
Potential source(s) of funding:	Chevron ECIA
Implementation:	2018
Responsibility:	Planning and Building Services; Department of Public Works
Co-Benefits:	Protect local economy and property assets Health: Lower emotional stress, minimize toxics exposure
Tracking Metrics:	Adoption of Adaptive Management Plan
Implementation Partners:	ABAG, BCDC, EBRPD, CCC Flood Control District

Description: The City will build on the achievements of the Richmond Bay Specific Plan and Contra Costa County Adapting to Rising Tides (ART) project to develop a comprehensive vision for the City's extensive shoreline that addresses climate change impacts to private property, commercial and industrial assets, public infrastructure, water quality, ecological protection, public access, public health and recreation. This strategy complements General Plan Action EC6.G, which calls for the City to develop a shoreline protection system that is initially built to accommodate a mid-term rise in sea level of 16 inches[17], along with an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels of sea level rise.

The Contra Costa ART project identified many commercial and industrial parcels at risk from current and/or future flooding in the City of Richmond. Commercial and industrial facilities, including the Port of Richmond and an extensive network of industrial pipelines, are critical components of community function, providing jobs, goods and critical services, and opportunities for economic development and growth in the City and throughout Contra Costa and the Bay Area region. The disruption of these facilities can have significant local social and economic impacts, as well as ecosystem and public health consequences if hazardous materials are released into the environment.

Richmond is also home to dozens of Brownfield sites that are vulnerable to sea level rise, where concentrations of various metals, corrosive materials, petroleum products, volatile organics, organochlorine pesticides, and other compounds pose greater risk to human health and the environment

[17] This is based on a 2012 study by the National Research Council (NRC), *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future,* which projects 11 inches of sea level rise in the San Francisco Bay by 2050 (with a range of 5 to 24 inches) and 36 inches by 2100 (with a range of 17 to 66 inches).

if flooding or a rising groundwater table act to disperse the contaminants. Brownfields cleanups are site-specific and based on current standards for where the site is located, e.g., upland or aquatic, and the approved site reuse. Upland sites that become aquatic as sea level rises will most likely not have been cleaned up to the higher standard usually required for aquatic sites. In addition, the opportunity for further cleanup of Brownfields to address changing flood or groundwater conditions will vary because cleanup depends in part on being able to locate the responsible party and on these parties having the necessary funds to undertake the cleanup.

Richmond's natural shorelines provide an array of recreational, flood protection, and ecosystem service benefits. Natural shorelines help reduce incoming wave heights, protecting shoreline structures from wind waves and tidal energy. Their loss can place shoreline communities at greater risk of flooding by increasing the likelihood that structural shoreline protection is overtopped or fails, and can increase the cost of maintaining, repairing and upgrading these already expensive structural protection assets. Much of the shoreline infrastructure, including levees, flood control facilities, and a waste water treatment plant is more than 50 years old, built in the Clean Water Act era when federal and state grants covered most costs. When clean water regulations, flood control specifications, and Bay fill policies were written 20-50 years ago, conditions were quite different than they are today or what they are projected to be in the future. More recently, scientific results from regional water quality monitoring programs and ecosystem restoration activities are suggesting the need to adjust priorities for the management of wastewater, sediment and flooding while continuing to protect the Bay's ecological resources.

Shoreline parks in Richmond, including four regional shoreline parks owned and managed by East Bay Regional Park District (EBRPD), are typically comprised of marsh habitat, wetlands, bluffs and other natural areas that bring communities in direct contact with the Bay and its natural resources. These areas provide a wide variety of services and activities to the public, including scenic views; walking, running, and biking on paths and trails; nature viewing; interpretive displays; swimming; paddleboating; sailboarding; motorboating; picnicking; playgrounds; family/group event areas and facilities; dog recreation; historic or cultural activities; and sport facilities. In addition, Richmond's shoreline parks provide a variety of environmental, health, and economic benefits, such as critical wildlife habitat for aquatic, terrestrial, and avian species, reduced flood risks to inland communities, and improved public health. These valuable services may be lost as these natural shorelines face increased wave and tidal energy, and in some locations, longer duration periods of flooding or permanent flooding as sea level rises.

The appropriate shoreline adaptation strategy depends upon the shoreline geomorphology, the natural and manmade assets at risk, the appetite for risk, the resources available, and current legislation. Retreating from rising seas is inherently difficult in areas like Richmond where the shoreline has been developed, presenting enormous societal and political challenges that are likely to generate decades-long debates. Strategies that focus on strengthening or maintaining the existing levee alignment can buy time for much harder decisions to be made. Innovative approaches, like using horizontal levees to restore protective marshes and integrate ecosystem restoration with management of wastewater, sediment and flooding are promising for Richmond but require more study and can be stymied by current regulations. The regulatory framework provided by FEMA, the Clean Water Act and the Endangered Species Act have a big impact on the U.S. landscape and will do so in the future. In general, regulation needs to evolve along with adaptation strategies, continuing to protect the environment and natural habitats but allowing room for innovation and response actions as the environment changes over the next century and beyond.

The City will engage stakeholders in a discussion on shoreline resiliency that considers multiple objectives, which could lead to more effective capital improvement plans, better access to different financial and material resources, and approaches that provide co-benefits to issues beyond climate change.

RC5 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RC5.1. Build on the achievements of the Richmond Bay Specific Plan and CCC ART project to establish a broad shoreline vision and comprehensive long-term plan for shoreline development that includes multi-objective solutions for protecting private property, public infrastructure, water quality, ecological protection, public access, and recreation. • RC5.2. Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G). • RC5.3. In conjunction with CCC Flood District, conduct further analysis needed to better understand the extent of flooding caused by combinations of Bay water levels, sea level rise, and flood flows. • RC5.4. Develop guidelines and update zoning for new development along the shoreline that anticipate sea level rise impacts (see also RC2.1. Amend the City's Flood Damage Prevention Ordinance to meet current FEMA requirements for constructing in special flood hazard zones and areas vulnerable to sea level rise and liquefaction. These requirements may include policies related to flood-proofing of structures located adjacent to special Flood Hazard Zones). • RC5.5. Site emergency response facilities at elevations that would not be exceeded by sea level rise and associated flood waters. • RC5.6. Construct a shoreline protection system and storm drainage system that are initially built to accommodate a mid-term rise in sea level of 16 inches, with a design that is adaptable to meet higher than anticipated values in the mid-term, as well as for the long-term (GP Action EC6.G).
Partnerships	• RC5.7. Partner with **local business and industry groups** to assess the vulnerability of commercial and industrial assets to climate change exposures, identify common needs and concerns, and share resources in mitigating risk. • RC5.8. Partner with **ABAG** and **BCDC** to integrate climate adaptation planning into the City's Local Hazard Mitigation Plan (LHMP), to address risks from flood hazards associated with climate change.
Outreach and Education	• RC5.9. Engage stakeholders in a discussion on shoreline resiliency that considers multiple objectives.

Strategy RC6: Support Programs and Adaptation Responses to that Protect Public Health and Promote Health Equity

Performance Goal:	Update Local Hazard Mitigation Plan, General Plan Safety Element, and building codes as appropriate to incorporate public health impacts of climate change.
Financial Impact to City:	Staff time; outreach materials
Potential source(s) of funding:	Chevron ECIA, CalBRACE
Implementation:	Ongoing
Responsibility:	City Manager's Office, Richmond Emergency Services
Co-Benefits:	Reduced inequities, improved health equity, lower energy costs Health: Reduced heat island effect and associated heat-related illness, decreased illness and premature mortality
Tracking Metrics:	Adoption of updated plans and building codes
Implementation Partners:	Contra Costa Health Services, local community-based organizations, University of California at Berkeley School of Public Health, local health care and social service providers, Community Energy Services Corporation (CESC).

Description: As explained in the City's Health in All Policies (HiAP) Strategy, climate change presents a significant opportunity and risk to community health in Richmond, threatening to exacerbate existing inequities. More extreme weather events, worsened air quality, and increased transmission of infectious disease may negatively affect human health, health behaviors, and the socio-economic factors that influence health outcomes. The impacts of climate change will not affect everyone equally. It is expected that already burdened and vulnerable populations, such as the elderly, infants and children, minority communities, and people living in poverty, may be disproportionally impacted by climate change.

Building on the City's HiAP Ordinance (2014), this strategy focuses on initial, short-term steps the City can take to reduce risk to climate change exposures and increase local preparedness efforts. Many actions focus on integrating climate change into existing planning and preparedness processes to better understand the vulnerabilities of specific populations to climate change, and to target programs, capacity building, and resources in those areas in culturally- and linguistically-appropriate ways. Public health programs will require solidifying partnerships with established health and social service providers, including Contra Costa Health Services (CCHS), while building relationships with local community-based organizations, such as the Community Clinic Consortium. All actions should consider ways to reduce the root causes of inequity.

RC6 Implementing Actions	
City Initiatives, Policies and Infrastructure	• RC6.1. Leverage Richmond's HiAP Strategy and Ordinance to prioritize City adaptive actions that address the root causes of existing inequities. • RC6.2. Formalize a policy or set of funding criteria that prioritize the use of resources for the most highly-impacted populations, using data-driven tools such as CalEnviroscreen to identify neighborhood-level vulnerability. • RC6.3. Prioritize the health and well-being of the City's most vulnerable populations (elderly, low-income, and health-compromised residents) who face significant risk from extreme heat events by 2100. • RC6.4. Incorporate street tree or tree canopy standards into future Specific Plans and the zoning code; update the City's approved street tree list to include species that will thrive under the future climate conditions anticipated for Richmond. • RC6.5. Work with Richmond Emergency Services to strengthen emergency management capacity and responses to heat, floods, landslides and other emergencies, particularly in vulnerable neighborhoods, in culturally-appropriate ways. • RC6.6. Incorporate into emergency response plans the public health risks to neighborhoods and vulnerable populations from leaking pipelines or hazardous waste sites that incur damage from sea level rise, severe storms or other climate related events. • RC6.7. Identify Brownfields (contaminated lands) vulnerable to sea level rise and associated flooding and rising groundwater levels, and assess risk of contaminant exposure to people and the environment. Identify where governance vulnerabilities will present challenges to risk mitigation. • RC6.8. Create an urban heat island reduction program that evaluates risk/vulnerability, identifies specific interventions (e.g. tree planting, revegetation, cool roofs, etc.), and establishing funding for urban heat reduction programs.
Partnerships	• RC6.9. Leverage the City's participation in CESC's Healthy Homes to identify and reduce asthma triggers and other home health hazards that are exacerbated by climate change. • C6.10. Partner with University of California at Berkeley School of Public Health or CCHS to forecast climate impacts and assess public health vulnerabilities. • RC6.11. Establish and strengthen partnerships with CCHS, health care providers (hospitals, emergency care centers, and homeless service providers and shelters), and community-based organizations to communicate and reach population groups to which the City does not already have affective access to but that might be vulnerable to climate change impacts, including extreme heat days and high ozone and high particulate matter days. • RC6.12. Work with community-based organizations to improve access to culturally-appropriate cooling centers. • RC6.13. Continually communicate with CCHS, the Department of Public Health and other local and county agencies to understand change in disease vector populations and mitigation strategies. • RC6.14. Leverage existing weatherization and energy efficiency programs to improve building heating and cooling comfort for low-come and vulnerable populations. • RC6.15. Promote local agriculture and food systems to increase access to healthy, fresh foods and improve nutritional quality, reduce upstream energy use, and increase local social cohesion.
Outreach and Education	• RC6.16. Engage the public and promote community involvement in actions to reduce climate change risks, using linguistically- and culturally- appropriate approaches that are effective for diverse populations. • RC6.17. Education community on health issues associated with flooding, including health consequences from inadequate clean up (mold, hazardous waste) • RC6.18. Raise community awareness of locations and accessibility of emergency shelters and cooling centers.

City of Richmond

Climate Change Adaptation Study

F

APPENDIX

October 2016

Acknowledgements

The City of Richmond has been an active participant in the Contra Costa County Adapting to Rising Tides Project, led by the Bay Conservation Development Commission (BCDC) in partnership with the Metropolitan Transportation Commission, the State Coastal Conservancy, the San Francisco Estuary Partnership, the San Francisco Estuary Institute, Alameda County Flood Control and Water Conservation District and the San Francisco Public Utilities Commission, and consulting firm AECOM. Environmental Science Associates (ESA) completed this Adaptation Study in coordination with BCDC, relying in part on reports and maps developed for the Adapting to Rising Tides project to assess the City of Richmond's vulnerabilities with respect to sea level rise and coastal flooding.

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1. Executive Summary

The City of Richmond Climate Change Adaptation Study (Adaptation Study) examines a broad spectrum of the community's climate change vulnerabilities and prioritizes potential adaptation responses based on the greatest risks, needs, and synergies with related planning efforts. The Adaptation Study is meant to guide adaptation planning by identifying important City-owned and community assets that are vulnerable to climate change impacts, assessing the risk that climate change poses to those assets, and recommending response actions that the City should integrate into its planning efforts to mitigate that risk. The overall goal is to establish a stronger framework for gathering data, making decisions, and prioritizing actions that will improve the City's resilience to climate change over time.

The Adaptation Study is intended to support current and upcoming planning initiatives including the City of Richmond Climate Action Plan, City of Richmond Local Hazard Mitigation Plan, and the next iteration of the City's General Plan Safety Element. The Governor recently signed Senate Bill 379 requiring all cities and counties, upon the next revision of their local hazard mitigation plan, to include climate adaptation and resiliency strategies in their general plan safety element to enhance community safety and climate protections. While *Richmond General Plan 2030* includes a policy to minimize the flood risks associated with sea level rise (Policy SN1.2 Flood Management), and a supporting action to identify sea level rise hazard zones for all new development (Action SN1.D Flood Hazard Zone Designation), the City's next General Plan Safety Element revision will include more extensive goals, policies, and objectives for adapting to climate change based on the vulnerability and risk assessment resented herein, as well as the priority actions that are identified for increasing community resilience to climate change.

The Adaptation Study assesses vulnerabilities for the following twelve functional categories of community assets, which include City-owned or operated facilities deemed critical for operations, utility services, and risk management, and other assets that are important to community health, safety, and well-being:

1. Community Services and Public Facilities
2. Public Health
3. Housing and Schools
4. Water Supply
5. Wastewater Management
6. Stormwater Management
7. Transportation Infrastructure
8. Flood Management
9. Energy Infrastructure
10. Solid Waste/Hazardous Materials Management
11. Parks, Natural Areas, and Ecosystems
12. Commercial and Industrial Assets

Richmond's greatest risks related to climate change are a product of the City's bayside setting, the inherent sensitivities of its Mediterranean climate, and its dependence on imported water from the distant Sierra Nevada Mountains as its primary water supply. Some of the City's most critical assets are located in close proximity to the low-lying shoreline where risk of damage or disruption from sea level rise is significant. These include wastewater treatment facilities, residential neighborhoods, the Chevron Refinery and other industrial areas including the Port of Richmond, highways, rail lines, emergency response facilities, and parks. Climate change is expected to bring hotter and drier summers and winter

storms that are predicted to be fewer in number but higher in intensity. These changes can stress natural habitats and public health while posing a potentially serious risk to the long-term reliability of the City's potable water supply. Based on this study, the City-owned and community assets at highest risk from climate change by the year 2100 include the following:

1. Property and infrastructure located in areas along the Bay shore prone to coastal flooding from sea level rise, and associated higher risk of liquefaction during seismic events. Current levees are not designed to protect these assets from sea level rise;
2. The City's long-term potable water supply, which is largely dependent on runoff from the Sierra Nevada Mountains, especially during dry years;
3. Road transportation assets including streets and highway approaches that are located in flood-prone areas along the Bay shore;
4. The health and well-being of the most vulnerable of the City's residential populations, and its natural inhabitants (flora and fauna), which can experience severe stress from extreme heat, drought and extreme precipitation events.

Richmond is already engaged in multiple planning efforts that address some or all of these risks, but this Adaptation Study represents the City's first widely coordinated effort to identify and document vulnerabilities across a broad range of community assets and assess the risk of climate-related impacts to those assets over near-term (to 2050) and longer-term (to 2100) planning horizons.

Coastal Flooding

Adaptation strategies for sea level rise should be woven into a comprehensive vision for the Bay shore that addresses climate change along with other issues including water quality, the protection of shoreline ecology, public access and recreation. Many of the shoreline adaptation challenges faced by Richmond arise from decades of managing stormwater, water supply, and flood protection as separate systems rather than using an integrated approach that incorporates broad stakeholder engagement and multi-objective assessment and planning to address the dependencies and relationships between systems, and the potential for exacerbating risk of failure to critical assets. Moreover, much of the shoreline infrastructure, including levees, flood control facilities and waste water treatment plants, is more than 50 years old, built in the Clean Water Act era when federal and state grants covered most costs. Even though concerns about maintaining the area's infrastructure have been growing for decades, a commensurate increase in funding has not occurred. Beyond the price tag, the regulatory and institutional challenges of doing multi-benefit projects remain substantial. Most clean water regulations, flood control specifications, and Bay fill policies were written 20-50 years ago, when conditions were quite different than they are today or what they are projected to be in the future.

Retreating from rising seas is inherently difficult in areas where the shoreline has been developed, presenting enormous societal and political challenges that are likely to generate decades-long debates. Strategies that focus on strengthening or maintaining the existing flood protection can buy time for much harder decisions to be made. Innovative approaches, like using horizontal levees to restore protective marshes and integrate ecosystem restoration with management of wastewater, sediment and flooding are promising for Richmond but require more study and can be stymied by current regulations. In general, regulation needs to evolve along with adaptation strategies, continuing to protect the environment and natural habitats but allowing room for innovation and response actions as the environment changes over the next century and beyond. There are lessons to be learned from international experience, such as the coastal armoring approaches used by the Dutch, but the ecological, political and cultural landscape of the Bay is quite different from other places, and

appropriate adaptation strategies are highly dependent on local geomorphology and ecology, the assets at risk, the appetite for risk, and the resources available.

Water Supply

The City's current water supply is highly vulnerable to drought, but the risk of failure is uncertain. The City is dependent on the East Bay Municipal Utility District (EBMUD) for the bulk of its long-term water supply. During periods of extended drought, the ability of EBMUD to supply its customers (including City of Richmond) is at risk. In its Water Supply Management Plan 2040 (WSMP 2040), EBMUD acknowledges that, during severe droughts, it would be unable to meet water demands with its Mokelumne River supplies, without imposing extreme rationing measures. California's current drought, now in its fourth year, is putting added emphasis on long-term water security and forcing public agencies to redouble conservation efforts and expand contingency planning. Accordingly, EBMUD and the City of Richmond are increasing efforts to improve conservation, upgrade storage and delivery systems, and diversify local water supplies.

Critical Transportation Assets

Sections of Interstates 580 and 80, and the Richmond Parkway, as well as many surface streets in the City of Richmond, including Castro Street, Central Avenue, and San Pablo Avenue, are at significant risk from sea level rise by the year 2100. Sections of passenger and commuter rail are also at risk. Currently, these assets are not adequately protected from sea level rise; as an intermediate measure, the City should develop contingency plans for temporary loss of these assets, a period that may last from a few hours to several weeks or longer, depending on the damage.

Many roads in the Richmond Hills are in high risk zones for wildfires by the year 2100. The vulnerability of these assets should be better defined, along with consequences of failure and contingency plans in the event they become damaged or inaccessible.

Vulnerable Populations

The City's most vulnerable populations face significant risk from extreme heat events. These populations will also face higher risk of health problems from higher concentrations of ground-level ozone (a key component of smog) and other air quality impacts. Climate change will act as a stress multiplier for many existing health problems that already disproportionally impact low-income and communities of color in Richmond, and is also expected to impact socio-economic conditions that can make it harder to access basic services such as health care, food, and housing. The City has an important role, in partnership with public agencies and community based organizations, to educate and engage the public on climate change issues, and to promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations.

Summary

Richmond, like many cities in the Bay Area, faces multiple vulnerabilities to climate change, along with considerable uncertainty regarding the magnitude of risk associated with those vulnerabilities. In the face of this uncertainty, it can be difficult to build stakeholder consensus and to know how to best apply limited resources when there are so many competing demands for City budgets and staff time. However, there are many actions the City can take now to become better prepared for a changing climate, based on rational decision making that is supported with ongoing monitoring and an adaptive management approach that triggers future actions when they are needed. This Adaptation Study provides a

compendium of current plans, studies, data, policies, and actions that are relevant to the City's adaptation planning efforts. It summarizes a broad range of climate change vulnerabilities to the City's functional, informational, and management systems and identifies potential consequences to the economy, to public health, to the people of Richmond and to the environment. The study helps identify the City's greatest risks from climate change and identifies priority actions for mitigating that risk, building community awareness, and preparing for an uncertain future.

2. Study Methodology

The City of Richmond Climate Change Adaptation Study (Richmond Adaptation Study) is essentially a climate change vulnerability and risk assessment that considers a broad range of climate change exposures, including higher temperatures, rising sea level, and extreme precipitation events. The methodology used to develop the Richmond Adaptation Study is based on the Adapting to Rising Tides (ART) Program methodology[1] developed by the San Francisco Bay Conservation and Development Commission (BCDC) and NOAA Coastal Services Center to understand how San Francisco Bay Area communities can adapt to sea level rise and storm event flooding. The ART Program has engaged local, regional, state and federal agencies, as well as non-profit and private stakeholders, to explore how the Bay Area can increase resilience to sea level rise and storm events (both locally and regionally) while protecting critical ecosystem and community services.

The ART approach was derived from existing adaptation planning models with significant input from ART project working group members and partners. It is well-suited to consider climate change impacts beyond sea level rise and flooding, and is consistent with state guidance for adaptation planning, including the California Climate Adaptation Planning Guide[2] (CCAPG), which recommends a sequence of nine steps in developing strategies to address climate change impacts: (1) assess exposure to climate change impacts; (2) assess community sensitivity to the exposure; (3) assess potential impacts; (4) evaluate existing community capacity to adapt to anticipated impacts; (5) evaluate risk and onset, meaning the certainty of the projections and speed at which they may occur; (6) set priorities for adaptation needs; (7) identify strategies; (8) evaluate and set priorities for strategies; and (9) establish phasing and implementation.

The figure below outlines each step of the ART planning process as it was applied to the City of Richmond Adaptation Study: project scoping and organizing; assessing vulnerability and risk; defining assessment outcomes and key issues; planning adaptation responses; and implementing and monitoring responses. The process is both sequential and iterative (as new information becomes available and conditions change, some previous steps need to be revisited).

2.1 Scope and Organize

Identify the project scope and scale, project area, assets to be evaluated; convene and engage a stakeholder working group in defining what will be addressed in the project and developing the resilience goals for the project.

2.2 Assess

Conduct an assessment of vulnerability and consequences for categories of assets and critical individual assets (e.g., Port of Richmond) in the project area, and create current and future flooding and hazard exposure maps.

2.3 Define

Synthesize the assessment information into vulnerability and consequence findings. Share these findings with the stakeholder working group and engage them in identify the key planning issues for the project.

2.4 Plan

After reviewing the project resilience goals with the stakeholder working group, develop adaptation responses for the vulnerabilities and key planning issues that lay a clear and transparent path towards implementation.

2.5 Implement and Monitor

Identify resources to assist with implementation; conduct feasibility studies as needed for specific actions; communicate project outcomes to stakeholders, including boards, commissions, committees and other decision-making bodies. Integrate adaptation responses into governance, capital investment and management.

A unique characteristic of the ART planning process is the integration of four assessment frames – society and equity, environment, economy and governance – into each step of the planning process. This approach worked well for considering the full range of sustainability issues facing the City of Richmond.

Society and Equity	Economy	Environment	Governance
Addresses the effects on communities and the services on which they rely with specific attention to disproportionate impacts due to existing inequalities.	Addresses the economic values that may be affected such as costs of physical/infrastructure damages or lost revenues during periods of recovery.	Addresses the environmental values that may be affected, including ecosystem function and services, and species biodiversity.	Addresses factors such as ownership, management responsibilities, jurisdiction, mandates, and organizational structure that influence vulnerability and resilience.

3. Setting

3.1 Statewide Climate Change Projections

Greenhouse gas (GHG) emissions forecasts underlie predictions of future climate change and assessments of potential exposure to climate change impacts. Climate change planning documents in California and throughout the world commonly consider two GHG emissions scenarios to represent the range of likely future outcomes. Scenario A2 (Medium–High Emissions) assumes a "business-as-usual" path with high population growth and a higher consumption global economy that lacks cooperation in sustainable development, while B1 (Lower Emissions) is a lower GHG emission scenario that represents social consensus on climate change and action for sustainable development.[3] Generally, the B1 scenario can be viewed as an optimistic "best case" scenario for emissions that relies on fundamental shifts in global policy, while A2 represents more of a status quo scenario reflecting real-world conditions incorporating incremental improvements and can be the more realistic choice for decision-makers to use for climate adaptation planning. To date, actual global emissions have more closely tracked, and even exceeded, the A2 scenario originally put forth in 2001.

The State of California's Climate Change Impacts Assessment[4] (the State's has conducted three major assessments of local and statewide vulnerabilities to climate change since 2006) provides the scientific basis from for the state's adaptation strategy. The Impacts Assessment used a set of six global climate models with the two emissions scenarios to project future conditions of air temperature, changes in precipitation patterns, sea-level rise and other variable that are useful for planning purposes. Based on historical simulations, the selected models are capable of producing a reasonable representation of California's seasonal precipitation and temperature, variability of annual precipitation, and the El Niño/Southern Oscillation.[5] The six global climate models are:

1. National Center for Atmospheric Research (NCAR) Parallel Climate Model (PCM)
2. National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluids Dynamic Laboratory (GFDL) model
3. French Centre National de Researches Meterologiques CNRM3 model
4. NCAR CCSM3 model
5. German MPI ECHAMS model
6. Japanese MIROC3.2 (medium-resolution) model

All of the global climate models show increased warming throughout the 21st century, with average annual air temperature increasing about 2ºF to 5ºF by 2050. The Mediterranean seasonal precipitation pattern is expected to continue during the 21st century, with most of the precipitation occurring during winter from North Pacific storms. The hydro-climate (hydrology and weather) is expected to be influenced by the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) with alternating periods of wet and dry water years. In the Sierra Nevada Mountains, there will be some shift to more winter precipitation occurring as rain instead of snow, with a reduction in snowpack accumulation and shifts in runoff patterns, especially during the summer and fall. By 2050, scientists project a loss of at least 25% of the Sierra snowpack.[6]

3.2 Bay Area Region Climate Change Projections

The State of California's Climate Change Impacts Assessment includes downscaled results for the Bay Area.[7]

Temperature

The historical average annual temperature in the San Francisco Bay Area region is 56.8ºF (13.8ºC). Overall average air temperatures in the SF Bay Area are expected to rise 2.7ºF (1.5ºC) between 2000 and 2050 regardless of the GHG emissions scenario, but the A2 and B1 scenarios project increases of 10.8ºF (6ºC) and 3.6ºF (2ºC), respectively, by the end of the 21st century. The temperature projections begin to deviate between the A2 and B1 scenarios around mid-century, with the A2 scenario increase about twice the B1 scenario by 2100.

Precipitation

Precipitation in the San Francisco Bay Area region is essentially all due to rain, and significant shifts in the timing of precipitation are not expected to occur.[8] The SF Bay Area is likely to continue with a Mediterranean climate of cool wet winters and hot dry summers. Possible changes in precipitation projected by the GCMs are uncertain in part due to the highly variable precipitation that California experiences on an annual and decadal time scale. Up to the year 2050 annual precipitation changes produce mixed results; however there is an indication that conditions will be drier than the historical average in the second half of the century. Looking at averaged projections by month, it is possible to identify greater reductions in precipitation in March and April while November, December and January may remain relatively unchanged. While average conditions may be drier the expectation is that more intense downpours will occur during a somewhat shorter rainy season.

Sea-Level Rise and Coastal Flooding

Sea-level rise is expected to increase the risk of coastal erosion and flooding along the California coast, and higher water levels due to sea-level rise could magnify the adverse impact of storm surges and high waves. Impacts to assets from extreme high tides in addition to net increases in sea level will likely result in increased inundation frequency, extents, and depths leading to catastrophic flooding and coastal erosion. Understanding the extent, depth and duration of inundation and the patterns of erosion will be necessary for characterizing infrastructure vulnerability in coastal areas. The picture is further complicated by the concurrent vertical movement of the land due to tectonic activity. Projections of the relative sea level, the sum of both sea level rise and vertical land movement, are therefore important in the San Francisco Bay area.

Sea level has been measured at the Presidio tide gauge in San Francisco since 1854, with a recorded rise in relative sea level of 7.6 inches (19.3 cm) over the last 100 years.[9] Present sea-level rise projections suggest that the rate of global sea level rise in the 21st century can be expected to be much higher.

California, via the Ocean Protection Council, (OPC, 2013[10]), has adopted the San Francisco Bay region sea level rise projections from the National Research Council (NRC, 2012[11]), which includes an allowance for vertical land motion. For the Bay Area, this study projects 11 inches of sea level rise by 2050 (with a range of 5 to 24 inches) and 36 inches by 2100 (with a range of 17 to 66 inches). The California Coastal Commission (CCC), in its *Sea Level Rise Policy Guidance* (2015), also references to the NRC 2012 report as the current "best available science" informing coastal land use planning and development.[12]

Chapter 4 examines the local impacts of sea level rise on the City of Richmond.

3.3 Community Assets

Community assets considered in the vulnerability analysis include City-owned or operated facilities deemed critical for operations, utilities, and risk management, and other assets that are important to community health, safety, and well-being. It also includes the residents and businesses of Richmond.

Community Services and Public Facilities: This category of assets includes facilities that are critical in times of emergencies and natural disasters, such telecommunications infrastructure, cooling centers, police and fire stations, emergency operations centers and evacuation shelters.

Public Health: Public health is a community asset impacted by climate change, where vulnerability is a function of an individual or a community's ability to respond and adapt to climate stressors, which in turn is dependent on socioeconomic characteristics and underlying health and physical abilities. This study places a special focus on the City's populations who are most vulnerable climate change impacts, including those with special needs, living in poverty, or most exposed to the physical impacts of climate change.

Housing and Schools: This category of assets includes the City's single family homes, multifamily housing, and K-12 schools

Water Supply: Natural and manmade water systems for supplying clean, safe and reliable water supply for the City of Richmond, including potable water reservoirs, groundwater wells, piping systems, pumping stations, turnouts, and water treatment infrastructure. The City of Richmond receives 100% of its water supply from EBMUD, which in turn gets its supply from distant Sierra Nevada mountain watersheds.

Wastewater Management: Richmond is served by three sanitary sewer districts: Richmond Municipal Sewer District, managed by the City of Richmond; West County Wastewater District (WCWD); and Stege Sanitary District (SSD), managed by East Bay Municipal Utility District (EBMUD). The City's wastewater collection and treatment infrastructure includes treatment plants and operations centers, sewer lines, and treated effluent outfalls.

Stormwater Management: The City of Richmond has approximately 94 miles of storm sewer pipes plus numerous gutters, manholes, outfalls, storm gates, pump stations and other drainage infrastructure that helps manage rainfall runoff and prevent flooding. Local creeks, open space, and other permeable surfaces (i.e., green infrastructure) can also be considered of the City's stormwater management system.

Transportation Infrastructure: This includes critical roads, and bridges, and other transportation infrastructure including the Richmond BART and Amtrak stations, rail lines, key highways and roadways, and bicycle and pedestrian paths.

Flood Management: The collection of levees, berms, embankments, tidal marsh wetlands, transportation structures (e.g., rail and road beds), and other structures that collectively provide flood mitigation for the City's shoreline and creek channels.

Energy Infrastructure: The City's energy supply and supporting infrastructure, including electrical substations and transmission lines, natural gas lines and pumping stations, and emergency generators. Changes in precipitation patterns caused by climate change are expected to affect the availability of hydropower.

Solid Waste/Hazardous Materials Management: The systems and infrastructure that support the safe and secure management of solid waste and hazardous materials/waste, as well as the management of contaminated lands (brownfields and landfills) that prevents release of contaminants to the environment.

Parks, Natural Areas, and Ecosystems: This includes natural environments and habitats considered valuable or essential to the health and well-being of the community, including a variety of plants, animals, and other organisms that reside in City of Richmond. Richmond's open space preserves, located primarily in the hills above Wildcat Creek and along the Bay, provide opportunities for hiking, biking, fishing, picnicking, nature study, and community gatherings. They also have significant ecological and aesthetic value, providing important habitat for wildlife and a scenic backdrop to the urban area.

Commercial and Industrial Assets: This category includes the commercial and industrial facilities provide jobs, goods and critical services, and opportunities for economic development and growth in the City and throughout Contra Costa and the Bay Area region. This also includes oil refineries, industrial pipelines, the Port of Richmond, and its associated marine terminals.

3.4 Relevant Local Planning Initiatives

For this Study, ESA reviewed and incorporated the most relevant local planning initiatives and documents related to climate change adaptation planning for the City of Richmond. The primary documents influencing this Study include:

City of Richmond General Plan 2030

The *City of Richmond General Plan 2030* was adopted in April 2012. The General Plan includes an Energy and Climate Element, which provides policies and implementing actions that are designed to: provide leadership to manage climate change; promote clean and efficient transportation options; encourage sustainable and efficient energy systems; promote sustainable development; support community revitalization; and build climate-resilient communities.

General Plan Action EC6.G calls for the City to develop a shoreline protection system that is initially built to accommodate a mid-term rise in sea level of 16 inches, along with an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels of sea level rise.

Richmond Health In All Policies (HiAP) Strategy

The City is fully committed to achieving the highest level of health for all Richmond residents. The City's HiAP Strategy reflects this pledge to health equity by mainstreaming health and wellness throughout City policy, programs, and operations, including the CAP. The HiAP Strategy established the following two, interrelated goals: 100% health equity and 0% health inequities. The City defines health equity as attaining the highest level of health for all people, while describing health inequity as differences in health that are available, unfair, and unjust. Environmental, socioeconomic conditions, and other root causes contribute to health inequity.

The HiAP Strategy calls on the City to include a discussion of environmental justice section for the City's vulnerable populations in the CAP. The HiAP strategy highlights policies and programs, such as the Richmond Recovery Rebate (R3) and affordable housing that focuses on improvements for low-income residents that would address existing health inequities.

Local Multi-Hazard Mitigation Plan (LHMP)[13]

The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Contra Costa County and participating cities (including City of Richmond) in the county maintain a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction.

Volume 2 of the 2011 LHMP includes the City of Richmond Annex, with no explicit coverage of climate change as a hazard, but it assesses at a very high level hazard risks from earthquake, severe weather, flood, dam failure, landslide, wildfire and drought, and provides useful maps of critical facilities, flood zones, and wildfire hazards. There is also a West Contra Costa Unified School District Annex that addresses potential hazards to its critical facilities. The Richmond Fire Protection District and East Bay Regional Park District participated under the Unincorporated County section.

EBMUD's 2010 Urban Water Management Plan (UWMP)[14]

Urban water suppliers (of a certain minimum size) in California are required to assess the reliability of their water sources over a 20-year planning horizon, and report their progress on 20% reduction in per-capita urban water consumption by the year 2020, as required in the Water Conservation Bill of 2009 (SBX7-7). Every five years, water suppliers must prepare and adopt an urban water management plan (UWMP) that identifies how the agency will maximize the conservation and efficient use of urban water supplies, and describes the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable.

EBMUD's 2010 UWMP assesses current and projected water usage, water supply planning, and current and projected conservation and recycling programs. EBMUD's UWMP describes the agency's residential and non-residential conservation programs, rebate and incentive programs and outreach and education activities Geared toward reducing water use and meeting the SBX7-7 target. The UWMP also includes a Water Shortage Contingency Plan that acknowledges the increased uncertainty in EBMUD's water supply reliability due to climate change, the regulatory environment, and competition for water rights. In past dry periods (e.g., the 1976-77 drought) when runoff from the Mokelumne River Basin was insufficient to meet service area demands, EBMUD relied on stored water in its reservoirs to meet most of its customers' water needs. Mandated rationing in 1977 helped avoid depleting the system storage, and fortunately, Northern California experienced a very wet year in 1978, which contributed to the system's rapid recovery. If that drought had continued into a third dry year in 1978 and rationing had been lifted, EBMUD would not have had sufficient water to meet customer needs or its downstream obligations.

3.5 Relevant State and Regional Planning Initiatives

California Climate Adaptation Strategy[15]

In 2009, California adopted a statewide Climate Adaptation Strategy that summarizes climate change impacts and recommends adaptation strategies across seven sectors: Public Health, Biodiversity and Habitat, Oceans and Coastal Resources, Water, Agriculture, Forestry, and Transportation and Energy. The 2009 Climate Adaptation Strategy used downscaled global climate models to more accurately assess statewide climate impacts as a basis for providing guidance for establishing actions that prepare, prevent, and respond to the effects of climate change.

The California Natural Resources Agency released a 2013 update to the Climate Adaptation Strategy called Safeguarding California, which augments previously identified strategies in light of advances in climate science and risk management options.

Cal-adapt[16]

Following the 2009 publishing of the California Climate Adaptation Strategy, the California Natural Resources Agency in partnership with UC Berkeley's Geospatial Innovation Facility (GIF) and the California Energy Commission's Public Interest Energy Research (PIER) Program developed the Cal-adapt web-based climate adaptation planning tool. Cal-adapt allows planners and other decision makers to identify potential climate change risks in specific geographic areas throughout the state. It synthesizes volumes of existing downscaled climate change scenarios and climate impact research and presents it in an easily available, graphical layout that is intended to benefit local planning efforts. Maps and data can be downloaded in a variety of tabular and GIS formats. Interactive maps and charts are provided for looking changes over time under different GHG emissions scenarios for:

- Temperature: monthly and decadal averages
- Temperature: degrees of change
- Temperature: extreme heat events
- Snowpack: decadal averages
- Precipitation: decadal averages
- Sea Level Rise: threatened areas
- Wildfire: fire risk areas

Living with a Rising Bay (2011)[17]

In 2011, the San Francisco Bay Conservation and Development Commission (BCDC) prepared this shoreline vulnerability assessment to help local and regional government agencies and the public understand how existing planning and management challenges will be exacerbated by climate change and to assist in developing strategies for dealing with these challenges. The assessment focused on shoreline development, the Bay ecosystem, and governance. The report provided the basis for a subsequent amendment to the Bay Plan specifically addressing sea level rise.

Contra Costa County Adapting to Rising Tides (ART) Project[18]

The ART planning process is currently being applied to an adaptation planning project in west and central Contra Costa County, which includes the City of Richmond and the shoreline between Richmond and Bay Point. The ART project team is working work with Contra Costa County stakeholders including staff from City of Richmond and other local, county, regional, state and federal agencies, as well as those with public or private investments or interests in the project area, to understand the vulnerabilities of shoreline communities and infrastructure to current and future flooding. The project is also assessing the potential consequences of the identified vulnerabilities, including if there will be disproportionate impacts to certain community members, disruption of transportation and utility networks, loss of employment sites and loss of access to goods and services.

Vulnerability assessments are being conducted for a variety of assets in the project area, across the full range of economic and public service sectors. A series of Profile sheets are being developed that summarize and characterize the vulnerabilities and risks of assets (e.g., West Contra Costa Sanitary

Landfill) and asset categories (e.g., stormwater management). The project's extensive findings, including recommended responses for increasing asset resilience to sea level rise, will be available on the Contra Costa County ART Project website starting in the Spring of 2016.

The Contra Costa County ART Project findings will help highlight the risk to assets that function as interconnected networks, such as highways, rail corridors, utility infrastructure, and systems of shoreline protection along the Bay's edge, where disruption to one segment can cause cascading, secondary impacts to adjacent and distant segments, rendering the entire systems highly vulnerable. Much of the networked infrastructure in the Bay Area is essential to day-to-day community and economic functions, and is critical during an emergency or disaster. These networked systems typically include myriad stakeholders, jurisdictions, and management systems. It is important for local jurisdictions to understand dependencies on regional networked infrastructure and climate-related vulnerabilities and risks they represent.

Stronger Housing, Safer Communities[19]

ABAG's Stronger Housing, Safer Communities project looked at vulnerability and resilience of housing in the Bay Area to sea level rise (SLR) and seismic impacts. The project includes a focused community profile that examines hazards in the Richmond Inner Harbor area, which includes two Census Tracts (3790 and 3800) and all or part of eight neighborhoods: Atchison Village, Iron Triangle, Santa Fe, City Center, Coronado, Cortez, Marina Bay and Southwest Annex. It also includes all of the City's Richmond Bay Specific Plan area (formerly known as the South Shoreline Specific Plan), the Ford Peninsula major activity center in Marina Bay, and two Districts, Regatta/Marina Bay and Southern Gateway. Information from the detailed community profile is relevant and useful to the Adaptation Study.

Climate Change Vulnerability in Contra Costa County: A Focus on Heat[20]

This report by Contra Costa Health Services (CCHS) describes the vulnerability of different communities in Contra Costa County to the health impacts of climate change, with a focus on extreme heat events. CCHS developed a health and heat database and GIS mapping tool. The report also covers the following health impacts of climate change:

- Worse air quality associated with hotter temperatures, in the form of ground-level ozone (smog), particulate matter (smoke and exhaust particles), and allergens (pollen and mold), which exacerbate respiratory and cardiovascular problems;
- Wildfires resulting from drought and hotter temperatures, leading to worse air quality, displacement of residents and psychological stress;
- Flooding in bayside communities as a result of sea level rise, leading to displacement of residents, damage to buildings, drinking water contamination and mold in homes; and
- Infectious diseases such as West Nile Virus spread by mosquitoes, Valley Fever caused by fungus released from dry soil during drought conditions, and diarrheal diseases caused by bacteria in warming coastal waters.

The report also provides a special focus on the County's vulnerable populations and the differences in community vulnerability.

Bay Area Integrated Regional Water Management Plan (IRWMP)[21]

The Bay Area IRWMP presents a thorough summary of climate change projections and expected impacts to four water-related Functional Areas in the Bay Area, including water supply/water quality, flood control wastewater/stormwater, and watershed and habitat protection.

The Bay Area IRWMP reviewed climate change adaptation strategies from a wide range of regional and local initiatives and planning documents such as urban water management plans, habitat restoration plans, wastewater treatment master plans, watershed stewardship plans and water supply strategies. The IRWMP reviewed plans affecting all Functional Areas and sub regions. The review confirmed that, with the exception of urban water supply, the approach to water resources planning in general varies widely across Functional Areas and among agencies. For example, with respect to sea level rise and vulnerable water resources infrastructure (e.g., wastewater treatment plants), not all local plans reviewed contained adaptation strategies. This may reflect the absence of a legal requirement for a plan rather than a lack of planning for sea level rise; some agency websites indicated that climate change planning was indeed underway.

The Bay Area IRWMP identifies the following general strategies for adapting to climate change:

- Incorporate climate change adaptation into relevant local and regional plans and projects;
- Use a “No Regrets” approach to address immediate or ongoing concerns while reducing future risks;
- Establish a climate change adaptation public outreach and education program;
- Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation strategy development and regional approaches;
- Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness; and
- Update building codes and zoning.

Additional strategies identified in Bay Area local plans for adapting to water supply impact include local capture and reuse projects, and desalination.

4. Climate Change Exposures

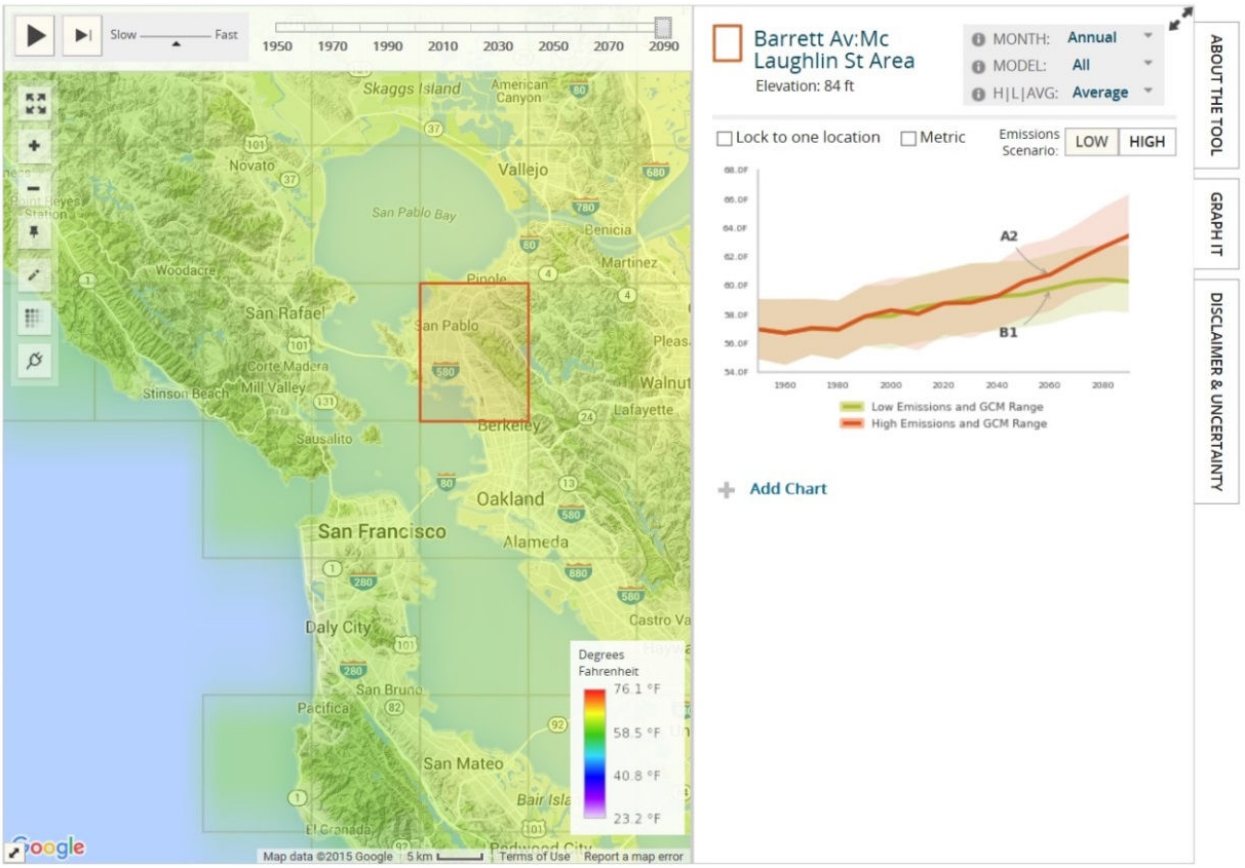
Using Cal-Adapt and other available tools, ESA summarized the type, magnitude, and onset of various local exposures of climate change that Richmond can expect to experience by the years 2050 and 2100, as predicted for the high emissions (A2) and low emissions (B1) scenarios by global climate models. The exposure analysis considers the effects of climate change on local temperature, local precipitation, drought, wildfire, and sea level rise, as well as the secondary exposure pathways facing the City of Richmond.

4.1 Temperature

California in general expects overall hotter conditions for both mean and extreme temperatures. An increase in heat waves and wildfires are expected to be among the earliest climate impacts experienced across the state.[22]

Figure 4.1, generated from Cal-Adapt, indicates that between A2 and B1 scenarios, the City of Richmond area can expect to experience a rise in average annual temperature of about 3 to 6 degrees Fahrenheit above the historical average by the end of the century.

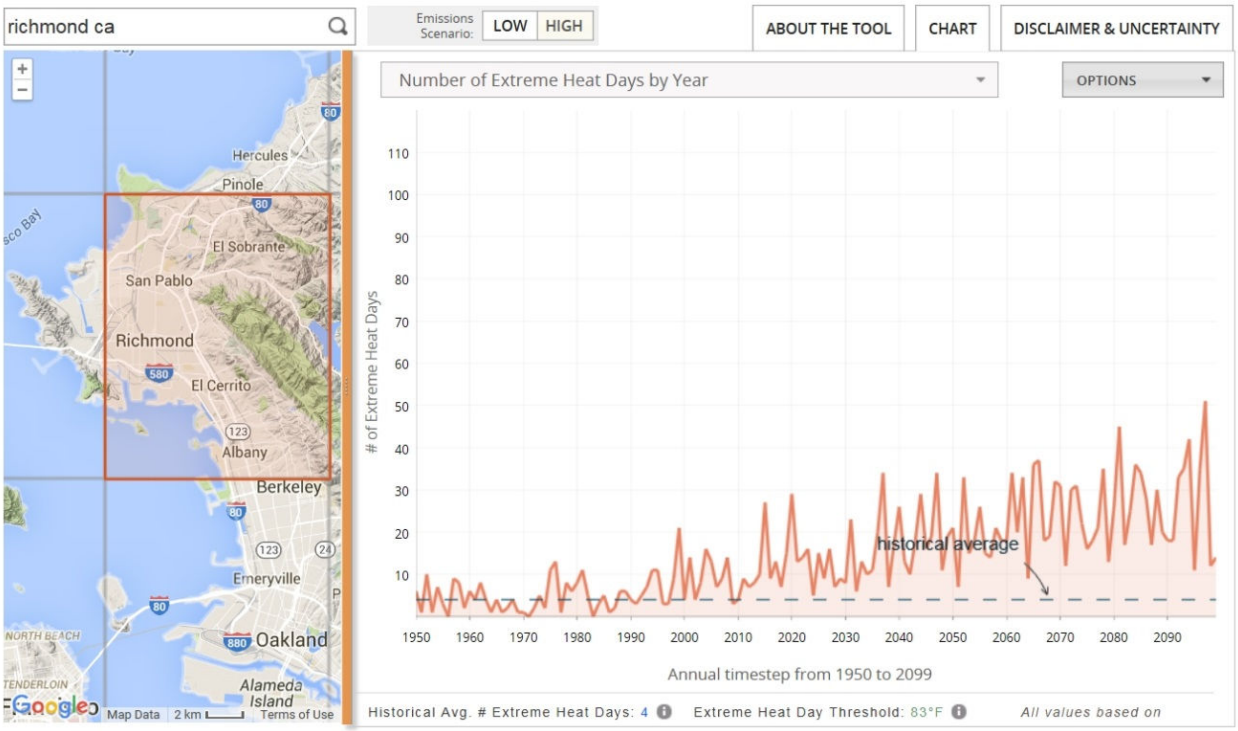
Figure 4.1: Projected Change in Annual Average Temperature for A2 and B1 Scenarios



SOURCE: Cal-adapt.org (9/28/2015)

Figure 4.2 shows the expected increase in extreme heat days, defined in the Cal-Adapt tool as a day in April through October where the maximum temperature exceeds the 98th historical percentile of maximum temperatures based on daily temperature data between 1961-1990.

Figure 4.2: Number of Extreme Heat Days per Year – low emissions (B1) scenario



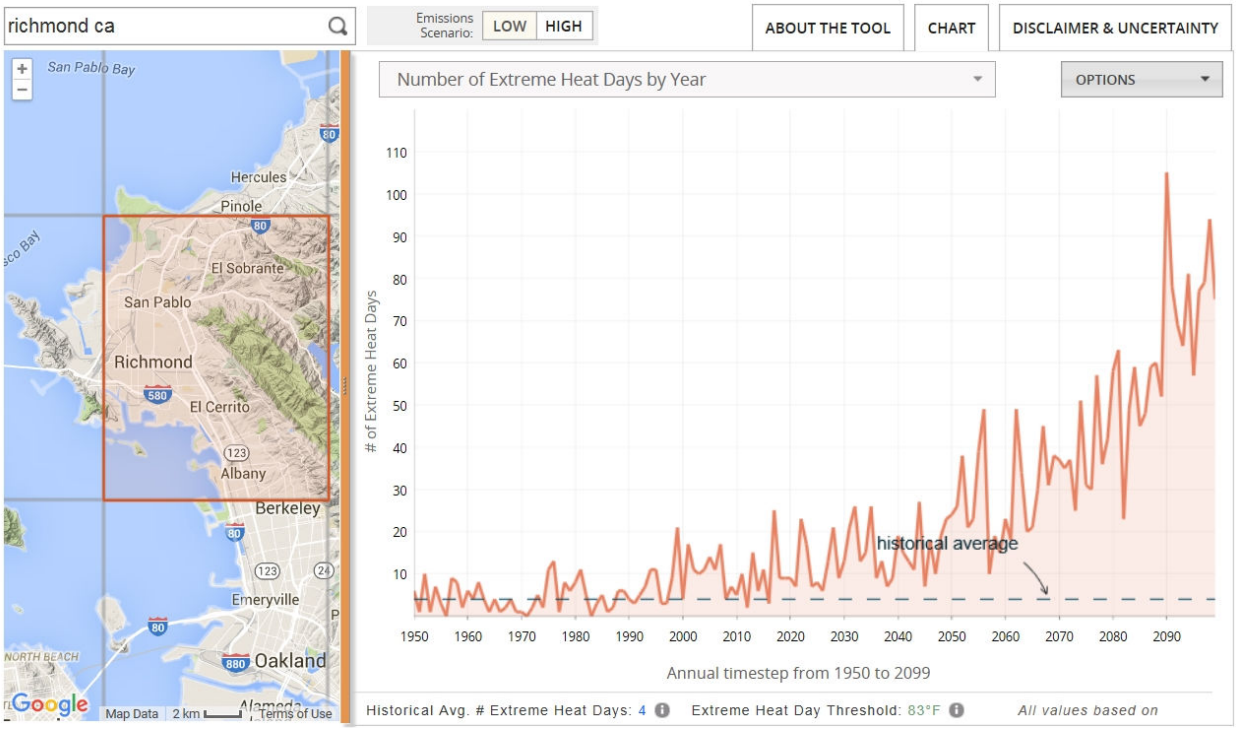
SOURCE: Cal-adapt.org (09/28/2015)

By the year 2100, Richmond is expected to experience approximately 25 to 30 extreme heat days per year under the low emissions (B1) scenario, compared to a historical average of about 4; under the high emissions scenario (A2), the expected number of extreme heat days triples to approximately 75, as shown in Figure 4.3.

Because of the increase in average temperature, the number of extreme heat days, and the number of warm nights, heat-related illness and mortality are expected to increase. For example during the 2006 heat wave, the County saw a significant increase in the number of heat-related emergency department visits in both coastal and inland areas, particularly in inland climate zone (Richmond is in the coastal area).[23] Though extreme heat events in coastal areas like Richmond are not expected to be as severe or as long-lasting as further inland, the resident population is not as well prepared or equipped to deal with higher temperatures. Air conditioning is far less common, for example.

Higher temperatures and drier summer conditions produce higher levels of ozone which could lead to declines in air quality and negative impacts to respiratory and cardiovascular health. During the 2006 summer heat wave, Contra Costa County exceeded the state standard for ozone six times during a fourteen day period.[24]

Figure 4.3: Number of Extreme Heat Days per Year – high emissions (A2) scenario



SOURCE: Cal-adapt.org (09/28/2015)

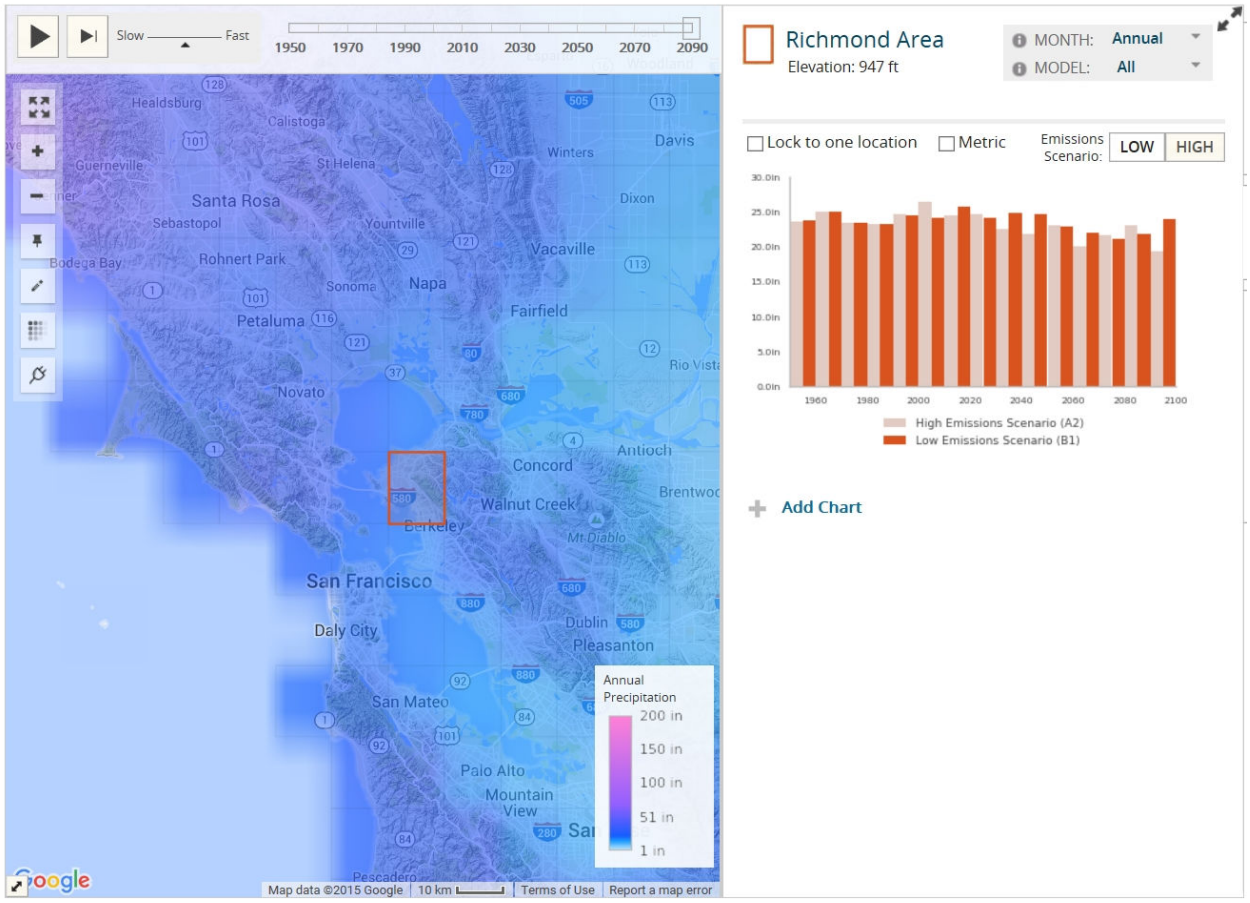
4.2 Precipitation

Local precipitation exposures encompass changes in annual averages as well as peak events during extreme storms. Since the City already has an arid climate, it is sensitive to a decrease in annual local precipitation, which can cause local drought, impacting local flora and contributing to wildfire risk (for regional drought and impacts to water supply, see Section 0 below; for wildfire risk see Section 4.4 below). An increase in local precipitation during extreme storms can increase the peak storm runoff, thereby increasing the risk of flooding due to the overtopping of stormwater channels, pipes, pumps, and creeks.

Figure 4.4 shows that the average annual precipitation in the City of Richmond, when averaged across global climate models and decades, is expected to decrease slightly by 2100 under both emissions scenarios. Individual GCMs predict larger changes, with some GCMs predicting decreased annual precipitation and other GCMs predicting increased annual precipitation. These opposing directions of change result in the relatively small net change when averaging all GCMs. This range in GCM predictions is representative of the current uncertainty as to the potential effects of climate change on precipitation.

Extreme storms include periods of intense rainfall that can overwhelm the City's storm drain and creek flood management systems, causing flooding. The current stormwater drainage system is designed for extreme precipitation based on historic climate data. Based on the GCM that projects generally wetter conditions for the Bay area, there some chance that the precipitation from individual storms could increase by approximately 10%. Selecting the wetter GCM and the higher end of the precipitation distribution is more conservative and thus more risk averse.

Figure 4.4: Decadal Average Precipitation to 2100 for A2 and B1 scenarios



SOURCE: Cal-adapt.org (11/26/2014)

Along the Bay shore, higher average sea levels will elevate Bay water levels, which can impede the drainage of precipitation via the creeks. This exposure will be felt most prominently where storm drains are located at low elevations. Since this exposure is caused by sea level rise, it is addressed in Section 4.5 below.

4.3 Drought

As outlined in the Bay Area IRWMP, regional changes in precipitation and temperature patterns present a long-term risk to the region's water supply. Expected changes in precipitation and temperature patterns present a long-term risk to the City's water supply. Climate models predict reductions in the average annual Sierra snowpack with a shift in snowmelt runoff to earlier in the year, changes in the timing, intensity and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow.

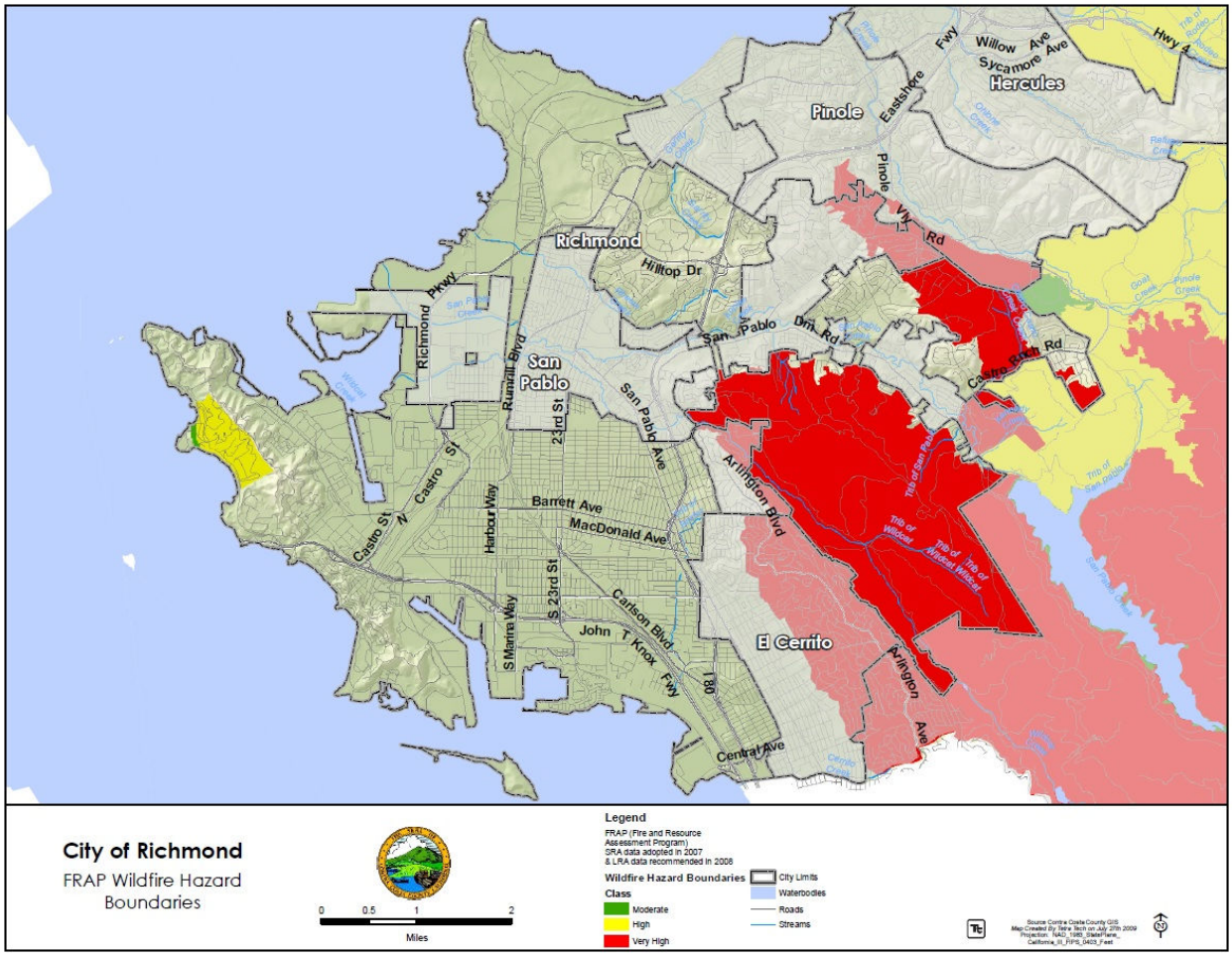
Long-term changes in watershed vegetation and increased incidence of wildfires could affect water quality in local reservoirs. Higher temperatures would also increase evaporation which in turn would increase irrigation demand. More frequent or more intense droughts could also stress local flora and fauna.

4.4 Wildfire

Wildfire frequency and intensity are expected to increase throughout California due to warmer temperatures, longer dry seasons and decreased plant moisture. This is especially true in forested areas along the coast and the Sierra Nevada. More fires will increase public safety risks, damage property, stress local fire suppression capabilities and drive up emergency response costs to the local government. Wildfires also impact watersheds, water quality, and wildlife habitat.

Figure 4.5, taken from the City of Richmond Annex to the Contra Costa County Hazardous Mitigation Plan Update[25] (May 2011), identifies areas of highest wildfire hazard occurring in the vicinity of Wildcat Canyon Regional Park and in the El Sobrante Hills neighborhoods along Castro Ranch Road. The City can expect these areas to become even more prone to wildfire hazard as the local climate changes, along with increased risk to other areas, such as the area around Point Molate highlighted in yellow at the western edge of the City.

Figure 4.5: Wildfire Hazard Areas in the City of Richmond



4.5 Sea Level Rise

The City's primary exposure to sea level rise is property and infrastructure located in areas along the Bay shore prone to inundation and coastal flooding, and associated higher risk of liquefaction during seismic events. Sea level rise may also entail several secondary exposures. For instance, the higher Bay water levels may expose portions of the shoreline to additional erosion potential. These newly exposed portions may not have suitable bank protection to resist erosion. In addition, increased Bay water levels will alter the groundwater gradients along the shoreline, possibly worsening flooding in areas with shallow groundwater or causing landward salinity intrusion. This change will most directly impact shallow aquifers, which are not currently used for water supply. However, shallow aquifers do interact with some City assets, including the City's stormwater collection system.

As discussed in *Section 3.2 – Bay Area Region Climate Change Projections*, the 2012 NRC report projects 11 inches of sea level rise (measured at Mean Higher High Water, or MHHW) in the Bay by 2050 (with a range of 5 to 24 inches) and 36 inches by 2100 (with a range of 17 to 66 inches). In addition to sea level rise, water levels are determined by local conditions ranging from tidal events (e.g., King Tides), storm surges, waves, and precipitation combined with high tides. These factors, many of them expected to be exacerbated by climate change, contribute to coastal flood hazards.

To depict the range of possibilities represented by these multiple factors, the Contra Costa County ART Project mapped a range of possible scenarios associated with extreme tide levels and sea level rise (SLR), representing combinations of 0 to 66 inches of SLR with tidal variations ranging from the 1-year extreme (King Tide) to the 100-year extreme tide. The mapping uses water levels from a regional San Francisco Bay hydrodynamic modeling study recently conducted by the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA).[26]

By mapping Bay water elevations higher than 66 inches above MHHW, the Contra Costa County ART Project inundation maps illustrate the short-term flooding that could occur when extreme tides are coupled with SLR. A single map is used to visualize both a permanent inundation scenario likely to occur before 2100 and a temporary flood conditions from specific combinations of SLR and extreme tides. For example, 77 inches above MHHW is similar to a 36-inch SLR plus 100-year extreme tide, or a 48-inch SLR plus 50-year extreme tide. One must keep in mind, however, that inundation maps used to approximate the extent of temporary flooding associated with an extreme tide do not illustrate the duration of flooding or the potential mechanism(s) for draining floodwaters once the extreme tide recedes.

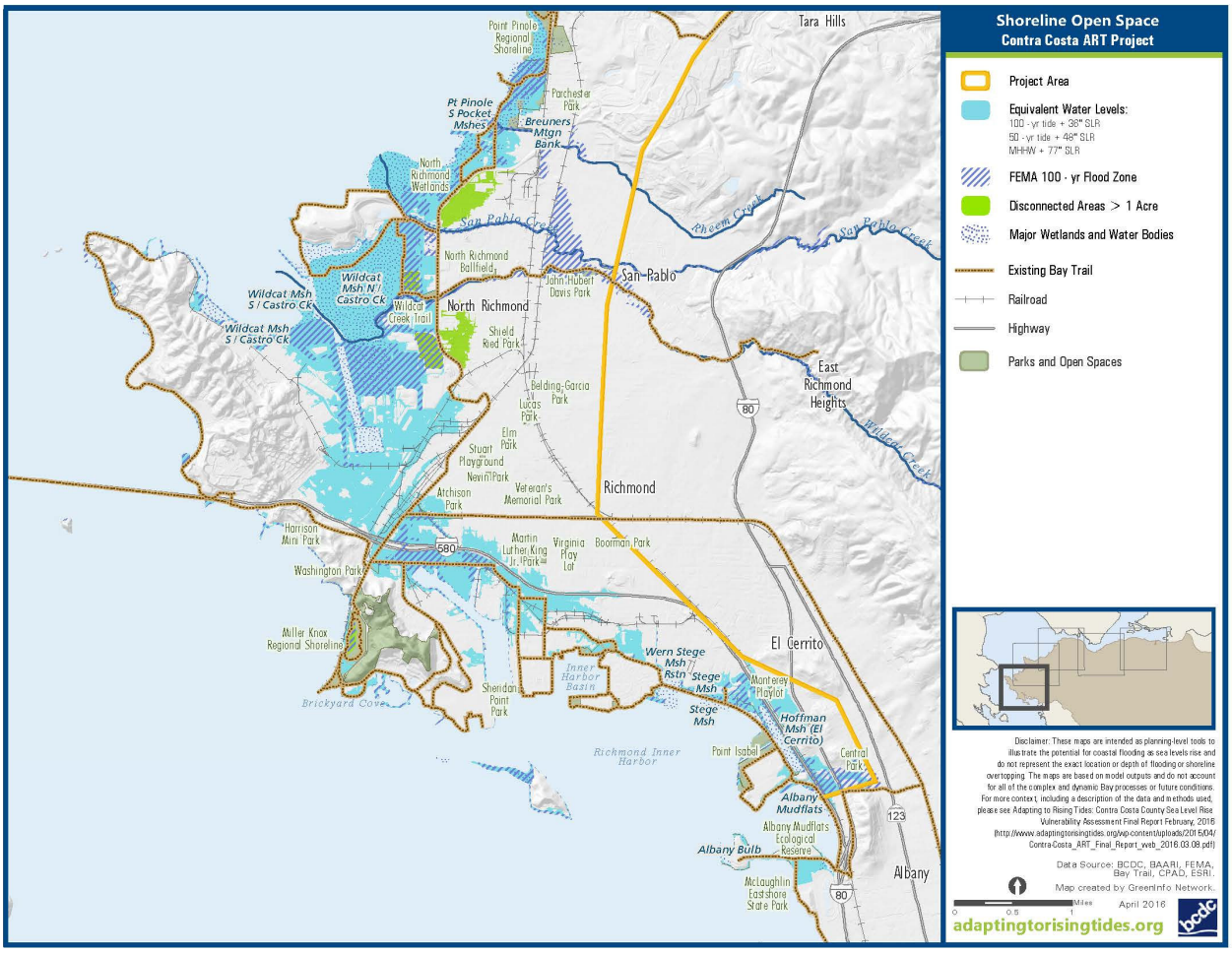
Figure 4.6 provides an example inundation map from Contra Costa County ART Project, with light blue shading depicting where Richmond's shoreline area could potentially be inundated by a 100-year coastal flood augmented by three feet of SLR, or by 48-inch SLR plus 50-year extreme tide (with both events being equivalent to SLR of 77 inches above MHHW). The ART project maps also show the FEMA 100 year flood zone under current conditions.

In addition to the Contra Costa County ART Project, several coastal flood hazard assessments and management efforts are underway or planned for the City's shoreline, including:

- Development of a perched lagoon design for the Miller Knox Regional Shoreline that would connect to San Francisco Bay with a tidal channel across a new sandy beach. This shoreline enhancement project would improve open and wetland habitats, water quality, and the public access experience for park users. The lagoon would be dynamic linked to the Bay, yet provide accommodation for sea level rise and habitat transgression.

- To facilitate re-development, Richmond Bay Specific Plan includes a sea level rise vulnerability assessment. This assessment will inform and guide the location and design of projects along this stretch of the City's shoreline.

Figure 4.6: Potential Inundation from Sea Level Rise along Richmond Shoreline



5. Vulnerability and Risk Assessment Framework

This section is organized around twelve functional categories of community assets, systems and services that are vulnerable to climate change, which include City-owned or operated facilities deemed critical for operations, utility services, and risk management, and other assets that are important to community health, safety, and well-being:

1. Community Services and Public Facilities
2. Public Health
3. Housing and Schools
4. Water Supply
5. Wastewater Management
6. Stormwater Management
7. Transportation Infrastructure
8. Flood Management
9. Energy Infrastructure
10. Solid Waste/Hazardous Materials Management
11. Parks, Natural Areas, and Ecosystems
12. Commercial and Industrial Assets

5.1 Vulnerability

Vulnerability is the degree to which facilities, systems, and services are susceptible to the climate change exposure (changes in sea level rise, temperature, and precipitation). Climate *risk* is commonly described as the *likelihood* and *consequence* of a climate variable's impact on a vulnerable asset. Risk ratings consider the certainty of the science associated with each climate variable as well as consequence of failure concerning the asset. Due to the inherent uncertainty of the timing and severity of climate change impacts it is often difficult to assess the likelihood of a particular asset being affected within a certain timeframe, so in many cases the evaluation of consequence is the most important component in assessing risk.

In evaluating vulnerability, both the exposure to climate change impacts and the sensitivity to those exposures are considered in determining potential consequences. To help asset managers and decision-makers understand the defining characteristics of a vulnerability issue, the ART planning process assesses vulnerability using the following five categories:

Information identifies challenges in obtaining the information necessary to sufficiently understand climate change vulnerability and risk. Information gaps not only represent barriers to fully understanding the issues, but can themselves be causes of vulnerability and risk. Easy access to relevant, up-to-date, and appropriate information bolsters managers' capacity to successfully address the issues identified in a vulnerability assessment. Types of information challenges can include a) lack of information, b) unavailable information, and c) poorly coordinated information sources.

Physical and functional qualities identify the existing conditions or design and functional aspects of an asset that make it acutely sensitive or severely limit its adaptive capacity to climate change impacts. For example, physical factors affected by sea level rise or flooding could include elevation of an asset (e.g., at or below grade), an asset's sensitivity to water or salinity, or its sensitivity to erosion (e.g., beaches,

marshes, mudflats and levees). Assets may have functional vulnerabilities if they cannot tolerate even short disruptions (e.g., a city's emergency response capabilities could suffer if flooding isolated a fire station). Others may be vulnerable due to a lack of redundancy. The Port of Richmond has a fundamental, system-wide lack of redundancy or alternative for serving a comparable local function. An asset may also be vulnerable if it is dependent on other, vulnerable assets or systems. And a fixed, linear system such as the Union Pacific rail line used for cargo and passenger transportation is especially sensitive to impacts because it relies on fixed, linear infrastructure. Depending on the location, damage at a single point along one rail line can potentially disrupt service throughout the rail network until the damage is repaired.

Governance identifies challenges with management, regulatory authority, or funding options for adapting to impacts. Questions to ask in assessing governance vulnerability may include: a) Who owns or manages the asset(s) in question? b) Are permits are needed to maintain, repair or improve the asset? c) Which agencies are involved? d) What funding sources are available to assess hazard risk or vulnerability or to improve asset resilience?

Management control describes the challenging management characteristics of an asset. For example, the management or regulatory structure of some assets may result in the need for a long lead-time to develop and implement adaptation responses. This classification can also help agencies pinpoint challenges and opportunities within and outside their organizations for addressing certain vulnerabilities and risks. Questions regarding management control factors can include:

- Does an adequate response require a multi-agency effort?
- Is the current management approach adequate to address new challenges represented by climate change?
- Is the existing management authority or regulatory scheme adequate to address the issues?
- Are financing or funding resources adequate to support anticipated management challenges?

The timing of vulnerabilities is potentially relevant to prioritizing issues and deciding how to sequence and coordinate adaptation strategies. Many issues require significant lead time for planning and taking action that can reduce vulnerability.

5.2 Consequences

The ART planning process evaluates the following consequences due to climate change exposures and vulnerabilities, considering the scale (e.g., geographic extent) of the climate impact, which could range from very localized (e.g., inundation of a segment of the Bay Trail) to regional (e.g., disruptions to goods movement).

Economy identifies consequences on important drivers of economic health in the region and the City. These include impacts to goods movement, commuting, employment centers, and business sectors.

Environment - Ecosystem Services identifies consequences on the services provided by the environment, including biodiversity, flood and erosion control, water quality improvement and carbon sequestration. For example, loss of a wetland that acts as a buffer between the Bay and inland areas could diminish the protection that it provides against flooding and erosion in adjacent neighborhoods. These consequences may also result from secondary effects due to impacts on other asset types (e.g., a wastewater treatment system), which in turn harm the capacity of a natural shoreline to provide ecosystem services.

People (Society and Equity) identifies the consequences of an issue affecting how and where people live, work, recreate, and access key services such as emergency shelters, health care, food, water, and power. Special consideration given to population characteristics, particularly impacts on young children, the elderly, people with special mobility or medical needs, people without automobiles, renters, people without insurance, the linguistically isolated, people at or below poverty level and caretakers of young children, the elderly and animals are especially vulnerable to flooding and storm events. Evaluation of consequences considers:

- Health and safety: Damage and disruptions to emergency response centers such as fire and police stations, emergency shelters, and health-care facilities could prevent effective response and recovery from sea level rise and storm event impacts.
- People where they live: This includes damage to homes and entire neighborhoods as well as disruptions to key services that residential areas rely on, such as utilities.
- People's livelihoods: Impacts on employment centers as well as employees' access to jobs via roads, the Bay Trail, and transit were identified.
- Socially vulnerable populations: The Contra Costa County ART Project assessment identified populations such as renters, non-English speakers, persons with health or physical mobility constraints, and others who face greater barriers to planning for and responding to impacts.
- People where they recreate: The assessment identified consequences to public spaces, such as parks and the Bay Trail, that provide highly valued recreation opportunities.

5.3 Risk Assessment

In general, highly vulnerable assets with severe consequences due to failure or disruption represent the highest risk, and the risk increases with time along with the expected increase in severity of climate change impacts. Some helpful questions used in assessing risk include the following:

- What is the age, condition, or useful remaining life of the asset?
- What is the ability of the asset or system to adjust or respond favorably to climate change exposures, or to cope with consequences? What tools, plans, and/or resources are currently in place to facilitate adaptation? (i.e., adaptive capacity)
- If impacted, could the asset be repaired or would it require complete replacement?
- What would it cost to repair or replace the asset?
- Would asset failure or incapacity disrupt a critical service? If so, how long could the disruption last? Is there a redundant systems or service that is less vulnerable?
- What are the economic, health, and/or safety costs associated with a disruption in service?

6. Asset Profiles: Vulnerability, Risk, and Response Actions

The following sections provide Risk Profiles for the twelve City of Richmond functional asset categories described in the previous section, identifying specific assets at risk as well as general services or capabilities at risk, based on exposures and potential impacts from climate change. It is important to point out the inter-related nature of these functional categories with respect to climate change vulnerability. Due to cascading impacts, it is not always obvious where true vulnerabilities lie. For example, the loss of power during a storm could impact the ability of the local wastewater treatment plant to adequately treat inflowing sewage, while stormwater overflow that is directed to the plant could exceed the plant's treatment capacity. The combination of these factors leads to a much bigger emergency than does each factor in isolation. Thus, it is important for the City's planners and managers to consider inter-related systems when assessing vulnerability.

Each of the following Risk Profiles incorporates available information from the Contra Costa County ART Project, including draft Profile sheets that have been developed for several of the region's assets and asset categories that are relevant to this study. Profile sheets are referenced in each section as appropriate, and presented in alphabetical order in Appendix D to this document.

6.1 Emergency Response Services and Public Facilities

Contra Costa County ART References: Public Services Chapter

This category of assets includes emergency services and facilities, community gathering places, and public buildings that provide critical support for the community in times of emergencies and natural disasters. In addition to hospitals and other medical facilities (covered under Public Health and Safety), these assets include the City's emergency operations centers, cooling centers, police and fire stations, and emergency shelters.

In Richmond, rising sea levels and coastal storms will impact the shoreline more frequently with higher storm surges, more extensive inland flooding, and increased erosion. Extreme heat events can strain the ability of current services and facilities to accommodate the needs of vulnerable populations. If more frequent or severe natural disasters occur, existing emergency response and communications services may not be adequate to deal with the consequences. Extreme storms and extreme heat combined with drought may also strain emergency response systems.

The City's most vulnerable populations (elderly, low-income and health-compromised residents) face higher risk than the general population from climate change emergencies including flooding and extreme heat events. The map in Figure 6.1 shows the disadvantaged communities designated by California Environmental Protection Agency (CalEPA) as representing the 25 percent highest scoring census tracts according to CalEnviroScreen 2.0.[27] These areas are disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure or environmental degradation. They tend to be areas with concentrations of people that are of low income, high unemployment, low levels of home ownership, high rent burden, sensitive populations, or low levels of educational attainment. The City has an important role, in partnership with public agencies and community-based organizations, to educate and engage the public on climate change issues, and to promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations.

Emergency Shelters

The Richmond Fire Department Office of Emergency Services (OES) leads the city in comprehensive emergency management including planning and preparedness for, response and recovery from, and mitigation of natural or manmade disasters. Several community shelters are available in the City, as shown on Figure 6.2. Many of these are located in schools or other public buildings that act as temporary shelters if residents are displaced by an earthquake, flood or other disasters, while some can function as a base of operations for relief efforts. If residents are required to shelter in place then utility services and supplies, including clean water and food, will likely be needed as well as access to and from the facility so that employees can get to the facility to work.

Emergency Response Facilities

Fire stations and law enforcement facilities in Richmond are vulnerable to flooding in instances where buildings have at-grade openings and were not built to withstand flooding. In addition, emergency response services rely on roads that could be flooded and power supplies that could be disrupted. Ensuring that emergency and disaster response services are not interrupted will require actions to improve the individual facilities and coordination with city, county and state transportation agencies to ensure road access and utility services are maintained.

Figure 6.1: Disadvantaged Communities in Richmond

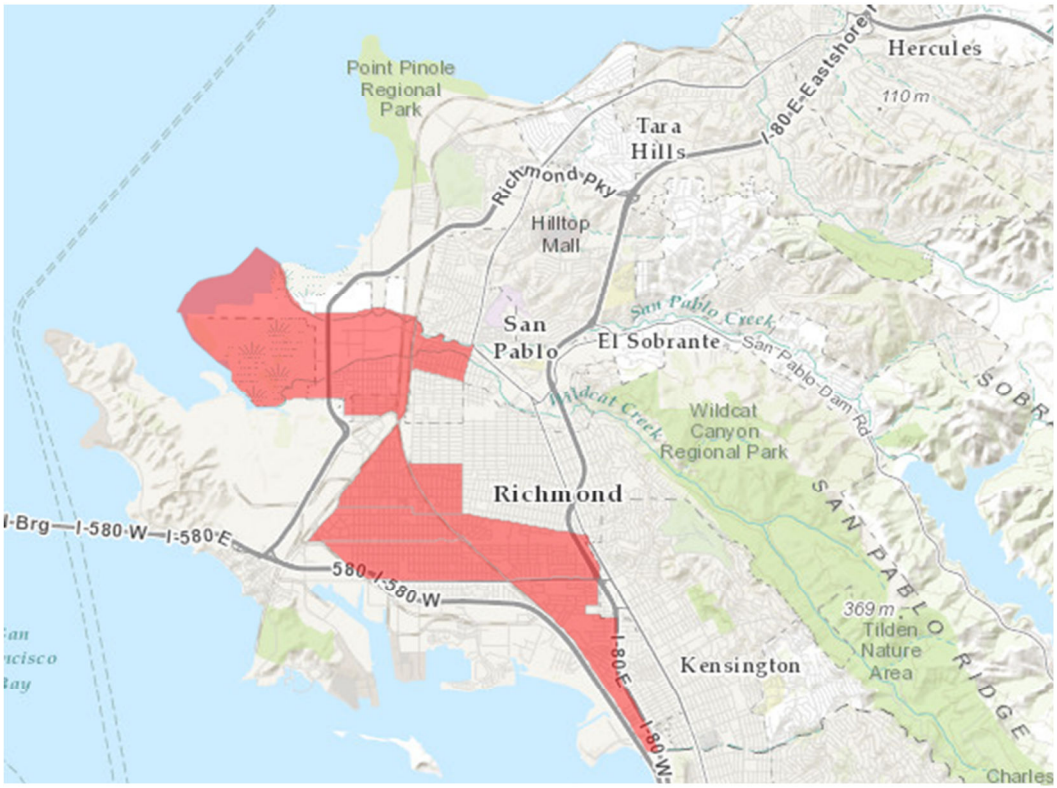
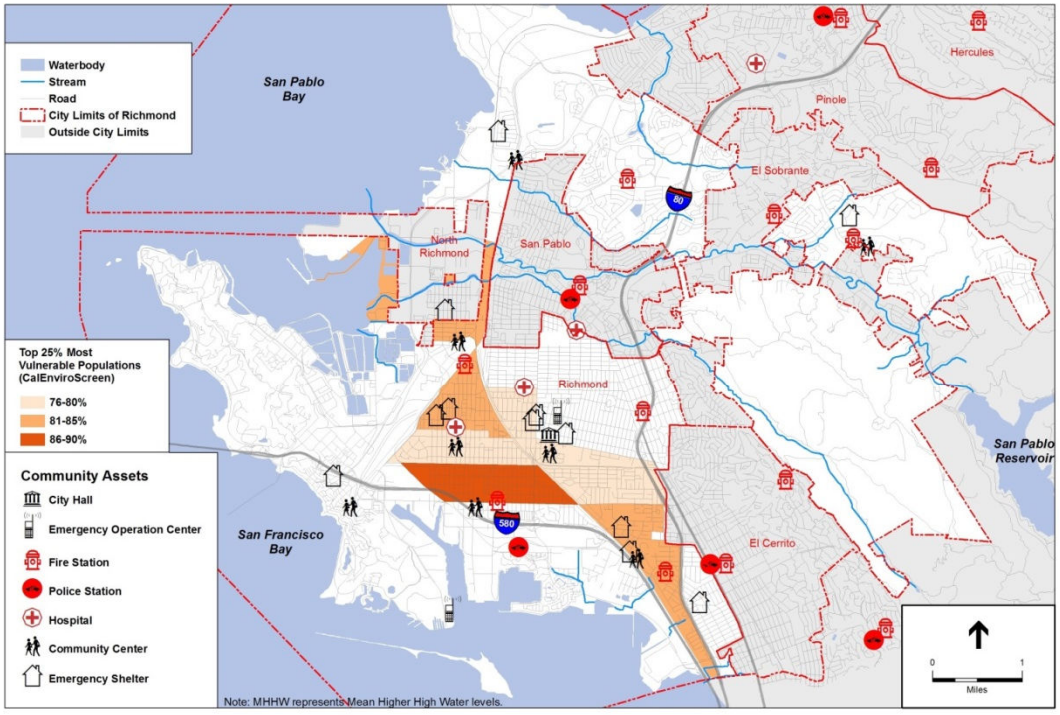


Image Source: California Environmental Protection Agency http://www.calepa.ca.gov/EnvJustice/GHGInvest/

Figure 6.2: Community Assets and Vulnerable Populations



SOURCE: U.S. Census Bureau, 2015; CCC, 2004, 2011, 2012; City of Richmond, 2014, 2015; AECOM, BCDC, 2015; CalEnviroScreen Version 2.0

Project 150097.00

Table 6.1: Vulnerability and Risk Profile for Community Services and Public Facilities

Exposures and Sensitivities

Exposure	Potential Impacts and Sensitivities
Temperature	• Longer periods of higher temperatures will increase extreme heat days increasing strain on key public assets and emergency response facilities.
Precipitation	• Extreme storms and fluvial flooding can interrupt power supply and impact critical facilities, including key access roads for emergency responders • Many construction materials used in buildings are water and heat sensitive
Drought	• Dry conditions increase the risk of wildfire and increase stress on water supply, which can in turn hinder fire suppression capability
Wildfire	• Excessively dry periods increase the risk of wildfires at the urban-wild interface along the eastern portion of the City, endangering response facilities and communication towers
Sea Level Rise	• Increased frequency and depth of coastal flooding will cause more frequent damage to facilities in flood prone-areas and more frequent disruptions of power, access to goods, services, and jobs, and will stain regional and local resources for disaster response and recovery. • As Bay water levels rise, storm events may flood larger areas for longer periods of time due to reduced drainage to the Bay, causing more extensive damage due to the duration of the flooding, cause longer disruptions to power, access to goods, services, and jobs, and the need for additional disaster response and recovery resources. • As Bay water levels rise there is the potential that shoreline protection, such as levees, berms and revetments, will be damaged or fail to due to increased tidal and wave energy. Shoreline protection may be overtopped during storm events when there are extreme tides levels and wind-driven waves, flooding inland areas, including public facilities and community services that are currently protected. • As the Bay rises it is predicted that groundwater will also rise, increasing the risk of liquefaction during seismic events. • Flooding of low-lying roads, highways, and airport could hinder or prevent access by emergency vehicles. • Flooding of operation and control centers could disrupt critical communications, emergency response and recovery, and utility operations.

Vulnerabilities

Category	Vulnerability
Information	• Information on location of residents with specific needs is not tracked and available to first responders during flooding or extreme weather events
Physical	• Emergency response facilities may include essential mechanical and electrical equipment below-grade or on the ground floor. If the facilities are flooded, this equipment may be disrupted or damaged leading to emergency response delays and costly repairs. Many emergency response facilities are highly susceptible to damage from sea level and groundwater rise because of their construction methods such as at-grade entrances and roll-up doors. When flooding damages these structures, the release of hazardous materials including paints, cleaners, oils, batteries, fuel, and medical waste can occur. • Most buildings, including public facilities, are vulnerable because they are not designed to withstand flooding and may have equipment or habitable space at- or below-grade. • Communication towers in the East Bay hills face significant risk from wildfire by 2100.
Functional	• Emergency response facilities cannot maintain operations if connections to power, clean water, and telecommunications are disrupted or if the road network that provides access between the facilities and the areas served are damaged. • Many of the schools in the study area are already overcrowded. If one or more school is damaged, or is closed to provide disaster response, finding adequate alternative classrooms for the displaced student would be difficult.

Table 6.1: Vulnerability and Risk Profile for Community Services and Public Facilities

Vulnerabilities (cont.)	
Category	**Vulnerability**
Governance & Management	• Current Local Hazard Management Plan does not take future flood risk into account. • Planning and resources are inadequate to address contingencies and secondary impacts associated with widespread or long-lasting sea level rise or storm event impacts, especially if emergency response facilities are affected. • Emergency response agencies rely on emergency plans, which do not take future flood risk into account. Not all agencies and communities are in compliance with existing plans, and poor coordination among local, regional, and state authorities increases the vulnerability of emergency response services and the people who rely on them.
Consequences	
Category	**Consequence**
Economy	• By protecting the local community, law enforcement and fire protection facilities provide value to the local economy. If emergency response is delayed or impaired due to flooding recovery costs could rise and local communities and the region could suffer long term economic consequences. • Decreased economic activity due to flooding, high heat, or storms as people stay indoors and avoid travel. • Damage to public facilities and City-owned assets affects municipal budget and could result in local tax increases or future loss of services that support local economy.
Public Health	• Disruption to communication systems could disrupt ability of residents to get adequate emergency health care
People	• Sea level rise and coastal flooding could disproportionally affect vulnerable populations in the vicinity of North Richmond along Wildcat and San Pablo Creeks. • The neighborhood Fire stations and law enforcement facilities respond to disasters and smaller emergencies in the community, benefitting residents and those who work in the area. Relying on emergency responders from elsewhere in the county may lead to delays in response time and dangers to public health and safety.
Environment	• Emergency response facilities and personnel play a critical role in hazardous materials spills and emergencies, including oil spills and other environmental contamination events. Richmond includes many major industrial sites with the potential for harmful chemical releases to occur if there is a widespread flood event, and emergency responders provide a critical function in helping protect environmental and human health during these events. In addition, if flooding damages police, sheriff or fire stations there could be a release of hazardous materials including paints, cleaners, oils, batteries, fuel, and medical waste. Healthcare facilities often store materials such as medical waste, pharmaceuticals, cleaners, and toxics that can impair water quality if released into the Bay or near-shore habitats.

Priority Actions

Awareness and Education

- PublicServices-1. Make sea level rise maps and other climate change hazards information available in public forums including the City web site and the City's public libraries.

Mitigation and Risk Reduction

- PublicServices-2. Construct new public buildings and emergency response facilities at elevations that would not be exceeded by flood waters.

- PublicServices-3. Assess communication towers in the East Bay hills for their vulnerability to wildfire including their criticality in the overall system, the consequences of failure. Emergency preparedness plans should be updated accordingly.
- PublicServices-4. Develop and adopt plans for future relocation of people, uses, and services that are at risk of becoming isolated where sole or limited access ways cannot be improved or protected, and where no other alternative means of access is feasible.
- PublicServices-5. Provide incentives or require that public structures vulnerable to sea level rise be retrofitted using waterproof shutters, shields or doors and salt-resistant materials to reduce flood damage, with a particular focus on retrofitting critical community facilities.

Preparedness

- PublicServices-6. Update Local Hazard Mitigation Plan (LHMP) to incorporate sea level rise, flood risk, extreme heat events and other climate change hazards.
- PublicServices-7. Facilitate coordination between emergency service providers, utilities and transportation agencies to develop contingency plans for maintaining operations when roads are damaged or impassable due to flooding, if power is lost for long periods of time, or if telecommunication services are interrupted.
- PublicServices-8. Identify or develop a network of emergency shelters and cooling centers to be used by each City neighborhood in times of flooding, extreme heat events, and other climate-related emergencies.
- PublicServices-9. Work with neighborhood council groups to develop emergency response plans that include strategies to address flooding, extreme heat, and other climate-related events; consider ramifications of access routes and transportation modes being disrupted.
- PublicServices-10. Survey all public-serving facilities and infrastructure in Richmond and determine whether emergency response systems are in place.
- PublicServices-11. As City owned or operated emergency response facilities and infrastructure are upgraded or constructed, require that improvements mitigate anticipated climate change impacts.
- PublicServices-12. Provide expanded Community Emergency Response Team (CERT) trainings, refresher classes, and annual exercises that include future flood events.

6.2 Public Health

Contra Costa County ART References: Public Services Chapter

Climate change is expected to impact many facets of public health. Extreme heat, poor air quality, sea level rise, and regional drought may negatively affect human health, health behaviors, and the socio-economic factors that influence health outcomes. For example, extreme heat may cause premature death, cardiovascular stress and failure, heat-related illness such as heat struck, heat exhaustion, and kidney stones. Air pollution can cause increased asthma, allergies, chronic obstructive pulmonary disease, and other cardiovascular and respiratory diseases. All impacts can lead to mental and health disorders such as depression, anxiety, Post-traumatic Stress Disorder, substance abuse, and other conditions. This functional asset category covers the health-related impacts of climate change, with a special focus on the City's populations who are most vulnerable to those impacts.

Figures 6.1 and 6.2 show the communities in Richmond designated as disadvantaged the CalEnviroScreen 2.0 tool. CalEnviroScreen uses a science-based method for evaluating multiple pollution sources in a community while accounting for a community's vulnerability to pollution's adverse effects. It uses a set of 21 indicators to identify communities most burdened by pollution from multiple sources and most vulnerable to its effects, taking into account their socioeconomic characteristics and underlying health status. These same communities are typically those most sensitive to climate change exposure, including extreme heat events, enduring heat waves, sea level rise, extreme storms, diminished air quality, and new disease vectors.

The City's most vulnerable populations (elderly, low-income and health-compromised residents) face significant risk from extreme heat events. These populations will also face higher risk of health problems from worsening air quality and new disease vectors. The City has an important role, in partnership with public agencies and community-based organizations, to educate and engage the public on climate change issues, and to promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations.

Climate change will act as a stress multiplier for many existing health problems that already disproportionally impact low-income and communities of color in Richmond, and is also expected to impact socio-economic conditions that can make it harder to access basic services such as health care, food, and housing.

Decisions about public health interventions unrelated to climate change, such as diabetes management, heart prevention, or hospital surge capacity, may have a significant influence on the health consequences of climate change. Improved surveillance systems, buildings and infrastructure, disaster preparedness programs can all be considered steps to reduce the health risks from climate exposures. And because the public health system is highly managed and already provides a robust structure for managing public health emergencies, it is likely to be more adaptable in the face of climate change.

Despite these facts, economic resources, public institutions, infrastructure, human capital, equity, and technology will all influence the adaptive capacity of the people of Richmond. Equity in particular will be a challenge for the City, determining how adaptable Richmond is to the potential public health consequences of climate change. Adaptive capacity increases with greater access to resources and health services and better socio-economic characteristics, such as educational attainment and work status. Continued work to reduce existing inequities, health or otherwise, may be the most important element of adaptive capacity for the City.

Public Healthcare Facilities

Healthcare facilities need to ensure continuity and quality of care for community members, and rely on outside infrastructure, staff, and services to function. West Contra Costa Healthcare District serves the western portion of Contra Costa County, including Richmond. The West Contra Costa County Healthcare District operated Doctors Medical Center, a public hospital in San Pablo, until April 2015 when it closed due to lack of funds. The closure has reduced inpatient capacity in West Contra Costa by 79%, as the Kaiser Permanente Medical Center in Richmond is now the sole provider of hospital services.

Individuals with ongoing medical needs are more likely to be vulnerable in a disaster event, and may require specialized care, equipment or supplies. A major concern in Richmond is that community members may be unable to access health care if their neighborhoods are cut off from the rest of the county, in particular in parts of the City with limited public health care facilities options. In addition, flooding of local roads or neighborhoods, loss of power, or disruption of water or wastewater services could impact health centers and public health clinics ability to provide services. In addition, flooding of streets and roads could disrupt the ability of the mobile clinics to provide services, especially if they cannot get to locations where patients are able to access them.

Table 6.2: Vulnerability and Risk Profile for Public Health

Exposures and Sensitivities – Public Health	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• More frequent and severe heat waves lead to death and illness. • Higher temperatures exacerbate existing air quality issues. • Energy disruptions result in power outages, increasing backup generator use, roadway congestion, and air pollution. • Contributes to increased wildfire risk which increases concentrations of air pollution, worsens air quality, and exacerbates respiratory conditions.
Precipitation	• Extreme storms could cause flooding that may cause population displacement, loss of home and livelihood, death from drowning and injuries. More frequent or more powerful storms disproportionally impact public safety of vulnerable populations, especially those in low-lying areas. • Extreme storms challenge emergency response actions, overburden stormwater management systems, and increase risk of vector-borne disease. • Extreme weather events can affect mental health by increasing levels of anxiety and post-traumatic stress disorder.
Drought	• Less local rainfall and diminished Sierra snowpack jeopardizes reliability and quality of potable water supply. • Hotter drier weather can cause agricultural crop yields to diminish and higher food prices which can increase food insecurity, malnutrition, and obesity. • Contributes to increased wildfire risk which increases concentrations of air pollution, worsens air quality, and exacerbates respiratory conditions.
Wildfire	• Increases concentrations of air pollution, worsens air quality, and exacerbates respiratory conditions. • Risk of fatalities and injuries to those living adjacent to East Bay Regional Parks and to firefighters and first responders dealing with a fire.

Table 6.2: Vulnerability and Risk Profile for Public Health

Exposures and Sensitivities – Public Health (cont.)	
Exposure	**Potential Impacts and Sensitivities**
Sea Level Rise	• More frequent and deeper flooding threatens safety and health of residents living in low-lying areas, causing injury and loss of life, population displacement, loss of home and livelihood. • Inundated or saturated areas are potentially at higher risk of liquefaction during earthquakes • Flooding can lead to increased levels of anxiety and post-traumatic stress disorder • Displacement of economic activity could result in job or wage loss leading to lower incomes and more unemployed people, key predictors of health outcomes.
Vulnerabilities – Public Health	
Category	**Vulnerability**
Information	• Information on individual-level vulnerability and risk is not known or tracked by the City or CCHS, making people who live alone particularly vulnerable to climate change. • Many subpopulations and individuals most at risk to climate change lack appropriate information about the health effects of climate change, particularly heat and air quality issues. • Poor coordination and lack of information sources about climate change can cause confusion and miscommunication amongst Richmond residents. Providing linguistically- and culturally-appropriate approaches that are effective for diverse populations is essential.
Physical	• Vulnerable populations will be disproportionately impacted by climate change exposures. • Vulnerability factors include race and ethnicity, education level, social class, immigration status, income level, occupation (particularly individuals who work outside, such as construction workers), age, individuals with medical conditions, people living in neighborhoods with high levels of impervious surfaces and low tree cover, living in housing units that lack air conditioning, and households without access to a vehicle, among other factors. • Most buildings, including hospitals and medical facilities, are vulnerable because they are not designed to withstand flooding and may have equipment or habitable space at- or below-grade.
Functional	• Climate change will act as a stress multiplier for many existing health problems and social inequities which already disproportionally impact low-income and communities of color. • Climate change is expected to impact socio-economic conditions and access to basic goods and services, such as health care, food, and housing, exacerbating existing cumulative stresses. • Healthcare facilities serve community members with limited mobility, or who have medical needs and require special equipment. Emergency evacuation of these facilities is challenging and will require sufficiently trained staff, a high level of coordination, specialized equipment, and an appropriate location to shelter those that were housed in these facilities. • Healthcare facility programs that serve individuals with limited economic resources, education, or English proficiency, may not be easily replaced if the facility is damaged or is inoperable or inaccessible during a flood. • Healthcare facilities rely on outside infrastructure and services to function, such as roads, electricity, clean water, telecommunications, and deliveries of specialized supplies. • Some healthcare facilities provide highly specialized medical care, such as dialysis centers, that patients need to access on a regular basis. These facilities serve a critical function that cannot easily be replaced, and generally do not have temporary or mobile back-up facilities available. • Durable medical providers serve community members that have specific medical needs, and can serve individuals that are homebound and rely on a consistent delivery of medical supplies, e.g. oxygen tanks. These service providers can only operate if roadways are functioning and patients' homes are accessible.

Table 6.2: Vulnerability and Risk Profile for Public Health

Vulnerabilities – Public Health (cont.)	
Category	**Vulnerability**
Governance & Management	• Numerous public agencies and non-profit organizations, e.g. Kaiser Permanente, are involved in preparedness and response efforts, and a management approach already exists for public health emergencies. • Many public health exposures are already being felt, such as extreme heat events. Other climate change exposures, e.g. sea level rise, will have a longer time scale. • The CCHS provides health services and surveillance in Richmond. • The City's HiAP Strategy provides a framework and actionable steps to reduce existing health inequities. • Healthcare facilities with out-of-date or inadequate emergency preparedness and response plans, or that do not implement plan action items, are more vulnerable to storm event and earthquake hazards.
Consequences – Public Health	
Category	**Consequence**
Economy	• Increase in the number of work and school days lost. Lost work days reduce overall economic productivity. • Richmond families may spend a higher proportion of their household budget on health care costs, reducing the amount of other goods and services. • Damage to healthcare facilities can result in financial burdens for building owners and operators, as well as staff that may end up out of work. Specialized medical equipment and the facilities that house them can be extremely costly and difficult to replace if damaged. Additionally, disruption or loss of healthcare services can result in community members needing alternative care arrangements or additional time off of work. This can lead to lost wages, and may require family members or other caregivers also taking time off of work.
Public Health	• Richmond residents and workers are likely to experience numerous health impacts, including higher mortality rates, more hospitalizations and emergency department visits, increased respiratory illnesses, cardiovascular diseases, and mental health issues. • Impacts on mental and emotional wellbeing from environmental degradation, forced migration, and damage to homes, property, and businesses.
People	• The City's most vulnerable residents are at risk of health emergencies or longer-term adverse health effects, increasing existing health inequities. • Healthcare facilities serve community members who rely on these services for care and quality of life. Disruption of facilities can result in significant hardships for these community members and their families, who may not have access to alternative care that is equivalent, affordable, and in an easily accessible location. Damage to neighborhoods where staff and clients live may also result in access issues and disconnection from healthcare services, and senior and healthcare facilities may not be able to function.
Environment	• N/A

Priority Actions

Climate change is a serious health issue that will affect all Richmond residents in various ways. The City of Richmond needs to develop priority actions to support individuals, community groups and other agencies to prepare for climate change and strengthen resiliency in communities across the city. The following general response actions are recommended to minimize public health risk from climate change impacts:

Raise Local Awareness

- PublicHealth-1. Engage with community organizers, businesses, and residents throughout the City to bridge community capacity building with government decision-making to ensure broad participation in local actions and benefits are accrued by all individuals in Richmond.
- PublicHealth-2. Engage the public and promote community involvement in actions to reduce climate change risks, using linguistically and culturally appropriate approaches that are effective for diverse populations.
- PublicHealth-3. Partner with West Contra Costa School District to integrate climate-related education into school curricula and after school learning programs; engage students in identifying opportunities for school resiliency improvements and provide peer-to-peer education.
- PublicHealth-4. Promote youth engagement, and integrate climate change considerations into the school curriculum, so that students, teachers and school administrators can all play a role in raising awareness about climate change impacts.
- PublicHealth-5. Make sea level rise maps and other climate change hazards information available in public forums including the City web site and the City's public libraries.

Mitigation and Risk Reduction

- PublicHealth-6. Prioritize City adaptive actions that address the root causes of existing inequities.
- PublicHealth-7. Prioritize the health and well-being of the City's most vulnerable populations (elderly, low-income, and health-compromised residents) who face significant risk from extreme heat events by 2100.
- PublicHealth-8. Provide a key opportunity to enrich Richmond youth in energy, and environmental science and policy, and will make our future generations more climate conscious citizens.
- PublicHealth-9. Formalize a policy or set of funding criteria that prioritize the use of resources for the most highly-impacted populations, using data-driven tools such as CalEnviroscreen to identify neighborhood-level vulnerability.
- PublicHealth-10. Reduce urban heat islands through strategies such as revegetation, urban greening, tree planting and maintenance, and green infrastructure. Incorporate street tree or tree canopy standards into future Specific Plans and the zoning code.
- PublicHealth-11. Engage with and seek support from Association of Bay Area Government's (ABAG) community resilience programs; in particular their multiple hazard risk assessment and study of housing and community resilience in the face of natural disasters.
- PublicHealth-12. Promote local agriculture and food systems to increase access to healthy, fresh foods and improve nutritional quality, reduce upstream energy use, and increase local social cohesion.
- PublicHealth-13. Create an urban heat island reduction program that evaluates risk/vulnerability, identifies specific interventions (e.g. tree planting, revegetation, cool roofs, etc.), and establishing funding for urban heat reduction programs.
- PublicHealth-14. Develop a Safe Home program that provides in home assessments for low-income families with children to identify and reduce asthma triggers and other home health hazards.

Preparedness

- PublicHealth-15. Partner with University of California at Berkeley School of Public Health or CCHS to forecast climate impacts and assess public health vulnerabilities
- PublicHealth-16. Establish and strengthen partnerships with CCHS, health care providers (hospitals, emergency care centers, and homeless service providers and shelters), and community-based organizations to communicate and reach population groups to which the City does not already have affective access to but that might be vulnerable to climate change impacts, including extreme heat days and high ozone and high particulate matter days.
- PublicHealth-17. Identify or develop a network of emergency shelters and cooling centers to be used by each City neighborhood in times of flooding and other climate-related emergencies, and develop a warning response plan during heat events.
- PublicHealth-18. Work with Richmond Emergency Services to strengthen emergency management capacity and responses to heat, floods, landslides and other emergencies, particularly in vulnerable neighborhoods, in culturally-appropriate ways.
- PublicHealth-19. Continually communicate with CCHS, the Department of Public Health and other local and County agencies to understand change in vector populations and mitigation strategies.
- PublicHealth-20. Build new community gardens, edible landscapes on City-owned parcels.

Resources

The following resources are available for public health planning and developing public health programs related to climate change:

- CalEnviroScreen helps identify California communities that are disproportionately burdened by multiple sources of pollution.
- Cal-BRACE (Building Resilience Against Climate Effects): The goals of the CalBRACE project are to enhance the California Department of Public Health's (CDPH) capability to plan for and reduce health risks associated with climate change. The program provides resources and technical assistance for the state and local public health departments to build climate adaptation capacity and enhance resilience at the local and regional levels. CalBRACE is funded by the Center for Disease Control (CDC) and joins 15 other states and 2 cities across the United States that are also conducting climate adaptation planning efforts from a public health perspective through the CDC Climate Ready States and Cities Initiative.
- Partner with the Bay Area's Climate Readiness Institute to stay up to date on climate-related health issues and related planning, and to bring health messages into the mainstream of climate change communications and extreme heat event response strategies
- CDC's Assessing Health Vulnerability to Climate Change: A Guide for Health Departments
- CA Climate Change Portal: Public Health and Climate Change Adaptation
- The CEC publication *Mapping Climate Change Exposures, Vulnerabilities, and Adaptation To Public Health Risks In The San Francisco Bay and Fresno Regions* provides an overall assessment of climate change adaptive capacity of the San Francisco Bay Area. Maps in the report demonstrate that different parts of the region have higher vulnerability for different components of vulnerability. Consistent with Richmond's CalEnviroScreen scores, the most vulnerable areas for air pollution exposures are on the most heavily trafficked highway corridors

surrounding the most populated areas of the San Francisco Bay Area, such as Highway101 along the Peninsula connecting San Jose and San Francisco.

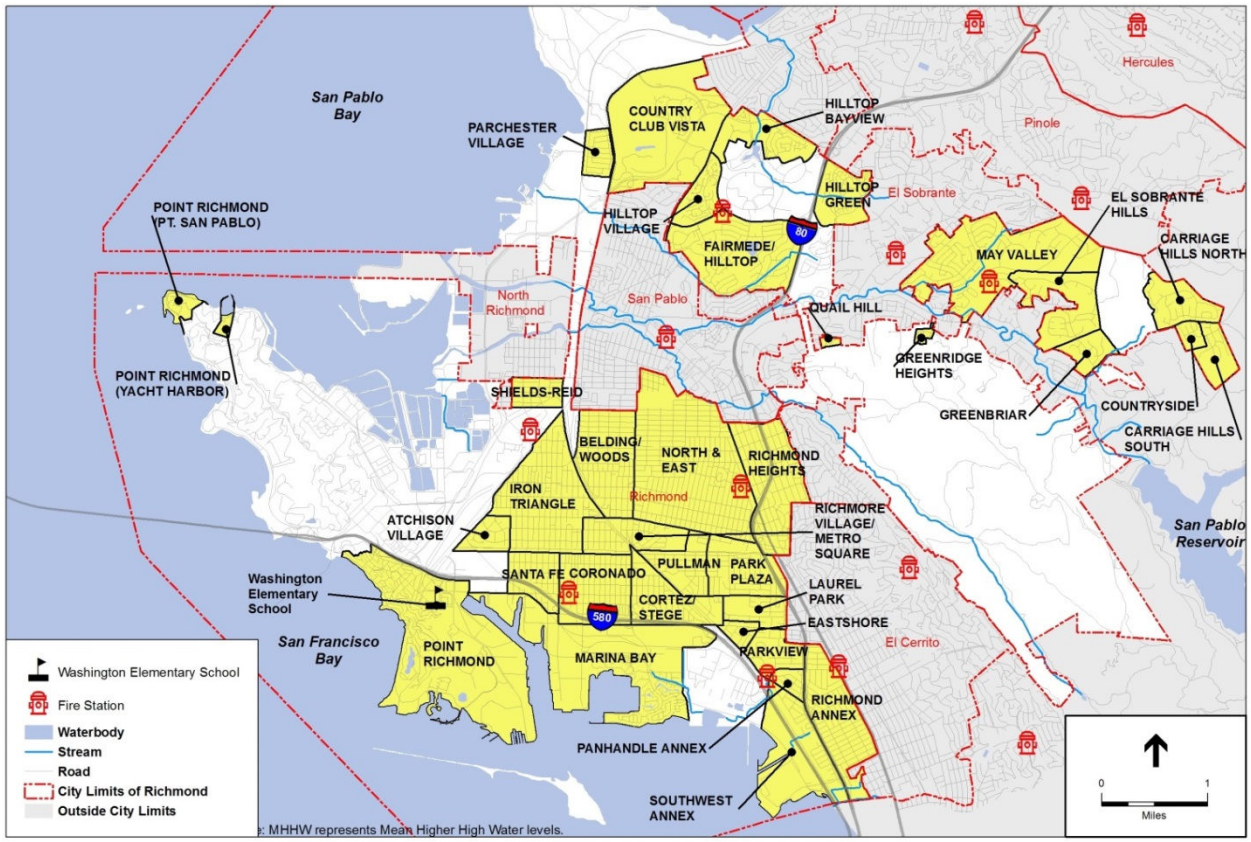
- *The Climate Change Vulnerability in Contra Costa County: A Focus on Heat* health and climate study report describes the vulnerability of different communities in Contra Costa County to the health impacts of climate change, with a focus on extreme heat events. The first part of the report describes the various health impacts of climate change that are expected to occur in Contra Costa County. The second part of the report focuses on extreme heat, which is the factor that will likely have largest impact on county residents. A series of maps help identify areas of the county that are more vulnerable to heat waves by showing differences in the social, health, economic and environmental characteristics between communities. To view the maps please visit here.
- The *Social Vulnerability to Climate Change in California* study looks specifically at factors that influence an individual's vulnerability to climate change.
- *Centers for Disease Control and Prevention Climate Effects on Health* Provides basic information and infographic of health impacts.
- *Climate Change, Health, and Equity: Opportunities for Action (March 2015):* Climate change and health inequities report includes a conceptual framework to help understand how these issues are linked, and to identify opportunities and recommendations for action.
- *The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap (May 2009):* This report helps to document the Climate Gap, connecting the dots between research on heat waves, air quality, and other challenges associated with climate change. But we do more than point out an urgent problem; we also explore how we might best combine efforts to both solve climate change and close the Climate Gap — including an appendix focused on California's global warming policy and a special accompanying analysis of the federal-level American Clean Energy Security Act.
- *Why We Need Climate, Health, and Equity in All Policies (2014):*Discusses climate change and health equity from a root cause framework

6.3 Housing and Schools

Contra Costa County ART References: Housing Chapter, Public Services Chapter, Parchester Village Profile Sheet

This category of assets includes single family homes, multifamily housing, and K-12 schools. Figure 6.3 provides an orientation map of the City's neighborhoods. Figures 6.4 through 6.6 are inundation maps from the Contra Costa County ART Project's final assessment report[28] on sea level rise vulnerability, showing housing, schools, and public services (e.g., fire stations, police stations, health facilities, and wastewater treatment plants) potentially exposed to flooding with water levels of 77 inches above MHHW (similar to a 36-inch SLR plus 100-year extreme tide, or a 48-inch SLR plus 50-year extreme tide).

Figure 6.3: City of Richmond Neighborhoods



SOURCE: U.S. Census Bureau, 2015; CCC, 2004, 2011, 2012; AECOM, BCDC, 2015; City of Richmond, 2014, 2015

Project 150097.00

Figure 6.4: Housing, Schools and Public Services – Richmond Southeast

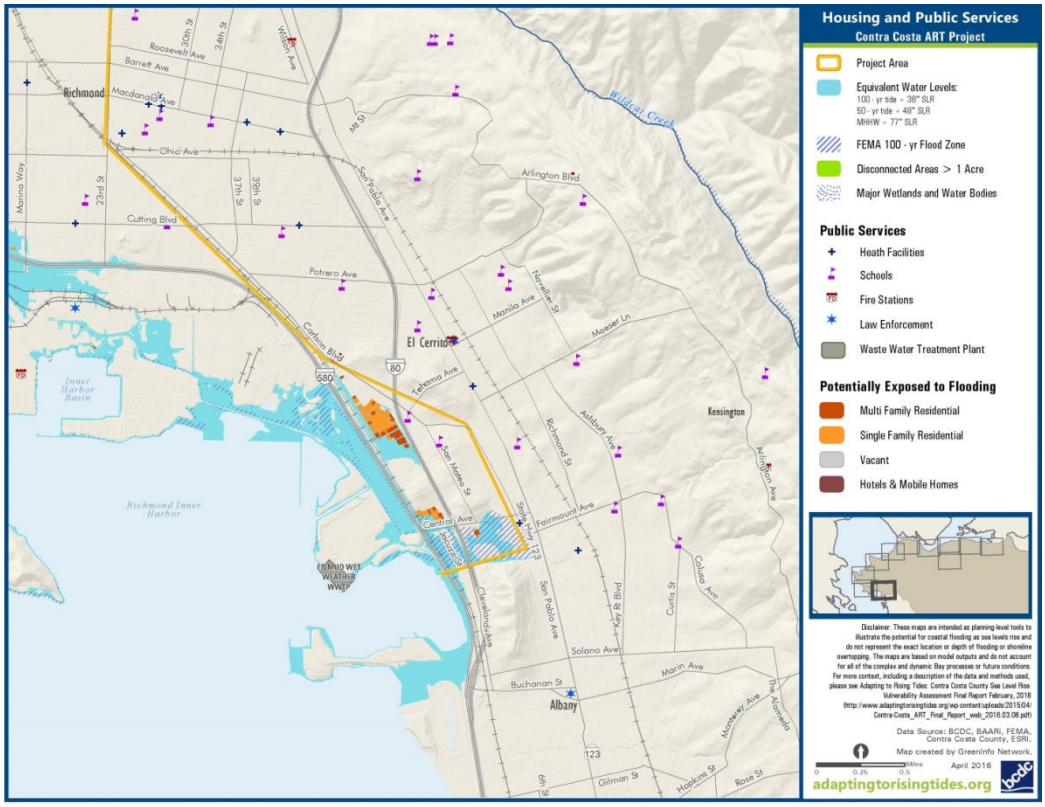


Figure 6.5: Housing, Schools and Public Services – Richmond Port and Harbor Areas

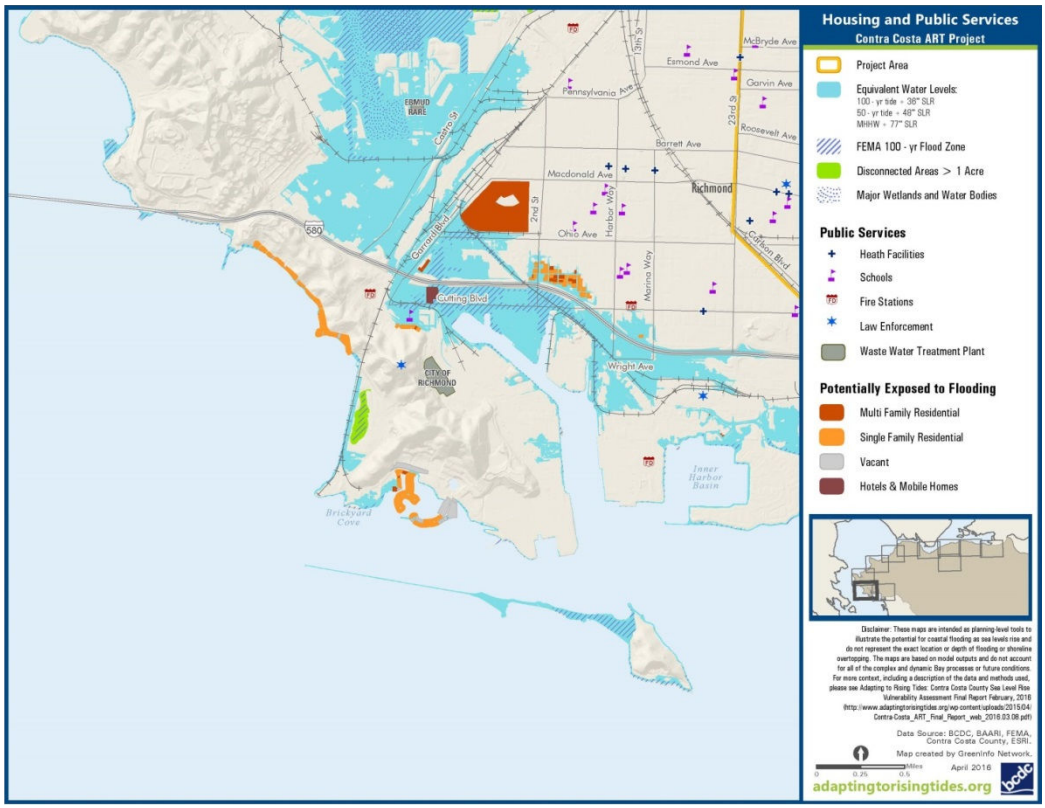
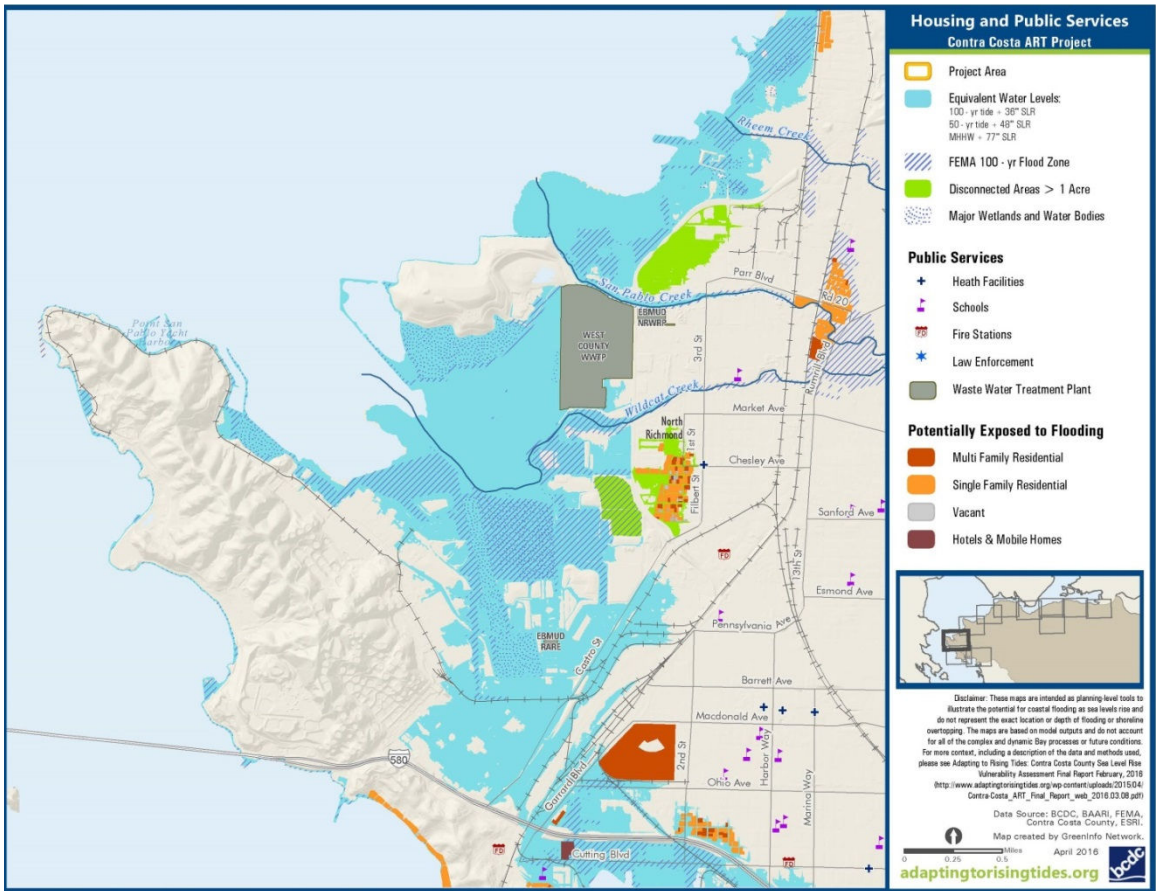


Figure 6.6: Housing, Schools and Public Services – Richmond Northwest



Single Family Homes

The Contra Costa County ART Project highlights the importance of safe and resilient housing In the Bay Area, as a crucial component to ensuring effective disaster recovery. In the face of disaster, limiting housing damage and keeping residents in their homes not only helps people who may lack the resources to effectively recover, but also keeps communities intact. Understanding where and what types of housing units are at risk from flooding helps prioritize efforts and lays the foundation for developing comprehensive, actionable strategies to reduce vulnerabilities and build more resilient communities. The Contra Costa County ART Project found that hundreds of single-family residential parcels are at risk from either current or future flooding that will be more frequent or extensive in the future due to sea level rise.

The Contra Costa County ART Project highlights three single-family neighborhoods in Richmond that could be directly flooded by sea level rise. This includes the portion of Santa Fe between Virginia and Florida Avenues, and 1st to 6th streets (see Figure 6.5). This neighborhood is not within the existing 100-year floodplain and single-family residences in this are at risk from 5 feet or more of sea level rise. Also at risk are the homes directly on the shoreline in the Brickyard Cover and Point Richmond neighborhoods, both of which are within the current 100-year floodplain. Many of the single-family homes in these neighborhoods may be elevated above the current 100-year base flood level, however as sea levels rise the amount of flood mitigation provided may not be adequate. Some parcels in Brickyard

Cove and Point Richmond are at risk from less than 3 feet of sea level rise, which is also the same water level that could occur during a 50-year return period coastal storm event.

Two neighborhoods in Richmond are not at direct risk of flooding as sea level rises but could be impacted by street or basement flooding if the stormwater system backs up due to insufficient capacity to store and convey flows during an storm events (see the City of Richmond Stormwater Profile Sheet). Homes in the southernmost and central part of Southwest Annex neighborhood (see Figure 6.4) are low-lying and at risk from nuisance flooding with 3 feet of sea level rise. This neighborhood sits between I-580 and I-80, and is protected from the Bay by I-580, the UP rail line, Point Isabel Regional Park, and the Hoffman Marsh wetlands associated with Baxter Creek. Homes in the northwest corner of Parchester Village at the corner of Banks Drive and Jenkins Way (uppermost portion of Figure 6.6) are low-lying and at risk of nuisance flooding from 5 feet of sea level rise. This neighborhood is protected from the Bay by the UP rail line and the Parchester Marsh.

Multi-Family Housing

The Contra Costa County ART Project also assesses the vulnerability of multi-family residential housing in Richmond, which is an important asset that provides an affordable housing alternative to single-family homes. This type of housing is particularly important for lower-income or medically dependent residents who may be unable to temporarily relocate after a flood event. Renters living in multi-family housing (e.g., apartments) have limited opportunity to improve the flood resilience of where they live, as funding for improvements typically requires cooperative decision making or dependence on homeowner or condominium associations.

Within the City of Richmond, the Southwest Annex and Atchison Village neighborhoods have multi-family units not directly at risk of sea level rise that could be impacted by street or basement flooding if the stormwater system backs up due to insufficient capacity to store and convey flows during an storm events (see Single-family section above for a discussion of the risks faced in this area). In the Southwest Annex neighborhood, duplex, fourplex, and smaller apartments (5-12 units), and 6 vacant parcels on Monterey Streets and Burlingame Avenue are low-lying and at risk of nuisance flooding from 6 feet of sea level rise. In the Atchinson Village Neighborhood (see Figure 6.5), apartments on Chanslor Circle, West Chanslor Avenue and West Bissell Avenue are low-lying and at risk of nuisance flooding from 6 feet of sea level rise. In addition, apartments on Chanslor Circle, in the southwestern portion of Atchinson Village are at direct risk of flooding with 4 feet of sea level rise.

In addition, some of the duplex, fourplex, and apartments in the Santa Fe Neighborhood are at direct risk of sea level rise and others could be impacted by nuisance flooding from 6 feet of sea level rise (see discussion in Single-family section above). Condominiums on South Garrard (approximately 8 units) and in Marina Bay (3 buildings) are at risk from 6 feet of sea level rise and one condominium, one duplex and two vacant parcels in Brickyard Cove are within the current 100-year floodplain and are at risk from 1 foot of sea level rise.

The Association of Bay Area Governments (ABAG) and BCDC recently completed a study, *Stronger Housing, Safer Communities* (2015) that looked at vulnerability and resilience of housing in the Bay Area to flooding from sea level rise, seismic shaking, and liquefaction. The project includes a focused Community Profile[29] for the Richmond Inner Harbor area, which includes all or part of eight neighborhoods: Atchison Village, Iron Triangle, Santa Fe, City Center, Coronado, Cortez, Marina Bay and Southwest Annex. It also includes all of the City's Richmond Bay Specific Plan area, the Ford Peninsula major activity center in Marina Bay, and two Districts, Regatta/Marina Bay and Southern Gateway (see

Figure 6.3 for the locations of these neighborhoods). Much of this area is within the current 100-year flood plain and is susceptible to future flooding as sea level rises. There are also pockets of Bay fill along the shoreline that are susceptible to liquefaction. Many residents in the profile area are very low income and are burdened by housing and transportation costs. Neighborhoods are ethnically diverse with many areas having a high percentage of non-English speaking households. Established residents in the profile area are likely limited in their ability or resources to invest in housing resilience, and are more likely to be displaced if their homes are damaged.

K-12 Schools

Schools are vulnerable to sea level rise and storm event impacts because of their physical construction and function. School buildings are not typical constructed to resist flooding, for example they have at-grade entrances and critical equipment either at or below grade that cannot get wet. In addition, because there are young children and possibly limited-mobility or special education students on campus schools are particularly difficult to evacuate in the event of an emergency. Even schools that are not directly impacted by flooding may be vulnerable to disruptions in transit, road networks, utilities or other services.

Washington Elementary School, located on Wine Street and West Cutting Boulevard in Richmond, is exposed to 4 feet or more of sea level rise and is within the current 500-year floodplain. In addition, access to the school could be disrupted as West Cutting Boulevard and adjacent streets are at risk of flooding with 4 feet of sea level rise. Although there may be alternative routes to get to and from the school they are unlikely to offer the same level of service.

Table 6.3: Vulnerability and Risk Profile for Housing and Schools

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• Longer periods of higher temperatures combined with dry conditions increase wildfire risk to homes and businesses in high risk fire zones • Extreme heat can damage asphalt (parking lots, driveways, private roads) and stress the capacity of building cooling systems
Precipitation	• Extreme storms can increase erosion and produce localized flooding • Many construction materials used in buildings are water sensitive
Drought	• Increased need for landscape irrigation; potential damage to urban trees
Wildfire	• Excessively dry periods increase the risk of wildfires at the urban-wild interface along the eastern portion of the City, endangering nearby homes and property
Sea Level Rise	• Increased frequency and depth of coastal flooding will cause more frequent damage to homes and schools in flood prone-areas and more frequent disruptions of power, access to goods, services, and jobs, and will stain regional and local resources for disaster response and recovery. • As Bay water levels rise, storm events may flood larger areas for longer periods of time due to reduced drainage to the Bay, causing more extensive damage due to the duration of the flooding, cause longer disruptions to power, access to goods, services, and jobs, and the need for additional disaster response and recovery resources. • As Bay water levels rise there is the potential that shoreline protection, such as levees, berms and revetments, will be damaged or fail to due to increased tidal and wave energy. Shoreline protection may be overtopped during storm events when there are extreme tides levels and wind-driven waves, flooding inland areas, including some residential areas that are currently protected.

Table 6.3: Vulnerability and Risk Profile for Housing and Schools

Exposures and Sensitivities (cont.)	
Exposure	**Potential Impacts and Sensitivities**
Sea Level Rise (cont.)	• As the Bay rises it is predicted that groundwater and salinity levels will also rise. This may cause damage to below grade living spaces, finished basements, and electrical/mechanical equipment. In addition, increasing groundwater levels can increase liquefaction susceptibility.
Vulnerabilities	
Category	**Vulnerability**
Information	• Decision makers and emergency responders have limited information about the specific characteristics or needs of individuals or households, or about the specific condition of the single or multi-family residences they live in. This makes preparing for and response to flooding more difficult.
Physical	• Most residential structures are vulnerable because they are not designed to withstand flooding, are not constructed from waterproof or non-corrodible materials, or were built to have only the first floor above the current 100-year flood elevation. • When flooding damages residences household materials, many which are considered hazardous (including paints, cleaners, oils, batteries, pesticides, asbestos, and medical waste) can be released, not only impacting nearby habitats but also causing contamination of homes and businesses exposed to the floodwaters. • Single and multi-family residences with mechanical or electrical equipment (heating, cooling, appliances, electrical panels, etc.), habitable spaces, or parking areas below-grade are vulnerable to both flooding and elevated groundwater. • Older residential housing with deferred maintenance such as older roofs, a lack of weatherization, or without flood mitigation to protect below-grade spaces (e.g. functioning sump pumps) will not be as able to withstand a major storm or flood event. • Schools have at-grade facilities that could be damaged in a flood event. In addition, the schools have varying levels of earthquake safety depending on their construction date and retrofit status.
Functional	• Neighborhoods with limited housing vacancy and a lack of affordable options are less resilient to flooding as temporarily or permanently relocating residents affected by flood events is challenging particularly for those residents that are already housing cost burdened. Displaced residents may not have access to equivalent or affordable replacement housing near the jobs, schools, services, and facilities they rely on. • Single and multi-family housing relies on infrastructure and services provided by public and private agencies to function, such as roads, electricity, food, water, wastewater, and telecommunications. If these services are damaged or disrupted residents may not be able to stay in their homes until repairs or upgrades are completed. • Housing owned or rented by people who are over 75, under 5, speak limited or no English, rent, rely on public transportation, are medically dependent or with limited mobility, are vulnerable because their occupants have characteristics that often make it harder for them to prepare, respond or recover from flood events. • Households with pets or that house animals are vulnerable because if there is an evacuation they will require temporary shelter or a permanent relocation site that can also house their animals. In past events, pet owners have been reluctant to evacuate if they were not able to bring their animals with them. • Multi-family residences are often rented, and renters often lack flood insurance, which could provide assistance with replacing damaged personal items or providing an alternative place to live if there was a flood event. In addition, flooding of multi-family housing with a large number of units could displace a sizable number of renters who would need to find alternative, affordable, housing.

Table 6.3: Vulnerability and Risk Profile for Housing and Schools

Vulnerabilities (cont.)	
Category	**Vulnerability**
Functional (cont.)	• Single and multi-family provide housing for community members who work, play, shop and live in neighborhoods. When this housing is damaged and people must relocate out of the neighborhood, businesses, schools and other neighborhood services that rely on employees and customers for their livelihood can be impacted. • Schools rely on roads, transit, electricity, water, wastewater, and communication services to function. Even short-term disruptions in these services could disrupt school activities and require school cancellations. • Schools need teachers and support staff to function. If school staff cannot access the school because of disruptions within or outside the study area, the school cannot operate as intended. • Schools serve children, and this function makes them both difficult to evacuate during disasters and important for a community's emergency response as many serve as temporary shelters post-disaster.
Governance & Management	• Single and multi-family landowners are unlikely to own or have control over the shoreline that protects their housing from flooding. In some cases this protection is either a road or railway embankment that provides ad-hoc flood protection. Ensuring current levels of flood protection is maintained, and enhanced as sea levels rises, will require cooperation and coordination between the community at risk and those that own and manage the shoreline. • Schools may be protected from flooding by shoreline features that are owned and managed by others, and may not be intended as structural shoreline protection. Improving the level of flood protection will therefore require coordination of both public and private schools and school districts with other agencies and entities. • Schools may not have sufficient staff or the capacity to manage an evacuation. Evacuating schools and childcare centers will require careful coordination so that there is adequate supervision of young people and safe locations identified where family members can be reunited. • Schools are funded and governed at the local level and may not have adequate resources to improve their buildings, change the access to the school, or plan for the future relocation that may be necessary as flood conditions worsen with sea level rise.
Consequences	
Category	**Consequence**
Economy	• Flooding can result in costly damage to homes and belongings, which can result in financial burdens for residents. Residents may bear additional costs due to the need for alternative housing as well as dislocation from jobs and services. The broader community of taxpayers and ratepayers may also bear some of the expense of rebuilding areas even if they do not themselves live in affected areas. Additionally, long-term evacuations could result in the permanent relocation of residents outside of the community, with associated economic consequences for the neighborhoods, residents and employers that remain. • If schools are damaged or access to them is disrupted there could be local economic impacts on families that have to either stay home with young children rather than going to work or find and pay for day care. If schools are closed for long enough periods some families may choose to move to other areas so children can attend a neighborhood school, which could impact local businesses and the economy.
People	• Disruption or damage to single-family housing can have significant consequences for residents and the community, particularly for cost-burdened individuals who may have difficulty finding affordable and appropriate alternative housing. Flooding and storm events can result in significant hardships, including loss of lives, personal items and financial information; dislocation from homes, jobs and schools; and disconnection from community

Table 6.3: Vulnerability and Risk Profile for Housing and Schools

Consequences (cont.)	
Category	**Consequence**
People (cont.)	services and ties. Flooding can also have consequences for public health, as floodwaters can leave mold, mud, waste, and other toxics behind in single-family residences; residents who are unable to move, temporarily relocate, or adequately repair their home after a flood are more vulnerable to these impacts. Relationships between residents are important for neighborhood function, and can be severed during disaster events. These connections are difficult to repair once disrupted, which can have negative impacts on community resilience. • Schools provide a critical community function and contribute to the overall well-being of the community. They also provide shelter during emergencies for students and community members. Damage to school buildings could result in education disruptions for students and financial burdens for school districts that could exacerbate already stressed schools and districts that face budget shortfalls and overcrowding. Schools that serve low-income, transit-dependent, or linguistically isolated students are even more vulnerable because of the populations they serve. Schools rely on communities for staff, access, funding, and, most importantly, students. If the neighborhoods where students and teachers live are damaged, schools will not be able to fully function.
Environment	• Floodwaters that pass through neighborhoods can pick up and carry household hazardous wastes and other debris that can impair water quality and habitats critical to biodiversity.

Priority Actions

Awareness and Education

- Housing/Schools-1. Make sea level rise maps and other climate change hazards information available in public forums including the City web site and the City's public libraries.
- Housing/Schools -2. Integrate climate-related education into school curricula and after school learning programs; engage students in identifying opportunities for school resiliency improvements and provide peer-to-peer education.

Mitigation and Risk Reduction

- Housing/Schools -3. Amend the City's Flood Damage Prevention Ordinance to meet current FEMA requirements for constructing in special flood hazard zones and areas vulnerable to sea level rise and liquefaction. These requirements may include policies related to flood-proofing of structures located adjacent to special Flood Hazard Zones.
- Housing/Schools -4. Develop guidelines for new development along the shoreline that consider climate change impacts to private property, schools, public infrastructure, water quality, ecological protection, public access, and recreation.
- Housing/Schools -5. Provide incentives or require that structures vulnerable to sea level rise be retrofitted using waterproof shutters, shields or doors and salt-resistant materials to reduce flood damage.
- Housing/Schools -6. Enhance minimum design requirements for new small-scale residential building foundations in liquefaction zones.
- Housing/Schools -7. Leverage existing weatherization and energy efficiency programs to improve building heating and cooling comfort for low-come and vulnerable populations.

- Housing/Schools -8. Increase efforts to reduce hazards for homes (and schools) in high wildfire hazard areas through improving engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on defensible space mitigation strategies. (Identified as a high priority initiative in the City's Local Hazard Mitigation Plan).
- Housing/Schools -9. Work with UC Berkeley, the Richmond Distressed Housing Rehabilitation Program, lenders, neighborhood groups, and other local partners to promote affordable, climate change-resistant, healthy, and energy-efficient housing and neighborhoods.
- Housing/Schools -10. Participate in and seek to qualify for the highest possible rating of the Community Rating System of the National Flood Insurance Program to reduce flood risks and private property insurance costs.

Preparedness

- Housing/Schools -11. Partner with one or more Richmond-based CBOs to pursue grant funding from Kresge Foundation for building the resilience of the City's vulnerable populations.
- Housing/Schools -12. Work with neighborhood council groups (especially Iron Triangle, Atchison Village, City Center, Santa Fe, Coronado, Cortez/Stege, Marina Bay, and Southwest Annex) to provide resources to residents on all climate-ready home programs, and provide a platform to get ongoing feedback on the function and accessibility of programs.
- Housing/Schools -13. Leverage Cap and Trade funds to support the development of climate resilient affordable housing.

6.4 Water Supply

Contra Costa County ART References: Water Management Chapter

This asset category includes the natural and manmade systems for supplying a clean, safe and reliable water supply for the City of Richmond, including potable water reservoirs, piping systems, pumping stations, turnouts, and water treatment infrastructure.

The City's current potable water supply is highly vulnerable to drought, but the risk of failure is uncertain. The City is dependent on the East Bay Municipal Utility District (EBMUD) for its long-term water supply. EBMUD's Urban Water Management Plan (UWMP) reports that more than 90 percent of the water delivered to EBMUD's customers originates from the Mokelumne River watershed, collects snowmelt and runoff from the Sierra Nevada Mountains, while approximately 10 percent originates as runoff from the protected watershed lands in the East Bay Area.[30] California's current drought, now in its fourth year, is putting added emphasis on long-term water security and forcing public agencies to redouble conservation efforts and expand contingency planning. Both EBMUD and the City of Richmond are increasing efforts to improve conservation, upgrade storage and delivery systems, and diversify local water supplies. EBMUD's 2010 UWMP includes a Water Shortage Contingency Plan[31] that acknowledges the increased uncertainty in EBMUD's water supply reliability due to climate change, the regulatory environment, and competition for water rights. In past dry periods (e.g., the 1976-77 drought) when runoff from the Mokelumne River Basin was insufficient to meet service area demands, EBMUD relied on stored water in its reservoirs to meet most of its customers' water needs. Mandated rationing in 1977 helped avoid depleting the system storage, and fortunately, Northern California experienced a very wet year in 1978, which contributed to the system's rapid recovery. If that drought had continued into a third dry year in 1978 and rationing had been lifted, EBMUD would not have had sufficient water to meet customer needs or its downstream obligations.

EBMUD delivers water to the East Bay through a large and complex conveyance system that includes aqueducts, reservoirs, water treatment plants, pumps, water mains and other infrastructure. Some of this infrastructure is at risk from climate change impact. None of EBMUD's reservoirs or treatment plants in Contra Costa County are at risk of flooding, however EBMUD relies on the Mokelumne Aqueducts that could be exposed to flooding as a result of Delta levee failure. The three aqueducts provide built-in redundancy but if all three failed, EBMUD would rely on water from a local terminal reservoir that could provide 4-6 months of service. EBMUD has documented reliability risks for all major infrastructures from various hazards, including flooding. Redundancies in the water system that address seismic hazard vulnerabilities could also help avoid service disruption during a flood event.

The greatest potential impact of sea level rise on local water service will occur in the Sacramento-San Joaquin Delta. Sea level rise will increase salinity in the Delta, impacting water quality. Additionally, increased liquefaction potential during seismic events, storm event flooding, and rising sea levels will increase the potential for failure of Delta levees. Failure of the levees could result in damage to the Mokelumne Aqueducts and disruption of water supply in particular to the Western Region. To ensure water supply reliability EBMUD has built redundancy into their distribution and treatment systems. However, as a growing City in the fastest growing county in the Bay Area, with an expected population growth rate of 27% between 2010 and 2040, Richmond will need to find new opportunities to improve water supply resilience to both accommodate growth and adapt to a changing climate.

Table 6.4: Vulnerability and Risk Profile for Water Supply

Exposures and Sensitivities

Exposure	Potential Impacts and Sensitivities
Temperature	• Regional water demand likely to spike due to irrigation demand and increased evaporation losses • Shorter season of winter storms and earlier Spring runoff will reduce Sierra snowpack and the natural storage reservoir the snowpack provides for the state. • Secondary impact of elevated fire risk may increase water demand for fire suppression
Precipitation	• Greater risk of fluvial flooding of critical drinking water facilities • Potential to interrupt power supply needed for water delivery
Drought	• Decrease in total precipitation, with decreased snowpack in Sierra, leading to Regional Water System (RWS) shortages • Longer periods of low flow condition can affect water quality • More vulnerability to extreme heat event • Regional water demand will generally increase due to irrigation demand and increased evaporation losses • More extraction of local groundwater could deplete supply and cause land subsidence
Wildfire	• Reservoir and water supply infrastructure at risk from wildfire; could disrupt supply and/or affect water quality • Water imported from Sierra Nevada Supplies is potentially vulnerable to water quality change from fire-induced erosion • Could disrupt infrastructure, or access to infrastructure through fire damage and fire-induced erosion
Sea Level Rise	• Increased frequency and depth of coastal flooding of critical drinking water facilities • Increased potential for fluvial flooding due to reduced drainage to the Bay • Potential for saline intrusion to contaminate deep aquifer that provides potential emergency potable water supply. • Increased inundation and rising groundwater may limit access to facilities and pipelines for maintenance and operations; Inability to access valves and access manholes • Buoyancy and corrosion of pipes

Vulnerabilities

Category	Vulnerability
Information	• None identified
Physical	• Above or below ground water supply pipelines and aqueducts that are located on predominantly low soil strength bay muds may be subject to higher groundwater as sea levels rise, increasing the risk of damage during a seismic event due to liquefaction. • Floodwaters as well as rising groundwater will increase the potential that pipelines become buoyant and float, making them susceptible to damage that will increase the need for maintenance, repair, and replacement. • As sea level rises, the Delta will get increasingly saline, which will impact the availability of fresh water supplies.
Functional	• EBMUD relies on chemicals for treatment, power to run the facilities, and road access to maintain their assets and ensure workers can reach the facilities. If flooding impacts power supplies or the roads and highway system that provide access to and from water supply facilities, the ability to provide continuous water service may be interrupted. • During extended drought EBMUD's regional water system may be inadequate to supply Richmond, and may suffer decline in quality
Governance & Management	• None identified

Table 6.4: Vulnerability and Risk Profile for Water Supply

Consequences	
Category	**Consequence**
Economy	• If water supply is disrupted or severely curtained, and emergency supplies are exhausted, economic disruption would be significant.
People	• Water is critical for emergency response, especially for hospitals, and fire protection, and is required for recovery after a disaster such as an earthquake or widespread flooding. Any unforeseen, long-term disruption of water would impact all customers, and in particular members of the community such as the elderly or young children who are particularly in need of safe drinking water.
Environment	• No direct environmental impacts are currently anticipated.

Priority Actions

Awareness and Education

- Water-1. Work with EBMUD to promote local water conservation programs and awareness of drought conditions as the "new normal" for California water users.

Mitigation and Risk Reduction

- Water-2. Work with EBMUD to improve effectiveness of water conservation programs, upgrade storage and delivery systems, and diversify local water supplies.

Preparedness

- Water-3. Explore the use of potential alternative water supplies, including recycled water and use of local groundwater sources.
- Water-4. Continue as an active participant in the ongoing development of the Bay Area Integrated Regional Water Management Plan (IRWMP) and other regional water planning efforts, to improve water supply resilience in the face of population growth and climate change.

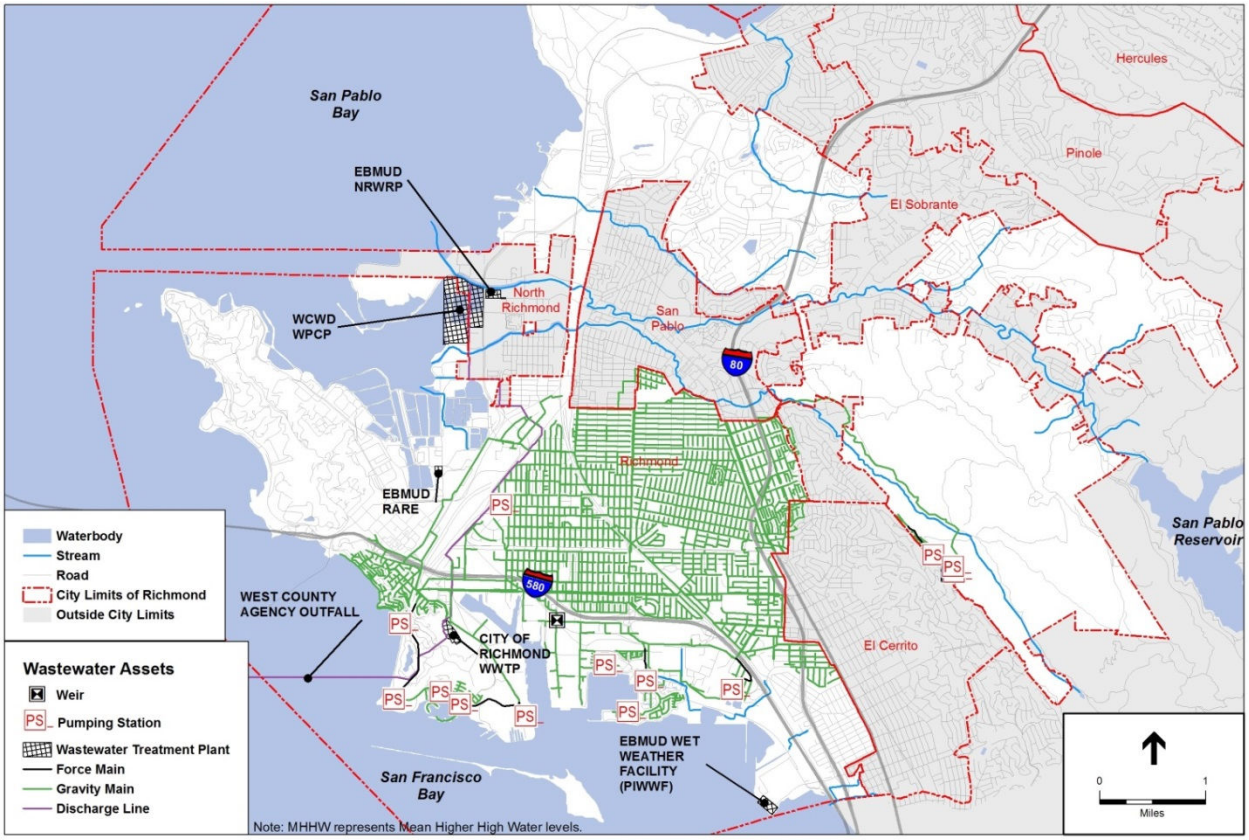
6.5 Wastewater Management

Contra Costa County ART References: WCWD WPCP Profile Sheet, EBMUD PIWWF Profile Sheet, EBMUD RARE and NRWP Profile Sheet

This functional asset category covers Richmond's wastewater collection and treatment infrastructure. Wastewater, or sewage, is the refuse liquid and waste materials from washing, flushing or manufacturing. Wastewater is collected, conveyed, treated, and discharged through an interconnected network of structures and facilities. Wastewater collection assets are those facilities that protect public health by conveying wastewater from its source to treatment and discharge facilities.

The City has three sanitary sewer districts: Richmond Municipal Sewer District, managed by the City of Richmond; West County Wastewater District (WCWD); and Stege Sanitary District (SSD), managed by East Bay Municipal Utility District (EBMUD). The locations of these plants are shown on Figure 6.7, as well as Figures 6.4, 6.5, and 6.6 in Section 6.3: Housing and Schools. Richmond maintains about half of the sewer lines within the City's boundaries. Many of the residents living in the northern half of Richmond are served by WCWD. Residents in the southern section of the Richmond Annex are serviced by Stege Sanitation District.[32]

Figure 6.7: City of Richmond Wastewater Assets



SOURCE: U.S. Census Bureau, 2015; CCC, 2004, 2012; BCDC, 2015; AECOM, BCDC, 2015; City of Richmond, 2014, 2015

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Richmond Municipal Sewer District

The Richmond Municipal Sewer District (RMSD), which is operated and managed by the City of Richmond, provides wastewater disposal service to a 52.6 square mile service area with approximately 65% of the City's residents (68,000) as well as industrial, commercial and public customers. The city operates and manages the RMSD, but has contracted out the management of the treatment plant to Veolia Corporation. The City of Richmond Wastewater Treatment Plan (WWTP) has a capacity of 9 million gallons per day (MGD) and a peak wet weather flow of 16 MGD. Dechlorinated effluent from the plant is discharged to the Bay through a deep water outfall owned and managed by the West County Agency, a joint powers authority between the city and WCWD to construct and maintain the outfall and diffuser. The West County Agency outfall has a design capacity of 58.94 MGD. The outfall extends approximately 4,700 feet into Central San Francisco Bay, with the last portion being a diffuser section designed to ensure maximum dilution and mixing with deep Bay waters. The treatment plant is neither within the 100-year floodplain nor at risk of flooding due to sea level rise; however the effluent pump stations that lift and convey wastewater to the treatment plant may be at risk.

West County Wastewater District

WCWD provides wastewater disposal services in the unincorporated areas of Contra Costa County, and portions of the cities of Richmond, San Pablo, and Pinole. Wastewater from these areas is conveyed though a system of pipes and pumps to the WCWD Water Pollution Control Plant (WPCP) for discharge or reuse. Currently, most of WCWD's 8 million gallons per day average dry weather flow secondary treated effluent is sent to EBMUD's North Richmond Water Reclamation Plant (NRWRP), and the Richmond Advanced Recycling Expansion (RARE) for reuse by Chevron. Flows in excess of 12.5 MGD and flow that does not meet the quality required by EBMUD are dechlorinated and discharged to the Bay through the West County Agency deep water outfall. WCWD owns and manages the water treatment plant and entered into a joint powers authority, the West County Agency, with the City of Richmond's Municipal Sanitary Sewer District to construct and maintain the outfall and diffuser.

The majority of the WPCP and critical pumps are in the 500-year floodplain of San Pablo Creek and Wildcat Creek. Although the plant is partially protected by berms, it may also be exposed to future flooding and storm events. Furthermore, elevated groundwater levels may compromise trunk and lateral lines in the flood zone by making them buoyant. A high groundwater table may also increase liquefaction potential adding to the risk of damage to the pumps and pipelines during a seismic event.

The WCWD WPCP is in the process of upgrading aging infrastructure, which may delay sea level rise planning. Since outfall capacity may be further reduced during high storm tides, sea level rise and storm events could exacerbate any existing issues, resulting in more frequent and potentially longer lasting occurrences when discharge capacity is limited. In the event of flooding, the assets may not be accessible to workers due to flooded roadways. Additional problems may arise if the plants' electrical power supply is compromised and there is not adequate backup diesel fuel supply to operate the 2 megawatt emergency generators or there is disruption to the natural gas supply for the equalization basin pumps.

The EBMUD North Richmond Water Reclamation Plant (NRWRP) and the Richmond Advanced Recycling Expansion (RARE) receive secondary treated wastewater from West County Wastewater District (WCWD) and treat it for reuse by industrial, public and private customers. The RARE delivers purified water to the Chevron refinery to generate steam and the NRWRP provides tertiary treatment to meet Chevron's tower cooling needs.

EBMUD completed a hazard and risk assessment of its infrastructure in 2011, which determined that 23 EBMUD facilities are in the 100-year floodplain, and 32 facilities are at risk of 55 inches of sea level rise. The RARE may be affected by sea level rise, while the NRWRP is potentially not at risk from sea level rise, it is in the 500-year flood plain. The expected life of the existing EBMUD assets is to around mid-century. A high groundwater table may increase liquefaction potential adding to the risk of damage during a seismic event. In the event of flooding around the facilities, these may not be accessible to workers due to flooded roadways. Additional problems may arise if the plants' power is compromised, and workers cannot access the facility with additional fuel for back-up power supplies needed to maintain plant operations.

Stege Sanitary District

Stege Sanitary District collects wastewater its service area and delivers it to East Bay Municipal Utility District's (EBMUD's) North Interceptor, which is then directed to EBMUD's Main Wastewater Treatment Plant outside of Contra Costa County.[33] During peak wet weather flow conditions, wastewaters from the North Interceptor are diverted to the Point Isabel Wet Weather Facility (PIWWF) for discharge via the Point Isabel Wet Weather Facility Outfall and diffuser to the Richmond Inner Harbor. While PIWFF is not in the floodplain, the assets that direct flows to this facility and outside of the County, the North Interceptor and Force Main, may be at risk of damage.

Although the PIWWF facility is planned for retirement by 2035, more frequent storm events may cause inflow and infiltration beyond current levels. A high groundwater table may also increase liquefaction potential adding to the risk of damage during a seismic event. Before PIWWF is retired, EBMUD would need to monitor and plan for short-term maintenance in the event of damage to the assets. Since outfall capacity is further reduced during high storm tides, sea level rise and storm events will exacerbate existing issues, resulting in more frequent and potentially longer lasting occurrences when discharge capacity is limited. In the event of flooding around the facilities, these may not be accessible to workers due to flooded roadways. Additional problems may arise if the plants' power is compromised, and workers cannot access the facility with additional fuel for back-up power supplies needed to maintain plant operations.

Table 6.5 outlines the key vulnerabilities and consequences of climate change exposures to wastewater management.

Table 6.5: Vulnerability and Risk Profile for Wastewater Management

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• None identified.
Precipitation	• Increased stormwater inflow into wastewater collection system. • Localized flooding of wastewater systems from direct precipitation. • Storms could knock out power to wastewater treatment plants.
Drought	• None identified.
Wildfire	• None identified.
Sea Level Rise	• Increased frequency and depth of coastal flooding of critical wastewater treatment facilities, such as the RARE and the NRWP. • Increased inundation and rising groundwater may limit access to facilities and pipelines for maintenance and operations; Inability to access valves and access manholes. • Buoyancy and corrosion of pipes. • Peak discharge trough outfall could be reduced. • Short-term flooding can disrupt biological treatment processes.
Vulnerabilities	
Category	**Vulnerability**
Information	• There is limited information on contractual agreements between EBMUD and the Chevron refinery. It is unclear if their emergency response or operational plans include flood contingencies.
Physical	• The EBMUD North Interceptor runs through predominantly low soil-strength bay muds and artificial fill and it is subject to a high groundwater table because of its proximity to San Francisco Bay. Flooding increases inflow and infiltration, particularly inflow of stormwater to the interceptor through manholes and other structures, limiting the capacity of the interceptor for sewage. Flooding also increases liquefaction potential, adding to the risk of damage due to seismic event. • The earthen berms that prevent wastewater overflows from the sludge drying ponds and equalization facilities into the Bay may also provide some level of protection from flooding. The berms' elevation ranges from 9.3 feet to 10 feet and surround the WCWD WPCP on three sides. WCWD estimates that these structures may provide protection to 2030 but the structural stability and adaptability of the berms is unknown. • WCWD's assets, including the earthen berms, are located in an area of very high liquefaction susceptibility, making them susceptible to damage. Additionally, interceptor pipelines in the flooding area are also subject to rising groundwater, which may make them buoyant, and result in the need for maintenance, repair, and replacement. • Wastewater plants require an uninterrupted power supply to function. If electrical and mechanical components of the facilities, including pumps, control panels, and standby power generation, are at or below grade and are not waterproofed or salt-resistant, the facility will not be able to function. Major upgrades of the wastewater treatment plant and pump stations that could address this vulnerability are scheduled for rehabilitation. • Flooding can increase inflow from stormwater to interceptor pipelines through manholes and other structures, and higher groundwater conditions can increase infiltration into the system. These increases in wet weather flows will further limit the capacity to convey and treat wastewater prior to discharge or reclamation/recycling.

Table 6.5: Vulnerability and Risk Profile for Wastewater Management

Vulnerabilities (cont.)	
Category	**Vulnerability**
Functional	• Storm events and extreme high storm tides have the potential to reduce outfall and diffuser capacity and exacerbate wet weather flow capacity issues. The discharge capacity of the outfall and diffuser may be reduced during existing high storm tides, which could occur more often with climate change and may eventually require an effluent pump station. The reduced capacity will (1) have consequences on how EBMUD and the WCWD's WPCP handle wet weather flows and may threaten the overall performance of the systems. • The wastewater facilities rely on roads and highways to bring employees, fuel, and other materials to the site and if the roads used to access these facilities experience extensive flooding the plants may not be able to continue operations. • Wastewater treatment systems are large, expensive, and complex, and there is little redundancy within each system, making them vulnerable to sea level rise and storm events. • A rising groundwater table may increase liquefaction potential, and may cause damage to treatment plants during a seismic event. • WCWD relies on sludge lagoons to dry solids for landfill disposal and land application. Although WCWD is evaluating a mechanical dewatering process to replace the sludge drying lagoons, the project would be implemented during FY 26/27-28/29 at a cost of $22.8 million. WCWD does not have a plan to decommission Lagoons No. 5, 7, and 9. It is uncertain if the drying lagoons will be protected from sea level rise prior to the implementation of the new mechanical dewatering process. • The WCWD equalization basin is low-lying and at risk of future flooding. The equalization facilities have sufficient capacity to handle wet weather flows from a 5-year storm event. If the WCWD's berms fail or in the event of a larger storm event, the facilities will not be functional and result in sewer system overflows. • WCWD solar panels are located in an area vulnerable to increased flooding due to storm events and sea level rise. If they are not waterproof, salt tolerant, or relocated, WCWD will lose the 1MW of low-cost, renewable energy they provide.
Governance & Management	• All wastewater agencies collaborate with other entities to treat and discharge wastewater collected in their respective service areas and therefore will need to collaborate on funding, planning, and decision-making to avoid system-wide failures. • Wastewater infrastructure is interconnected to, and affected by, other systems and assets (e.g., stormwater contributes to wet weather flows to wastewater treatment plants) that are owned and managed by different public and private entities. The process and relationships may not be in place to support the coordination and collaboration that will be needed to address these shared vulnerabilities. • EBMUD owns the NRWRP the RARE but depends on WCWD for wastewater and on Chevron's use of the treated recycled water. The process and relationships may not be in place to support the coordination and collaboration that will be needed to address these shared vulnerabilities. • Unincorporated areas of Contra Costa County, and portions of the cities of Richmond, San Pablo and Pinole depend on the WCWD's wastewater treatment plant to treat and discharge their treated effluent to two EBMUD water reclamation facilities and/or a deep Bay outfall. Since the outfall is jointly owned and managed with the City of Richmond's Municipal Sanitary Sewer District, it may complicate planning and funding decisions to address sea level rise and future storm event challenges. • Directing resources for long-term planning to address the risks posed by sea level rise may not rise in priority given existing capital demands. For example, WCWD's collection system consists of aging infrastructure with numerous pipe segments in need of repair or replacement in the short term.

Table 6.5: Vulnerability and Risk Profile for Wastewater Management

Consequences	
Category	**Consequence**
Economy	• A wastewater system disruption could potentially have wide-ranging consequences in the communities serviced by the wastewater treatment plants. Cumulative impacts on commercial and industrial businesses and the associated employment, goods, and services they provide could also be significant. Operations and maintenance cost, as well as capital improvement costs could increase with storm event and sea level rise flooding. • If the RARE and the NRWRP stopped operating, flows would be replaced by potable water. There would not be an economic impact. • The WCWD's treated wastewater serves as recycled water for Chevron, so disruption of the plant would trigger additional losses to EBMUD and Chevron and employees that work there. Operations and maintenance cost, as well as capital improvement costs could increase with storm event and sea level rise flooding.
People	• EBMUD provides a critical public health and safety function. If storm events or sea level rise overwhelm and compromise the system, it could affect EBMUD's ability to treat and discharge wastewater. Without EBMUD's service, Stege Sanitary District would have to direct its wastewater to another treatment plant, and/or sewer backups could occur in Richmond, causing residents to be out of their homes at least temporarily and businesses to close. • WCWD's WPCP provides a critical public health and safety function. If storm events or sea level rise overwhelm and compromise the system, it could affect the plants' ability to treat and discharge wastewater. With only one wastewater treatment plant serving such a large area, the cities and County depending on WCWD may not have the ability to direct their wastewater to another plant, resulting in system-wide failure.
Environment	• If storm events or sea level rise overwhelm and compromise wastewater system assets, untreated sewage could overflow into the environment. Toxic substances and excessive nutrients degrade water quality and harm fish and other aquatic organisms. • The RARE and the NRWRP have a combined typical usage of 7.5 MGD. If these facilities stop functioning, flows would be replaced with potable water. The environmental impact of this would depend on water supply conditions at the time of failure.

Priority Actions

Mitigation and Risk Reduction

- Wastewater-1. Ensure that WCWD's infrastructure upgrade includes improvements that mitigate anticipated sea level rise impacts. Sea level rise and high tide storm events could exacerbate any outfall capacity issues in particular.
- Wastewater-2. Ensure that wastewater treatment plant electrical and mechanical components are either located above grade or are waterproofed or salt-resistant to lower risk of failure when flooded.

Preparedness

- Wastewater-3. Survey all wastewater treatment plants in Richmond and determine whether emergency response systems are in place.
- Wastewater-4. Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G).
- Wastewater-5. Establish plans to deliver fuel to backup power generation systems.

6.6 Stormwater Management

Contra Costa County ART References: City of Richmond Stormwater Profile Sheet

This functional asset category includes the City's stormwater facilities and drainage systems. The City of Richmond has approximately 94 miles of separate storm sewer pipes plus numerous gutters, manholes, outfalls, storm gates, pump stations and other drainage infrastructure that helps manage rainfall runoff and prevent flooding.[34]

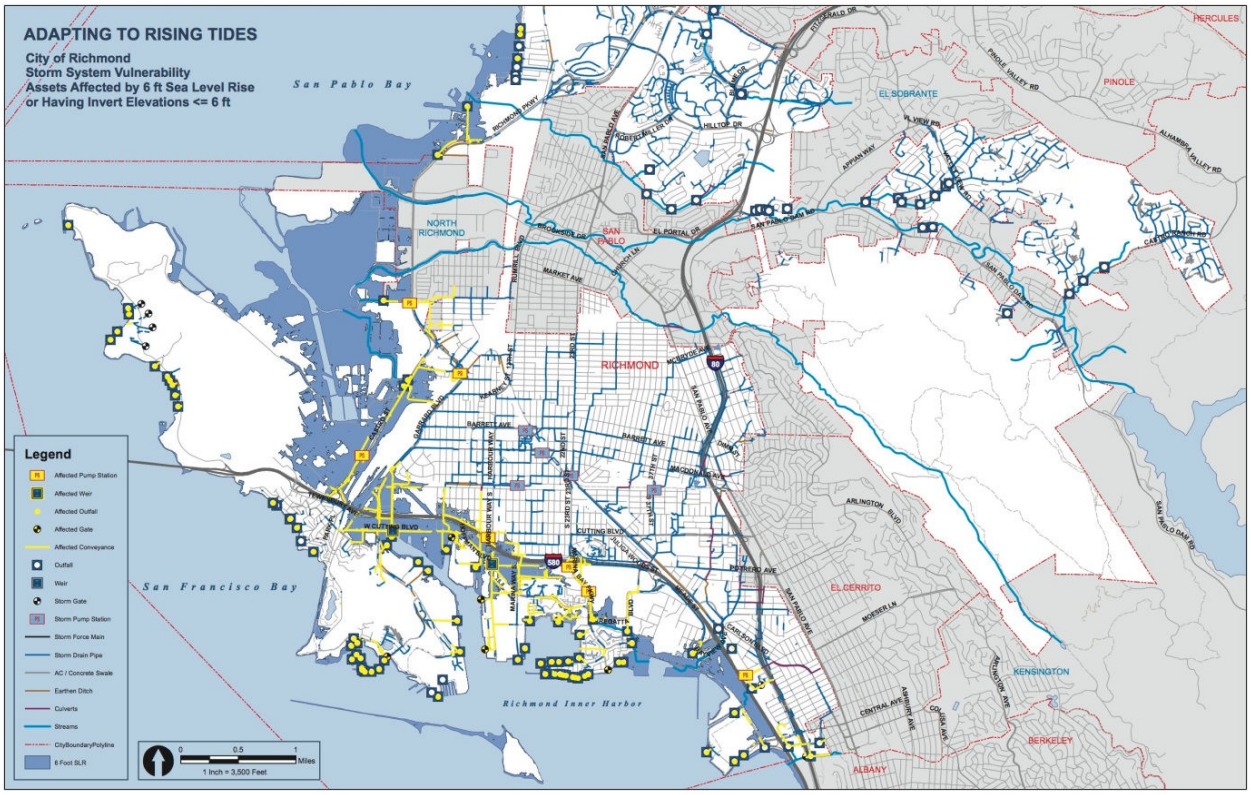
City stormwater assets that are directly exposed to flooding, or have their lowest elevation below future high tides, are vulnerable to sea level rise. Assets that are not directly exposed but rely on gravity drainage or have insufficient capacity to store and convey both stormwater and Bay water are also vulnerable. Because of their inherent function and location, large pipes, culverts, outfalls, storm gates, weirs, pump stations and force mains are especially at risk. For example, pipes and culverts are larger and carry more flow the closer they are to the receiving waters, and pump station and their attached force mains are typically located in low-lying areas, for example at road underpasses or roads that are below grade. The City has very limited resources to conduct studies to better understand the current condition of the stormwater system that are needed to under its future vulnerability to sea level rise.

The City of Richmond recently conducted an assessment to determine which components of the storm system assets are at risk from 6 feet of sea level rise plus mean higher high water (MHHW) or have their lowest point (invert elevations) below 6 feet of sea level rise. Table 6.6 below lists the number of collection devices by category, those with invert elevation below 6 feet SLR, and the percent of assets at risk. These vulnerable assets are highlighted in yellow on the map in Figure 6.5. For more detail see the *City of Richmond Stormwater Profile Sheet.*

Table 6.6: Stormwater assets in the City of Richmond potentially affected by 6 feet of sea level rise plus MHHW (NAVD88)

Collection Device	Total City-wide	Total with invert below 6 feet SLR	% at risk
	Number	**Number**	
Collection Device (storm drains, catch basins, etc.)	5270	396	8%
Manhole	1846	349	19%
Weir (engineered sanitary sewer overflow)	2	2	100%
Outfall	136	79	58%
Storm Gate (not including sluice gates)	16	9	56%
Pump Station	12	7	58%
	Miles	**Miles**	
Force Main	0.22	0.19	86%
Pipe	151.9	25.5	17%
Pipe with diameter of 36 inches or greater	36.1	8.6	24%
CMP (corrugated metal pipe)	4.8	0.4	9%
Culvert (large, often square conveyances)	6.1	2.4	39%
Concrete Ditch	13.5	0.4	3%

Figure 6.8: Map of City Stormwater Assets Potentially Affected by Sea Level Rise



Outfalls are the first line of defense against sea level rise in the city's stormwater system. An exposure analysis conducted by the city indicates that 79 outfalls would be inundated at high tide with 6 feet of sea level rise. As these outfalls do not have storm gates to prevent Bay water from entering the stormwater system, where upstream pipe capacity is insufficient to store both stormwater and Bay water, there could be street and basement flooding during extreme tides or even the daily high tide. This is already a problem in many low-lying areas along the Richmond shoreline where historic marshes were filled for development. For example, the Richmond Annex neighborhood already experiences "sunny day flooding" when stormwater does not drain during high tide and backs up into people's homes. Higher water tables associated with sea level rise could also infiltrate the stormwater system and further reduce pipe capacity, and pipes and other infrastructure that was not constructed for saline conditions may be vulnerable to corrosion. Although some of the city outfalls have storm gates, these are often inaccessible to city staff and there is no plan in place to repair and maintain over time.

In addition to sea level rise affecting gravity fed stormwater drainage, sea level rise will also affect force main pipes because pump stations are vulnerable to flooding. Pump stations require uninterrupted power and access, meaning back-up power or fuel supplies will be needed to maintain operation during long duration disruptions. This can be problematic during storms where road access is disrupted. Furthermore, pump stations are built with the ability to lift water to a certain elevation at a certain rate, which may be exceeded with sea level rise. Operating pump stations more frequently or adding pumps will increase maintenance costs, energy use and GHG emissions. For these reasons, adding pump stations to improve gravity fed stormwater drainage may be difficult.

Table 6.7: Vulnerability and Risk Profile for Stormwater Management

Exposures and Sensitivities

Exposure	Potential Impacts and Sensitivities
Temperature	• None identified.
Precipitation	• Increased discharge to stormwater system. • Fluvial flooding can damage stormwater infrastructure.
Drought	• None identified.
Wildfire	• Increased sediment from fire-damaged areas can impede drainage and increase maintenance.
Sea Level Rise	• Increased potential for stormwater and fluvial flooding due to reduced drainage to the Bay. • Increased inundation of outfalls during high tide resulting in street and basement flooding. • Higher water tables could infiltrate the stormwater system and further reduce • Increased frequency and depth of coastal flooding may damage stormwater infrastructure.

Vulnerabilities

Category	Vulnerability
Information	• The city has not conducted a drainage study to analyze the capacity of the stormwater system to store and drain various combinations of Bay water levels, sea level rise, and flood flows. This coastal-riverine flood analysis would inform capital improvement projects and would be especially useful for weighing the costs and benefits of building extra capacity now or waiting until later to act (e.g., putting in slightly larger pipes than are necessary now may be more expensive in the short term, but is likely to be far less costly than replacing them again when sea level rises.)
Physical	• As sea level rises, the capacity of stormwater pipes to discharge flood flows will diminish over time. Further analysis is needed to understand the most sensitive pipes and thresholds for stormwater backups. • As sea level rises, stormwater infrastructure such as pipes and pump stations that were not constructed for saline water conditions will suffer from corrosion if they are not improved replaced. • Corrugated metal pipes do not have as long of a lifespan as other material types, and exposure to flooding or seawater could cause them to fail earlier than expected.
Functional	• Pump stations rely on uninterrupted power to operate. Although some of the pump stations have backup generators and fuel onsite that will help avoid service disruption, access to these facilities to resupply fuel and allow for maintenance may be limited by flooding of the transportation system. • Assets that rely on gravity drainage are often at the lowest elevation in the system and therefore are often in low-lying areas that could be exposed to flooding. For example, the city's two engineered sanitary sewer overflow weirs could be flooded potentially causing a sanitary sewer overflow into the storm system, or the conveyance of floodwaters into the sanitary system, overloading the wastewater treatment plant with high salinity and lower strength (organic matter content) flows than the system is used to.
Governance & Management	• The city has only one staff person dedicated to their stormwater program and this time is spent implementing the NPDES Permit. Consultants are used to inspect and maintain stormwater infrastructure as well as manage the city bond-funded capital improvements program. There are no resources allocated specifically to support long-range stormwater management planning to address the impacts of sea level rise.

Table 6.7: Vulnerability and Risk Profile for Stormwater Management

Consequences	
Category	**Consequence**
Economy	• Flooding of streets and roads due to diminished function of the stormwater system could disrupt access to local goods, jobs, and services, and affect operations at the Port of Richmond. • Regional passenger and freight rail service could be affected by flooding, which would impact the regional economy. • Flooding of homes and businesses in neighborhoods could impact the local economy if residents and employees need to seek other places to live or work, especially if the disruption is long enough or the damage is severe.
People	• Reduced discharge capacity of the stormwater system and failures of pump stations could cause flooding of streets and roads, neighborhoods, job centers, and parks, disproportionally affecting residents with limited resources to respond or recover.
Environment	• Damage, disruption or failure of the stormwater system could cause flooding in post-industrial areas such as the South Richmond shoreline, which may mobilize contaminants and impact wetland habitat and Bay water quality. • Overflowing of sanitary sewer overflow weirs could cause the release of untreated, or partially treated, wastewater which could have public or health environmental impacts.

Priority Actions

Mitigation and Risk Reduction

- Stormwater-1. Construct a shoreline protection system and storm drainage system that are initially built to accommodate a mid-term rise in sea level of 16 inches, with a design that is adaptable to meet higher than anticipated values in the mid-term, as well as for the long-term (General Plan Action EC6.G).
- Stormwater-2. Enhance infiltration of stormwater on City-owned properties through use of pervious pavement and bioswales, revegetating areas, adding trees, and increasing green spaces.
- Stormwater-3. Conduct public outreach to educate property owners about the importance of stormwater management and flood control so they support bond initiatives and increases in assessments for infrastructure repair and improvement
- Stormwater-4. Enforce creek protection, stormwater management, and discharge control ordinances, following the RWQCB Best Management Practices (BMPs), to keep watercourses free of obstructions and protect drainage facilities
- Stormwater-5. Conduct watershed analyses to identify opportunity sites for green infrastructure or low impact development (LID) techniques to improve stormwater and flood control system capacity to accommodate sea level and groundwater rise.
- Stormwater-6. Require new developments and redevelopments to reduce and manage stormwater through on-site capture and retention, low impact development (LID), green infrastructure, and other means.

Preparedness

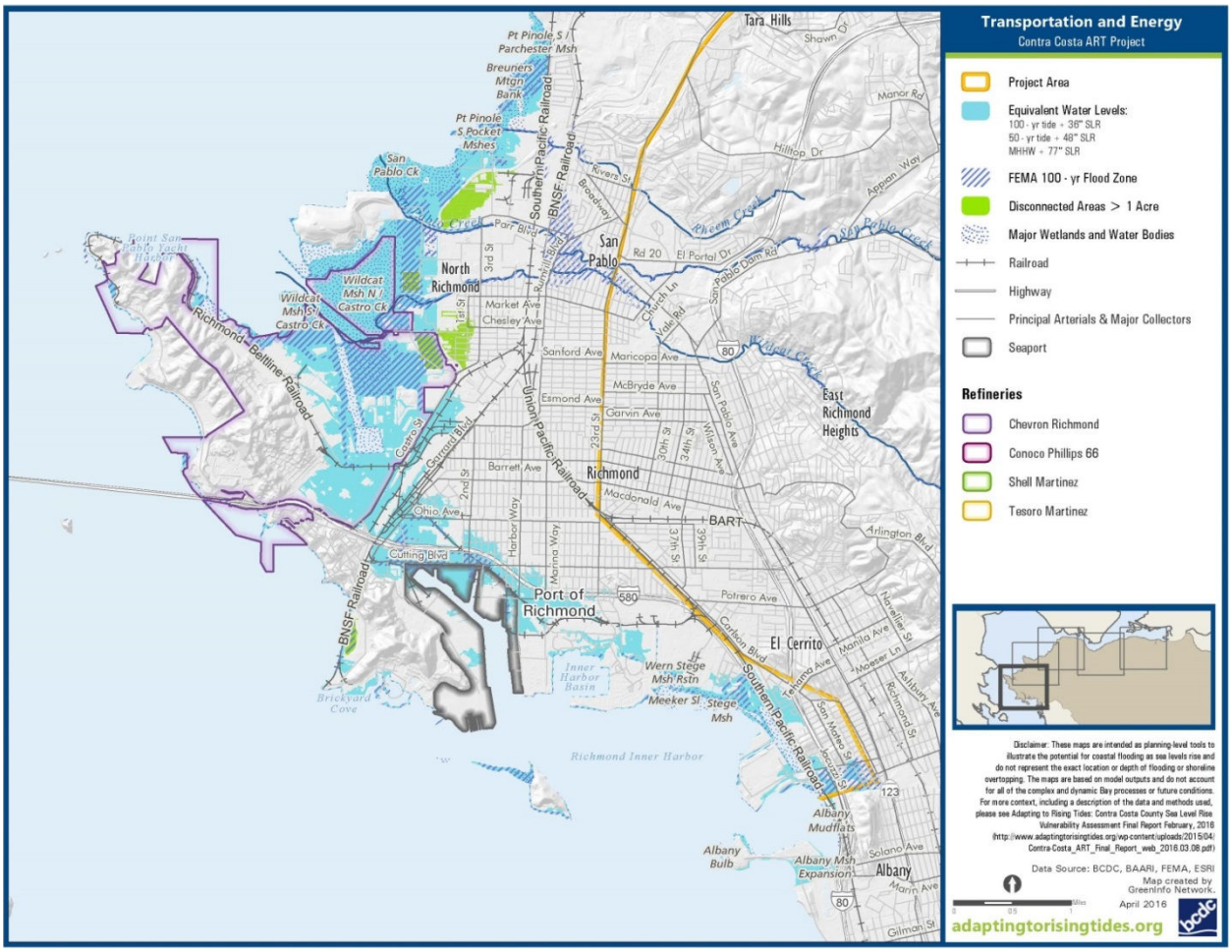
- Stormwater-7. Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G).

6.7 Transportation Infrastructure

Contra Costa County ART References: Ground Transportation Chapter

This functional category encompasses the City's major ground transportation infrastructure including railways, state and federal highways, local arterials and access roads, and bridges. The Port of Richmond and marine offshore terminals, which are integral to goods movement, are discussed in Section 6.12. Pedestrian pathways and bikeways are discussed in Section 6.11.

Figure 6.9: City of Richmond Transportation Infrastructure



Roadways

Critical connections both within the county, and between the county and the region, are at risk of flooding, including the Richmond Parkway, San Pablo Avenue, and I-580. Even short term closures of the roadway network could have significant social and economic costs as there is limited redundancy for car or bus commuters in the project area, especially those that live in fairly isolated communities, and if there are alternative routes they may not be able to accommodate the same capacity. Lastly, residents without access to a vehicle may be most vulnerable since rerouted buses would result in delays that could impact their ability to get to work especially those that connect to other transit modes such as the intra-regional BART system.

Flooding of local streets and roads may be caused by storm events that overtop the shoreline or by a failure of stormwater infrastructure to maintain function as sea level rises. According to the Contra Costa County ART Project, the City of Richmond owns and manages a number of roads at risk of flooding, with local streets and roads in the Point Richmond, Marina Bay, and Iron Triangle neighborhoods potentially exposed flooding with 4 feet of sea level rise or more. In particular, this includes local streets and roads to the south of I-580 between South Marina Way and South Garrard Boulevard and north of I-580 where South Garrard Boulevard turns into West Ohio Avenue. In addition, where roads are low-lying they could flood with lesser amounts of sea level rise than is currently depicted on inundation maps if stormwater infrastructure is affected by higher Bay water levels (see Section 6.6 on Stormwater Management). Particular areas of concern include, but are not limited to:

- Much of Richmond Parkway/Castro Street from the I-580 interchange north to Hensley Street is at risk of flooding with 4 feet of sea level rise or more, while the portions of Central and Bayview Avenues on the bayside of I-580 in the Southwest Annex neighborhood could flood with 5 to 6 feet of sea level rise.
- Richmond Parkway/Castro Street is an important arterial road that provides local access to jobs, goods and services. It also provides connections to important West County routes, including I-580, I-80 and San Pablo Boulevard that commuters traveling between the East Bay and San Francisco as well as along the East Bay shoreline rely on.
- Central Avenue, which connects local goods and commuters to I-580, I-80, and San Pablo Avenue, and provides access to regional and local jobs, EBMUD's Point Isabel Wet Weather Facility, and the Point Isabel Regional Shoreline, which is one of the most visited East Bay Regional Parks.
- Richmond Parkway/Castro Street and Central Avenue are key routes that would affect commuter access to local and regional jobs, Richmond residents, and the movement of goods if not fully functional. Both are listed as a West County route of regional significance and are major truck and transit routes. Communities of concern in Richmond that do not have access to a vehicle could be most affected by their disruption since rerouted buses would result in delays that could impact their ability to get to work on time. In addition, if either of these roads flood, emergency services may have a difficult time reaching the communities in need, in particular between Carlson Boulevard and I-580, in a timely fashion.

Interstates in the project area provide access to employment sites and public services within Contra Costa County, are critical for goods and commuter movement along the East Bay shoreline, and connect Contra Costa to Marin, the San Francisco Peninsula, Solano County, and points beyond. Interstate roadways at risk in Richmond include:

- **I-580 from the Castro Street Interchange to the Contra Costa County Line.** As described in the *Contra Costa County ART Project Ground Transportation Chapter,* I-580 is a major truck route and a route of regional importance with an average daily traffic of 67,000 vehicles. The segment from the Castro Street Interchange to the Contra Costa County line is at risk of future flooding and storm events at various locations; some segments would have to be elevated 3 to 5 feet to be protected from sea level rise. Even temporary damage or a partial closure would impact traffic at a regional scale. There are very limited alternatives to re-route goods movement, in particular because this segment is a main route for truck traffic to/from the Port of Oakland Seaport, and re-routing truck traffic in the Bay Area can be challenging due to road use restrictions. In addition, loss of this segment would have significant impacts on worker access to local and regional jobs, and would greatly affect access to local and regional shoreline recreation.

- **I-80 Approach to the Carquinez Bridge and San Pablo Avenue Interchange.** While much of the highway and the bridge approach segment is raised, this segment of I-80 does sit within the 100-year floodplain and is at risk rising sea levels. The reinforcing in concrete structures that supports the elevated portion of the roadway and the south anchorage building, which houses the bridge tension cables, could be impacted by a rising groundwater table as well as exposure to higher salinities. As one of the most congested freeways in the region, disruption of I-80 would affect commuters and the movement of goods. Transit operator Sol Trans (78, 80) serves commuters along this segment, traveling from South Vallejo to/from the El Cerrito Del Norte BART station. This segment of I-80 also provides local and regional access to shoreline recreation along West Contra Costa County, including Point Pinole Regional Shoreline, San Pablo Regional Shoreline, Carquinez Strait Regional Shoreline. Even temporary damage or disruption of this segment will have consequences on local and regional shoreline recreational access.

Passenger and Commuter Rail

In the San Francisco Bay Area goods and commuters both move by rail, on a shared track, along the shorelines of Santa Clara, Alameda, Contra Costa, and Solano Counties. The rail lines that cross the Contra Costa County ART Project area are critically important, and support inter- and intra-regionally important goods and commuter movement. Goods moved by rail in Richmond include rail carload commodities (e.g., motorized vehicles and petroleum products other than gasoline or fuel oils) and intermodal rail shipments (shipping containers that can be moved by container ship, rail or truck). The rail lines are also used for passenger drains and freight trains daily.

- Most of the Union Pacific (UP) rail line in and around Richmond is directly on the shoreline. The Burlington Northern Santa Fe (BNSF) line parallels the UP rail line from Richmond to Pinole, heads inland, and then rejoins the UP line near Bay Point. Both rail lines cross at least 17 tidal creeks and channels as well as coastal floodplains. In many locations where UP rail line is directly on the shoreline there are tidal marshes and mudflats on the bayside of the rail track that help reduce wind, wave and tidal energy, protecting the rail line from erosion and flood damage.
- Given the interconnected nature of rail, and lack of redundancy, a disruption of any segment, either within or outside of Richmond, could have significant impacts. Rail lines in Richmond are critical to moving agricultural, automotive, chemical, industrial, and other goods from the region's seaports to local and national markets, and are integral to inter-city passenger rail service. In addition, in many locations the rail line serves as the first line of defense against inland flooding. Relocating or adding new rail track and right-of-ways is costly, and significant time and money are needed for planning, financing and implementing changes to the rail network. If the rail system is disrupted truck traffic in particular from the region's seaports could increase, having negative and widespread effects on road congestion, air quality, noise and quality of life for those living and working near the ports. Collaboration between private rail owners (UP and BNSF), local agencies that own or manage adjacent lands, and those that rely on rail either for providing service or for flood protection, will be necessary to find and implement appropriate, multi-benefit solutions to address flood risks.

Table 6.8: Vulnerability and Risk Profile for Transportation Infrastructure

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• Roads: Can buckle, deform, soften pavement • Rail: extreme heat stresses materials and can buckle rails • Control and communication systems can overheat
Precipitation	• Fluvial flooding of low-lying transportation infrastructure – erosion and other damage (exacerbated by sea level rise) • Increased precipitation increases surface water on roads
Drought	• None identified
Wildfire	• Fire damage to roads and highways
Sea Level Rise	• Increased frequency and depth of coastal flooding will cause more frequent damage to transportation infrastructure in flood prone-areas, affecting access to goods, services, and jobs, and will stain regional and local resources for disaster response and recovery. • As Bay water levels rise, storm events may flood larger areas for longer periods of time due to reduced drainage to the Bay, causing more extensive damage due to the duration of the flooding, cause longer disruptions to power, access to goods, services, and jobs, and the need for additional disaster response and recovery resources. • As Bay water levels rise there is the potential that shoreline protection, such as levees, berms and revetments, will be damaged or fail to due to increased tidal and wave energy. Shoreline protection may be overtopped during storm events when there are extreme tides levels and wind-driven waves, flooding inland areas, including transportation infrastructure that is currently protected.
Vulnerabilities	
Category	**Vulnerability**
Information	• There is insufficient information available on the rail lines in Richmond and beyond to thoroughly evaluate the vulnerability of the rail infrastructure. Existing types and level of use, track and siding condition and maintenance information, and capital improvement plans are not publicly available.
Physical	• In the event of an emergency, maintenance and repair of the rail system may be delayed until a specialized team and custom materials are secured. Multiple disruptions throughout the system may further delay the recovery process. • A rising groundwater table could damage the track bed and ballast materials. If constantly saturated, maintenance would need to increase in frequency to avoid structural unsoundness of the rail line structure. • Storm events and wave action have the potential to damage the ballast, embankment, and cause the rail tracks to become structurally unsound. • Saltwater intrusion may cause corrosion of the reinforcing in concrete structures that support the elevated portion of I-80, and the anchorage buildings. Steel in the portion of these structures that will be exposed to salinity is coated with epoxy that prevents salt from getting at the steel and extends the life of the structure. In addition, bridge anchorage buildings are similarly designed and equipped with pumps and other flood resistant items. However, the potential for rising groundwater to cause salinity to affect portions of the structures that were not expected to be exposed to water or salt needs further investigation. • A rising groundwater table could damage the at-grade pavement structural sections, in particular if the roadbed is constantly saturated. This will be a particular problem for the Richmond Parkway and Castro Street, as well as I-580 where it is in close proximity to the Bay, between I-80 and South 51st Avenue, where the pavement is very low and already needs to be protected from current groundwater levels.

Table 6.8: Vulnerability and Risk Profile for Transportation Infrastructure

Vulnerabilities (cont.)

Category	Vulnerability
Functional	• Power is needed for traffic signal operation and functionality of passenger rail stations. Temporary protocols and backup supplies may not be sufficient during a prolonged outage or during system-wide failures. In addition, power outages pose a safety concerns at signalized intersections and will likely require direct human supervision until power returns. • If any segment of the rail line were disrupted the entire system would shut down, even in areas where the rail line is double tracked as it is likely that both would be affected at the same time in a flooding event. • There is no redundancy in the commuter rail system that would provide the same capacity as currently exists. Commuters could use alternate modes, however I-80 and I-680 could be flooded at the same time as the rail line, and are unlikely to provide the same level of service. For example, temporary bus service may result in longer commutes and delays. • There is no redundancy in the railroad system for goods movement that would provide the same capacity as currently exists. Depending on the location of the disruption, freight could be rerouted however this would result in increased costs and may not accommodate all types of cargo currently moved by rail. In addition, the roadways may not have the capacity needed to move freight in a timely manner. • There are limited alternative routes for commuters if either of the two interstate segments are flooded. Local streets do not provide adequate redundancy, as they cannot accommodate the same traffic capacity, which is projected to increase considerably. Damage to the local street network near the highway facility itself is possible, including damage to on and off ramps to/from the local street network, would impede use of the facility and traffic movement through the affected area. • There are limited alternative transit providers serving corridors parallel to I-580 that could provide some redundancy for commuters, however, it is unlikely these transit providers could provide commuters an adequate alternative, both in terms of capacity and desired route, for more than a short duration disruption. • There is limited redundancy for car or bus commuters that rely on of I-80 to access the Carquinez Bridge. Re-routing commuters through other bridges may not be an adequate alternative both in terms of capacity and desired route. • There are very limited alternatives to re-route goods movement if I-580 was disrupted, in particular because the segment in the project area supports truck traffic to/from the Port of Oakland Seaport, and re-routing truck traffic can be challenging due to road use restrictions. • Flooding on Central Avenue could leave Richmond and surrounding communities without access to both I-80, I-580. Additionally, Central Avenue provides the only entry to Point Isabel Regional Shoreline and is the sole access, on the southern end via San Joaquin Street, to the community located between I-580 and I-80. • Power is needed for local traffic signal operation and it is not known if there are alternative power supplies in the event of an outage. Signalized intersections would likely be treated as three/four-way stops during power outages presumed to be temporary, with city workers, vehicles, equipment, power, and communication needed to effectively reroute traffic. • While traffic can be rerouted in the event of flooding, highly congested areas such as Central Avenues at I-80 could experience significant disruption for extended periods of time, and I-580 could be impacted at the same time as I-80, further exacerbating traffic and delaying relief efforts. • AC Transit (72M) connects commuters via Richmond Parkway to the Richmond BART station. Any alternative public transit routes could result in significant delays for commuters.

Table 6.8: Vulnerability and Risk Profile for Transportation Infrastructure

Vulnerabilities (cont.)

Category	Vulnerability
Governance & Management	• Planning for sea level rise and storm event impacts is challenging given that rail lines are owned and maintained by private entities that have not been willing in the past to coordinate and share information and resources, or work directly with local decision makers to find shared solutions for past or current issues. • Significant coordination is required to maintain the Capitol Corridor passenger rail service given the number of asset owners, managers, and service providers that need to work together. This coordination will be even more important in addressing the challenges of sea level rise while trying to achieve a vision of faster, more efficient passenger service. • A number of entities have permitting authority over railroads; if improvements are necessary to increase resilience, permits from the following agencies could be necessary, which would increase the time needed to implement changes: BCDC, USACE (Section 404), RWQCB (401 Certification), USFWS (Biological Opinion), and CDFW (CESA compliance). • Some segments of the railroad are protected by other lands owned by others, or levees paid for by the public. Coordination to ensure shoreline solutions address the needs of the railroads, the landowner, and adjacent developed or natural areas will be critical. • Funding mechanisms to pay for rail improvements may be complicated as large public investments may be necessary to protect this privately owned infrastructure. • Agency coordination is required to maintain the connections between interstates and local streets and roads. For example, Contra Costa County maintains the main connectors to I-80 in Crockett, the City of Martinez maintains the main connectors to I-680, and the City of Richmond to I-580 and I-80. • Improvements to local streets, roads, interstates, or transbay bridges that impact the Bay or shoreline, or cross creeks, rivers, wetlands, or other natural habitats, may require permits from a number of different regulatory agencies which increases the time needed to design and implement changes: BCDC, USACE (Section 404), RWQCB (401 Certification), USFWS (Biological Opinion), and CDFW (CESA compliance). • The lack of planning funds, capital improvement financing, regulatory mechanisms or incentives limits the ability to understand and address the impact of sea level rise and storm event on local streets and roads, in particular where flooding will be caused by diminished capacity of the stormwater system or where sea level rise will increase riverine flood risks. • Many types of assets are often co-located with streets and roads, for example there may be buried electrical or communication utilities, roadway drainage systems, or pipelines within right-of-ways. Improvements will require coordination with public and private utility companies. • Caltrans will need to collaborate with the Contra Costa County Mosquito Abatement District, the Contra Costa County Flood Control District, a number of local jurisdictions, and private landowners to improve the flood resilience of interstates, transbay bridges, and their approaches within and beyond the project area.

Consequences

Category	Consequence
Economy	• The railroads provide a key service moving agricultural, automotive, chemical, industrial, and other goods from the region's seaports to local and national markets. The Surface Transportation Board classifies the BNSF and UP railroads as Class 1, which means that the annual operating revenue for each is over $433.2 million. Similarly, commuter movement is an important asset for the region, and Capitol Corridor alone generates $170 million in economic activity. • Interstates in Richmond are critical to both the flow of goods and the ability of commuters to access local and regional jobs. As many of workers inbound to the Contra Costa County come from Solano County, and those commuting outbound are heading to San Francisco and points south along the East Bay, disruption of I-580 and I-80, local

Table 6.8: Vulnerability and Risk Profile for Transportation Infrastructure

Consequences (cont.)	
Category	**Consequence**
Economy (cont.)	approaches and on/off ramps, and the transbay bridges they are connected to could have significant consequences on both the local and regional economy. In particular, workers who rely on vulnerable public transit assets or roads may be unable to get to work, affecting not only their wages but the economy of the region as a whole. • As congestion currently impacts the region's economy, any increased congestion resulting from temporary or long-term damage to a part of the transportation network could have significant costs to the region. For example, I-580 and I-80 are important truck routes, and the loss of either, even for a short duration, would impact regional, intra-state and inter-state goods movements. • Local streets and roads, and in particular the Richmond Parkway and San Pablo Avenue, provide access to local jobs, goods and services. Disruption to either of these corridors could have significant impact on the local economy, which could also cause cascading consequences on the regional economy.
People	• Disruption of the railroad would have an effect on commuters, goods movement, the economy and the region as a whole. Everyone sharing the road would spend more time in traffic and may have a difficult time getting to work or obtaining necessary goods and services. In the long run, commuters would have to spend more money to use their personal vehicles. Additionally, in places where the railroad serves as the first line of defense, a failure of the railroad would result in flooding of developed or natural areas inland of the rail line. • As some of the most congested roadways in the region, disruption of I-580 or I-80 would significantly affect commuters if not fully functional. Moreover, both interstates provide local and regional access to shoreline recreation, including access to Point Isabel and Albany Waterfront East Shore State Park, Point Pinole Regional Shoreline, San Pablo Regional Shoreline, and Carquinez Strait Regional Shoreline. • Local streets and roads in Richmond, including Richmond Parkway and San Pablo Avenue are key routes that would affect commuters, residents, and the movement of goods if not fully functional. Neighborhoods served by a single access road are at risk of being disconnected from emergency services and are less likely to be able to remain in their homes after a flood event. Those without access to a vehicle may be most vulnerable since there are limited alternative routes in Richmond and the only transit alternative to buses, which rely on local streets and roads, is Capitol Corridor passenger rail, which is not affordable for short commuter trip. Rerouting buses would result in delays that could impact their ability to get to work on time.
Environment	• Long-term disruption would lead to more cars and trucks on the road, which would increase greenhouse gas emissions. Pipelines owned by Kinder Morgan are located under the UP right-of-way, which could be damaged if the embankment is destabilized. The pipelines transport petroleum and if ruptured during a flooding event, would result in a highly mobile spill that can cause great damage to the surrounding terrestrial environment and the Bay. • Disruption of local streets and roads that public transit relies on could cause more individuals to drive, which could affect air quality. In addition, the loss of a portion of the transportation network may increase congestion, potentially resulting in greater emissions and lower fuel efficiency.

Priority Actions

Mitigation and Risk Reduction

- Transportation-1. Construct vital transportation infrastructure at elevations that would not be exceeded by flood waters (GP Action EC6.G).
- Transportation-2. Seek collaboration between private rail owners (UP and BNSF), local agencies that own or manage adjacent lands, and those that rely on rail either for providing service or for flood protection, to find and implement appropriate, multi-benefit solutions to address flood risks.
- Transportation-3. Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for transportation infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G).

Preparedness

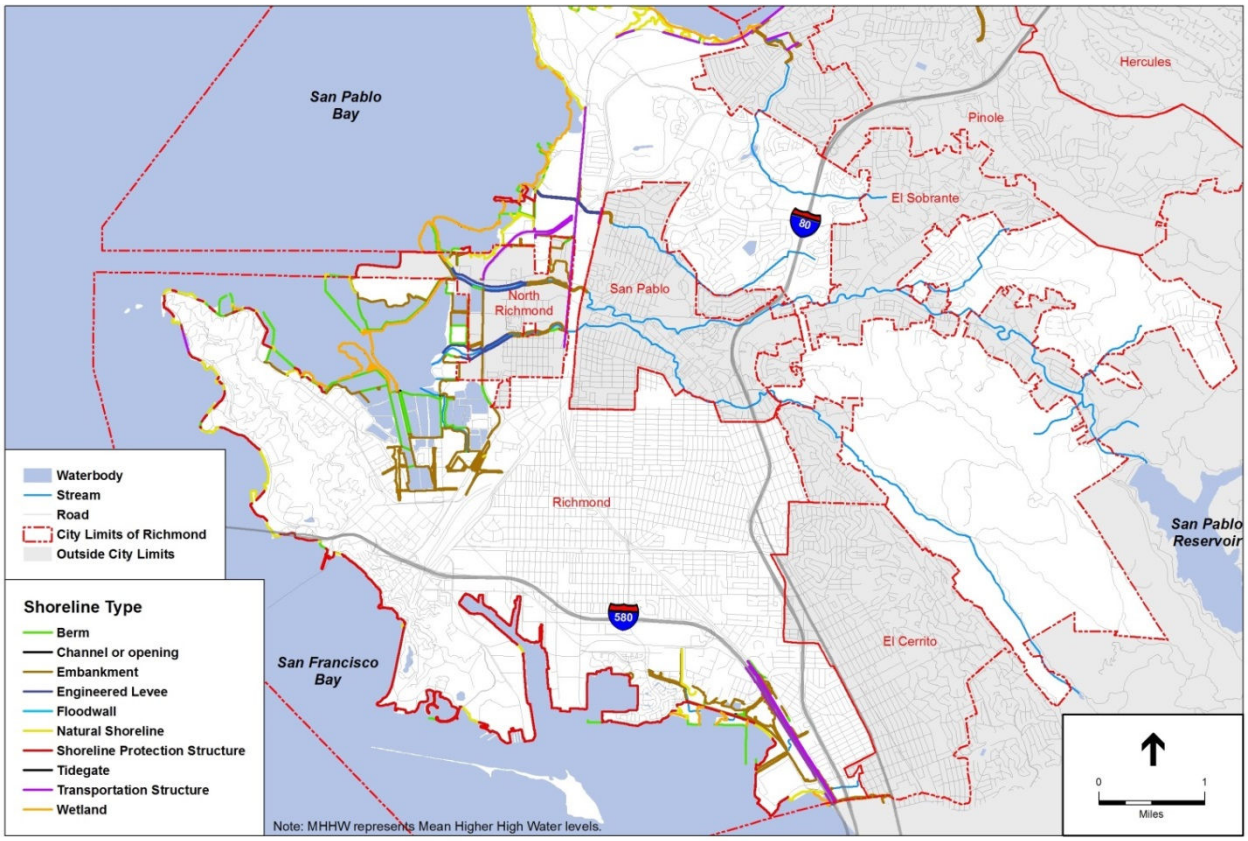
- Transportation-4. Develop contingency plans for temporary loss of roadway assets due to flooding; Work with business operators and other stakeholders to develop a plan to re-route diesel trucks away from neighborhood streets and sensitive uses such as homes, schools, parks and playgrounds to minimize impacts from emissions and traffic conflicts.
- Transportation-5. Expand or form broad public-private partnerships (multi-sector/agency) to guide the planning and implementation of multi-objective transportation improvements and new investments that are resilient to sea level rise and storm events.
- Transportation-6. Work with adjacent communities to develop and jointly implement transportation adaptation strategies that address changes in transportation system condition and use due to sea level rise and storm events.
- Transportation-7. Conduct a "hot spot" analysis to identify key routes and nodes critical to traffic flow, assess their vulnerability and risk, and develop actions to improve their resilience to sea level rise and storm events.
- Transportation-8. Increase the capacity to accommodate re-routed traffic on alternative routes, or build new routes, in areas not at risk from sea level rise and storm events.
- Transportation-9. Conduct analyses of critical transportation infrastructure to identify the potential for increased erosion, scour and wear due to increased tide and wave energy.

6.8 Flood Management

Contra Costa County ART References: Wildcat and San Pablo Creeks Profile Sheet

As shown in Figure 6.10, the City of Richmond shoreline is characterized by a mix of levees, berms, embankments, tidal marsh wetlands, transportation structures (e.g., rail and road beds), and other structures that provide flood mitigation for the City's shoreline and creek channels. Although most of these features do not provide a level of flood protection sufficient for FEMA certification, they do prevent flooding of developed areas along the shoreline for some coastal scenarios.

Figure 6.10: City of Richmond Shoreline Characteristics

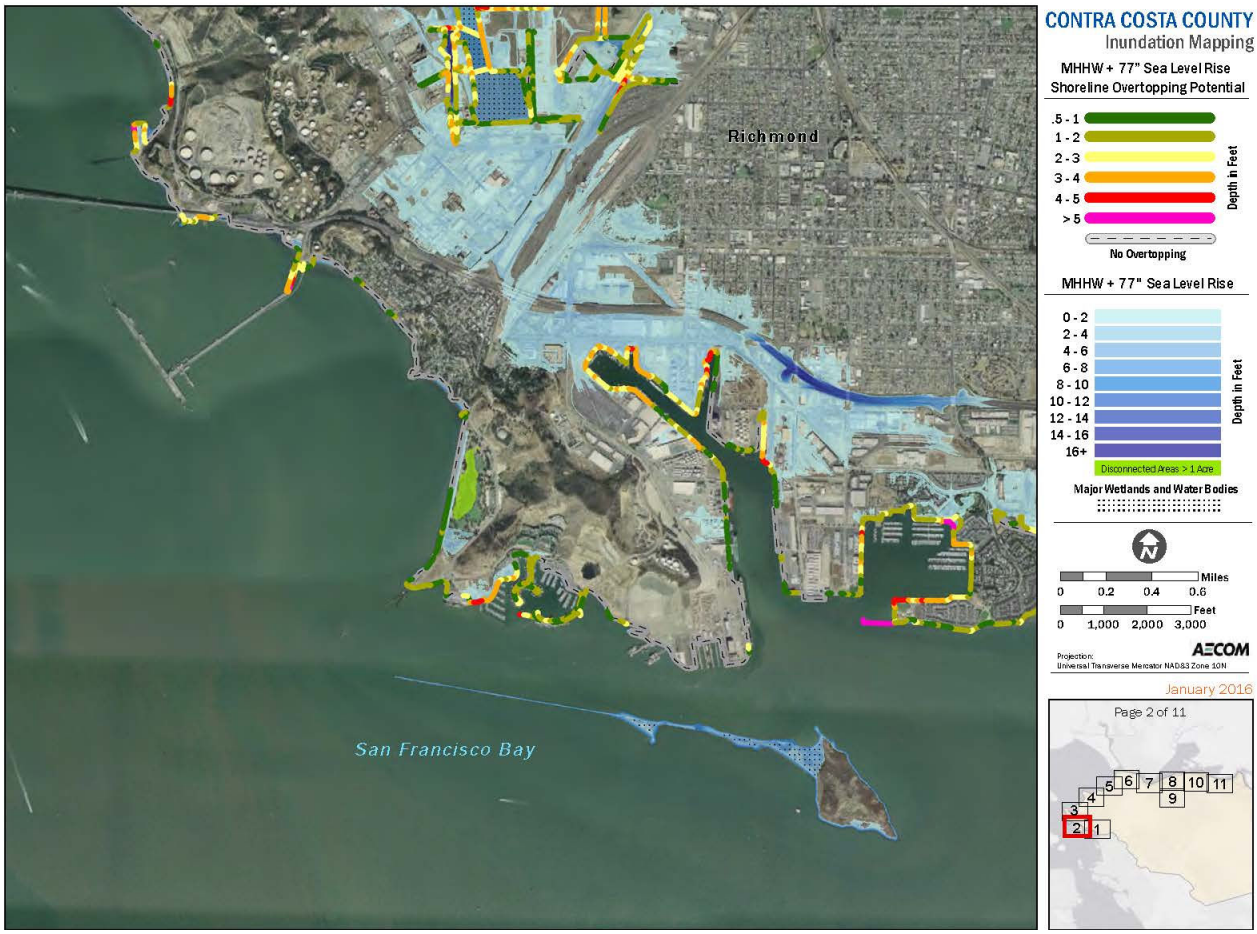


SOURCE: U.S. Census Bureau, 2015; CCC, 2004, 2012; AECOM, BCDC, 2015; City of Richmond, 2014, 2015

Project 150097.00

The Contra Costa County *Sea Level Rise Vulnerability Assessment Final Report*[35] from February 2016 provides a series of maps like the one shown in Figure 6.11, which depict shoreline overtopping potential (where the water surface elevation under a particular SLR scenario exceeds the elevation of the shoreline, based on the identified shoreline features currently in place) and average resulting water depths for SLR scenarios ranging from MHHW + 12 inches to MHHW + 108 inches. The report also includes a series of maps showing shoreline types, based on the same data sets used to generate Figure 6.10.

Figure 6.11: City of Richmond Shoreline Characteristics



Many shoreline flood management systems along the Bay are deficient relative to FEMA certification standards for levee crest elevation. This implies that the levees are at risk of being overtopped by 100-year Bay water levels, thereby failing to prevent inundation on the landward side. Sea level rise, which may cause the present 100-year water level of 11.0 ft NAVD to be exceeded annually by a King Tide by end-of-century, will worsen this deficiency of the flood management system. Where existing levees are deficient relative to geotechnical and erosion protection criteria, sea level rise will increase the geotechnical and erosion forces that the levees face, which makes levee failure more likely. A failed levee would further reduce flood protection, enabling overtopping to occur at lower elevations and greater rates.

Tidal marsh wetlands front portions of the City's coastal levees. In these locations, the marshes provide the ecosystem services of buffering wave heights and erosion. As such, the marshes contribute to the 'horizontal levee' system reducing coastal flood risk (ESA PWA, 2013[36]). Toward the end of the century, these marshes may not be able to independently sustain their elevation relative to sea level rise and may convert to mudflat (Stralberg et al., 2011[37]). Loss of the tidal marsh vegetation would expose the shoreline levees to greater risk of failure.

Wildcat and San Pablo Creeks drain approximately 11 and 42 square miles, respectively. Once the creeks exit the upper watershed canyons, they flow westward and parallel to each other through

San Pablo, Richmond, and North Richmond passing through an area of mostly industrial land uses before reaching Wildcat Marsh. From 1987 to 1992, U.S. Army Corps of Engineers (USACE) constructed a flood control project (referred to as Phase I[1]) on Wildcat and San Pablo Creeks to provide protection to development downstream of Union Pacific Railroad for the 100-year riverine flow at mean higher high water (MHHW). As the local sponsor, the Contra Costa County Flood Control and Water Conservation District (CCCFC&WCD) owns and maintains the channels as part of Flood Control Zones 6 and 7.

CCCFC&WCD is currently planning a levee rehabilitation project on Wildcat and San Pablo Creeks expected to begin in 2016. CCCFC&WCD found that in some locations the channel levees do not meet minimum FEMA freeboard requirements. Observations and modeling indicated that accumulated silt, despite a 2006 desilting effort, causes freeboard and channel bank deficiencies. Due to the difficulty in obtaining environmental permits and paying for mitigation for silt and vegetation removal, CCCFC&WCD decided to raise the levees to meet FEMA requirements, which are more stringent than the USACE original design. The levees were decertified in 2010 and recertification is required to remove the flood insurance requirements from the adjacent properties, including the West County Wastewater Plant and low-income North Richmond neighborhood. CCCFC&WCD receives only 8% of the funding necessary to maintain Wildcat and San Pablo Creeks due to funding restrictions associated with Propositions 13 and 218. As such, CCCFC&WCD applied for and received a Local Levee Critical Repair grant from the Department of Water Resources for the levee rehabilitation project.

Sea level rise will exacerbate riverine flooding. Tidal influence in Wildcat and San Pablo Creeks is within the USACE Phase I project and current levee rehabilitation project, currently extending to Garden Tract Road in Wildcat Creek and to Richmond Parkway in San Pablo Creek. Sea level rise will cause the tides to extend further ('migrate') upstream and raise water levels in the creek. This will progressively reduce the capacity of the creeks to discharge riverine flows, such that smaller, more frequent storms will cause overbank flooding and stormwater backups, particularly in low-lying areas that will no longer be able to effectively gravity drain against the higher downstream tidal condition. However, even before flooding, sea level rise will reduce available freeboard and levees may lose their FEMA accreditation, which would require residents and property owners in the floodplain to purchase flood insurance.

While overlaying FEMA Flood Insurance Rate Maps (FIRMs) and sea level rise inundation maps suggests the risk of joint coastal-riverine flooding, it may underestimate the potential for an increase in flood risk in the current 100-year floodplain due to sea level rise. Furthermore, simply overlaying FEMA FIRMs and sea level rise inundation maps (see Figure 6.12) may overlook areas at risk from joint coastal-riverine flooding. CCCFC&WCD performed sensitivity analysis as part of levee rehabilitation project hydraulic modeling and determined that the designed raised levees as can accommodate approximately 2 feet of sea level rise above MHHW before overtopping. Further analysis is needed to better understand the extent of flooding caused by combinations of Bay water levels, sea level rise, and flood flows.

[1] Significant flooding occurs upstream of Phase I; numerous efforts to initiate a Phase II flood control project have thus far been unsuccessful.

Figure 6.12: Current FEMA Flood Zones overlain with Sea Level Rise Projection

Map of current FEMA flood zones overlain with +6 feet sea level rise above MHHW (NOAA SLR Viewer; bright green indicates disconnected, low-lying areas and increasingly dark shades of blue indicate increasing flood depth).

Table 6.9: Vulnerability and Risk Profile for Flood Management

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• None identified.
Precipitation	• Erosion of levees and wetlands from increased wave forces. • Breaching and overtopping of levees.
Drought	• None identified.
Wildfire	• None identified.
Sea Level Rise	• Higher Bay water levels will cause changes in tidal and wave energy, leading to increased shoreline erosion and the potential that levees and other types of shoreline protection will be overtopped.
Vulnerabilities	
Category	**Vulnerability**
Information	• FEMA Flood Insurance Rate Maps (FIRMs) do not factor in sea level rise, which make it difficult for flood managers and communities to prepare for future flooding. Furthermore, FEMA FIRMs show the overlay of the 100-year riverine and coastal floodplains, whereby the 100-year riverine flow sets the upstream and the 100-year tidal condition sets the downstream flood extent. The joint probability of riverine and coastal events likely increases the elevation and extent of the 100-year floodplain, but FEMA FIRMs depict riverine and coastal flooding as independent events and use the higher of the two flood elevations where riverine and coastal floodplains overlap.

Table 6.9: Vulnerability and Risk Profile for Flood Management

Vulnerabilities (cont.)	
Category	**Vulnerability**
Physical	• After the levee rehabilitation project is completed, lower Wildcat and San Pablo Creeks will offer 100-year flood protection, but sea level rise will diminish its capacity to discharge flood flows over time, which could cause flooding at the West County Wastewater Plant and North Richmond community. • Some segments of the rail system located along the shoreline could serve as the first line of defense during storm events. However rail (track bed and ballast materials) is not constructed or maintained to prevent inland areas from flooding. In places where the railroad serves as the first line of defense, a failure of the railroad would result in flooding of inland communities and infrastructure.
Functional	• None identified.
Governance & Management	• Since Wildcat and San Pablo Creeks are federal facilities, improvements must be consistent with USACE policy to remain eligible for federal disaster relief. The USACE original design was constructed to include significant vegetation (not only for mitigation, but as a sustainability feature). However, subsequent USACE policy prohibits vegetation on any part of flood control levees. These conflicting vegetation goals make channel maintenance difficult. • CCCFC&WCD has to compete for grants to maintain and improve the creeks for flood control channel condition and capacity. A reliable financing mechanism is needed to address outstanding maintenance, capital improvement, and long-range flood management planning.
Consequences	
Category	**Consequence**
Economy	• Increased flooding along Wildcat and San Pablo Creeks could lead to disruptions to wastewater and transportation services, affecting the regional economy.
People	• Increased flooding in Wildcat Creek could result in extreme burden for North Richmond community members because they have limited resources to pay for flood insurance as well as prepare for, respond to, and recover from flood events.
Environment	• Increased flooding in Wildcat Creek could affect marsh habitat and endangered rail and saltmarsh harvest mouse populations in Wildcat Marsh. Increased flooding in Wildcat and San Pablo Creeks could also mobilize industrial substances and introduce contaminants to surrounding areas.

Priority Actions

Mitigation and Risk Reduction

- Flood-1. Conduct further analysis needed to better understand the extent of flooding caused by combinations of Bay water levels, sea level rise, and flood flows.
- Flood-2. Partner with ABAG and BCDC to integrate climate adaptation planning into the City's Local Hazard Mitigation Plan (LHMP), to address risks from flood hazards associated with climate change.
- Flood-3. Construct a shoreline protection system and storm drainage system that are initially built to accommodate a mid-term rise in sea level of 16 inches, with a design that is adaptable to meet higher than anticipated values in the mid-term, as well as for the long-term (GP Action EC6.G).

- Flood-4. Develop an Adaptive Management Plan that outlines an institutional framework, monitoring triggers, and a decision-making process, and creates an entity with taxing authority that would pay for infrastructure improvements necessary to adapt to higher than anticipated levels (GP Action EC6.G).
- Flood-5. Prioritize funding, or identify funding sources, to complete critical outboard levee repairs along Richmond shoreline to address erosion, overtopping, and subsidence, e.g., adding to existing riprap and maintain slopes.
- Flood-6. Inspect structural shorelines to identify problems early and maintain as necessary as sea level rises.

Preparedness

- Flood-7. Investigate opportunities for long-term, coordinated, multi-benefit shoreline protection approaches that would protect inland commercial and industrial areas from flooding, create habitat, and maintain or improve flood control capacity.
- Flood-8. Participate in collaborative regional discussions related to both regional and local scales, that include representatives from FEMA, USACE, BCDC, among others, to facilitate planning for future sea level rise and storm events by sharing technical knowledge on forecasting/modeling, discussing funding strategies for improvement projects, and identifying possible regulatory challenges and solutions for flood control improvement projects.

6.9 Energy Infrastructure

Contra Costa County ART References: Energy Sector Chapter

This functional asset category includes critical local facilities for the City's energy security including power stations, transmission lines, gas pipelines, and the City's reliance on regional infrastructure.

Electricity Infrastructure

Numerous studies have highlighted the impact of climate change on California's energy infrastructure, which in turn impacts power availability to the City. In a recent study, the California Energy Commission (CEC) highlights a constellation of negative climate change impacts on the grid system including higher temperature impacts on power plant capacity, electricity generation, transmission lines, substation capacity, and peak electricity demand; increased wildfire frequency or severity and the resulting impacts near transmission lines; and sea level encroachment upon power plants, substations, and natural gas facilities.[38] The study suggests that up to 25 coastal power plants and 86 substations in California are at risk of flooding (or partial flooding) due to sea level rise, and that hydropower generation in the Sierra Nevada (which supplies 75% of California's hydro power) will be diminished by approximately 20%. This will place a higher demand on other sources of renewable energy as cities like Richmond pursue their low-carbon energy targets.

Electricity is critical during an emergency. In addition to enabling communications, electricity is needed to run pumps (stormwater, flood control, wastewater) and maintain emergency response centers and facilities. Power substations provide electricity through a networked grid; if one substation is damaged or disrupted there could be downstream (cascading) consequences even though there is some redundancy within the overall grid. As shown in the table below, five substations in Richmond are exposed to current and/or future flooding. Four of which are privately owned and one is owned by PG&E. One is located in the 100-year floodplain and is exposed to 4 feet of sea level rise or more.

Table 6.10: Richmond Power Substations Inundated by Current 100-year Flood and with Sea Level Rise

Substation	City	Owner	Current 100-year Flood	Sea Level Rise					
				1'	2'	3'	4'	5'	6'
RICHMOND R	RICHMOND	PG&E	No	No	No	No	No	Yes	Yes
STANDARD OIL 1	RICHMOND	OTHER	No	No	No	No	No	Yes	Yes
STANDARD OIL 2	RICHMOND	OTHER	No	No	No	No	No	Yes	Yes
STANDARD OIL 4	RICHMOND	OTHER	No	No	No	No	No	No	Yes
STANDARD OIL 5	RICHMOND	OTHER	Yes	No	No	No	Yes	Yes	Yes

Utility Natural Gas Infrastructure

A potential climate risk to the natural gas infrastructure is inundation of pipelines (for a broader discussion of industrial pipelines, please see section on Commercial and Industrial Assets) and pumping stations due to temporary flooding or sea level rise. PG&E's natural gas distribution network includes mains and service lines that which connect customers with the service mains. Buried pipelines are directly and indirectly sensitive to higher groundwater table and salinity intrusion. Exposure to salt water can corrode pipelines that are not protected as specified in federal and state regulations. Rising

groundwater levels could increase liquefaction potential leading to additional damage during a seismic event. In the event of flooding, pipelines that are not weighted or anchored may float and become exposed, particularly during prolonged flooding and in marshy or sandy soils. Erosion during storm events could also expose and damage pipelines. Damage to pipelines could result in service disruptions as well as threats to public safety and the environment in the event of an explosion or release of hazardous contents.

The location of PG&E's natural gas mains and service lines is restricted information, and was not available for this study.

Table 6.11: Vulnerability and Risk Profile for Energy Security and Infrastructure

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• Transformers exploding • Overhead lines sagging • More frequent and severe heat waves lead to energy usage spikes • Thermal inefficiency in generating plants could reduce energy supplies to grid system • Degraded efficiency in transmission lines could disrupt supplies.
Precipitation	• Flooding from San Pablo and Wildcat Creeks • Loss of access to facilities
Drought	• Reduced snowpack for hydropower generation
Wildfire	• Grid disruption could result when wildfires disrupt or impede grid transmission interrupting the delivery of energy supplies.
Sea Level Rise	• Increased inundation and rising groundwater may limit access to energy facilities and infrastructure for maintenance and operations; Inability to access transmission towers. • As the Bay rises, groundwater levels and salinity intrusion will increase, damaging below or at-grade infrastructure, and requiring additional pumping and costly maintenance and repairs of stormwater and flood control facilities.
Vulnerabilities	
Category	**Vulnerability**
Information	• Lack of easily accessible information on natural gas pipeline material, age, eccentricities, and weld type make this infrastructure vulnerable to inefficiency in maintenance and implementation of projects related to pipelines. • Information was not available regarding the possibilities of load sharing among substations, or if electricity companies plan for or have the operational capacity to load share in the event of shutdowns.
Physical	• Facilities and network systems, including onsite wastewater treatment plant, roads, rail/ship terminals, and pipelines that are located in low-lying areas are unlikely to have been constructed to withstand flooding, higher groundwater levels, or salinity. • Pipes that are not properly protected are sensitive to corrosion if exposed to saltwater either in areas that are flooded or if there is saltwater intrusion. The material covering some pipelines may be sensitive to erosion, which could result in direct exposure and potential damage of the pipeline. • Flooded pipelines could float and become exposed if not weighted or anchored. Rising groundwater also increases the risk of liquefaction, which could damage buried pipelines in a seismic event.

Table 6.11: Vulnerability and Risk Profile for Energy Security and Infrastructure

Vulnerabilities (cont.)	
Category	**Vulnerability**
Physical (cont.)	• The equipment in substations is sensitive to water. Salt water, in particular, may cause corrosion, especially if the plant or station has not been shut down in advance of flooding. Below ground electrical or mechanical equipment may be sensitive to groundwater intrusion. • Structures and equipment may be damaged during a seismic event especially in areas susceptible to liquefaction, which may become more extensive as groundwater rises.
Functional	• Damage to pipelines could result in service disruptions as well as threats to public safety and the environment in the event of an explosion or release of hazardous contents. • Even if pipelines in the project area are protected, the asset is dependent on all parts of the pipeline network to be in working order. Although many of pipeline segments have safety valves to allow for a shut down in an emergency, this process may take some time and therefore advance warning is necessary if the pipeline is to be safely shut down. • Substations are part of the electricity grid, and if one substation goes out, electricity can usually be rerouted through another substation to its customers. However, if several substations go out, the service could be interrupted and it could have downstream consequences.
Governance & Management	• In the event that a pipeline is affected by a storm flooding event, existing operations and maintenance plans may not have well-coordinated plans that are shared with emergency responders and other relevant entities describing procedures for shutdown and other measures to minimize damages. Pipelines are often co-located with other interconnected infrastructure, like railroads and roads, so governance decisions may require coordination between these agencies, in addition to other stakeholders owning adjacent parcels. • Existing operations and maintenance plans of power plants and substations may not include well-coordinated shutdown plans to be implemented in the event of an emergency.
Consequences	
Category	**Consequence**
Economy	• The disruption of substation power could result in business closures, with corresponding losses in productivity, revenues, and income. • Disruption of natural gas pipelines could result in the slowing or halting industrial production, with corresponding losses in productivity, revenues, and income.
People	• Direct societal consequences of pipelines flooding are likely to be minimal to moderate, depending on the severity of disruption of natural gas transport and distribution. However, if damaged pipelines explode or leak there could be health risks to nearby populations. • Disruptions to substations could result in loss of power, with consequences for residents and those who work in the affected areas. Substations contain hazardous materials that could harm people and contaminate their property if released into floodwaters.
Environment	• Substations contain hazardous materials that could harm the health of wetland habitats and sensitive species if floodwaters carry them into the Bay or nearshore areas.

Priority Actions

Mitigation and Risk Reduction

- Energy-1. Consider increased risk to energy assets from climate change exposures (sea level rise, flooding and associated higher risk of liquefaction) and potential cascading impacts in emergency response and contingency plans, including the Local Hazard Mitigation Plan.

- Energy-2. Incorporate into emergency response plans the public health risks to neighborhoods and vulnerable populations from natural gas pipeline leaks.

Preparedness

- Energy-3. Work with PG&E to better understand the vulnerabilities of Richmond's electricity and natural gas infrastructure and the consequences of failure or disruption.

6.10 Solid Waste/Hazardous Materials Management

Contra Costa County ART References: Waste Collection Chapter, Contaminated Lands Chapter, West Contra Costa Sanitary Landfill Profile Sheet

This category of assets includes the systems and infrastructure that support the safe and secure management of solid waste and hazardous materials/waste, as well as the management of contaminated lands (brownfields and landfills) that prevents release of contaminants to the environment.

Figures 6.13, 6.14 and 6.15, from the Contra Costa County ART Project, show the location of landfills, brownfields and industrial parcels at risk from sea level rise and coastal flooding. Location of hazardous materials sites potentially exposed to flooding are shown on Figures 6.18, 6.19. and 6.20 in Section 6.12: Commercial and Industrial Assets.

Figure 6.13: Industrial Parcels and Hazardous Materials Sites – Richmond Southeast

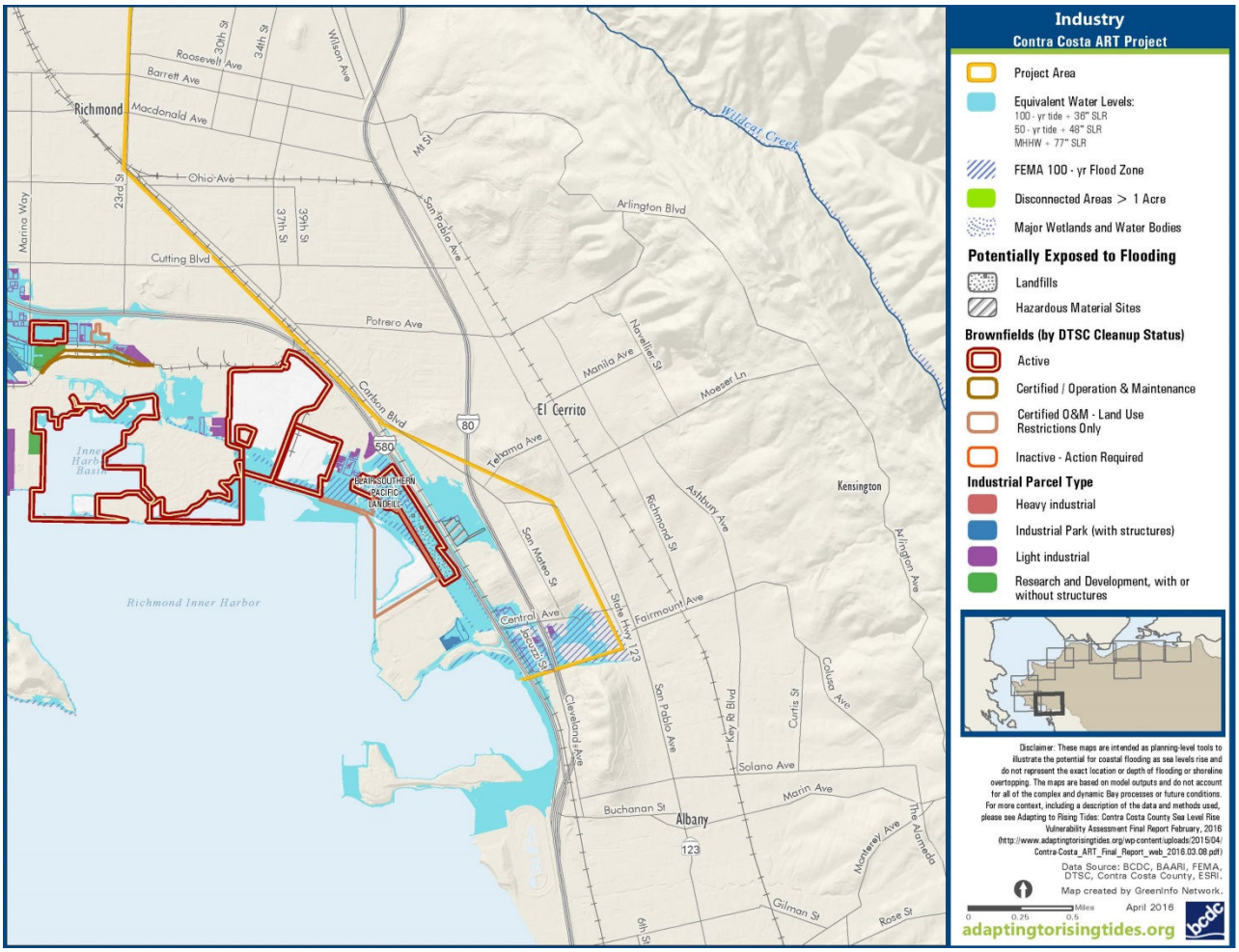
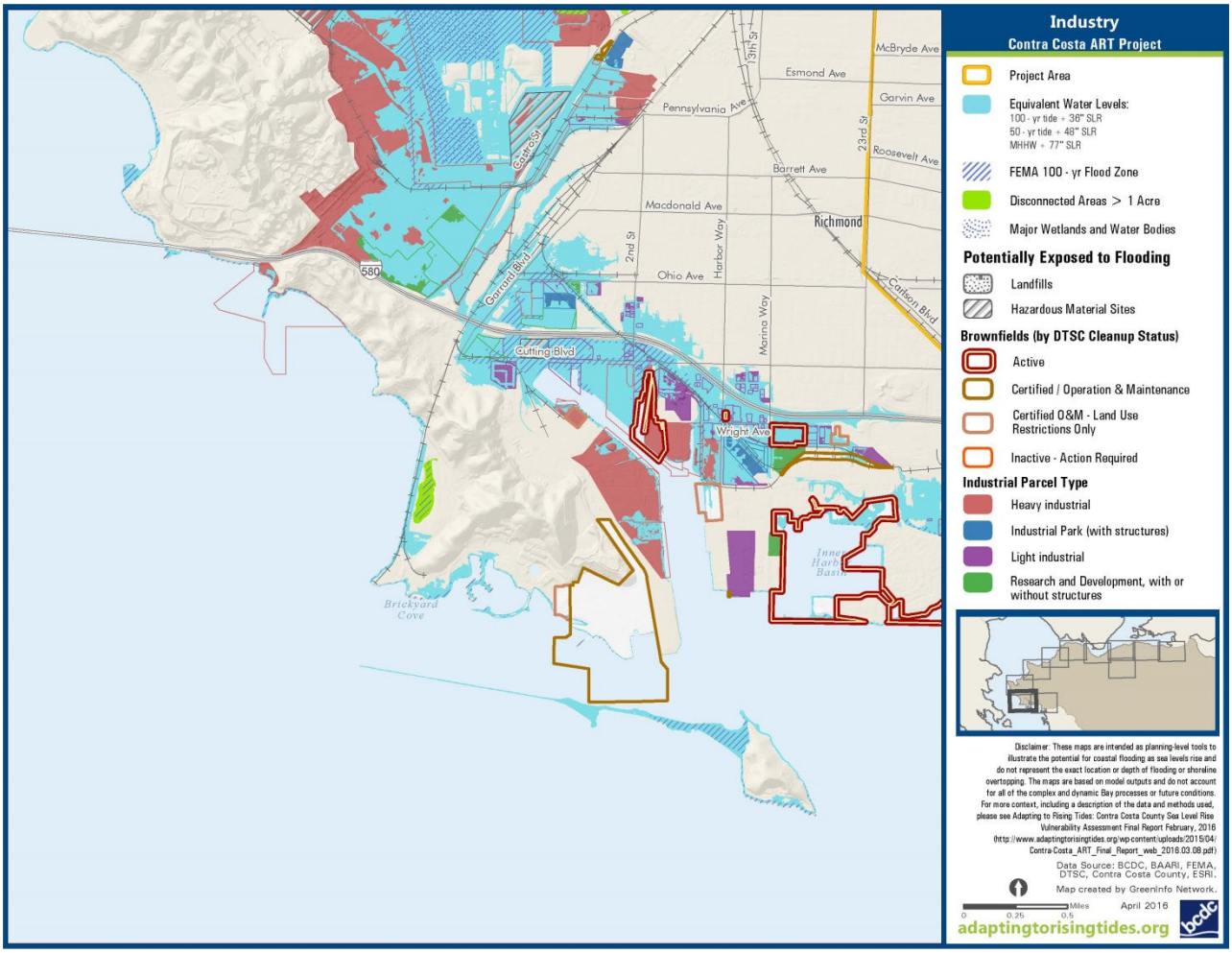


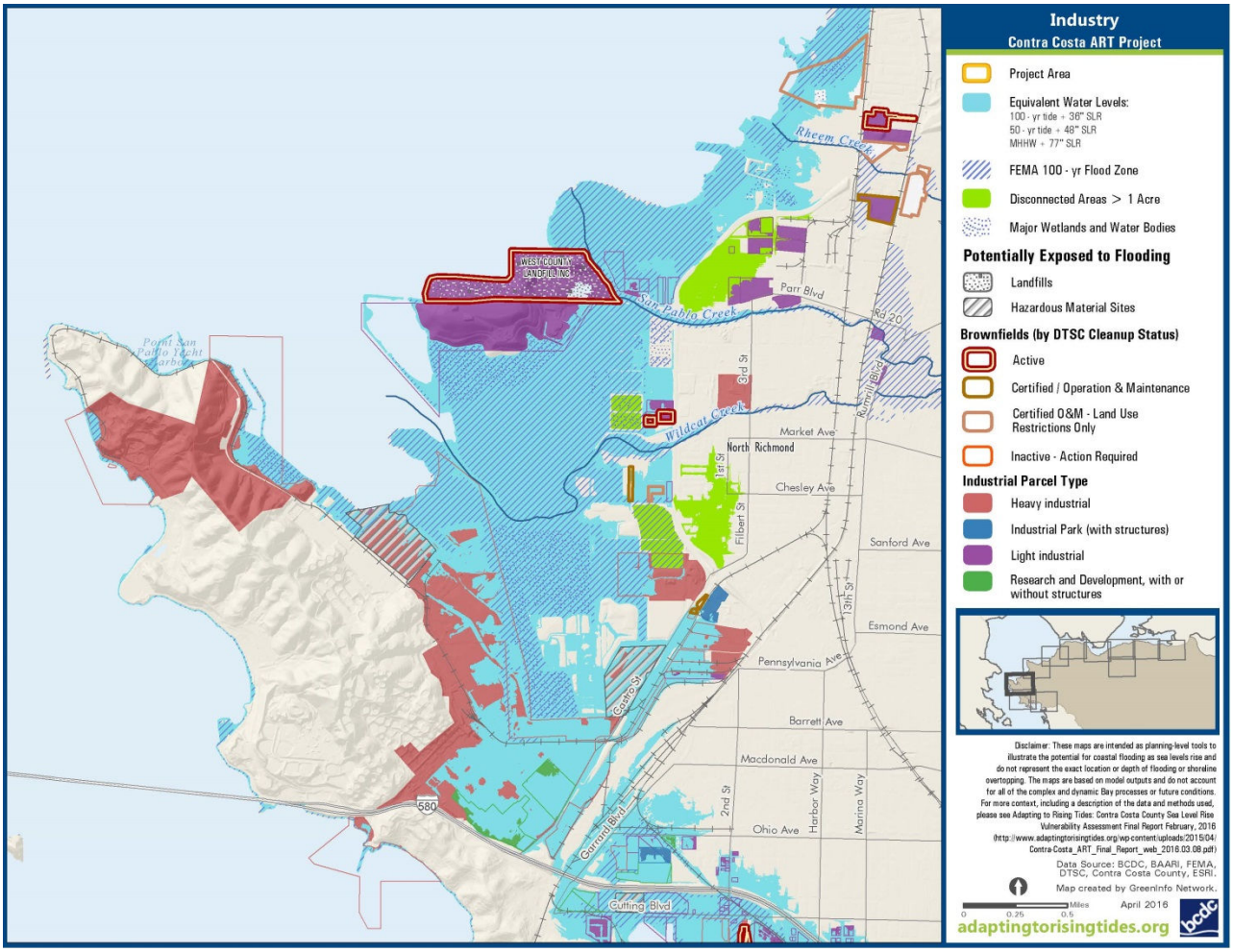
Figure 6.14: Industrial Parcels and Hazardous Materials Sites – Richmond Port and Harbor Areas



West Contra Costa Sanitary Landfill

Closed since February 2012, the West Contra Costa Sanitary Landfill (also known as the West County Sanitary Landfill) is located at Parr Boulevard and Garden Tract Road, adjacent to tidal wetlands (including Wildcat Marsh) and San Pablo Bay. It is a capped facility that includes both Class I and Class II landfill components. The Class I landfill is located within the Class II landfill and is a Hazardous Waste Management Facility (HWMF). The HWMF is 28 acres and the Class II landfill is approximately 160 acres. The HWMF and the Class II landfill are each surrounded by slurry walls with leachate extraction and monitoring wells. Leachate is conveyed to the nearby West County Wastewater Treatment Plant for treatment and discharge. The Golden Bear Transfer Station and the three-megawatt Nove power generation facility are located within the footprint of the landfill. Additional permitted activities at WCCSL include a concrete crushing plant, a green waste grinder, and a construction and demolition debris recycling facility. The WCCSL provides public access and recreational benefits and there is Bay Trail access around the closed the landfill (Wildcat Marsh and Landfill Loop Trails).

Figure 6.15: Industrial Parcels and Hazardous Materials Sites – Richmond Northwest



Increased flooding, groundwater levels, or tidal, wind and wave energy could have significant consequences on landfill waste containment systems, potentially impacting public health and nearby ecosystems if contaminants are released. Low-lying portions of the landfill are within the 100-year floodplain and are at risk from sea level rise. The permanent containment of non-hazardous and municipal wastes at the landfill is vulnerable to flooding because of the proximity to the Bay, limited access via Parr Road, the type of onsite facilities and uses, and the potential that flooding could be long duration or even result in permanent inundation. The direct disruption of the closed landfill, particularly the Class I landfill component, could have significant consequences for public health and nearby ecosystems if contaminants were released into the environment. While there is currently a leachate collection system in place, the current system may or may not be sufficient to collect and treat additional water volumes that might result from sea level rise. Access to the landfill is from Parr Boulevard, which could be disrupted with 2-3 feet of sea level rise.

Current Regional Water Quality Control Board (RWQCB) long-term flood protection requirements are one mechanism to ensure landfills are identifying and addressing increased flood risks due to sea level rise. However, as this approach is geared towards site-specific actions it may not suffice in locations where landscape-scale responses that include landfill sites are warranted.

Hazardous Waste

The City's Household Hazardous Waste (HHW) drop-off station is located with the West County Resource Recovery Recycling Center on Pittsburg Avenue in Northern Richmond. The facility is governed by West Contra Costa Integrated Waste Management Authority ("RecycleMore"), a joint powers authority (JPA) of the Cities of El Cerrito, Hercules, Pinole, Richmond and San Pablo, and Contra Costa County, and is managed by West County Resource Recovery, Inc., a subsidiary of Republic Services. Inc. Hazardous wastes are received at this facility on an ongoing basis. The facility has capacity limitations applicable for each type of hazardous material it receives and only stores waste temporarily on site before it is transported to other locations for recycling or disposal, as appropriate.

The Richmond HHW facility is not considered to be directly at risk from sea level rise. It is not within the 100-year floodplain, but it is within the current 500-year floodplain. Although the Richmond HHW facility is not directly exposed to sea level rise, its function could be impacted if local roads are flooded. The HHW facility relies on road access to get people (staff, county residents) and hazardous waste to and from the facility, and if the road network is disrupted due to flooding the facility may not be able to function as a collection site. Diminished or lost access would disrupt community disposal of household hazardous waste, which after a flood would also have consequences on the efficiency and safety of the post-flood clean-up process. If there was unexpected flooding of the HHW facility there could be significant consequences for public health and nearby ecosystems if wastes were released into the environment.

Waste Transfer Station

There is one waste transfer station in Richmond, Golden Bear Transfer Station, which acts as an intermediate collection point for municipal solid waste. The station transfers locally-collected waste to the Keller Canyon Landfill in Pittsburg. Golden Bear Transfer Station is owned and operated by Republic Services, Inc., and is located at the end of Parr Boulevard at the mouth of San Pablo Creek in an area of industrial and commercial land uses.

Golden Bear Transfer Station is located within the 100-year floodplain and will be exposed to 2-3 feet of sea level rise. The station is vulnerable to future flooding because it relies on vulnerable roads and access routes to move trucks and waste in and out of the facilities. The station is accessed solely by Parr Boulevard, which is at risk of flooding with 2-3 feet of sea level rise. Temporary or permanent closure of the transfer station could cause significant disruptions for community garbage collection services, and increase the distance and expense of hauling waste.

Brownfields

Brownfields are environmentally distressed properties where expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Both the RWQCB and the California Department of Toxic Substances Control (DTSC) share oversight of cleanups through a 2004 Memorandum of Agreement. Of the 63 Brownfield sites identified by the Contra Costa County ART Project, more than two-thirds are in the City of Richmond, with many potentially exposed to increased flooding from sea level rise. There are at least 68 different contaminants of concern associated with Brownfields evaluated in the Contra Costa County ART Project area, including various metals, corrosive materials, petroleum products, volatile organics, organochlorine pesticides, and other compounds. Nearly all of the Brownfield sites have multiple contaminants of concern, and often have more than one contaminant of the same type, for example more than one kind of metal. The most common contaminant of concern is lead, which is found at nearly two-thirds of sites considered in the project area. These contaminants can potentially affect soil, sediments, sediment vapor, groundwater or surface water.

Brownfields cleanups are site-specific and based on current standards for where the site is located, e.g., upland or aquatic, and the approved site reuse. Upland sites that become aquatic as sea level rises will most likely not have been cleaned up to the higher standard usually required for aquatic sites. In addition, the opportunity for further cleanup of Brownfields to address changing flood or groundwater conditions will vary because remedies are site specific and because cleanup depends in part on being able to locate the responsible party and on these parties having the necessary funds to undertake the cleanup. Where responsible parties cannot be found or do not have sufficient funds, the cleanup process may be delayed or public funds must be used.

Table 6.12: Vulnerability and Risk Profile for Solid Waste/Hazardous Materials Management

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• None identified
Precipitation	• Increased erosion potential • Increased flooding of roadways and facilities
Drought	• None identified
Wildfire	• None identified
Sea Level Rise	• Higher Bay water levels especially during storm events will flood larger areas for longer periods of time, which may result in the increased mobilization of pollutants if contaminated lands such as closed landfills are subjected to prolonged inundation. • As the Bay rises it is predicted that groundwater levels will also rise, which could contribute to mobilizing pollutants that are currently in vadose zone at brownfields and other contaminated lands.
Vulnerabilities	
Category	**Vulnerability**
Information	• The Richmond HHW facility has an emergency preparedness and response plan. However, if this plan is out of date, or if facility operators do not practice or implement plan action items, or do not adequately coordinate with local, regional and state authorities, this facility will be more vulnerable to storm event hazards.
Physical	• The volume and type of wastes contained at West Contra Costa Sanitary Landfill make it extremely challenging and expensive to relocate the function of the landfill and therefore it needs to be protected in place. • While landfill cover systems are designed to prevent water infiltration, leachate extraction systems may or may not be sufficient, depending on the volume of inundation, to collect and dispose of the additional leachate if flooding occurs. • Waste containment systems designed for existing conditions may not be adequate to withstand permanent flooding, increased storm energy, or increased storm wave erosion, depending on their design and maintenance and the location of the landfill. • Displacement of the ground due to liquefaction during a seismic event could compromise the stability of waste containment facilities, such as landfill caps or liners, caps over remediated sites, and slurry walls constructed to contain contaminants. Damage to the caps, liners, and containment systems could be costly to repair and would make the landfill more vulnerable to flooding. • The HHW facility is at grade, and may have hazardous waste stored at grade that could be impacted by a flood event. • The HHW facility is not designed to withstand flooding. If it was exposed to floodwaters, it could suffer damage that would require extensive repairs.
Vulnerabilities (cont.)	
Category	**Vulnerability**

Table 6.12: Vulnerability and Risk Profile for Solid Waste/Hazardous Materials Management

Physical (cont.)	• Waste that is temporarily stored at the transfer station site would only be released into the environment if there was an unexpected, catastrophic high impact flood event that occurred without time for the waste stored on site to be removed or contained. • Some Brownfields can be cleaned up through the removal of contaminated soil. For sites where the removal of all contaminants is infeasible due to technical challenges or funding issues, remaining contamination is typically capped and remediated in place. Remediation practices such as permeable reactive barriers that need to be in-situ for a long duration and rely on existing groundwater flow rates, directionality and salinity level, may not continue to be effective as sea level rises. • Past remediation and cleanup standards may not consider impacts of sea level rise, and sites that have been cleaned up to upland standards, or for specific groundwater and salinity levels, could be vulnerable if exposed to increased temporary flooding, permanent inundation, or changes in groundwater or salinity levels. • Sediment-bound contaminants are vulnerable to erosion, which could transport them into the Bay, while water soluble contaminants are vulnerable to flooding and rising groundwater. While groundwater in nearshore clay or mud deposits does not move very fast or far, sites that are located further inland may be vulnerable to increasing groundwater levels.
Functional	• The West Contra Costa Sanitary Landfill requires local road access for site management (e.g. monitoring, repairs or upgrades to waste containment systems). Short-term disruption of road access during a storm event or longer-term disruption due more persistent flooding will interrupt ongoing operations and make site management more difficult. • The landfill is a multi-use asset, and the Bay Trail loop on the landfill provides important public recreation opportunities and scenic views. The portion of the Bay Trail east of the landfill along Richmond Parkway does not provide redundancy for shoreline access, but does provide connectivity between Bay Trail points north and south of the landfill loop. • The HHW facility relies on local roads and transportation to function, and has limited access in and out. Flooding of the road network could fairly easily disrupt operations at the facility. • If the HHW facility was closed permanently, siting a new facility would be very challenging due to regulatory restrictions, funding, and concerns from the public. • Garbage collection trucks and personal vehicles drop off waste at Golden Bear Transfer Station, and large trailers transport that waste to Pittsburg via local roads that are at risk of flooding. There are also limited access roads at the station. If these roads were disrupted, the transfer stations would be unable to function. • Transfer stations are specialized facilities and finding alternative sites to serve the same function would be challenging if the Golden Bear Transfer Station was closed. Transfer stations have a number of siting requirements, such as a location able to accommodate large trucks, and easy access to truck-accessible haul routes that avoid congested areas. Adjacent communities may also object to the creation of a new transfer station, due to concerns about increased truck traffic, noise, health and safety, property values, or other issues. • Trucks that normally use Golden Bear Transfer Station may be able to rely on the Contra Costa Transfer and Recovery Station in Martinez as a temporary alternative transfer location in the event that Golden Bear is inaccessible, as it is an intermediate point en route to the Keller Canyon Landfill. • Brownfields are typically cleaned up to specific upland standards and for the type of proposed re-use, for example industrial, habitat or open space land uses. Sites that become partially or fully exposed to the tides as sea level rises would need to be cleaned up to more stringent aquatic standards. Locating the original responsible party and requiring them to fund the further cleanup to protect aquatic resources would be challenging. • Some of the Brownfields in Richmond are protected from flooding by structures on site, for example the Shipyard #3 and Union Carbide Brownfield sites are within the Port of Richmond and are protected from flooding by the port's structural shoreline. Other Brownfields sites are protected from flooding by shorelines that are owned and managed by others.

Vulnerabilities (cont.)

Category	Vulnerability

Table 6.12: Vulnerability and Risk Profile for Solid Waste/Hazardous Materials Management

Governance & Management	• The Hazardous Waste Management Facility and West Contra Costa Sanitary Landfill serve multiple objectives, including hazardous and municipal waste storage, respectively, and are subject to a complex regulatory process. Any comprehensive planning or major changes at the site would require Republic Services to coordinate internally among its subsidiaries, as well as obtain multiple permits and coordinate with multiple entities, including the State DTSC, the RWQCB, the San Francisco BCDC, City of Richmond, Contra Costa County, West County Wastewater District, and East Bay Regional Park District. • The West County HHW facility is owned by a JPA, as well as managed by a separate private entity. While a JPA provides a framework for joint decision-making, it could complicate planning and funding decisions to address sea level rise and future storm event challenges. • The HHW facility will need to coordinate with other landowners and managers to address flooding of the assets it relies on, in particular the roads that provide access to and from the facility. • If the Golden Bear Transfer Station was closed permanently, siting and operating a new, alternative transfer station would require numerous state and local approvals and permits from multiple agencies. • Because the Golden Bear Transfer Station is located in an area where other important assets are also at risk (i.e., the West County Wastewater District and the West County Sanitary Landfill), any solution to flooding needs to be addressed in the larger context and take into account the other adjacent uses. • Most Brownfields sites are privately owned, and cleanup depends in part on being able to locate the responsible party and on these parties having the necessary funds to undertake the cleanup. Where responsible parties cannot be found or do not have sufficient funds, the cleanup process may be delayed or public funds must be used. • Agencies may have shared oversight responsibilities over individual Brownfields sites, or different agencies may have oversight over sites that are physically close to one another. This could potentially create challenges in coordinating information and action to address sea level rise impacts. • There are no effective regulatory or financing mechanisms to prioritize the remediation of Brownfields that will be affected by sea level rise. Additionally, these sites may not provide the most appropriate redevelopment opportunities, further diminishing any incentive to conduct cleanup activities. This is especially true for sites such as landfills that once cleaned up are generally reserved for habitat or open space.
Consequences	
Category	**Consequence**
Economy	• A release of contaminants from West Contra Costa Sanitary Landfill could strain local emergency resources and could result in high cleanup and recovery costs. Additionally, onsite services and facilities, such as Nove Power and the Golden Bear Transfer Station, could cease operation either temporarily or permanently, resulting in the need for alternative and comparable services. Jobs at onsite facilities could also be impacted. • Flooding of the HHW facility could strain local emergency resources and could result in high cleanup and recovery costs. • Disruption or closure of the Golden Bear Transfer Station would increase the cost associated with waste collection in West and/or Central Contra Costa, due to the additional distance that local garbage collection trucks would need to travel to drop off waste. Jobs at the transfer station or driving transfer trucks could also be impacted. • Brownfields cleanup can be very costly, and often must be undertaken with public funds, which are extremely limited and difficult to obtain. Brownfields undergoing active cleanup are also typically slated for redevelopment, and disruption of these site and release of contaminants could result in loss of economic investment or potential.
Consequences (cont.)	
Category	**Consequence**
People	• The West Contra Costa Sanitary Landfill would pose a risk to public health if contaminants

Table 6.12: Vulnerability and Risk Profile for Solid Waste/Hazardous Materials Management

	currently contained on site were released to surrounding surface or groundwater. In place leachate collection systems may or may not be sufficient to collect and treat additional water-intrusive volumes. Flooding could also result in a disruption or loss of public access and recreation, including the use of picnic areas and trails suitable for walking, biking, and wheelchair access. • At the HHW facility there could be significant consequences for public health if hazardous wastes were released into the environment. If the HHW facility was disrupted, the community would lose access to a safe disposal location for household hazardous waste, and would have to find alternative disposal locations either temporarily or permanently. Some individuals might resort to illegal dumping of hazardous waste. Access to HHW facilities is also important for the safe disposal of hazardous waste after a flood event in communities they serve, and disruption of one or both facilities could affect the efficiency and safety of the post-flood clean-up process. • If the Golden Bear Transfer Station was disrupted, waste collection for communities in West and Central Contra Costa County would lack a transfer point, and would likely need to be temporarily or permanently re-routed to the Contra Costa Transfer and Recovery Station in Martinez (if active) or directly to the Keller Canyon Landfill. This could disrupt garbage collection services for the community, and some individuals might also resort to illegal dumping of waste without a convenient drop-off location. Access to transfer stations is also important for the safe disposal of waste after a flood event in communities they serve, and disruption of the station could affect the efficiency and safety of the post-flood clean-up process. • With sea level rise, Brownfields that have not been fully cleaned up, or cleaned up to a less stringent upland or re-use standards, may pose a risk to public health if onsite contaminants are released to residential areas or to areas with sensitive receptors (e.g., elderly, very young, medically challenged). While there are engineering control methodologies and technologies available for use at upland sites to protect occupants of buildings constructed on contaminated sites, and in particular where groundwater drives soil vapors up and into occupied spaces, these technologies will not be in place in areas that are newly exposed to contaminates due to sea level rise or changing groundwater levels.
Environment	• There could be significant water quality impacts if there was a release of contaminants from the West Contra Costa Sanitary Landfill into adjacent natural areas that support a variety of species and habitats. The site provides habitat for a variety of species, both as part of the covered and vegetated landfill and at a 40-acre onsite retention pond. If the asset were disrupted, it could cause the direct loss of habitat and species onsite, as well as having impacts on surrounding natural areas such as San Pablo Bay, San Pablo Creek, San Pablo Creek Marsh, and Wildcat Marsh. • At the HHW facility there could be significant consequences for habitat and wildlife if hazardous wastes were released into the environment. A release would most likely impact nearby creeks or groundwater. A number of household hazardous wastes are specifically designed to have negative biological impacts (e.g. pesticides, poisons), and many others are known to cause serious physical or reproductive harm to wildlife. Rising groundwater levels could also result in hazardous waste leaching into the water table if the waste is not stored properly. • Because of the small quantities of waste material stored or transferred at the Golden Bear Transfer Station, impacts to the environment would be limited. However, the disruption or closure of the transfer station could possibly create air quality impacts, given the increased distance that local garbage collection trucks would need to travel in order to drop off waste. • Many common Brownfields contaminants that remain on site post-cleanup are at levels that are not harmful to people, however the levels that remain on sites cleaned up to upland standards can be harmful to aquatic receptors. If released to the Bay and shoreline, these contaminants would have significant adverse impacts on aquatic species.

Priority Actions

Mitigation and Risk Reduction

- Waste-1. Identify Brownfields vulnerable to sea level rise and associated flooding and rising groundwater levels, and assess risk of contaminant exposure to people and the environment. Identify where governance vulnerabilities will present challenges to risk mitigation.
- Waste-2. Prioritize the remediation of contaminated sites based on the timing of exposure to sea level rise, storm events, and elevated groundwater, degree of vulnerability, and extent of the consequences.
- Waste-3. Require facilities that generate, transport, and/or store hazardous materials to consider vulnerability and risks of sea level rise, storm events, and elevated groundwater in emergency plans, facility operations, and capital improvement plans
- Waste-4. Require that hazardous materials are stored above predicted flood levels or are protected from flood damage
- Waste-5. Encourage residents and landowners to use hazardous waste disposal and drop off locations to reduce the amount of potentially hazardous materials released during a flood event.

Preparedness

- Waste-6. Enhance emergency response and contingency plans for the City of Richmond HHW facility for flood event that causes temporary shutdown or prevents access to the facility.
- Waste-7. Develop contingency plan for temporary shutdown or prevention of access to the Golden Bear Transfer Station in the event of flooding, which could impact community garbage collection services.

6.11 Parks, Natural Areas, and EcoSystems

Contra Costa County ART References: Natural Shorelines Chapter, Parks and Recreation Chapter

This asset category includes parks, natural areas and ecosystems that provide recreational and aesthetic value, are critical to local flora and fauna, and provide ecosystem services (e.g., flood control, wave surge protection, erosion control, nutrient retention, water quality improvement). Figure 6.16 depicts the City's shoreline parks and wetland areas as well as the Bay Trail as it currently exists along the shoreline. Figure 6.17 provides a more comprehensive view of Richmond's parks and open space including upland areas not at risk from sea level rise but vulnerable to other climate change impacts such as heat, drought, and invasive species.

Figure 6.16: City of Richmond Shoreline Open Space

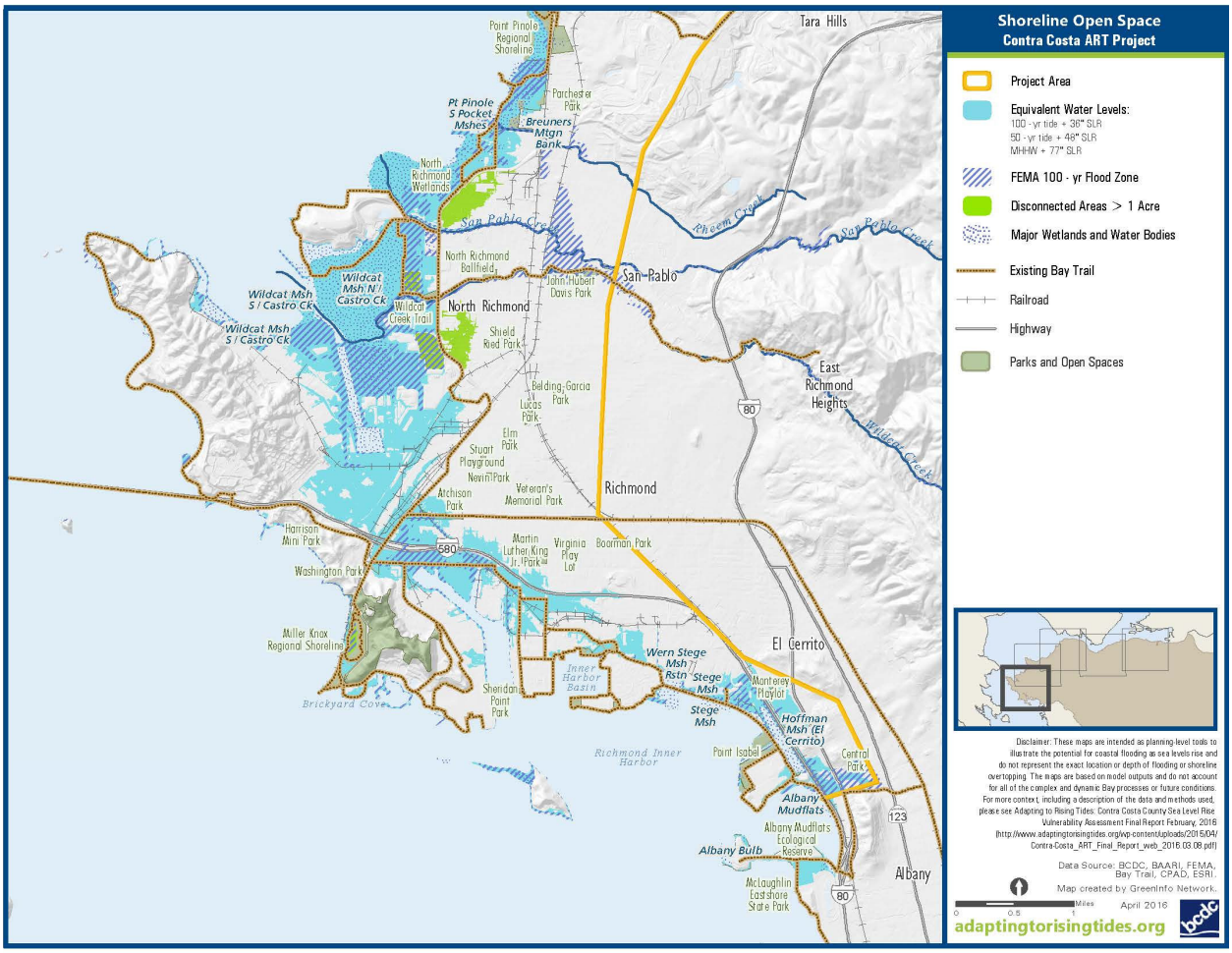
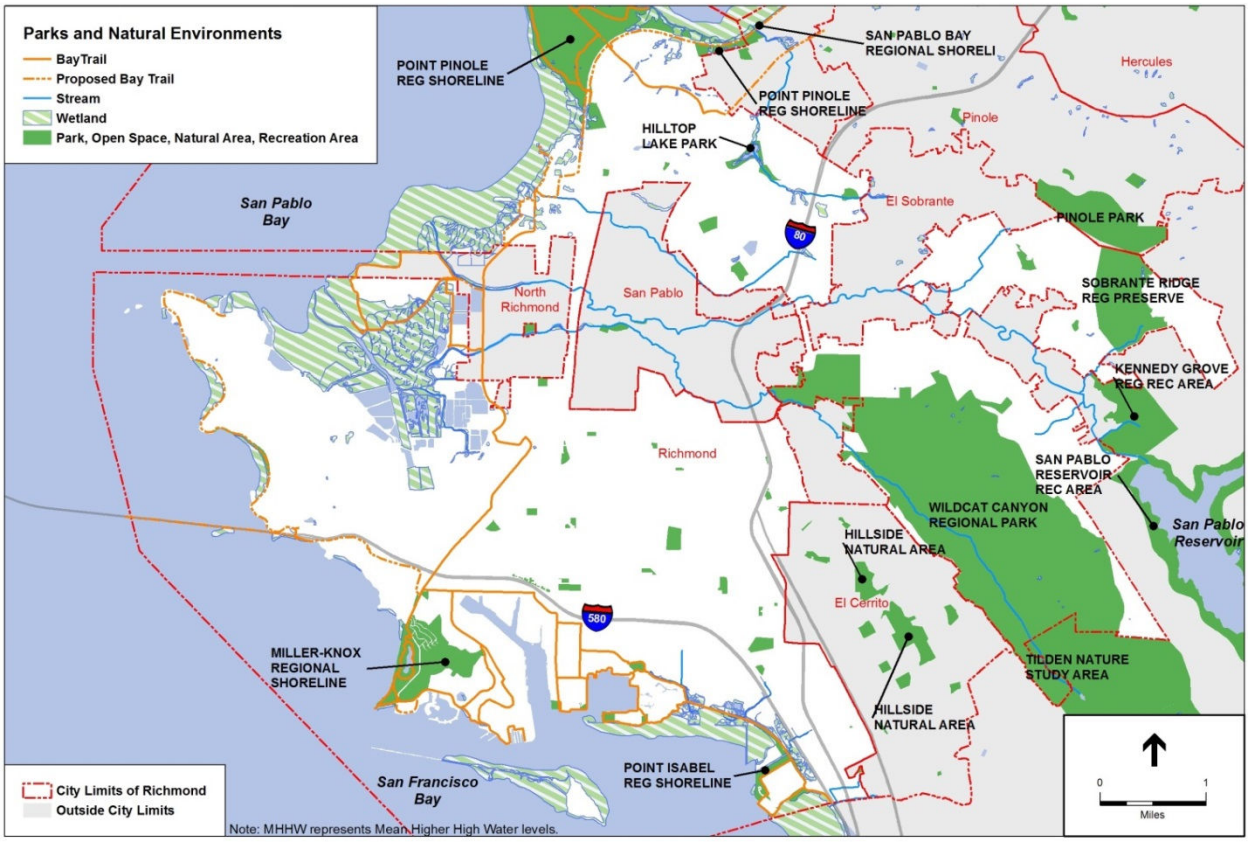


Figure 6.17: City of Richmond Parks and Open Space



SOURCE: U.S. Census Bureau, 2015; City of Richmond, 2014, 2015; CCC, 2004, 2012; AECOM, BCDC, 2015; FEMA, 2015; NWI, 2014

Project 150097.00

Natural Areas

Natural shorelines range from fully tidal marshes that are either exposed to the open Bay or are protected from wave and tidal energy by offshore mudflats, to muted tidal marshes and ponds that are protected from the Bay by berms and levees and have water levels controlled by tide gates and other structures. These systems provide an array of ecosystem service benefits, the loss of which would diminish the value of the Bay Area as a desirable place to live. Natural shorelines help reduce incoming wave heights, protecting shoreline structures from wind waves and tidal energy. Their loss can place shoreline communities at greater risk of flooding by increasing the likelihood that structural shoreline protection is overtopped or fails, and can increase the cost of maintaining, repairing and upgrading these already expensive structural protection assets.

In Richmond, Meeker Slough/Stege Marsh is located at the mouth of Baxter Creek, which drains the Berkeley Hills, and Wildcat Marsh and San Pablo Marsh are located at the toe of a large alluvial fan formed by Wildcat and San Pablo Creeks. Breuner Marsh and Parchester (also called “Giant”) Marsh are located on the west side of Point Pinole, where there is a large eelgrass bed offshore.

Historically, tidal marshes keep pace with sea level rise by accumulating mineral sediment and by moving upward and landward in the tidal frame. The currently accelerating rates of sea level rise in tandem with the declining concentration of Bay suspended sediment may outpace the capacity of these

natural dynamic systems to keep up. Furthermore, much of the Bay shoreline, including the project area shoreline, is fairly well developed and there are few opportunities for marshes to migrate inland. The Contra Costa County ART Project evaluated tidal marshes in Richmond and elsewhere in the Bay using the PRBO online decision support tool (http://data.prbo.org/apps/sfbslr/) that predicts the conditions under which tidal marshes will "downshift" from higher to lower elevation marsh habitat (e.g., from high to mid-marsh or mid- to low marsh), and eventually to mudflat. The project found that, without improved maintenance, restoration and enhancement, the existing tidal marshes in the project area will be lost between 2070 and 2100 (high sea level rise and low sediment assumptions). Low sediment supply constrains accretion rates and the lack of broad transition zone habitat or landward marsh accommodation space constrains marsh migration. High marsh that only floods now during extreme high tides may downshift to mid and low marsh by mid-century and convert to mudflat before the end of century as sea level rise rates accelerate and marsh edge erosion will increase due to greater wind-wave action in deeper water, narrowing marshes such as Stege Marsh in the Central Bay.

Parks and Recreation

Shoreline parks in the Bay Area are often comprised of marsh habitat, wetlands, bluffs and other natural areas that bring communities in direct contact with the Bay and its natural resources. Parks and recreation areas in Richmond provide a wide variety of services to the public. Resources and activities at these sites include scenic views; walking, running, and biking on paths and trails; nature viewing; interpretive displays; swimming; paddleboating; sailboarding; motorboating; picnicking; playgrounds; family/group event areas and facilities; dog recreation; historic or cultural activities; and sport facilities. In addition, shoreline parks provide a variety of environmental, health, and economic benefits, such as critical wildlife habitat for aquatic, terrestrial, and avian species, reduced flood risks to inland communities, and improved public health.

Parks and recreational areas in Richmond serve users in four major categories:

- Regional shoreline areas that attract visitors from the entire Bay Area and beyond;
- Small shoreline parks that serve a surrounding community or neighborhood;
- Marinas, often privately owned or managed, which provide boat access and other for-profit recreation experiences; and
- San Francisco Bay Trail, a bicycle and pedestrian corridor that traverses southern, central, and northeastern portions of Richmond. The Bay Trail is planned at the regional scale but individual trail segments are owned and maintained by cities, park districts, other agencies, and private landowners.

The valuable services parks and recreational areas provide may be diminished or lost as these natural shorelines face increased wave and tidal energy, and in some locations, longer duration periods of flooding or permanent flooding as sea level rises. Shoreline parks can buffer Bay Area communities from flooding events in three ways. The first is by detaining stormwater in wetlands and permeable surfaces. The second is by reducing the height and strength of waves across wetlands, which reduces the need for expensive shoreline protection like levees and seawalls. The third is by serving as a setback from the Bay, separating denser and more sensitive development from storms and sea level rise. Sea level rise will increase the importance of the role of shoreline parks and natural areas in these critical flood and stormwater management services.

Regional Parks

East Bay Regional Park District (EBRPD) owns and manages the four regional shoreline parks in Richmond, which include Miller-Knox Regional Shoreline, Point Isabel Regional Shoreline, Wildcat Creek Trail and Wildcat Marsh Trail, and Point Pinole Regional Shoreline. These regional shoreline parks contain important marsh habitat, unique historical resources, and large-scale recreation assets including trails, fishing, wildlife viewing, and off-leash dog areas.

Regional Parks in Richmond face flooding, groundwater infiltration, erosion, and habitat impacts from sea level rise and future flooding. The Contra Costa County ART Project looked at sea level rise impacts to three park areas in Richmond, including the extent to which each park would exposed to each water level (see table below). For many of the parks, the total park acreage includes submerged areas. To avoid a gross misrepresentation of the exposure percentages, the analysis was based on the land area of the park. This land area, or footprint, was visually determined and digitized in GIS using aerial imagery in combination with maps that show park boundaries. Therefore the footprint values in the table below are approximations, as are the calculated exposure percentages.

Table 6.13: Park Area and Percentage Inundated at Present and With Sea Level Rise for Regional Parks in Richmond

Asset	City	Current 100-year Flood	Sea Level Rise					
			1'	2'	3'	4'	5'	6'
Point Pinole	Richmond	Yes	13%	18%	19%	21%	22%	23%
Miller Knox Shoreline	Richmond	Yes	1%	2%	2%	2%	2%	7%
Brooks Island/Point Isabel	Richmond	Yes	14%	22%	27%	30%	32%	33%

City Parks

Richmond City parks provide recreation facilities for city residents and visitors at the neighborhood scale. There are five parks in the City of Richmond that are potentially exposed to current and future flooding. These five parks represent about 8% of the City of Richmond's total park acreage (287 acres) and are all located along the shoreline so provide views of the Bay even though they do not have swimming or boat access. The Public Works Parks and Landscaping Division manages park facilities while programs at the parks are managed by the Recreation Department. City parks are funded through city tax revenue and the city budget process.

Table 6.14: Richmond City Parks Exposed to Current and/or Future Flood Risk

Asset	City	Current 100-year Flood	Sea Level Rise					
			1'	2'	3'	4'	5'	6'
Richmond Marina Park	Richmond	Yes	No	No	No	Yes	Yes	Yes
Lucretia Edwards Park	Richmond	Yes	No	No	No	Yes	Yes	Yes
Barbara and Jay Vincent Park	Richmond	Yes	No	No	No	Yes	Yes	Yes
Shimada Friendship Park	Richmond	Yes	No	No	No	Yes	Yes	Yes
Sheridan Observation Point	Richmond	Yes	No	No	No	Yes	Yes	Yes

These city parks may experience shoreline erosion and flooding in low-lying areas. Flood damage of shoreline protection, public access areas, lawns, restrooms, picnic areas, and parking lots would require park closures and costly repairs. Due to their small size, these parks will likely either need to be protected in place, relocate, or be lost since it will be difficult to move park uses away from the shoreline within their existing footprint. These parks also rely on vulnerable roads and trails for access.

Marinas

Richmond is home to five active marinas which provide public access to the shoreline for paddleboat water recreation, as well as sailboat and motorboat access. Marinas can also house live-aboard residents and many marinas have inland facilities including office space, restaurants, and housing. Marinas often provide power, water treatment, and refueling services to boats that moor either in permanent berths or temporary slips. Marinas are difficult to expand or relocate due to their need for unique shoreline conditions such as natural harbors to minimize dredging.

Table 6.15: Marinas in Richmond Exposed to Current and/or Future Flood Risk.

Asset	City	Current 100-year Flood	Sea Level Rise					
			1'	2'	3'	4'	5'	6'
Marina Bay Yacht Harbor	Richmond	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Channel Marina Yacht Harbor	Richmond	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sugar Dock	Richmond	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Brickyard Cove Marina	Richmond	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Richmond Yacht Club	Richmond	Yes	Yes	Yes	Yes	Yes	Yes	Yes

As summarized in Table 6.15, all five marinas in Richmond are exposed to current and future flood risk, and are vulnerable to sea level rise and storm even flooding, because of their shoreline location and functions. Although boats and docks are able to accommodate changes in water levels, onshore facilities are not waterproofed and often contain hazardous materials like fuel, wastewater, and motor oil.

Bay Trail

The Bay Trail is a regional trail network with over 330 miles completed and a total of 500 miles planned as a loop around San Francisco Bay. The City of Richmond contains 32 miles of Bay Trail that traverses the southern, central, and northeastern portions of the City. Trail segments provide recreation for walkers, bikers, and joggers as well as serve as pedestrian and bicycle commuter pathways. Different portions of the trail are paved, gravel, boardwalk, or on-street bicycle lanes depending on the location and surrounding land uses. The Coastal Conservancy and Association of Bay Area Governments plan the overall Bay Trail and support projects through grants but the actual trail segments are built, owned, and managed by local agencies like park districts, cities, and flood control agencies.

In Richmond, large sections of the Bay Trail are located on erodible shoreline such as levees, bluffs, and natural shorelines. The Bay Trail will potentially be exposed to shoreline erosion and flooding of low-lying portions, which may damage trails and lead to closures and costly repairs. The Bay Trail relies on connectivity in its function as a regional network, as even small sections of damage can disrupt the use

of large segments. In addition, the Bay Trail is managed and funded by many different agencies so adaptation will require extensive coordination to maintain trail alignments and connectivity.

Table 6.16: Parks, Natural Areas, and EcoSystems

Exposures and Sensitivities	
Exposure	**Potential Impacts and Sensitivities**
Temperature	• Extreme heat and overall higher temperatures can decrease soil moisture, increase evaporation, increase heat stress at individual and population scales, disrupt phonologic cycles, increase invasive species, increase competition for freshwater resources, and impact food supply.
Precipitation	• Increase in erosion events and sediment loss
Drought	• Stress to local flora and fauna, natural habitats
Wildfire	• Loss of natural habitat • Fire makes forested areas more vulnerable to storm-induced erosion and sediment loss
Sea Level Rise	• Increased inundation of tidal marshes leading to drowning and loss of marsh vegetation. • Fragmentation of wetlands • Loss of high tide refugia for dependent species • Inundation and erosion of parklands
Vulnerabilities	
Category	**Vulnerability**
Information	• There is a limited understanding of how tidal marshes will respond to accelerating sea level rise or how these habitats will be affected by management actions (e.g., increasing sediment supply or building transition zone habitat).
Physical	• Almost all of the tidal marshes are mostly mid-marsh and predicted to drown by 2070 (depending on sea level rise rates and sediment supply). The marshes with more high marsh habitat now (Parchester Marsh, Whittell Marsh) are predicted to convert to mudflat a few decades later. • All of the tidal marshes except Point Pinole Southern Marsh and Whittell Marsh are bordered or constrained by development and transportation assets, such that there is no accommodation space for them to migrate landward to avoid being squeezed by a rising Bay. • Numerous parks in Richmond may be damaged by sea level rise and coastal flooding, including Point Isabel Recreational Shoreline, Miller Knox Regional Shoreline, and Point Pinole Regional Shoreline. These EBRPD shoreline parks may face trail damage and disconnection as the erosion continues. • EBRPD parks include low-lying and salt-sensitive turf that will be damaged by storm event flooding and/or groundwater intrusion. • City Parks are vulnerable to shoreline erosion and saltwater intrusion in lawn areas. • Restrooms and parking lots can be damaged by short term flooding and require costly repairs. • Marinas are always located in low-lying shoreline areas and their dryland facilities are vulnerable to flood impacts because of their construction (e.g., restaurants, clubhouses and bathrooms are not elevated or waterproofed). • Marinas often provide refueling and oil change and recycling services to boaters. These services include the storage and transport of hazardous materials, which may be mobilized during flood events impairing water quality. • Portions of the Bay Trail in Richmond are exposed to either current flooding or future sea level rise, particularly along the south shoreline and in the low lying areas near the mouths of Wildcat and San Pablo Creeks. Some of these sections are located atop levees and other erodible shoreline. Sea level rise and storm events may damage these shorelines and the trail. • Some Bay Trail surfaces, especially dirt and gravel paths, are sensitive to flood events. Even paved trails require clearing and cleaning after major flood events.

Table 6.16: Parks, Natural Areas, and EcoSystems

Vulnerabilities (cont.)	
Category	**Vulnerability**
Functional	• Tidal marshes that provide wildlife habitat and flood protection benefits will not be sustained if they downshift to low marsh or convert to mudflat. San Pablo Marsh and Wildcat Marsh have healthy tidal marsh ecosystems and are likely to continue to provide wildlife habitat throughout this century based on Point Blue modeling of abundance and diversity of five indicator bird species across multiple scenarios. Furthermore, Wildcat Marsh, San Pablo Marsh, and Breuner Marsh are wide enough that they likely provide wave attenuation benefits. • EBRPD shoreline parks contain extensive wetland habitat that may downshift and/or disappear if sediment supply and upland transition zone are insufficient to accommodate future water levels. • EBRPD shoreline parks rely on roads for access that are vulnerable to current and future flooding. The county and cities manage these roads, so EBRPD will need to coordinate with local governments to maintain park access. • City Parks rely on roads for access and power and water for restrooms and lights that are vulnerable to current and future flooding. • There are limited city parks in Richmond near the shoreline. If existing parks are lost or damaged by flooding, this park shortage could be further exacerbated. • Marinas rely on roads, parking lots, and other vulnerable access ways to function as recreation sites. • Marinas need adequate water depths both within the marina and between the marina and deeper Bay waters and therefore can only be built and maintained along certain parts of the shoreline due to sediment accumulation patterns. If flooding damages marinas, there may not be adequate capacity within the region to expand existing or create new marinas to replace the lost uses. • Marinas provide limited live-aboard housing to vulnerable residents. These residents may need special consideration when planning for flood events and for eventual relocation. • The Bay Trail requires connectivity with other trail segments, staging areas like parking lots, and city and regional transportation networks to function. Vulnerabilities of other road and trail segments may limit access to the Bay Trail, affecting its function for recreation and commuter movement.
Governance & Management	• Proactive management of tidal marshes to improve resilience to sea level rise and storm events involves confronting regulatory requirements related to state and federal threatened, endangered, and special status species. Maintenance of tidal marshes requires review and authorization from multiple state and federal agencies, often with limited work windows and restrictions on the type of actions that can be taken. • The process of obtaining permits from multiple agencies (e.g., U.S. Army Corps of Engineers, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the San Francisco Bay RWQCB, the California Department of Fish and Wildlife, and the San Francisco BCDC) as well as obtaining local authorization from cities or counties for marsh restoration and enhancement is cumbersome and time-consuming. Projects that include railroad tracks, highways, pipelines, and PG&E towers require additional approvals. • The prevailing model of fragmented regulatory decision-making, the prominent goals of natural resources law, and passive management and historical preservation combine to limit the ability to deal with uncertainty and change in marsh restoration and enhancement projects. Since each project is considered separately, having a large project area can make it easier to satisfy regulatory requirements. However, a sea level rise rates accelerate the lack of a regional framework guiding marsh restoration and enhancement actions will inhibit shoreline resilience planning the advances nature based solutions. • EBRPD will need to coordinate with neighboring landowners, including cities, the Bay Trail, and Union Pacific railroad, to address shoreline erosion and coastal flooding in its parks. • Richmond's current Parks Master Plan does not account for the impact of climate change on its park facilities or services.

Table 6.16: Parks, Natural Areas, and EcoSystems

Vulnerabilities (cont.)

Category	Vulnerability
Governance & Management (cont.)	• Marinas are often privately owned or managed and may not have the information or capacity to plan for sea level rise impacts. • The Bay Trail is owned, managed and funded by many different agencies within the county and will require extensive coordination to adapt to future flooding while retaining connection to the greater trail network. • The Bay Trail is co-located with flood control, shoreline protection, habitat, and transportation assets. Projects that improve the resilience of these assets to flooding will need to consider multi-objective solutions to protect Bay Trail function.

Consequences

Category	Consequence
Economy	• All of the tidal marshes except Hoffman Marsh, Stege Marsh/Meeker Slough, Point Pinole Southern Marsh, and Whittel Marsh are the first line of defense against coastal flooding of adjacent development and transportation assets and loss of this nature-based flood protection would increase the height and cost of structural shoreline protection. • EBRPD provides $16.7 Million dollars in recreation value each year to Contra Costa County and regional residents and visitors. • City parks provide recreation value to residents and also help maintain healthy and safe communities. • Marinas provide unique shoreline recreation value and direct economic activity through berth rentals and inland businesses like restaurants. The closure of marinas may impact local economies and tax revenue. • The Bay Trail provides recreation value and non-motorized transportation options for residents. This economic value may be lost if the trail is flooded or inundated.
People	• Loss of marshes would be a loss of shoreline recreational opportunities since people enjoy views of marshes and the species within them. • Residents and business owners could lose shoreline access and wildlife viewing recreation opportunities if parks are damaged or disrupted. • Residents could lose shoreline access recreation opportunities if parks are damaged or disrupted. This consequence may be more severe for transit-dependent or limited-mobility residents who cannot access substitute recreation further away from their homes. • Marina residents and visitors rely on marinas for recreation and housing. If marinas are damaged or closed due to future flooding, other facilities may not be available, especially north of Richmond in the project area. • Residents could lose shoreline access, recreation opportunities, and non-motorized transportation corridors if the Bay Trail is damaged or closed due to future flooding.
Environment	• Marshes provide habitat for threatened and endangered species. Storm event flooding makes these species more vulnerable to predation and can reduce reproductive success if nests are flooded. Downshifting habitat means marshes will be flooded more often, exacerbating these population stresses, until conversion of marsh to mudflat results in complete loss of tidal marsh species at this marsh. • Marsh habitat in EBRPD shoreline parks may downshift or drown due to future water levels if there is not sufficient sediment supply and upland space for transgression. This could lead to habitat loss and impacts on shoreline species. • Marinas create, store, and transport hazardous materials like fuel and motor oil. If these facilities are flooded, hazardous materials may be mobilized and lead to impaired water quality and environmental habitat degradation. • Bay Trail segments provide nature viewing and environmental education opportunities that may be lost if the trail is flooded or damaged.

Priority Actions

Raise Local Awareness

- Parks/Ecosystems-1. Increase local awareness about the need to protect Richmond's natural inhabitants (flora and fauna), which can experience severe stress from extreme heat, drought and extreme precipitation events.

Mitigation and Risk Reduction

- Parks/Ecosystems -1. Establish a shoreline vision and comprehensive long-term plan for shoreline development that includes multi-objective solutions for protecting and preserving parks, natural areas, and shoreline ecosystems.
- Parks/Ecosystems -2. Plans may be needed to protect regional park assets or limit their use during extreme storms and King Tides. Point Isabel Recreational Shoreline, Miller Knox Regional Shoreline, Point Pinole Regional Shoreline, and sections of the Bay Trail face moderate risk from sea level rise by 2050 and significant risk from sea level rise by 2100.
- Parks/Ecosystems -3. Update the City's Parks Master Plan to incorporate sea level rise and other climate change impacts.
- Parks/Ecosystems -4. Ensure that local marinas have adequate hazardous material management plans in place of that anticipate the hazards associated with sea level rise and extreme storms.
- Parks/Ecosystems -5. Update the City's approved street tree list to include species that will thrive under the future climate conditions anticipated for Richmond.

6.12 Commercial and Industrial Assets

Contra Costa County ART References: Business and Industry Chapter, Energy Chapter, Seaports and Marine Oil Terminals Chapter

Commercial and industrial facilities provide jobs, goods and critical services, and opportunities for economic development and growth in the City and throughout Contra Costa and the Bay Area region. Commercial businesses are an important part of community function as community members tend to shop and access services (e.g. medical and dental) near where they live and work and those with limited mobility or those who rely on public transit have few options for travelling outside of their neighborhoods for services and critical goods. Figures 6.18, 6.19, and 6.20 show the location of Richmond's commercial parcels in shoreline areas that may be exposed to flooding with water levels of 77 inches above MHHW (similar to a 36-inch SLR plus 100-year extreme tide, or a 48-inch SLR plus 50-year extreme tide). For locations of industrial parcels, refer to Figures 6.13, 6.14, and 6.15 in Section 6.10: Solid Waste/Hazardous Materials Management. The locations of Richmond's seaport and the Chevron refinery are delineated in Figure 6.9 in Section 6.7: Transportation Infrastructure.

Figure 6.18: Commercial Parcels – Richmond Southeast

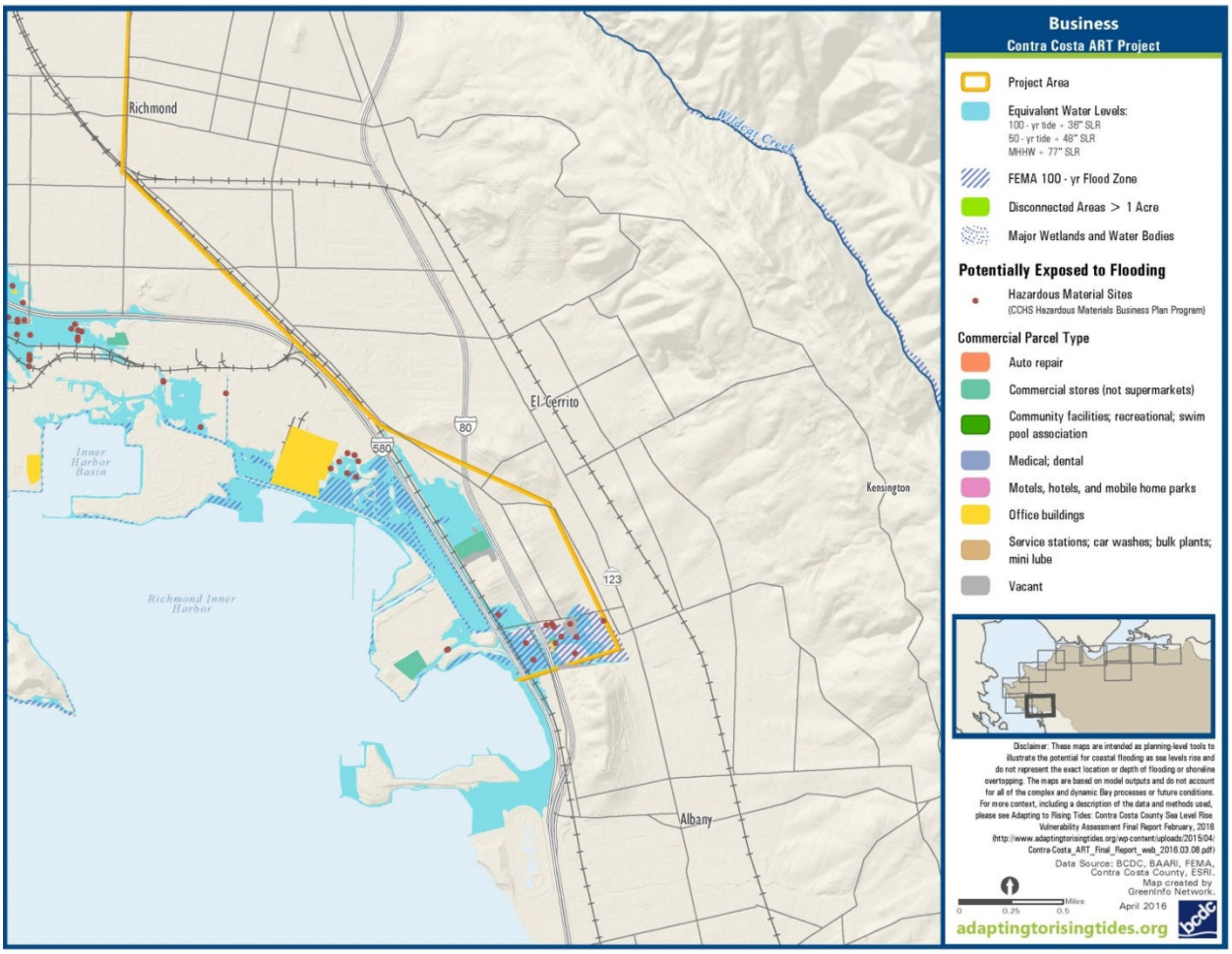
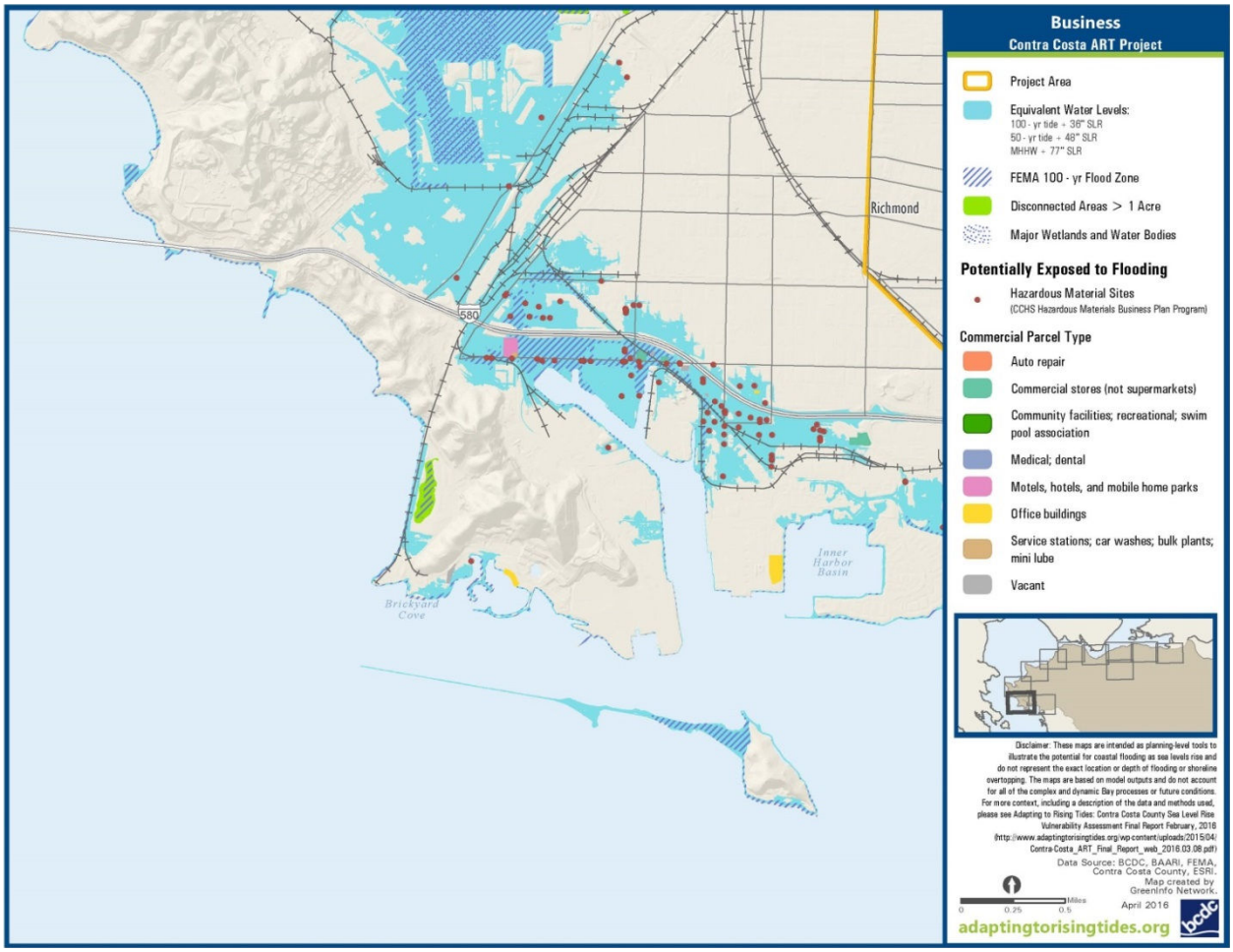


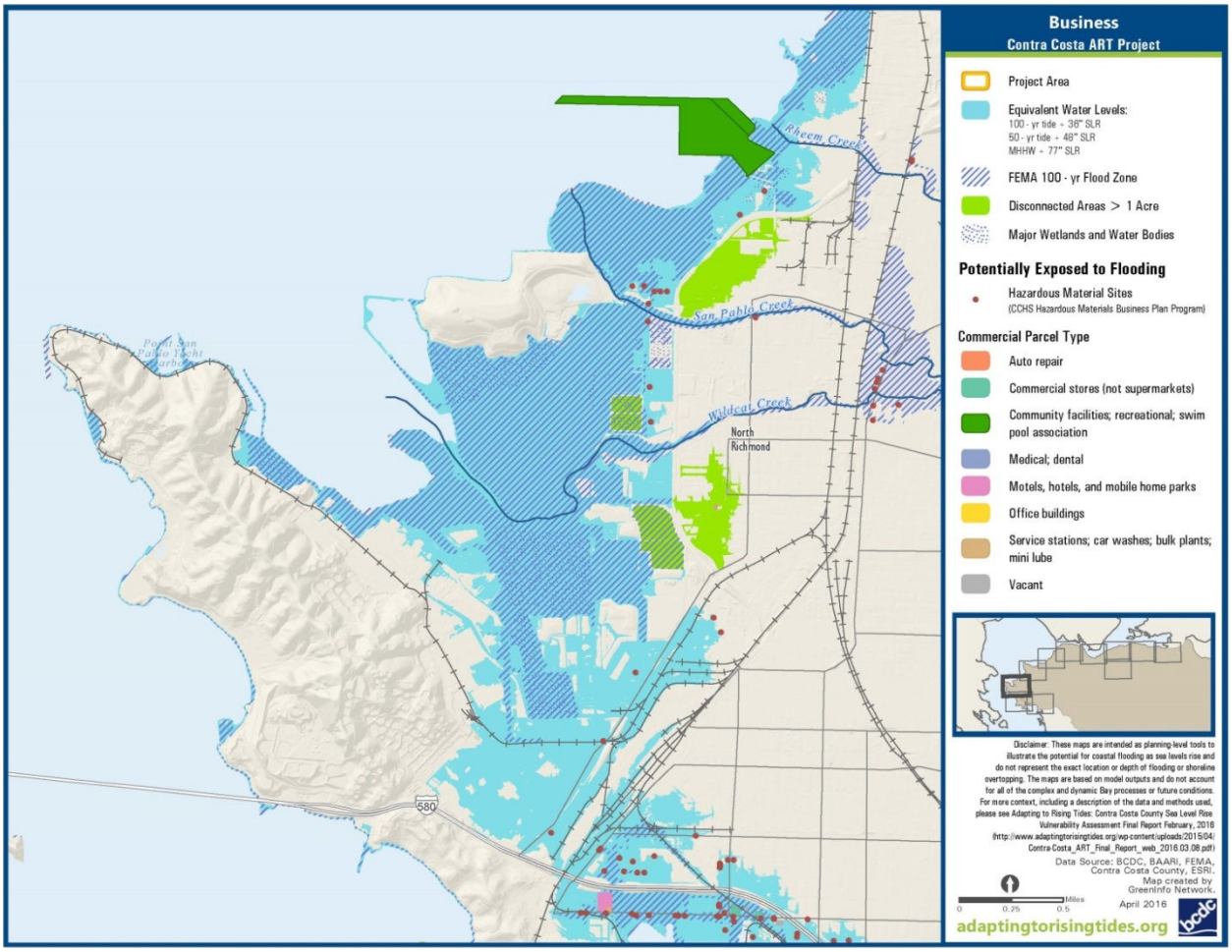
Figure 6.19: Commercial Parcels – Richmond Port and Harbor Areas



The Contra Costa County ART Project identified 58 commercial parcels at risk from current and/or future flooding in the City of Richmond. Sixteen of these are boat harbors/marinas, most of which are in the Brickyard Cove neighborhood. The remaining commercial uses are stores, office buildings and restaurants that are mostly located along the southern Richmond shoreline, to the south of I-580. Access to commercial facilities may be disrupted due to a flood event, which can have far-reaching consequences for local communities, including workers being unable to report to work and critical services and facilities being inaccessible to community members. Most commercial facilities are not designed to withstand flood events, and may be more vulnerable if they lack contingency plans or back-up utilities and supplies. The disruption of commercial facilities can have significant local social and economic impacts, as well as ecosystem and public health consequences if hazardous materials are released into the environment.

The Contra Costa County ART Project also identified 186 parcels of industrial land in Richmond and North Richmond at risk from current and/or future flooding. These include heavy industry and research and development parcels associated with Chevron's Richmond Refinery. Two of Chevron's larger parcels are identified as vacant and are currently mostly undeveloped and one, which sits under the Richmond-San Rafael Bridge approach, is mostly open water.

Figure 6.20: Commercial Parcels – Richmond Northwest



There is a cluster of mixed industrial land uses at risk associated with the seaport and related industries south I-580 between West Ohio Avenue and West Cutting Boulevard and to the west of South Garrard Boulevard. The remaining parcels at risk are mostly light industrial parcels associated with the West County Landfill, including the West County Resource and Recovery Center, and parcels near Parr Boulevard and the Richmond Parkway.

Industrial facilities may be more vulnerable if they have inadequate hazardous materials storage or contingency plans, or lack back-up utilities and material supplies. The closure or disruption of industrial facilities can have significant local and regional economic impacts, and can have ecosystem and public health consequences if hazardous materials are released into the environment.

Chevron Refinery

Chevron's Richmond Refinery (for location see Figure 6.9) processes crude oil to make petroleum products and other chemicals, including motor fuel and lubricants. Temporary or permanent disruption of refinery operations, if there is flooding on site or because access to the refinery (roads or rail) is disrupted, would have significant impacts locally, regionally, and statewide. Improving the resilience of refinery operations will require coordination with asset owners and managers that operate on-site as well as those that provide goods and services from off site.

Chevron's Richmond Refinery site includes refinery operations (e.g., distillation towers, cracking units, cooling towers, storage tanks), a marine oil terminal, a Cogeneration Power Plant (125 MW capacity), stormwater and industrial wastewater treatment ponds, and EBMUD's Richmond Advanced Recycling Expansion. Connections on and off the site are essential to the operation of the refinery. Pipes, pumps, electrical utilities, and other mechanical equipment connect services on the refinery site. Transmission lines, roads, interstate roads (i.e. I-580) terminals, pipelines, and rail (UPRR and BNSF) connect the refinery to services and markets located off site. The refinery's tank farm is located at higher elevation, but the refinery process area and off site connections are located at lower elevation.

Low-lying and shoreline portions of the Chevron Refinery site, in particular along the eastern side of the site, are located in the 100-year floodplain. These areas and adjacent low-lying areas could also be flooded with 2 feet of sea level rise or more. Flooding on the east side of the refinery may impact pipelines, roads, rail lines, buildings, and the wastewater treatment plant, and could expose these assets to potentially corrosive seawater. In addition, elevated groundwater levels may impact existing groundwater containment and extraction systems (groundwater protection system) and may interfere with the refinery's capacity to collect and treat process wastewater, groundwater seepage, and stormwater runoff, and discharge these water sources through the existing system of deepwater and perimeter outfalls.

Pipelines

Industrial pipelines transport hazard liquids and gasses, including crude oil, refined, petroleum and natural gas to different locations throughout the region for processing and then further transport to other locations and uses. The pipeline system in the project area serves an area that extends beyond the region as product is often transported throughout Northern California and beyond. Northern Contra Costa County is the epicenter of refineries and industrial uses in the Bay Area and pipelines, which span the County and are an essential component to the regional economy.

Buried pipelines are directly and indirectly sensitive to higher groundwater table and salinity intrusion. Exposure to salt water can corrode pipelines that are not protected as specified in federal and state regulations. Rising groundwater levels could increase liquefaction potential leading to additional damage during a seismic event. In the event of flooding, pipelines that are not weighted or anchored may float and become exposed, particularly during prolonged flooding and in marshy or sandy soils. Erosion during storm events could also expose and damage pipelines. Damage to pipelines could result in service disruptions as well as threats to public safety and the environment in the event of an explosion or release of hazardous contents.

Port of Richmond

The Port of Richmond is a deepwater port located approximately nine miles from the Golden Gate Bridge along the Richmond inner harbor. In 2012 the port ranked first in liquid bulk and automobile tonnage among the San Francisco Bay area's five ports. The port includes five city-owned and ten privately owned terminals that handle bulk liquids, vehicles, dry bulk materials and break-bulk cargoes. The City's Port Department manages the city-owned terminals, which are leased to various private entities. The once city-owned terminal (Terminal One) is currently in the process of being sold for residential re-development.

The seaport is linked to inland parts of the region, state, and nation through rail lines, including UPRR and BNSF, and roads including I-580 and Canal Boulevard. On dock rail service is provided to many of the terminals by UP and BNSF rail lines and there is enhanced truck access to I-580 from the port. The seaport supports employment in a variety of sectors, ranging from Port-related jobs such as longshoremen, to rail and truck operators.

While most of the Port of Richmond, and in particular the terminals, are generally not directly vulnerable to climate impacts, sea level rise and storm events will affect operations by limiting access to and from the seaport. Temporary or permanent disruption of local road and interstate access would disrupt seaport operations; however loss of rail service to move bulk materials and automobiles would have significant impacts the local and regional economy as these goods cannot easily be moved by truck. At 4 feet of sea level rise, low-lying areas near West Cutting Boulevard and Canal Boulevard may start to get flooded. At 5 feet of sea level rise, much more of the streets north and east of the Seaport (Harbour Way South, Wright Avenue and Ohio Avenue) would become vulnerable to flooding. Temporary or permanent disruption of local road and interstate access would disrupt seaport operations. Equally important, however, loss of rail service to move bulk materials and automobiles would have significant impacts the local and regional economy as these goods cannot easily be moved by truck.

Marine oil terminals are primarily used to load and unload raw materials used in refineries, typically petroleum-based materials, and are specially equipped with pipes, pumps, electrical utilities, and other mechanical equipment to load/unload material from ships. In Richmond, Chevron Richmond Long Wharf Marine Oil Terminal supports operations at the Chevron Richmond Refinery. The Chevron Richmond Refinery uses the Richmond Long Wharf Marine Terminal to receive all its crude oil, and some intermediate feed and blending stocks. In addition, the Chevron Richmond Refinery uses the Richmond Long Wharf Marine Terminal to ship products and intermediate stocks to domestic and foreign markets.

Marine oil terminals are all vulnerable in varying degrees to rising sea levels due to their physical location next to the water, but it's the land components attached to the terminals that will be most vulnerable to sea level rise as these assets may not be built to withstand tidal, wind and wave erosion. The marine oil terminals' land connections already in the 100-year flood plain will be the first ones to face exposure to sea level rise. Marine Oil Terminals are built to withstand tidal, wind and wave erosion, but sea level rise and storm events will affect access to and from the terminal and may impact the equipment located on the terminals, including the pipelines connecting the terminals to their respective refinery/storage location. Temporary or permanent disruption of access to the terminal would result in economic impacts to the city, region, and state.

Table 6.17: Vulnerability and Risk Profile for Commercial and Industrial Assets

Exposures and Sensitivities

Exposure	Potential Impacts and Sensitivities
Temperature	• Longer periods of higher temperatures combined with dry conditions increase wildfire risk to facilities in high risk fire zones • Extreme heat can damage asphalt (parking lots, driveways, private roads) and stress the capacity of building cooling systems
Precipitation	• Extreme storms can increase erosion and produce localized flooding • Many construction materials used in buildings are water sensitive
Drought	• Increased need for landscape irrigation; potential damage to urban trees
Wildfire	• Excessively dry periods increase the risk of wildfires at the urban-wild interface along the eastern portion of the City, endangering nearby property
Sea Level Rise	• Increased frequency and depth of coastal flooding • Increased potential for fluvial flooding due to reduced drainage to the Bay • Inundated or saturated areas are potentially at higher risk of liquefaction during earthquake • Increased frequency and depth of coastal flooding will cause more frequent damage to commercial and industrial properties in flood prone-areas and more frequent disruptions of power and goods movement, and hinder the ability of employees to access their job site or place of employment. • As Bay water levels rise, storm events may flood larger areas for longer periods of time due to reduced drainage to the Bay, causing more extensive damage due to the duration of the flooding, cause longer disruptions to power and goods movement, and hinder the ability of employees to access their job site or place of employment. • As Bay water levels rise there is the potential that shoreline protection, such as levees, berms and revetments, will be damaged or fail to due to increased tidal and wave energy. Shoreline protection may be overtopped during storm events when there are extreme tides levels and wind-driven waves, flooding inland areas, including some commercial and industrial areas that are currently protected. • As the Bay rises it is predicted that groundwater and salinity levels will also rise. This may cause damage to below grade facilities, storage areas, and electrical/mechanical equipment. In addition, rising groundwater levels can increase the risk of liquefaction during seismic events.

Vulnerabilities

Category	Vulnerability
Information	• Commercial and industrial land uses are privately owned, and therefore there is often a lack of publically available information about the types of facilities on site and their potential vulnerabilities to flooding, the location and capacity of the site drainage systems, they number and types of connections to off-site critical services that are necessary to maintain operations, and the status of current flood protection, in particular for sites located on the shoreline. • At privately owned commercial and industrial sites, there can inadequate publically available information regarding hazardous materials to inform vulnerability assessments. The Contra Costa Health Services Hazardous Materials Program makes information available to the public about Hazardous Business Plan, CalARP and ISO, including amount of materials stored on site, and if storage occurs below grade about underground storage tanks. There is limited information about the flood prevention or protection measures in place, in particular for the smaller Hazardous Business Plan sites. • There is limited information about refinery sites or operations, including the different components of the refinery and associated industrial facilities such as the cogeneration or wastewater treatment ponds plants that are often co-located on these sites.

Table 6.17: Vulnerability and Risk Profile for Commercial and Industrial Assets

Vulnerabilities (cont.)

Category	Vulnerability
Information (cont.)	• Lack of easily accessible information on pipeline material, age, eccentricities, and weld type make this infrastructure vulnerable to inefficiency in maintenance and implementation of projects related to pipelines. • There is a lack of detailed and easily accessible information about the private seaport terminals.
Physical	• Many commercial uses are vulnerable to flooding because the buildings and structures were not designed to withstand flooding, nor are they constructed of waterproof or non-corrodible materials. • Some commercial entities use or store hazardous materials including paints, cleaners, oils, batteries, pesticides, asbestos, and medical waste, which if not stored properly or not elevated above possible flood waters could be released during a flood. • Many buildings rely on electric or mechanical components, such as fans, boilers, and pumps that cannot function if wet and are often located below grade or on the ground floor. • Commercial and industrial uses with unprotected at- or below-grade entrances are at risk of damage if flooded. This is particularly an issue for garages or warehouses with large roll up doors, and sites with below-grade or ground level sensitive equipment. • Commercial and industrial sites that rely on power but that do not have back-up power generation and fuel supplies are more vulnerable to disruption and loss of goods stored on site. • Buildings, infrastructure and other facilities associated with industrial sites that are not currently with the 100-year floodplain are unlikely to have been constructed to be waterproof or corrosion resistant. In particular operations that rely on electric or mechanical components, such as fans, boilers, and pumps that cannot function if they are flooded or exposed to salt water, are vulnerable to sea level rise. • Many industrial land uses generate or store hazardous substances that could have public health or environmental impacts if released into groundwater or surface waters. While many of the industrial sites in the project area are regulated under the California Accidental Release Prevention Program or Industrial Safety Ordinances others are not and are therefore subject to less stringent reporting and contingency planning requirements. • Pipelines and electrical components connecting the Marine Oil Terminals to land-based refinery facilities may begin to corrode if they are exposed to salt water. • Linear, networked infrastructure such as pipelines and rail lines may be more susceptible to damage during a seismic event if liquefaction potential increases due to higher groundwater. Buried pipelines are vulnerable to groundwater rise and liquefaction, which can cause the pipelines to break. • Pipes that are not properly protected are sensitive to corrosion if exposed to saltwater either in areas that are flooded or if there is saltwater intrusion. The material covering some pipelines may be sensitive to erosion, which could result in direct exposure and potential damage of the pipeline. • Flooded pipelines could float and become exposed if not weighted or anchored. Rising groundwater also increases the risk of liquefaction, which could damage buried pipelines in a seismic event. • Rail lines, local roads (Richmond Parkway/Canal Boulevard, South Garrard Boulevard, West Cutting Boulevard, Wright Avenue, Marina Way South, Hoffman Boulevard and Harbour Way South) and the Interstate that serve the Port of Richmond are vulnerable to flooding. Some of the terminals at the seaport have only one road leading in/out and operations would be disrupted if these roads were damaged or closured. • The Port of Richmond terminals currently do not have groundwater pumping systems in place and rising groundwater could damage roads, rails and electrical components that support port operations.

Table 6.17: Vulnerability and Risk Profile for Commercial and Industrial Assets

Vulnerabilities (cont.)	
Category	**Vulnerability**
Physical (cont.)	• Flooding could damage electrical equipment located at or below-grade, such as electrical equipment found in graving basins in the Port of Richmond. • The historic Shipyard 3 graving basins at the Port of Richmond do not have storm drain pumps to remove floodwaters that could inundate the facility during a storm event. • Marine oil terminals are largely resilient to rising sea levels, but the connections to the shoreline, such as roads and pipelines, may be exposed to impacts of rising sea level, depending on its elevation. • Pipelines and electrical components connecting the marine oil terminals to land-based facilities may become exposed to seawater or increased liquefaction vulnerabilities due to rising sea level.
Functional	• Commercial uses rely on outside infrastructure and services provided by public and private agencies, including roads, electricity, water, and wastewater. Disruption of road access, power, water or wastewater services can impact the commercial use, which either may need to be closed or if open may not be accessible to customers. • Commercial uses providing medical and dental services are critical because loss in these services could have significant impacts on community members; in particular those that are mobility limited or rely on public transportation. • Commercial uses that provide local neighborhoods and communities with goods and services that are otherwise limited are particularly important as if they have to close or go out of business due to flooding residents will either have to do without or travel to find replacement goods and services. • Many industrial land uses rely on off-site utilities connections including power, telecommunications, water supply, and wastewater treatment or discharge. These interconnections with off-site services can be critical to maintaining operations, in particular for those facilities that need water in their manufacturing processes. • Industrial land uses rely on roads, rail lines and terminals, pipelines, airports and marine terminals to ensure materials and supplies are imported, goods produced are exported, and employees can get to/from work. Many of these transportation systems, which are owned and operated by others, are vulnerable to flooding and their disruption could impact operations at industrial facilities of all types. • Because heavy industrial land uses need large amounts of land, have specific operational facility needs, and are dependent on fixed infrastructure for goods movement (for example marine terminals, pipelines and rail lines), these land uses can be difficult, if not impossible, to relocate. • Many industrial processes are continually operating and need adequate warning time to fully or partially shut down in advance of storm related flooding. • Facilities with hazardous materials stored below ground could be vulnerable to rising groundwater. • Refineries rely on power and water to function. Disruption of power, including from onsite cogeneration plants, or damage to wastewater treatment plants may cause refinery operations to slow down or even shut down entirely. • Refinery operates continuously, so the process of safely shutting down requires time and effort. During an emergency, such as an unexpected flood event, there could be far ranging consequences on the economy, environment, and public health if a refinery has to shut down little or no preparation. • Temporary or permanent disruption at ship/rail terminals would affect the capacity to ship and receive goods, and potentially disrupt refinery operations. • Damage to pipelines could result in service disruptions as well as threats to public safety and the environment in the event of an explosion or release of hazardous contents. • Even if pipelines in the project area are protected, the asset is dependent on all parts of the pipeline network to be in working order. Although many of pipeline segments have safety valves to allow for a shut down in an emergency, this process may take some time and therefore advance warning is necessary if the pipeline is to be safely shut down.

Table 6.17: Vulnerability and Risk Profile for Commercial and Industrial Assets

Vulnerabilities (cont.)

Category	Vulnerability
Functional (cont.)	• Both the rail and interstate corridors that connect to the Port of Richmond lack redundancy, with no alternative route for rail cargo and little additional capacity for truck traffic on alternative interstates. • In the event that a large portion of seaport operations is disrupted, there could be insufficient capacity at either on or off site terminals to handle displaced shipping needs, in particular petroleum shipping, which could cause a ripple effect in the economy. • Port of Richmond operations rely on electrical power, domestic water, and sanitary sewer services provided by others. The port does have backup power available to help maintain critical operations. • Marine oil terminals are part of the goods movement system, and if access to and from the terminals were disrupted by flooding or storm events, the economy would be severely impacted regionally and potentially nation-wide.
Governance & Management	• Commercial uses may be owned and operated by property owners that may not have the capacity to engage in local planning, or by renters that have little control over improvements to the property where they business is located. • Industrial property owners and site operators may have engaged with public agencies on reducing flooding and other risks through existing regulatory programs. Planning for sea level rise will require non-regulatory collaboration and partnerships between the public and private sector to ensure that multi-benefit shoreline solutions are advanced that balance economic, environmental and social equity goals. • The operations and management of refinery sites, the number of agencies that regulate planning and operations, the number of associated facilities, and the reliance on others to provide access and services (i.e. energy, wastewater, rail, marine terminals) will complicate implementing changes necessary to improve resilience to flooding disruptions. • In the event that a pipeline is affected by a storm flooding event, existing operations and maintenance plans may not have well-coordinated plans that are shared with emergency responders and other relevant entities describing procedures for shutdown and other measures to minimize damages. Pipelines are often co-located with other interconnected infrastructure, like railroads and roads, so governance decisions may require coordination between these agencies, in addition to other stakeholders owning adjacent parcels. • There are hazardous material sites that use, generate or transport smaller quantities of hazardous materials. And while in Contra Costa, the CalARP and ISO sites have a high level of compliance with hazardous material inventories and contingency planning requirements, the number and diversity of other sites may result in differing levels of compliance with operational and regulatory requirements. • Because of the number and concentration of heavy industrial land uses in the Contra Costa County ART Project area, there is already coordination among the multiple entities that have a role in responding to hazardous materials emergencies. The number of hazardous materials sites, their location across the county shoreline, and the potential extent of flooding that could occur during a large storm may stress available resources and could require even a higher level or coordination and contingency planning. • Current emergency planning and response for many hazardous material sites does not require consideration of future flood risk. For CalARP and ISO stationary sources, there is a requirement to look at external events as part of a Hazard Review or Process Hazard Analysis, including flooding. As past flooding that was very improbable becomes a possibility, as sea levels rise stationary source will need to consider the risk of flooding, the safeguards that are in place, and how to reduce the risk to an acceptable level. • Different entities own and manage the seaport and the vital transportation systems, such as rail (Union Pacific and Burlington Northern Santa Fe) and highways (Caltrans is responsible for I-580). These entities will need to collaborate to develop and implement adaptation strategies. • Marine oil terminals are leased from the California State Lands Commission, and their building standards are defined in the California Building Code.

Table 6.17: Vulnerability and Risk Profile for Commercial and Industrial Assets

Consequences	
Category	**Consequence**
Economy	• Commercial and Industrial uses provide Richmond with economic benefits that include jobs for residents, services to the community, goods and products needed in other parts of the region, and tax revenue to the City and the county. Damage or disruption of commercial and industrial facilities uses could result in high costs due to lost productivity, as well as significant costs of replacement or repair of buildings, specialized equipment, and goods stored onsite. Flooding of commercial uses could cause temporary or permanent jobs loss for hundreds of workers, resulting in lost business revenues, employee wages, and fees or taxes. • Temporary or permanent closures of industrial operations of all kinds could have broad economic impacts throughout the region, particularly if heavy industrial facilities such as the refineries are damaged or their connections to goods movement infrastructure is disrupted. • Facilities that generate, treat, or transport hazardous materials are usually job sites, and their disruption or closure can result in lost wages and larger-scale economic impacts. Additionally, flooding of hazardous materials sites can strain local emergency resources and can result in high cleanup and recovery costs. • If refinery operations are disrupted for a long period of time there could be a loss of jobs at the refinery site as well as in associated sectors. If refinery operations are disrupted for a significant amount of time there could be impacts on the regional economy including higher fuel prices and potentially even fuel shortages. • If the pipelines were disrupted, the movement of goods (fuel, gas, diesel) would either be suspended or transferred to an alternate means of transport. Pipelines are an essential component to refineries, which are a major part of the economy. Therefore interruption of pipeline operations in Contra Costa County could have far reaching economic consequences. • Loss of power at the Port of Richmond or the disruption of rail or interstate access would impact the goods movement network, and result in economic losses for the city, region, and state. Disruption of rail access to the seaport could be especially significant, not only because it could result in increased truck traffic, but also many of the commodities shipped through the Port of Richmond cannot easily be moved by truck. • Marine oil terminal jobs and indirectly associated goods movement jobs may become vulnerable if marine oil terminals are disrupted for a long period of time.
People	• Disruption of commercial uses that provide medical and dental services, other critical services, or goods and services that are locally limited could have significant consequences on neighborhoods and community members, particularly those who rely on public transportation or have limited mobility. The disruption or closure of commercial uses can have significant consequences for employees, as loss of access to the workplace can cause lost wages and jobs. Community members may lose access to goods and services they rely on, impacting neighborhood function and community resilience. Flooding of facilities that store hazardous materials can result in public health or environmental impacts if contaminants are released into floodwaters. • The disruption or closure of industrial land uses can have significant consequences for employees as loss of access to the workplace can cause lost wages. Loss of these facilities may also have consequences on the people within the City and the region, as the industrial land uses within the City produce and provide a number of critical goods and products used in many other sectors. Unexpected flooding of facilities that store hazardous materials can also result in public health impacts in nearby communities. • The flooding or other disruption of hazardous materials sites can expose communities to substances harmful to human health and safety. • Slow downs or shut downs of refinery operations could impact local and regional jobs both on site and in the sectors serving the refinery. Flooding of the refinery site could also result in public health impacts if there is an unscheduled disruption in operations.

Table 6.17: Vulnerability and Risk Profile for Commercial and Industrial Assets

Consequences (cont.)	
Category	**Consequence**
People (cont.)	• Direct societal consequences of pipelines flooding are likely to be minimal to moderate, depending on the severity of disruption of fuel and natural gas transport and distribution. However, if damaged pipelines explode or leak there could be health risks to nearby populations. • Temporary or permanent disruption at the Port of Richmond would affect the capacity to ship and receive goods, and this could impact people's jobs, especially ship workers and truck drivers. Disruption of the rail to the seaport could result in increased road traffic within the surrounding neighborhoods' local roads and Interstate system. • Temporary or permanent disruption at the marine oil terminal would affect the capacity to ship and receive goods, potentially disrupting refinery operations and local jobs.
Environment	• Flooding of hazardous materials sites and facilities that store hazardous materials (such as pharmaceuticals, petroleum products, cleaners, pesticides or toxics) can have long-lasting and far-reaching consequences on water quality, natural habitats, and species if released into the Bay, river systems, or near-shore habitats. • Hazardous materials present at various sites within the Port of Richmond could be released into the Bay by floodwaters, or contaminate rising groundwater. If the rail is disrupted, the use of trucks to bring goods to and from the seaport may increase. This would lead to greater air pollution from the increased road traffic. • Hazardous materials present at the marine oil terminal could be released into the Bay by floodwaters, or contaminate rising groundwater. • Contaminants present on refinery sites that could be carried with floodwaters into inland areas, released into the Bay, or migrate into rising groundwater. Most refineries have fire and emergency response teams on-site that could help mitigate the extent of impact if there was a flood event. If the rail system is disrupted and trucks are used to bring goods to and from the refineries there may be an increase in roadway congestion, impacts on air pollution levels, and increase GHG emissions. • The pipelines may carry jet fuel, diesel, and other petroleum products and hazardous materials, which, if released, would harm natural area habitats and sensitive species.

Priority Actions

Awareness and Education

- Commercial/Industrial-1. Make sea level rise maps and other climate change hazards information available in public forums including the City web site and the City's public libraries.

Mitigation and Risk Reduction

- Commercial/Industrial-2. Partner with local business and industry groups to assess the vulnerability of commercial and industrial assets to climate change exposures, identify common needs and concerns, and share resources in mitigating risk.
- Commercial/Industrial-3. Amend the City's Flood Damage Prevention Ordinance to meet current FEMA requirements for constructing in special flood hazard zones and areas vulnerable to sea level rise and liquefaction. These requirements may include policies related to flood-proofing of structures located adjacent to special Flood Hazard Zones.
- Commercial/Industrial-4. Provide incentives or require that structures vulnerable to sea level rise be retrofitted using waterproof shutters, shields or doors and salt-resistant materials to reduce flood damage.

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