Attachment A – Land Acknowledgement

Land Acknowledgement Statement

We should take a moment to acknowledge the land on which we are gathered. For thousands of years, this land has been the home of Patwin people. Today, there are three federally recognized Patwin tribes: Cachil Dehe Band of Wintun Indians of the Colusa Indian Community, Kletsel Dehe Band of Wintun Indians, and Yocha Dehe Wintun Nation.

The Patwin people have remained committed to the stewardship of this land over many centuries. It has been cherished and protected, as elders have instructed the young through generations. We are honored and grateful to be here today on their traditional lands.

Approved by Yocha Dehe Tribal Council (July 23, 2019)

Attachment B – 2022.10.24 YCCAC Meeting Minutes

MEETING MINUTES
Yolo County Climate Action Commission
October 24, 2022 | 4:00 PM – 6:00 PM

COMMISSION MEMBERS:
Suzanne Reed, District 1 Appointee
Robin Datel, District 2 Appointee
Mark Aulman, District 3 Appointee
Andrew Truman Kim, District 4 Appointee (**VICE-CHAIR**)
Adelita Serena, District 5 Appointee
Chris White, Technical Lead
NJ Mvondo, Environmental Justice Lead (**CHAIR**) (*not in attendance*)
Bernadette Austin, Climate Scientist/Subject Matter Expert
Pelayo Alvarez, Climate Scientist/Subject Matter Expert (*not in attendance*)
Mica Bennett – At Large (*joined at 4:25*)
Ken Britten – At Large

EX-OFFICIO MEMBERS:
Sarah Morgan, Yocha Dehe Wintun Nation
Camille Kirk, UC Davis (*joined at 5:05*)

SUPERVISORS:
Supervisor Don Saylor, Yolo County Board of Supervisors, District 2
Supervisor Jim Provenza, Yolo County Board of Supervisors, District 4

MEETING MINUTES

1. **Authorize remote (teleconference/videoconference) meetings by finding, pursuant to Assembly Bill 361, that local officials continue to recommend measures to promote social distancing as a result of the COVID-19 pandemic.**

2. **Land Acknowledgement** (*read by C. White*)

3. **Approval of the Agenda**

   Decision: Approve
   Approved By / Seconded By: M. Aulman / S. Reed

Ayes: S. Reed, R. Datel, M. Aulman, A. Kim, A. Serena, C. White, B. Austin, K. Britten
Noes: None
Abstain: None
Absent: M. Bennett

4. **Public Comment**
    - A question was asked about clarification regarding the timeline for the RFP selection process.

5. **Approve September, 26 Meeting Minutes**

Decision: Approve
Approved By / Seconded By: S. Reed / K. Britten
Ayes: S. Reed, R. Datel, A. Kim, A. Serena, C. White, B. Austin, K. Britten
Noes: None
Abstain: M. Aulman
Absent: None

6. **Staff Announcements/Reports (Staff)**
    - A question was asked if the Nov. 22nd Board of Supervisors meeting is when County staff will have a selected a consultant to go before the Board.
        - Staff is targeting Nov. 22nd to bring forward a contract to the Board.
    - A question was asked if equity is being utilized when reviewing the applications?
        - Staff is utilizing equity best practices. Equity was an important part of the scope of work that the Commission developed that is guiding the selection process.
    - A question was asked if the Sustainability page can be in the main website drop down menu.
        - Staff will replace what is currently in the "Living" tab on the drop-down menu with "Sustainability" once the beta-tested web pages are finalized.
    - Staff proposed December 19th at 4PM as a new meeting time for December.
        - A question was asked about the consideration of an earlier YCCAC meeting date in December.
        - Staff responded that an earlier Monday in December would be a quick turnaround time from the November meeting. Staff is continuing to explore other dates for the December YCCAC meeting.

Public Comment
- A question was asked about how equity is being evaluated and if there could be more transparency before a final decision is made on a consultant.
    - Staff cannot share more information at this stage of the selection process, though there will be opportunity for public comment when the contract goes before the Board.

- A question was asked if staff would consider the creation of translated social media posts.
- A question was asked if there is opportunity for additional early actions to be considered before the Climate Action and Adaptation Plan (CAAP) is completed?
    - Staff will consider moving forward with other actions as capacity allows.

7. Updates from Working Groups

- The Equity and Engagement Working Group met on October 13th and discussed the compensation policy and engagement/participation. The Working Group is currently operating as an ad-hoc working group.
    - Staff shared that they are applying for a grant from the Urban Sustainability Directors Network to fund the compensation policy that is being brought before the Board.
    - Working Group members requested Commission members share contacts that are not traditionally serving on working groups, and highlighted youth.
- A question was asked about the group's strategy for engaging with youth.
    - Some working group members are connected with the Yolo Youth Commission and hope to utilize new social media platforms to boost youth engagement.
- The Natural and Working Lands Group is preparing to reach out to potential members over the next few months and the group is determining the best number of people on the group to help engage with and develop strategies.
- A question was asked if Commission members could reach out to groups/individuals to gauge interest prior to passing their contact information to the Equity and Engagement Working Group and if the working group has a charter.
    - Working Groups welcome any references of contacts to serve on this group.

8. Commission Member Reports, Comments, Future, Future Agenda Items

- The City of Woodland's Advisory Committee will have a working session with City Council in January. The Committee is looking to connect and collaborate with other cities in the County going forward.
- A request was made to have a future agenda item on how food security, food systems, and food waste will be dealt with by the Commission.
- The City of Winters has created three working groups, one of which is an outreach and engagement working group. Another is exploring funding options and planning documents to determine where climate opportunities are.
- A comment was made in support of the compensation policies that will be going to the Board for consideration on November 22nd.
- A suggestion was made to consider the County Fair as a potential outreach opportunity.

- A comment was made that the previous Climate Action Plan doesn't highlight wildfire and a suggestion was made to add wildfire safety as a future agenda item.
- A question was asked regarding a recap on the compensation policy and when it will be going before the Board.
    - Staff intends to bring the compensation policy to the Board for approval on the Nov. 22nd Board meeting.

9. Long Range Calendar

- Long range calendar updates were shared.

10. Adjournment

- Meeting adjourned at: 5:35 PM.

Attachment C - Climate Action Staff Report from November 22, 2022 Board of Supervisors Meeting

County of Yolo
www.yolocounty.org

To: The Chair and Members of the Board of Supervisors

Regular-Community Services # 43.

Board of Supervisors Sustainability

Meeting Date:	11/22/2022
Brief Title:	Approve Climate Action and Adaptation Plan Contract and Associated Items
From:	Taro Echiburú, Director, Department of Community Services
Staff Contact:	Kristen Wraithwall, Sustainability Manager, Department of Community Services. x8047
Supervisorial District Impact:	Countywide

Subject

Receive update on Climate Action and Adaptation Planning Process and consider approval of associated items, contracts, and funding allocations. (General fund impact $495,420) (4/5 vote required) (Wraithwall)

Recommended Action

A. Receive Update on Climate Action and Adaptation Plan contract and associated items;

B. Approve and authorize the Director of Community Services to execute an agreement with Dudek in an amount not to exceed $595,420 for the development of the Yolo County Climate Action and Adaptation Plan;

C. Adopt budget resolution allocating $495,420 in General Fund contingency to provide funding for "Basic Services" and $100,000 in American Rescue Plan (ARP) funding to support the optional "Additional Services" of the Climate Action and Adaptation Plan ("CAAP") contract;

D. Approve amendment to Memorandum of Understanding between Yolo County and the Yolo County Resource Conservation District ("RCD") to support CAAP development;

E. Approve allocation of $45,287 in ARP funding to support the Yolo Resource Conservation District's role in the Climate Action and Adaptation Planning process;

F. Approve four (4) strategies to support equitable community engagement in Climate Action and Adaptation Planning Process:
   - 1. Funding for Outreach Partners;
   - 2. Incentives for Public Meeting/Survey Participation;
   - 3. Stipends for Yolo County Climate Action Commission Members; and

- 4. Stipends for CAAP Working Group Members.

G. Approve allocation of $51,000 in ARP funding to support Equitable Community Engagement Strategies.

Strategic Plan Goal(s)

Sustainable Environment

Reason for Recommended Action/Background

HISTORY

On September 29, 2020, the Yolo County Board of Supervisors passed Resolution No. 20-114, titled “A Resolution Declaring a Climate Crisis Requiring Urgent and Inclusive Mobilization in Yolo County.” This resolution set forth the ambitious goal of achieving a countywide carbon-negative (climate-positive) footprint by 2030 and urged the investment of countywide resources to initiate a just transition to an inclusive, equitable, sustainable, and resilient local economy while also supporting and advocating for regional, national, and international efforts necessary to reverse the climate, social justice, and economic crises. The resolution directed the County to create a working advisory body, the Yolo County Climate Action Commission (“Commission”), to develop and propose a new Climate Action [and Adaptation] Plan (“CAAP”) designed to reduce all greenhouse gas emissions in Yolo County and achieve the County's ambitious climate goals. County and the Commission have been working to lay the groundwork to achieve a carbon-negative footprint by 2030, including taking the following actions:

- **September 2021:** Commission begins meeting.
- **September 2021 to January 2022**: Yolo County staff and the Commission sought applications from the public for "early actions" to further Yolo County’s climate action and sustainability initiatives and support the goals in the 2020 emergency climate resolution.
- **April 25, 2022**: The Commission votes to recommend seven (7) priority early action projects to the Board of Supervisors to reduce greenhouse gas emissions and sequester carbon.
- **June 7, 2022**: The Board of Supervisors approves the first six (6) early action projects, as recommended by the Yolo County Climate Action Commission.
    - The Board of Supervisors approves allocation of $149,845 from American Rescue Plan Funds ("ARP") funds to support Carbon Farming Partnership project.
    - The Board of Supervisors approves allocation of $100,000 from ARP funds to support the Electrification Retrofit Rebate Outreach Program project.
- **July 26, 2022**: The Board of Supervisors reviews and approves Climate Early Action Grant Strategy, which leverages the County’s investment in achieving the goal of a countywide carbon-negative footprint by 2030 by directing staff to secure grants to implement priority early action projects to reduce greenhouse gas emissions and sequester carbon in unincorporated Yolo County.
- **August 4, 2022:** After extensive discussion between the Commission, County Staff, and the public, the County developed a scope of work for the CAAP and released a competitive Request for Proposals (“RFP”) for consultants/consulting firms to provide Climate Action & Adaptation Planning Services within unincorporated Yolo County.
- **August 22, 2022:** The Commission voted to recommend a suite of four (4) equitable community engagement strategies for the CAAP development process.
- **September 8, 2022:** The RFP closes; the County received 4 proposals.
- **October 25, 2022**: The Chair of the Commission provides an update to the Board of Supervisors on Commission progress and CAAP timeline.

SUMMARY OF ITEM COMPONENTS AND FUNDING REQUESTS

Table 1. Summary of Item Components and Funding Requests

Item Component	Description	Not-to-Exceed Cost	Source of Funding
Climate Action and Adaptation Plan ("CAAP") Contract with Dudek	2-year agreement with Dudek, a California Corporation, to provide Climate Action and Adaptation Planning Services to Yolo County.	$595,420	General Fund Contingency: $495,420 (*Basic Services*) ARP: $100,000 (*Optional Additional Services*)
Yolo Resource Conservation District Scope of Work for CAAP Support	2-year agreement with RCD to provide support for CAAP development, including engagement with agricultural community/partners; facilitate Yolo County Climate Action Commission's Natural & Working Lands Working Group; support the development of an inventory of natural & working lands emissions by type; identify sequestration strategies, etc.	$45,287	ARP
CAAP Community Engagement Package	Four (4) strategies to support equitable community engagement as part of the CAAP development process: 1. Funding for Outreach Partners; 2. Incentives for Public Meeting/Survey Participation; 3. Stipends for Yolo County Climate Action Commission Members; and 4. Stipends for CAAP Working Group Members.	$51,000	ARP

BACKGROUND

THE CLIMATE ACTION AND ADAPTATION PLAN REQUEST FOR PROPOSALS

On August 4, 2022, the County released a competitive Request for Proposals ("RFP") (*Att. B. - Exhibit A - RFP*) for consultants/consulting firms to provide Climate Action & Adaptation Planning Services within unincorporated Yolo County. The RFP outlined a number of values the County wishes to emphasize, including but not limited to:

- Developing strong partnerships in the CAAP process with the County's communities, including the agricultural sector (including farmers and farm workers), Tribes, businesses, youth, marginalized groups, and other County communities;
- Centering equity and a Just Transition in all CAAP processes and outcomes;
- Creating an approach which takes regional goals and neighboring jurisdictions activities into account and allows the County to work across jurisdictions to support the CAAP;
- Promoting health, equity, and holistic resilience in every step of the process;

- Creating an ambitious and achievable CAAP, with a focus on implementation that will reach the goal of being carbon negative by 2030; and
- Creating a CAAP that reflects the unique role Yolo County plays in the region, including the carbon sequestration benefits of agriculture and the value of agriculture to the regional economy.

The RFP included 7 key tasks:

1. Community Engagement and Equity Strategy
2. GHG Inventory with Updated Targets
3. Emissions Reduction Strategies
4. Climate Vulnerability Assessment and Adaptation and Resilience Strategies
5. Funding and Financing Roadmap
6. Implementation and Monitoring Plan
7. Final CAAP Products

The RFP was posted until September 8, 2022, and the County received 4 proposals. After careful review and evaluation, Dudek, a California Corporation, received the highest score in the evaluation process (*Att. C. Exhibit B - Dudek Proposal; Att D. Exhibit C - Cost Proposal*). Dudek's planners have authored award-winning and transformative plans that have been recognized for their innovation in both environmental planning as well as opportunity and empowerment. With an emphasis on resilience, equity, community-driven processes, and action-oriented solutions, Dudek will work with the County to craft a plan to meet the goal of achieving a net negative footprint by 2030.

CAAP CONTRACT FINANCIAL DETAILS AND FUNDING REQUESTS

The cost of Basic Services provided by Dudek shall not exceed $495,420; however, the contract (*Att A. Contract*) identifies a number of optional Additional Services--such as preparing vehicle miles traveled ("VMT") estimates for unincorporated Yolo County under 1990 and 2005 conditions, preparing VMT metrics for consistency with SB 743, and preparing a detailed carbon inventory to estimate total carbon storage associated with existing land uses within the County--that may be provided at the request of the County. The total amount of compensation for any Additional Services shall not exceed $100,000 dollars, for a total contract amount not to exceed of $595,420. If no Additional Services are requested by the Director, the total amount shall not exceed $495,420. Any compensation for additional services must be explicitly pre-approved in writing by the Director.

County staff recommend that $495,420 in Climate Action Contingency be allocated to cover the Basic Services of the Contract, and that $100,000 in climate action ARP funding be allocated to cover any optional Additional Services requested by the County.

ADDITIONAL CAAP SCOPE OF WORK FOR THE YOLO COUNTY RESOURCE CONSERVATION DISTRICT

In order to achieve the County's goal of achieving net-negative carbon emissions by 2030, carbon sequestration will need to play a central role in the CAAP development and implementation processes. According to the Carbon Cycle Institute, agricultural and natural lands are the most valuable tool to massively scale-up rates of carbon sequestration across the globe while also building climate resilience and ecological health. The Institute asserts carbon sequestration must become the next value-added agricultural product. The County has been a leader in agricultural land conservation for over 150 years and is poised to become a leader in helping growers address climate change impacts as well. With 85 percent of County lands designated for agricultural use, agricultural lands are arguably the County's most valuable resource for increasing carbon sequestration and mitigating climate change. In order to ensure growers' goals, needs, and expertise are centered in the CAAP development process, County Staff identified the Yolo County Resource Conservation District ("RCD") as a trusted partner who could help lead and facilitate conversations with the agricultural community.

The County has an existing Memorandum of Understanding (MOU) with RCD (dated February 24, 2009) to assist with the implementation of county conservation projects and plans due to the RCD's unique expertise, capabilities, and equipment. The MOU notes that additional services may be added by RCD and/or the County from time to time through supplements to Exhibits subject to prior approval by the Board of Supervisors. Due to the importance of natural and working lands to the CAAP development process, staff are requesting approval for the addition of an amendment (*Att. E. Amendment*) for additional scope of work (*Att. F. Exhibit A*-2), which outlines how RCD will support Yolo County on the development of the CAAP. This work will include, but is not limited to, engagement with farmers, farm workers, private landowners, the Yolo County Farm Bureau, and the agricultural industry and other agricultural groups; facilitation of the Commission's Natural and Working Lands Working Group; working with the CAAP consulting team to support the development of an inventory of natural and working lands emissions by type; contributing to the development of measures to support adaptation and resilience strategies that relate to natural and working lands including regenerative agriculture and open space, transportation and infrastructure; and drafting final CAAP products relating to natural and working lands.

Staff are seeking approval of an allocation of $45,287 in ARP funds to support RCD's role in the Climate Action and Adaptation Planning process.

CAAP COMMUNITY ENGAGEMENT ELEMENT

The recent evolution in effective community engagement processes has underscored that funded engagement—in the form of stipends or other compensation—is a highly-effective tool for supporting dynamic, equitable community engagement and establishing trust and buy-in with the outcomes of public processes. Community-based organizations (“CBOs”) and community leaders in Yolo County —particularly those who are Black, Indigenous, and People of Color (“BIPOC”) —are often asked to spend unpaid time reviewing documents and providing feedback on lengthy public processes, creating a strain for organizations and individuals that are already under-staffed and under-resourced. Participation stipends—and support in the form of free childcare and food, for example—not only enable more active and engaged involvement from community organizations and residents that face capacity challenges, but they reflect a respect for the lived experiences of County residents, and a commitment to ensuring diverse communities have a voice in decision-making processes.

Implementation of new funding strategies to support the public engagement work associated with the development of the County’s Climate Action and Adaptation Plan (“CAAP”) will ensure policies, projects, and programs developed through the CAAP are more equitable, address the true needs of Yolo County residents in all 5 County districts, and identify the actual root cause of social disadvantage and environmental harm. While establishing these programs is not without complications, members of the Commission, the Commission’s Climate Action and Adaptation Plan Scope of Work Ad Hoc Working Group (“Ad Hoc Working Group”), and members of the public have repeatedly raised the issue of stipends/compensation as a topic of critical importance to the success of the County’s CAAP development process.

Now that the County is poised to begin the CAAP development process, County staff believe it is critical that the County compensate Commission members—and subsequently working group members—to be messengers to their communities, and recruit Yolo County residents to participate in working groups and other engagement activities such as workshops, surveys, and town hall events. Trusted messengers—and the distribution of stipends and/or childcare, food, etc.—will enable the County to reach individuals and groups in the community who might not see climate action as a natural area for their engagement. Compensating Commission members to help lead this recruitment and selection process and subsequently guide working groups and engagement workshops puts the trusted actors who know their communities best in the driver's seat.

County Staff raised the importance of this topic at the July 11, 2022, meeting of the Board of Supervisors Climate Action Ad-Hoc Subcommittee ("Subcommittee"). At this meeting, the Subcommittee decided to seek input from the Commission regarding stipends for public meeting participation. Given the imminent launch of the CAAP development process and the need for targeted working group discussion on the topics of equity & engagement and natural & working lands, staff sought Subcommittee approval to develop a suite of compensation/stipend options for consideration by the Commission. After extensive discussion and careful review, on August 22, 2022, the Yolo County Climate Action Commission voted to recommend the following four community engagement proposals in concept (*summarized in Table 2 below*).

Options recommended by the Commission were then brought to the September 6, 2022, Subcommittee meeting for further discussion. It is assumed that final approval of any stipend options will be required the Board of Supervisors, as the Yolo County Travel and Expense Reimbursement Policy highlights that there is a prohibition on stipends for "County boards, commissions or committees except as specifically authorized in advance by the County Board of Supervisors."

1. Funding for Outreach Partners. If approved, Yolo County (with support from the CAAP consulting team and the Commission) will identify "anchor" CBOs that would apply for mini-grants and/or contract funding to develop and implement an outreach plan in support of the CAAP Equity and Engagement Strategy. The outreach plan may include review of draft materials, meeting facilitation and survey administration, development and printing of materials, and stipends to support outreach activities. The Commission recommended that the Equity and Engagement Working Group work with the CAAP Consulting Team and County Staff to identify up to 5 Outreach Partners that would be compensated up to $5,000 each ($25,000 total) to lead engagement activities in Yolo County in support of the CAAP development process.

<u>Examples</u>
Several jurisdictions, including the City of Sacramento and the County of Los Angeles have contracted with CBOs to lead portions of community engagement in support of public processes such as Climate Action Plan development and/or COVID education. The City of Sacramento has recently launched a Participatory Budgeting Program, which administers Outreach Partner stipends with amounts varying from $250-$5,000 based on the services agreed upon. Services include:

- Sharing messaging with residents
- Sharing approved digital content
- Distributing materials (i.e. flyers, door hangers, etc.)
- Participating in social media activation events
- Displaying posters in locations visible to community members
- Attending a training webinar
- Sharing messaging during virtual meetings/webinars
- Completion of activity reports with details on outreach activities

The County of Los Angeles developed a process wherein a designated Anchor CBO in each of the 5 Supervisorial Districts served as an Outreach Partner for Climate Action Plan development. These organizations played a central role in uplifting equity discussions, both by participating in the design and facilitation of workshops as well as by ensuring that discussions were inclusive of the perspectives of low-income communities of color. Anchor CBOs received a total of $20,000 each from the County of LA for these services, granted in installments as each phase of work was completed. Outreach Partner organizations were approved by their Supervisor's Office, and all agreed to provide the following specific services:

- Review and provide comment for key documents
- Support at each of the workshops to assist with facilitation, note-taking, and logistics
- Promote, plan, and co-facilitate a Saturday Fair and Expo in their assigned Supervisorial District, including providing 10-15 staff or volunteers on the day of the event

2. Support for Public Meeting Participation. If approved, Yolo County will allocate $5,000 for incentives such as childcare, food, gift cards, etc., to support for participation in select CAAP workshops, town halls, surveys, etc. Staff will work with the Commission's Equity and Engagement Working group and the CAAP Consulting Team to develop a policy to ensure the $5,000 budget is controlled (*ie. raffling off gift cards as opposed to having an unlimited number to distribute*).

Examples:

- For past processes requesting public input, Yolo County's Health and Human Services Agency has entered survey respondents into raffles to win gift cards.
- In April 2021, the City of Davis approved $20,000 for Climate Action Plan ("CAP") outreach with an EJ focus. Part of this funding was used to purchase items—including socks and food—along with gift cards to compensate residents for providing in-person input on the City's CAP process.
- The City of Oakland provided full meals and free childcare at each of the 8 in-person engagement workshops for their 2020 Climate Action Plan update.
- Members of the public who provided input on the City of Santa Cruz's 2022 Climate Action Plan draft were entered into a drawing to win a gift bag of local products.
- Mendocino County provides culturally relevant food at all public meetings of their Cultural Diversity Committee and stipends to all individuals who provide information and/or education based on their lived experiences in Mendocino County.

3. Stipends for Commission Members. If approved, Yolo County will provide compensation to Commission members for their participation in regularly scheduled meetings at a rate of the amount of $100 per Commission meeting attended. This rate takes into consideration the length of Commission meetings as well as the time required to serve as a messenger to their community for CAAP-related outreach, material preparation, and meeting follow-up. The Commission also recommended an additional $50 per meeting attended to the Chair/Co-Chair (for a total of $150 per Commission meeting attended) to compensate for the additional work required to support the development of Commission materials, prepare community presentations, and engage in regional collaborative work. Any County Staff member, elected official, or individual/organization currently under contract with County to provide related services will not be eligible for compensation. Eligible Commission members will have the opportunity to opt out if they do not require a stipend to participate.

Examples:

- Each member of the County of Sacramento's newly formed Climate Action Taskforce (*the Sacramento County equivalent of Yolo County's Climate Action Commission*) is eligible to receive $70 for each meeting that they attend.
- Yolo County Health and Human Services is currently seeking residents for a new Community Advisory Program to help write the 2023-2026 Yolo County Community Health Improvement Plan. Community Advisors will receive a stipend of $25 per hour for participating in meetings and for up to 2 hours of additional research or review time per month.
- Yolo County provides members of the Planning Commission with $100 per meeting attended.

- The Los Angeles County Metropolitan Transportation Authority provides all Advisory Body Members with $100 per meeting and provides an additional $50 ($150 per meeting total) to those who also prepare materials for the meetings.
- The City of Sacramento compensates Boards and Commissions at varying rates, including $50 per meeting for the Arts, Culture, and Creative Economy Commission, and $100 per meeting for the Planning and Design Commission.
- The City of Los Angeles Administrative Code authorizes Board and Commission members to receive $50 per meeting attended (although the City notes that stipends are typically waived).

4. Stipends for Working Group Members. If approved, Yolo County will compensate members of the two Climate Action and Adaptation Plan Working Groups—including the Equity and Engagement and Natural and Working Lands Working Groups—at a rate of $50 per meeting attended. While the Commission recommends that Commission Member representatives be eligible for working group stipends, they recommend that Commission Members be eligible for no more than one $50 working group stipend per month in addition to their Commission stipend (even if they are serving on multiple working groups). Any County Staff member, elected official, or individual/organization currently under contract with County to provide related services will not be eligible for compensation. Eligible Working Group members will have the opportunity to opt out if they do not require a stipend to participate.

Examples:

- The City of Stockton provides $50 per meeting to participate as a Resident Committee Advisor on the Stockton Mobility Collective, which supports a bundle of clean transportation and community development projects.
- The Bay Area Climate Adaptation Network provides eligible Equity-centered CBOs $25 per hour stipends to participate in network meetings, including working groups.

Table 2. Summary of Community Engagement Strategies

Engagement Option	Eligible Entity	Recommended Engagement Budget	Total Cost
1. Funding for Outreach Partners	Community based organizations (CBOs); existing 501(c)(3) organizations, or group(s) with a fiscal sponsor	Up to $5,000 per CBO (depending on services provided)	Up to $25,000 Assuming up to 5 Outreach Partners are identified.
2. Incentives for Public Meeting/ Survey Participation	Members of the public	Up to $5,000 for childcare, food, or other material items such as gift cards	Up to $5,000
3. Stipends for Commission Members	Commission members	$100/meeting attended for Commission Members Additional $50/meeting attended ($150 total) for Chair/Co-Chair	Up to $12,600 per year Assuming 12 monthly meetings with all 11 Commission members receiving stipends.
4. Stipends for Working Group Members	Commission members and community members at large sitting on working group(s)	$50/meeting attended	Up to $8,400 per year Assuming 2 working groups, 12 monthly

			meetings, with 7 members per group.

** Any County Staff member, elected official, or individual/organization currently under contract with County to provide related services would not be eligible for compensation.*

Staff is seeking approval of an allocation of $51,000 in ARP funds to support these community engagement strategies for 2023. However, the Department of Community Services, Sustainability Division has applied for a $20,000 grant (the maximum allowable grant amount) from the Urban Sustainability Directors Network to provide funding for Options 3 and 4 above (Stipends for Commission Members and Stipends for Working Group Members to serve as Community Messengers for the CAAP process). It is expected that the grant awards will be announced on November 18, 2022.

If the County's grant application is successful, the ARP request for this item will be reduced to $31,000.

Collaborations (including Board advisory groups and external partner agencies)

Representatives from the following County Departments, advisory groups, and external partners participated in the review of the Request for Proposals for climate action and adaptation planning services:

- Yolo County Administrator's Office
- Yolo County Department of Community Services
- Yolo County Climate Action Commission
- Yolo County Resource Conservation District

The Yolo County Climate Action Commission includes appointed representatives from all 5 County Districts, as well as ex-officio members from the Yocha Dehe Wintun Nation and University of California, Davis. In addition, County Staff and the Commission are collaborating with the Yolo Resource Conservation District on climate action community engagement related to natural & working lands. County staff have received input from the Climate Action Subcommittee of the Board of Supervisors on these items.

Competitive Bid Process/Vendor Performance

A Request for Proposals for consultants/consulting firms to provide Climate Action & Adaptation Planning Services within unincorporated Yolo County was issued on August 4, 2022 and posted until September 8, 2022. Four proposals were received and evaluated. After evaluation of the four proposals, it was determined that Dudek should be awarded the contract. Additional information regarding the competitive bid process is included below, including the evaluation criteria and scoring breakdown of the four proposals received. No protests concerning the contract award were received.

Evaluation Criteria Included in RFP

- Experience and Qualifications of Consultant/Staff
- Proposer's Understanding & Approach to Project
- Project Schedule/Deliverables
- Cost Proposal
- Responsiveness/Responsibility
- Quality Assurance and Oversight
- Compliance with the County's Terms and Conditions
- Past Performance
- Quality and Completeness of Submitted Proposal

Bids Received

Consultant Group	Criteria Evaluation Point Ranking
Dudek	92.06 out of 100
Sustainability Solutions Group USA, Inc.	79.39 out of 100
Ascent Environmental, Inc.	76.66 out of 100
Environmental/Justice Solutions	51.54 out of 100

Fiscal Impact

Fiscal impact (see budgetary detail below)

Fiscal Impact (Expenditure)

Total cost of recommended action:	$ 691,707
Amount budgeted for expenditure:	$ 0
Additional expenditure authority needed:	$ 691,707
One-time commitment	Yes

Source of Funds for this Expenditure

$495,420
$100,000
$45,287
$51,000

Explanation (Expenditure and/or Revenue)

Further explanation as needed:

A budget resolution (Attachment G) is attached for the development of the Yolo County Climate Action and Adaptation Plan (CAAP) in the amount of $595,420, funded with Climate Sustainability Contingency ($495,420) and American Rescue Plan ($100,000).

If the American Rescue Plan (ARP) funding requests to support the Yolo Resource Conservation District's role in the CAAP ($45,287) and/or the to support Equitable Community Engagement Strategies is approved ($51,000), an administrative adjustment will be requested and completed between Community Services and Financial Services.

Attachments

Att. A. CAAP Contract with Dudek
Att. B. Exhibit A - RFP
Att. C. Exhibit B - Dudek Proposal
Att. D. Exhibit C - Cost Proposal
Att. E. Yolo RCD MOU Amendment
Att. F. RCD MOU - Exhibit A-2
Att. G. Budget Resolution_CAAP
Att. H. Presentation

Form Review

Inbox	Reviewed By	Date
Madison York	Madison York	11/08/2022 03:19 PM
Leslie Lindbo	Leslie Lindbo	11/10/2022 12:48 PM
Taro Echiburu	Julie Dachtler	11/10/2022 01:11 PM
Financial Services	KauXue Thao	11/10/2022 01:57 PM
County Counsel	Hope Welton	11/14/2022 05:02 PM
John Rowe	John Rowe	11/15/2022 02:23 PM

Form Started By: Kristen Wraithwall Started On: 10/27/2022 08:49 PM

Final Approval Date: 11/15/2022

Attachment D - Dudek Proposal for Climate Action and Adaptation Planning Services

Proposal FINARFPKK2218 for

September 8, 2022

CLIMATE ACTION & ADAPTATION PLAN

County of YOLO

DUDEK
1102 R STREET
SACRAMENTO, CALIFORNIA 95811
T 916.443.8335 F 916.443.5113

1/ Exhibit "A" Proposal Transmittal Letter

September 8, 2022

Karen Kawelmacher, Lead Buyer
Yolo County Procurement Division
625 Court St., Room 103
Woodland, CA 95695

Subject: Proposal for Climate Action and Adaptation Plan

Dear Ms. Kawelmacher,

We are honored to prepare this proposal for the Yolo County (County) Climate Action and Adaption Plan (CAAP) in response to the County's Request for Proposals (RFP). The Dudek team includes Richard McCann of M.Cubed and Matt Kowta of BAE (both of Davis) for agricultural and energy sector as well as regional economics, Fehr & Peers for traffic, Mike Hendrix for greenhouse gas mitigation strategies, Robb Davis for communication and engagement, and Excel Interpreting & Translating for language interpretation. The experts on our team offer a highly qualified, technically competent, thoughtful, and well-rounded approach that will result in responsive and implementable outcomes for this complex and visionary CAAP. Moreover, the team offers extensive CAAP experience as well as funding and financing acumen and strategy to strengthen resiliency. We have local expertise in County agriculture and sustainability policies and deep understanding and experience with reaching underserved and underinvested communities.

Dudek meets the minimum qualifications stated in the County's RFP and understands the work to be done. The Dudek team can accomplish the scope of services in a comprehensive and thorough manner to meet the needs and the aspirations of the County. Our team will bring the following advantages to the project:

Comprehensive, Well-versed Team. The Dudek team offers a full suite of planning, outreach, and greenhouse gas (GHG) technical services, providing defensible and clear planning documents. Our team will blend community-driven, climate-robust, and cost-effective ideas to form actionable policies that clearly meet the regulatory requirements of the state and the County's goals as expressed in its Climate Crisis Declaration.

Award-Winning Plans. Our planners have authored award-winning and transformative plans that have been recognized for their innovation in both environmental planning as well as opportunity and empowerment. We take pride in tailoring our plans to the particular issues and challenges facing a community. With an emphasis on resilience, equity, a community-driven process, and action-oriented solutions, our plans are crafted to fulfill the County's long-range vision.

In-House Creative Design and Publications Services. Our in-house creative design staff's experience covers a broad range of media while practicing our firm's universal design focus: to craft visual stories that cut through complex topics and deliver clear, understandable messages that resonate with both expert and non-expert audiences. Our in-house publications staff specializes in finalizing complex technical publications and outreach materials to successfully convey project goals, objectives, and information to the targeted audience.

Authorized Representative

Name:	Joseph Monaco
Title:	President/CEO, Dudek
Headquarters:	605 Third Street Encinitas, CA 92024
Local Address:	1102 R Street Sacramento, CA 95811
Phone:	760.942.5147
Email:	jmonaco@dudek.com

Deep Bench of Available and Engaged Resource Experts. We take pride in our open culture, flat structure, and operational flexibility. Our project managers can nimbly assign staff and quickly acquire the necessary resources to get projects done. This efficient and supportive environment results in high employee retention that helps ensure that the intellectual resources within a team stay intact for the duration of a project. For this project, we have brought in several local experts who have worked on local sustainability and resilience solutions and facilitated broad-based outreach to the County's most underserved communities.

Communication, Engagement, and Facilitation Expertise. Inclusive and effective public participation is vital to successful project processes and consensus building, from project funding through completion. Dudek is experienced in culturally sensitive, language-appropriate communication, outreach, and engagement to people in underrepresented and underserved communities as well as Tribal governments. We are skilled in bringing people and communities to the table to address concerns and hear suggestions from multiple stakeholder groups, agencies, committees, and commissions to assess needs, risks, and vulnerabilities; define community goals; and coalesce around common purposes. The Dudek team relies on strong presentation and public speaking skills and is comfortable working in teams so that materials and presentations are accessible, clear, informative, and tailored to agricultural, Tribal, and underrepresented and underserved communities.

Strategic Funding and Grant Writing Services. Our team supports jurisdictions and assists in identifying grant opportunities, funding and financing tools, scoping competitive projects, and developing technically competent grant applications for the successful award of monies. We are well versed in the various grant programs at the state and federal level, and we work with our clients to strategize in advance of the release of grant solicitations so that projects are ready and competitive. We also work with jurisdictions to be responsive and competitive regarding unexpected grant opportunities. We support our clients in the management of grants, which is important to build a solid and successful record of accomplishment, implementation, and responsible grant administration.

Qualified Linguists and Language Proficiency. Founded in 2010, Excel Interpreting & Translating (Excel) has the highest standards and adheres to accepted interpreter ethics, principles, and confidentiality. They offer 265 languages, including American Sign Language and Certified Deaf Interpreters. In addition to proficiency in speaking and understanding both spoken English and the target language, Excel's linguists interpret effectively, accurately, completely, and impartially without omitting, adding, or summarizing what is spoken—from source to target languages and vice versa.

Dudek looks forward to working with the County on this project. Please reach out to Jane Gray at jgray@dudek.com or 805.308.8531 with any questions regarding our qualifications or approach.

Sincerely,

Joseph Monaco	**Jane Gray**
President/CEO	Project Manager/Engagement Lead/ Funding Strategy

Joseph Monaco is authorized to bind Dudek and commit Dudek to this proposal.

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APPENDICES

2

EXHIBIT "B"

PROPOSAL QUALIFICATION & EXPERIENCE

2 EXHIBIT "B" PROPOSAL QUALIFICATION & EXPERIENCE

I. General Company Information

The Dudek team includes M.Cubed and BAE Consultants for economics; Fehr & Peers for traffic; Mike Hendrix for Greenhouse Gas, Robb Davis for communication and engagement, and Excel Interpreting for language translation.

A. COMPANY OVERVIEW

Experience and Areas of Expertise

Dudek is a multidisciplinary environmental firm with 42 years' operating experience and more than 700 planners, scientists, civil engineers, landscape architects, and support staff in 17 offices across eight states. We provide a full suite of services, including long range community planning; environmental planning/permitting; cultural resource management; biological resource management; and noise, air quality, and construction compliance management. We assist private and public clients on a broad range of projects that improve our clients' communities, infrastructure, and natural environment. From planning, design, and permitting through construction, we help move projects forward through the complexities of regulatory compliance, budgetary and schedule constraints, and conflicting stakeholder interests.

Our team is readily available to provide high-quality service to Yolo County (County). We have established relationships with local, state, and federal agencies in the region through working directly for the agencies or with them through air quality and greenhouse gas (GHG) calculations and GHG mitigation policies. Using local County experts familiar with the policy and community landscape, we can quickly identify project opportunities and constraints to plan and navigate successful approval strategies.

CLIMATE ADAPTATION AND RESILIENCE

Dudek's climate resilience planners help California's local communities understand the forecasted effects of climate change and identify funding sources to implement solutions. We design plans centered in broad community values to ensure community support and longevity. Our plans focus on implementation by identifying projects that are competitive for state and federal funding to bring about tangible results.

Our planners and funding experts work with a wide range of communities to create climate adaptation and resilience plans. Our work is underpinned by the belief that resilience plans are an opportunity to create healthy and safe places for all community members. At every scale, we emphasize the importance of capacity building and environmental justice to make communities stronger and improve everyday life.

We understand that climate action and adaptation plans (CAAPs) need to be backed by science and adhere to complex legislative requirements while responding to community needs. Yolo County's Climate Crisis Declaration gives further import to the Dudek team's efforts. We create custom

DUDEK SERVICES

- Climate Adaptation Planning
- Environmental Justice Planning
- Spanish Translation
- Land Use Planning
- Public Involvement
- Transportation Planning and Analysis
- Habitat Restoration and Management
- Noise Analysis
- Air Quality Analysis
- Visual Resource Analysis
- Construction Management
- Hazardous Materials Testing
- Hydrology and Water Quality
- NEPA Compliance
- Biological Resource Management
- Cultural Resource Management

downscaled assessments to determine where climate-related hazards will most profoundly affect communities and vulnerable populations. Our custom public outreach events educate and empower communities to create plans that best implement their values and dreams.

Our plans detail complex concepts through graphics, making them user- friendly and understandable to local government officials and the public. Our focus on implementation and funding paves a clear path to success. Finally, by equally emphasizing science, equity, and community support, our plans can create lasting change in the communities in which we work.

AIR QUALITY/GHG

Dudek air quality professionals offer in-depth expertise to cost-effectively navigate complex air quality and GHG emissions requirements for projects throughout the Western United States. Our professionals conduct the necessary analysis and prepare accurate, legally defensible technical studies to help meet aggressive project deadlines. Our extensive project experience enables us to anticipate potential issues and address them in a timely, effective fashion.

The Dudek air quality team has extensive experience estimating criteria air pollutant, toxic air contaminant (TAC), and GHG emissions from construction and operation of a variety of projects, including residential and commercial development, industrial operations, educational facilities, hospitals, utility-scale energy sites, transportation infrastructure improvements, and water/wastewater facilities. We identify project-specific emission sources, determine appropriate analysis assumptions, accurately estimate project-generated emissions, evaluate associated potential impacts, and propose emission reduction techniques as appropriate. Our analyses use federally and state-recommended models, such as the CalEEMod, MOVES, EMFAC, and OFFROAD; air dispersion modeling such as AERMOD; and cancer and non-cancer risk assessments such as HARP2. When needed, we develop custom spreadsheets to calculate emissions outside of constrained models using industry-standard emission factors and data inputs, evaluating impacts (or benefits) of a project.

Our team has experience preparing toxic air contaminant emission inventories and performing health risk assessments associated with the Assembly Bill 2588 Air Toxic “Hot Spots” Program, including construction, operational, and roadway health risk assessments. We perform ambient air quality analyses for criteria air pollutants using AERMOD.

We have been on the forefront of energy assessments and have developed methods to estimate project construction and operational petroleum consumption using CalEEMod carbon dioxide emission estimates and industry standard conversion factors. All facets of energy consumption are presented, including electricity and natural gas consumption, and are estimated consistent with the air quality and GHG emissions assessment. Our energy analyses highlight project energy efficiency features to reduce energy consumption and identify applicable regulations projects would be required to comply with to ensure a project would not result in wasteful, inefficient, or unnecessary consumption of energy resources or conflict with a plan for renewable energy or energy efficiency.

Notably, we effectively communicate complex analyses to decision makers and the public and will work closely with lead agency staff to ensure our methodology, assumptions, and results are understood and accurately reflect the project. Our team has developed strong relationships with air district staff across California and each analysis is tailored to be consistent with the applicable regulatory environment and current recommended impact analysis approaches. Our analyses are presented in accordance with applicable case law, on the forefront of evolving science and legal defensibility.

PUBLIC COMMUNICATION AND ENGAGEMENT

Public and stakeholder communication and engagement are foundational to successful planning projects and processes. Effective language, appropriate and inclusive outreach, and engagement must be rooted in the local culture, sense of place, and identity of the people who make up the community. Our engagement approach is always tailored to the specific needs of the communities in which we work.

Dudek supports local agencies in identifying specific areas where outreach and engagement are critical to meet objectives. We assist local agencies draw from the concerns and suggestions of multiple stakeholder groups, committees, and commissions to define community goals and coalesce around common purposes. Our staff is skilled in engaging with local community members and agency officials to weave community into planning process.

The Dudek team understands that members of several communities in the County have been historically and disproportionately disenfranchised from decision making while also bearing the brunt of climate impacts. These include agricultural production and processing workers as well as small farm operations. Community members often lack direct representation and decision-making authority. Barriers to inclusion may be due to language, time constraints, need for childcare, perceptions about governance, as well as agencies' inability to effectively assess and engage these communities due to lack of institutional knowledge. Building trust with communities occurs when communication is clear, relatable, and authentic. Dudek has enlisted Robb Davis who has been a local elected official and managed County-wide outreach efforts for community-based organizations.

Further, Dudek has brought in local expertise on key economic and sustainability issues, including agricultural production, energy and water use, and County employment and development. Richard McCann of M.Cubed has represented agricultural interests on state and local matters for three decades and worked to create the Valley Clean Energy Alliance. Bay Area Economics has conducted numerous local economic studies and Managing Principal Matt Kowta has sat on a local commission addressing transportation issues.

For the CAAP to be actionable and used, it must be supported by the communities in the County. Hence, the public and stakeholders must understand and be part of shaping the vision and proposed outcomes of the CAPP and have had a hand in meaningfully shaping the destiny of their community given their involvement in implementation and living the CAAP.

CREATIVE SERVICES AND PUBLICATIONS SERVICES

Our in-house technical storytelling and creative services staff specializes in creating easy-to-understand renderings of complex systems and processes. Our staff has extensive experience in providing engaging design and visual communications that translate technical subjects like water systems and management to effective marketing messages. Using the latest technologies to create customized digital illustrations and simulations, our staff will transform the County's visions in a way that informs and assists the public and interested stakeholders in evaluating projects and understanding technical, complex information. Our staff designs PowerPoint presentations, infographics, and outreach material that are customized to the County's unique brand to provide a seamless experience for public outreach. Our in-house technical storytelling and creative services staff work products include the following:

- **Social Media Graphics** can be tailored to maintain clients' existing design elements to maintain continuity with other outreach efforts. Through concise messaging and easily navigable links, we can convey key information while inviting the public to access additional resources and provide feedback.
- **Print Design** includes large multi-page publication layouts, brochures, flyers, large-scale banners and posters, logos and branding, and custom illustrations that communicate complex narratives that are both visually compelling and deliver a key message.
- **Infographics** often involve 3D renderings, photo-realistic elements, and animation to communicate complex ideas and immerse the audience in the information and deliver it in a concise and compelling way.
- **3D Renderings and Simulations** use existing photographs as backgrounds while incorporating planned projects. These simulations can be included in technical reports and marketing and public outreach material.

Our technical publications staff specializes in complete document solutions, finalizing complex technical publications and outreach material under tight deadlines. Our staff has worked on many sensitive and controversial projects, and our editors and publications specialists understand the importance of preparing robust and consistent responses to comments. Our in-house publications team uses document management, checks for consistency, proofreads and copyedits, formats, and reviews document accessibility to successfully provide error-free outreach material and technical documents.

WEBSITE PUBLISHING

Dudek staff have extensive experience incorporating documents into an online environment for public review and dissemination. We use ESRI StoryMaps and Experience Builder, create interactive maps, graphics, web-based PDF documents, and interactive forms. We also develop web portals using Microsoft SharePoint for client and public collaboration.

Dudek's graphics and IT services capabilities include website design and development, including the following:

- Information architecture and site planning
- Graphic user interface and user experience design (UI/UX)
- Responsive site design for display on mobile and tablet devices
- Programming in HTML, JavaScript, CSS, PHP, and WordPress, among other scripting languages
- Image optimization for fast download of maps and images.

The Dudek team can also develop customized online content, such as videos and motion graphics, and provide hosting services for client websites and landing pages, as needed.

The Dudek graphics team, in collaboration with our web development/content publishing team and publications staff, will produce and publish the web-based versions of project deliverables as needed. Our web content publishers are familiar with requirements for posting documents to our clients' websites and have received commendation on file organization and our ability to adhere to web standards.

Financial Stability

Dudek is a 100% employee-owned corporation that has been profitable each year since its founding in 1980. The firm is in sound financial condition and has no financial issues that would impede our ability to provide the services sought for this contract. Dudek has a strong, experienced, fiscally responsible management team, allowing the firm to finance operations with internally generated funds.

B. BACKGROUND AND DEPTH OF ABILITY

The Dudek team has a background in climate-related planning, paired with the depth of staff to meet the County's needs. Our depth and breadth of experience means we can quickly assemble and mobilize the appropriate level of service to match your project needs and budget.

1. TOTAL NUMBER OF EMPLOYEES

Dudek has a total of 760 employees in 17 offices across the nation. Our size is an asset to our clients, allowing us to provide superior customer service and bypass the bureaucratic processes that can be experienced by large international and federal contracting firms.

2. BUSINESS STRUCTURE

Dudek is a California Corporation that maintains an organizational structure that places clients at the top, supported by project managers who have the ability and agency to be decision-makers and entrepreneurs. Internal administrative processes are kept to a minimum, enabling project managers to be flexible and responsive to client needs. This structure and our empowering culture have resulted in low employee turnover, and the team we present in this proposal will see your project through to completion.

Figure 1 outlines Dudek's key personnel, support staff, and lines of communication for this project. **Table 1** details personnel roles and qualifications, and resumes are included in **Appendix A.**

Figure 1. Key Personnel and Support Staff

County of **YOLO**

PROJECT MANAGEMENT

Project Manager/Communication and Engagement Lead/Funding Strategy
Jane Gray

Deputy Project Manager
Jennifer Reed

PROJECT TEAM

GHG Inventory
Mike Howard (Natural and Working Lands)
Sarah Halterman
Shane Russett*
Mike Hendrix[1]

GHG Inventory (Measure Development), Resilience Strategy
Rose Newberry, AICP, WEDG

GHG Inventory (Measure Development)
Henry Eckold*
Nick Johnston*

GHG Inventory
David Larocca

Communication and Engagement
Robb Davis, PhD[5]
Madelyn Murray*

Economics
Richard McCann[2] *(Energy)*
Matt Kowta[3] *(Agriculture)*

Traffic/Inputs for GHG
Lisa Valdez

Traffic
Amanda Meroux, EIT*
Ronald Milam[4]
Greg Behrens[4]

Forestry
Scott Eckardt, RPF

Wildlife, Water, and Climate Resilience
Fraser Shilling, PhD

GIS
Curtis Battle

Web Development
Christopher Starbird

Graphic Design
Melanie Betlach
Karen Castaneda

Technical Storytelling
Raoul Rañoa

Language Interpretation
Koy Saephan[6]

[1] Mike Hendrix Consulting
[2] M.Cubed
[3] BAE Consultants
[4] Fehr & Peers
[5] Independent Consultant
[6] Excel
* Dudek Support Staff

Table 1. Dudek Team

Name and Role	Qualifications	Education
DUDEK		
Dudek Project Management, Leads, and Key Personnel		
Jane Gray Project Manager/ Engagement Lead/ Funding Strategy	– 23 years' project management and environmental planning experience – Specializes in agricultural resource and policy planning, policy analysis, and land use planning	Universität Dortmund, Germany MS, Regional Planning and Management State University of New York, Buffalo BS, Social Work
Jennifer Reed Deputy Project Manager	– 15 years' experience in air quality and environmental planning – Leads Dudek's air quality services team and specializes in air quality, greenhouse gas (GHG) emissions, health risk assessment (HRA), and energy technical analyses	University of California, Santa Barbara BA, Environmental Studies BA, Geography
Mike Howard GHG Inventory (Natural and Working Lands)	– 21 years' experience in biological resource assessment, regional habitat conservation planning, and regulatory permitting – Specializes in developing permitting and environmental documentation solutions for large, complex projects	University of California, Santa Barbara MESM, Applied Ecology BS, Environmental Studies BS, Ecology
Sarah Halterman GHG Inventory	– 6 years' professional experience in air quality and climate change – Specializes in air quality and GHG emissions inventories, climate action planning, energy technical analyses, and long-range planning documents	University of California, Los Angeles MA, Geography University of Maryland, College Park BS, Environmental Science and Policy: Global Environmental Change
Rose Newberry, AICP, WEDG GHG Inventory (Measure Development), Resilience Strategy	– 8 years' experience in air quality and planning – Specializes in climate adaptation and resilience strategy	California Polytechnic State University, San Luis Obispo MCRP, Environmental Planning and Sustainability Humboldt State University BS, Environmental Management and Protection/Natural Resources Planning
David Larocca GHG Inventory	– 25 years' experience – Specializes in air quality permitting	BS, Mechanical Engineering, University of Florida

Name and Role	Qualifications	Education
DUDEK		
Dudek Project Management, Leads, and Key Personnel		
Lisa Valdez Traffic/Inputs for GHG	– 23 years' experience in transportation planning and analysis – Specializes in long-range transportation plans, multimodal mobility plans, and transportation analyses	California Polytechnic State University, San Luis Obispo MCRP, City and Regional Planning University of California, Santa Cruz BA, Environmental Studies Lancaster University, England Education Abroad Program, Environmental Science
Scott Eckardt, RPF Forestry	– 19 years' professional experience in the natural resource management field – Specializes in forest resource and fire management issues in open-space and wildland-urban interface (WUI) areas throughout California	California State University, Long Beach MA, Geography California Polytechnic State University, San Luis Obispo BS, Forestry and Natural Resources Management
Fraser Shilling, PhD Wildlife, Water, Climate Resilience	– 30 years' post PhD experience – Specializes in interactions between human development and natural systems, environmental data sharing through web services, and climate resilience	University of Southern California PhD Ecology BSc Biological Sciences
Curtis Battle GIS	– 11 years' experience in a wide variety of GIS platforms and techniques – Specializes in GIS support for biological technical reports, vegetation mapping, and wildlife surveys	San Diego State University MS, GIScience BA, Geography Mesa College AS, Geographic Information Systems Specialist
Chris Starbird Web Development	– 17 years' experience – Specializes in database design, interactive web development and design, web-based mapping, and high-quality cartographic design	University of California, Santa Barbara BA, Geography
Melanie Betlach Graphic Design	– 21 years' experience in design – Specializes in publication layout, print work, brand creation and style guides, Microsoft templates, and illustration	Academy of Art University MFA, New Media/Computer Arts University of California, Santa Cruz BA, Biology

Name and Role	Qualifications	Education
Karen Castaneda Graphic Design	– 9 years' experience – Specializes in marketing and corporate branding	Universidad Autónoma de Nuevo León, Facultad de Artes Visuales BS, Graphic Design
Raoul Rañoa Technical Storytelling	– 24 years' experience – Specializes in print and Web graphics, including prepress, vector, and 3-D illustration; GIS; social media; video; and motion graphics	California Polytechnic State University, Pomona BA, Communications (Journalism Focus)
DUDEK		
Dudek Support Staff		
Shane Russett GHG Inventory	– 3 years' professional experience – Specializes in climate modeling, soil carbon sequestration, and data analysis	University of California, Berkeley BA, Atmospheric Science
Henry Eckold GHG Inventory (Measure Development)	– 3 years' experience – Specializes in climate action and adaptation planning, general plans, and GIS	California Polytechnic State University, San Luis Obispo MCRP, City and Regional Planning BS, Environmental Management and Protection
Nick Johnston GHG Inventory (Measure Development)	– 4 years' professional experience in planning – Specializes in safety and climate adaptation	California Polytechnic State University, San Luis Obispo BS, City and Regional Planning
Madelyn Murray Communication and Engagement	– 4 years' experience in environmental research, grant writing, and regional planning support – Specializes in supporting underserved communities, outreach and engagement, and climate resiliency	University of California, Santa Barbara BA, Environmental Studies (Ecology emphasis)
Amanda Meroux, EIT Traffic	– 4 years' experience – Specializes in the preparation of traffic impact analysis, technical documents, and traffic control plans	University of California, Davis BS, Civil and Environmental Engineering
Mike Hendrix Consulting		
Mike Hendrix GHG Inventory	– 24 years' experience – Specializes in air quality and greenhouse gas (GHG) emissions analysis, climate change analysis, and climate action planning	University of California, Riverside BS, Environmental Science

Name and Role	Qualifications	Education
M.Cubed		
Richard McCann Economics (Energy)	– 37 years' experience – Specializes in economic consulting, including cost-effective analyses and vulnerability analyses	University of California, Berkeley PhD, Agricultural and Resource Economics MS, Agricultural and Resource Economics BS, Political Economy of Natural Resources University of Michigan MPP, Institute of Public Policy Studies
BAE Consultants		
Matt Kowta Economics (Agriculture)	– 30 years' experience – Specializes in development feasibility and market analysis, affordable and workforce housing, public finance and fiscal impact, and strategic economic development	UC Berkeley Master of City Planning UCLA BA, Geography
Fehr & Peers		
Ronald Milam, PTP, AICP Traffic	– 28 years' experience – Specializes in disruptive trends, SB 743 implementation, and new metrics to help inform challenging transportation policy and technical questions	University of California at Davis BS, Environmental Policy Analysis and Planning (Emphasis on Land Use and Transportation Planning)
Greg Behrens, AICP Traffic	– 14 years' experience – Specializes in community mobility and transit service improvement projects, including projects throughout Yolo County	University of Washington MS, Urban Planning University of California, Santa Barbara BA, Urban Studies and Planning
Independent Consultant		
Robb Davis, PhD Communication and Engagement	– 30 years' experience – Specializes in community-based health programming in underserved communities in Yolo County	Johns Hopkins University Bloomberg School Public Health PhD, Population Dynamics Master's, Public Health (MPH)
Excel Interpreting & Translation		
Koy Saephan Language Interpretation	– 22 years' experience – Specializes in ensuring equal access to resources for everyone, regardless of language proficiency	University of Los Angeles BA, English Literature

3. APPLICABLE LICENSES, CERTIFICATIONS, AND EXPIRATION DATES

The Dudek team has the applicable licenses and certifications to perform work on this project. Dudek's California Business License is C1210012, which does not have an expiration date. In addition, several members of the Dudek team hold professional licenses and certifications, which are noted in individual resumes provided in **Appendix A**.

II. Experience and Qualifications

A. VENDOR MINIMUM REQUIREMENTS

The Dudek team meets the County's minimum requirements:

1. Each key member of our team has a minimum of five (5) years' experience performing the services required in this RFP, including climate action planning, sustainability planning, and other long-range planning efforts. Documentation is provided in the form of resumes in **Appendix A**.
2. Samples of five (5) relevant work products are included in Appendix B, showing related and recent Climate Action Planning projects and projects with similar scope and complexity.

100%

The team presented in this proposal will be 100% committed to this contract and up to 100% available.

B. CAPABILITIES AND SKILL

Relevant Background Information and Experience

The Dudek team has the capacity to perform the tasks required in the County's RFP. The team specifically assembled for this contract, including each of our subconsultant partners, has the availability and capacity to provide services on the project. We have included a wide range of team members with different specialties to accommodate the specifics of any impending project.

The team presented in this proposal is fully committed and available for this contract. With projected availabilities ranging from 30-100%, our selected team will promptly proceed with the project. Team members can commit substantial effort (up to 100%) to the task when it is necessary for the success of the project.

Collectively, the Dudek team has successfully delivered the following projects relevant to the County's CAAP.

DUDEK EXPERIENCE

San Diego Regional TerraCounty Assessment Project

Client: SANDAG

Dudek was selected by SANDAG to conduct a carbon storage and sequestration study for the San Diego Region, which provided jurisdiction-level accounting of carbon storage, sequestration, and GHG emissions for natural and working (i.e., agricultural) lands. The study employed GIS tools developed in collaboration with the California Department of Conservation, and SANDAG recently obtained grant funds from the State of California under the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68) to conduct the assessment. Dudek built the geospatial database of data inputs, ran the baseline scenario, and evaluated future land use and management scenarios using the GIS-based tools to provide an accounting of landscape carbon in the natural and working lands of San Diego County. Dudek also identified and assessed the effectiveness of management activities for maintaining and increasing carbon storage and decreasing GHG emissions from natural and agricultural lands, including through habitat restoration, fire management, avoided conversion, land use planning, urban tree planting, improved fertilizer management, soil amendments, and use of cover crops and mulches. In addition, Dudek participated in stakeholder outreach and coordination throughout the assessment.

The Carbon Storage Study is available online here: https://www.sandag.org/index.asp?classid=17&subclassid=46&projectid=510&fuseaction=projects.detail

Holistic Implementation of Adaptation and Transportation Resilience Strategies Contract

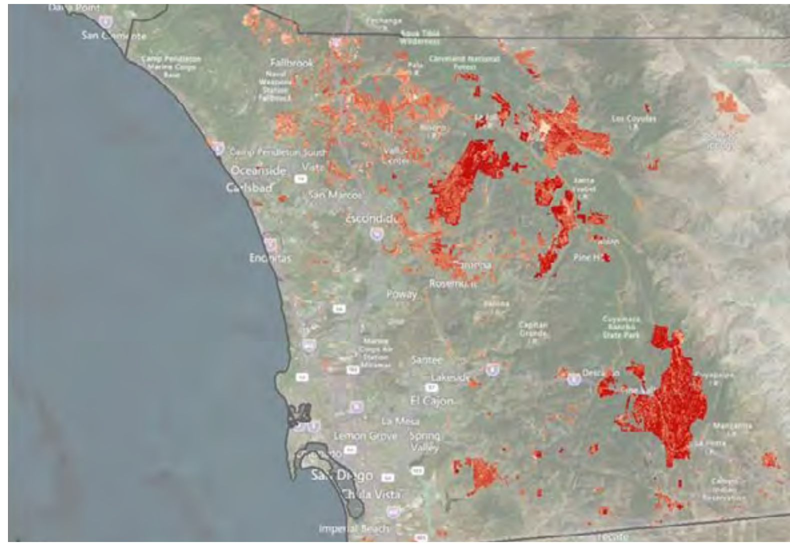
Client: SANDAG

Under our as-needed environmental services contract with SANDAG, Dudek prepared a tool and toolkit that local jurisdiction planners and project managers can use to identify what adaptation strategies should be implemented and why. This tool provides a deliberate process for understanding local vulnerabilities and values as well as for evaluating adaptation strategies based on equity, economic, environmental, and feasibility criteria. The Toolkit describes how local jurisdictions can choose the most relevant evaluation criteria and assign weighting, as needed, to reflect their hazard profile and vulnerable communities. The Toolkit also includes resources to help local jurisdictions move forward with implementation, including best practices, monitoring metrics, and potential funding opportunities.

Carbon Storage of Agricultural and Grazing Lands

Client: Resource Conservation District of Greater San Diego County

We were contacted by the Resource Conservation District of Greater San Diego County (RCDGSDC) to quantify and map the carbon storage of the agricultural and grazing lands in the County. RCDGSDC and the San Diego County Local Agency Formation Commission received a Sustainable Agricultural Lands Conservation grant from the California Department of Conservation, which is primarily funded through California Climate Investments cap-and-trade funds. The grant was to develop approaches to protect at-risk agricultural lands from sprawl and to promote a healthy agricultural economy while also avoiding increases in greenhouse gas emissions associated with the conversion of agricultural land to more greenhouse gas-intensive nonagricultural uses. Dudek used agricultural and grazing lands mapping data provided by San Diego State University and the RCDGSDC, as well as spatial data on soil types

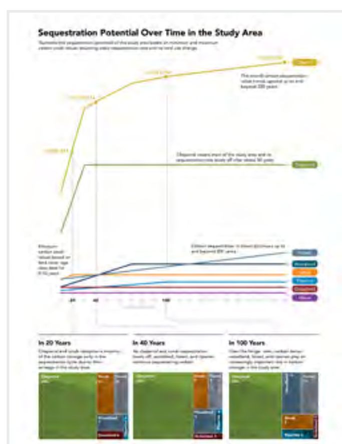


in the County, and linked that spatial data with carbon stock values used in the SANDAG carbon storage study, which was derived from California Air Resources Board research and data, to provide estimates of the total carbon storage on lands mapped as agricultural and grazing lands in San Diego County.

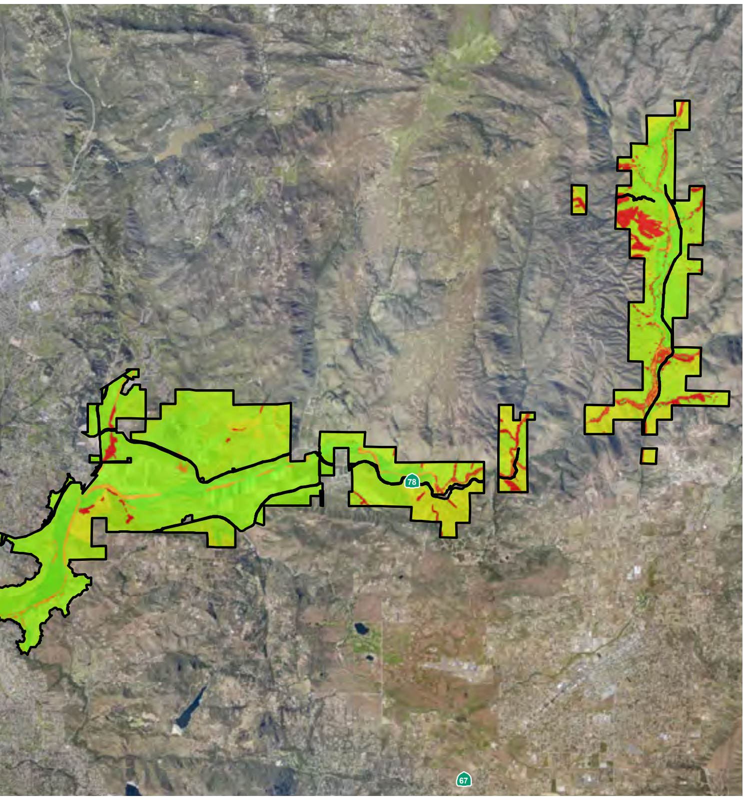
Carbon Storage and Sequestration Assessment for Four Watersheds of San Diego County

Client: San Diego Canyonlands and San Diego River Conservancy

Dudek was selected by San Diego River Conservancy, in collaboration with San Diego Canyonlands, to develop an assessment of the carbon storage and sequestration potential of the natural and working (i.e., agricultural) lands for the Otay River, San Diego River, Sweetwater River, and Tijuana River watersheds of San Diego County, California. The study focused on developing estimates of landscape carbon storage and sequestration that accurately reflected the current conditions and characteristics of the local watersheds. Dudek used the highest resolution spatial data available for land cover and soils coupled with estimates of carbon stocks from biomass studies tailored to the specific vegetation and land covers found in the county. Dudek used the GIS-based model referred to as



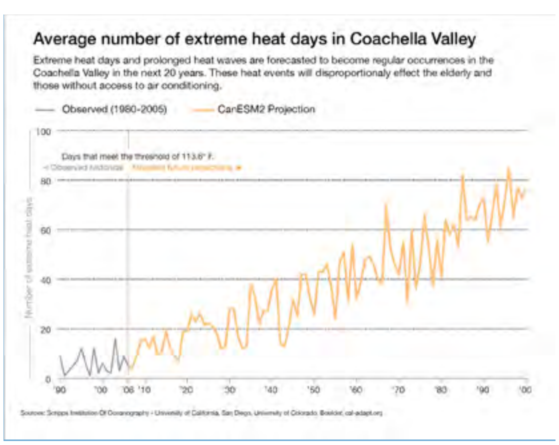
InVEST (Integrated Value of Ecosystem Services and Tradeoffs) to map and quantify the baseline carbon storage as well as to estimate carbon sequestration potential using land coverage class data representing minimum and maximum carbon stocks. The study also discussed the implications of climate change on carbon storage as well as natural and agricultural land strategies for managing carbon.



Carbon Storage Study

Client: City of San Diego Public Works

Dudek prepared a carbon storage study for 40,000 acres of watershed protection lands managed by the City of San Diego Public Works Department. This study used the GIS-based InVEST tool to model carbon storage in the aboveground live, aboveground dead, belowground live, and soil carbon pools in City-owned lands around reservoirs and in preserve lands in San Diego County. Dudek's Mike Howard led the study and was responsible for developing the study methods, researching and identifying the best carbon stock values for the various carbon pools across all land cover types, interfacing with our GIS team to run the model, and analyzing the reporting for city staff. City staff used the results of the carbon storage study to explore implications of land management actions on watershed protection lands and to help develop climate action plan strategies.



Eastern Coachella Valley Action Plan for Climate Resilience

Client: Coachella Valley Association of Governments

Dudek led the team preparing the Eastern Coachella Valley's Action Plan for Climate Resilience by working with local stakeholders and regional agencies to identify policy gaps in creating projects that result from climate-related hazards as well as projects that are eligible for grant funding. Dudek performed a disruptive trend analysis to discuss trends and technology in housing and sustainability that have emerged since many of the regional plans were written. The Final Action Plan serves as an implementing document to fund green infrastructure, affordable housing, parks, and transportation projects with broad community support and specific funding sources. The project won a Merit Award for Innovation in Green Community Planning from the American Planning Association - Inland Empire Section.

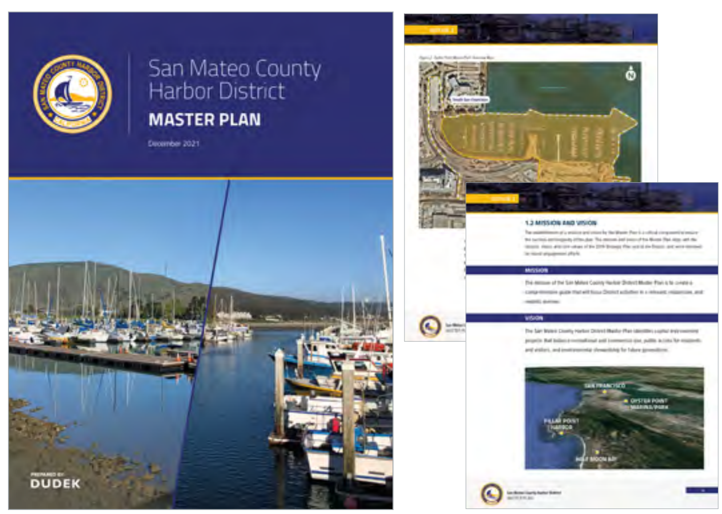
San Mateo County Grant Writing and Administration

Client: County of San Mateo

Dudek worked with San Mateo and Santa Clara Counties as well as their respective RCDs on a project and grant application, which was successfully funded for the Department of Conservation's Working Lands and Riparian Corridors Grant Program. The goal was to enable the development and implementation of a robust natural and working lands component of San Mateo's Climate Action Plan as well as develop a guidance document for statewide climate action planning efforts. The innovative and interregional project marries policy development with on-the-ground project implementation to achieve reductions in GHG emissions and carbon sequestration. The proposed project will focus on the critical role of rural working lands and agricultural preservation in regional planning for climate action and long-term resilience. The goal of the project was two-fold: (1) jointly sustain peri-urban agricultural lands in production while preventing land speculation and unplanned development and (2) facilitate widespread adoption of agricultural practices that increase carbon sequestration, which in turn increases regional climate resilience.

San Mateo County Harbor District Master Plan Development and Planning Services

Client: San Mateo County Harbor District



Dudek prepared the San Mateo County Harbor District Master Plan, a comprehensive guide that will focus San Mateo County Harbor District activities at Pillar Point Harbor and Oyster Point Marina/Park in a relevant, responsive, and realistic manner for decades to come. The Master Plan will support the Harbor District in navigating and defining the best possible use of its land and water resources and in identifying and achieving capital improvement projects that are aligned with community values.

The Master Plan process included a survey of all water and land-side San Mateo County Harbor District assets and robust public outreach, including four virtual public workshops, an online survey, in-person pop-up events, canvassing, and one-on-one stakeholder interviews. Pillar Point and Oyster Point are well-used San Mateo County Harbor District destinations by residents, visitors, and commercial fisherman. It was critical to the District and the project team to ensure community values and desires were taken into consideration when developing the capital improvement-focused Master Plan.

San Carlos Hazardous Fuels Reduction

Client: FIRE SAFE San Mateo County

Dudek supported the City of San Carlos in its efforts to implement proposed fuel reduction activities on approximately 130 acres of City-owned open space in the wildland-urban interface. The project was funded by a Federal Emergency Management Agency grant. The purpose of the project was to reduce hazardous fuel loads and vertical and horizontal fuel continuity within the wildland-urban interface in four City-owned parks located in an area classified by the City of San Carlos as a Hazardous Fire Area. Dudek prepared fuel treatment prescriptions and conducted biological and cultural resources field surveys. Dudek also prepared a notice of exemption to support CEQA compliance. Proposed fuel management activities include grazing, brush and tree thinning/pruning, herbicide treatment of invasive species, and vegetation chipping and mastication. Additionally, Dudek foresters assisted the City of San Carlos in identifying priority fuel reduction areas and refining work areas based on sensitive resources and site constraints, including biological and cultural resources.

Vacaville Energy and Conservation Action Strategy Update

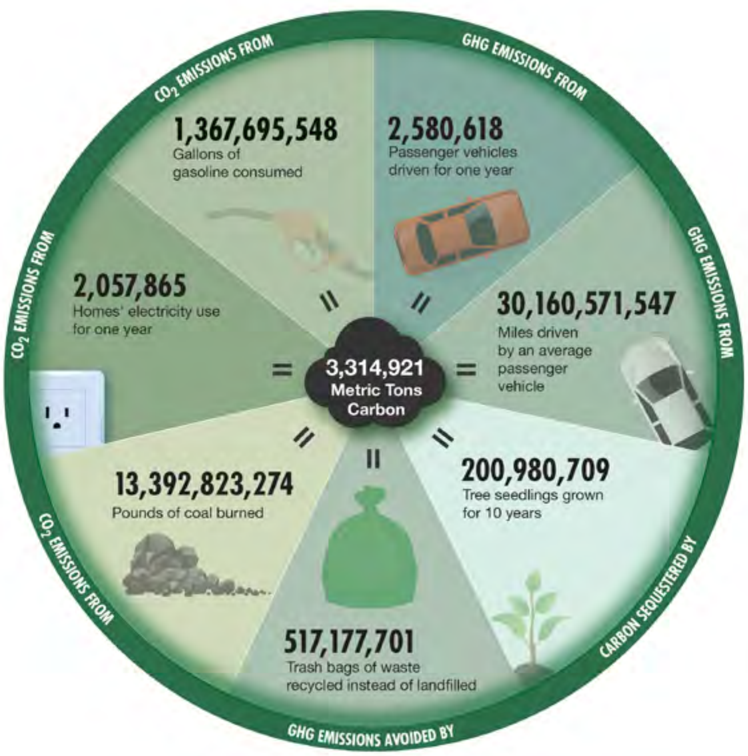
Client: City of Vacaville

Dudek developed methodology to update the City of Vacaville's GHG emissions inventory and performed emission forecasts through 2035 using the most current state and federal laws. Our team developed and reviewed policy to reduce half of the city's annual GHG emissions and create simple implementation and tracking for city staff. We worked with city and agency staff to identify existing goals and projects to include and improve upon to ensure seamless integration of the action plan into regular city business. We consulted with private industry to understand how policies would affect local development plans and land use patterns. As part of community outreach and engagement, we presented to the council and public on the strategies and contents of the plan.

Transformative Climate Communities

Client: City of Indio

Dudek prepared the City of Indio's Transformative Climate Communities Plan. The plan is a roadmap to identify and prioritize projects and investments in the City of Indio's Jewel Community to support neighborhood-level environmental, public health, workforce, and economic benefits. These projects were identified through extensive public outreach and local agency coordination to maximize public support and best meet the desires, dreams, and opportunities of the Jewel Community. This plan takes an in-depth look at four grants aligned with the key themes and provides initial documentation and recommendations for grant applications. It was awarded the Opportunity and Empowerment Award for the Inland Empire Section of the American Planning Association in 2021.



Tejon Ranch White Paper Carbon Study

Client: Tejon Ranch

In early 2020, Dudek prepared a carbon storage study for the approximately 250,000-acre Tejon Ranch study area. Our proposed project team members Mike Howard, Jennifer Reed, and Scott Eckardt worked together on this study to estimate the important carbon storage role that the natural and working lands of this ranch provide. For the Tejon Ranch carbon storage study, we assigned carbon values to over 110 different vegetation and land cover types based on various reputable sources of data including California Air Resources Board carbon inventories, the U.S. Forest Service Forest EVALIDator web application, and the Intergovernmental Panel on Climate Change GHG inventories. After estimating the snapshot of total carbon stored within the conserved lands to understand the estimated carbon in everyday terms, we then presented the equivalent of the carbon stored in GHG emissions (after converting from carbon to carbon dioxide [CO_2]) from various sources, including passenger vehicles driven for 1 year and homes' electricity use for 1 year.

State Route 37 Climate Change Adaptation/Resilience Project

Client: Caltrans

While with UC Davis, Dr. Shilling worked with Caltrans District 4 and over 200 local stakeholder organizations and individuals to develop an assessment of risks from sea level rise to State Route 37 (San Pablo Bay) and the surrounding natural and working landscapes. The two-part project involved extensive public, organization, and regulatory agency interaction; bespoke flood modeling; species and habitat risk assessment; and engineering and cost alternatives. Stakeholders were asked about their use of the corridor, their tolerance of new tolls, and how they would balance travel and ecological consequences of possible alternative scenarios. The resulting adaptation models and plans have been included in Caltrans and Metropolitan Transportation Commission's current planning for the corridor, which will be implemented using a combination of state and federal funds.

Prop 68 Technical Assistance Program: Communication, Engagement, Facilitation, and Technical Assistance for Tribal Governments and Unrepresented Communities

Client: California Department of Water Resources (DWR)

Dudek is working with the California Department of Water Resources (DWR) on outreach, communication, engagement, and facilitation with GSAs, Tribal governments, and underrepresented communities as well as technical assistance and support services for the Technical Assistance Program (Program). Our team's communication and engagement work includes the following:

- Preparation of Communication and Engagement Plans in English and Spanish
- Identifying, prioritizing, and mapping Tribal governments, Tribal communities, and underrepresented communities
- Communication and engagement of Tribal governments, Tribal communities, and underrepresented communities on Sustainable Groundwater Management Act (SGMA) and the role of their local groundwater sustainability agencies (GSAs)
- Conducting the needs, risks, and vulnerabilities of water systems in Tribal governments, Tribal communities, and underrepresented communities in SGMA-regulated basins, and sharing these outcomes with GSAs to facilitate coordination and dialogue
- Development and implementation of a multi-lingual needs assessment survey
- Development and production of 9 educational videos in 7 languages
- Conducting personal interviews of Tribal and Underrepresented Community members
- Development of social media posts and workshop flyers paired with basin-specific and community specific workshops for the purpose of promoting the program
- Conducting workshops and attending meetings, preparing water-system-related need, risk, and vulnerabilities assessments

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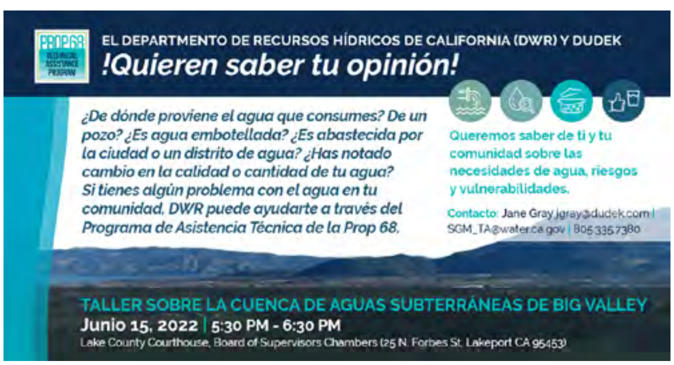
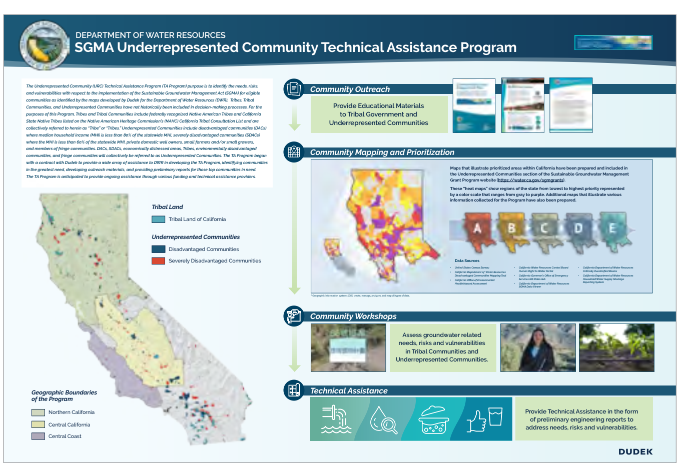
- Development of education materials focused on water conservation for all 10 hydrologic regions in the state
- Providing technical assistance services and support for actionable engineering and hydrological projects/programmatic solutions that support water resilience and water equity

Additionally, our graphic design and media production teams crafted and implemented custom branding, including logos, colors, and iconography, for all communications such as handouts, flyers, posters, project study areas (PSAs), social media posts, and videos. The videos and PSAs were prepared to reach speakers of multiple languages, including English, Spanish, Tagalog, and Traditional and Simplified Chinese, Hmong, and Mixteco (Alto and Bajo). Videos were developed with input from native speakers to ensure culturally sensitive coloration and iconography, and animations were compliant with the Americans with Disabilities Act to ensure accessibility. Videos are available to view online here: [Prop 68 Technical Assistance Program - YouTube]





The Dudek Team is also preparing onsite engineering, geologic, hydrologic, and other technical services to the communities based upon a ranking of water systems. The types of services provided include, but are not limited to:

- Groundwater level monitoring
- Aquifer testing to determine long-term yield and supply
- Identifying Groundwater Dependent Ecosystems
- Analyzing well interference
- Identifying additional water supply
- Analyzing existing well condition using downhole video log
- Rehabilitation of water storage tank
- Long-term water supply and demand analysis
- Analyzing and facilitating water transfers

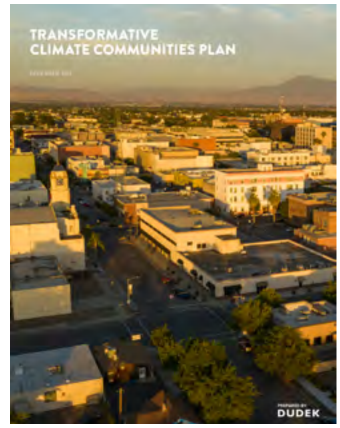
Excel Interpreting & Translation assists with language translation for the project. A description of the Underrepresented Communities Technical Assistance Program is available on the DWR website here: Underrepresented Communities Technical Assistance Program (URC TA Program)

https://water.ca.gov/Work-With-Us/Grants-And-Loans/Sustainable-Groundwater/Underrepresented-Communities-Grants

Bakersfield Transformative Climate Communities Plan

Client: City of Bakersfield

The Bakersfield Transformative Climate Communities (TCC) Plan is an extension of the city's planning efforts, primarily the Downtown Vision Plan. The TCC Plan identifies projects that support the development of housing, employment, and active transportation through Cap and Trade, as well as other State-level funding sources. Dudek led a qualitative and GIS-based review of City plans and policy to identify projects that are most competitive for grant funding based on their defensible greenhouse gas reductions and community support.



Dudek created a form for the public to submit their transformative project ideas. Dudek scored each of the more than 100 projects on 10 criteria spanning grant requirements, transformation, and support. This created a transparent process to decide which projects would be highlighted in the plan and included in additional outreach, as well as provided direction on how to refine lower scoring projects to be included later.

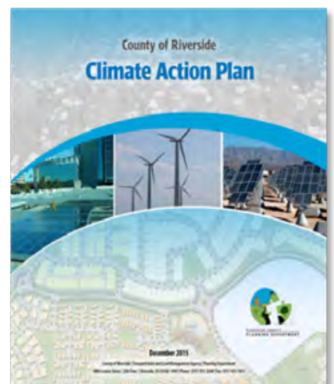
SUBCONSULTANT EXPERIENCE // MICHAEL HENDRIX CONSULTING

Riverside County Municipal and Community Climate Action Plan

Client: County of Riverside

Michael Hendrix assisted the County of Riverside in developing its Climate Action Plan (CAP) in two phases. In Phase One, Mr. Hendrix calculated 2009 communitywide and municipal emission inventories for the County, set 2020 and 2035 reduction goals, and provided energy performance standards for new development projects as part of the General Plan Update. The communitywide inventory included emissions related to the agricultural sector (working lands) and developed trend lines of agricultural activities through year 2045.

Phase 2 provided a Draft CAP that developed a detailed comprehensive set of reduction measures and an implementation strategy to meet the reduction goal. Mr. Hendrix developed a menu of reduction options called Screening Tables that allowed a flexible way for future development projects to demonstrate consistency with, and tier from, the CAP, which streamlines the CEQA analysis of those development projects. The CAP provides a legally defensible document that future projects can tier from in the analysis of climate change during the CEQA process, which will streamline future project approval and implementation.



In 2018, Mr. Hendrix also assisted the county in the CAP Update that included 2017 communitywide and municipal inventories, a 2030 reduction goal, updated emission forecasts through 2045, and new and revised reduction measures designed to meet the 2030 and 2035 reduction goals. Updates to emissions associated with the agricultural sector were also completed as part of the CAP update.

The Riverside County CAP can be found at [Riverside County Climate Action Plan (rctlma.org)]

This created a transparent process to decide which projects would be highlighted in the plan and included in additional outreach, as well as provided direction on how to refine lower scoring projects to be included later.

City of Agoura Hills Climate Action and Adaptation Plan

Client: City of Agoura Hills

Michael Hendrix is working with the City of Agoura Hills to develop its CAAP, which includes community and stakeholder outreach to understand community priorities for a successful CAAP; development of the city GHG inventory for the years 1990, 2008, and 2018; forecasts for 2020, 2030, and 2045; target setting; GHG reduction measures; and strategy development. One of the key components of this project is to estimate the GHG emissions associated with different economic sectors, including wastewater treatment for the years 2018, 2020, and 2030.

Mr. Hendrix also provided global climate change modeling, downscaled to provide more granularity, to predict climate change impacts, and he developed climate change adaptation strategies to create climate resiliency within the city. A key component of adaptation is to provide community resiliency centers on microgrids with battery storage to equip the community with a safe and functioning space during power outages, extreme heat events, and emergency operations.

Michael Hendrix Consulting is currently working with the city to implement the CAAP, which includes assistance with code development to employ many of the reduction measures as well as development of an integrated monitoring system and CAAP Progress Reports.

The Agoura Hills CAAP can be found at: [Climate Action and Adaptation Plan (CAAP) | City of Agoura Hills, CA (agourahillscity.org)]

Regional Greenhouse Gas Reduction Plan for 21 Cities and San Bernardino County

Client: San Bernardino County Transportation Authority (SBCTA)

Michael Hendrix assisted the San Bernardino Associated Governments (now SBCTA) and 21 cities within San Bernardino County to develop a regional inventory and reduction plan that accurately responds to the State of California's global warming solutions and GHG reduction targets. The work included:

- Developing community GHG inventories for all 21 cities
- Providing an Excel-based climate action plan tool for each city government, which allows the selection of measures and the level of implementation and provides technical and decision-making support
- Developing regional and local climate action measures for the following major sectors: building energy efficiency, renewable energy, transportation, waste, wastewater, water, and urban forestry

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- Developing community climate action plans for each city government using a menu-based approach as well as a unified regional document designed for the public
- Facilitating monthly coordination meetings of the planning directors of all partnership cities
- Coordinating with all partnership cities in understanding GHG inventories, identifying GHG reduction targets, making GHG reduction selections, and providing advice on measure modification and GHG reduction target selection
- Providing template screening tables for each of the partnership cities as the implementation mechanism for their city chapters of the Regional GHG Reduction Plan
- Providing a Program EIR (PEIR) that evaluated the environmental impacts of the Regional GHG Reduction Plan with specific city chapters for each of the 21 participating cities, allowing each to tier from the PEIR for CEQA certification when adopting its own CAP from its respective chapter of the Regional GHG Reduction Plan

After completion of the GHG Reduction Plan, Mr. Hendrix prepared CAP implementation tools, including an implementation strategy report, assessment of funding sources for GHG reduction measures, final customization of screening tables for each city, a CAP progress report template, and development of an implementation tracking tool.

In 2018, Mr. Hendrix assisted SBCTA in the Regional GHG Reduction Plan Update that included all 24 incorporated cities and the county. A 2016 Inventory update was completed for each of the 24 cities and the unincorporated county area which included an inventory of emissions associated with agricultural working lands, updated 2030 reduction targets, forecasts through 2045, and new and revised reduction measures designed to achieve the reduction targets. This work was completed in 2022.

The reduction plan and implementation tools can be found at [Regional Greenhouse Gas Reduction Plan (2021) - SBCTA (gosbcta.com).]

SUBCONSULTANT EXPERIENCE // M.Cubed

Delta Climate Change Vulnerability Analysis

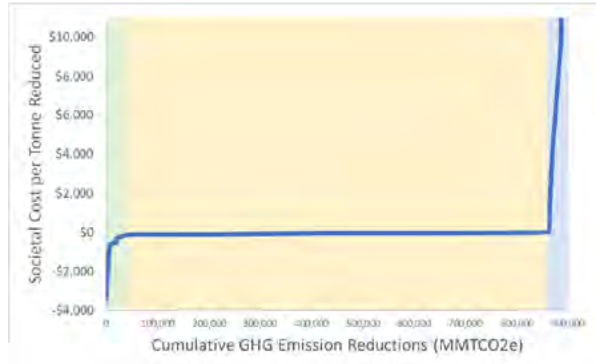
Client: Delta Stewardship Council

M.Cubed worked with a project team to estimate the amount of economic assets and activity exposed to the hazards of increased climate volatility within the Sacramento-San Joaquin Rivers Delta and dependent on water exports. The asset inventory is being deposited into a GIS database that is used to match against scenarios of various sea-level rise and flood intensity. The economic activity exposed to water supply vulnerability is derived from reductions in water supplies across a distribution of delivery conditions for the State Water Project and Central Valley Project that result in either reduced agricultural output or increased municipal water supply costs. The economic value identified as vulnerable is used to develop strategies to adapt to climate change and associated sea level rise.

Imperial County Climate Action Plan

Client: Imperial County Transportation Commission

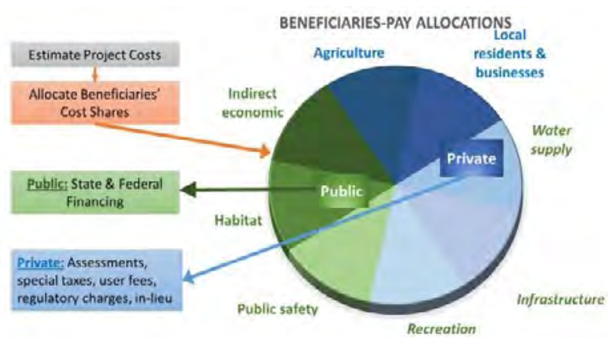
M.Cubed prepared a cost effectiveness analysis of the individual proposed greenhouse gas emission control strategies for Imperial County and its individual jurisdictions. The team reviewed the emission inventory, relevant studies, and climate action plans of other jurisdictions. They developed a supply curve of measures for 2030 and 2050, including on-farm emission reductions and soil carbon sequestration.



Delta Flood Risk Management Assessment District Feasibility Study

Client: Delta Protection Commission

Using a stakeholder-driven process, M.Cubed assessed the feasibility of establishing financing mechanisms to fund improvements and maintenance in the Sacramento-San Joaquin Delta levees. The analysis focused on funding from beneficiaries using appropriate mechanisms including a benefit assessment district. Fifty financing mechanisms were identified and reviewed, with the list narrowed to eight recommendations for future consideration, each tailored to specific benefits derived by beneficiaries. The project coordinated with the Delta Stewardship Council's Delta Levee Investment Strategy.



Barriers, Perceptions, and Potential Solutions to Shipper Adoption of Zero-Emission Transportation

Client: Environmental Defense Fund

Through interviews with shippers and carriers, M.Cubed identified barriers to adoption of zero-emission trucking and proposed solutions that can be encouraged and supported by investors with environmental, sustainability, and governance objectives.

Yolo County General Plan Update Fiscal and Economic Evaluation

Client: County of Yolo

BAE was the economics subconsultant on a team that prepared the Yolo County General Plan Update. This General Plan update, covering agricultural areas of Yolo County as well as a number of smaller unincorporated towns, sought to balance growth pressures, need for fiscal sustainability, and preservation of agricultural lands and related activities. BAE first prepared a local economic background study that analyzed demographics and economic conditions in the unincorporated area of the County and helped the consultant team as well as policy makers understand the market forces that were driving an unprecedented number of proposals for large-scale developments in the unincorporated areas and their economic implications for the future of the County. This phase also included preparation of the housing needs assessment portion of the Housing Element update. In support of economic development, BAE compiled information about the existing local economic activity in targeted industry sectors, including agriculture, biotechnology, and tourism. BAE then collaborated with County staff to conduct analysis to support the preparation of an economic development strategy that would accompany the General Plan and serve as a work program for economic development staff. BAE's role included attending and facilitating a series of targeted industry focus group meetings to explore local economic development opportunities and needs. BAE then drafted recommended policies to be included in the economic development strategy, to best support economic development in the targeted industry sectors.

BAE's work on General Plan alternatives included evaluating market demand in the absence of historic regulatory constraints to growth, fiscal implications of growth, community size thresholds to support various community services and amenities, and the market viability of various growth models. BAE then prepared a market and fiscal analysis for the Draft General Plan Update, to evaluate such issues as the viability of the plan's jobs/housing balance and match policies as they applied to key development locations within the county, potential fiscal impacts of the overall General Plan buildout, and fiscal impacts of buildout of key sub-areas. BAE's work on the final phases of the General Plan Update included assistance in fine-tuning General Plan policies, to ensure a feasible and sustainable General Plan implementation.

Cache Creek Parkway Plan Feasibility Analysis

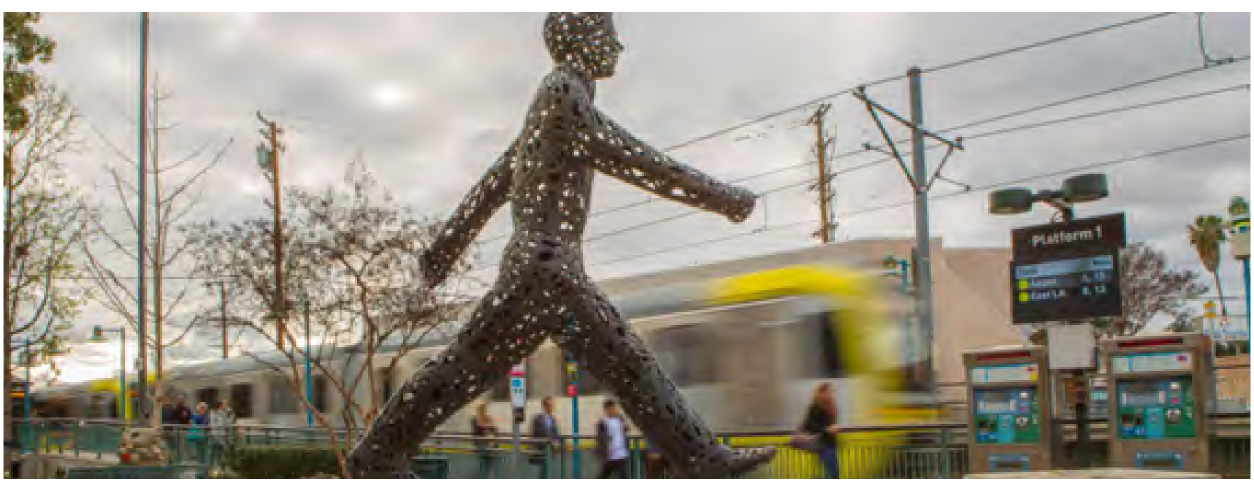
Client: County of Yolo

Yolo County retained BAE to conduct a financial feasibility analysis for the buildout and long-term maintenance of the Cache Creek Parkway Plan, a master plan for the reclamation of former aggregate mining sites for conversion to a networked system of regional open space and recreation amenities. The Parkway plan anticipates that the County will take possession of approximately 30 former mining sites along Cache Creek west of Woodland, CA as mining operations are completed. BAE modeled several different scenarios for the Parkway development, ranging from mostly passive open space with limited visitor facilities to scenarios with visitor amenities and recreation facilities and potential to support hiking, swimming, mountain biking, boating, and other types of recreation. BAE developed a long-term cash flow model that projected timing for capital improvement costs and also projected revenue flows to support capital expenditures and operations and maintenance costs. The model is flexible to allow easy adjustment of the timing for development of individual properties and the specific capital improvements and maintenance requirements. BAE provided the model to County staff to use as a tool to monitor and plan for Parkway implementation. The Cache Creek Parkway Plan won a statewide Award of Excellence from the California Chapter of the American Planning Association.

Climate Action Plan Funding Strategy

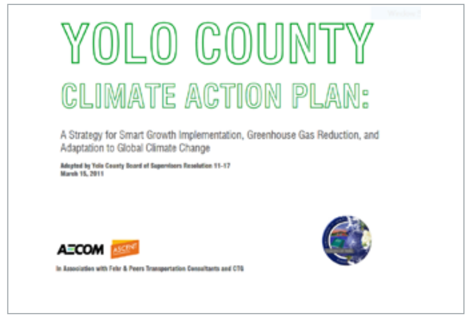
Client: City of South Pasadena

BAE served as the economics subconsultant for preparation of the 2020 Climate Action Plan for the City of South Pasadena. With an extensive array of climate mitigation and adaptation strategies, the CAP required an equally robust strategy to fund the city's aggressive plan to reduce greenhouse gas emissions and prepare the city for adaptation to the effects of climate change. To guide the city's efforts to implement the CAP, BAE developed a funding strategy that began with a set of over-arching funding principles. BAE then identified the general types of funding sources that the city would seek to implement the plan. This included a discussion of potential financing tools that could be used to manage long-term investments in CAP implementation as well as the potential pros and cons of using different funding sources and financing mechanisms. Finally, the funding strategy identified one or more current funding opportunities for each of the CAP measures. The latter was presented in matrix format and included fields for the estimated cost range for each measure, the lead city department responsible for implementation, and one or more specific funding sources.



Yolo County Climate Action Plan

Client: County of Yolo



Fehr & Peers was selected as part of a multi-disciplinary team to develop a CAP for Yolo County. Fehr & Peers developed VMT forecasts to be used in assessing the GHG contribution from mobile sources. The VMT forecasts follow the California Air Resources Board (CARB) Regional Targets Advisory Committee (RTAC) recommended accounting method. Fehr & Peers also provided guidance on transportation and land use strategies that can reduce GHG emissions based on extensive research into best management practices for entities such as the California Air Pollution Control Officers Association and the California Energy Commission. This Plan was a 2011 APA Award Winner for Innovation in Green Community Planning.

Davis Climate Action and Adaptation Plan

Client: City of Davis

Fehr & Peers served as a subconsultant to assist with the development of the Davis CAAP. Fehr & Peers prepared existing and future VMT estimates, conducted an origin-destination analysis using StreetLight data, and developed GHG reduction strategies related to on-road transportation.

https://www.cityofdavis.org/city-hall/community-development-and-sustainability/sustainability-program/climate-change

Sacramento 2040 General Plan Update and CAP

Client: City of Sacramento

Building upon work completed by Fehr & Peers during previous City of Sacramento General Plan updates, the firm is leading a major update to the mobility element for the city's 2040 General Plan and contributing to the city's CAP. This update will account for new laws, planning guidelines, and mobility trends that have emerged that require a fresh perspective for developing the mobility element and associated transportation components of the CAP and general plan EIR. The city is committed to achieving net zero for carbon emissions, and the contribution from transportation is one of the more challenging aspects for the CAP. To ensure a solid understanding of the contributing sources to transportation demand and related emissions, Fehr & Peers is applying the sophisticated regional SACSIM19 activity-based travel demand model developed by the Sacramento Area Council of Governments and using new VMT reduction strategies from the recently updated Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (California Air Pollution Control Officers Association, 2021). The SACSIM model allows tracking of individual travelers, vehicle types, and associated demographic and socioeconomic characteristics to provide a complete picture of daily travel demand and VMT as well as show how they are affected by general plan and CAP policies and actions. Fehr & Peers' work has been designed to meet new legal and planning requirements while also providing a risk assessment about how changes and new expectations could threaten or disrupt desired outcomes. The resulting transportation and land use system will reflect the city's overarching goals of minimizing VMT/GHG emissions, increasing accessibility, and improving safety.

https://www.cityofsacramento.org/Community-Development/Planning/Major-Projects/General-Plan

2. RESOURCES TO FULFILL SCOPE OF WORK

As a mid-sized firm, Dudek provides a personalized, targeted-level service combined with the breadth and depth of capabilities characteristic of larger firms to meet your project's requirements. Whether it's a quick phone call or an additional scope element, Project Manager Jane Gray can quickly mobilize new approaches, resources, and team members to meet your needs. Our depth of staff allows us to be responsive to a variety of needs on multiple, concurrent tasks and remain flexible to changing requirements and unforeseen issues.

Our 700+ person in-house team includes:

- AICP-certified environmental planners
- Air quality specialists
- Accredited LEED professionals
- Registered environmental assessors
- Certified arborists and foresters
- Professional foresters
- Certified GIS professionals
- Graphic designers
- CDFW- and USFWS-permitted biologists
- Registered professional archaeologists
- Registered landscape architects
- Noise specialists
- Licensed hydrogeologists
- Licensed geologists
- Licensed professional engineers
- Licensed contractors

For this project, Dudek has proposed a team of 21 key personnel and 5 support staff. Project roles are outlined in **Table 1,** and **Appendix A** includes resumes that detail qualifications, previous education, and work experience.

Subconsultants

Michael Hendrix Consulting: GHG

Michael Hendrix Consulting (MHC) is a dynamic sustainability and climate action planning firm that provides individual solutions to each client. MHC's clients seek assistance with their high-priority projects where unique environmental compliance issues need innovative solutions.

MHC provides useful and implementable strategies within the plans, programs, and projects they work on that increase the health, welfare, and safety of the communities they serve. This reflects MHC's belief that analyses and plans need to function in a coherent, efficient, and implementable fashion that fit the project and character of the community and local government in which they reside.

M.Cubed: Economics (Energy)

M.Cubed, founded in 1993, provides economic and public policy consulting services to public and private sector clients. Practice areas include project impact analysis, water and energy utility resource planning and ratemaking, resource use efficiency and conservation measures, regional economic modeling, natural resource allocation policies, and environmental plan preparation and review.

M.Cubed is familiar with the institutional settings and constraints that dictate policy choices in the environmental, energy, water, solid waste, utility regulation, agricultural and economic development arenas. The firm regularly manages interdisciplinary teams of analysts to solve multifaceted policy problems. With access to a wide range of research and computing facilities, as well as extensive statistical, econometric, and mathematical model building capability, M.Cubed is well positioned to provide clients with the detailed analyses required by today's complex economic and natural resource policy issues.

BAE Urban Economics: Economics (Agriculture)

BAE Urban Economics, Inc. is an award-winning, national urban economics and real estate consulting practice. Since 1986, BAE has completed more than 2,400 engagements for public agencies, non-profit organizations, financial institutions, and real estate developers. All BAE work is led by seasoned professionals who are responsible for project direction and quality control. The firm intentionally seeks to build a team that reflects the diversity of the communities it serves.

BAE offers a broad range of services focused on the nexus of market economics, feasibility planning, and community-based planning. The firm strives to achieve the "triple bottom-line" of sustainable economics, community equity and social justice, and environmental sustainability. They believe that there are practical solutions to urban issues which will achieve this triple bottom-line, and that consideration of environmental impacts and social benefits, as well as financial returns, creates the best overall value and the highest quality outcomes for its clients and their communities.

Fehr & Peers: Traffic

Fehr & Peers has specialized in providing transportation planning and engineering services to public and private sector clients since 1985. The firm has worked extensively with every jurisdiction in Yolo County over the past 25 years and offers in-depth knowledge of the transportation, land use, and climate issues that shape the County now and in the future. Local projects include a multitude of transportation planning/engineering, CEQA, and climate projects throughout the County. They serve as an on-call transportation consultant for a variety of jurisdictions in Yolo County including the City of Davis, UC Davis, and the City of Winters.

Fehr & Peers develops creative, cost-effective, and results-oriented solutions to planning and design problems associated with all modes of transportation. They are nationally recognized experts who routinely publish original research, serve on national committees, and teach courses to others in the industry. Fehr & Peers has a long history of working with agencies on their climate action plans, and the topic of climate change has been one of Fehr & Peers' long-term research initiatives to help better understand the potential effects of climate change on travel, as well as how transportation systems could help communities combat the effects of climate change.

For climate action plans CAPs and greenhouse gas reduction plans, Fehr & Peers is recognized as a leader in VMT forecasting and transportation demand management (TDM) analysis. Fehr & Peers prepared the VMT guidance contained in the FHWA Handbook for Estimating Transportation Greenhouse Gases for Integration into the Planning Process (2013) and developed similar guidance for Caltrans. Their work also includes over 20 CAPs and over 100 TDM projects with many of these being performed in communities that demand technical rigor, accuracy, and defensibility.

Excel Interpreting & Translating: Language Translation

Excel is a small, culturally competent, and nimble team in the administration and provision of language services. With more than seven thousand contract linguists throughout California, Excel has demonstrated success providing interpretation and translation services to meet the demand for language access for all clients. Competent professional interpreters meet industry standards in their methods and modes of interpreting, both consecutively and simultaneously. Excel understands that translation is much more than replacing words in one language with the equivalent in another. It is about the intended message and the tone that the author of the source materials is trying to get across. It is about being accurate with the data and statistics and with the many nuances that make language unique and understandable to those who speak it. In addition to exceptional interpreting services, Excel specializes in delivering translation services in over 100 languages, with expertise in local, state, and federal government projects.

The Excel team is comprised of individuals from diverse backgrounds who are familiar with the communities they serve and have been successful in their ability to provide language services to all of their clients. With their connections and involvement in the community, they are also a cultural intermediary and community resource for clients.

Resumes for Dudek staff and subconsultants are included in **Appendix A.**

III. Proposer's Understanding and Approach to Project

A. Summary of Understanding

The Dudek team understands its responsibilities as the following:

- Prepare a CAAP that fulfills the values specified in the RFP on Page 4
- Working with County staff and Commission working groups to develop the Community Engagement and Equity Strategy by working with staff to co-develop engagement materials and to follow up on meeting outcomes
- Update the County's GHG inventory with the latest available, reliable data and provide projections for specified intermediate years out to 2050. The team will prepare a retrospective assessment of progress to date and identify accessible metrics and benchmarks.
- Prepare a narrative for a consumption-based GHG inventory. In addition, the Dudek team will recommend an approach for integrating consumption-based and production-based inventories at a future date as well as means of tracking and reporting progress as better data and accounting methods become available
- Collaborate with the Yolo County Resources Conservation District (RCD) to prepare a high-level inventory of GHG emissions and carbon sequestration potential for natural and working lands (NWL)
- Propose and develop a contained set of emission mitigation and sequestration strategies that can be readily implemented. The Dudek team will prepare engineering and economic analyses of the portfolio with implementation issues. Clear priorities will be specified to match available County resources
- Identify vulnerabilities to climate change and prepare adaptation and resilience strategies
- Develop a feasible funding and financing roadmap with specific recommendations
- Prepare an implementation and monitoring plan that is readily adapted over time and integrated with County resource management tools

The Dudek team understands that the County is unique and has a strong agricultural history and future. The predominant land use is agriculture and the County has a concentration of agricultural industry, agriculturally dependent businesses and communities, agricultural research facilities operated by national and international agricultural businesses, particularly in the area of seed research and development, which is due to a combination of a climate that provides a good testing ground for developing plants with drought tolerance and proximity to researchers at the university. These exceptional aspects of Yolo County will be considered and provide tremendous opportunities with regard to CAAP development and implementation, particularly related to partnerships, innovation, and transitional and implementation The CAAP will focus on reducing agricultural emissions and also present economic opportunities for farmers to sequester carbon as statewide efforts increase. In addition, the County can be on the leading edge of developing independent resilience strategies.

As detailed in the following Scope of Work, the Dudek team proposes an innovative approach. The most important element is that the community must embrace the CAAP rather than seeing it as a burden. This begins with community engagement with local guidance on reaching underserved communities and making presentations accessible. The CAAP will be framed as an opportunity to both leverage community assets and to transform to economically advantageous activities that are sustainable and resilient. In particular, growers will be brought in to work collaboratively on the best pathways to reducing emissions and sequestering carbon. The CAAP will present a clear priority for mitigation actions beginning with the largest potential reductions and the most economically advantageous. Strategies that integrate sectors and uses will be emphasized. Adaptation and resilience strategies will focus on underserved communities that can least afford independent action. The Dudek team will present actionable options for financing and funding these strategies.

The Dudek team is committed to completing the project in a timely manner, according to the schedule presented in Part C following the Scope of Work. We will be able to successfully complete the tasks by July 2024.

B. Approach to Scope of Work

TASK 1:

Community Engagement and Equity Strategy

At the beginning of every community engagement project, Dudek prepares a communication and engagement plan, which begins will a clear and consistent message of collaboration and clear schedule and timeline for community engagement. Therefore, this task, Community Engagement and Equity Strategy is very familiar to us and fits into our approach. One of the differentiators in our approach to communication and outreach is our integration of "Asset Framing" as a foundational principle. When working with underrepresented and underserved/underinvested communities, there is a tendency to frame issues through deficits. This is known as "deficit framing." While it is important to ascertain the communities' needs, risks, vulnerabilities, and priorities, this can be stigmatizing. Just as important is to have an understanding of what community assets are and how communities perceive their assets. The concept of asset framing is a cognitive framework to prime associations for worth and hope as a motivator and shaper or equitable action as opposed to fear and deficit as the only motivator to equitable action. Hence, this narrative model provides opportunities for communities to define assets and aspirations before characterizing challenges. It engenders resilience and creativity, both of which are critical to solving complex societal problems.

We understand that the Community Engagement and Equity Strategy will be based on the research and vision outlined by County Staff, CivicSpark Fellow(s), and the Yolo County Climate Action Commission (YCCAP), as well as the YCCAP Working Groups, specifically the Natural and Working Lands Group with the RCD and the Equity and Engagement Group. Dudek will outline a variety of progressive strategies to communicate and engage with frontline communities, including posting and promoting the project and engagement opportunities on social media, by meeting people where they are at community events and community centers, by conducting pop-up and tabling events, and within interactive and tactile driven workshops.

To most effectively use and respect the time of participants, topics for public input will focus on what community members, farmers and business owners can best contribute—their preferences among different portfolios of action options and how they would respond to various strategies. The list of available effective actions is already well known, and too many CAAP processes devote too many resources to trying to engage the public on deeply technical issues. Instead, the Dudek team will start by presenting the known actions with understandable parameters such as likely reductions and costs. As portfolio options are constructed, the tradeoffs and benefits will be explained to educate stakeholders and the public on what achieving the CAAP goals entails. These portfolios will be adapted to accommodate important feedback through the various channels used by the Dudek team.

Personal Interviews

As mentioned above, prior to outlining the strategy, the Dudek team would conduct individual or small group interviews with County Staff, CivicSpark Fellow(s), YCCAP, and the members of the YCCAP Working Groups, specifically, the NWL with the RCD and the Equity and Engagement Group to ensure there are common goals and common understanding about the CAAP. Subsequently, the Dudek team will conduct personal interviews with community leaders, non-governmental organizations, community-based organizations, and other community members in languages they are comfortable speaking in to ascertain what the priorities, community strengths assets, needs, risks, vulnerabilities, and needs are. Additionally, interviews and/or focus group sessions will be conducted with local agricultural industry representatives, such as farmers, landowners, agricultural research companies, agricultural support services companies, the Yolo County Farm Bureau, and/or other agriculture groups such as the Yolo Subbasin Groundwater Agency to be identified in consultation with County staff, to explore their needs and priorities as they relate to the CAAP effort.

The outcomes of these personal interviews will inform the next steps of the strategy, specifically, how community members want to be involved, when is the best time and place to be involved, and what community members want out of a process. At the close of the interviews and discussion with the team, including the County Staff, CivicSpark

Fellow(s), and YCCAP, the Dudek team may develop a multi-lingual survey that will be utilized at community events, workshops, placed on materials via a QR code to capture the community strengths assets, needs, risks, vulnerabilities, and priorities.

Social Media Posts

Social media outlets are a tool to provide cogent messaging and visual content about a variety of project-related outreach opportunities, including information about the CAAP, opportunities to participate in workshops, pop-up events, opportunities to learn about the project and provide feedback at community events, and to communicate where the team is in the development of the CAAP.

Social Media posts will be branded; use Americans with Disabilities Act (ADA) accessible colors, images, and branding associated with the Yolo County CAAP; and contain plain language and related messages that utilize a fifth-grade level of reading proficiency. Social media posts will be in English, Spanish, and other languages, as appropriate. The development and scheduling of social media posts will be developed along the timeline of the various engagement and outreach opportunities, such as community events, pop ups, and workshops. Three social media posts will be developed per activity, i.e., three social media posts associated with each community event. These will be scheduled for a week before the event, three days prior to the event, and the day of the event. Drafts and final social media posts for all events will be provided in draft form before they are finalized.

Tabling at Community Events or Pop-Up Events

Prior to workshops and to create enthusiasm and awareness of the CAAP and related workshops, the Dudek team will work with the YCCAP Working Groups, specifically, the NWL with the RCD and the Equity and Engagement Group to identify and attend community events that are already occurring and provide an overview of the CAAP process, opportunities to talk to people about the project, conduct the survey, and preview the blocks and interactive pop-up model of Yolo County.

Workshops

A total of three workshops will be organized over the course of the CAAP development and sequenced to progressively build upon themes required for a successful CAAP. Workshops will be structured for the purposes of understanding, creating meaningful dialogue, and discussing the development of reduction and adaptation strategies and strategies for implementation. Each workshop will contain elements of presentation, breakout and processing, and reporting out. Workshop facilitation and materials will be in English and Spanish and ADA compliant.

An effective tool for community projects is using tactile tools, which engages more sensory components of a participant and can lead to more creativity and cooperation. This strategy also ignites the power of play, which allows people to let their guards down a bit and communicate about complex concepts in a more relaxed environment. At public events and workshops, the Dudek team will utilize blocks, community mapping, and models to create organic conversation and interaction and provide an opportunity for people to envision and play with the scope and outcomes of the project. These opportunities also provide a wider lens to view the entire community, spatial inputs and outputs and connectivity. The Dudek team can build a pop-up model of the County to vision and test out various scenarios of carbon sequestration.

Dudek will work with trusted local community representatives to determine the timing, location, and duration of workshops. Workshops will be planned, and content will be coordinated with the County team and in consultant with community leaders and other key stakeholders. Content will be developed with the utmost attention to cultural sensitivity. Workshops Information from the personal interviews, surveys, and community events, in concert with technical information will be utilized for workshop material.

Visual Technical Storytelling

The CAAP will require technical information to be communicated in a relatable and accessible way for various communities in the County at various outreach and workshop events, as well as in materials in the CAAP. Our visual storytellers will work in concert with our technical subject matter experts to shape complex processes into visual stories tailored to the agricultural community, including growers, residents, non-governmental organizations, community-based organizations, and others that are effective for use in all media. Our creative services team goes beyond the typical visuals used to convey complex processes, such as graphs and maps, and uses 3D renderings to simplify complexity. Our team will take lengthy or complex descriptions of air quality and climate and carbon sequestration processes, workflow that may be hard for readers to visualize, and create engaging, easy-to-understand graphics that do the explaining for the CAAP.

TASK 1.1

Select and Configure Community Empowerment Solution

Dudek's Outreach and Web Development staff will work with the County in selecting, setting up, and configuring an out-of-the-box community empowerment solution that will allow individual community members to login and track their contributions and progress towards combating climate change. Example solutions include but are not limited to BrightAction (https://www.brightaction.com/) and Cool Block (). The resulting tracking solution will mirror the County's existing branding elements as well as borrow from the branding developed in Task 1.3 – Website Development. This turn-key solution will engage, motivate, and empower community members to take actual steps towards a more climate sustainable community.

Assumptions For Task 1.1

- Costs associated with licensing the selected hosted engagement solution are not included in the cost for this task and will be passed on to the County at no markup.
- Branding features and capabilities are limited to what is offered out-of-the-box by the selected engagement solution.

TASK 1.2

Website Development

At Dudek, we have learned that to maximize stakeholder communication and community involvement, it is crucial to break down any barriers that may prevent the public from conveniently participating in the project planning and implementation process. In our digital age, this is most easily accomplished by developing a web resource that clearly defines the project's goals and timeline, details the time and location of various stakeholder events, provides a mechanism for the stakeholder to easily provide feedback to the Dudek team, and houses a digital version of the public document.

Dudek's web and graphics team will work with County staff to develop a stand-alone or "boutique" website that will act as the web portal for the project. This process will begin with reviewing existing websites with similar goals and determining a feature list. The result of this process will be a plan that utilizes a site architecture and theme geared towards local government and public outreach and based on proven technologies. The proposed site features will include the following:

- A user-friendly, accessible, and responsive website built for mobile-first on standard web technologies
- An 'About' section describing the project goals and timeline
- An 'Upcoming Events' section that lists past and future project meetings/events, facilitates webinar registration, and offers recordings of previously held webinars. This section will be updateable by non-technical staff
- A 'Get Involved' section that will link visitors to the community engagement tool
- A project email address that will allow the public to submit comments to the team via email
- A form allowing visitors to subscribe to a project email newsletter database
- A 'Frequently Asked Questions (FAQ)' page, updateable by non-technical staff
- Integration with Google Translate, to allow for on-the-fly machine language translation in multiple languages

We have the capability to build, host, and maintain these solutions for the County using Dudek and third-party infrastructure. From our experience, creating these web-enabled solutions will often lead to additional use-cases for the technology, and an important part of our work is to provide value beyond the current project and to empower our clients to harness and utilize these technologies across their organizations for future initiatives.

Assumptions For Task 1.2

- Website hosting, web map hosting, and domain name purchase costs are included in the proposed fees but are limited to the timeframe of the project. After project completion, if the County wishes to continue hosting the services, hosting costs will be passed on to the County without markup. Additional Web Team support beyond the timeframe of the project may require a contract amendment
- The domain name used for the site will not be a subdomain of the County's site and will not require coordination with the County IT department
- The top-level domain will be one that is publicly available such as .org or .com and will not be a .gov domain
- All webinar videos will be hosted on a third-party streaming service such as YouTube, Vimeo, or similar and linked to from the proposed website

TASK 2

GHG Inventory and Updated Targets

TASK 2.1

Production Based Municipal and Community-Wide Inventories Update

The goal in this task related to the production-based inventory is to build upon the work that has already been accomplished during past data collection and inventory development, ensuring that the inventories are following current protocols and methodologies to have a consistent set of inventories that can be used in the development of emissions trends for the County. The trend in emissions will be helpful in determining the overall trend in emissions over time, changes in emission trends that relate to changes in activities within the County, feasible target setting, and potential areas for improvement and additional reductions.

Building upon the work that has already been accomplished also provides some efficiencies in that we will be updating the Excel-based Inventory Spreadsheet tool, adding sectors of emissions as appropriate such as NWL, and making sure that the updated tool is using current emission factors (EFs), following updated protocols and current methodology. Another goal we have in developing the inventory is to make the Excel-based inventory tool more user friendly so that County staff can update subsequent inventories or in developing future emission scenarios. To that end, we will be including emission forecasting tabs and reduction measure tabs so that the updated Excel-based inventory tool is more dynamic and useful for updating the inventory, exploring various reduction scenarios and seeing forecasted outcomes.

Under this task, we will compile the existing conditions data for both municipal operations and community-wide emissions within the unincorporated County area for the most recent year a full data set is available (most likely 2021). For Municipal Operations, the sectors of emissions include the following:

- On-Road Transportation: Fuel consumption and mileage from County owned and operated vehicle fleets
- Off-Road Mobile Equipment: Fuel consumption and hours of operation for County-owned or operated construction equipment and other mobile equipment not part of the County's vehicle fleet
- Energy: Consumption of natural gas and electricity from County-owned or operated buildings, facilities, and County-owned streetlights/traffic lights
- Water Conveyance and Wastewater Treatment: Water consumption and wastewater generation from County-owned or operated buildings, facilities, and parks
- Solid Waste Management: Waste disposal operations, including waste disposal, methane capture and flaring, greenwaste disposal or composting, recycling programs, any specialty stationary equipment, and mobile offroad equipment not within the Off-Road Mobile Equipment list above
- Optional Scope 3 Sector of Municipal Emissions: Emissions from employee commutes is not a mandated sector of emissions under the Local Government Operation Protocol (LGOP) but is useful in evaluating employee trip reduction programs or baselining an employee trip reduction program. To develop this sector of emissions an employee commute survey will be used

For the Unincorporated Community-Wide Emissions Inventory the following sectors of emissions will include the following:

- Off-Road Mobile Equipment: Work with the County, Yolo County Agricultural Commission, and RCD to better articulate the types and quantities of farm equipment operating in the County and obtain equipment operating data and emissions from the California Air Resources Board (CARB) OFFROAD model for the County. The inventory will be informed by and reconciled with the U.S. Department of Agriculture (USDA) National Agricultural Statistical Service's (NASS) 2017 Census of Agriculture and 2018 Census of Irrigation for Yolo County so that the inventory can be updated with each five-year release of the censuses. (In addition, the Dudek team will explore whether the State Board of Equalization still reports red-dye diesel sales by county.)
- Energy: Annual natural gas and electricity consumption for residential, commercial, industrial, and agricultural land uses within the Unincorporated County area provided by Pacific Gas and Electric (PG&E), and the Valley Clean Energy Alliance. In addition, the Dudek team will determine whether propane is a significant fuel use in the County.
- Water Conveyance and Wastewater Treatment: Water consumption and wastewater generation from consumption for residential, commercial, industrial, and agricultural land uses within the Unincorporated County area provided by the various water districts (likely surface water only for agriculture)
- Solid Waste: Waste disposal rates for residential, commercial, industrial, and agricultural land uses within the Unincorporated County area. Note that the emissions associated with this sector within the Community-wide emissions inventory will be a subset of the broader Waste Management emissions within the Municipal Inventory. However, this information will be useful in determining waste generation by land use type to improve waste diversion strategies the County is already employing
- NWL: This sector of emissions (and potential sinks) is discussed in Task 3
- On-Road Transportation: Emissions from On-Road vehicles attributable to land uses within the Unincorporated County area will be provided by Fehr & Peers as discussed below.

A comprehensive inventory captures all vehicles miles traveled (VMT) generated by community activities. This includes the vehicle travel associated with residents, workers, students, visitors, etc. engaged in activities occurring within unincorporated Yolo County. Fehr & Peers will prepare VMT estimates for baseline conditions and 2040 conditions using the regional SACOG SACSIM19 travel forecasting model developed for the SACOG 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). Fehr & Peers will prepare VMT estimates for 2027, 2030, 2035, and 2045 conditions using linear interpolation of the baseline and 2040 VMT estimates produced from the SACSIM19 model.

The specific VMT analysis methodology will rely on the origin-destination (OD) trip method. This method accounts for all the VMT associated with trips that have at least one trip end located within unincorporated Yolo County. Using the OD trip method, Fehr & Peers will prepare estimates for the following two types of VMT:

- Full accounting of all VMT generated by unincorporated Yolo County
- Partial accounting of VMT generated by unincorporated Yolo County, whereby trips that share trip ends across two jurisdictions (i.e., a trip from unincorporated Yolo County to the City of Davis) are discounted by 50 percent. This approach accepts the notion that for interjurisdictional VMT, each jurisdiction is only responsible for half of the VMT

Prior to preparing VMT estimates, Fehr & Peers will conduct a review of the land use and transportation system inputs for Yolo County included in the "off-the-shelf" SACSIM19 model (e.g., future land use projections for Dunnigan). The purpose of this review is to verify if the SACSIM19 land use and transportation system inputs are appropriate for the purposes of the CAAP. The land use summary will aggregate land use quantities by type for individual County jurisdictions (i.e., Cities of Davis, West Sacramento, Woodland, and Winters and the University of California Davis campus), unincorporated communities, (e.g., Dunnigan, Esparto, etc.), and the remaining areas within unincorporated Yolo County. Fehr & Peers will present the results of this review to County staff and the Dudek team prior to commencing modeling activities.

Optional Task A

If desired by County staff and the Dudek team, Fehr & Peers will update the SACSIM19 land use and transportation system inputs for unincorporated Yolo County under baseline and 2040 conditions.

Optional Task B

The Dudek team will prepare VMT estimates for unincorporated Yolo County under 1990 and 2005 conditions using the NASA Database of Road Transportation Emissions (DARTE). DARTE is the first nationally consistent inventory of United States on-road CO2 emissions built from bottom-up source activity data and establishes a national benchmark for monitoring, reporting, and verification of GHG emissions.

Optional Task C

The Dudek team will prepare VMT metrics for consistency with SB 743. Specifically, Fehr & Peers will estimate residential VMT per capita and work VMT per employee generated by unincorporated Yolo County under baseline and 2040 conditions.

Optional Task D

The Dudek team will summarize the VMT that would be associated with other jurisdictions in accordance with the partial accounting method described in Task 2. Specifically, Fehr & Peers will summarize the remaining 50% of VMT generated by unincorporated Yolo County that would be allocated to the City of Davis, the City of West Sacramento, the City of Winters, the City of Woodland, and all other jurisdictions combined under baseline and 2040 conditions.

TASK 2.2
Consumption Inventory Narrative

The Dudek team will work with County staff to develop goals of the consumption-based inventory narrative prior to collecting data and drafting the narrative. Goals for including a consumption-based inventory narrative include providing context of the production-based inventory by showing the lifecycle of sectors of emissions, including mining, manufacturing, goods movement, consumption, and disposal or resources. Another goal for a consumption-based inventory is to educate the public about the goods and energy they consume, including the embedded carbon in food, goods, and materials they consume. One other goal could be to provide context on how particular reduction measures will reduce emissions beyond those monitored using the production-based inventory approach. Consumption-based inventory narratives are often used to demonstrate the carbon reduction benefits of buying local products including food.

After we have consulted with the County on the goals of the consumption-based inventory narrative, we will acquire data needed to provide consumption of key goods, material, and energy within the County. A consumption inventory narrative will be drafted following recommendations by the Governor's Office of Planning and Research (OPR) in Chapter 8 of the General Plan Guidelines, and additional guidance provided by the University of California, Berkeley, and the CoolClimate Network.

The data collection and draft consumption inventory narrative will be provided to County staff for review, comments, and edits. We will revise the consumption inventory narrative to address the comments and edits. A graphic depiction of both the Production based inventory and the Consumption based inventory will be developed for inclusion in the CAAP and the CAAP webpage. The graphic will show by sector of emissions how the two inventories intersect.

In addition to the narrative, at the County's discretion, we can also provide a Household Carbon Calculator using the consumption-based inventory data collected for the County that could be integrated into the County CAAP webpage. This tool would enhance the public's understanding of lifecycle carbon embedded into the energy, goods, and services they consume within their household.

TASK 2.3
Municipal and Community-Wide Emissions Forecasts

As shown below, the future year projections (2027, 2030, 2035, 2040, and 2045) will use socioeconomic metrics to scale the 2021 data. A unified set of socioeconomic data (population, agricultural crops, jobs [potentially jobs by type], and households) is thus required. We will work with the County on the development of the forecasts and make any needed adjustments to this dataset prior to the completion of the forecasting work. This set of socioeconomic data will be used for the traffic modeling, inventories, forecasts, and the tracking tool.

The GHG emissions forecasts will use the unified set of socioeconomic data to forecast future emissions (2027, 2030, 2035, 2040, and 2045) based on the current levels of efficiency. This forecast is called the Business As Usual (BAU) forecast. We will then look at how future Federal, State, and regional actions such as the renewable portfolio standards, low carbon fuel standards, the Sustainable Communities Strategy (SCS) reduce emissions within the County and provide Adjusted BAU (ABAU) forecasts.

TASK 2.4

Technical Assessment of Past GHG Reduction Measures

We will provide a technical assessment of the GHG reduction measures in the 2011 CAP, use the inventories and County CAP monitoring to assess reductions of each measure in 2016 and estimated in 2021 and continued reductions through the forecast years (2027, 2030, 2035, 2040, and 2045). The retrospective analysis will include a reconciliation adjustment between the forecasted population and economic activity in the 2011 CAP and the realized values based on state and federal data. This assessment will also evaluate achievement of the progress indicators, participation rates of each applicable measure, implementation costs based on County records and cost estimating tools.

We will also assess barriers to implementation based on participation rates, achievement of progress indicators, and the municipal and community wide GHG emissions inventory for the

Table A: Proposed Data Sources and Methods for GHG Inventories and Forecasts

Sectors	Existing (2021)	Adjusted BAU (ABAU)				
		2027	2030	2035	2040	2045
Residential Electricity Use	PG&E, VCEA	Population + RPS based allocated from CEC IEPR forecast			Population + SB 350 base allocation from CEC IEPR forecast	
Residential Natural Gas Use	PG&E	Population based allocation from California Gas Report			Population + natural gas phase out plan allocated from California Gas Report	
Agricultural Electricity Use	PG&E, VCEA	Ag Sector Jobs + RPS based allocation from CEC IEPR forecast			Ag Sector Jobs + SB 100 based allocation from CEC IEPR forecast	
Agricultural Natural Gas Use	PG&E	Ag Sector Jobs based allocated from California Gas Report			Ag Sector Jobs + natural gas phase out based allocation from California Gas Report	
Commercial/ Industrial Electricity Use	PG&E, VCEA	Jobs + RPS based allocation from CEC IEPR forecast			Jobs + SB 100 based allocated from CEC IEPR forecasts	
Commercial/ Industrial Natural Gas Use	PG&E	Jobs based allocation from California Gas Report			Jobs + natural gas phase out based allocation from California Gas Report	
On-Road Transportation	Traffic Model (VMT Analysis)	Traffic Model + Pavley, LCFS, CAFE, SB 375, EO N-79-20			Traffic Model + EO N-79-20	
Off-Road Vehicles and Equipment Agriculture	Off-Road Model + Ag Commission or BOE data	Ag Sector Jobs based allocation from either CARB OFFROAD model or BOE data				

Sectors	Existing (2021)	Adjusted BAU (ABAU)				
		2027	2030	2035	2040	2045
Off-Road Vehicles and Equipment Construction)	Off-Road Model	Population, Housing, or Jobs Depending on Equipment Type +LCFS based allocation from either CARB OFFROAD model or BOE data				
Waste Generation	Yolo County Solid Waste Management and CalRecycle	Residential = Population; Commercial = Jobs + Increased Landfill Capture (assuming SB 1383)				
Wastewater Generation	Per Capita Using Plant Specific Factors	Population				
Urban Water Consumption And Agricultural Water Consumption (AWC)	UWMP from water districts Agricultural Water Consumption from Agricultural Water Management Plan, GSA/GSP and Crop Consumption Factors	UWMP + AWC 20×2020			Population + 20×2020	
Natural and Working Lands	Estimating tree canopies using Google Earth Satellite images	Agriculture, habitat conservation, and open space footprint based on General Plan Land Use Map				

Acronyms and Abbreviations:
RPS: Renewable Portfolio Standard
SB 350: Senate Bill 350: Clean Energy and Pollution Reduction Act
LCFS: Low Carbon Fuel Standards
CAFE: Corporate Automobile Fuel Efficiency Standards
CARB: California Air Resources Board
SB 375: Senate Bill 375: Sustainable Communities and Climate Protection Act
UWMP: Urban Water Management Plans
CEC – California Energy Commission
IEPR – Integrated Energy Policy Report

year 2021.[1] The assessment of remaining barriers will also review County codes, PG&E and VCEA processes and procedures, and water district procedures in determining potential barriers.

Based on this assessment, we will make recommendations for updated to the reduction measures to be included in the forthcoming CAAP.

TASK 2.5
GHG Reduction Targets

We will provide recommendations on GHG reduction targets to the County. The recommendations will look at two criteria in recommending GHG reduction targets.

1 If data is not available for 2021, the Dudek team will discuss with County Staff whether using 2019 data would be more appropriate due to the anomaly of the pandemic in 2020.

The first criterion will be feasibility using the production based municipal and community-wide inventories and emission trends for the County understanding that the County has an aspirational target of net zero emissions by 2030. On August 31, 2022, the state legislature passed a number of climate-related legislation, among them AB 1279, SB 1020, SB 1137, AB 1757, and SB 905. If AB 1279 is signed into law, this would be the binding legal standard for setting reduction goals. Therefore, the second criterion is conforming to and complementing statewide goals set by current legislation. Likewise, the Dudek team will continue to monitor and stay abreast of evolving state laws and regulations that impact electricity generation and transportation emissions. We will conduct a feasibility analysis of the County's carbon negative goal within the various forecast years of 2030, 2035, 2040, and 2045. The feasibility analysis will look at the ABAU emission forecasts for the years 2030, 2035, 2040, and 2045 and potential carbon sinks within working lands. The feasibility analysis will also take into account the technical assessment of past GHG reduction measures and forecasts of the continued reductions from those reduction measures.

Task 2 Deliverables:

Revised GHG inventory, emissions projections, retrospective technical assessment, and updated GHG reduction targets and measures (outline, draft, revised draft, final).

TASK 3

Develop Reduction Strategies

The Dudek team anticipates multiple available strategy options, including those to address sequestration and emission reductions from NWLs, and emission reductions from transportation and land use, energy and renewables, solid waste and waste diversion, and water use (i.e., water storage, wastewater processing, and water reuse).

Developing the emission reduction strategies will begin with completing the inventory for the most significant economic sector in the County. The agricultural community is the backbone of the land use, the identity, culture and economy of the Count, all of which is inextricably interwoven. Estimating the emissions from natural and working lands is the starting point for identifying the potential for sequestering carbon in those lands. That potential may be sufficient for the County to extend its mitigation to encompass other communities within the County to each other's mutual benefit.

The Dudek team understand the circular economy of Yolo County and needs for investment and economic development. The Team, including the economists, will provide input to the County on the prioritization and refinement of CAAP measures developed to optimize support for a circular economy and place-based local economic development, leveraging Yolo County's unique context, resources, challenges, and opportunities.

Identifying other strategies will focus on a contained set of emission mitigation and sequestration strategies that can be readily implemented. The Dudek team will prepare engineering and economic analyses of the portfolio with implementation issues. Clear priorities will be specified to match available County resources The strategies will be framed as opportunities to both leverage community assets and to transform to economically advantageous activities that are sustainable and resilient. The CAAP will present a clear priority for mitigation actions beginning with the largest potential reductions and the most economically advantageous. Strategies that integrate sectors and uses will be emphasized; synergism will be key. For example, using electric vehicles for energy storage to extend the use of renewable power is a promising option.

Natural and Working Lands Emissions Inventory

Dudek understands that an analysis of baseline conditions is critical to conducting an evaluation of sequestration potential. This is part of Dudek's approach. In coordination with the County's RCD, Dudek will develop an inventory of the NWLs emissions by type to be incorporated into the updated GHG emissions inventory prepared for Task 2. Dudek will update the agriculture sector emissions from the 2018 Countywide Greenhouse Gas Emissions Inventory Update (2018 GHG Inventory Update) using new and best available data sources, emission factors, and methodologies. Per the 2018 GHG Inventory Update, anticipated sources of agricultural emissions include, residue burning, livestock, rice cultivation, irrigation pumps, pesticide application, fertilizer application, lime application, and urea application. Additional sources may be included if deemed necessary and appropriate in coordination with RCD staff and the relevant partners. The updated inventory will aid in development of GHG emission reduction strategies, as discussed below.

Dudek will also support RCD in development of an assessment of Countywide sequestration potential based on land use, which is discussed further below. While not essential to the assessment of overall carbon sequestration potential, an estimate of current baseline carbon storage for the County would provide greater context for strategy development and can be provided as a separate optional task (Optional Task F), as detailed below.

EMISSIONS REDUCTION AND CARBON SEQUESTRATION STRATEGIES

Dudek will work with County staff, including RCD, and other related partners to develop creative, equitable, multi-beneficial, and high-impact GHG emissions reduction and carbon sequestration strategies to meet the updated reduction targets developed in Task 2. Prior to candidate strategy development, the Dudek team will research GHG emission reduction and carbon sequestration initiatives currently in practice within the County, through engagement with local farmers and farmworkers, Tribes, businesses, and other County communities as appropriate. The Dudek team will also review existing plans, programs, and actions related to GHG emissions reduction and carbon sequestration in the County, including but not limited to the County of Yolo 2030 Coun*tywide General Plan* (2009), the *Yolo County Climate Action Plan* (2011), *The Yolo County Resource Conservation District Strategic Plan* (2019), and the *Yolo County Sustainability Plan* (2021), among others. Specifically, Dudek will support RCD staff to develop a comprehensive summary of current NWL management strategies in practice within the County that support carbon sequestration and storage. The countywide emission reduction and sequestration strategies will have substantial impact on future GHG emissions and ideally, many of the candidate strategies our team develops will build on this existing initiative informed by what is and is not working.

The Dudek team will evaluate the existing countywide emissions reduction and sequestration strategies holistically to identify pathways for efficient and cost-effective reductions. This list will include those approved already among Early Actions that have received funding. We will research new strategies through interviews with subject matter experts and stakeholders from within the local community. These interviews will be supplemented by a literature review of national and local best practices and will be guided by best available and publicly accessible science. Given that successful implementation of the GHG reduction strategies will rely on the combined participation of County staff, communities, agriculturalists, agricultural workers, small businesses, and community leaders, stakeholder engagement is a particularly important component of GHG reduction strategy development.

The Dudek team will develop a suite of potential GHG reduction strategies for County consideration, ensuring that each is customized to best meet the needs and priorities of the County and the community at large. Final strategies will be selected using agreed-upon suitability metrics that align with the County's goal of prioritizing actions that reduce GHG emissions in a cost-effective manner. Suitability metrics could include the following:

Reduction and sequestration potential will evaluate the potential GHG emission reductions and/or carbon sequestration potential from each strategy categorized by its source category (e.g., transportation, energy, waste, or water).

Relative cost will provide high-level cost and savings to the County government, residents and businesses for implementation of the strategy and assess whether adequate funding exists.

Timing will assess how quickly the strategy can be implemented and the GHG reduction and/or carbon sequestration benefits will be realized.

Co-benefits will provide information on benefits to the community other than GHG reduction and/or carbon sequestration with strategy implementation (e.g., resource conservation, improved air quality, social equity, etc.)

Feasibility will outline the political, technological, and cost feasibility of each strategy. The feasibility assessment will also include detail on the amount of coordination between agencies, if the strategy is common practice, and the funding source.

These metrics will be estimated using best available information provided by County staff, RCD, similar agencies, or other sources where necessary. The suitability analysis is intended to provide a high-level review of the potential costs, related GHG reductions and sequestration potential, and anticipated timeline for the strategies, and is provided for context and screening-level strategy selection as opposed to an in-depth evaluation.

Using the suitability metrics above, the Dudek team will coordinate with the County and the participating stakeholders if applicable, to establish a finalized catalogue of GHG reduction and carbon sequestration strategies that will help the County meet the updated GHG emission reduction targets. The Dudek team will then estimate GHG emissions reduction scenarios assuming implementation of the strategies for each of the target years. During this process, refinements to proposed strategies can be made to ensure that adequate reductions are achievable within the defined timeline.

Several specific suggested actions are listed below.

Carbon sequestration potential

Yolo County, including community members, governmental entities, non-governmental organizations, businesses, and others have invested in agricultural, natural (open space) and working lands over many years. These are extant carbon sequestration sinks, hence the Dudek team will take these areas into consideration in the inventory. Dudek team will support RCD to develop an analysis of Countywide sequestration potential using recent regional scale (County) GIS land use data and SACOG crops data and potentially other data together with land-use specific sequestration potential metrics (i.e., metric tons of carbon per acre) by strategy. We will assist RCD in calculating total sequestration potential for the entire County, providing maps to assess these potentials geographically. Dudek will also support RCD to develop a guide for landowners to understand the carbon sequestration potential unique to their land use and practices. The guide will identify all agricultural practices that can reduce GHG emissions and sequester carbon. For each agricultural practice, we will (1) explain the practice, (2) identify which crop commodity this could apply to (e.g., tomatoes, almonds, pasture), and (3) identify the co-benefits (e.g., water quality, air quality, and climate resilience/adaptation, 4) discuss the implementation parameters; and 5) discuss potential cost considerations). This analysis will build off of the County's Carbon Farming Partnership and Yolo Agricultural Equipment Retrofit Program Early Actions. This guide will help landowners understand their carbon sequestration potential and will serve as a high-level overview for the County to inform CAAP implementation and future prioritization.

County natural and working lands have sufficient potential to offset substantial amounts of GHG emissions in other Yolo communities so that the entire county can approach net zero emissions in the near term. The Dudek team will further specify this potential for excess sequestration, and propose options for transacting those excesses in a mutually beneficial manner.

Building energy efficiency and resiliency

This action builds off of the Electrification Retrofit Rebate Outreach Program Early Action. The Dudek team will work with the County to obtain the addresses of pre-1978 residential units within the unincorporated County area and cross reference this information with low and very low-income residents within the County. The Dudek team will also identify disadvantaged communities that intersect with the list of pre-1978 homes. Finally, the Dudek team will glean information from Task 1 that identifies groups of community members that could require better inclusion. This information will be used to target existing residential units with energy efficiency and resiliency retrofits. The types of energy efficiency measures that are most appropriate for multi-family housing will be developed in consultation with Yolo County Housing which has been a national leader in implementing these measures. The energy efficiency retrofits would be funded through a grant program described in Task 5 and work as follows:

- Once the addresses of targeted pre-1978 residential units have been identified, a letter to the homeowner or apartment building owner would be sent out explaining the program and asking if they would want to participate. For those that decide to join the program, an energy efficiency audit will be conducted. The energy efficiency audit would include baseline energy and water use (and resulting GHG emissions), recommendations on energy efficiency/ renewable energy improvements that could be made, estimated utility savings to the residents, and GHG reductions anticipated from the retrofit.
- The owner will receive the energy efficiency audit with the recommendations. The homeowner apartment building owner would need to decide if they would want the improvements implemented on their unit(s). For rental properties, the owner will need to enter into an agreement with them not to raise rental rates for a predetermined time period before the property will be determined eligible for the energy efficiency program.
- Once the residential units are determined eligible for the program and energy efficiency/ renewable energy improvements are identified, the residential units will be prioritized based on whether the unit is within an identified disadvantaged community, or in need of better inclusion based on the information gained in Task 1.

- Qualified contractors will be identified to implement the retrofits with a preference given to qualified contractors within the County.
- Qualified contractors would be scheduled to work on the identified residential units. Once the work is completed, an inspection of the work will be done.
- A follow-up energy efficiency audit of the residential unit will be completed to verify utility use. The post improvement utility use will be compared to the baseline utility use identified in the original energy efficiency audit. From this information, GHG reductions would be calculated.
- A monitoring system will be developed to track the progress of the program, the list of qualified residential units is following the prioritization of residential units, tracks completion of work, grant funds consumed, resulting utility savings, and GHG reductions.

Transportation Measures Analysis

The County has adopted the Zero Emission Vehicle Master Plan as an Early Action and participated with Valley Clean Energy and the City of Davis for installation of electric vehicle charging and mobility hubs funded through SACOG. The Dudek team will identify strategies that best leverage these efforts. One potential area could be converting heavy duty agricultural product hauling trucks to electricity given the relatively short haul length (I.e., likely less than 200 miles.) The team will review cost and feasibility studies and means of incentivizing conversion. - The Dudek team will provide support for the development of VMT and GHG reduction measures related to land use and transportation. Fehr & Peers will provide recommendations on and qualitatively describe the efficacy of transportation-related measures that would reduce GHG emissions generated by Yolo County. We will use our TDM+ tool, the Caltrans *VMT Mitigation Playbook*, and our research that contributed to the recently updated *California Air Pollution Control Officers Association Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (December 2021) to inform our recommendations.

Optional Task E

The Dudek team will quantify the VMT and/or GHG emissions reduction potential of the strategies identified in Task 3.

Optional Task F: Baseline Carbon Inventory

Under separate scope and budget, The Dudek team can prepare a detailed carbon inventory for a baseline year to estimate total carbon storage associated with existing land uses within the County.

TASK 4

Develop a Climate Vulnerability Assessment and Adaptation and Resilience Strategies

TASK 4.1
Climate Vulnerability Assessment

The Dudek team will develop a climate vulnerability assessment in compliance with the requirements of SB 379 and the Adaptation Planning Guide to lay out the County's main risks associated with climate change. Climate-related hazards will be identified and assessed, including but not limited to drought, extreme heat, flooding, and wildfire. To ensure the assessment is easily understood by community members, each of these hazards will be considered relative to who, what, when, where, and how. First, the hazard will be defined in the "what" section. Next, the hazard's relationship with time will be explained in the "when" section, with an emphasis on how it is projected to change due to climate change. The "where" section will lay out which communities, infrastructure, and assets within the County are most at risk of exposure and will include a map of the hazard county wide and for each of the 12 census designated places. This will be followed by the "who" section, which will identify populations, ecosystem services, and types of agriculture are sensitive to the specific hazard being assessed, as applicable. Each hazard will be concluded with a "how" section that will act as a capability assessment outline the County's current efforts addressing climate change effects. This section will state what the County and its various partners have done to this point to build resilience and adapt to the hazard, and will cite at planning documents, County code, and other existing County programs. A summary of findings associated with the above vulnerability assessment will be included in the CAAP.

TASK 4.2
Climate Adaptation Policies

Dudek will build on the GHG reduction strategies and supplement adaptation strategies where vulnerabilities in the County need additional support. To align with the most up-to-date climate adaptation planning guidance and ensure a holistic policy approach, the adaptation portion of the tool will include the phase of emergency management being addressed: mitigation, preparedness, response, and recovery. Within each goal, policies specific to hazards and community-based topics will be developed. Community-based topics may include policies specific to agriculture, public health, regional partnerships, local programs or organizations, food resilience, and more.

The potential for community resilience hubs, such as the one that was under consideration at the new Capay Valley Community and Health Center, will be identified. Flood management strategies being evaluated by Yolo County Flood Control and Water Conservation District and other agencies will be identified, and the Dudek team will determine if those are using climate change forecasts. The team will explore through public input the need for measures and ordinances related to protecting outdoor workers during extreme heat events.

Task 4 Deliverables

Climate Vulnerability Assessment, adaptation and resilience strategies organized by sector and hazard (outline, draft, revised draft, final)

TASK 5
Funding and Financing Roadmap

The success of the County's CAAP will depend on the concrete actions taken to implement the recommended strategies and measures. These actions will likely include financial incentives, both in fees and subsidies including loans, infrastructure investment, and new ordinances and regulations, potential grants, General Fund contributions, special funds, and other relevant mechanisms/ programs such as revolving loan funds or local project endowment.

An important step in this process is estimating the net costs or benefits of the selected measures and strategies, how those costs and benefits are distributed over time and across individuals, and the acceptability and feasibility of implementation in this context. For example, an electric vehicle is likely less costly than a conventional gasoline car over its lifetime, but electric vehicle costs significantly more to purchase with much lower operational costs. In addition, some measures are likely to require changes in operations or behavior that create costs or cause improvements in environmental conditions, both of which are difficult to quantify financially. Determining the amount and type of financial arrangements in this situation will require insights into the specific groups targeted for these strategies.

The initial step of the analysis will be to conduct the cost-benefit analysis of the portfolio of measures being considered. The analysis will be done on a net present value or levelized cost basis (each is economically equivalent.) Some of the identified measures may be either synergistic with each other or could diminish individual measures reductions, which in turn will impact the economic analysis if done in a standalone manner. For example, increased renewable electricity generation combined with building electrification reduces the emission reductions from energy efficiency improvements, but electrification can build loads in a manner that reduces overall electric rates. In addition, to the extent feasible with input from affected stakeholders, implementation issues and additional transaction costs will be identified for these measures for consideration to mitigate during implementation. Measures that create net costs will be candidates for direct grants and subsidies while those with net benefits are candidates for debt financing to be repaid from future benefits.

The County must identify and develop sustainable sources of ongoing funding. This requirement means that, while useful to initiate certain strategies, the County cannot rely on one-time grants from outside sources. That funding will have to come instead from a combination of sources:

- Loans to individuals, businesses, and farms to finance actions that create positive financial value but may require substantial outlays before those net benefits arrive

- Transactions tied to GHG emission mitigation beyond the assigned responsibility of a class of individuals, businesses, farms, or the County as a whole, where the purchaser can credit the reductions against their emission reduction responsibility
- Direct government outlays financed from either general tax revenues or specific taxes, fees, or charges tied to GHG emitting activities. Much of these outlays can be initially financed from indebtedness to be repaid by taxpayers or resource users

The Dudek team will undertake its analysis of available funding options along four pathways:

1. Further identify grant opportunities to fund and finance identified projects beyond those already in the County's *Climate Early Action Grant Strategy*. Of particular interest will be those targeted by state and federal agencies for rural and agricultural actions. For example, the team will determine if the County is eligible for the Residual Set Aside amount of $5.6 billion in the *Tribal and Rural Allocation of the Regional Early Action Planning Grant Program (REAP 2.0)* issued July 26, 2022.[2] The Strategic Growth Council manages several other programs that could be applicable.[3] A potential use of these funds could be to establish a rotating financing facility from which low-interest loans could be issued and repaid.
2. Determine in consultation with the County finance staff if the County has significant financial reserves available that could be put to use as loans within the community rather than being held earning low interest in financial institutions.[4] In addition, determine the available debt/bond capacity for the County that could be used to fund a rotating load program.
3. Identify opportunities for emission reductions and carbon sequestration that could be financed through offset credits acquired by other communities within the County or outside entities with compliance needs with either state regulations or forthcoming environment, social, and governance regulations from the Securities and Exchange Commission. These offsets might be made available to developers in local cities who cannot achieve net zero emission requirements, at least initially.
4. Assess the potential direct government financing options, including taxes, fees, and charges that the County could impose. The Dudek team will start from a list of several dozen such measures that it has developed with legal and economic evaluations and expand that list in consultation with the County's finance staff. Estimates of potential revenues will be calculated to provide a forecast for determining the cost and limits on implementing the proposed portfolio of measures and strategies.

Based on these analyses, the Dudek team will identify potential financing programs, with specific attention to reaching disadvantaged communities and businesses. For many of the likely measures, those making the investment decisions may not be the same as those using the resources. For example, tenant farmers have a limited incentive in land improvement or irrigation investments that take several years to gain benefits. Low-income housing generally has a similar split-incentive problem. Loan programs will have to be designed with appropriate repayment provisions. Grants and other subsidies will have to be coordinated among the affected parties.

Deliverables:

- A table with the quantified costs and benefits of each measure along with a discussion of qualitative costs, benefits, and identified impediments to implementation that enter into financial considerations
- A discussion of available funding sources with linkages to the identified measures and strategies. This will include whether the County will need to adopt new ordinances or regulations, where the County should apply for outside funds, what is needed for the County to participate in offset transactions, and how raising revenues could be tied to beneficiaries using resources such as the carbon sink
- A description of the potential means and programs for financing implementation of the identified measures and strategies

2 https://www.hcd.ca.gov/docs/grants-and-funding/TR-REAP-2-0-Final-Guidelines.pdf
3 https://sgc.ca.gov/programs/
4 For example, an analysis by the City of Davis Utilities Commission found that its enterprise funds had several million dollars available in excess of reasonable reserve requirements that could be reinvested in the community.

TASK 6

Implementation and Monitoring Plan

The Dudek team will develop an implementation and monitoring plan to assist County staff with an efficient and effective fulfillment of strategies and recommendations. Building on the County's 2021 Sustainability Plan and to ease implementation, each recommended action will include a responsible party, timeframe, cost (based on estimated staff hours), and prioritization. To ensure consistency with the County's 2011 CAP, GHG-related actions will specify if they are mandatory or voluntary, and if they apply to new and/or existing development. Recommended actions will also state co-benefits for the topics being addressed, visually displaying them on an infographic. Each action will identify topics being addressed in the following four fields: GHG-reduction sectors, specific hazards, vulnerable communities or people, and major assets or infrastructure.

The Dudek team will also include at least one tracking metric for each goal, policy and action. Tracking metrics will come from the most applicable federal, state, and local sources, and may be qualitative or quantitative in nature. Organizations and programs providing data may include but are not limited to the Federal Emergency Management Agency, the U.S. Department of Agriculture (USDA), Cal-Adapt, CalEnviroScreen, California Department of Forestry and Fire Protection, the California Department of Public Health, the California Department of Motor Vehicles, Yolo County Transportation District, and Yolo County's own various departments. The Dudek team will also consider agricultural climate indicators, for example those outlined in the USDA's publication "Climate Indicators for Agriculture." The Dudek team will prioritize tracking metrics that are reliably updated and locally specific. Within the plan, each tracking metric will state the data source, a brief description of the data, the most recent datapoint for the County, the spatial nature of the data, and how frequently the data source is anticipated to be updated. As possible, the Dudek team will work with the County to incorporate the tracking metrics into the Yolo County Community Indicator Dashboard under a new climate tab. Since this Community Indicator Dashboard is broader than the CAAP itself, the County and Dudek team may elect to use a set of summary indicators instead of action-specific indicators when working on this dashboard.

TASK 7

Final CAAP Products

Throughout the generation of the CAAP, there will be several deliverables. The following is a complete list of deliverables for each Task throughout the entirety of the project.

- Outline of the Community Engagement and Equity Strategy
- Formulated questions (in English and Spanish) for personal interview
- Draft and Final Community Engagement and Equity Strategy
- Draft and Final Survey/Community Assessment (in English, Spanish, and ADA compliant)
- Draft and Final Social Media Posts (in English, Spanish, and ADA compliant)
- Draft and Final Materials for Community Events and Workshops (in English, Spanish, and ADA compliant)
- Draft and Final GHG Inventory and Update Targets (portions of which will be translated into Spanish and all of which will be ADA compliant)
- Draft and Final Reduction Strategies (portions of which will be translated into Spanish and all of which will be ADA compliant)

- Draft and Final Climate Vulnerability Assessment and Adaptation and Resilience Strategies (portions of which will be translated into Spanish and all of which will be ADA compliant)
- Draft and Final Funding and Financing Roadmap
- Draft and Final Implementation and Monitoring Plan
- Draft and Final CAAP (all or portions of which will be translated into Spanish and all of which will be ADA compliant)

TASK 8

Project Management

While project management is not a task identified in the RFP, Dudek proposes the following tasks and deliverables to best assist the County in the implementation of the project. Ms. Gray will serve as the project's main point of contact and project manager. She has been with Dudek for more than 15 years and understands our culture and staff. She has extensive experience in managing complex and multi-faceted projects with various consultants, clients, and stakeholder groups. Additionally, she has experience in communication, outreach, engagement, and capacity building with underserved populations and in underserved communities in New York, Arizona, California, and Western Africa.

Ms. Reed will serve as the Deputy Project Manager. She has over a decade of experience in project management, Air Quality analyses, successful CAAP development and implementation and policy development.

The primary aspects of Dudek's approach to project management include communication, managing adherence to the scope, keeping the progression of work on schedule, cost controls, and predicting and avoiding risk. Dudek prides itself on integrating a fundamental focus on high-quality work, optimized resource allocation, subconsultant management, and change management, as well as maintaining focus towards meeting both client and project goals and objectives.

The following sections describe the Dudek project management approach. Our approach focuses on the following five main components:

- Project planning
- Communication
- Project execution
- Project control
- Quality control

The Dudek team is experienced in applying an adaptive management approach to adjust the level of detail or use of specific project management techniques and tools as necessary on as-needed task assignments.

PROJECT PLANNING

Planning is a critical step in the successful management of every project. Dudek project managers begin the planning stage during the development of the project/task proposal and continue applying an adaptive approach throughout project execution. Planning considerations include the following:

- Clarifying the County expectations and requirements and confirming the project goals and outcome
- Communicating with the County and project stakeholders
- Iteratively estimating and refining resource requirements, level of effort, and cost
- Monitoring project budget and schedule
- Integrating quality standards at each project stage

COMMUNICATION

The most-effective project manager is one who facilitates the continual flow of information, data, instructions, and guidance among the County and Dudek team members and subconsultants. When maintaining this flow, we use resources efficiently and minimize wasteful rework. We achieve constant communication as follows:

- Regularly calling or emailing the County key contact staff person to discuss project milestones, activities, and potential issues
- Regularly discussing the project with key project staff to coordinate work efforts, monitor task completion, and review budget conformance

- Updating, as necessary, the project description, schedule, work progress reports, and inventories of available data so that all team members are aware of information that may affect their work products and schedules
- Diligently documenting issues, action items, and decisions

PROJECT EXECUTION

The structure and flexibility of the Dudek team provides the ability to adapt resources and the execution approach to meet project needs throughout the project life cycle. The Dudek project execution approach is based on applying a common understanding of the goals and objectives to project-related decision making. Key aspects of the Dudek approach include identification of logistical, environmental, and regulatory factors with potential planning impacts; evaluation and communication of critical issues; and focus on quality data collection, analysis, and reporting.

PROJECT CONTROL

Dudek project managers monitor and control the project budget, schedule, and quality using a suite of tools from project inception to completion. Dudek project tools include real-time project budget management, schedule management software, and quality assurance/quality control checks. As the CAAP advances, our project manager communicates with the team on a regular basis to evaluate resource requirements, budget, and schedule.

QUALITY CONTROL

Data collected or received by Dudek are cataloged in a master data intake database that is stored in a commonly accessible network location with other spatially related files and metadata files for management/control according to Dudek's policy for GIS project data organization. Electronic deliverable data and data tables will be checked against the hard copy laboratory reports. All spatial data received will be reviewed for metadata and verified visually. Dudek-generated data will undergo quality control checks for completeness, accuracy, and precision, as well as appropriate metadata completeness.

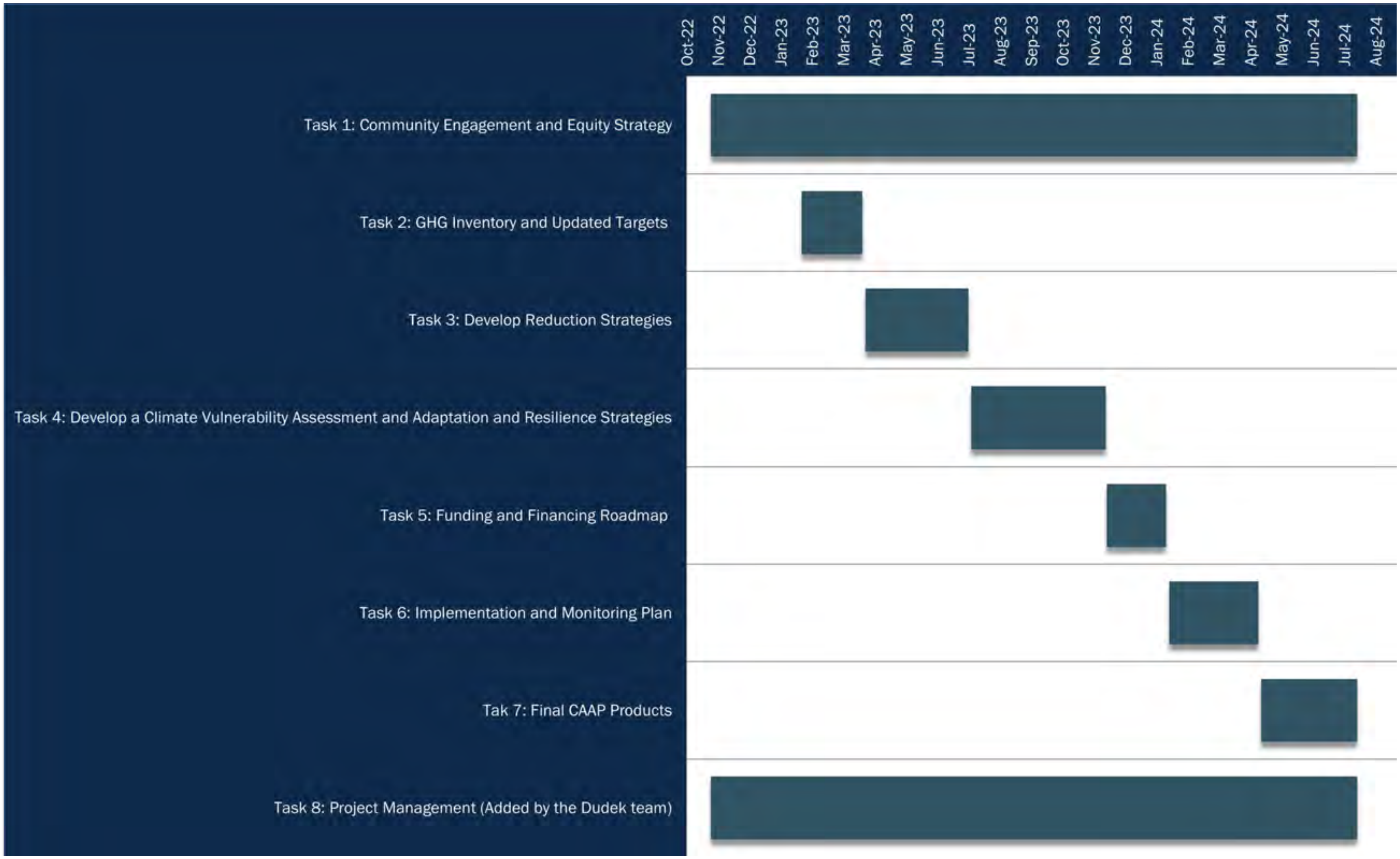
Dudek's editorial team will work closely with our project manager to apply the highest standards of quality to all County deliverables. For a typical Dudek work product, the following process will be used:

- **Technical Review.** An appropriate technical reviewer will be assigned to all written work products. This step in the review process is focused on the legal adequacy and technical accuracy of all deliverables, and multiple reviewers may be used depending on the complexity of the document.
- **Editorial Review.** Once the technical review is complete, Dudek editors will conduct an editorial review of deliverables. Prior to submittal to the County, each document will be formatted by Dudek's publications staff.
- **Document Production.** Dudek's publications production team verifies the quality of each formatted document before publication. Dudek's editorial team, in collaboration with the publications and information technology (IT) staffs, will produce and publish the web versions of project deliverables.

C. Project Schedule/Deliverables

Figure 2 details the Dudek team's proposed timeline to successfully complete the tasks. Dudek can meet the County's timeline but would welcome a conversation about a 24-month timeline.

Figure 2. Proposed Schedule



IV. Cost Proposal

A. Exhibit C

Exhibit C is submitted as a separate Excel file, per the County's Q&A.

B. Budget Narrative

1. Project Costs

The Dudek team's overall project cost is $495,420.

2. Per Task Cost

- **Task 1.** Community Engagement and Equity Strategy: $88,150
- **Task 2.** GHG Inventory and Updated Targets: $84,600
- **Task 3.** Develop Reduction Strategies: $62,980
- **Task 4.** Develop a Climate Vulnerability Assessment and Adaptation and Resilience Strategies: $56,840
- **Task 5.** Funding and Financing Roadmap: $43,240
- **Task 6.** Implementation and Monitoring Plan: $52,920
- **Task 7.** Final CAAP Products: $23,870
- **Task 8.** Project Management (added by the Dudek team): $82,8200

3. Additional Information

A. LINE ITEMS

Task 1. Community Engagement and Equity Strategy

The costs provided are commensurate with the high level of effort and caliber of work proposed. The budget includes culturally and language competent engagement and outreach specialists, language experts and interpreters, graphic and creative designers, technical experts, and publications staff. It is presumed that Task 1 will commence at the beginning of the CAAP and continue through the entire project. The Dudek team will continue to be nimble and responsive to community engagement, from initial interviews and strategy through pop up and engagement events and workshops. Likewise, the Dudek team will have open and ongoing communication with community members, in responses to questions and comments that come up at public meetings, via email through the public project portal and/or by phone. It is the goal to respond to questions and comments that come through the project portal, via email or phone within 24 hours of receipt. The Dudek team understands that responsive and equitable communication for all interested parties is of the upmost importance to Yolo County, for the project, and for the communities who will be impacted and implementing the CAAP.

Task 2. GHG Inventory and Updated Targets

The costs associated with this task are based on technical staff estimates and coordination with the RCD, Yolo County, and the working groups. The budget assumes a high level of coordination, discussion, and feedback loops. We anticipate a timeline of 3 to 4 months for this task. An iterative process is assumed as well as preparation of an administrative draft, draft, and final documents. The hours estimated and staff utilized are commensurate with the level of effort and caliber of work proposed.

Task 3. Develop Reduction Strategies

The costs associated with Task 3 include CAAP technical staff, including input from energy and agricultural economists, and anticipates communication and coordination with the Climate Committee and County staff, especially in relation to reduction measures from farming practices. This task will also absorb feedback from Task 1 to fully understand the farmers' perspectives and inform farmers of their needed participation in the CAAP. The anticipated timeline for this work is 4 to 6 months. An iterative process is assumed as well as preparation of an administrative draft, draft, and final documents. The hours estimated and staff utilized are commensurate with the level of effort and caliber of work proposed.

Task 4. Develop a Climate Vulnerability Assessment and Adaptation Resilience Strategy

The costs associated with Task 4 include CAAP technical staff. The team will identify climate risks in coordination with the County, and the adaptation component will require communication, coordination, and consensus building with the Climate Committee and County staff as well as the communities. The work is anticipated to be completed within 4 to 6 months. An iterative process is assumed as well as preparation of an administrative draft, draft, and final documents. The hours estimated and staff utilized are commensurate with the level of effort and caliber of work proposed.

Task 5. Funding and Financing Roadmap

The costs associated with the Funding and Financing Roadmap entail work that will require technical staff (grant funding experts as well as economists) and coordination with the Climate Committee and County staff. This task will require input from interested parties as well as information and data gathered in Task 1. The work is anticipated to be completed within 3 months. An iterative process is assumed as well as preparation of an administrative draft, draft, and final documents. The hours estimated and staff utilized are commensurate with the level of effort and caliber of work proposed.

Task 6. Implementation and Monitoring Plan

The costs associated with the implementation and monitoring plan requires technical staff coordination with the Climate Committee and County staff. This task will require input from interested parties as well as information and data gathered in Task 1. The work is anticipated to be completed within 3 months. An iterative process is assumed as well as preparation of an administrative draft, draft, and final documents. The hours estimated and staff utilized are commensurate with the level of effort and caliber of work proposed.

Task 7. Final CAAP Products

The staffing and budget costs associated with the Final CAAP products presume technical editing and publications staff work as well as graphic services and creative design services, GIS and mapping documents, and the complete summation of an administrative record. The process that is assumed for the final CAAP includes the preparation of administrative draft materials, opportunities for review and comments, preparation of draft materials for review and comments, screen check draft materials, and final documents.

Task 8. Proposed Task – Project Management

The Dudek team is proposing a project management task for several reasons, including 1) complexity of the project; 2) number of internal and external people and teams associated with the project that include staff on the County side, communities, interested parties, and other agency coordination; 3) emphasis on communication as a tool for successful project development and delivery; 4) need to establish and support project momentum; and 5) responsive and well-executed project management is a best management tool. The hours estimated and staff utilized are commensurate with the level of effort and caliber of work proposed

B. INTERNAL MANAGEMENT AND FISCAL CONTROL

Dudek project managers review project financials on a weekly basis. For budget control, we use the Deltek Vision accounting system, a web-based cost-tracking system that tabulates costs weekly, and is available 24 hours per day, 7 days per week. This software will provide Ms. Gray and our task order managers with the necessary information to manage the projects' financial progress, such as total labor costs and expenses to date for the reporting period, available budget remaining, and staff hours used in the reporting period.

Ms. Gray will evaluate progress against costs, assess the spending trend, and make corrections to keep task orders on track. Having continuous access to budget information will help Ms. Gray monitor each team member's progress toward meeting the internal budget and will allow her to anticipate potential budget constraints early, before they become a problem.

C. COST EFFICIENCIES

Cost containment commences with a clear schedule, regular communication, and appropriately sequencing tasks, sub-tasks, and synergizing efforts. Project Management, leadership, and close coordination internally among the Dudek team members and close coordination with the Project Manager and Management team at Yolo County will be instrumental in making the best, most cost-effective, and most project-effective decisions throughout the development of the CAAP.

Another opportunity for cost containment is regular monthly project reporting and budget assessments, including summaries of percentages used and percentages remaining per task and summaries of percentage used and percentage remaining for the overall budget. The summaries would include narrative associated with what has been accomplished, what remains to be done, expected level of effort to complete the task, and an assessment of whether activities are on target and within budget.

V. Responsiveness/ Responsibility

A. Contract Defaults

Contract Termination: In May 2019, the City of Santa Barbara terminated a contract with Dudek's Santa Barbara office for Design and Preliminary Environmental Review for the Santa Barbara Police Station Project. Subsequent to that termination, and after contracting with a different Dudek team, Dudek was able to complete work for this project to the City's satisfaction. Further, the City has continued to enter into new contracts with Dudek for projects.

Dudek has not been debarred or suspended by any government agency.

B. Legal Claims

Dudek's litigation history in the past five years includes the following:

City of Carlsbad vs. Ledcor Construction Inc.

On June 13, 2016, the City of Carlsbad filed a civil complaint in California Superior Court, County of San Diego, against Ledcor Construction Inc. Dudek was named as a co-defendant. The project architect, RRM Design Group, was also later named as a defendant. The suit was related to construction of the City's First Responder Training Center. Dudek served as construction manager for the City on the project. Dudek denied any liability in the matter. The matter has been resolved between the City and Dudek and was dismissed in August 2019.

Terra Lago Community Association v. Indo Land Ventures, LLC, et al.

On November 12, 2015, Terra Lago Community Association sued Indio Land Ventures for alleged construction defects arising out of the construction of a residential development complex located in Indio, California. Dudek was named as one of many cross-defendants for its role in preparing the lake-liner design; the other parties were involved in various construction aspects of the lake. Dudek did not participate in any supervision or other construction management activities. Plaintiff initially demanded $25,275 to settle the claims against Dudek, and their claims ultimately resolved in full for $10,000. The parties executed a settlement and release agreement which the Court approved, and the case was dismissed.

C. Problem Resolution

Our project managers are empowered to solve problems and make decisions in a timely fashion to keep project momentum moving forward. Ms. Gray will identify potential issues and possible solutions as early as possible, so they can be raised to the County and resolved quickly. She will get in front of developing problems by keeping you informed when County staff may need to get involved and offer alternatives to mitigate unnecessary delays.

Our approach to problem resolution is characterized by the following:

- **Early Detection.** Dudek employs an early detection approach to issue resolution with our clients. Observed problems will be discussed immediately with the appropriate individuals to avoid or correct any discrepancies. In her role as Project Manager, Ms. Gray will be the primary point of contact for issue resolution. Regardless of the time of day, she will be immediately available to address any issues that may arise under this contract.
- **Corrective Action.** Dudek will work closely with the County to identify and implement corrective actions for any issues that may arise under this contract. In the unlikely event that an issue arises with Dudek's performance or the performance of one of our subconsultants, Ms. Gray will immediately engage appropriate executive management to investigate the situation and develop appropriate corrective actions.
- **Closure.** Once corrective actions have been implemented, Dudek will follow up with the County to verify that the issues have been resolved. Dudek will disseminate the results of the corrective action process to the Dudek team to avoid repeating similar issues under this contract.

VI. Quality Assurance and Oversight

Quality Assurance Program

We create legally defensible environmental documents using thorough data collection, applying in-depth project analysis, and carefully addressing challenges as they arise. To provide the highest design and technical quality for our deliverables, Dudek has developed and adopted a formal quality assurance/quality control program that is applied to all the firm's activities.

Prior to initiating or preparing any technical deliverable, Ms. Gray will confirm the following:

- Define the project delivery and environmental solution needed
- Define the purpose and objective of the project and supporting document(s)
- Ensure that applicable format and content guidelines are utilized
- Establish how the approach methodologies, developed solution and documentation will be used, including identifying the intended audience
- Review the applicable manuals, plans, guidance, and annotated outline specifying the level of detail to be developed
- Collaborate on graphics, data presentation, and overall assembly of materials

The Dudek Publications team will work closely with Ms. Gray to apply the highest standards of quality to all County deliverables, considering the ongoing need for virtual collaboration and technical reviews. With experience preparing thousands of environmental documents and technical reports, our editorial and publications staff specialize in complete document solutions, helping you manage complex technical publications under tight deadlines. Dudek's quality assurance/quality control process includes sign-off on every transmittal by our technical editor after receiving a technical edit, reducing the time spent on document version changes.

As applicable and within the context of County guidance, the following quality assurance/quality control program elements will be used:

Quality Control

Style Guide Development

- Establish designs that complement client's branding

Technical Review

- Verifiy that all content and data are error-free

Editorial Review

- Make sure that product meets or exceeds client standards

Document Production

- Produce and deliver high-quality products

- Quality Control Reviews
  - Checking of Calculations, Delineations, and Determinations
- Quality Assurance
  - Defined Reporting Structure
  - Defined Duties and Responsibilities
  - Document Control
  - Subconsultant Control
- Documentation style guide development
- Subject matter expert/technical review
- Editorial, contract, and task order manager review
- Document(s) production

Our quality assurance program saves time and produces clear, objective, and accurate documents.

Staff Screening and Selection

The team assembled for this project has the deep technical skills and the proficiency required by the project, as well as a clear understanding of the development of CAAPs and their implementation. Our project managers are agile problem solvers, with the ability to make decisions in a timely fashion to maintain project momentum and meet the needs of those we serve. We are proud of our low employee turnover; our staff's long tenure demonstrates our dedication to the projects we work on and the long-standing relationships we have in the places we live and work.

We provide professional growth opportunities while empowering employees to perform at a high level of accuracy, integrity, and creativity. We work in collaborative teams that are self-supporting and provide a level of energy and responsiveness that is a hallmark of Dudek's services. Staff are compensated at competitive rates consistent with the California labor marketplace.

We encourage and cover membership costs for professional organizations and conference attendance, such as the Association of Environmental Professionals, International Conference on Ecology and Transportation, Association of Environmental Professionals, American Planning Association, and National Association of Environmental Professionals. Together these integrated elements of Dudek's corporate structure and culture illustrate our commitment to and investment in our employees.

VII. Past Performance

Dudek's past performance references are included in the Exhibit D section of this proposal.

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EXHIBIT "C"

PROPOSAL COST

3 EXHIBIT "C"
PROPOSAL COST

Dudek's Cost Proposal is submitted using the County-provided Excel file, per the instructions in the Q&A.

Name & Role	Fully Burdened Hourly Rate
Jane Gray Project Manager/Engagement Lead/Funding Strategy	$235
Jennifer Reed Deputy Project Manager	$210
Mike Howard GHG Inventory (Natural and Working Lands)	$265
Sarah Halterman GHG Inventory	$155
Rose Newberry, AICP, WEDG GHG Inventory (Measure Development), Resilience Strategy	$165
David Larocca GHG Inventory	$225
Lisa Valdez Traffic/Inputs for GHG	$210
Scott Eckardt, RPF Forestry	$235
Fraser Shilling, PhD Wildlife, Water, Climate Resilience	$235
Curtis Battle GIS	$145
Chris Starbird Web Development	$165
Melanie Betlach Graphic Design	$165
Karen Castaneda Graphic Design	$150
Raoul Ranoa Technical Storytelling	$165
Shane Russett GHG Inventory	$110
Henry Eckold GHG Inventory (Measure Development)	$135

Name & Role	Fully Burdened Hourly Rate
Nick Johnston GHG Inventory (Measure Development)	$110
Madelyn Murray Communication and Engagement	$135
Amanda Meroux, EIT Traffic	$135
Michael Hendrix GHG Inventory	$195
Richard McCann Economics (Energy)	$255
Matt Kowta Economics (Agriculture)	$320
Ronald Milam, PTP, AICP Traffic	$388.88
Greg Behrens, AICP Traffic	$209.40
Robb Davis, PhD Communication and Engagement	$125
Koy Saephan Language Interpretation	$175

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EXHIBIT "D"

PREVIOUS CUSTOMER REFERENCES

4 EXHIBIT "D" PREVIOUS CUSTOMER REFERENCES

Exhibit D – Previous Customer Reference Form

PROFESSIONAL CONSULTING SERVICES FOR

CLIMATE ACTION & ADAPTATION PLAN RFP

Contractor Name: Dudek

Please provide at least five customer references for whom you have performed a job similar in size and scope, preferably California state or local government agencies or within the greater Sacramento area.

1. Company Name: County of Riverside (Michael Hendrix Consulting)
   Address: 4080 Lemon Street, 12th floor
   Riverside, California 92501-3634
   Contact Person: Phayvanh Nanthavongdouangsy
   Telephone: 951.955.6573
   E-Mail: pnanthav@rivco.org
   Services Provided: Riverside County CAP, CAP Update, implementation and monitoring tools, and staff training.
   Service Dates: From: 2010 To: 2020 Contract Value: $ 504,447

2. Company Name: City of Agoura Hills (Michael Hendrix Consulting)
   Address: 30001 Ladyface Court
   Agoura Hills, California 91301
   Contact Person: Ramiro Adeva, PE
   Telephone: 818.597.7342
   E-Mail: RAdeva@agourahillscity.org
   Services Provided: City of Agoura Hills Climate Action and Adaptation Plan, CEQA Initial Study/ Mitigated Negative Declaration and CEQA process, and CAP implementation and monitoring.
   Service Dates: From: 2019 To: Ongoing Contract Value: $ 237,383

3. Company Name: San Bernardino County Transportation Authority (Michael Hendrix Consulting)
   Address: 1170 W 3rd St 2nd floor
   San Bernardino, CA 92410
   Contact Person: Josh Lee
   Telephone: 909.884.8276
   E-Mail: jlee@gosbcta.com
   Services Provided: San Bernardino County Regional GHG Reduction Plan, EIR, CAP implementation tools, GHG Reduction Plan Update, and CEQA Addendum to the EIR.
   Service Dates: From: 2009 To: 2022 Contract Value: $ 732,852.49

Exhibit D – Previous Customer Reference Form

PROFESSIONAL CONSULTING SERVICES FOR

CLIMATE ACTION & ADAPTATION PLAN RFP

4. Company Name: California Department of Water Resources (Dudek)

Address: CNRA HQ Building, 715 P Street
Sacramento, CA 95814

Contact Person: Kelley List

Telephone: 916.651.9222

E-Mail: Kelley.List@water.ca.gov

Services Provided: Outreach, communication, engagement, and facilitation for tribal governments and underrepresented communities; technical assistance and support services for DWR's Technical Assistance Program

Service Dates: From: 2021 To: Ongoing Contract Value: $ 2.5M

5. Company Name: SANDAG (Dudek)

Address: 401 B Street, Suite 800
San Diego, CA 92101

Contact Person: Allison Wood

Telephone: 619.699.1973

E-Mail: allison.wood@sandag.org

Services Provided: Carbon conduct a carbon storage and sequestration study for the San Diego Region, which provided jurisdiction-level accounting of carbon storage, sequestration, and GHG emissions for natural and working lands.

Service Dates: From: 2020 To: 2022 Contract Value: $ 100,000

Exhibit D – Previous Customer Reference Form
PROFESSIONAL CONSULTING SERVICES FOR
CLIMATE ACTION & ADAPTATION PLAN RFP

6. Company Name: City of Sacramento (Fehr & Peers)
   Address: 915 I Street, Sacramento, CA 95814

   Contact Person: Fedolia "Sparky" Harris
   Telephone: 916.808.2996
   E-Mail: fharris@cityofsacramento.org
   Services Provided: Transportation planning for Sacramento 2040 General Plan Update

   Service Dates: From: 2018 To: Ongoing Contract Value: $ 493,000

7. Company Name: City of Davis (Fehr & Peers)
   Address: 23 Russell Blvd., Suite 1, Davis, CA 95616

   Contact Person: Kerry Loux
   Telephone: 530.757.5610 ext. 8246
   E-Mail: kloux@cityofdavis.ca.us
   Services Provided: Transportation planning for Davis Climate Action and Adaptation Plan

   Service Dates: From: 2021 To: Ongoing Contract Value: $ 42,000

Exhibit D – Previous Customer Reference Form

PROFESSIONAL CONSULTING SERVICES FOR

CLIMATE ACTION & ADAPTATION PLAN RFP

8. Company Name: Delta Protection Commission (M.Cubed)

Address: 2101 Stone Boulevard, Suite 240, West Sacramento, CA 95691

Contact Person: Erik Vink, Executive Director (Retired)

Telephone: 530.304.5499 (home)

E-Mail: eavink@gmail.com

Services Provided: Used a stakeholder-responsive process to assess the feasibility of establishing beneficiaries-pay financing mechanisms to fund improvements and maintenance in Sacramento-San Joaquin Delta levees

Service Dates: From: 2015 To: 2018 Contract Value: $ 670,000

9. Company Name: County of Yolo (BAE)

Address: 625 Court Street, Woodland, CA 95695

Contact Person: Elisa Sabatini

Telephone: 530.406.5773

E-Mail: elisasabatini@yolocounty.org

Services Provided: Conducted a financial feasibility analysis for the build-out and long-term maintenance of the Cache Creek Parkway Plan

Service Dates: From: 2016 To: 2019 Contract Value: $ 51,350

Form Completed By:	Jane Gray, Project Manager	805.308.8531	9/1/2022
	Name	Phone	Date

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EXHIBIT "E"

SIGNATURE PAGE

5 EXHIBIT "E" SIGNATURE PAGE

County of Yolo
SIGNATURE PAGE

PROFESSIONAL CONSULTING SERVICES FOR
CLIMATE ACTION & ADAPTATION PLAN RFP
Exhibit "E"

Solicitation Name: Climate Action and Adaptation Plan RFP

The undersigned supplier hereby certifies that he/she has read the document in its entirety, understands the specifications, agrees to all instructions, terms, conditions, and addenda set forth in this request. Supplier further certifies that the prices and terms submitted for said product(s) and/or service(s) have been carefully reviewed and are submitted as correct and final, and shall be honored for the length of time indicated in the request.

All paper submittals must be manually signed in ink in the appropriate space below. If submitting electronically via BidSync, print name of "Authorized Person" in the space provided for signature.

I certify, under penalty of perjury, that I have the legal authorization to bind the firm hereunder:

Dudek
Company Name

605 Third Street
Address

Encinitas, CA 92024
City State Zip

Signature of Person Authorized to Sign

Joseph Monaco
Printed Name

President/CEO
Title

9/1/2022
Date

For clarification of this offer, contact:

Name: Jane Gray

Title: Project Manager

Phone: 805.308.8531

Fax: 760.632.0164

Email: jgray@dudek.com

5. Signature_Page_Exhibit_E_Needs Certified E-Sig

Final Audit Report 2022-09-07

Created:	2022-09-07
By:	Amy Steele (asteele@dudek.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAA-XPW4xPXmnbYxpgbuOGWi6z2UoF7yll9

"5. Signature_Page_Exhibit_E_Needs Certified E-Sig" History

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2022-09-07 - 5:33:50 PM GMT

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2022-09-07 - 5:37:15 PM GMT- IP address: 100.43.248.202

Document e-signed by Joe Monaco (jmonaco@dudek.com)
Signature Date: 2022-09-07 - 5:37:45 PM GMT - Time Source: server- IP address: 100.43.248.202

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2022-09-07 - 5:37:45 PM GMT

Adobe Acrobat Sign

6

EXHIBIT "F"

NON-COLLUSION AND NON-CONFLICT OF INTEREST STATEMENT

6 EXHIBIT "F" NON-COLLUSION AND NON-CONFLICT OF INTEREST STATEMENT

NON-COLLUSION AND NON-CONFLICT OF INTEREST STATEMENT

PROFESSIONAL CONSULTING SERVICES FOR
CLIMATE ACTION & ADAPTATION PLAN RFP

Exhibit "F"

I, Joseph Monaco, am the
(name)

President/CEO of Dudek,
(Position Title) (Company)

The term **"Offeror"**, as used herein, includes the individual or business entity submitting the Offer and for the purpose of this Affidavit includes the directors, officers, partners, managers, members, principals, owners, agents, representatives, employees, other parties in interest of the Offeror, and anyone or any entity acting for or on behalf of the Offeror, including a subcontractor in connection with this Offer.

1. **Anti-Collusion Statement.** The Offeror has not in any way directly or indirectly:
a. Colluded, conspired, or agreed with any other person, firm, corporation, offeror or potential offeror to the amount of this Offer or the terms or conditions of this Offer.
b. Paid or agreed to pay any other person, firm, corporation, offeror or potential offeror any money or anything of value in return for assistance in procuring or attempting to procure a contract or in return for establishing the prices in the attached Offer or the offer of any other offeror.

2. **Preparation of Solicitation and Contract Documents**. The Offeror has not received any compensation or a promise of compensation for participating in the preparation or development of the underlying Solicitation or Contract documents. In addition, the Offeror has not otherwise participated in the preparation or development of the underlying Solicitation or Contract documents, except to the extent of any comments or questions and responses in the solicitation process, which are available to all offerors, so as to have an unfair advantage over other offerors, provided that the Offeror may have provided relevant product or process information to a consultant in the normal course of its business.

3. Participation in Decision Making Process. The Offeror has not participated in the evaluation of offers or other decision making process for this Solicitation, and, if Offeror is awarded a contract hereunder, no individual, agent, representative, consultant, subcontractor, or subconsultant associated with Offeror, who may have been involved in the evaluation or other decision making process for this Solicitation, will have any direct or indirect financial interest in the contract, provided that the Offeror may have provided relevant product or process information to a consultant in the normal course of its business.

4, Present Knowledge. Offeror is not presently aware of any potential or actual conflicts of interest regarding this Solicitation, which either enabled Offeror to obtain an advantage over other offerors or would prevent Offeror from advancing the best interests of the County in the course of the performance of the Contract.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct:

9/1/2022
(Date)

(Signature)

6. Non-Collusion_Non_Conflict_of_Interest_Statement_Exhibit_F_Needs Certified E-Sig

Final Audit Report 2022-09-07

Created:	2022-09-07
By:	Amy Steele (asteele@dudek.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAxk4iUj37_9v2BL9mZ1K-6KGsqctV8nLm

"6. Non-Collusion_Non_Conflict_of_Interest_Statement_Exhibit_F_Needs Certified E-Sig" History

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Document e-signed by Joe Monaco (jmonaco@dudek.com)
Signature Date: 2022-09-07 - 5:38:20 PM GMT - Time Source: server- IP address: 100.43.248.202

Agreement completed.
2022-09-07 - 5:38:20 PM GMT

Adobe Acrobat Sign

7

EXHIBIT "G"

EXCEPTIONS

7 EXHIBIT "G" EXCEPTIONS

EXHIBIT G – EXCEPTIONS

PROFESSIONAL CONSULTING SERVICES FOR

CLIMATE ACTION & ADAPTATION PLAN RFP

Exceptions to Insurance and Contract **Terms and Conditions**

All County RFP requirements by section, subsection or numbered item for which Vendor has stated "Read and do not comply" are considered exceptions and must be documented in this form. Vendor may add additional rows to the table as necessary to include all exceptions taken. If no exceptions were taken, Vendor should write "No Exceptions" under the "Requirement(s) Section Number and Text" for Exception in row number 1.

Exception Number	Requirement(s) Section Number and Text	Describe the Nature of the Exception and Explain how Vendor's Response Still Meets the RFP Requirements
1	XII.CONTRACTOR'S RESPONSIBILITIES B	This form of indemnity includes a separate duty to defend, which Dudek typically qualifies for professional liability claims. Dudek requests that the following sentence be added to the very end of XII.B as follows: "Notwithstanding the foregoing, with respect to any professional liability claim or lawsuit, this indemnity does not include providing the primary defense of County, provided, however, Contractor shall be responsible for County's defense costs to the extent such costs are incurred as a result of Contractor's negligence, recklessness or willful misconduct."
2		.
3		
4		
5		

APPENDIX A

Personnel Resumes

Jane Gray

ENVIRONMENTAL SPECIALIST, PROJECT MANAGER

Jane Gray is a regional planner, environmental specialist, and project manager with 23 years' project management and environmental planning experience, specializing in water/wastewater planning and permitting, agricultural resource and policy planning, policy analysis, land use planning, project development and entitlement services, and grant writing and management. Ms. Gray has a diverse and nuanced planning background, having worked as a project manager, analyst, and environmental planner for non-governmental entities, public agencies, and private firms and corporations. She has been responsible for projects varying from small-scale development and infrastructure planning in developing economies to private residential and commercial developments throughout California.

Ms. Gray brings and effective and customized approach to efficiently deliver services. Her ability to skillfully negotiate the often-disparate interests involved in projects and bring about consensus is an asset in any situation. Ms. Gray has organizational expertise, technical aptitude, planning proficiency, and competency facilitating projects through contentious issues in a variety of communities.

Education

Universität Dortmund, Germany
MS, Regional Planning and Management

State University of New York, Buffalo
BS, Social Work

Professional Affiliations

Chair, Central Coast Regional Water Quality Control Board

2nd District Appointee to the County Agricultural Advisory Committee

Project Experience

Project Management, Technical Needs Assessment Technical Assistance, Communication and Engagement, California Department of Water Resources. Providing program management and leading the development and implementation of the Prop 68 Technical Assistance with the California Department of Water Resources (DWR) for Tribal Governments, Tribal Communities and Underrepresented Communities. Ms. Gray is the Project Director leading and managing all components of the contract. She is spearheading Communication and Engagement, Workshop coordination and facilitation, stakeholder engagement and community dialogue, needs, risks and vulnerabilities assessments, surveys heat mapping and community prioritization and evaluation. The project entails extensive data collection, management and curation of ethnographic information, extensive community surveying, and provision of technical assistance, technical summaries and memoranda, report writing and outcome analysis.

Project Management, Needs Assessment, Outreach and Engagement for the Santa Barbara County Integrated Regional Water Management DACTI Grant and DACTI Plan, California. Provided overall project management, coordination consultants, internal staff, project proponents, and communities for the Needs Assessment for the (DACI) grant. Coordinated with all agencies' staff and communication with NGOs and CBOs to conduct detailed ethnographic surveys and gather and characterize water, wastewater, climate, and other, needs, opportunities, strengths, threats, risks, and vulnerabilities for the development of solutions that are either project-based, instructional-capacity- based, or require other solutions. Worked with the communities to scope and determine solutions, production of outreach, educational engagement materials, presentations, and dialogues with the communities, agencies, NGOs, and CBOs. Prepared, summarized and detailed ethnographic study of the various communities in the region and comprehensive inventory of needs, opportunities, strengths, threats, risks, and vulnerabilities, as well as proposed solutions and associated time horizons. Preparation of a comprehensive DACTI Plan.

Project Management, Public and Stakeholder Engagement and Facilitation for the formation of a Groundwater Sustainability Agency in the Cuyama Valley, Santa Barbara County Water Agency, Santa Barbara County, California. Wrote a successfully awarded grant for formation of a Groundwater Sustainability Agency (GSA) in the Cuyama Groundwater Basin. Prepared a Communication and Engagement Plan, conducted extensive bilingual public and stakeholder outreach and community engagement, coordinated bilingual materials and workshops, and coordinated monthly, year-long negotiations and meetings with four counties that overlie the Cuyama Valley Basin as well as the Cuyama Community Services District, Cuyama Basin Water District to develop a voting structure, formation documents, and establish a GSA for the Cuyama Valley Groundwater Basin.

Project Management, Public and Stakeholder Engagement and Facilitation for the formation of a GSA in the San Antonio Creek Valley, Santa Barbara County Water Agency, California. Wrote a successfully awarded grant for formation of a GSA in the Santa Antonio Creek Valley groundwater basin. Conducted public and stakeholder outreach, agricultural interests, and community engagement; coordinated the Los Alamos Community Services District and the Santa Barbara County Water Agency to develop a voting structure, formation documents, and establish a GSA for the San Antonio Creek Valley Groundwater Basin.

Project Management, Public and Stakeholder Engagement Manager for the Creek and Watershed Management Plan, City of Goleta, California. Providing community engagement and facilitation services for the duration of the Plan development related to public meetings and workshops, Technical Advisory Committee meetings, and other community outreach events and forums. This includes coordination of language-appropriate support services, generation of meeting and workshop materials, meeting minutes, agenda, and presentations.

Project Management, Public and Stakeholder Communication, Engagement, and Facilitation for the formation of a Groundwater Sustainability Agency (GSA) and development of a Groundwater Sustainability Plan (GSP) in the Montecito Groundwater Basin, Montecito Water District, Santa Barbara County, California. Prepared a Communication and Engagement Plan, conducted extensive public and stakeholder outreach and community engagement, and coordinated workshops to form and establish a GSA for the Montecito Groundwater Basin, which at the time the effort begun was not required to form a GSA. Prepared a Communication and Engagement Plan and conducted extensive public and stakeholder outreach and community engagement, formation of a Technical Advisory Committee (TAC), Stakeholder Advisory Committee (SAC), coordinating workshops and meetings throughout the generation of a state-compliant Groundwater Sustainability Plan.

Project Management, Biomass to Energy Demonstration Project Goleta Sanitary District, Santa Barbara County, California. Served as CEQA and entitlement project manager. Responsible for management, consultant coordination and preparation of technical studies as well as a Mitigated Negative Declaration and Substantial Conformity Determination and CDP. Specifically, the Project demonstrates that source separated food waste can be pre-treated and processed to produce a high-quality biogas, which can ultimately be used as a fuel source for electrical energy generation.

Program Management of Santa Barbara Countywide Integrated Regional Water Management (IRWM) Program and Plan Santa Barbara County Water Agency (SBCWA), California. Serving as extension of county staff. The position entails overall program management assistance and coordination of more than 30 agencies and nonprofits involved in regional benefit projects for competitive grant applications and over 120 stakeholders. Coordinates and manages the public stakeholder process and all public outreach efforts associated with the IRWM program.

Jennifer Reed

AIR QUALITY SPECIALIST, ENVIRONMENTAL PLANNER

Education

University of California, Santa Barbara
BA, Environmental Studies, 2007
BA, Geography, 2007

Professional Affiliations

Association of Environmental Professionals

Air and Waste Management Association

Jennifer Reed is an air quality specialist/environmental planner with 15 years' experience. Ms. Reed leads Dudek's air quality services team, and has been responsible for the management, research, and analysis of projects subject to compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). She has completed numerous environmental documents in support of a diverse range of public and private developments. Ms. Reed specializes in air quality, greenhouse gas (GHG) emissions, health risk assessment (HRA), and energy technical analyses, and continues to be on the forefront of evolving science, emissions modeling computer programs, and regulatory framework.

Ms. Reed has prepared air quality and GHG assessments for a wide variety of development projects throughout California, including large residential projects, commercial and retail projects, industrial projects, mixed-use developments, colleges and universities, healthcare facilities, energy projects, water and wastewater infrastructure, and transportation improvements, including California Department of Transportation (Caltrans) air quality analyses. Additionally, she has considerable experience in project planning and regulatory compliance pursuant to the California Coastal Act (CCA) and has experience in project management, land-use permit processing, constraints analysis, development feasibility studies, due diligence investigations, and various other land-use planning projects. Ms. Reed teaches an annual course on air quality and GHG emissions at the University of California at Davis Continuing and Professional Education and is an active member in Association of Environmental Professionals Climate Change Committee.

Project Experience

Energy and Conservation Action Strategy (ECAS) Update, City of Vacaville, California. Contributed to the preparation of the Energy and Conservation Action Strategy (ECAS) Update, which provides a strategic roadmap for the City of Vacaville to meet the State's GHG reduction targets established by Senate Bill 32 and demonstrate substantial progress towards meeting Executive Order S-3-05. The year 2035 was identified as the target year, which required a reduction of approximately 54% from the 2035 business-as-usual scenario. The ECAS builds on the strategies and measures established by the City's 2015 ECAS, identifies GHG reduction targets, and develops locally applied actions to reduce GHG emissions from communitywide activities. Emission sectors included transportation, residential energy, non-residential energy, water and wastewater, solid waste disposal, off-road equipment, and carbon storage. The ECAS identified new city policies to account for a reduction of over 300,000 metric tons of carbon dioxide equivalent, which exceeded the City's GHG reduction target.

Grapevine Specific Plan Project, Tejon Ranch Corporation, Kern County, California. Prepared the air quality and GHG emissions technical report for the project, provided management of the HRA and criteria pollutant air quality impact analysis, and provided ongoing technical support. The Grapevine Specific Plan project, which is located in the west-central portion of 270,000-acre Tejon Ranch, would be developed as a residential community and employment center within 4,780 acres of the 8,010-acre property. The project, which includes up to 12,000 residential units and 5.1 million square feet of commercial and light industrial land uses (including a community college and medical campus), is designed as a series of conveniently located village centers, each composed of a mix of housing, neighborhood-serving retail and office uses, schools, parks, and community services. Specific tasks include construction and operational criteria air pollutant and GHG emissions estimates, industrial source emissions calculations, carbon monoxide hotspot analysis, odor assessment, and Valley Fever assessment. Also prepared the air quality and GHG emissions technical report for the Supplemental Recirculated Environmental Impact Report, which evaluated buildout of the project under five development and vehicle miles traveled scenarios.

TerraCount Assessment for San Diego County, San Diego County, California. Project manager and GHG lead for the San Diego Association of Governments carbon storage and sequestration assessment for San Diego County using the California Department of Conservation's TerraCount tool. The analysis will estimate the carbon inventory for the natural and working lands of San Diego County to estimate the current carbon storage and forecasted trends to 2050 and report out the effects of management activities and co-benefits in the region.

Tejon Ranch Ranch-Wide Carbon Storage Analysis White Paper, Kern and Los Angeles Counties, California. Managed and contributed to an evaluation of carbon stored within approximately 250,000 acres of conserved land including permanently preserved land, agricultural land, and retained natural open space within development areas.

Yuba-Sutter Regional Conservation Plan EIR/EIS, Counties of Yuba and Sutter, California. Prepared the air quality and GHG/climate change analyses for the Yuba-Sutter Regional Conservation Plan, which will serve as a habitat conservation plan (HCP)/ natural community conservation plan (NCCP) for the Counties of Yuba and Sutter and Cities of Wheatland, Yuba City, and Live Oak.

California Air Resources Board (CARB) Southern California Consolidation Project, Department of General Services (DGS), Riverside, California. Contributed to the air quality and GHG emissions analysis for the consolidation and relocation of CARB's motor vehicle emissions standards development and testing to an 18-acre campus style facility. The new campus, which will be a national and international center for air pollution and climate change research, is designed to accommodate approximately 460 employees and will include approximately 800,000 square feet of testing space, chemistry laboratory space, office/administrative space, and facilities and support space (e.g., warehouse, shipping and receiving area, and vehicle wash areas). Key issues for the project were air quality and greenhouse gases, due to vehicle miles traveled for the employees traveling to the new campus and CARB's goal to achieve net zero energy for the project. In addition to employee vehicle emissions, emissions were estimated for vehicle testing, vehicle fueling, fuel storage, boilers, a fuel cell plant, an emergency generator, chemistry laboratory, and miscellaneous operations that generate criteria air pollutant, GHGs, and toxic air contaminant emissions. A net carbon storage and sequestration analysis for the project was conducted.

Globemaster Corridor Specific Plan EIR/EIS, City of Long Beach, California. Prepared the air quality, GHG emissions, and energy analysis for Phase 2 of the C-17 Transition Master Plan, which provides a framework for development and improvement of the former Boeing C-17 site, Cherry Avenue corridor planning, and surrounding area. Operational emissions were estimated for the Proposed Project (7,011,195 square feet) and Existing Scenario (2,094,175 square feet), which included over 20 different land uses, including warehouse and manufacturing.

Casden Development Projects EIR, City of Oxnard, California. As deputy project manager and lead environmental analyst, oversaw and contributed to the air quality, land use and planning, public services, long-term impacts, and alternatives sections of the EIR. This project includes the development of two adjacent project sites, resulting in a total of 344 residential units.

DUDEK

Mike Howard

SENIOR PROJECT MANAGER

Mike Howard is a senior project manager with 22 years' experience in biological resource assessment, regional habitat conservation planning, and regulatory permitting, and he specializes in developing permitting and environmental documentation solutions for large, complex projects. Mr. Howard has conducted and overseen biological studies throughout California, including focused endangered plant and wildlife species surveys, vegetation community mapping, jurisdictional wetland delineations, and wildlife movement studies. Specializing in habitat conservation planning, he has managed and served as lead conservation biologist on numerous habitat conservation plans (HCPs) and natural community conservation plans (NCCPs) throughout California.

Mr. Howard regularly works with federal and state agencies, local governments, and project stakeholders to collaboratively develop conservation strategies for species and natural communities while streamlining the permitting processes for covered activities. He is an expert in resource management and monitoring, and he has developed and implemented monitoring and adaptive management programs, open space management plans, conservation easements, and property analysis records for habitat reserves and open space areas across the state. Mr. Howard is an expert at evaluating complex, multijurisdictional projects for compliance with CEQA and NEPA.

Education

University of California, Santa Barbara
MESM, Applied Ecology, 1998
BS, Environmental Studies, 1996
BS, Ecology, 1996

Professional Affiliations

Society for Conservation Biology

Society of Wetland Scientists

Project Experience

Carbon Storage and Sequestration Study for San Diego County, San Diego County, California. Technical lead for the San Diego Association of Governments carbon storage and sequestration assessment for San Diego County using the geographic information system (GIS) based modeling tools developed by the California Department of Conservation. Responsible for building the spatial data layers and conducting the carbon inventory for the carbon pools of the natural and working (i.e., agricultural) lands of San Diego County to estimate the current carbon storage and forecasted trends to 2050 and report out the effects of management activities and co-benefits in the region.

Carbon Storage and Sequestration Assessment for Four Watersheds of San Diego County, California, San Diego County, California. Project Manager and study lead in the development of a spatially explicit model to quantify and map the distribution of carbon storage in the Otay River, San Diego River, Sweetwater River, and Tijuana River watershed. Researched international, national, state, and regional literature to parameterize the GIS model based on the vegetation and soil types for the above- and belowground carbon pools. Results of the study to be used for decision support by the San Diego River Conservancy for management of watershed lands for carbon co-benefits.

Department of Water Resources San Joaquin Field Division Habitat Conservation Plan, Kern County, California. Project manager and lead conservation biologist for the development of a multiple species HCP and California Endangered Species Act permitting covering the operations and maintenance of the approximately 140 linear miles of the California Aqueduct and a portion of the Coastal Branch Aqueduct in the southern San Joaquin Valley.

California Desert Biological Conservation Framework, Desert Region, California. Project Manager and study lead in the preparation of the California Desert Biological Conservation Framework developed for the California Energy Commission (CEC), California Department of Fish and Wildlife (CDFW), Bureau of Land Management (BLM), and US Fish and Wildlife Service (USFWS). This conservation framework was envisioned as a companion document to the DRECP with an emphasis on supporting “step-down” habitat conservation planning at the regional and local levels by leveraging the conservation strategies of the DRECP.

Desert Renewable Energy Conservation Plan (DRECP), Desert Region, California. Deputy project manager and lead conservation biologist responsible for all aspects of technical analysis, report preparation, and stakeholder and agency communication on this seven-county, 22.5-million-acre NCCP/HCP and environmental impact report/environmental impact statement (EIR/EIS) being developed for renewable energy development in the California deserts by the California Energy Commission (CEC). Oversaw development of the project’s geographic information system (GIS) database, developed species distribution models and profiles for more than 50 Covered Species, crafted biological goals and objectives, developed the biological resources environmental setting, established an implementation structure, constructed a plan-wide reserve design, created the monitoring and adaptive management framework, and integrated biological and non-biological elements into a comprehensive conservation strategy for the desert region of California. Communicated with and presented information on a regular basis to the primary planning agencies—CEC, the California Department of Fish and Wildlife (CDFW), the Bureau of Land Management, and the U.S. Fish and Wildlife Service (USFWS)—multiple cooperating agencies, the governor’s office, county representatives, and environmental and industry stakeholders. As part of the environmental documentation prepared for the DRECP, served as the principal biologist responsible for developing the effects analysis approach for analyzing five action alternatives and a no action alternative, each with varying renewable energy development areas and reserve designs.

San Bernardino County Regional Conservation Investment Strategy (SBC RCIS), San Bernardino County, California. Project Manager and lead conservation biologist for the SBC RCIS developed for the County of San Bernardino, San Bernardino County Transportation Authority (SBCTA), and Southern California Association of Governments (SCAG). The SBC RCIS is being developed under the newly established program by the California Department of Fish and Wildlife (CDFW) to provide a mechanism to streamline the approval of mitigation actions. Developed the conservation lands inventory, identified focal species, conducted a gap conservation analysis, developed conservation goals and objectives, and identified conservation actions and priorities in the 3.5-million-acre RCIS area.

Southern Subregion Habitat Conservation Plan (SSHCP) Implementation, Orange County, California. Serve as project manager overseeing the implementation of the monitoring and adaptive management program in the Habitat Reserve of the SSHCP for the Rancho Mission Viejo Land Trust. Develop and implement monitoring protocols for covered species, conduct regular vegetation mapping updates, evaluate ecosystem health in oak and riparian woodlands, and evaluate species occupancy in coastal scrub to monitor effectiveness of the SSHCP conservation strategy. Work with the land trust, wildlife agencies, and the science panel to develop Management Action Plans every 5 years. Produce the annual report each year documenting permit compliance for this long-term permit approved in 2006.

Sarah Halterman

AIR QUALITY SPECIALIST

Sarah Halterman (*she, her, hers*) is an air quality specialist with five years' professional experience. Ms. Halterman specializes in the preparation of air quality and greenhouse gas (GHG) emissions inventories, CEQA/NEPA environmental impact analyses, climate action planning, energy technical analyses, and long-range planning documents for the reduction of criteria air pollutant and GHG emissions.

Ms. Halterman has prepared air quality, GHG, and energy assessments for a wide variety of projects throughout California, including many within the San Diego region. These projects include long-range plans for communities, the Port, and School District, among others. Such plans also include those that address the reduction of criteria air pollutant and GHG emissions at a program-level. Additionally, Ms. Halterman has substantial experience with environmental assessments of community development projects within the County of San Diego.

Education

University of California, Los Angeles
M.A. Geography, 2015

University of Maryland, College Park
B.S. Environmental Science and Policy: Global Environmental Change, 2011

Project Experience

Sustainable Santee Action Plan, City of Santee, California. Assisted with updates to the Sustainable Santee Action Plan, and prepared analysis for related environmental documents pursuant CEQA review. The Plan was developed to quantify GHG emissions within the City and provide strategies to reduce emissions in accordance with state-wide goals and targets. Involvement also included meetings with the City and community stakeholders to address concerns. (2017–2018)

Coronado Climate Action Plan, City of Coronado, California. Contributed to the research, writing, and analysis for the development of the Coronado's Climate Action Plan. Technical involvement included quantification of baseline emissions from community and municipal building energy, water use, and wastewater processes, and of projected emissions in future years 2030, and 2045. Also researched and quantified cost estimates for various GHG reduction measures and served as lead author on several Plan chapters. (2020-2021)

National City Bayfront Plan, Port of San Diego, San Diego, California Prepared the air quality and GHG emissions sections of the National City Bayfront Plan EIR, including mass emissions quantification, analysis, and chapter writing. The project involves redevelopment of the National City waterfront area, including eight individual project components. These project components include changes to land and water use designations, amendments to local plans and codes, construction and operation of an RV park, boat storage, hotels, bikeway, restaurants, retail, and a rail connector and storage track. (2019-2021)

Alpine Community Plan Update, County of San Diego, California. Assisted with the air quality, GHG, and energy analysis for the Alpine CPU Supplemental EIR. The analysis required quantification of how the proposed changes to the Alpine CPU would affect air quality and GHG emissions and energy usage, and how those would influence the original significance determinations from the 2011 County General Plan Update PEIR. (2019)

Capital Improvement Program PEIR, SDUSD, San Diego, California. Assisted with the preparation of the air quality, GHG emission, and energy analyses and sections of the Capital Improvement Program EIR. The PEIR was developed to assist the SDUSD in streamlining typical projects, which include those to repair, renovate, and revitalize District schools, and administration facilities. (2020-2021)

Alpine County Park Project, County of San Diego Department of Parks and Recreation, County of San Diego, California. Prepared the GHG emissions EIR section for the Alpine County Park, which involves the development of a 25-acre active park with multi-use turf areas, baseball field, recreational courts, trails, dog park, and other related facilities. Preparation of the analysis included coordination with County staff to ensure thorough evaluation of GHG impact considering on-going County CAP challenges. (2020-2021)

Boulder Oaks Preserve Improvement Project, County of San Diego Department of Parks and Recreation, County of San Diego, California. Assisted with the preparation of the air quality and GHG emissions technical report and IS/MND sections for the Boulder Oaks Preserve Improvement Project. Analysis involved quantification of the emissions related to improvements to the Boulder Oaks Preserve and the operational emissions with the opening of the Preserve to public access. Improvements included development of new trails, maintenance of existing trails, staging areas, roadway improvements, and renovation of related facilities. (2018-2020)

Lakeside Equestrian Center Project, County of San Diego Department of Parks and Recreation, County of San Diego, California. Prepared the air quality and GHG emissions technical report and IS/MND sections for the Lakeside Equestrian Center. Analysis involved quantification of the emissions related to the construction of two arenas, and related equestrian facilities, as well as the emissions related to operational live-stock activities such as practices, training, contests, shows, and events. (2018-2019)

Whole Site Modernization Projects, San Diego Unified School District (SDUSD), San Diego, California. Prepared the air quality and GHG emissions sections for several modernization IS/MND projects for schools with the SDUSD. School improvements included construction of new fields, modernization of education facilities, HVAC upgrades, and ADA compliance updates. (2018-2021)

Riverside Housing and Public Safety Element Updates and Environmental Justice Policies Project, City of Riverside, California. Prepared the air quality and GHG emissions sections of the Riverside Housing and Public Safety Element Updates and Environmental Justice Policies Project EIR. The proposed project involves 581 acres of general plan amendments including an increase of 31,564 new residential dwelling units and 3,181,930 square-feet of new non-residential development across the City. (2020-2021)

Placer County Housing Element Update, Placer County, California. Prepared the air quality and GHG emissions sections of the Placer County Housing Element Update EIR. The analysis addressed the impacts of proposed housing-related code amendments to the Placer County General Plan, Placer County Zoning Ordinance, Zoning Maps, and Community Design Guidelines Manual. Impacts of air quality and GHG emissions were assessed considering proposed population growth, future economic factors, and demographics. (2020)

San Bernardino County Regional GHG Reduction Plan, County of San Bernardino, California. Provided technical support for the San Bernardino GHG emissions inventory update and related plan. The assessment involved research and development of assumptions for the water and wastewater activity for the 24 municipalities within the County of San Bernardino to accurately estimate emissions from these sources for baseline year 2016. These emissions estimates were then used to quantify emissions for future years 2020, 2030, and 2045. (2018-2019)

Shane Russett

AIR QUALITY ANALYST

Shane Russett (*he/him*) is an air quality analyst with 3 years' professional experience as a biogeochemist and atmospheric scientist, specializing in climate modeling, soil carbon sequestration, and data analysis. Mr. Russett has worked in several research laboratories and the public sector. He works closely with employers to collect, analyze, visualize, and communicate climate-related data.

Education

University of California, Berkeley
BA with Honors and Distinction, Atmospheric Science, 2022

Project Experience

Otay Ranch Town Center Project, City of Chula Vista, California. Currently preparing an air quality and GHG emissions addendum memorandum for the Otay Ranch Town Center project. The project proposes modifying existing entitlements to allow the development of up to 840 residential units, while reducing the allowed commercial square-footage to 816,000 square feet of retail uses. (2022)

Vista Foothill Project, City of Vista, California. Currently preparing the air quality, GHG, and energy sections for an MND for the Vista Foothill development. The project is a single-family residential development located on an approximately 13.5-acre parcel at 2387 Foothill Drive in the City of Vista. 8.88 acres (24 lots) of the site is currently zoned for housing and 1.38 acres of the site is zoned for open space. (2022)

Relevant Previous Experience

Hollings Scholar, National Oceanic and Atmospheric Administration, Princeton, New Jersey. Was tasked with projecting changes in temperature and concentrations of carbon dioxide, ozone, and particulate matter in various future scenarios using the GFDL-ESM4 modeling software. Completed analysis on netCDF files using Matlab, Python, and Linux. After working remotely under the supervision of Dr. Larry Horowitz, presented research results to a panel of National Oceanic and Atmospheric Administration scientists.

Undergraduate Researcher, Silver Lab, Berkeley, California. Worked in biogeochemistry at University of California Berkeley's Silver Lab for 3 years, testing the ability of farmland to sequester atmospheric carbon. Completed field research for senior honors thesis. Using elemental analysis, calculated the total carbon sequestered in Marin County farmland soil in several plots with different amendments added to each. Compiled results after completing data analysis in Microsoft Excel and presented to a panel of Berkeley professors and students.

Undergraduate Researcher, California Polytechnic University, San Luis Obispo, Statistics Department, California. Was responsible for annotating and completing statistical analysis on humpback whale recordings collected in Monterey Bay. Compiled a statistical report analyzing the effects of stimuli such as the presence of boats on humpback whale vocalizations. Heavily utilized Microsoft Excel and Raven Pro software.

Rose Newberry, AICP, WEDG

ENVIRONMENTAL JUSTICE LEAD PLANNER

Rose Newberry (*ROSE NEW-beh-ree; she/her*) is a planner with 8 years' experience specializing in environmental justice and climate adaptation. Ms. Newberry has extensive experience helping communities identify vulnerable populations and creating policy and tools to correct health disparities caused by historic planning inequities. Ms. Newberry's plans include explanatory graphics and communicate complex scientific information and planning frameworks for a range of audiences.

Ms. Newberry helps communities facing a range of environmental justice concerns and political landscapes modify their daily planning practices to meet the demands of climate change and environmental justice.

Ms. Newberry's understanding of municipal planning and environmental justice concerns makes her uniquely qualified to help clients infuse justice into their plans and decision making.

Education

California Polytechnic State University, San Luis Obispo
MCRP, Environmental Planning and Sustainability

Humboldt State University
BS, Environmental Management and Protection/Natural Resources Planning

Certifications

American Institute of Certified Planners (AICP) No. 31064

Waterfront Edge Design Guidelines (WEDG) Associate

Professional Affiliations

American Planning Association

American Society of Adaptation Professionals

Project Experience

Regional Resilience Tool for the San Diego Association of Governments, San Diego County, California. Ms. Newberry and the Dudek team recently completed a methodology that local jurisdiction planners and project managers can use to identify what climate adaptations and environmental justice strategies should be implemented and why. This methodology provides a deliberate process for understanding local vulnerabilities and values and evaluating adaptation strategies based on equity, economic, environmental, and feasibility criteria.

Rialto Climate Adaptation Plan, City of Rialto, California. Served as the project manager for the Rialto Climate Adaptation Plan. In this role, Ms. Newberry developed a scaled-down vulnerability assessment to analyze Rialto's specific exposure and vulnerability to air pollution, extreme heat, fire, and floods and how those specifically affect disadvantaged communities historically exposed to elevated levels of pollution. Dudek is creating specific equity and climate metrics, such as asthma rates, tree canopy cover, and low-income homes in climate-hazard areas, to track the implementation of policy. These measures will assist Rialto in evaluating if the plan meets the specific needs of disadvantaged communities in the city. Ms. Newberry also led a capability assessment, which reviewed local plans, policies, and programs to evaluate how well they were meeting the needs of disadvantaged community members, including those who depend on transit to get to work, older adults, renters, and people with limited English capabilities. Ms. Newberry managed the geographic information system (GIS) database for the city and is responsible for data collection and identifying adaptation strategies that use data for implementation and tracking.

Energy and Conservation Action Plan Update, Vacaville, California. Served as the senior planner. Developed methodology to update Vacaville's greenhouse gas emissions inventory and performed emission forecasts through 2035 using the most current State and Federal laws. Developed and reviewed policy to reduce half of the city's annual greenhouse gas emissions and create simple implementation and tracking for city staff. Worked with city and agency staff to identify existing goals and projects to include and improve upon to ensure seamless integration of the action plan into regular city business. Consulted with private industry to understand how policies would affect local development plans and land use patterns. Presented to the council and public on the strategies and contents of the plan.

Transformative Climate Communities, City of Indio, California. Served as lead planner on the City of Indio's Transformative Climate Communities Plan. The plan is a roadmap to identify and prioritize projects and investments in the City of Indio's Jewel Community to support neighborhood-level environmental, public health, workforce, and economic benefits. The plan explores community projects in four key themes: community, housing, transportation, and urban greening. These projects were identified through extensive public outreach and local agency coordination to maximize public support and best meet the desires, dreams, and opportunities of the Jewel Community. This plan takes an in-depth look at four grants aligned with the key themes and provided initial documentation and recommendations for grant applications. Ms. Newberry created a project evaluation framework that allowed the project team to compare multiple projects for their grant readiness. This both helped identify priority projects and also created a transparent process outlining where otherwise popular projects were falling short and would not be competitive for funding. Ms. Newberry authored a "future proofing" scheme to adjust the weights and re-rank projects if the grant or political landscape changes. In 2021, the plan was awarded the Inland Empire Opportunity and Empowerment Section Award.

Eastern Coachella Valley Action Plan for Climate Resilience, California. Served as deputy project manager for the Eastern Coachella Valley's Action Plan for Climate Resilience. Ms. Newberry worked with local stakeholders and regional agencies to create projects that are resilient to climate-related hazards, eligible for grant funding, and help the residents of the Eastern Coachella Valley live, work, and play in healthy and safe communities. Ms. Newberry helped design and interpret public engagement activities with rural disenfranchised farm-worker communities to understand their basic needs and how those needs could be funded though climate adaptation grants. Ms. Newberry also reviewed local plans to better tailor their policy and implementation to respond to climate change and target resources to communities who are most affected by climate change. This included analyzing disruptive trends and technology in housing and sustainability that have emerged since many of the regional plans were written and suggesting updates to regional plans to meet these best practices where they would work to implement larger community goals. The Final Action Plan serves as an implementing document to fund green infrastructure, affordable housing, parks, and transportation projects with broad community support and specific funding sources. In 2020, the plan was awarded the Green Community Planning Merit Award.

Safety and Environmental Justice Elements, Cities of Highland, El Cajon, South El Monte, Lomita, and Pismo Beach and Lassen County, California. Ms. Newberry has completed four and is currently preparing two safety elements—three of which have either integrated or standalone Environmental Justice Elements. Ms. Newberry creates unique frameworks that present the background data in an easy-to-understand "what, when, where, who, and how" format that quickly communicates the scientific, socio-economic, and policy framework surrounding a natural hazard or public health concern. Ms. Newberry works with the community and uses best practices to develop pragmatic goals, policies, and actions to address natural hazards—including the role of climate change—while navigating a range of political landscapes and community desires.

DUDEK

Henry Eckold

ASSOCIATE PLANNER

Henry Eckold (*HEN-ree ECK-old; he/him*) is an associate planner with 3 years' experience in climate action and adaptation planning, general plans, and geographic information system (GIS). Mr. Eckold specializes in environmental science and equity and the ties that bring these two topics together. He uses knowledge of environmental and land use laws to create effective planning documents. He has experience performing localized spatial analysis for the purposes of outreach and determining vulnerability. Mr. Eckold's knowledge of the natural sciences and experience with innovative outreach brings new ideas to the planning table.

Education

California Polytechnic State University, San Luis Obispo
MCRP, City and Regional Planning
BS, Environmental Management and Protection

Professional Affiliations

American Planning Association

Association of Environmental Professionals

Project Experience

Energy and Conservation Action Plan Update, Vacaville, California. Served as a planner. Updated Vacaville's greenhouse gas (GHG) emissions inventory and performed emission forecasts through 2035 using the most current state and federal laws. Wrote policy to reduce over 400,000 GHG emissions (nearly half of the city's annual GHG emissions) over the course of 15 years. These policies spanned the energy, residential, commercial, transportation, solid waste, and off-road sectors and accounted for carbon sequestration. Presented to the council and public on the strategies and contents of the plan.

Safety Element, Lassen County, California. Serving as Deputy Project Manager. Performed vulnerability assessments and background research on multiple unincorporated communities throughout Lassen County to develop more localized, adaptable policies. Paid attention to the rural, dispersed nature of the county as it relates to hazards, evacuations, and information dispersal.

Climate Adaptation Plan, City of Rialto, California. Served as a planner. Researched and implemented a down-scaled vulnerability assessment to assess the specific spatial exposure and vulnerability of the population to air pollution, extreme heat, fire, and floods. Drafted the vulnerability assessment for three scales: the people scale, community scale, and city infrastructure scale. Assessed Rialto's capability to adapt through research and plan review. Developed a climate hazard and vulnerability database to assist with implementation and future policy development. The development of this database required communication across departments and with various regional agencies to ensure data would be accurate and easily able to update. Adapted public engagement efforts over the course of the pandemic, performing a survey, in-person and virtual workshops, and youth-led high school engagement. Included equity considerations into the proposed climate adaptation policies as a best practice and to assist the City with anticipated future environmental justice planning efforts.

San Martin Agricultural Specific Plan, Santa Clara County, California. Awarded multiple 2021 regional American Planning Association (APA) Awards including Northern California APA Opportunity and Empowerment Award of Merit and Central Coast APA Academic Award of Excellence. Served as a member of the planning team. Created an agricultural-focused specific plan on a limited timeline during the COVID-19 pandemic for the purposes of community empowerment and grant competitiveness. Performed background research on the unincorporated community of San Martin's agriculture industry, its primary economic driver. Developed agritourism strategies and corresponding implementation documents, such as a San Martin marketing plan and agritourism toolkit for local farmers.

Transformative Climate Communities Planning Grant, City of Pomona, California. Serving as Deputy Project Manager. Performing coordination planning for the City of Pomona and the community group Pomona ACTS. The purpose of these efforts is to work with local agencies, developers, and organizations to explore what is possible, build an understanding of the Transformative Climate Communities (TCC) grant, and provide the City with detailed information needed for a future implementation grant application. To this point, 18 interviews have been held with local organizations. From these interviews, 27 potential projects were discussed and assessed for grant competitiveness using a project assessment tool based on the TCC Grant Guidelines. Additional analysis was performed specifically for certain transportation projects to advance their planning efforts.

Waterfront Eureka Plan, City of Eureka, California. Serving as Deputy Project Manager. Developing a strategic development plan for Eureka's waterfront. Performed background research on the project area which revealed multiple major planning topics that need to be accounted for in the plan, including sea level rise concerns, affordable housing needs, an aging population, historic buildings, and more. Provided the City with a suite of strategies intended to prevent displacement and increase the affordable housing stock. Created and analyzed multiple build out scenarios that will act as informative tools during public engagement and policy development.

Technical Assistance Services, California Department of Water Resources, Multiple Regions, California. Served as a planner. Performed intensive plan review to develop a consolidated list of water needs for disadvantaged communities in the central valley, central coast, and northern regions of California. Also assisted with community outreach by developing a contact database for all school board members, board of supervisors, city councilors, health clinics, environmental organizations, community groups, and other water-related organizations in the central valley, central coast, and northern regions of California.

Grant Writing Services, Various Agencies and Municipalities, Multiple Locations, California. Served as a grant writer. Provided technical grant writing services for multiple water-related projects. Met with clients and communicated data, informational, and schedule needs. Succinctly communicated project impacts on various topics, such as environmental justice, GHG emissions, climate adaptation, tribal impacts, economic impacts, and more.

Housing, Public Health, Safety, and Environmental Justice Elements, City of Highland, California. Serving as a planner. Performed equity and hazard vulnerability assessments that considered state and regional datasets of varying scales. Successfully navigated review by the California Department of Forestry and Fire Protection (CAL FIRE). For the Housing Element, performed spatial data analysis the Sites Inventory Assessment performed various additional GIS needs. Successfully completed Board of Forestry and Fire Protection review and was commended at the Resource Protection Committee hearing on how readable the element was and the level of attention paid to equity across the policies.

Eastern Coachella Valley Action Plan for Climate Resilience, Coachella Valley, California. Served as a planner. Assisted with the implementation of a GIS-based tool for outreach, allowing for spatial community feedback to be a part of the capital improvement prioritization. Performed research and analysis using available datasets to complete a grant-specific matrix that scored and determined the most grant-competitive climate adaptation projects.

DUDEK

Nick Johnston

ASSOCIATE PLANNER

Nick Johnston (*NIK JOHN-ston; he/him*) is a planner with 4 years' professional experience specializing in sustainability planning and community outreach. He also has a significant background in planning for safety and climate adaptation elements, environmental justice elements, and development services; all of which support his broad understanding of various planning principals and enables him to better communicate a variety of planning topics with the general public and planning adjacent disciplines.

Education

California Polytechnic State University, San Luis Obispo BS, City and Regional Planning, 2020

Certifications

Certified Green Professional (CGP)

- *National Association of Home Builders*

LEED Green Associate

- *U.S. Green Building Council*

Professional Affiliations

American Planning Association

National Association of Home Builders

Project Experience

Climate Adaptation Plan, City of Rialto, California. As a planner, performed spatial analysis to create maps that represented existing conditions within the City of Rialto. These maps communicated potential strengths, vulnerabilities, and other community characteristics that inform the vulnerability assessment and ultimately the policy development. Also provided design assistance in formatting the document and preparing the plan for publication.

Public Health, Safety, and Environmental Justice Elements; Cities of Highland, South El Monte, and Lomita; California. Served in a variety of roles in assisting with the completion of these elements. Primarily, served in a design and publications capacity, responding to edits before preparing them for final publishing. The Dudek team worked with the community and used best practices to develop pragmatic goals, policies, and actions to address natural hazards—including the role of climate change—while navigating a range of political landscapes and community desires.

Regional Resilience Framework, San Diego Association of Governments, California. Served as a Planner on this project and created outreach material, Storymaps, and presentations to foster community outreach. The Dudek team is developing a framework to help the San Diego region streamline strategies to adapt to and be more resilient to clime change hazards. Dudek is acting on behalf of the local association of governments to support the updating and creation of climate adaptation plans among the member agencies and working to facilitate a coordinated approach to total resiliency.

Tulare County Local Hazard Mitigation Plan and Climate Adaptation Resiliency Plan Outreach Services, Tulare County, California. Served as a project Planner for outreach services in support of the Tulare County Local Hazard Mitigation Plan and Climate Adaptation Resiliency Plan. Outreach activities included in-person community engagement events and hybrid stakeholder workshops.

DUDEK

David Larocca

PROGRAM MANAGER

David Larocca is a senior engineer with 25 years' experience, including multidisciplinary project management; project siting and regulatory feasibility analyses; regulatory applicability and environmental analyses; conditional use permitting; compliance support; and air quality permitting. Mr. Larocca work has involved many industries, including energy utility, oil and gas, primary and secondary metals, pulp and paper, petroleum, and chemical manufacturing. He is experienced with projects involving Conditional Use Permitting, National Environmental Policy Act (NEPA), Federal Energy Regulatory Commission (FERC) Certification; Transmission Line and Power Plant Licensing – Certificate of Public Convenience and Necessity (CPCN); New Source Review (NSR), Prevention of Significant Deterioration (PSD), and Non-Attainment NSR; Minor Source Permitting (PSD Avoidance Strategy Development); Title V – Air Operation Permits; National Emission Standards for Hazardous Air Pollutants (NESHAP); and Title IV – Acid Rain Permits. Additionally, Mr. Larocca has served as an expert witness for five successful energy projects.

Education

BS, Mechanical Engineering, University of Florida, Gainesville, Florida, 1993

Certifications

Engineer Intern, No. 495ET165

Project Experience

Wind Repowering BLM SF299 and POD, California. Manager and author of BLM SF299 and Preliminary Plan of Development (POD) for decommissioning seventy-three existing wind turbines and construction and operation of seven new wind turbines. The POD describes activities for site access and overall development on BLM administered land, including decommissioning existing wind turbines and construction and operation of new wind turbines. The POD also includes construction and operation of new and existing access roads, temporary laydown yards, a 34.5- kilovolt (kV) electrical collector system (both above ground and below ground), connection to existing interconnection point(s), and other associated facilities, and reclamation of approximately 2.8 miles of existing access roads.

Delaney to Colorado River 500kV Transmission Line Project; CAISO Competitive Application, California/Arizona. Project manager for environmental components of the implementation of programmatic management services and preparation of a proposal to the California Independent System Operator (CAISO) for the competitive solicitation of the Delaney to Colorado River 500-kilovolt (kV) Transmission Line Project. This project was a result of the CAISO 2013-2014 Transmission Plan which identified an economically driven need for a 500-kV transmission line between the Southern California Edison (SCE)-owned Colorado River 500-kV substation and the Arizona Public Service Co. (APS)-owned Delaney 500-kV substation.

Battery Storage Siting, Arizona. Project Manager for siting a 200 MW battery storage facility in Arizona. Multi-disciplinary evaluation of siting criteria and priorities (weights), conducted collaboratively with client and project engineers, planners, environmental and GIS professionals.

Solar PV Generation, Washington. Task Manager for the conditional use permitting of utility scale solar generation project in Washington State. Conditional use permitting includes consideration of compliance with county regulations and Washington State Environmental Policy Act (SEPA). The Adams Neilson Solar project is a 28 MW photovoltaic generation facility near the town of Lind. The project was developed in response to a competitive RFP from Avista. Project development and entitlement work began in August 2017. An MDNS was issued for SEPA in January 2018 by Adams County, and the approval of the Conditional Use Permit (CUP) by the Adams County Board of Supervisors was received in February 2018.

Natural-Gas Fired Generation Facility Siting, Montana, Colorado, and Arizona. Project Manager performing fatal flaw analyses and bid support for multiple proposed gas-fired generation facilities for peaking operation, located in Montana, Colorado, and Arizona. Our team evaluated site options and developed detailed permitting requirements and budgets in support of client response to request for generation resources.

Harry Allen to Eldorado 500kV Transmission Line Project; CAISO Competitive Application, Nevada. Project manager for environmental components of the implementation of programmatic management services and preparation of a proposal to the CAISO for the competitive solicitation of the Harry Allen to Eldorado 500-kV Transmission Line Project. This project was a result of the CAISO 2013-2014 Transmission Plan which identified an economically-driven need for a 500-kV transmission line between SCE majority-owned Eldorado 500-kV substation and NV Energy-owned Harry Allen 500-kV substation

Natural Gas Storage Facilities; Floridian Natural Gas Company, LLC Martin County, Florida. Multidisciplinary project manager and air technical lead for the proposed construction and operations of two nominal 190,000 cubic meter liquefied natural gas storage tank, liquefaction systems, vaporization systems, and two approximately 4-mile parallel pipelines to connect the facility with the existing interstate pipeline systems northwest of the site. Managed the preparation of the application for authorization for the project under Section 7(c) of the Natural Gas Act (NGA), including Resource Reports 1 through 13, all in compliance with the requirements of the Federal Energy Regulatory Commission (FERC). Additional activities undertaken included a Phase I Environmental Site Assessment (ESA), water use permitting and stormwater management design, process wastewater permitting, air permitting and wetland permitting, support for local government approvals and public meetings, and geotechnical and seismic investigations.

Shady Hills Generating Station; EFS Shady Hills, LLC. Pasco County, Florida. Multidisciplinary project manager for the federal and state permitting of a 218-megawatt (MW), simple-cycle peaking generating facility. The project was the first simple-cycle greenhouse gas PSD project permitted through the US Environmental Protection Agency (EPA) Region IV

Charles P. Crane Generating Station; Constellation Power Source Generation, Baltimore County, Maryland. Project manager for the preparation of the CPCN EA in support of fuel conversion and long-term use of sub-bituminous coal in Charles P. Crane Generating Station Units 1 and 2. Long-term use of sub-bituminous coal reduces the SO2 emissions from the facility. Provided expert testimony for the PSC Hearing Officer, including testimony on air quality impacts.

735-MW, Combined-Cycle Power Plant / 500-kV Interconnection / Natural Gas Pipeline; Keys Energy Center. Prince Georges, Maryland. Project manager for the preparation of the Certificate of Public Convenience and Necessity (CPCN) Environmental Assessment (EA) in support of the construction and operation of a 735-MW, natural gas-fired, combined-cycle combustion turbine power plant. In addition to the generating facilities, the project included a 500-kV interconnection and approximately 8 miles of natural gas pipeline. Provided expert testimony for the Public Service Commission (PSC) Hearing Officer, including testimony on noise and air quality impacts. 735-MW, Combined-Cycle Power Plant / 500-kV Interconnection / Natural Gas Pipeline; Keys Energy Center.

DUDEK

Madelyn Murray

Education

University of California, Santa Barbara
BA, Environmental Studies (Ecology emphasis)

ENVIRONMENTAL PLANNER

Madelyn Murray (*MAD-uh-lin MUR-ee; she/her*) is an environmental planner with 4 years' experience in environmental research, grant writing, and regional planning support. Ms. Murray specializes in supporting underserved communities, outreach and engagement, and climate resiliency. As demonstrated in her work, Ms. Murray understands the nuances of connecting with and gathering feedback from diverse populations, whose needs often vary. Ms. Murray provides her expertise and diligent support on numerous grant applications and plan updates. She has also assisted on a wide variety of community outreach and engagement efforts. Her multidisciplinary background in ecology, sustainability, and outreach coupled with her passion for environmental justice allow her to make critical decisions on each project's impact to the community and environment.

Project Experience

Transformative Climate Communities Implementation Grant Support and Community Engagement, City of Indio, California. Supported the City of Indio as an extension of staff for the preparation of the Sustainable Growth Council's Transformative Climate Communities (TCC) Implementation Grant. Managed and executed ongoing outreach and community engagement, which were significant components of the TCC Implementation Grant process. Additional support included preparing grant materials, project scoping, decision-making guidance, and various communication efforts.

Public and Stakeholder Engagement for Master Plan Development, San Mateo County Harbor District, California. Assisted in outreach and engagement tasks for Master Plan development, including the creation of social media posts, surveys, and handouts. Additional efforts included hosting in-person pop-up events and facilitating online workshops.

Communication and Engagement for Integrated Wildfire Safety Program, County of Los Angeles, California. Developed a tailored Communication and Engagement Plan to guide the County of Los Angeles in outreach efforts. Additional support included creating informational surveys, outlining schedules and agendas, and providing guidance on workshops.

Housing Element Update, City of Indio, California. Provided support on the City of Indio's Housing Element update through completing a housing assessment and needs analysis pursuant to state housing law, including the analyzation of demographic, economic, infrastructure, and housing data.

Housing Element Update, City of South El Monte, California. Provided support on the City of South El Monte's Housing Element update through completing a housing assessment and needs analysis pursuant to state housing law, including analysis of demographic, economic, infrastructure, and housing data.

Grant Writing for U.S. Bureau of Reclamation Environmental Water Resources Program Grant, Southern California Edison, California. Advised Southern California Edison on grant opportunities and assisted in gathering materials, writing, and developing a complete grant application.

On-Call Grant Writing Services, City of Solvang, California. Provided grant writing services and support for the City of Solvang. Grant applications included the CAL eVIP South Central Coast Incentive Project.

On-Call Grant Writing Services, City of Encinitas, California. Providing ongoing grant writing services and support as well as project scoping for the City of Encinitas. Grant applications include State Coastal Conservancy ongoing funding and U.S. Fish and Wildlife Service ongoing funding opportunity.

On-Call Grant Writing Services, San Mateo County, California. Providing grant writing services for multiple agencies within San Mateo County. Applications have included the Proposition 68 Department of Conservation Grant for a Climate Action Plan update, Proposition 68 Recreational Trails and Greenways Grant, the Senate Bill 2 Planning Grants Application, California Office of Emergency Services Federal Emergency Management Act Hazard Mitigation Grant Program applications, California Fire Safe Council County Coordinators Grant Opportunity, and Proposition 68 Regional Park Program application.

Grant Analysis and Plan Writing Support for Indio TCC Round 3, City of Indio, California. Provided background research and wrote plan content on funding opportunities, relevant grants, and feasible projects with associated information and recommendations. Additionally, provided technical assistance on projects and funding. In 2021, the plan was awarded the Inland Empire Opportunity and Empowerment Section Award.

Grant Analysis and Plan Writing Support for Bakersfield TCC Round 3, City of Bakersfield, California. Provided background research on funding opportunities, past grants, and other requirements. Accumulated relevant data and wrote portions for the TCC grant support and plan, especially pertaining to affordable housing and the municipal code.

On-Call Grant Writing Services, Midpeninsula Regional Open Space District, California. Provided ongoing grant writing services and support as well as grant and project scoping for the Midpeninsula Regional Open Space District. Maintained a project option database to connect with grant opportunities. Applications have included Proposition 68 Wildlife Conservation Board Wildlife Corridor Program Pre-Application and a Proposition 1 Round 13 State Coastal Conservancy Grant.

Grant Writing for California Natural Resources Agency Urban Flood Protection Grant of Proposition 68, San Diego State University, San Diego, California. Researched funding opportunities for a proposed project. Provided high levels of support through gathering information, documentation, and project components in preparation of submitting an application to the California Natural Resources Agency.

Technical Assistance, Communication and Engagement, Department of Water Resources, California. Providing support with development and implementation of Proposition 68 Technical Assistance for the California Department of Water Resources (DWR) for Tribal Governments, Tribal Communities, and Underrepresented Communities. Specifically provided support on curating water surveys, composing educational materials, and various research tasks. The project entails extensive data collection, management and curation, extensive community surveying, and provision of technical assistance, report writing, and outcome analysis.

On-Call Grant Writing Services, Coachella Valley Water District, California. Providing ongoing grant writing services and support for Coachella Valley Water District. Grant applications have included the Drought Resiliency Grant and the Water Efficiency and Energy Grant, both from the United States Bureau of Reclamation's WaterSMART program.

DUDEK

Lisa Valdez

SENIOR TRANSPORTATION PLANNER

Lisa Valdez (*LEE-SUH Val-DEZ; she/her*) is a senior transportation planner with 23 years' experience in transportation planning and analysis, including managing the development of long-range transportation plans, multimodal mobility plans, and transportation analyses for public and private clients throughout the U.S. Her expertise includes traffic impact analyses, freight, corridor, and parking demand studies, and transportation demand management plans. Ms. Valdez is experienced in California Environmental Quality Act (CEQA), National Environmental Policy Act, and Fixing America's Surface Transportation Act compliance. She has led technical analyses for large-scale transportation infrastructure and commercial renewable energy projects, as well as multimodal statewide, regional, and local transportation plans and studies. Ms. Valdez is skilled at collaborating with multi-disciplinary teams to effectively guide projects through complex national, state, and local regulatory processes.

Education

California Polytechnic State University San Luis Obispo, MCRP, City and Regional Planning

University of California, Santa Cruz, BA, Environmental Studies

Lancaster University, England Education Abroad Program, Environmental Science

Professional Affiliations

American Planning Association

Institute of Transportation Engineers

Urban Land Institute

Relevant Previous Experience

California Transportation Plan 2050, California State Department of Transportation, California. Assisted with the writing of the final draft California Transportation Plan 2050, a 30-year vision for California's multimodal transportation system. This plan is intended to provide innovative, sustainable, and integrated mobility solutions to guide the implementation of a low-carbon statewide transportation system that fosters economic vitality, protects the environment and natural resources, and promotes public health and quality of life equitably for all Californians. The public review draft was published by the California Department of Transportation in August 2020.

Hawaiʻi Statewide Long Range Transportation Plan, Hawaiʻi State Department of Transportation, Hawaiʻi. Served as the Deputy Project Manager supporting Hawaiʻi's comprehensive statewide long range planning effort. Led the technical analysis for the data collection, inventory and assessment of existing conditions across all modes, and the investigation of emerging trends as part of the development of plausible alternative futures. This planning effort included extensive involvement with a wide range of stakeholders, and Ms. Valdez supported the stakeholder outreach program, including project visioning and goal setting activities.

City of Las Vegas Master Mobility Plan, City of Las Vegas, Nevada. Assisted with the research and writing of the Master Mobility Plan, a 20-year look ahead to the future mobility of downtown Las Vegas. Worked with the project team to identify complete streets projects that will alleviate congestion, improve mobility for all users, enhance safety, and provide economic opportunities and growth in the City of Las Vegas. A unique component of the plan is recognizing and accommodating the emerging trends in transportation technology, from the automation of vehicles to the influx of transportation network companies. The plan also includes a comprehensive funding strategy for future projects.

I-11 Tier 1 EIS, Arizona State Department of Transportation, Nogales to Wickenburg, Arizona. Provided transportation planning and stakeholder outreach support for the I-11 Tier 1 Environmental Impact Statement (EIS), evaluating a proposed 280-mile-long interstate corridor linking Nogales to Wickenburg, Arizona. Used travel demand model forecasts to evaluate and document the potential transportation benefits of each alternative, including level of service improvements, travel time savings and reliability, and improved regional, national, and international freight mobility. The project was led by the Arizona State Department of Transportation (DOT) and Federal Highway Administration.

State Route 509 Gateway Program Environmental Evaluation, Washington State Department of Transportation, Washington. Identified and documented changes in environmental conditions and effects associated with the State Route 509 Phase I Improvements. The analysis identified changes in traffic volumes, level of service, travel speeds and reliability, vehicle miles traveled, safety performance, and qualitatively identified changes in freight travel, transit, high occupancy vehicle lane usage, and accessibility to the Seattle Tacoma airport. Summarized findings in comprehensive Transportation Technical Report.

Texas–Oklahoma Passenger Rail Study, Texas State Department of Transportation, Texas and Oklahoma. For the Texas DOT, prepared the traffic analysis for the Texas-Oklahoma Passenger Rail Study and subsequent traffic section of the service-level EIS. Evaluated the potential effects on travel demand by mode (e.g., auto, passenger rail, intercity bus, air travel) for a range of passenger rail service options for an 850-mile corridor from Oklahoma to South Texas. The study evaluated how travel demand/mode share, travel time savings and reliability, vehicle-miles traveled, level of service, and ridership is expected to change due to the infrastructure and service improvements of each alternative.

I-11 Northern Nevada Alternatives Analysis, Nevada State Department of Transportation, Nevada. Provided planning support on a variety of tasks. This included developing and systematically evaluating corridor alternatives and documenting issues, constraints, and opportunities for the proposed I-11 corridor connecting Las Vegas with I-80 in Northern Nevada. As part of this effort, evaluated the potential social, economic, and environmental effects of highway bypasses on local communities to help inform corridor recommendations.

Hawaiʻi Statewide Freight Plan, Hawaiʻi. For the Hawaiʻi DOT Statewide Freight Plan, led the research, analysis, and documentation, including preparing a concise Executive Summary brochure for the public and decision-makers. The Hawaiʻi DOT Statewide Freight Plan describes the economic context of freight planning in Hawaiʻi, identifies freight trends and needs to improve freight efficiency through a performance-based approach, and presents an implementation strategy supporting the goals and objectives of the plan.

Georgia's 2050 Statewide Transportation Plan Update, Georgia State Department of Transportation, Georgia. As part of Georgia's Statewide Transportation Plan update, prepared a chapter on Travel and Tourism, a first of its kind for the state's transportation planning process. Transportation plays a vital role in Georgia's $63.2 billion tourism industry by providing access to and around tourist destinations, supporting its 462,000 tourism related jobs, providing mobility options for its 109 million annual visitors, and reducing automobile traffic in congested urban and resort areas. The chapter provides an overview of Georgia's tourism industry, identifies associated transportation needs at the state and regional level, and provides strategic policy, planning, and investment recommendations to enhance travel and tourism in the state.

Amanda Meroux, EIT

ENVIRONMENTAL ANALYST, ASSISTANT TRANSPORTATION ENGINEER

Education

University of California, Davis

BS, Civil and Environmental Engineering, 2017

Certifications

Engineer-in-Training (EIT), No. 161772

Professional Affiliations

American Society of Civil Engineers (ASCE)

Institute of Transportation Engineers (ITE)

Amanda Meroux (*uh-MAN-duh meh-ROO; she/her*) is an assistant transportation engineer with 3 years' experience, specializing in the preparation of traffic impact analysis (TIA), technical documents, and traffic control plans. Ms. Meroux has an educational backgroud in civil and environmental engineering, emphasizing air quality and transportation studies. She has experience working with TIA procedures, including vehicle miles traveled (VMT) analysis, data collection, cumulative project development, trip generation calculations, level of service (LOS) analysis for intersections and roadway segments, signal warrant analysis, construction traffic, internal circulation and access evaluation, and vehicle turning analysis. She has utilized various types of transportation and design software, including Synchro/SimTraffic, Traffix, AutoTurn, Highway Capacity Software, as well as other technical programs, such as ArcGIS and AutoCAD. Ms. Meroux has experience in the assessment of air quality, climate change, and human health impacts using the California EmissionsEstimator Model air and risk assessment model, as well as performing quantitative analyses for National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) environmental documents.

Project Experience

Montclair Place District Specific Plan, City of Montclair, California. Prepared the TIA that identified potential traffic impacts associated with the demolition of the existing Montclair Place Mall to construct a pedestrian-oriented, mixed-use downtown district, with structured parking facilities throughout a series of planned phases. The Montclair Place District Specific Plan provides development standards and architectural guidelines in the plan area through the year 2040, and would include over 6,000 residential units, over 500,000 square feet of general office and medical office uses, and over one million square feet of shopping and retail uses. Traffic impacts related to VMT were analyzed using the San Bernardino Transportation Analysis Model. Additionally, traffic impacts related to LOS were analyzed at 56 intersections throughout the study area, at project driveways, and along the Interstate-10 freeway. Caltrans facilities were analyzed using Highway Capacity Manual 6 methodology through the Highway Capacity Software 7 and Synchro 10/SimTraffic (version 10) software for freeway mainline, weaving, and ramp analyses.

24-Acre Site Master Plan Refinement, Auburn Recreation District, Placer County, California. Prepared the focused transportation and circulation assessment for the partial development of the project site with recreational facilities, including playground areas, bocce ball courts, a dog park, and trails. The assessment included an analysis of the project's proposed trip generation, 95th percentile queuing at the project access driveway and study intersections, and the available sight distance at the project access driveway. Additionally, a location and site analysis was performed to determine whether the proposed project would serve as a local serving land use for the purposed of VMT screening.

Byron Airport Development Program, County of Contra Costa, California. Prepared the TIA that identified potential traffic impacts associated with the development of light industrial, warehousing and logistics, commercial, and low-intensity office uses on the airport property. The TIA included arterial roadway segment and intersection LOS analysis under the Existing and Future Year (2040) conditions with and without the project as well as project access analyses, queuing analyses, and signal warrant evaluations to determine impacts and required mitigation measures. Additionally, traffic impacts related to VMT were analyzed using the Contra Costa County Transportation Analysis Model, and transportation demand management and VMT reduction measures were recommended.

Theater District Living and Learning Neighborhood, University of California San Diego, San Diego, California. Prepared a traffic assessment reviewing the Theater District Living and Learning Neighborhood's (TDLLN) consistency with the programmed growth, associated traffic impacts, and mitigation measures previously identified in the certified 2018 Long Range Development Plan La Jolla Campus Final Environmental Impact Report (2018 LRDP Program EIR). The TDLLN consists of the development of residential and administrative space for a new college, with approximately 2,000 undergraduate student housing beds, along with conference and retail space. The assessment reviewed consistency of both LOS and VMT findings in the 2018 LRDP Program EIR with the proposed TDLLN.

Zero-Emission Truck and Bus Pilot Commercial Deployment Project Grant Proposal, Sacramento, California. Prior to working at Dudek, worked on a grant proposal as an intern with the Sacramento Metropolitan Air Quality Management District to deploy electric buses in three school districts around Sacramento County. Analyzed school bus trip data to determine optimal bus routes, collaborated with project engineers, and produced geographic information system (GIS) maps for analytical, presentation, and application purposes.

Facilities Master Plan Programmatic EIR, Orange County Sanitation District, Orange County, California. Assisted in the preparation of the transportation section of the EIR, providing an analysis of the transportation and traffic impacts associated with implementation of the proposed Facilities Master Plan (FMP) projects. FMP projects addressed in the Programmatic EIR (PEIR) would be located at various sites throughout the Sanitation District's service area, which covers an approximately 479-square-mile area within the northwestern and central portions of Orange County, and include a series of approximately 83 Capital Improvement Program projects proposed to be implemented by the Sanitation District through 2040 to rehabilitate, replace, and optimize their existing facilities in continued service to residents and businesses within their service area. The transportation section analyzed the potential construction-related (temporary) transportation impacts and operations-and-maintenance-related (permanent) transportation impacts related to four FMP project components.

Santa Barbara Community Wildfire Protection Plan PEIR, City of Santa Barbara, California. Prepared the transportation section of the EIR for the comprehensive fire management program for the City of Santa Barbara, known as a Community Wildfire Protection Plan (CWPP). The purpose of the project is to update the City's 2004 Wildland Fire Plan to account for changes in the City's fire environment and work completed under the 2004 Plan with a comprehensive, coordinated plan to mitigate the impact of wildland fire to the City. The transportation section included analysis of existing transportation conditions within the City, including bicycle, pedestrian, and transit facilities, as well as analysis of associated regulatory requirements, potential impacts, and mitigation measures related to implementation of the proposed CWPP.

Scott Eckardt, RPF

PROJECT MANAGER, LICENSED FORESTER

Scott Eckardt (SCOT EC-hart) is a project manager and licensed forester with 19 years' professional experience in the natural resource management field, specializing in forest resource and fire management issues in open-space and wildland–urban interface (WUI) areas throughout California. Mr. Eckardt's project experience includes assessment and inventory of woodlands and forests; monitoring of woodland and forest resources on development sites; assessment of fire and fuel hazard conditions; WUI inspections for local fire departments; preparation of fire protection plans (FPPs) and community wildfire protection plans (CWPPs); GPS mapping; environmental monitoring; and preparation of assessment reports, oak woodland management, preservation plans, and California Environmental Quality Act (CEQA) technical documents. In addition, he routinely utilizes geographic information system (GIS) data and aerial imagery in mapping, analysis of resource data, preparation of project plans, conducting project impact analyses, evaluating mitigation opportunities, and modeling fire behavior and wildfire hazard conditions. Mr. Eckardt previously worked for the California Department of Forestry and Fire Protection (CAL FIRE) in South Lake Tahoe, where he conducted fuel reduction, vegetation thinning, and forest rehabilitation projects.

Education

California State University, Long Beach
MA, Geography, 2006

California Polytechnic State University, San Luis Obispo
BS, Forestry and Natural Resources Management, 1998

Certifications

Registered Professional Forester (RPF), No. 2835

Certified Arborist, No. WE-5914A

Association for Fire Ecology Certified Wildland Fire Professional

Professional Affiliations

Cal Poly Forestry and Natural Resources Management Department Advisory Council

Society of American Foresters

International Society of Arboriculture (ISA)

Project Experience

Fire Protection Planning, Various Development Projects throughout California. As project manager and technical specialist, managed and conducted on-site fuel loading and vegetation distribution analyses, risk assessment, and hazard area identification in support of project-level FPPs. Additionally, has performed and managed fire behavior modeling efforts in support of FPP development. Detailed site vegetation, topography, and climate data are collected, processed, and analyzed in developing BehavePlus fire behavior models, more robust GIS-based FlamMap, or FARSITE fire behavior models. The resulting tabular or geographically explicit fire behavior data are incorporated into the FPP and are used in determining risk levels and defining defensible space/fuel modification zones for proposed project improvements. Site risk assessment and fire behavior modeling results are also critical in determining appropriate fire protection standards for buildings to be included as a component of the project. Additionally, has drafted and prepared FPP documents outlining site hazards, relevant code requirements, and mitigation for non-conforming issues. Fire protection planning services have been provided for the following projects:

- Yokohl Ranch, Tulare County, California
- Otay Ranch, Village 13, Chula Vista, California
- West Coyote Hills, Fullerton, California

- Santa Barbara Botanical Garden, Santa Barbara, California
- Merriam Mountains, Escondido, California
- Salvation Army Divisional Camp, Ramona, California
- Pauma Estates, Escondido, California
- Onyx Ridge, Rancho Santa Fe, California
- Bella Vista Residential Development, Rancho Santa Fe, California.

Ranchland Environmental Studies, The Yokohl Ranch Company, LLC, Tulare County, California. Served as a technical specialist for preparation of the Yokohl Ranch Project's FPP. In support of the FPP, managed and conducted on-site fuel loading and vegetation distribution analyses, risk assessment, and hazard area identification. Additionally, conducted fire behavior modeling efforts in support of FPP development. Detailed site vegetation, topography, and climate data were collected, processed, and analyzed in developing BehavePlus fire behavior models, more robust GIS-based FlamMap fire behavior models. The resulting tabular and geographically explicit fire behavior data were incorporated into the FPP and used in determining risk levels and defining defensible space/fuel modification requirements. The modeling results were also critical in determining appropriate fire protection standards for buildings to be included as a component of the project. Additionally, drafted and prepared the applicable portions of the FPP.

Calpeco Transmission Line Upgrade CEQA, CPUC, Placer and Nevada Counties, California. Served as a technical expert and prepared the forestry resources section of the project EIS/EIS/EIR, which included performing detailed calculations on forest land impacts, including impacts to sequestered carbon. Additionally, supported the environmental review process by reviewing other EIS/EIS/EIR Sections, including fire/fuels, biological resources, and climate change. The project involves realignment and capacity upgrades to a power line system that runs from Truckee southward to Kings Beach, then westward to Tahoe City. The project occurs within the jurisdiction of the CPUC, the Tahoe Regional Planning Agency (TRPA), and the U.S. Forest Service. The Final EIS/EIS/EIR has been completed.

FPP for Tejon Mountain Village, DMB Associates, Lebec, California. Served as a technical expert, performed fuel loading and vegetation distribution analyses, and performed GIS-based fire behavior modeling in support of the FPP for the Tejon Mountain Village EIR. Detailed vegetation, topographic, and climate data were collected or retrieved and processed in developing GIS-based data files for inclusion in FlamMap fire behavior modeling efforts for the FPP. The resulting data were incorporated into the FPP and were critical in determining appropriate defensible space setback distances for proposed project improvements. Further, the fire behavior modeling results were critical in determining appropriate fire protection standards for buildings to be included as a component of the project. The project was approved by the Kern County Board of Supervisors.

South Sacramento Habitat Conservation Plan (SSHCP), County of Sacramento, California. Mr. Eckardt analyzed fire history data and provided a discussion of the role of fire on vegetation structure and composition to support preparation of the Changed and Unforeseen Circumstances Section of the SSCHP. Fire history data, specifically fire size, return interval, and location within the Plan Area, was evaluated to determine the effect that climate change may have on the frequency and size of fires that may occur in the Plan Area over the duration of the permit term. This analysis was also used to identify a threshold between what would be considered a changed circumstance and what would be considered an unforeseen circumstance and to determine management actions to be taken in the Plan Area should a wildfire occur.

DUDEK

Fraser Shilling

SENIOR ECOLOGIST

Fraser Shilling (*FRAY-zer SHIL-ling*; *he/him*) is an ecologist with 30 years' post-PhD experience. Dr. Shilling has been an academic scientist, independent consultant, and has joined Dudek's Environmental Division to start the Transportation Ecology Program. He has led over 40 research and consulting projects for a wide range of public and private organizations. Dr. Shilling specializes in investigations of interactions between human development and natural systems, environmental and tribal justice, environmental data sharing through web services, and climate resilience.

While working part-time at Dudek, Dr. Shilling is also an Academic Researcher and Director of the Road Ecology Center at the University of California, Davis. He investigates climate resilience, transportation and landscape ecology, sustainability systems, and environmental pollution and policy. He regularly speaks at Transportation Research Board annual conferences, Infra-Eco Network Europe, and the International Conference on Ecology and Transportation on transportation, wildlife, and environmental impacts. He is lead author of the California Watershed Assessment Manual and contributing author to Roads and Ecological Infrastructure, The Water Sustainability Reader, Handbook of Road Ecology, and wildlife crossing guidance manuals for California, Idaho, South Dakota, and Vermont departments of transportation. He is the lead organizer for the International Conference on Ecology and Transportation.

Education

University of Southern California, PhD Ecology

BSc Biological Sciences

Professional Affiliations

NASEM Transportation Research Board, Environmental Analysis and Ecology Committee (AEP70), Member

Global Congress on Linear Infrastructure and Environment, Co-Chair

Relevant Project Experience

State Route 37 Stewardship and Adaptation Study Served as Scientific Lead. Science and engineering-based program to identify solutions to sea level rise threats to SR 37 in the north Bay. Supervised consultants (AECOM) and staff in interacting with stakeholders, modeling, and engineering design to develop adaptation strategies and options. The project resulted in an MOU among transportation agencies in the region, MTC and Caltrans. It has resulted in a continuing series of adaptation proposals and interest from legislative and congressional partners necessary for funding this multi-billion dollar program.

Development of Micro-Scale Traffic Simulation with Sea Level Rise in Bay Area Cities. Supervised a graduate student developing a modeling approach to study micro-scale traffic circulation impacts from various sea level rise scenarios in two San Francisco Bay area cities. The county transportation organizations collaborated with Dr. Shilling on selecting candidate cities and shared data. The modeling suggests two modes for traffic circulation impacts (gradual and sudden) and points to weak links in the travel network that would need to be improved to ensure short-term emergency and long-term access needs.

Stakeholder Engagement in Association with Coastal Flood Prediction Model and Monitoring Station. Engaged with local landowner and agency stakeholders to develop and place a monitoring and flood-warning station for water levels with the coastal shoreline portion of a river. Currently assisting with development of the flood prediction model, which combines fluvial, tidal, wave, and sea level rise sources of water levels to develop a prediction and warning system for vulnerable infrastructure and communities.

Development of Methods to Track Shoreline Change in Response to Sea Level Rise. Served as Scientific Lead. Developed and deployed methods for fine scale measurements of shoreline change in California and Georgia in collaboration with University of Georgia and local agencies. These included time-lapse cameras, unmanned aircraft systems-based elevation and vegetation measurements, and satellite imagery analysis. The time lapse camera systems in California and Georgia are the only systems of their kind in the U.S. and allow for very fine scale monitoring of geomorphic and water level changes.

Development of a Web-based Econometrics Tool to Help Plan for Projects to Reduce Wildlife-Vehicle Collisions. Served as Scientific Lead. Managed all aspects of project, including supervising graduate student, programmer, and sub-consultants. The tool was developed in collaboration with senior staff from four state Departments of Transportation (DOTs) (Arizona, Montana, Oregon, Wyoming). Led formulation, design, testing and implementation of the tool, which is being used by DOTs to inform applications to the new federal funding for wildlife crossings.

Landscape Design and Ecology Lead for Large Highway Wildlife Crossings. Developed a method to mitigate noise and light pollution from traffic on wildlife approaching wildlife crossings. Guided design students in using 3-D design tools to develop and test scenarios to reduce traffic noise and light intrusion into the approach zones to the Liberty Canyon wildlife over-crossing (U.S. Route 101) and a proposed over-crossing over Interstate (I) 15, south of Temecula. Validated the designs with field-collected traffic noise and luminance measurements followed by spatial modeling and analysis.

Development of Automated Methods to Manage and Process Imagery from Wildlife Cameras. Served as Scientific Lead. developed artificial intelligence-based methods to process images from camera traps used in wildlife monitoring. Combined this image processing with web-system for management of camera trap projects and imagery data. This was the first use of artificial intelligence in batch wildlife-image processing online.

Recent Scientific Publications and Presentations

Shilling, F. 2021. Climate and Fiscal Impacts from Reduced Fuel Use during COVID-19 Mitigation. International Conference on Ecology and Transportation. September 23–29, 2021.

Shilling F. 2020. Fine-scale tracking of shoreline change from sea level rise to inform adaptation. Northeastern Transportation and Wildlife Conference. September 30, 2020

Fulton, J., M. Norton, and F.M. Shilling. 2018. Water-indexed benefits and impacts of California almonds. Ecological Indicators. Volume 96, Part 1. January 2019, Pages 711–717. https://doi.org/10.1016/j.ecolind.2017.12.063.

Shilling, F.M. 2016. Rising above the tide. Roads & Bridges. October. https://www.roadsbridges.com/rising-above-tide.

Shilling, F.M., J. Vandever, K. May, I. Gerhard, and R. Bregoff. 2016. Adaptive planning for sea level rise-threatened transportation corridors. Transportation Research Record: Journal of the Transportation Research Board, No. 2599, Transportation Research Board, Washington, D.C., 2016, pp. 9–16. DOI: 10.3141/2599-02.

Curtis Battle

GIS TECHNICIAN

Curtis Battle is a geographic information systems (GIS) technician with 11 years' experience in a wide variety of GIS platforms and techniques. Mr. Battle has expertise in ArcMap, ArcCatalog, and ArcPad; Trimble, Spectra, and Garmin GPS platforms; geodatabase construction and maintenance; quantitative geographic methods; cartography; species distribution modeling; remote sensing fundamentals and methods; Python programming; and cartography. He has provided GIS support for numerous environmental impact reports (EIRs); technical studies, including biological technical reports, vegetation mapping, and wildlife surveys; mitigated negative declarations; preliminary environmental analysis reports; initial studies; and mitigation monitoring and reporting programs.

Education

San Diego State University
MS, GIScience, 2016
BA, Geography, 2008

Mesa College
AS, Geographic Information Systems Specialist, 2011

Professional Affiliations

Golden Key Honor Society

Project Experience

TerraCount Assessment for San Diego County, San Diego County, California. GIS lead for the San Diego Association of Governments carbon storage and sequestration assessment for San Diego County using the California Department of Conservation's TerraCount tool. Responsible for developing GIS datasets, including all tool inputs, custom multi-year countywide land cover mapping, and future land use projections. The analysis will estimate the carbon inventory for the natural and working lands of San Diego County to estimate the current carbon storage and forecasted trends to 2050 and report out the effects of management activities and co-benefits in the region.

County of San Bernardino General Plan, County of San Bernardino, California. Served as principal GIS analyst on team preparing the Countywide Plan and Program EIR for the County of San Bernardino. Tasks included a comprehensive inventory of the County of San Bernardino's biological resources. This involved creation and cataloging of countywide vegetation, wildlife, and hydrological data.

Municipal Waterways Maintenance Plan, City of San Diego. Served as principal GIS analyst for a large-scale stormwater facility maintenance plan to be used as the environmental permitting document maintaining over 150 flood control facilities throughout the City of San Diego from 2018 to 2023. Responsible for vegetation mapping, analyzing impacts to all biological resources, and cataloging and maintaining large, diverse dataset of municipal infrastructure resources and cultural and historic resources.

Utility Undergrounding Program, City of San Diego, California. Served as lead GIS analyst supporting biological resource technical analysis, the City of San Diego's Public Utilities Department programmatic EIR, cultural resource records searches, archaeological monitoring and technical reports, and development of mobile and web applications to facilitate fieldwork and desktop review for the Utility Undergrounding Program and associated activities in over 800 utility districts throughout the city. The Utility Undergrounding Program required management and analysis of a large and diverse GIS dataset.

Urban Forestry Management Plan, City of Temecula, California. Served as the principal GIS analyst responsible for citywide tree canopy and land cover classification mapping. Duties included employing semi-automated and machine learning image classification techniques to analyze remotely sensed imagery and LIDAR. Provided additional GIS analysis and cartographic support.

The Enclave at Ivanhoe, Pv Ivanhoe LLC, EL Cajon, California. Served as principal GIS analyst for biological analysis letter, biological technical report, agricultural resources report, visual resources report, acoustical analysis, and historical resources technical report. This included mapping and impacts analysis for all biological resources on site, development of local agricultural resources assessment model for agricultural report, and cartographic support for visual and acoustical resourced reports.

Southern Subregion Habitat Reserve Vegetation Map Update, Rancho Mission Viejo Land Trust, Orange County, California. Served as GIS analyst supporting Rancho Mission Viejo's 2017 vegetation map update for the Initial Management Action Plan. Project involved collection of high-resolution satellite imagery and LIDAR to derive raster products characterizing the structure of vegetation, and to evaluate vegetation change within the Habitat Reserve over the period since 2012. The satellite and LIDAR change detection products helped biologists quantify on-site vegetation changes, assess the accuracy of boundary mapping between vegetation communities, and update the vegetation classification system used in the 2012 mapping.

Confidential Solar Project, Riverside County, California. Served as principal GIS analyst supporting development a large-scale solar facility in Riverside County, California. Duties include collecting, analyzing, managing and displaying a diverse collection of large and dynamic GIS datasets, building and maintaining mobile and desktop web applications for field data collection and desktop quality assurance/quality control, and preparing biological, hydrologic, and paleontological analyses.

Confidential Solar Project, Sacramento Valley, California. Served as principal GIS analyst supporting development of a solar facility in Sacramento Valley, California. Duties included GIS support for environmental constraints analyses, permitting, aquatic resource review, and species-specific biological resource studies. Built and maintained mobile web application to support field data collection for protocol-level biological and aquatic resources surveys. Utilized diverse collection of GIS datasets to model potential aquatic resource locations and biological and aquatic resource density.

San Bernardino County Regional Conservation Investment Strategy, San Bernardino County, California. Served as principal GIS analyst for the San Bernardino County Regional Conservation Investment Strategy developed for the County of San Bernardino, San Bernardino County Transportation Authority, and Southern California Association of Governments. Responsible for developing GIS datasets in support of the conservation lands inventory, identifying focal species, conducting a gap conservation analysis, developing conservation goals and objectives, and identifying conservation actions and priorities in the 3.5-million-acre Regional Conservation Investment Strategy area.

San Timoteo Creek Habitat Monitoring Program, Yucaipa Valley Water District, Riverside and San Bernardino Counties, California. Served as principal GIS analyst using satellite and aerial imagery to remotely monitor and measure long-term changes to riparian habitat, portions of which are occupied by the state-and federally listed endangered least Bell's vireo (*Vireo bellii pusillus*), within San Timoteo Creek associated with expansion of the Yucaipa Valley Water District's non-potable water distribution system between the years 2012 and 2020.

Christopher Starbird

GIS ANALYST

Christopher Starbird (*KRIS-tuh-fer STAR-bird; he/him*) is a geographic information systems (GIS) analyst with 17 years' experience in environmental projects for municipal, regional, and federal public agencies and non-profit organizations. Mr. Starbird uses the latest in mapping software from the Environmental Systems Research Institute (ESRI). His skills include database design, spatial analyses, three-dimensional (3D) modeling with shade and shadow analysis, glint and glare analysis, interactive web development and design, web-based mapping, and high-quality cartographic design. Mr. Starbird has completed course work in the areas of computer programming, GIS, cartography, and field techniques in geographic research, web-based interactive map presentation, and digital graphics design.

Education

University of California, Santa Barbara
BA, Geography

Project Experience

Indio Transformative Climate Communities Plan Public Outreach Website, City of Indio, California. Worked with the graphic design team to design and developed a mobile-friendly website to guide the general public through the many goals of this climate plan. The site includes an interactive map of the plan boundary, webinar registration information, Spanish translation, and mailing list registration forms. The site theme was custom designed for the client on the WordPress platform to allow for easy transfer of ownership upon project completion (https://indiotccplan.com).

California Wildlife Damage Management EIR/EIS, Project Website, California Department of Food and Agriculture. Served as the lead web developer/designer for the project website, which was designed to provide detailed information about the project's goals and to engage stakeholders. The website was built from the ground up to meet the state's strict requirements for accessibility and readability (WCAG 2.0). Users of the site can choose between four different languages via a customized machine translation plugin. Worked with the project team to create a web presence on the WordPress platform that could be easily edited by non-technical staff and increase the ease of transfer of ownership of the site upon project completion (https://californiawdm.org/).

San Jose Community Forest Management Plan, Stakeholder Outreach Website, City of San Jose, California. Served as the lead web developer/designer for the City of San Jose's Community Forest Management Plan. The website's intended purpose was to inform and motivate the community to get involved in the planning process. In addition to developing the look and feel of the site, worked closely with Dudek's Urban Forestry Team to create engaging interactive elements to the site, including a game where visitors can plant trees around a virtual property to see the positive impact an urban forest has on the environment (https://sanjosecfmp.com/).

The Axton Solar Project Community Outreach Website, Axton, Virginia. Working with the Dudek graphic design team, developed a custom website to match other project outreach design materials. The resulting site includes comment forms, webinar registration, and interactive mapping in a layout that is compatible with mobile and desktop screen sizes (https://axtonsolarproject.info).

Green Neighborhood Certification Program, Stakeholder Outreach Website, Sacramento Tree Foundation, California. Served as the lead web designer/administrator and took the project from design mock-up using Adobe Illustrator and Photoshop, to implementation in code using PHP, HTML, CSS, and JavaScript. Website development was accomplished by using the off-the-shelf WordPress content management system. Created a custom-tailored WordPress theme based on the Genesis theme framework, which allowed for design flexibility during development while also providing the potential for minor site updates by non-technical staff.

City of Santa Barbara Community Wildfire Protection Plan, Stakeholder Outreach Website, City of Santa Barbara, California. Worked closely with Dudek's graphic design and visual communications team and City of Santa Barbara staff to create an engaging web presence for the City of Santa Barbara's Community Wildfire Protection Plan (CWPP). Designed to get the word out about the CWPP planning process, as well as provide access to maps and graphics illustrating the issues at hand, the website serves as an example of outreach in the modern age. In addition to developing and launching the initial website, serves as the site administrator, performing updates and posts to keep the community informed. Because the website was hosted and maintained on City of Santa Barbara–operated infrastructure, Mr. Starbird had to coordinate with City of Santa Barbara IT staff to develop and deploy the web resource (https://cwpp.santabarbaraca.gov/).

Beverly Hills Creative Office Project Environmental Impact Report, City of Beverly Hills, California. Serving as lead GIS analyst in the preparation of the project's Environmental Impact Report (EIR) aesthetics assessment for the development of up to 11 new office buildings on a vacant, linear site in the City of Beverly Hills. The proposed four- to five-story office buildings would be designed in a range of architectural styles. Buildings at each end of the site would have traditional facades with columns and cornices, and buildings toward the center of the site would have more modern architectural treatments, such as glass screen walls and steel frames. Key issues include obstruction of views to the iconic City Hall tower and compatibility of bulk and scale with the surrounding development.

Pacific Coast Commons Specific Plan EIR, El Segundo, California. Serving as lead GIS analyst for preparation of an EIR for the Specific Plan. The project would involve redevelopment of the existing surface parking lots of the Fairfield Inn & Suites and Aloft Hotel properties, as well as the commercial properties, through the adoption of a Specific Plan that allows for the development of 263 new housing units and 11,252 square feet of commercial/retail uses on approximately 6.33 acres of land located in the City of El Segundo adjacent to Pacific Coast Highway. The Pacific Coast Commons-South portion proposes a six-story residential building with commercial/retail on the ground floor and an eight-level parking garage. The Pacific Coast Commons-Fairfield Parking portion of the project proposes a four-story parking garage with commercial/retail on the ground floor. The Pacific Coast Commons-North portion proposes a six-story residential building with commercial on the ground floor that faces Pacific Coast Highway, a six-story parking garage in the central portion of property, a new fire/access road, and apartment/townhome units. The project requires a General Plan amendment, zone change, site plan review, vesting tentative tract map, and a development agreement.

Buena Vista Project EIR, Los Angeles, California. Serving as lead GIS analyst for the EIR for a 2- to 26-story mixed-use project on an 8-acre parcel, which includes residential and commercial uses consisting of approximately 1,079,073 square feet of residential floor area (920 dwelling units); 15,000 square feet of neighborhood-serving retail uses; 23,800 square feet of indoor and outdoor restaurant; and 116,263 square feet of outdoor public trellis/balcony space. The project site is located in the Central City North Community Plan Area near the Metro Gold Line and the Los Angeles State Historic Park. The transit-priority project is proximate to a network of regional transportation facilities, including the Chinatown Metro Station. The site is located in a Methane Zone and contains remnants of previous land uses, including former oil wells and a gas station.

DUDEK

Melanie Betlach

GRAPHIC DESIGNER

Education

Academy of Art University
MFA, New Media/ Computer Arts, 2001

University of California, Santa Cruz
BA, Biology, 1996

Melanie Betlach (*MEL-uh-nee BET-lock; she/her*) is a seasoned graphic designer with 21 years' experience creating visually captivating work. Capabilities range from publication layout, print work including brochures and large banners and signage, brand creation and style guides, Microsoft Word and PowerPoint templates/optimization, and illustration. Ms. Betlach has extensive experience working with government and public agencies, including the City of San Marcos, Western Municipal Water District, and City of Menifee. Ms. Betlach's goal is to maximize usability and interaction with marketing collateral, whether it be print or digital.

Relevant Project Experience

Sustainable Groundwater Management Program/Tribal Government and Underrepresented Community Technical Assistance Program: Branding and Suite of ADA-Compliant Products, California Department of Water Resources. Created the logo and accompanying Americans with Disabilities Act (ADA)-compliant branded visual style guide for the program. Created branded materials including flyers, brochures, posters, video storyboards, and Microsoft Word templates. Collaborated with the creative team that produced branded video, animation, and social media graphics.

Evaluation and Implementation Toolkit and Prioritization Tool Guidebook, San Diego Association of Governments, California. Collaborated with a team of visual designers and planning and urban designers to create two interactive, functional, and visually stunning brochures of more than 30 pages each profiling regional climate change issues and local actions.

City of El Cajon Safety and Environmental Justice Elements: Proposal and Report, California. Created a stunning visual theme utilizing local flora as the backdrop for this winning proposal. Designed and implemented the Safety and Environmental Justice Elements providing a clear, efficient, and stylistically appealing design for the City and general public including vulnerability and capability assessments; goals, policies, and actions; and coordination with the California Department of Forestry and Fire Protection (CAL FIRE).

City of Lomita Safety and Housing Elements: Proposal and Reports, California. Designed and implemented a winning proposal in a user-friendly and interactive landscape format with clickable buttons and bookmarks to allow for easy electronic distribution due to COVID. Designed and implemented the Safety and Housing Elements to help educate and engage the local Lomita community in public hearings.

City of Eureka Waterfront Specific Plan Winning Proposal and Plan Report, California. Created a winning 40-page full spread proposal featuring the unique beauty of the City of Eureka waterfront and Victorian architecture while presenting Dudek's experience, understanding, award-winning plans and expertise. Utilizing the City of Eureka's new branding, created a book in InDesign compiling multiple chapters and linking with active Microsoft Word documents to allow for easy updating and coordination with the City.

San Mateo County Harbor District Master Plan, California. Created a stunning and communicative 87-page high profile Master Plan serving to guide future capital improvement projects, develop land and water under the District's jurisdiction, resolve existing land use conflicts, and identify future physical improvements and and opportunities for new District activities at Pillar Point Harbor and Oyster Point Marina/Park.

San Pasqual Valley Resource Management Guide, City of San Diego, California. Designed and prepared a public 155-page guide in collaboration with technical designers and hydrogeologists in an effort to help identify and reduce sources of sediment and nutrients to the surface waters and groundwaters in San Pasqual Valley, while simultaneously identifying steps to preserve the cherished natural and cultural resources.

Lassen County Safety and Noise Elements, California. Using the stunning backdrop of Lassen County imagery, designed a 78-page winning proposal in print and digital formats for the Lassen County Safety Element, which subsequently led to the awarding of the Lassen County Noise Element project. , created visually stunning Safety and Noise Elements using InDesign that included extra functionality with Microsoft Word, allowing for easy updates with the County.

2020 Integrated Regional Urban Water Management Plan, San Bernardino Valley Municipal Water District, California. Using the concept of a "marriage" between Urban Water Management Plans and Integrated Regional Water Management Plans, created custom graphics for print and presentation purposes describing this integrated relationship, allowing for quick visual digestion of the concept by the client.

Relevant Previous Experience

Creative Services Specialist, City of San Marcos, California, 2017–2019. Served as the sole in-house graphic designer. Provided graphic services to all departments. Projects ranged from print material such as newsletters, environmental design, signage, postcards, and flyers, to branded Microsoft Word, Publisher, and InDesign templates.

Graphic Design Consultant, 2002–2019. With a focus on life science, medical, and environmental firms, worked closely with clients to create scientific illustrations and infographics; 80+ page annual reports; marketing campaigns; branding and business collateral; print material such as brochures, newsletters, and signage; and e-campaigns and website digital pieces.

Publications

Betlach, M.C., J.T. Kealey, G.W. Ashley, and R. McDaniel. 1998. "Characterization of the Macrolide P-450 Hydroxylase from *Streptomyces venezuelae* which Converts Narbomycin to Picromycin. " *Biochemistry* 37(42): 14937–14942. https://doi.org/10.1021/bi981699c.

Tang, L., H. Fu, M.C. Betlach, and R. McDaniel. 1999. "Elucidating the Mechanism of Chain Termination Switching in the Picromycin/Methymycin Polyketide Synthase." *Chemistry & Biology* 6(8): 553–558. https://doi.org/10.1016/S1074-5521(99)80087-8.

McDaniel, R., A. Thamchaipenet, C. Gustafsson, H. Fu, M. Betlach, and G. Ashley. 1999. "Multiple Genetic Modifications of the Erythromycin Polyketide Synthase to Produce a Library of Novel 'Unnatural' Natural Products." *Proceedings of the National Academy of Sciences of the USA* 96(5): 1846–1851. https://doi.org/10.1073/pnas.96.5.1846.

Graziani, E.I., D.E. Cane, M.C. Betlach, J.T. Kealey, and R. McDaniel. 1998. "Macrolide Biosynthesis: A Single Cytochrome P450, PicK, is Responsible for the Hydroxylations that Generate Methymycin, Neomethymycin, and Picromycin in *Streptomyces venezuelae.*" *Bioorganic & Medicinal Chemistry Letters* 8(22): 3117–3120. https://doi.org/10.1016/S0960-894X(98)00553-8.

DUDEK

Karen Castaneda

GRAPHIC DESIGNER

Karen Castaneda (keh-ren kas-tuh-ney-duh; she/her) is a Graphic Designer with over 9 years of professional experience specializing in marketing and corporate branding. Ms. Castaneda brings a wealth of corporate marketing and design experience from her previous positions in the consulting, financial, and energy industries. Some of her feature work includes design pieces such as marketing collaterals, advertisement, video animation, social media, annual report booklets, large banners and booth designs for corporate events such as Offshore Technology Conference (OTC) for bp and Visum Executive for Sintec, to name a few. Ms. Castaneda adds a fresh perspective on design and branding to our creative team.

Education

Universidad Autónoma de Nuevo León, Facultad de Artes Visuales
B.S. in Graphic Design, 2011

Dudek Project Experience

Sustainable Groundwater Management Program/Tribal Government and Underrepresented Community Technical Assistance Program: Branding and Suite of ADA-Compliant Products, California Department of Water Resources. Created posters, flyers, social media posts, and visual infographics using maps (ADA)-compliant.

Coachella Valley Water District On-Call Biennial Engineering Services. Coordinated and implemented a 117-page winning proposal for the Coachella Valley Water District. Features of this proposal included coordination for printing, collaborated with Dudek's Technical Storytelling group for specialized graphics and maps, created specialty graphics and use of iconography. (2017–2021)

City of Rialto, Land Use and Safety Element Update, Environmental Justice Element, and Environmental Compliance. Working closely with the Planning and Urban Design Group, Ms. Castaneda crafted a beautiful and meticulous 79-page report layout with specialty graphics and iconography for this winning proposal.

Eco Rapid Transit Authority SOQ for Consultants. Covering features such as transportation planning, environmental planning and analysis, and engineering design and support and analysis, Ms. Castaneda created a 72-page proposal that was submitted digitally and produced for print. The report featured specialty graphics, bold imagery, a cool color palette and iconography.

City of Pico Rivera – City-Wide Community Design Standards and Guidelines for Residential, Commercial, Industrial and Mixed-Use Developments. Collaborating with a team from the Planning and Urban Design group, Ms. Castaneda designed and implemented a winning proposal that featured specialty graphics, data visualization, and iconography.

San Lorenzo Valley Water District – Communications and Community Outreach Services. Using the beautiful redwood valley where the San Lorenzo Valley Water District resides as a point of inspiration, Ms. Castaneda included stunning imagery as a backdrop to frame this multipage report into stunning portfolio piece.

Relevant Previous Experience

OTC, bp, Houston TX. Executed projects designing and incorporating brand identity into all visual materials for print/web production, and transformed complex ideas into compelling data visualization for the OTC conference.

Visum Executive, Sintec, Monterrey MX. Designed the branding for Visum Executive, a business conference focused for executive officers and upper level management such as PEMEX, HSBC, BMW, to name a few.

DUDEK

Raoul Rañoa

VISUAL/TECHNICAL STORYTELLING PRACTICE LEAD

Raoul Rañoa (*ra-OOL ra-NO-a; he/him*) is the lead of Dudek's Visual Storytelling practice. His 24-year career includes roles at the Los Angeles Times and JPL/NASA, where he honed his expertise in breaking down complex data and processes into visual stories suitable for both expert and general audiences. Mr. Rañoa is experienced in projects involving agriculture and tribal relations and has prepared print, online, and animated visuals covering every facet of the environmental consulting industry, including large-scale construction projects, unmanned aerial survey missions, sea level rise, hydrological processes, and green technology. He is knowledgeable in print and Web graphics production, including prepress, vector, and 3-D illustration; GIS; social media; video; and motion graphics. He also has management and university-level teaching experience, as well as experience in technical editing, writing, reporting, and cartography. Additionally, Mr. Rañoa's graphic designs are nationally recognized, having been featured in the Best American Infographics book series two years in a row.

Education

California Polytechnic State University, Pomona
BA, Communications (Journalism Focus)

Relevant Project Experience

DWR Technical Assistance Program, Department of Water Resources, State of California: Mr. Rañoa is coordinating, creating, and executing visuals illustrating DWR's efforts to support Tribal and other underrepresented communities. Visuals to be used for a K-12 lesson plan, public outreach, and social media campaigns. He is also leading the development of visuals illustrating Native American Tribal Water Stories and history within California. (Present)

Native Peoples Trade and Historic Hangar Interpretive Display, Port of Portland, Oregon. Mr. Rañoa was the lead designer in the research and design of multiple panels incorporating Native American and aviation history. (2022)

CDFA State Wildlife Services, State of California. Mr. Rañoa is the lead artist in creating visuals outlining all aspects of the project, including workflows between CDFA, USDA, and CACASA, public outreach efforts, website design, and public outreach. (Present)

IRWD Aerial Analysis for San Joaquin Marsh. Mr. Rañoa is crafting data visualizations outlining changes in the vegetation index and land cover from 2006 to 2020. (2022)

San Diego Canyonlands Carbon Storage and Sequestration Study, County of San Diego. Mr. Rañoa crafted data visualizations outlining carbon storage, land cover, and sequestration data for multiple watersheds. (2022)

San Pasqual Valley Resource Management Plan, City of San Diego/San Diego, California. Mr. Rañoa was the lead artist responsible for creating visuals outlining best management practices for multiple agricultural land uses, the hydrological processes occurring within the Hodges Reservoir Watershed and Hodges Reservoir, and the topographical makeup of the San Pasqual Groundwater Basin. (2021)

Downey Urban Forest Master Plan, City of Downey, Department of Public Works, California. Mr. Rañoa was responsible for creating data maps, 3D diagrams, and public outreach visuals outlining Cal Enviro Scores and the impact of invasive species and climate change. (2019)

Environmental On-Call Regional Transportation Infrastructure Sea-Level Rise Assessment and Adaption Guidelines, San Diego Association of Governments, San Diego County, California. Mr. Rañoa was responsible for creating data maps and 3D infographics illustrating the impacts of sea-level rise on local communities. (2019)

Fanita Rancho Interpretive Signs, HomeFed Corporation, Santee, California. Mr. Rañoa was responsible for designing and illustrating interpretive signs explaining the incorporation of native plants into the project area. Designs include 3D diagrams, illustrations, and maps. (2022)

San Diego State University Mission Valley Campus Master Plan/Design Guidelines, San Diego State University, San Diego, California. Mr. Rañoa was responsible for creating Environmental Impact Report and Design Guidelines infographics covering all aspects of the project. (2019)

Ojai Groundwater Sustainability Plan, Ojai Basin Groundwater Management Agency, Ojai, California. Mr. Rañoa was responsible for translating hydrological data into 3D visuals. (2021)

Long Beach C-17 Master Plan, City of Long Beach, California. Mr. Rañoa was responsible for creating data maps, infographics, and the design of Specific Plan. (2019)

Tijuana River Estuary Tidal Restoration Program, State of California Department of Parks and Recreation–Southern Service Center, California. As lead graphic designer, Mr. Rañoa was responsible for creating infographics outlining project phases step-by-step. (2019)

Relevant Previous Experience

California Institute of Technology. Responsible for infographics and data visualization for Mars missions. (2020)

Jet Propulsion Laboratory, Pasadena, California. Created space and environmental visuals. Interviewed staff scientists and researchers. (2018–Present)

Los Angeles Times, California. Served as senior artist for data visualization. Researched, wrote, and illustrated infographics, animations, and charts. Managed projects and staff. (1997–2018)

University of California, Los Angeles. Taught courses covering interactive media. (2007–2011)

Conference Presentations

- Guest lecturer at Loyola Marymount University: Data Visualization Techniques and Theory
- Speaker/Presenter at Western Groundwater Congress 2021: Rocket Science Visuals – Conveying Technical Information to Decision Makers and the Public
- Speaker at Santa Ana College: Principles of 3D Visualization

Awards

- 2003 Pulitzer Prize for the Widow Maker Investigative Series, reported at the Los Angeles Times
- 2012 Bingham Prize for Investigative Journalism, reported at the Los Angeles Times
- Society of News Design Best Portfolio/Judge for International Design Competition

MICHAEL HENDRIX

CLIMATE CHANGE AND AIR QUALITY CONSULTANT

EXPERTISE

- WHO air quality guidelines
- IPCC guidance and protocols
- U.S. Ambient Air Quality Standards
- NEPA guidelines
- CEQA guidelines

EDUCATION

B.S., Environmental Science, University of California, Riverside, 1998

PROFESSIONAL EXPERIENCE

Associate, LSA, Riverside, California, February 2016–April 2022

Project Director, Atkins North America, 2009–2016

Senior Project Manager, Michael Brandman Associates, 2002–2009

Environmental Analyst, Albert A. Webb Associates, 1998–2002

SPECIALIZED TRAINING

Certified Air Dispersion Modeler, Lakes Environmental 2004

Environmental Planning Certification, University of California, Riverside, 2002

Air Quality Certification, University of California, Riverside, 2001

PROFESSIONAL AFFILIATIONS

Air & Waste Management Association

Association of Environmental Professionals

National Association of Environmental Professionals

Institute for Sustainable Infrastructure

PROFESSIONAL RESPONSIBILITIES

Mr. Hendrix has over 24 years of experience involving air quality and greenhouse gas (GHG) emissions analysis, climate change analysis, and climate action planning. He has done extensive research analyzing specific technical issues of air quality, GHG emissions, and global climate change, as they relate to project compliance with World Health Organization (WHO) air quality guidelines, United Nations Intergovernmental Panel on Climate Change (IPCC) guidance and protocols, United States Ambient Air Quality Standards (AAQS), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). His experience also includes public outreach efforts for project-specific meetings and for informing local and State officials on general air quality and GHG emissions issues.

PROJECT EXPERIENCE

County of Riverside Transportation, and Land Management Agency, Climate Action Plan
Riverside County, California

Mr. Hendrix supervised the development of this project in two phases. In Phase One, Mr. Hendrix calculated communitywide and municipal emission inventories for the County, set 2020 and 2035 reduction goals, and provided energy performance standards for new development projects as part of the General Plan Update. Phase 2 provided a Draft Climate Action Plan (CAP) that developed a detailed comprehensive set of reduction measures and implementation strategy to meet the reduction goal. Michael developed a menu of reduction options called Screening Tables that allowed a flexible way for future development projects to demonstrate consistency with, and tier from, the CAP, which streamlines the CEQA analysis of those development projects. The CAP provides a legally defensible document that future projects can tier from in the analysis of climate change during the CEQA process, which will streamline future project approval and implementation.

West Sacramento Climate Action Plan
West Sacramento, Yolo County, California

Mr. Hendrix reviewed the screencheck draft 2010 CAP and provided the City with insight on how it could be improved. Recommended that the City focus the CAP on emission sources over which the City has jurisdictional control as compared to those it has no control. As an example, the City used traffic counts on all freeways passing through the city. However, the City has no jurisdictional control over pass-through traffic. Atkins provided the City with an alternative method of collecting traffic emissions data that would not count pass-through traffic in order to revise its GHG emissions inventory within the CAP. The City of West Sacramento is a member of the International Council of Local Environmental Initiatives (ICLEI), a nonprofit organization that encourages local governments to reduce GHG emissions and provides the Clean Air and Climate Protection (CACP) software tool and protocols for the development of CAPs. The City of West Sacramento used the CACP software and protocols to draft its CAP.

Sutter County Climate Action Plan
Sutter County, California

Mr. Hendrix was the project manager overseeing data collection in the GHG emissions inventories for the County and the development of emission reduction measures in the CAP. Challenges in the development of the CAP include the rural nature of the County and the unusual GHG emission sources associated with rice production and other agricultural processes. It is essential that GHG reduction strategies in the County CAP maintain the rural atmosphere and develop unique reduction measures associated with agricultural practices within Sutter County. An additional consideration to the success of the project is the politically conservative nature of the County's elected officials and the ability to draft a CAP without getting sidetracked into a debate on climate change. Mr. Hendrix met with the County representatives, Feather River Air Quality Management District, and the Attorney General's office to gain consensus on the strategy of the CAP to successfully tackle the challenges and provide the County benefits including CEQA tiering and acceptable agricultural processes.

City of Agoura Hills Climate Action and Adaptation Plan
Agoura Hills, Los Angeles County, California

Mr. Hendrix assisted the City of Agoura Hills to develop its Climate Action and Adaptation Plan (CAAP). Phase 1 was completed in January 2021 and involves community and stakeholder outreach to understand community priorities for a successful CAAP; development of the City baseline GHG inventory for the year 2018 and projections into 2020, 2030, and 2045; target setting and GHG reduction measures; and strategy development. MR. Hendrix also developed a citywide climate change risk and vulnerability assessment as a part of City's General Plan Safety Element Update. Phase 2 provided the CAAP CEQA analysis to ensure compliance with CEQA Guidelines Section 15183.5. Phase 3 is currently ongoing and involves the development of the implementation mechanisms as well as initiating the monitoring and reporting program.

City of Chino, Climate Action Plan
Chino, San Bernardino County, California

Michael Hendrix was the Project Manager overseeing data collection in the GHG emissions inventories for the City of Chino and the planned implementation of emission reduction measures in the CAP. The project also included a climate change risk analysis and adaption measures to address climate change impacts within the City. The CAP provides a legally defensible document that future projects can tier from in the analysis of climate change during the CEQA process, which now streamlines project approval and implementation. Mr. Hendrix's Screening Tables facilitated project review and analysis streamlining, and allowed a flexible way for future development projects to demonstrate consistency with, and tier from, the CAP. During the 2019 update of the CAP, Mr. Hendrix worked with the City's IT Department and developed its CAP Monitoring Program, which works within the Permit Application (Ascentis) software and provided a CAP Monitoring dashboard that automatically updates whenever new entries are made for permit applications.

Monterey One Water Climate Action and Adaption Plan
Monterey, Monterey County, California

Michael Hendrix worked with agency staff overseeing data collection in the GHG emissions inventories for the wastewater treatment agency and the planned implementation of emission reduction measures in the CAAP. The project also included a robust analysis of climate change risk for agency assets and adaption measures to address climate change impacts within the Monterey One Water service territory. GHG emission reduction measures include a focus on methane capture and reuse as fuel for the onsite combined cycle electric generators as well as photovoltaic (PV) solar generation at the Regional Treatment Plant. Water conservation and water reclamation and reuse is another emphasis of the agency. Monterey One Water also began the collection, clean-up and reuse of stormwater runoff. Finally, the agency is considering the electrification of its mobile equipment and vehicle fleet. Adaptation and resiliency to climate change includes the relocation and/or armoring of key assets that are anticipated to be prone to flooding due to sea level rise and extreme storm events. Mr. Hendrix assisted the engineering staff in the feasibility of developing microgrids for key facilities including the regional treatment plant that would pair renewable electric generation with energy storage systems to provide indefinite continuous power while facilities are separated from the electric grid.

POLICY ANALYSIS
FOR THE
PUBLIC AND PRIVATE
SECTORS
M.CUBED

DR. RICHARD MCCANN
PARTNER
426 12th Street
Davis, California 95616
530.757.6363
McCann@MCubed-Econ.Com

Professional Experience

M.Cubed, Partner, 1993-2008, 2014-present
Aspen Environmental Group, Senior Associate, 2008-2013
Foster Associates/Spectrum Economics/QED Research, Senior Economist, 1986-1992
Dames & Moore, Economist, 1985-1986

Academic Background

PhD, Agricultural and Resource Economics, University of California, Berkeley, 1998
MS, Agricultural and Resource Economics, University of California, Berkeley, 1990
MPP, Institute of Public Policy Studies, University of Michigan, 1986
BS, Political Economy of Natural Resources, University of California, Berkeley, 1981

Selected Projects: Climate Change Policy and Economics

Regional and Statewide Planning

- **Delta Climate Change Vulnerability Analysis, Delta Stewardship Council (2019-present).** Working with a project team on behalf of to estimate the amount of economic assets and activity exposed to the hazards of increased climate volatility within the Sacramento-San Joaquin Rivers.
- **Imperial County Climate Action Plan, Imperial County Transportation Commission (2019-2021)**. Prepared a cost effectiveness analysis of the individual proposed greenhouse gas emission control strategies for Imperial County and its individual jurisdictions. Developed a supply curve of measures for 2030 and 2050.
- **Master-Metered Utility Systems Transfer Program, Western Manufactured Housing Communities Association (2003-present)**. Prepared petition that opened a rulemaking to facilitate transfer of master-metered utility systems to serving utilities and testified in that proceeding. Testified before the State Legislature on proposed legislation. Persuaded all electric and gas utilities in California to institute a program to convert at least 50% of privately-owned MHP systems to utility ownership.
- **Delta Flood Risk Management Assessment District Feasibility Study, Delta Protection Commission (2015-2018)**. Used a stakeholder-responsive process to assess the feasibility of establishing beneficiaries-pay financing mechanisms to fund improvements and maintenance in Sacramento-San Joaquin Delta levees.
- **Greenhouse Gas Inventory for Santa Barbara County, County Office of Long Range Planning (2010-11).** Created an GIS-based inventory of greenhouse gas emissions in the unincorporated county for 2007 and forecasted the baseline for 2020 and 2035, excluding state-owned and federal lands, and reconciled it with the CO2 inventory being constructed by the SBCAPCD for the entire county.
- **Review of AB 32 Proposed Scoping Plan Economic Modeling, Environmental Defense Fund (2008).** Reviewed economic modeling by the California Air Resources Board Staff used to assess the Proposed Scoping Plan to meet greenhouse gas emission reduction goals specified in AB 32.

- **Analysis of Governor's Executive Order on GHG Regulation, Environmental Defense Fund (2005).** Described the current regulatory regime and policies for electricity related to regulated greenhouse gas emissions. This analysis was included in the state's Climate Action Team report.

Beneficial Electrification and Distributed Energy Resources

- **Decarbonization Incentive Rate Proposal, Local Government Sustainable Energy Coalition (2022-present.)** Developed proposal for incentivizing building and transportation electrification by charging those uses only the marginal costs of service.
- **Pacific Gas & Electric 2023 General Rate Case Testimony, California Farm Bureau (2022-present**). Analyzed the comparative cost of using rural community and customer microgrids instead of undergrounding 10,000 miles of distribution lines to mitigate wildfire risk.
- **Net Energy Metering 3.0 Rulemaking Testimony, Agricultural Energy Consumers Association and California Farm Bureau (2021-present).** Identified distinguishing aspects of aggregated NEM (NEMA) tariff that differ from residential NEM usage, and estimated the net value to utility customers.
- **Alternative Generation Technology Assessment, California Energy Commission (2001-2014).** Developed and maintained the Cost of Generation Model, spreadsheet-based tool used by the CEC to produce generation cost estimates for the Integrated Energy Policy Report (IEPR).

Local Community Energy Resources

- **Regulatory Analysis and Support, Joint Community Choice Aggregators and Sonoma Clean Power (2016-present)**. Testified at the California Public Utilities Commission (CPUC) in Pacific Gas and Electric's (PG&E) rate proceedings on the power charge indifference adjustment (PCIA) "exit" fee and other issues.
- **Davis Community Choice Advisory Committee, City of Davis (2014).** Served on City-appointed committee to assess options for creating a community choice aggregation utility for the City or Yolo County. The committee recommended a county-wide CCA which led to the formation of Valley Clean Energy Alliance.
- **Community Solar Gardens Testimony, Sierra Club (2014).** Testified in Pacific Gas and Electric and Southern California Edison Green Tariff applications on changes needed to encourage the development of neighborhood and community-scale renewable distributed generation by allowing direct contracting and removing unnecessary transaction costs.

Agricultural Energy Use

- **Agricultural Rate Setting Testimony, Agricultural Energy Consumers Association (1992-present).** Testified about agricultural economic issues related to energy use, linkage to California water management policy, and utility rates in numerous proceedings at the California Public Utilities Commission, California Energy Commission, and California State Legislature.
- **Agricultural Engine Conversion Program, Agricultural Energy Consumers Association (2005).** The analysis identified the rate reduction needed to induce conversions from diesel to electricity while still covering the utilities' incremental costs. The adopted program led to the conversion of 2,000 pumps in the San Joaquin Valley.

Transportation and Vehicular Emissions

- **Barriers, Perceptions and Potential Solutions to Shipper Adoption of Zero-Emission Transportation, Environmental Defense Fund (2021-2022).** Through interviews with shippers and carriers, identified barriers to adoption of zero-emission trucking and proposed solutions that can be encouraged and supported by investors with environmental, sustainability and governance (ESG) objectives.

bae urban economics

Matt Kowta, MCP
Managing Principal

Professional Experience
For over 30 years, Matt has pioneered innovative techniques in economic analysis to meet the challenges of contemporary urban development. Matt oversees consulting operations spanning all of BAE's offices, supporting clients with expertise in development feasibility and market analysis, affordable and workforce housing, public finance and fiscal impact, and strategic economic development.

Matt has led BAE's work developing funding strategies for Climate Action Plans in communities such as Dublin, Albany, Merced County, South Pasadena, Walnut, and Sacramento. In addition, Matt is very familiar with the Yolo County community context, via numerous assignments for the County of Yolo, including work on the Yolo County General Plan Update, development impact fee updates for rural Yolo County fire districts, feasibility analysis for the Cache Creek Parkway Plan, and economic impact analysis for the Cache Creek Mining Plan. Matt has also led BAE's work on public facilities financing plans, funding strategies and implementation plans for Specific Plans and General Plans along with numerous fiscal impact studies. Finally, Matt has worked extensively on issues relating to agricultural sustainability in diverse locations such as Santa Clara County, Fresno County, Butte County, Glenn County, and Yolo County.

Education
Master of City Planning, UC Berkeley

Bachelor of Arts, Geography, UCLA

General Plan Update
County of Yolo, CA
Market analysis and growth projections, Housing needs assessment, economic development, fiscal impact analysis

General Plan Update and CAAP
City of Sacramento, CA
Housing market analysis, Neighborhood profiles, Growth projections, CAAP funding and financing options

Conserving Coyote Valley
Coastal Conservancy, CA
Economic conditions and trends, Agricultural sustainability, Land use policy, Program cost analysis

Santa Clara County Agricultural Conservation Strategy
County of Santa Clara, CA
Real estate market trends and conditions, Agricultural conservation strategies

Cache Creek Parkway Feasibility Study
County of Yolo, CA
Operating cost estimates, revenue projections, cash flow modeling.

FEHR PEERS

Ronald Milam, PTP, AICP

Principal

EDUCATION

B.S. with Highest Honors, Environmental Policy Analysis and Planning (Emphasis on Land Use and Transportation Planning), University of California at Davis

REGISTRATIONS

American Institute of Certified Planners (011595)
TPCB, Professional Transportation Planner (52)

AFFILIATIONS

Transportation Research Board (TRB)
Institute of Transportation Engineers (ITE)
American Planning Association (APA)

EXPERTISE

- Expert Witness Testimony
- Professional Instructor
- Expert Panels
- Travel Demand Modeling
- Land use and Transportation Planning Studies
- Project Development Studies
- Environmental Impact Analysis
- Rail Studies
- Multi-Modal Station Siting and Design Studies
- Bikeway Planning and Design

ABOUT

Ronald T. Milam, AICP, PTP is the director of evolving the status quo at Fehr & Peers and co-leads the company's research and development. He is actively involved in a variety of project work and teaches transportation planning and CEQA transportation impact analysis courses for UC Berkeley Tech Transfer and UC Davis Extension.

A unique part of Ron's experience is thinking long-term and helping clients understand the future outcomes of their decisions. His recent work has focused on disruptive trends, SB 743 implementation, and new metrics to help inform challenging transportation policy and technical questions.

RELEVANT PROJECT EXPERIENCE

Professional Instructor
Instructor for training courses involving transportation impact analysis (CEQA/NEPA), transportation, planning, travel demand forecasting, GIS, traffic simulation, and land use/transportation interactions.

- Caltrans Smart Mobility Framework Learning Network, 2017
- UC Berkeley Tech Transfer – VMT Metrics Application & Analysis for SB 743 Compliance
- UC Davis Extension – The Intersection Between Transportation and Land Use
- UC Davis Extension – Updating Transportation Analysis in CEQA: How to Effectively Implement SB 743
- APA Advanced Transportation Planning Workshop - Choices and Tradeoffs, APA National Conference 2012
- UC Berkeley Tech Transfer - Managing Transportation and Land Use Interactions

Technical and Policy Guidance

Ron's experience has included the development of formal guidance material associated with policy and technical analysis for federal and state agencies.

- Caltrans Traffic Safety Bulletin 20-02-R1: Interim Local Development Intergovernmetnal Review Safety Review Practitioners Guidance, 2021
- Caltrans LD-IGR local develoment review guide, 2021
- Quantifying Greenhouse Gas Mitigation Measures – CAPCOA Update, 2021
- CalEEMod Update, 2021
- FHWA Traffic and Land Use Forecasting NEPA Reviewer Guidance, 2019
- Caltrans Smart Mobility Framework Learning Network and How-to-Guide, 2018
- Caltrans Transportation Analysis Guide/Transportation Impact Study Guide (TAG/TISG), 2017
- Caltrans Transportation Analysis Report Guidelines, 2011
- Caltrans Smart Mobility Framework, 2010
- Assessment of Greenhouse Gas Analysis Tools, State of Washington, 2009

CEQA Guidance and Applications

Ron has led the Fehr & Peers efforts for SB 743 implementation and routinely advises clients on complex CEQA projects.

- Assessment of Vehicle Miles Traveled (VMT) Metric for Use in SB 743 Implementation, OPR
- SB 743 Implementation Convenings with Caltrans, OPR, MTC, SACOG, SCAG, and SANDAG (2016-18)
- SACOG MTP/SCS EIR Transportation Impact Analysis
- SACOG SB 743 Implementation Tool
- SCAG/City of Los Angeles VMT mitigation bank/exchange pilot
- City of Pasadena General Plan Update and New Performance Metrics
- City of Palo Alto SB 743 Implementation
- City of Novato SB 743 Implementation
- City of San Francisco SB 743 Implementation
- City of Woodland General Plan/Climate Action Plan and EIR
- City of Sacramento General Plan and EIR
- City of Los Angeles SB 743 Implementation
- UC Davis LRDP EIR
- Stanford University General Use Permit
- BCAG SB 743 Implementation
- Butte County SB 743 Interim VMT Threshold
- WRCOG SB 743 Implementation Pathway
- WRCOG VMT mitigation bank/exchange white paper
- NCTC SB 743 Implementation
- EDCTC SB 743 Implementation
- Placer County SB 743 Implementation
- Placer County/TRPA SB 743 Implementation
- Lake County SB 743 Implementation
- Mendocino County SB 743 Implementation
- County of San Diego SB 743 Implementation
- VTA SB 743 Screening and Impact Tool
- California Attorney General's Office VMT Expert
- City of Roseville General Plan Update and EIR
- Newland Sierra Specific Plan EIR
- City of Petaluma General Plan and EIR
- City of San Rafael General Plan and EIR
- CSU System SB 743 Guidelines
- San Bernardino County Transportation Authority SB 743 Implementation
- Tuscan Ridge EIR (Butte County)
- Durham Creekside Estates EIR (Butte County)
- CG Development Nord Avenue VMT Analysis (Butte County)
- Butte Vista Estates VMT Analysis (Butte County)

Publications & Presentations

The unique aspects of Ron's work has led to a variety of publications and presentations.

- *SB 743, A New Passing Lane for Housing Projects*, California Land Use Law & Policy Conference
- *An Evolutionary Change to Transportation Impact Analysis*, 2019 TRB Annual Meeting
- *Disruptive Trends in Transportation*, 2018 Ohio State Real Estate Conference
- *Disrupting Transit, A First Penguin Perspective*, 2018 Urbanism Next
- *VMT Calculation Tools and Setting Thresholds- Poking at the Metric Like a Lab Rat,* 2017 TRB Annual Meeting
- *What's the Recipe for SB 743 Implementation?,* 2016 California APA Conference
- *SB 743 Legislative Intent vs. CEQA Practice*, 2015, California APA Conference

Greg Behrens, AICP

Senior Associate

EDUCATION

Master of Urban Planning
University of Washington

Bachelor of Urban Studies & Planning
University of California, Santa Barbara

REGISTRATIONS

American Institute of Certified Planners (029423)

AFFILIATIONS

American Planning Association (APA)
Young Professionals in Transportation (YPT)
Urban Land Institute (ULI)

EXPERTISE

- Transportation Planning
- Transit Service & Operations Planning
- Bicycle & Pedestrian Planning
- Geographic Information Systems

ABOUT

Greg Behrens is a senior associate with more than ten years of public and private sector transportation planning experience. He has served as project manager and lead planner on numerous community mobility and transit service improvement projects, including projects throughout Yolo County. His work focuses on helping communities solve complex transportation challenges, ranging from expanding active transportation options to enhancing public transit service access, performance, and operations, with an emphasis on enhancing the interface between transit systems and the communities they serve.

RELEVANT EXPERIENCE

Yolo Shifler Mining VMT Analysis (Yolo County, CA)
Fehr & Peers performed a VMT analysis of the Shifler Mining project in Yolo County, CA. A supplemental analysis of the project was completed in 2018 when employee number assumptions changed. This analysis involves calculating employee and truck VMT estimates.

Aggie Research Campus CEQA Addendum (Davis, CA)
Fehr & Peers reviewed traffic information for the comparison of existing and cumulative traffic volumes from the Mace Ranch Innovation Center (MRIC) EIR with recently collected traffic counts (e.g., May 2019 Mace Boulevard counts) and future traffic volume forecasts from the new UC Davis/City of Davis travel demand model. Review of study intersection and roadway segment delay and LOS results from the MRIC EIR. Review of project travel characteristics (e.g., trip generation) for the mixed-use project alternative from the MRIC EIR.

Olive Drive CEQA (Davis, CA)
Fehr & Peers prepared a transportation study in support of the proposed Olive Drive Mixed Use project in Davis, CA.

Dorado Oaks VMT (Diamond Springs, CA)
Fehr & Peers prepared the VMT analysis for the Dorado Oaks project in the Diamond Springs community of El Dorado County. The analysis followed the County's VMT threshold and methodology that was adopted in response to SB 743. The project includes the development of 381 dwelling units in a range of densities.

Downtown Davis Plan (Davis, CA)
As part of a multi-disciplinary planning team, Fehr & Peers prepared the transportation section of the Downtown Davis Plan, the guiding document supporting the future vision of the commercial, recreational, and cultural center of the Davis community and it's growth in the core area over the next fifteen years. Fehr & Peers is responsible for identifying the multimodal transportation facility investments necessary to support future Downtown Davis development, including those related to emerging transportation technologies such as autonomous vehicles and electric personal mobility devices. Key tasks included developing future modal priority networks, conceptual street designs, and policies related to the design, operation, and use of the downtown transportation system.

City of Roseville General Plan (Roseville, CA)
Fehr & Peers is preparing transportation analysis for the City of Roseville General Plan Update and Qualified Climate Action Plan. The General Plan update was partially motivated by the need to comply with SB 743 and the State's guidance on complete streets and financial constraints for the circulation element. Fehr & Peers will be leading the City through key decisions on the methodology, thresholds, and feasible mitigation for VMT analysis as well as how to treat LOS analysis in the future as part of development review.

Davis Amtrak Station (Davis, CA)
Fehr & Peers completed the Davis Amtrak Station Access and Mobility Study to evaluate multimodal access to the station. The project looked at future technology trends and their effects. Finally the project created development alternatives for improvements to the site and surrounding transportation infrastructure.

University Mall EIR (Davis, CA)
Fehr & Peers prepared a transportation impact study in support of the University Mall Redevelopment Project EIR in Davis, CA. Located immediately across Russell Boulevard from the UC Davis campus, the proposed project is comprised of a modernization of the existing on-site retail uses as well as the addition of college student housing.

West Davis Adult Community EIR (Davis, CA)
Fehr & Peers prepared a transportation impact study for a proposed active-adult community located in west Davis, CA.

City of Elk Grove General Plan Update (Elk Grove, CA)
Fehr & Peers is assisting the City of Elk Grove with their comprehensive General Plan update, including the transportation impact section for the General Plan EIR. The work also includes update to the transportation impact fee program. This work involves innovative new analysis for SB 743 compliance and techniques for establishing development policy guidelines for new growth areas. The analysis will support the establishment of VMT thresholds that reflect the general plan’s envisioned future, resulting from the land use and circulation elements.

UC Davis Aggie Square EIR (Davis, CA)
As a subconsultant, Fehr & Peers assisted with the preparation of a CEQA strategy and methodology memorandum in preparation for the UC Davis Aggie Square EIR effort.

ROBERT WILLIAM DAVIS

105 E Street, Apt 3E
Davis, CA 95616
(530) 564-9861
robbathome@gmail.com

Over a 30-year career in community-based health programming in underserved communities in 30+ nations around the world, in non-profit and municipal leadership, in private consulting, and at three universities, I have developed skills and competencies in the following areas:

- Curriculum and training design and facilitation for dialogue-based education across many disciplines—training in diverse settings from community groups to graduate students
- Conflict resolution—working in a variety of settings to support and train practitioners in principles of restorative justice, mediation, and conflict resolution
- Community-based participatory planning—engaging all community members in asset identification and problem-solving
- Mentoring and coaching students to develop skills and confidence in their technical practice in community-based programming and training.
- Program planning, monitoring, and evaluation in health, nutrition, and academic programming—with a focus on providing frontline practitioners with practical tools to track program progress
- Multi-disciplinary team building to solve complex social problems—forming and leading such teams
- Building healthy, strategic, and collaborative partnerships with implementing partners and discipline-specific technical advisors working in community-based programming
- Strategic planning—working in and facilitating work with non-profit boards and within a university leadership team
- Program and project planning, budget tracking, progress tracking (monitoring), and evaluation—working with program managers and frontline staff
- Fundraising—especially by connecting donors to a clear organizational vision
- Teaching—award-winning graduate-level teaching in a variety of disciplines (public policy advocacy, program planning and evaluation, dialogue education, research methods)

EDUCATION

Ph.D. in Population Dynamics. Johns Hopkins University Bloomberg School Public Health, Baltimore, MD, 1997.
Master’s in Public Health (MPH), Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, 1990.

LANGUAGES

Native English speaker; Fluent in French

PROFESSIONAL EXPERIENCE

Assistant Director of Student Expression, Center for Student Involvement, UC Davis
(August 2022 to Present)
Provide campus leadership and education regarding freedom of expression and campus policy in student-led activities and events.

Impact and Innovation Officer, Yolo Food Bank
(March 2021 to May 2022)
Develop and implement assessments of Food Bank programs including nutrition analysis and participant profiles in order to develop nutrition guidelines and propose new programming approaches.

Director, Intercultural Programs, Global Learning Hub, Global Affairs, UC Davis
(July 2019 to March 2021)
Direct Global Affairs' co- and extracurricular programming and events for student and scholar communities, assist in the execution of Global Affairs signature events, and catalyze new intercultural program/event development among constituent units across campus.

Special Populations Program Coordinator, Healthy Davis Together
(September 2020 to December 31, 2021)
Develop programming to deepen outreach for COVID-19 testing to hard-to-reach populations in Davis and surrounding communities.

Coronavirus Response Coordinator, Yolo Food Bank
(March 2020 to May 2020)
Develop and manage a novel, door-to-door food distribution for vulnerable populations affected by California's "stay at home" order; including organizing five distribution sites, managing over 150 volunteers weekly to distribute the food, developing safety protocols for volunteers and recipients, and tracking food distributed weekly.

International Student Advisor, Services for International Students and Scholars (SISS), UC Davis
(November 2016 to June 2019)
Advise on and produce documentation on various aspects of student visa requests and status maintenance for F-1 students including, but not limited to, dismissal procedures, optional and curricular practical training options, and on-campus employment, and record transfer. Train and regularly update staff campus-wide in immigration policies and regulations in a rapidly changing environment. Help lead Global Affairs strategic planning efforts and support SISS' emerging strategic planning efforts

Mayor, City of Davis (Mayor Pro-Tempore from July 2014 to June 2016)
(July 2016 to July 2018—part time)
Define and advance strategic priorities and policies for the City and supervise the work of the City Manager to achieve City Council goals—specifically related to housing, active transportation, fiscal transparency, police oversight, University/City relations, homelessness, and infrastructure maintenance.

Temporary Scholars' Assistant and Interim Student Intake Advisor, Services for International Students and Scholars (SISS), UC Davis
(December 2015 to November 2016)
Assist in the preparation of all documentation related to J-1/F-1 visa requests for scholars and students and communication with Departmental contacts and scholars and students related to requests.

Consultant and Trainer
(September 2010 to present)
Revolutionize training approaches and program monitoring and evaluation strategies in non-profits and businesses and at UC Davis (working with student advising staff across the campus)

Transitional Housing Shelter Staff—Davis Community Meals (DCM)
(October 2011 to June 2014)
Position individuals transitioning out of homelessness to achieve success in their individual plans.

Adjunct Faculty, Eastern Mennonite University's Summer Peacebuilding Institute
(Annually from May 2002 to May 2010)
Support graduate students from over 25 nations around the world to advance strategic peacebuilding efforts in their communities.

Koy Saephan, Founder/CEO, Excel Interpreting & Translating

1804 Tribute Road, Suite 210, Sacramento, CA 95815
koy@excelinterpreting.com, 916-412-4555

Koy Saephan, a former Mien refugee from Laos, founded Excel Interpreting & Translating (Excel) in 2010. She studied English Literature and earned her BA from the University of Los Angeles, California. She has worked as a professional interpreter and teacher and studied law for two years, before deciding to start her language company.

Ms. Saephan's professional interpreting career began in 2000, when she took and passed the California Judicial Council Court Interpreter Exam. She worked as a contract interpreter; freelancing until 2004 when she was hired by Sacramento County Superior Court as a full-time Mien interpreter. Before and after her position with Sacramento County, Ms. Saephan covered many interpreting and translating assignments in the education setting, including interpretation on a water resource project targeting farmers in the Central Valley.

Excel provides services in four core settings throughout California: government agencies, social services, education, and healthcare, including projects related to farming and water use. Excel realizes that translation is much more than replacing words in one language with the equivalent in another. It is about the intended message and the tone that the author of the source materials is trying to get across. It is about being accurate, not only with the data and statistics, but also with the many nuances that make language unique and understandable to those who speak it. In addition to exceptional interpreting services, Excel specializes in delivering culturally competent translation services in over 100 languages, with expertise in local, state, and federal government projects.

Strengths

- Experience since 2010, with strong references
- Offering 265 languages, including *ASL (and CDI)*
- Strong interpreter pool, capable as a single-source vendor
- Ability to meet high volume in all requests made, including last-minute
- 100 out of 100 job requests are filled, with a 98% successful completion rate
- Provide monthly metrics and reports on performance and language use
- Services available during all hours and days of the week, per scope of work, 24/7/365
- Flexible process - requests can be made by phone, email, or via an online client log-in portal
- Accountability and satisfaction for all jobs covered, with full written reports and complaint resolution within 24-48 hours
- Stringent Annual Compliance Medical Audits by medical clients (including Anthem of California)
- Live (and online) scheduling available, customizing our process to meet your needs
- Project Manager with many years of interpreting, teaching, and scheduling experience
- Confidentiality & HIPAA Training and Certificate
- Cultural Competency Training
- Finger printing and background clearance
- Never been debarred or suspended from language service contracts, public or private
- Founder/CEO heavily involved in local; community-based organizations
- Scholarships for students graduating as second language learners

Relevant Projects

Document Translation and In-Person Interpretation, San Juan Unified School District. Excel provided document translation and in-person interpretation to the English Learner and Multicultural Department at San Juan Unified School District. Services were for for students and parents with language assistance needs in school settings.

Document Translation and In-Person Interpretation, Agricultural Labor Review Board (ALRB). Excel provided certified in-person interpretation and document translation services for hearings involving limited-English-proficient individuals.

Document Translation and On-Site Interpretation, Alameda County Social Services Agency. Excel provided document translation and on-site interpretation services.

Education

University of Los Angeles
BA, English Literature

APPENDIX B

Sample Work Products

Carbon Storage and Sequestration Study

San Diego County

MARCH 2022

Prepared for:

SAN DIEGO ASSOCIATION OF GOVERNMENTS
401 B Street, Suite 800
San Diego, California 92101
Contact: Anna Van and Allison Wood

Prepared by:

DUDEK

605 Third Street
Encinitas, California 92024
Contact: Mike Howard and Jennifer Reed

Printed on 30% post-consumer recycled material.

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FIGURES

APPENDIX

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
CalEEMod	California Emissions Estimator Model
CARB	California Air Resources Board
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DOC	California Department of Conservation
EVC	existing vegetation cover (LANDFIRE)
EVH	existing vegetation height (LANDFIRE)
EVT	existing vegetation type (LANDFIRE)
GHG	greenhouse gas
GWP	global warming potential
MT	metric ton
N_2O	nitrous oxide
SANDAG	San Diego Association of Governments

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Executive Summary

The San Diego Association of Governments, with funding provided by the California Department of Conservation, prepared this study to evaluate the historic and projected carbon storage and sequestration of the natural and working lands of San Diego County, California, to guide policy decisions and management actions to meet climate goals.

Carbon is stored in the vegetation and soils of natural and working (i.e., agricultural) lands, and greenhouse gas emissions are generated from certain land cover/land use types. To estimate historic carbon storage and emissions in San Diego County, estimated carbon density values and emission rates, based on authoritative existing sources, were assigned to the land cover and soil types based on existing resource mapping. Based on the trend in carbon storage and emissions from the two historic reference years (2001 and 2016), future carbon storage and emissions for the natural and working lands of San Diego County were projected for the forecast year of 2050, which is referred to as the baseline reference scenario.

Based on this study's carbon inventory, total landscape carbon storage in San Diego County was approximately 254,600,000 metric tons of carbon dioxide equivalent (MT CO_2e) in 2001, and approximately 238,500,000 MT CO_2e in 2016, which is a 6.3% decline over the 15-year historic reference period. Total annual greenhouse gas emissions, from land cover emissions only, declined by 0.9% over the reference period from approximately 103,000 MT CO_2e per year in 2001 to 89,104 MT CO_2e per year in 2016. Projecting this trend to the 2050 forecast year under the baseline reference scenario, total landscape carbon storage for San Diego County was estimated to be 203,531,831 MT CO_2e, which is a projected 14.7% decline in total landscape carbon storage in 2050 relative to 2016. Total annual greenhouse gas emissions, from land cover emissions only, for the 2050 forecast year for San Diego County was estimated to be 35,921 MT CO_2e per year, which is a projected 59.7% reduction in annual greenhouse gas emissions in 2050 relative to 2016 based on the reference period trend.

Managing and maintaining carbon storage in natural and working lands has numerous complementary benefits, including agricultural land quality, conserved lands, water quality, flood risk, and biodiversity, among others, and future landscape carbon storage and sequestration can be influenced by various management activities and development scenarios. Land management activities can reduce or remove emissions from agricultural lands, increase carbon storage and sequestration through active habitat restoration of high-carbon-density land covers, maintain carbon persistence on the landscape through fire management, maintain landscape carbon storage through avoided conversion to lower-carbon-density land covers, and increase carbon storage and sequestration through urban tree planting. Alternate development scenarios in San Diego County can improve the landscape carbon storage trajectories relative to the baseline reference scenario, as demonstrated under the development-only scenario, which projected a total carbon storage of 237,922,447 MT CO_2e by 2050 (a 16.9% improvement above the baseline reference scenario), and under the moderated baseline scenario, which projected a total carbon storage of 211,694,393 MT CO_2e to 225,355,532 MT CO_2e (a 4.0% to 10.7% improvement above the baseline reference scenario).

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1 Introduction

1.1 Purpose and Funding

The San Diego Association of Governments (SANDAG) developed San Diego Forward: The 2021 Regional Plan (2021 Regional Plan), which is the long-term blueprint for the San Diego region that seeks to meet regulatory requirements; address traffic congestion; and create equal access to jobs, education, healthcare, and other community resources (SANDAG 2021a). As part of the implementation actions of the 2021 Regional Plan, SANDAG has been exploring nature-based climate solutions and the implications of land use and management on the carbon storage of natural and working (i.e., agricultural) lands.

This carbon storage and sequestration study was prepared for San Diego County, California, to explore the carbon storage and sequestration potential of the natural and working lands. This study was funded by SANDAG through a grant from the California Department of Conservation (DOC) under the California Drought, Water, Parks, Climate, and Coastal Protection and Outdoor Access for All Act of 2018 (Proposition 68). This study was originally designed to use a DOC geoprocessing and analysis tool, referred to as TerraCount, that was piloted for Merced County for use in understanding the impacts of land use and land cover change on carbon storage (DOC and TNC n.d.). Ultimately, this study was conducted using standard GIS geoprocessing and analysis approaches without employing the TerraCount tool, and, regardless of the tools used, the study achieved its goals of providing carbon storage and sequestration findings that will aid in planning and policy development for San Diego County.

1.2 Content and Process

This carbon storage and sequestration study followed a stepped process, as guided by the pilot Merced County TerraCount Study. The elements and process of the study are summarized as follows:

Background (Section 2). This study provides a background discussion that explains the technical basis for carbon storage and sequestration, including vegetation carbon sequestration, the natural carbon cycle, and carbon pools. Section 2 also presents a summary of greenhouse gas (GHG) emissions and climate change to understand the metrics used in this analysis and provide the foundation of why carbon storage matters in the context of climate change.

Landscape Carbon Inventory (Section 3). The first step in the study process was to estimate landscape carbon stocks and land-based GHG emissions across the entire jurisdiction, which is San Diego County. These carbon stocks and emission flows were estimated from publicly available, regularly updated spatial data sets on land cover, land use, crop type, climate zone, and soil type, combined with well-documented conversion factors that relate these parameters to carbon concentrations and GHG emission rates. The data sets used allow for the inventory to be conducted at multiple points in time, which supports the second step in the process, development of the baseline reference scenario. This landscape carbon inventory is intended to be used by SANDAG to evaluate past trends and explore the implications of future land use scenarios and land management actions on carbon storage and sequestration (i.e., carbon accumulation over time).

Baseline Reference Scenario (Section 4). The baseline reference scenario was the second step in the process, which is a linear extrapolation of past trends in landscape carbon stocks and land-based GHG emissions. The baseline reference scenario represents a business-as-usual scenario, in which carbon stocks and emissions continue to change at a projected rate. Baseline scenarios based on the trends observed from 2001 through 2016 can be extrapolated to a forecast year to evaluate the changes in carbon storage. The year 2050 was selected to be the forecast year for this study's baseline reference scenario, consistent with SANDAG's 2021 Regional Plan future projections. Establishing a baseline reference scenario is important as a way to estimate the trajectory of carbon stocks and GHG emissions to thereby identify and prioritize efforts to increase landscape carbon stocks or reduce land-based GHG emissions, such as land use policy changes and implementation of agricultural and land management activities.

Complementary Benefits (Section 5). The third step in the process was the complementary benefits assessment, which identifies distinct benefits provided by natural and working landscapes. Although natural and working lands provide many more benefits than presented herein, this analysis identifies key complementary benefits that may be experienced in the San Diego region when successfully maintaining or improving natural and working landscapes.

Forecasting (Section 6). The fourth and last step in the analysis process was forecasting, which evaluated potential alternate carbon storage outcomes for the 2050 forecast year that could result from implementation of land management activities that increase carbon storage and sequestration, and through effecting different development scenarios/trends than was assumed in the baseline reference scenario. Section 6.1 explores the potential for carbon storage and sequestration of various land management activities, such as oak and riparian restoration or avoided conversion to urban, and Section 6.2 evaluates different development scenarios, such as the 2021 Regional Plan and Sustainable Communities Strategy (SANDAG 2021a), that would result in increased carbon storage above that predicted by the baseline reference scenario.

Conclusion (Section 7). The conclusion presents a general summary of the study results.

Limitation, Challenges, and Future Consideration (Section 8). In an effort to help benefit future similar analyses, this study concludes with a discussion of limitations and challenges encountered during the analysis process, and provides future considerations and recommendations.

Acknowledgements and Preparers (Section 9). The process of developing this assessment included stakeholder coordination and input from the San Diego County Farm Bureau, SANDAG Environmental Mitigation Program Working Group, DOC TerraCount User Group, California Air Resources Board (CARB), and San Diego State University. This section acknowledges the individuals and agencies who assisted in preparation and guidance of this study.

References (Section 10). This report concludes with a list of references cited.

1.3 Intended Uses

The main use of this study is to help inform SANDAG's land use planning, support SANDAG's goal of implementing nature-based climate solutions, and ascertain the implications of land use and management on the carbon storage of natural and working lands, as noted above. This study may also be useful to help jurisdictions within San Diego County, namely cities and the County of San Diego, identify and implement natural carbon storage and sequestration GHG reduction measures in support of local GHG emission reduction plans or Climate Action Plans.

2 Background

2.1 Carbon Storage and Sequestration Background

Carbon sequestration is a fundamental process by which carbon dioxide (CO_2), which is a principal GHG, is removed from the atmosphere and stored in a carbon reservoir, such as vegetation. Vegetation (e.g., trees, shrubs, grasses) takes in CO_2 from the atmosphere during photosynthesis, breaks down the CO_2, stores the carbon within plant biomass, and releases the oxygen back into the atmosphere. Carbon storage capacity and sequestration rates vary across the landscape and are influenced by numerous intrinsic and extrinsic factors, such as vegetation and land cover types, vegetation stand age, land management regimes, and environmental factors.

The Earth's carbon cycle involves the exchange of carbon between the atmosphere, biosphere (plants, animals, and other life forms), hydrosphere (water bodies), pedosphere (soils), and lithosphere (Earth's crust and mantles, including rocks and fossil fuels). Carbon moves between land types (e.g., forests and grasslands) and carbon pools (e.g., wood, roots, and soils) due to natural processes (growth, decay, and succession) and disturbances (e.g., wildfire), or anthropogenic forces such as land use change (CARB 2018). "Carbon pools" include aboveground live biomass (boles, stems, and foliage in shrubs, trees, grasses, and herbaceous vegetation), aboveground dead biomass (standing or downed dead wood and litter), belowground live biomass (roots in shrubs, trees, grasses, and herbaceous vegetation), and soil organic matter (organic carbon in the top 30 centimeters of soil) (CARB 2018). Carbon inventories can provide stored carbon "snapshots," and give insight into the location and magnitude of natural and working lands' carbon stocks at discrete moments in time.

There is approximately 5,340 million metric tons of ecosystem carbon in the carbon pools that CARB has quantified. To put it into context, 5,340 million metric tons of carbon in land is equivalent to 19,600 million metric tons of atmospheric CO_2 currently existing as carbon in the biosphere and pedosphere as carbon cycles through the Earth's carbon cycle. Forest and shrubland contain the vast majority of California's carbon stock because they cover the majority of California's landscape and have the highest carbon density of any land cover type. All other land categories combined comprise more than 35% of California's total acreage, but only 15% of its carbon stocks. Roughly half of the 5,340 million metric tons of carbon resides in soils and half resides in plant biomass (CARB 2018).

2.2 Greenhouse Gases and Climate Change

A GHG is any gas that absorbs infrared radiation in the atmosphere; in other words, GHGs trap heat in the atmosphere. As defined in California Health and Safety Code, Section 38505(g), for purposes of administering many of the state's primary GHG emissions reduction programs, GHGs include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. Some GHGs, such as CO_2, CH_4, and N_2O, occur naturally and are emitted into the atmosphere through natural processes and human activities. Natural sources of CO_2 include respiration of bacteria, plants, animals, and fungus; evaporation from oceans; and decomposition of dead organic matter, in addition to anthropogenic changes in land use. CH_4 is produced through flooded rice fields, animal digestion, and decomposition of animal wastes, and sources of N_2O include soil cultivation practices (microbial processes in soil and water), especially the use of commercial and organic fertilizers, and manure management.

The effect each GHG has on climate change is measured as a combination of the mass of its emissions and the potential of a gas or aerosol to trap heat in the atmosphere, known as its global warming potential (GWP), which varies among GHGs. Total GHG emissions are expressed as a function of how much warming would be caused by the same mass of CO_2. Thus, GHG emissions are typically measured in terms of metric tons (MT) of carbon dioxide equivalent (CO_2e). The CO_2e for a GHG is derived by multiplying the mass of the gas by the associated GWP, such that MT of CO_2e = (MT of a GHG) × (GWP of the GHG). As applied herein, based on the Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC 2007), the GWP for CH_4 is 25, which means that emissions of 1 MT of CH_4 are equivalent to emissions of 25 MT of CO_2, and the GWP for N_2O is 298. In addition, the conversion of carbon to CO_2 is performed by multiplying the total carbon by the molecular weight ratio of CO_2 to carbon (44/12; 44 is the molecular weight of CO_2 and 12 is the atomic weight of carbon).

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, or wind patterns, lasting for an extended period of time (i.e., decades or longer). The Earth's temperature depends on the balance between energy entering and leaving the planet's system. Many factors, both natural and human, can cause changes in Earth's energy balance, including variations in the Sun's energy reaching Earth; changes in the reflectivity of Earth's atmosphere and surface; and changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere (EPA 2017).

The greenhouse effect is the trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. The greenhouse effect traps heat in the troposphere through a threefold process, as follows: Short-wave radiation emitted by the Sun is absorbed by the Earth, the Earth emits a portion of this energy in the form of long-wave radiation, and GHGs in the upper atmosphere absorb this long-wave radiation and emit it into space and toward the Earth. The greenhouse effect is a natural process that contributes to regulating Earth's temperature and creates a pleasant, livable environment on Earth. Human activities that emit additional GHGs into the atmosphere increase the amount of infrared radiation that gets absorbed before escaping into space, thus enhancing the greenhouse effect and causing Earth's surface temperature to rise.

The scientific record of Earth's climate shows that the climate system varies naturally over a wide range of time scales, and that, in general, climate changes prior to the Industrial Revolution in the 1700s can be explained by natural causes such as changes in solar energy, volcanic eruptions, and natural changes in GHG concentrations. Recent climate changes, in particular the warming observed over the past century, however, cannot be explained by natural causes alone. Rather, it is extremely likely that human activities have been the dominant cause of that warming since the mid-twentieth century, and are the most significant drivers of observed climate change (EPA 2017; IPCC 2013). Human influence on the climate system is evident from the increasing GHG concentrations in the atmosphere, positive radiative forcing, observed warming, and improved understanding of the climate system (IPCC 2013). The atmospheric concentrations of GHGs have increased to levels unprecedented in the last 800,000 years, primarily from fossil fuel emissions and secondarily from emissions associated with land use changes (IPCC 2013). Continued emissions of GHGs will cause further warming and changes in all components of the climate system.

Climate change from human activities is a global challenge that requires local participation, and reducing GHG emissions is a critical environmental and societal duty. Combating human-caused climate change and the detrimental effects globally requires ambitious efforts locally. The state has taken numerous actions to address climate change through executive orders, legislation, and CARB plans and requirements. Specifically, Executive Order S-3-05 (June 2005) established the statewide goal of reducing GHG emissions 80% below 1990 levels by 2050, Assembly Bill 32 provided initial direction on creating a comprehensive multiyear program to limit

California's GHG emissions at 1990 levels by 2020 and initiate the transformations required to achieve the state's long-range climate objectives, Senate Bill 32 (September 2016) codified the 2030 emissions reduction goal of Executive Order B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40% below 1990 levels by 2030, and Executive Order B-55-18 (September 2018) established a new statewide goal "to achieve carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions thereafter."

The importance of carbon storage and sequestration in the working and natural lands sector of California was emphasized in the 2017 Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Target (CARB 2017). The California Air Resources Board's 2017 Scoping Plan specified "California's climate objective for natural and working lands to maintain them as a carbon sink (i.e., net zero or negative GHG emissions), and where appropriate, minimize the net GHG and black carbon emissions associated with management, biomass utilization, and wildfire events." Two important state strategies for the natural and working lands sector are protection of land and land uses, and enhancement of carbon sequestration and resilience through management and restoration.

For California to meet its ambitious GHG reduction targets, state and local governments must work together as partners with landowners and land managers. In that spirit, the DOC joined with The Nature Conservancy and the County of Merced to produce the TerraCount GHG accounting method and scenario assessment tool.

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3 Landscape Carbon Inventory

3.1 Methods

3.1.1 Data Compilation and Processing

The first step in this assessment includes estimating a carbon inventory for the San Diego County region. The landscape carbon stock is the total amount of carbon stored in woody and herbaceous vegetation and soils. Some land management and agricultural activities can increase these stocks, drawing CO_2 out of the atmosphere; others, such as the development of natural lands for agriculture or urban uses, can result in a net release of carbon from vegetation and soils to the atmosphere (DOC and TNC n.d.). The landscape carbon inventory for natural and working lands was developed from several key land cover and soils datasets. The following describes the compilation and processing of these datasets for use in developing the landscape carbon inventory for San Diego County.

Land Cover

To explore changes in carbon storage over time, land cover datasets from two historical reference years were assembled for San Diego County. U.S. Geological Survey's LANDFIRE data is a nationwide, satellite-based land cover data product that covers the San Diego County region. LANDFIRE data was selected for this study because it is a standardized dataset using consistent remote sensing methods; it is updated regularly (i.e., 2001, 2008, 2010, 2012, 2014, 2016); and it includes data for land cover classes of existing vegetation types (EVT), existing vegetation cover (EVC), and existing vegetation height (EVH). Additionally, CARB developed carbon density values (Battles et al. 2013; CARB 2018; Gonzalez et al. 2015; Saah et al. 2016) linked to the LANDFIRE data (see Section 3.1.2 for a discussion on carbon density values).

The carbon inventory for San Diego County was conducted using historical LANDFIRE data from 2001 and 2016. LANDFIRE 2016 was selected as the end year to have one historical year as close as possible to current, existing conditions. LANDFIRE 2001 was selected as the beginning year to maximize the period between historical years over which the trend was developed. Additionally, regional factors, such as wildfire, were considered in the selection of data years. The 2003 Cedar Fire and 2007 Witch and Harris Fires were major incidents that burned substantial acreage of natural lands in San Diego County; therefore, selection of the 2016 reference year was considered preferable over 2010, 2012, or 2014 to minimize reference period trend effects resulting from wildfire effects. LANDFIRE data products were not available prior to 2001, and LANDFIRE 2016 was the latest data product available at the time of this study.

Although the 2001 and 2016 LANDFIRE datasets were the best reference years for San Diego County for this study, as described above, use of LANDFIRE 2016 presented some challenges due primarily to changes in the land cover type (EVT) classes. LANDFIRE 2016, also referred to as LANDFIRE Remap, was produced using new satellite imagery and new point and field data (LANDFIRE 2015). LANDFIRE 2016 is still comparable to previous LANDFIRE products and allows it to be used in monitoring change over time; however, most notably, LANDFIRE incorporates the National Vegetation Classification Standard for classifying EVT and includes additional map units to address non-natural land covers, such as urban, agriculture, barren, and water (LANDFIRE 2015; Picotte et al. 2019). Because the LANDFIRE 2016 EVT classes differ from those in LANDFIRE

2001, direct comparison of changes for all EVT types was not possible at the detailed level, but was possible using the assigned aggregated land cover classes, as described below.

The LANDFIRE 30-meter raster datasets (LANDFIRE 2001, 2016) were downloaded for San Diego County and processed and customized. The three datasets (EVT, EVC, EVH) for each data year were combined to create unique combinations of type, cover, and height. Each of the LANDFIRE types were aggregated and assigned to one of the 11 land cover classes: barren, forest, grassland, irrigated pasture, orchard, row crop, shrubland, urban, vineyard, water, and wetland. Additionally, agricultural mapping from LANDFIRE was augmented with statewide crop and land use mapping data maintained by the California Department of Water Resources (DWR 1999, 2016) and verified with County of San Diego crop reporting (County of San Diego 2001, 2016).

The land cover layers derived from this process were the geospatial foundation for assigning carbon stock and GHG emission values and the non-soils carbon pools for 2001 and 2016, as described in Section 3.1.2.

Soils

Soil mapping for the study area was based on the regional Soil Survey developed by the U.S. Department of Agriculture's Natural Resource Conservation Service for San Diego County and maintained and distributed by SanGIS (USDA 2020). Specific soil types were grouped into soil classes based on their soil properties and climate zone, including mineral soils (i.e., high activity clay and low activity clay), sandy soils, volcanic soils, and organic soils, consistent with the U.S. Environmental Protection Agency's GHG inventory methods (EPA 2018). As described by the Intergovernmental Panel on Climate Change's Guidelines for National GHG Inventories (IPCC 2006), "over time, soil organic carbon reaches a spatially-averaged, stable value specific to the soil, climate, and land-use and management practices." Therefore, the carbon in undisturbed soils would be expected to be stable, whereas soils subject to frequent disturbance, like croplands, would retain less carbon. The soil class data was processed into the same 30-meter raster as the LANDFIRE datasets.

Land Cover – Soils Composite

For the 2001 and 2016 data years, the land covers (EVT, EVC, and EVH) and soils were combined to create a composite layer for assigning carbon density values. For 2001, there were 444 unique combinations of land cover and soils in the composite layer. For 2016, there were 769 unique combinations of land cover and soils in the composite layer. The difference in unique combinations between the two reference years was due to changes in land cover over the reference period and differing LANDFIRE classifications.

3.1.2 Carbon Density and Emissions

Carbon inventories for San Diego County in 2001 and 2016 were developed by assigning carbon density values to the non-soil (i.e., aboveground live, aboveground dead, and belowground live) and soil carbon pools. Additionally, an inventory of the estimated N_2O and CH_4 emissions from the land cover types was developed.

A review of authoritative international, national, and state sources was conducted to identify the best and most appropriate carbon density values (typically expressed in units of MT of carbon per acre) to assign to non-soil and soil pools and GHG emissions. International (e.g., IPCC 2006) and national (e.g., EPA 2018 or the Forest Inventory and Analysis Program's EVALIDator tool [USFS 2019]) provide coarse approximations of carbon density values and generally do not provide data specific to the land cover types in San Diego County. CARB has actively been working to develop more accurate carbon density values for California (e.g., Battles et al. 2013; CARB 2013, 2018; Gonzalez et al. 2015; Saah et al. 2016). This study used CARB-provided carbon density values directly linked to LANDFIRE EVT, EVC, and EVH datasets for 2001, 2008, 2010, and 2014 data years for San Diego County. For new or novel classes in the LANDFIRE 2016 dataset (see Section 3.1.1), the carbon stock values from previous data years were crosswalked to the LANDFIRE 2016 classes. For soil carbon, carbon density values for the unique soil class/climate zone/land use combinations (i.e., mineral soils [high activity clay and low activity clay], sandy soils, volcanic soils, and organic soils) were assigned following the approach used in U.S. Environmental Protection Agency's Inventory of U.S. Greenhouse Gas Emissions and Sinks (EPA 2018).

The assignment of N_2O and CH_4 emissions depended on the land cover type. Consistent with the approach taken for the inventory conducted for Merced County (DOC and TNC n.d.), N_2O emission values were assigned to agricultural land cover types[1] and CH_4 emissions were assigned to wetland vegetation types.[2] Potential N_2O and CH_4 emissions from other land cover types were excluded from the inventory because they were not anticipated to occur in substantial quantities.

3.2 Inventory

3.2.1 Land Cover

The 2001 and 2016 LANDFIRE datasets used for the San Diego County carbon inventory are shown, by land cover class, in Figure 1. Table 1 provides a summary of the 2001 and 2016 land cover datasets by land cover class in the San Diego County study area.

Over the period from 2001 through 2016, natural land acreage (i.e., forest, grassland, shrublands, water, and wetland) decreased by 5.2% (approximately 95,000 acres), agricultural land acreage (i.e., irrigated pasture, orchard, row crop, and vineyard) decreased by 43% (approximately 44,000 acres), and barren and developed land cover increased by 17% (approximately 138,000 acres). Note that the classification system was modified slightly between LANDFIRE 2001 and LANDFIRE 2016, resulting in reclassification of certain ruderal grassland types from grassland to urban. Additionally, the increase in wetland in 2016 is largely the result of LANDFIRE reclassifications because wetland areas were not properly classified as wetlands in the 2001 dataset but were correctly classified as wetlands in the 2016 dataset.

1 Annual croplands, orchards/vineyards, and managed pasture typically receive nitrogen additions in the form of synthetic nitrogen fertilizer and/or organic nitrogen amendments, such as manure or compost. All sources of nitrogen in soils, including fertilizers, manures, plant residues, and biologically fixed nitrogen, contribute to soil N_2O emissions via denitrification and nitrification processes. Agricultural lands receiving high nitrogen additions produce larger N_2O emissions than lands where the main source of nitrogen is biological fixation, such as extensive rangelands (grasslands). A variety of factors influence the quantity of nitrogen that is converted to N_2O, including soil moisture, soil oxygen content, temperature, crop type, the type of fertilizer, and various properties of the soil itself. Nitrogen amendment practices change over time due to economic, regulatory, and other factors, which are not evaluated herein (DOC and TNC n.d.).

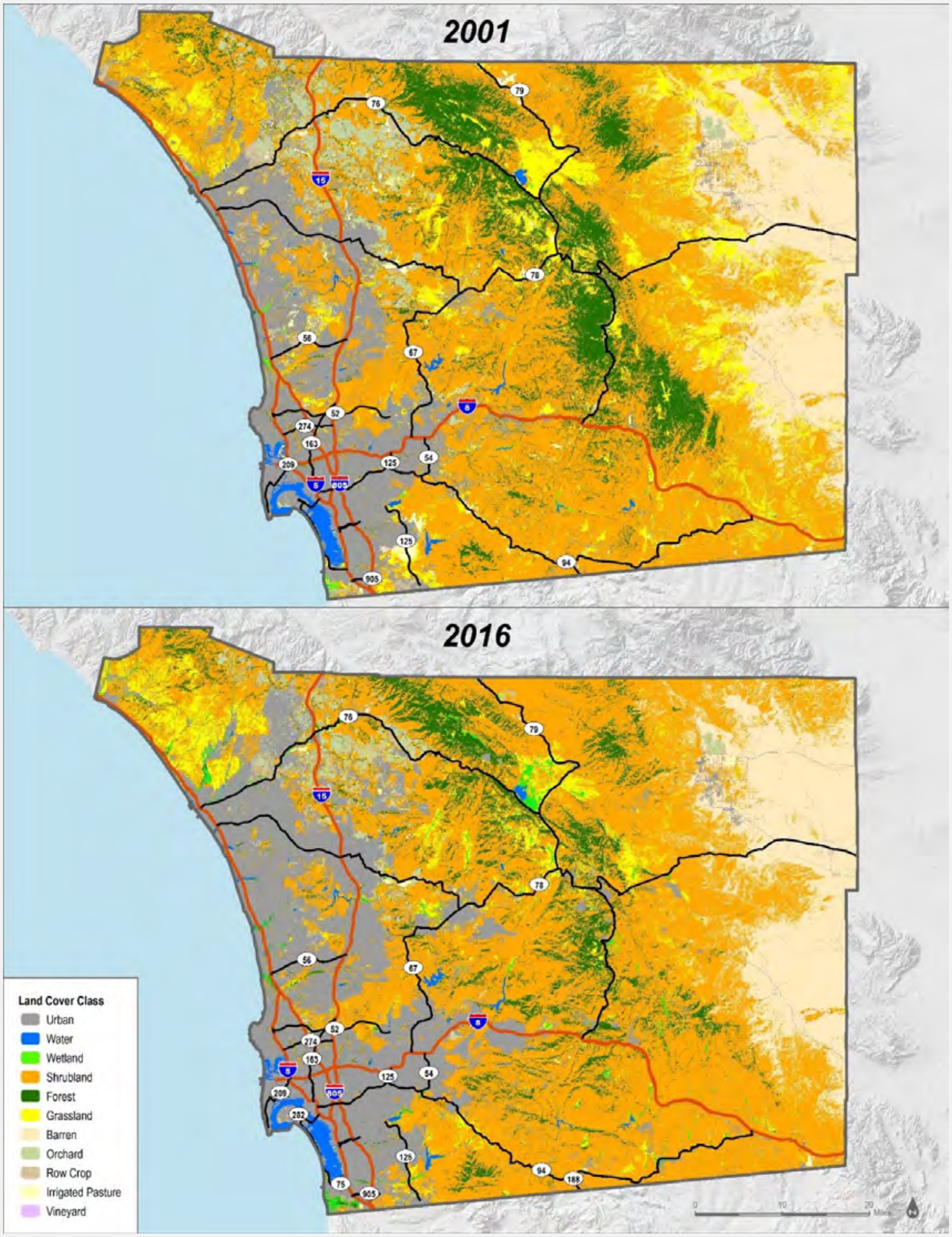
2 Wetlands emit methane from the decomposition of organic matter (DOC and TNC n.d.). Wetlands that are continuously inundated—wet year-round—have estimated methane emissions of 5.8 MT CO_2e per acre, while intermittently inundated wetlands have estimated methane emissions of 1.3 MT CO_2e per acre (2013 supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands). Consistent with the Merced County TerraCount Study, 5% of the wetlands were assumed to be continuously inundated, and 95% were assumed to be intermittently inundated for a prorated level of methane emissions of 1.5 MT CO_2e per acre of wetland.

Table 1. Land Cover Summary by Land Cover Class for 2001 and 2016

Land Cover Class	2001 Acres	2016 Acres	Annual Trend
Barren	334,684	348,341	0.3%
Forest	279,758	199,831	–1.9%
Grassland	244,539	117,419	–3.5%
Irrigated Pasture	17,973	3,295	–5.4%
Orchard	54,407	36,781	–2.2%
Row Crop	29,544	17,585	–2.7%
Shrubland	1,265,291	1,357,890	0.5%
Urban	473,639	598,200	1.8%
Vineyard	139	880	35.4%
Water	22,573	23,388	0.2%
Wetland	4,570	23,507	27.6%
Total Acres	**2,727,116**	**2,727,116**	—

Notes: Based on the customized LANDFIRE 2001 and LANDFIRE 20016 datasets for San Diego County. The classification system was modified slightly between LANDFIRE 2001 and LANDFIRE 2016, resulting in reclassification of certain ruderal grassland types from grassland to urban. Additionally, the increase in wetland in 2016 is largely the result of LANDFIRE reclassifications.

Figure 1. 2001 and 2016 Land Covers by Land Cover Class

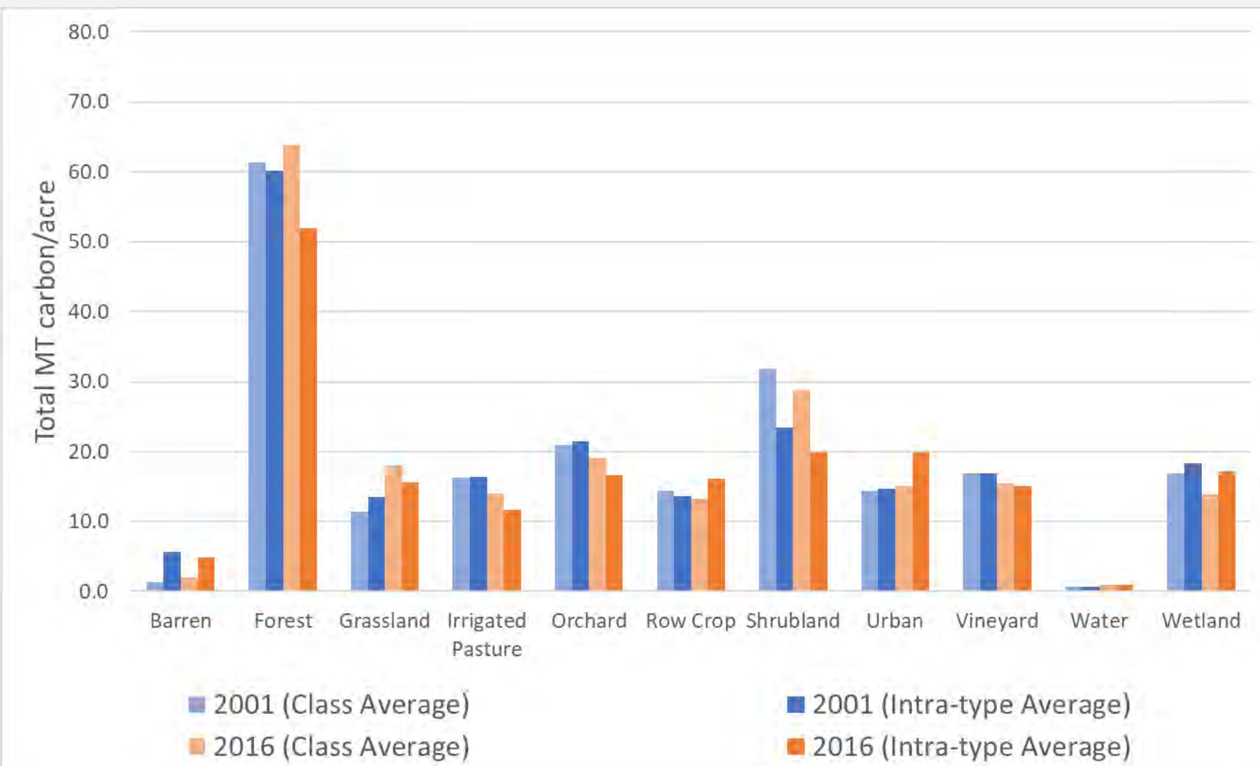


3.2.2 Carbon Storage and Emissions

Carbon density values were assigned to the unique combinations of the LANDFIRE land cover data and the soils data for the 2001 and 2016 inventory years, as described in Section 3.1, Methods. The assigned carbon density values vary across all land cover and soil types; however, for summary purposes, Figure 2 shows the average carbon density for each of the land cover classes for 2001 and 2016, in MTs of carbon per acre, using an overall average of each land cover class (class average) and using an average of each land cover type within each land cover class (intra-type average).

Using the methods described in Section 3.1, a carbon inventory was built for the 2001 and 2016 reference years. These are inventories of carbon stored in the landscape and are expressed in units of MT CO_2e for ease of comparison with other GHG inventories.

Figure 2. Land Cover Class Average and Intra-Type Average Total Carbon Density for 2001 and 2016



Overall, based on this landscape inventory, carbon storage in San Diego County declined by 6.3% over the 15-year assessment period from approximately 254,600,000 MT CO_2e in 2001 to 238,500,000 MT CO_2e in 2016. Carbon stored in natural lands decreased by 9.9%, and carbon stored in agricultural lands decreased by 46.5% over this period, while carbon stored in barren and urban lands increased by 33.6%. In the natural lands, forests and shrublands account for the largest carbon losses over this period, with 16,100,000 MT CO_2e and 4,300,000 MT CO_2e decreases, respectively. Average carbon densities in the forest and shrubland vegetation types also decreased over this period, which is indicative of a shift to vegetation that is less dense, potentially due to drought or mortality, and with less height, potentially due to type conversion, disturbance, or mortality. The study area was also affected by large-scale fires over this period, in 2003 and 2007, which are reflected in both the land cover and carbon inventory for San Diego County. Table 2 provides the landscape carbon inventory for 2001 and 2016 for San Diego County summarized by land cover class. Figure 3 depicts the spatial distribution of total carbon storage across San Diego County. The detailed 2001 and 2016 carbon inventories are provided in Appendix A.

Table 2. Landscape Carbon Storage Inventory Summary for 2001 and 2016

Land Cover Class	2001 Total Carbon Storage (MT CO_2e)	2016 Total Carbon Storage (MT CO_2e)	Annual Trend
Barren	1,594,260	2,602,038	4.2%
Forest	62,970,382	46,830,230	–1.7%
Grassland	10,228,152	7,806,193	–1.6%
Irrigated Pasture	1,071,184	169,076	–5.6%
Orchard	4,170,753	2,573,414	–2.6%
Row Crop	1,560,182	854,521	–3.0%
Shrubland	147,559,228	143,267,417	–0.2%
Urban	25,100,284	33,064,922	2.1%
Vineyard	8,645	49,896	31.8%
Water	58,921	78,740	2.2%
Wetland	282,978	1,203,641	21.7%
Total	**254,604,968**	**238,500,087**	**–0.4%**

Notes: Carbon densities assigned to the customized LANDFIRE 2001 and LANDFIRE 2016 datasets for San Diego County are based on IPCC 2006, EPA 2018, CARB 2018, Saah et al. 2016, Gonzalez et al. 2015, and Battles et al. 2013, expressed in metric tons of carbon dioxide equivalent (MT CO_2e). Includes the non-soil (i.e., aboveground live, aboveground dead, litter, and belowground live) and soil carbon pools. As noted in regard to the land cover mapping that supports this carbon inventory, the increase in wetland in 2016 is largely the result of LANDFIRE reclassifications. These inventories of carbon stored in the landscape are expressed in units of MT CO_2e for ease of comparison with other GHG inventories.

Table 3 provides the annual GHG (N_2O and CH_4) emissions summary for 2001 and 2016 for San Diego County by land cover class from two general sources: N_2O from nitrogen additions associated with agricultural land (managed pasture grasslands, irrigated pastures, orchards, vineyards, and row crops) and CH_4 from decomposition of organic matter in wetlands. GHG emissions from other sources are not included in Table 3, consistent with the inventory prepared for the County of Merced (DOC and TNC n.d.). SANDAG prepares a separate regional GHG emissions inventory as part of their Regional Plan. Annual GHG emissions declined by 0.9% over the assessment period largely due to the decrease in land cover of grassland and agriculture.

Table 3. Annual Greenhouse Gas Emissions Summary for 2001 and 2016

Land Cover Class	2001 Total Annual Greenhouse Gas Emissions (MT CO_2e per year)	2016 Total Annual Greenhouse Gas Emissions (MT CO_2e per year)	Annual Trend
Barren	—	—	—
Forest	—	—	—
Grassland	5,943	2,854	–3.5%
Irrigated Pasture	15,835	2,903	–5.4%
Orchard	43,525	29,425	–2.2%
Row Crop	30,793	18,328	–2.7%
Shrubland	—	—	—
Urban	—	—	—
Vineyard	51	324	35.4%
Water	—	—	—
Wetland	6,857	35,270	27.6%
Total	**103,005**	**89,104**	**–0.9%**

Notes: Greenhouse gas (N_2O and CH_4) emissions assigned to certain land cover types based on (DOC and TNC n.d.), expressed in metric tons of carbon dioxide equivalent per year (MT CO_2e per year). As noted in regard to the land cover mapping that supports this carbon emissions accounting, the increase in wetland in 2016 is largely the result of LANDFIRE reclassifications.

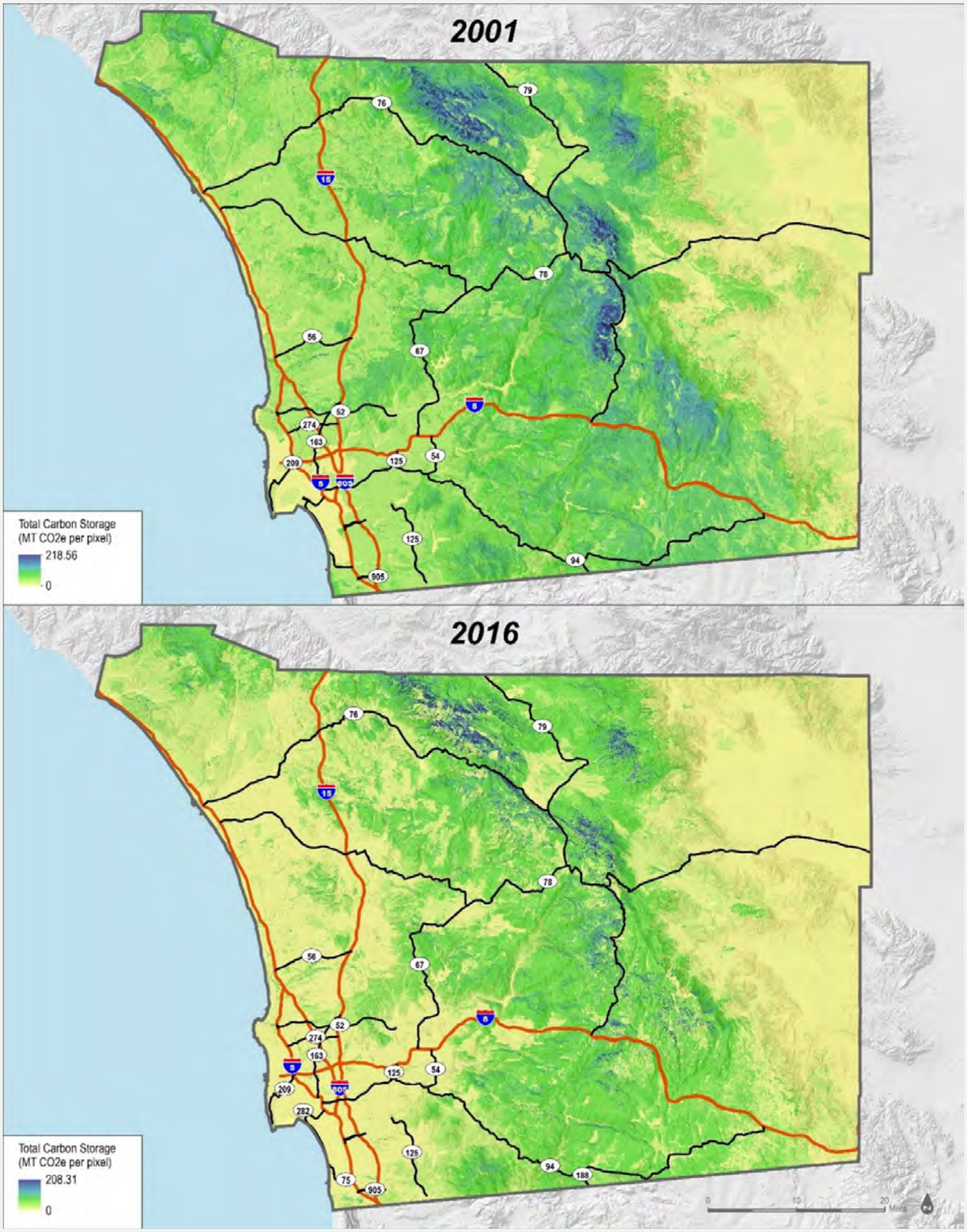
3.3 Discussion

San Diego County natural and working lands, including urban landscapes, stored approximately 238,500,000 MT CO_2e in 2016, which was a 6.3% decline from the inventoried storage in 2001. Based on a review of the inventory, this decline in carbon storage over the inventory period may be attributed to the following:

- The loss of forest and shrublands to fire, including the major fires of 2003 and 2007, and the subsequent conversion of those areas to other, less-dense vegetation types and younger age classes.
- The conversion of higher-carbon-density vegetation types to lower-carbon-density vegetation types as a result of drought, pests/disease, invasive species, and climate change.
- Land use changes resulting in the conversion of higher-carbon-density natural lands to lower-carbon-density urban and barren lands.
- Land use changes resulting in the conversion of higher-carbon-density agricultural lands to lower-carbon-density urban and barren lands.

For context, Merced County, which is approximately one-half the size of San Diego County, conducted a similar inventory and estimated carbon storage to be approximately 50,800,000 MT CO_2e based on 2014 data (DOC and TNC n.d.). Merced County is dominated by agricultural lands and grasslands. Sonoma County, a county dominated by forest and shrublands that is a little more than one-third the size San Diego County, estimated a carbon storage of 230,000,000 MT CO_2e based on 2014 data (TNC 2016).

Figure 3. 2001 and 2016 Total Landscape Carbon Storage



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4 Baseline Reference Scenario

The baseline reference scenario is intended to be an extrapolation of past trends in landscape carbon stocks and land-based GHG emissions to present a business-as-usual scenario, whereas carbon stocks and GHG emissions continue to change at a projected rate. The year 2050 was selected to be the forecast year for this study's baseline reference scenario, consistent with SANDAG's 2021 Regional Plan future projections. Establishing a baseline reference scenario is important as a way to estimate the trajectory of carbon stocks and GHG emissions to thereby identify and prioritize efforts to increase landscape carbon stocks or reduce land-based GHG emissions, such as land use policy changes and the implementation of agricultural and land management activities.

The carbon inventory (Section 3.2) was developed by assigning carbon densities to the unique combinations of the detailed land covers (EVT, EVC, and EHV) and soils (444 unique combinations in the 2001 reference year; 769 unique combinations in the 2016 reference year), which were then aggregated for summary purposes into the broad land cover classes (see Table 2). The trends observed from 2001 through 2016 were used to extrapolate out to the forecast year (2050) to develop the baseline reference scenario for this study.

Due to the variability and differences in the number and types of unique combinations between 2001 and 2016 for the detailed land covers and soils, extrapolating the carbon trend from the reference years to the forecast year was done at the broad land cover class level. This land cover class trend extrapolation was the same approach used by the Merced County and Sonoma County studies (DOC and TNC n.d.; TNC 2016).

A number of challenges were encountered in developing the baseline reference scenario based on the 2001 to 2016 trend:

- The reference period (2001 to 2016) was characterized by a substantial increase in urban development and decrease in grassland and agricultural land uses. Using the baseline reference scenario trend, carbon storage in urban areas would roughly double from 2001 to 2050, the carbon storage in grasslands would be one-fifth that of 2001 in 2050, and carbon storage in agricultural land use types (except vineyards) would be eliminated prior to 2050. Although the observed change over the reference period was considered a real change on the landscape in San Diego County, this trend may not be expected to continue at this rate out to the forecast year.
- Significant wildfires occurred in San Diego County between 2001 and 2016, including two of the 20 largest fires on record in California: the 2003 Cedar Fire (273,246 acres) and the 2007 Witch Fire (197,990 acres) (CAL FIRE 2021). Based on data maintained by the California Department of Forestry and Fire Protection (CAL FIRE), more than 35% of San Diego County burned in wildfires over the reference period. As such, wildfires during the trend period resulted in real differences in the landscape between 2001 and 2016, which were reflected in the LANDFIRE datasets, including notable declines in forest land cover types and corresponding increases in shrubland land cover types. Although wildfire is a persistent threat to carbon storage on the landscape in San Diego County, the trend over the reference period presented challenges to projecting out to the forecast year for these land cover classes.
- Water and wetland land cover types increased considerably over reference period due to changes in how LANDFIRE classified these land cover types; however, this trend was not considered to be a real change on the landscape, and was addressed accordingly in the baseline reference scenario projection.

The trend extrapolation was conducted at the land cover class level using a carbon-based extrapolation approach. The carbon-based extrapolation approach used the trend in the change in carbon storage and annual carbon emissions in each land cover class between the reference years and extrapolated that to the forecast year. This was the approach used for the studies of Merced and Sonoma Counties (DOC and TNC n.d.; TNC 2016). The forecast year estimate under this approach assumed that carbon storage and emissions change in each land cover class would be proportional to the change observed during the reference period.

For some land cover classes (i.e., irrigated pasture, orchard, and row crop), the trend resulted in zero carbon storage/emissions prior to 2050, and the carbon storage/emissions estimates for these classes were held at zero for the forecast year. Additionally, carbon storage for the water land cover class and carbon storage/emissions for the wetland land cover class were maintained at the 2016 levels, assuming that the trend observed during the reference period for these land cover classes as a relic of the LANDFIRE classification changes and not real changes on the landscape.

Under the baseline reference scenario, total landscape carbon storage for the forecast year for San Diego County was estimated to be 203,531,831 MT CO_2e. This represents a projected 14.7% reduction in total landscape carbon storage in 2050 relative to 2016 based on the reference period trend. Table 4 provides a summary of landscape carbon storage for the 2050 baseline reference scenario by land cover class for San Diego County. Under the baseline reference scenario, total annual GHG emissions for the forecast year for San Diego County was estimated to be 35,921 MT CO_2e per year. This represents a projected 59.7% reduction in annual GHG emissions in 2050 relative to 2016 based on the reference period trend. Table 5 provides a summary of the GHG emissions for the 2050 baseline reference scenario by land cover class for San Diego County. Figures 4a and 4b provide comparisons of the landscape carbon storage and annual emissions for the reference years and 2050 baseline reference scenario.

Table 4. Landscape Carbon Storage for the 2050 Baseline Reference Scenario

Land Cover Class	2001–2016 Total Carbon Storage Annual Trend	2050 Total Carbon Storage (MT CO_2e)
Barren	4.2%	4,886,332
Forest	–1.7%	10,245,885
Grassland	–1.6%	2,316,418
Irrigated Pasture	–5.6%	0
Orchard	–2.6%	0
Row Crop	–3.0%	0
Shrubland	–0.2%	133,539,312
Urban	2.1%	51,118,103
Vineyard	31.8%	143,399
Water	0%	78,740
Wetland	0%	1,203,641
	Total	**203,531,831**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
The annual trend in total carbon storage for the water and wetland land cover classes between 2001 and 2016 was a reflection of LANDFIRE classification changes; therefore, the 2016 carbon storage values for these land cover classes were maintained for the forecast year and were not based on the trend.

Table 5. Annual Greenhouse Gas Emissions for the 2050 Baseline Reference Scenario

Land Cover Class	2001–2016 Carbon Emissions Annual Trend	2050 Total Annual Carbon Emission (MT CO_2e per year)
Barren	—	—
Forest	—	—
Grassland	–3.5%	0
Irrigated Pasture	–5.4%	0
Orchard	–2.2%	0
Row Crop	–2.7%	0
Shrubland	—	—
Urban	—	—
Vineyard	35.4%	651
Water	—	—
Wetland	0%	35,270
	Total	**35,921**

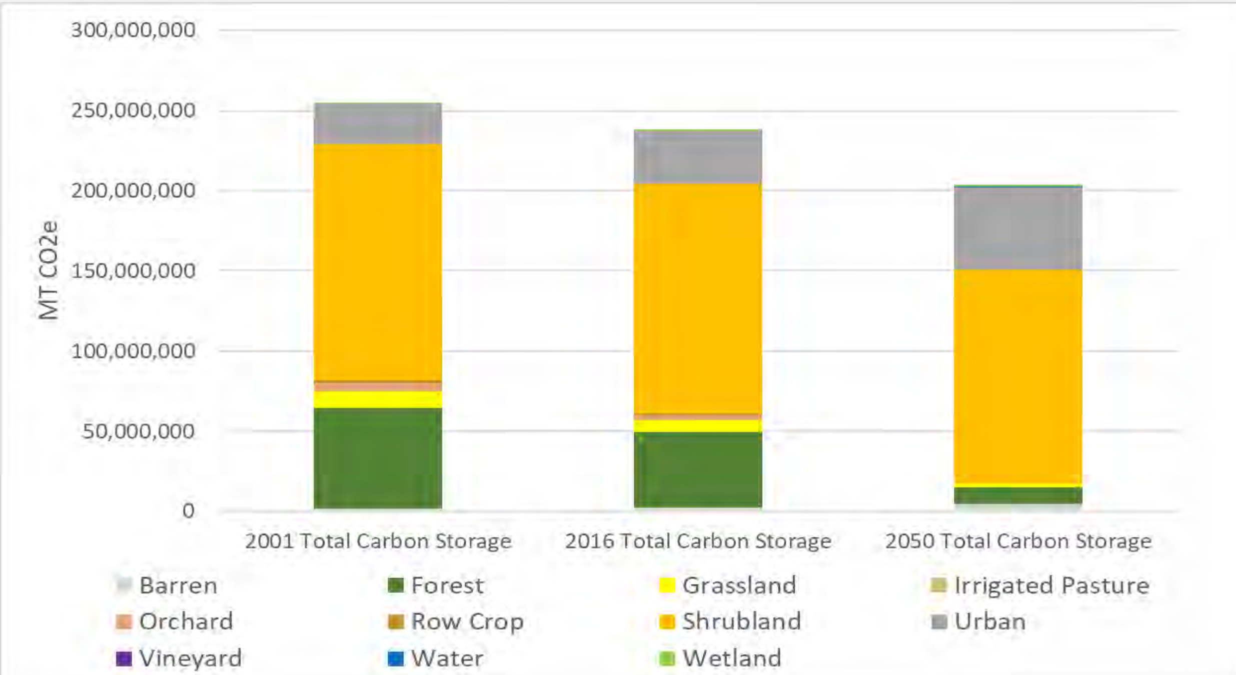
Notes: Greenhouse gas (N_2O and CH_4) emissions assigned to certain land cover types based on DOC and TNC n.d., expressed in metric tons of carbon dioxide equivalent per year (MT CO_2e per year). As noted in regard to the land cover mapping that supports this carbon emissions accounting, the increase in wetland in 2016 is largely the result of LANDFIRE classification changes; therefore, the 2016 emissions values for wetlands were maintained for the forecast year and were not based on the trend.

The carbon-based extrapolation method used to develop the baseline reference scenario was considered the most representative way to estimate the forecast year changes in carbon storage and emissions because the changes in storage and emissions in each land cover class are proportional to the changes observed during the reference period, and this approach was employed by the pilot projects developed for Merced and Solano Counties. As a means of testing and validating the baseline reference scenario estimates, an acreage-based extrapolation approach was also conducted. The acreage-based approach used the trend in the change in acreage in each land cover class between the reference years and extrapolated that to the forecast year and then assigned an average carbon density per acre for each land cover class to the projected forecast year acreage.

Under the acreage-based approach, several land cover classes had annual trend decreases that were maintained at zero (not projected to be negative acres), and wetland and water land cover classes were maintained at 2016 levels, consistent with the carbon-based approach. Additionally, several land cover classes had annual acreage trend increases that resulted in the total projected acreages to be more than the acreage of San Diego County; the urban land cover class acreage was manually adjusted downward for the forecast year to maintain the proper total San Diego County acreage under this approach. For the average carbon density per acre, two different averages were used: an overall average carbon density for each land cover class (land cover class average) and an average of each of the land cover types within each land cover class (intra-type average) (as depicted in Figure 2).

Total landscape carbon storage in 2050 based on the baseline reference scenario (Table 4) was estimated at 203,531,831 MT CO_2e. Using the alternative acreage-based approach, total landscape carbon storage ranged from 178,764,656 MT CO_2e to 213,397,766 MT CO_2e (a range of values results from the acreage-based approach due to the two different average methods for carbon densities). With the exception of the forest and grassland land cover classes, the baseline reference scenario estimates fall within the range of estimates provided by the alternative acreage-based approach for each of the land cover classes. For the forest land cover class, the baseline reference scenario estimated a total landscape carbon storage of 10,245,885 MT CO_2e, whereas the acreage-based estimates ranged from 3,556,817 MT CO_2e to 4,373,798 MT CO_2e. For forest, the rate of decline in carbon over the reference period (1.7%) is less than the rate of decline in acreage (1.9%), and there is a wide variability in carbon density across all the forest types, which results in the baseline reference scenario estimate being higher than that of the alternative acreage-based approach. For the grassland land cover class, the baseline reference scenario estimated a total landscape carbon storage of 2,316,418 MT CO_2e, whereas the acreage-based method estimated zero carbon storage in grasslands by 2050. For grassland, the rate of decline in carbon over the reference period (1.6%) is less than the rate of decline in acreage (3.5%), which results in the acreage of grassland and projected carbon storage to decline to zero by the forecast year. Total annual GHG emissions estimates were nearly the same for both approaches, with the baseline reference scenario estimate at 35,921 MT CO_2e per year and the alternative acreage-based estimate at 36,213 MT CO_2e per year.

Figure 4a. Comparison of Total Carbon Storage between the Reference Years and the 2050 Baseline Reference Scenario



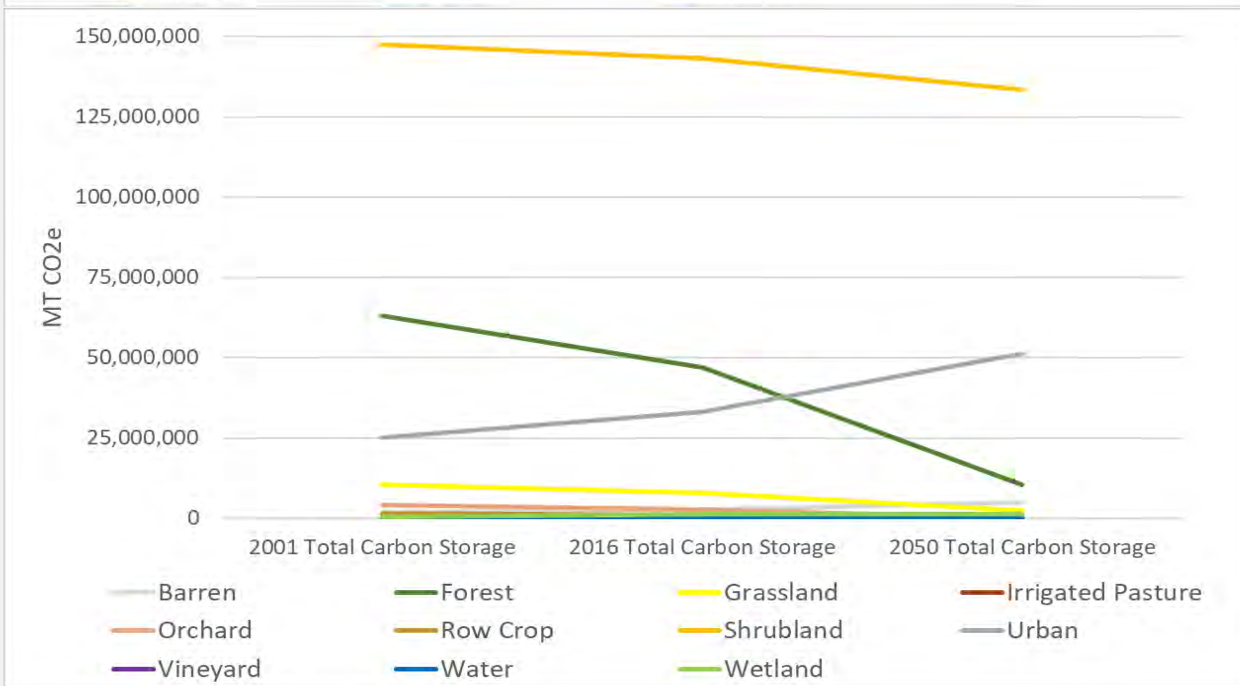
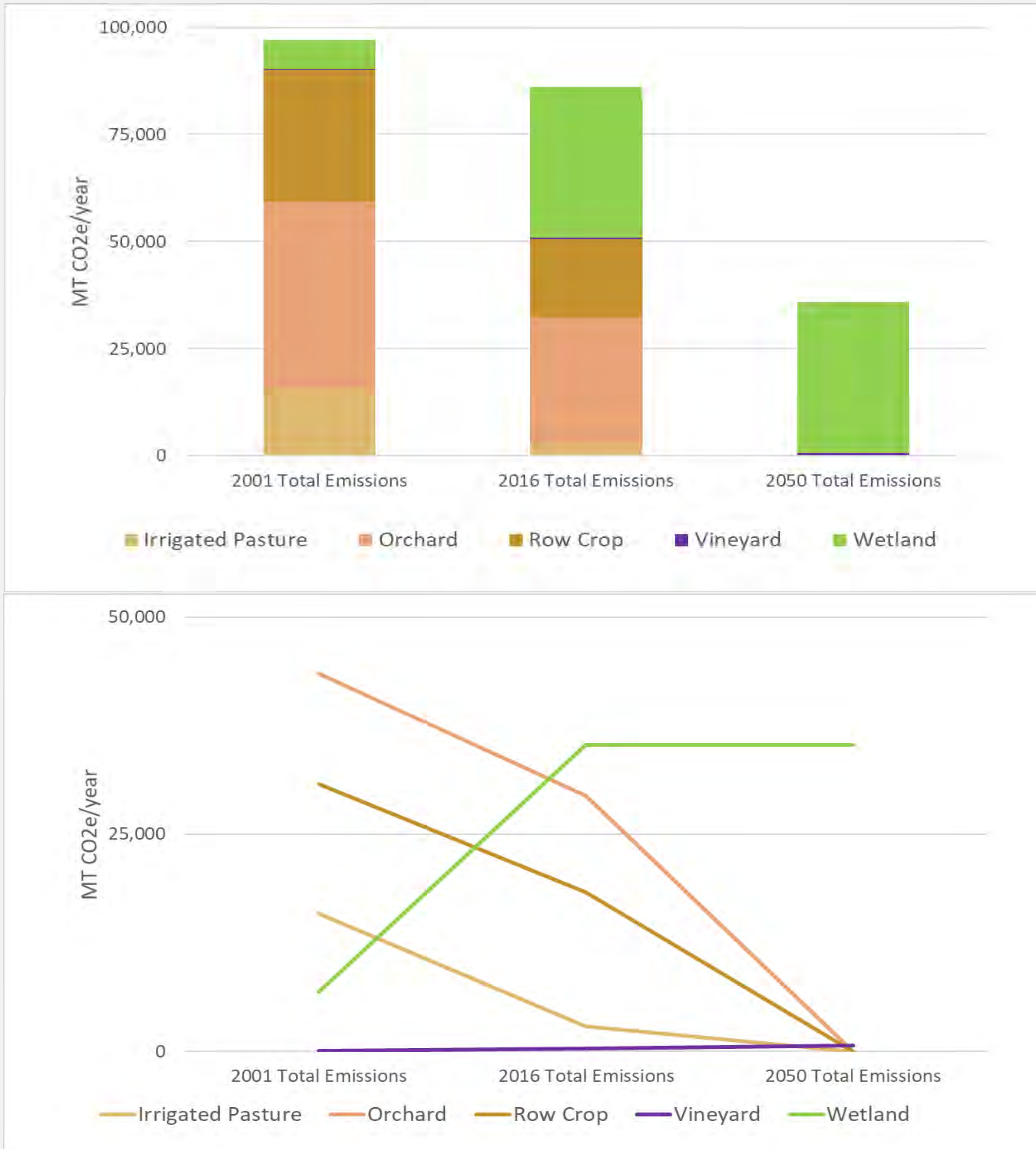


Figure 4b. Comparison of Total Annual Greenhouse Gas Emissions between the Reference Years and the 2050 Baseline Reference Scenario



5 Complementary Benefits

Maintaining and managing carbon storage in natural and working lands provides a variety of complementary benefits beyond offsetting GHG emissions. Complimentary benefits include social, economic, and environmental benefits achieved by applying specific land management activities besides GHG emission reductions assessed herein. The following provides an overview of selected complementary benefits of maintaining and managing carbon storage in natural and working lands in San Diego County, including agriculture quality, water quality, biodiversity, and human wellbeing. Natural and working lands provide additional benefits not included in this study. Land management activities for enhancing carbon storage in natural and working lands are described in Section 6.1, with associated complementary benefits noted.

In natural lands, maintaining and managing carbon storage through avoiding conversion to other lower-carbon land uses benefits conserved lands in San Diego County, including those shown in Figure 5 (SANDAG 2021b). Many complementary benefits are a result of conserving lands and avoiding conversion of natural lands to developed or urban lands, as described in detail below.

5.1 Agriculture

Maintaining and managing carbon storage in working lands benefits agricultural land quality in San Diego County, including farmlands of local importance, farmlands of statewide importance, grazing lands, prime farmlands, and unique farmlands as mapped by the California Farmland Mapping and Monitoring Program (Figure 6) (DOC 2018). A specific complementary benefit associated with agricultural land quality is the loss in important farmland where land is converted from agriculture to a developed land use. Relatedly, another agricultural quality related complementary benefit includes crop production value, which is the loss in crop value as a result of converting agricultural land to developed or urban land use.

Figure 5. Conserved Lands

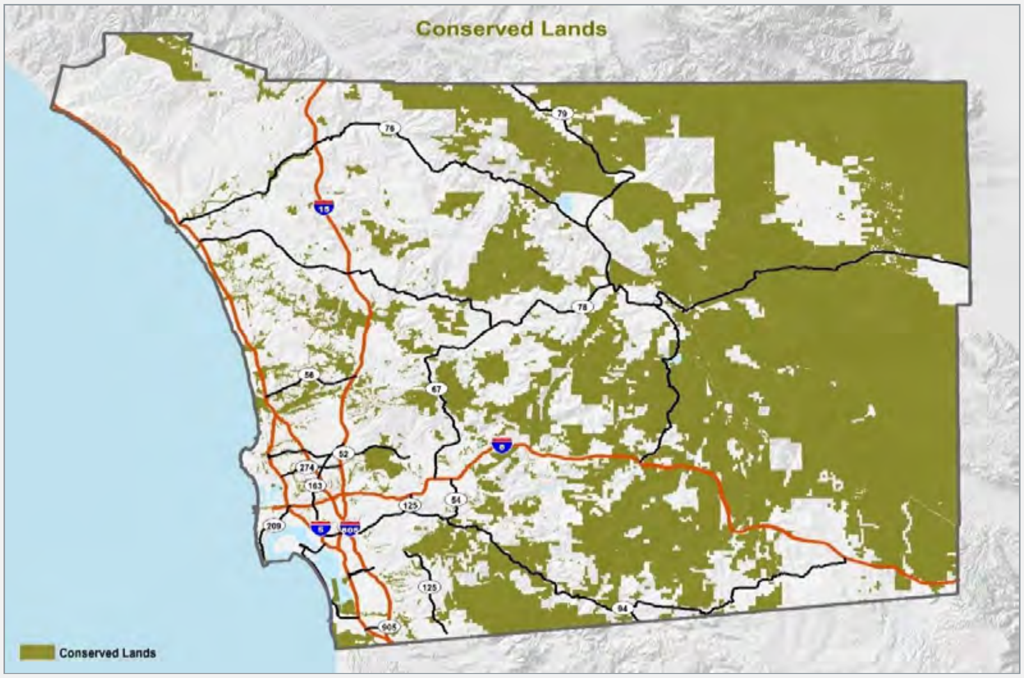
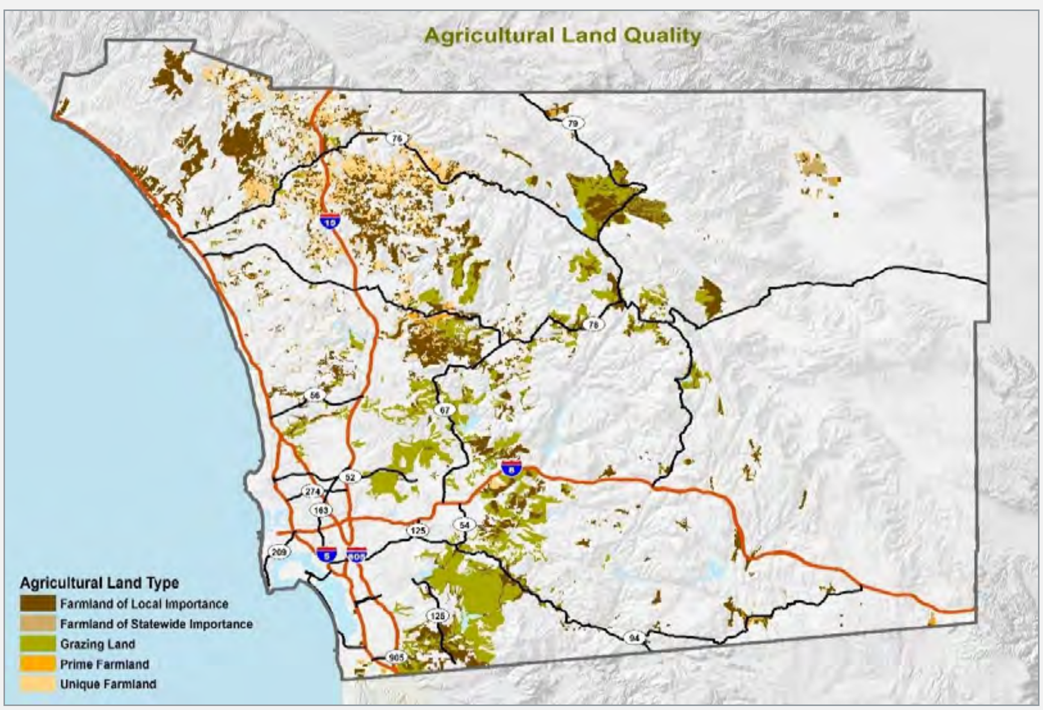


Figure 6. Agricultural Lands



5.2 Water Quality

Carbon storage maintenance and management in natural and working lands provides benefits for water quality. These complementary benefits include maintaining and improving water quality in water quality sensitive areas in San Diego County (Figure 7) (SANDAG 2021c).

Regarding complementary benefits associated with agriculture and urban water conservation, land cover changes can impact agricultural water use; when natural lands are converted to agricultural lands, agricultural water use increases. Alternately, urban lands expanding into agricultural lands can reduce agricultural water demand and increase urban water use. Water use also changes when lands convert from one agricultural type to another.

Water quality can also be impacted by land management activities related to nitrate runoff and nitrate leaching. Nitrate runoff is a major cause of poor water quality in streams and rivers, leading to eutrophication of (i.e., excessive richness of nutrients) and damage to aquatic ecosystems. Nitrate leaching is a cause of groundwater contamination that can lead to unhealthy drinking water. When land cover changes or activities are implemented to improve nitrogen fertilizer management, nitrate-related water quality concerns can also be affected.

Land cover changes can also impact groundwater recharge potential. Groundwater recharge is the amount of precipitation that infiltrates below the root zone, summed annually. When natural land cover changes to urban, the groundwater recharge potential in that area is reduced due to an increase in impervious surfaces.

Watershed integrity is another water-quality-related complementary benefit, particularly associated with riparian restoration activities. The integrity of watersheds is a valuable metric for evaluating the quality of habitat for a variety of animal species, animal movement, water quality, and general ecologic function. When urbanization and agricultural growth occur, they can degrade the ecological and social benefits of undisturbed or intact watersheds.

5.3 Biological Resources and Biodiversity

San Diego County is a biologically rich region supporting a unique assemblage of habitats and plant and wildlife species. Maintaining and managing carbon storage in natural lands has a range of complementary benefits for the region's biological resources. For example, numerous important bird areas have been identified in San Diego County, and avian species in the region would benefit from maintaining and managing carbon storage in these and other areas (Figure 8) (Audubon California 2008). Further, the natural lands of San Diego County provide important functions for wildlife movement and habitat connectivity that would benefit from carbon storage management and maintenance, as illustrated in Figure 9 (Jennings et al. 2019; Spencer et al. 2010).

Other biodiversity-related complementary benefits include the following:

- **Terrestrial Connectivity.** Animal species rely on landscapes that provide habitat connectivity so they can move between areas of quality habitat. Developed land covers are difficult to move through, agricultural land covers less so, and natural land covers the easiest. Land covers changes can improve or degrade terrestrial habitat connectivity.
- **Natural Habitat Area.** As with most biodiversity-related complementary benefits, conserving natural land cover also benefits natural habitat areas.

- **Priority Conservation Areas.** Priority conservation areas, as evaluated in the Merced County TerraCount study, are a combination of The Nature Conservancy priority conservation areas, Audubon important bird areas, and California Department of Fish and Wildlife essential connectivity areas. This metric can be tracked by the change in land cover class within priority conservation areas.
- **Terrestrial Habitat Value.** The loss of terrestrial habitat is one of the consequences of urbanization and agricultural growth. Terrestrial habitat value can be measures for mammals, birds, amphibians, reptiles, and threatened and endangered species.
- **Aquatic Biodiversity Value/Richness.** Changes to land covers from watersheds with high biodiversity to other land covers can also affect aquatic biodiversity.

5.4 Human Wellbeing and Resilience

Human wellbeing complementary benefits include flood risk, air quality, and scenic value, and resilience complementary benefits include both social and built resilience, and natural resilience. Carbon storage maintenance and management in natural and working lands provide benefits for flood risk, specifically moderating flood risk in flood-prone areas like 100-year flood hazard zones (Figure 10) (FEMA 2021). Developing within 100-year flood zone areas puts homes and lives at risk; therefore, conserving natural lands within these areas can minimize those potential risks. Regarding air quality, plants sequester pollutants, removing them from the air using gaseous uptake through plant stoma and by direct interception of airborne particles. The complementary benefit can be calculated based on a criteria air pollutant sequestration change in tons per year. Retaining an area's scenic value is a consideration for planners and officials in the San Diego region. Scenic value can be measured in terms of the visibility of the areas developed for public areas, parks, and roadways, focusing on the most visible areas.

As applied in the Merced County TerraCount Study, datasets were selected to use as proxies for resilience. Natural resilience was evaluated using the sum of two components: habitat stability and climate connectivity. This metric focuses on changes in land cover for areas that are either mapped as climate refugia or are mapped as climate linkages (climate refugia are areas where current vegetation is predicted to be relatively stable and less vulnerable to climate change, and climate linkages are areas that connect current to future climate zones). For social and built resilience, flood risk attenuation and groundwater banking potential were selected as the two proxies. This metric evaluates the changes in land cover for areas that are either in the 500-year floodplain or in areas of the highest groundwater banking potential.

Figure 7. Water Quality Sensitive Areas

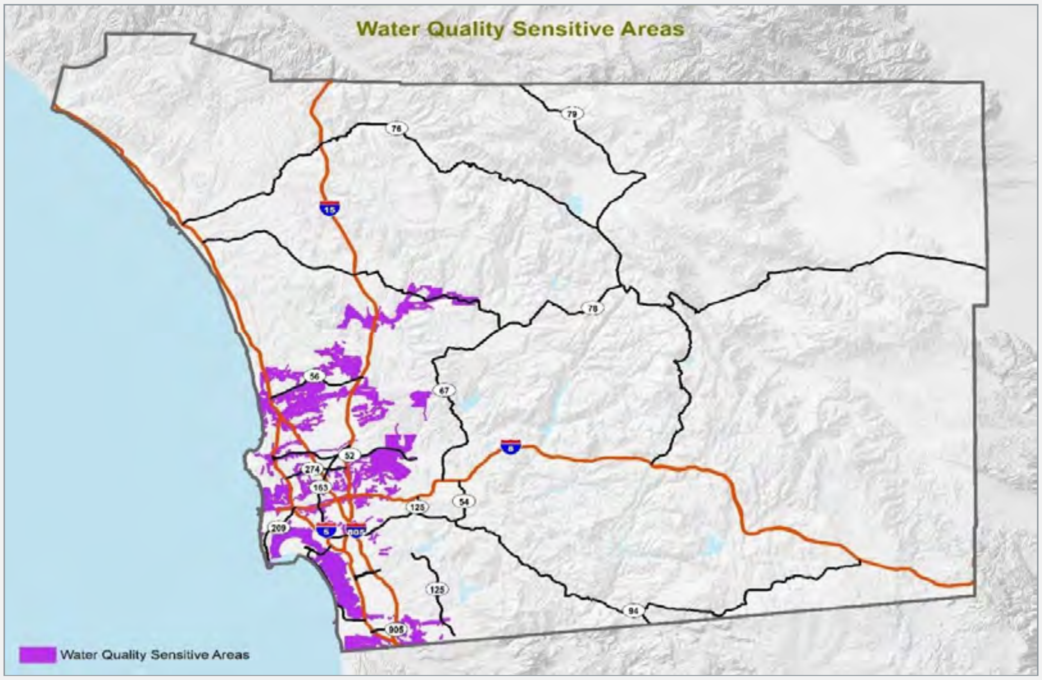


Figure 8. Audubon Important Bird Areas

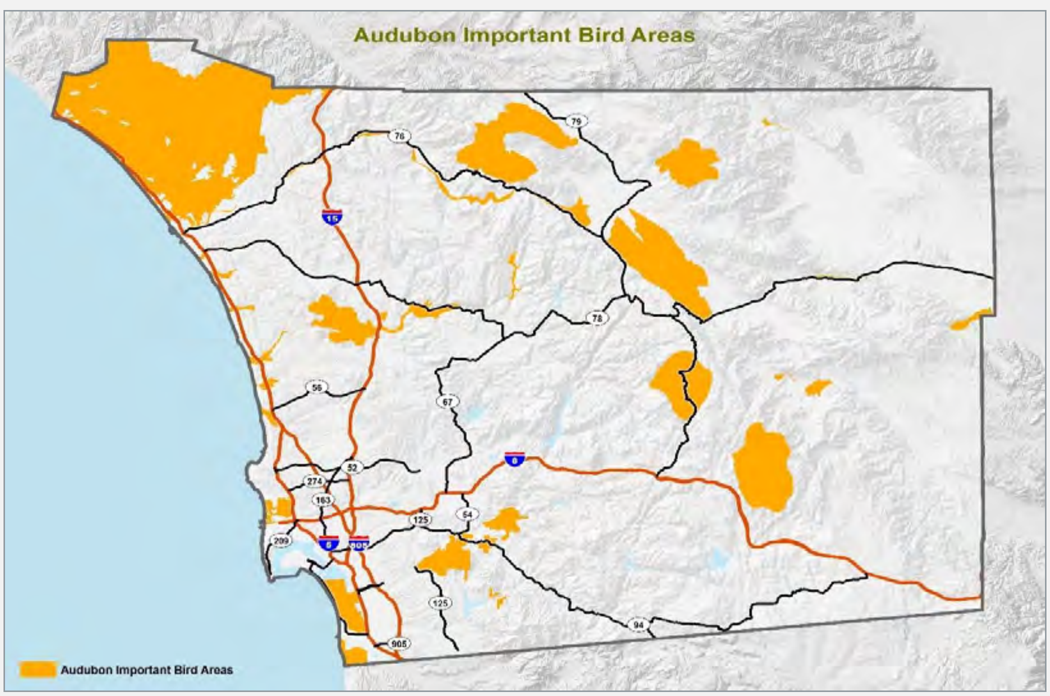


Figure 9. Habitat Connectivity

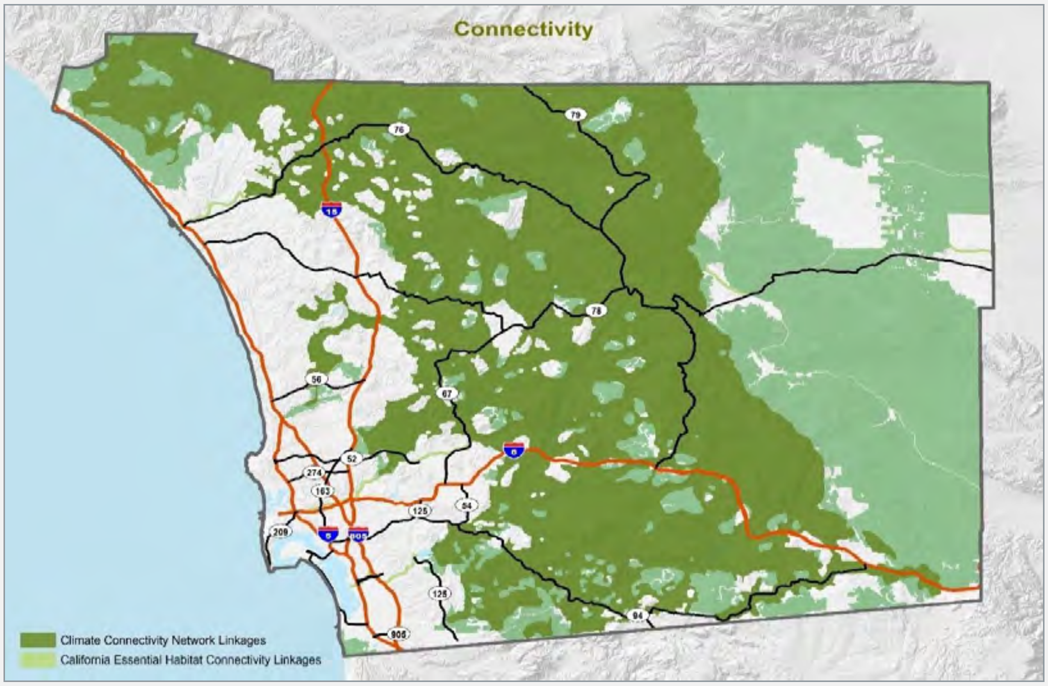
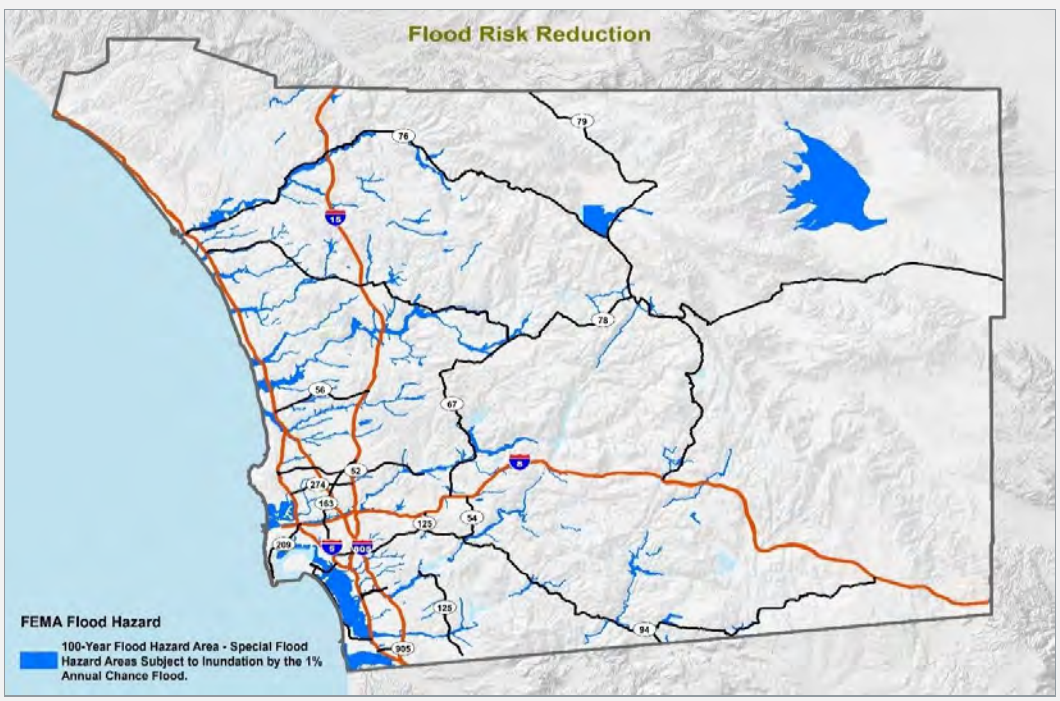


Figure 10. FEMA Flood Hazard Areas



6 Forecasting

The baseline reference scenario outlined in Section 4 presents a potential business-as-usual outcome for carbon storage in the natural and working lands of San Diego County for the 2050 forecast year based on the region's trend from 2001 to 2016. Alternate carbon storage outcomes for the 2050 forecast year could result from implementation of land management activities that increase carbon storage and sequestration, and through effecting different development scenarios/trends than was assumed in the baseline reference scenario. Section 6.1 explores the potential for carbon storage and sequestration of various land management activities, and Section 6.2 evaluates different development scenarios that would result in increased carbon storage above that predicted by the baseline reference scenario. The DOC TerraCount tool would have allowed the forecasting component of this study to be spatial, but due to complexities associated with applying the tool to San Diego County, this study conducted the forecasting elements using a non-spatial approach without employing the TerraCount tool.

6.1 Land Management Activities

6.1.1 Working Land Management Activities

A number of management activities implemented in agricultural lands have the potential to increase carbon storage and sequestration over time, including the following:

- Improved Nitrogen Fertilizer Management: Adjusting the application rate, source, method, and timing of synthetic nitrogen fertilizers
- Use of Alternative Soil Amendments: Replacing/augmenting synthetic nitrogen fertilizers with manure, compost, or other organic by-products
- Use of Cover Crops: Planting grasses and forbs[3]
- Uses of Mulches: Adding crop and other residues[4]
- Planting Hedgerows: Planting hedgerow trees[5]

Based on the land cover class summary provided in the Table 1, agricultural lands covered approximately 2.1% (58,541 acres) of San Diego County in 2016. Although there was a strong declining trend in agricultural land cover from 2001 to 2016 resulting in very little carbon storage remaining in agricultural lands by the 2050 forecast year under the baseline reference scenario, the past trend for agricultural land uses may not accurately predict the future outcome, and agricultural land uses may remain at or near 2016 levels or as projected by the moderated baseline scenario described in Section 6.2.2. Assuming that some agricultural land uses are maintained in San Diego County through 2050, implementing the working land management activities described

[3] CO2 removals are the result of planting seasonal leguminous cover crops that provide natural resource protection or improvement and supply partial fertilizer demand to areas managed for irrigated annual row crops.

[4] CO2 removals are based on the application of plant residues or other suitable materials produced off site to the land surface on irrigated pasture.

[5] Establishment of dense vegetation in a linear design to achieve a natural resource conservation purpose on areas managed as vineyards.

above has the potential to increase carbon storage or decrease GHG emissions as compared to unmanaged agricultural lands, as summarized below.

Annual CO_2e reduction/removal rates for these working land management activities have been developed by the U.S. Department of Agriculture for the carbon and GHG evaluation of Natural Resources Conservation Service conservation practice planning (COMET-Planner, USDA 2021; DOC and TNC n.d.). Improved nitrogen fertilizer management has the potential to reduce/remove 0.01 to 0.03 MT CO_2e per acre per year, which if implemented over 1,000 acres, could remove 10 to 30 MT CO_2e per year. Complementary benefits of improved nitrogen fertilizer management include improved air quality and water quality. Use of alternative soil amendments has the potential to reduce/remove 0.13 to 4.49 MT CO_2e per acre per year, which if implemented over 1,000 acres, could remove 130 to 4,490 MT CO_2e per year. A complementary benefit of replacing synthetic nitrogen fertilizer with soil amendments includes improved water quality. Use of cover crops has the potential to reduce/remove 0.18 to 0.25 MT CO_2e per acre per year, which if implemented over 1,000 acres, could remove 180 to 250 MT CO_2e per year. Complementary benefits of cover crops include improved air quality and water quality. Use of mulches has the potential to reduce/remove 0.21 MT CO_2e per acre per year, which if implemented over 1,000 acres, could remove 210 MT CO_2e per year. Of the complementary benefits discussed herein, none are specifically applicable to mulching. Planting hedgerows has the potential to reduce/remove 8.23 MT CO_2e per acre per year, which if implemented over 1,000 acres, could remove 8,230 MT CO_2e per year. Complementary benefits of hedgerow planting include improved air quality, scenic value, water quality, watershed integrity, and numerous biodiversity related benefits (terrestrial connectivity, natural habit area, priority conservation area, terrestrial habitat value, and aquatic biodiversity value).

6.1.2 Natural Land Management Activities

Carbon storage and sequestration can be increased in natural lands through the following management activities:

- Habitat Restoration: Implementation of active habitat restoration that converts lower-carbon-density land cover types, such as grassland, to higher-carbon-density land cover types such as shrubland, oak woodland, and riparian.
- Fire Management: Active wildland fire management and suppression to prevent and minimize large-scale fires that convert stored carbon to GHGs.
- Planning and Management to Avoid Natural Land Conversion: Land use planning and policies and land management activities that avoid and minimize the conversion of higher-carbon-density land cover types such as shrubland, forest and woodland, and riparian, to lower-carbon-density land cover types such as grassland, barren, and urban.

Based on the land cover class summary provided in Table 1, natural lands covered approximately 75.1% (2,046,988 acres) of San Diego County in 2016. Implementing the natural land management activities described above has the potential to increase carbon storage and sequestration above that of unmanaged natural lands, as summarized below.

Habitat Restoration

Implementing habitat restoration has the potential to increase landscape carbon storage and sequestration in San Diego County. Based on the carbon density values used in this study, grasslands have an average carbon density of 15.5 MT carbon (C)/acre, which is equivalent to 57.0 MT CO_2e per acre. Converting grasslands to higher carbon land cover types through habitat restoration has the potential to increase carbon storage and sequestration over time, as follows:

- Oak Woodland Restoration: Oak woodlands in San Diego County have an average carbon density of 65.8 MT C/acre (241.3 MT CO_2e per acre). Converting grasslands to oak woodlands has the potential to increase carbon storage by 184.3 MT CO_2e per acre. Implementing 1,000 acres of oak woodland restoration by the 2050 forecast year has the potential to increase carbon storage in San Diego County by 184,297 MT CO_2e.
- Riparian Restoration: Riparian communities in San Diego County have an average carbon density of 51.4 MT C/acre (188.7 MT CO_2e per acre). Converting grasslands to riparian has the potential to increase carbon storage by 131.7 MT CO_2e per acre. Implementing 1,000 acres of riparian restoration by the 2050 forecast year has the potential to increase carbon storage in San Diego County by 131,692 MT CO_2e.
- Chaparral and Coastal Sage Scrub Restoration: Chaparral communities in San Diego County have an average carbon density of 31.1 MT C/acre (114.0 MT CO_2e per acre), and coastal sage scrub in San Diego County has an average carbon density of 24.6 MT C/acre (90.3 MT CO_2e per acre). Converting grasslands to chaparral has the potential to increase carbon storage by 56.9 MT CO_2e per acre, and converting grasslands to coastal sage scrub has the potential to increase carbon storage by 33.3 MT CO_2e per acre. Implementing 1,000 acres of chaparral restoration by the 2050 forecast year has the potential to increase carbon storage in San Diego County by 56,939 MT CO_2e, and implementing 1,000 acres of coastal sage scrub restoration by the 2050 forecast year has the potential to increase carbon storage in San Diego County by 33,301 MT CO_2e.

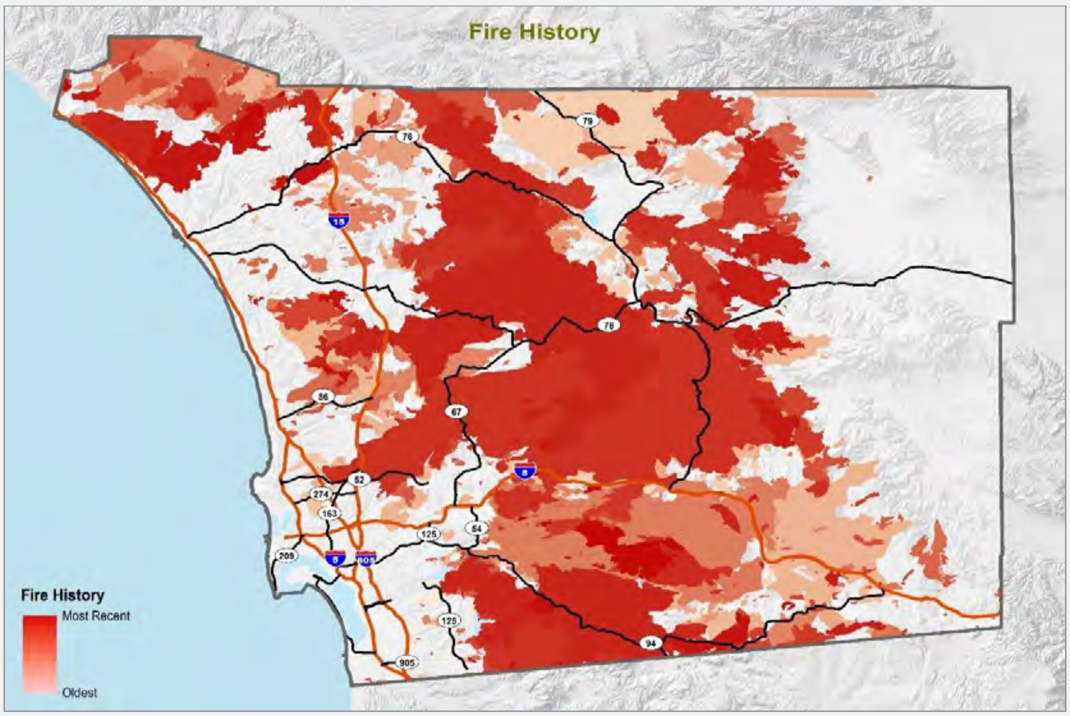
Habitat restoration can result in numerous complementary benefits, such as air quality, scenic value, flood risk, water quality, watershed integrity, and numerous biodiversity benefits (terrestrial connectively, natural habitat areas, priority conservation areas, terrestrial habitat value, and aquatic biodiversity).

Fire Management

Maintenance of the carbon storage provided in the natural lands, often referred to as carbon persistence, is important to meeting GHG goals. Wildland fires present a challenge for maintaining carbon storage within aboveground carbon in the vegetation of natural lands. As highlighted in the California Forest Carbon Plan, managing California's natural lands as a net carbon sink is a statewide climate goal, and wildfires have a direct effect on carbon storage/sequestration (Forest Climate Action Team 2018). Wildfires partially convert carbon stored in live and dead aboveground biomass to atmospheric carbon. As discussed with regard to the carbon inventory prepared for this study, major wildland fires occurred during the reference period in 2003 and 2007, and numerous other fires have also occurred and are expected to occur over the forecast period. Figure 11 shows the fire history (for records from 1910 to 2020) for San Diego County.

The age classes of the vegetation types in San Diego County, as influenced by numerous factors, including fire history, affect the current carbon storage and the carbon sequestered over time. Further, the effect of wildfire on storage/sequestration differs by vegetation type; scrub, chaparral, and grassland communities tend to burn more completely, whereas wildfires in riparian, wetland, and oak woodlands tend to burn less intensely, leaving more live and dead aboveground carbon on the landscape in these communities. Because this study was a snapshot in time and because fires have occurred in the past and will likely occur in the future in these lands, the results of this study provide a reasonable estimate of the average or baseline amount of carbon stored in the study area. Areas with more recent fires are likely to have somewhat lower carbon storage/density than estimated in this study, yet will accumulate carbon at a higher rate for a period of time going forward. Older age class areas with less recent fire activity are likely to have somewhat higher carbon storage/density than estimated here, but will also accumulate carbon at a slower rate going forward. Managing wildland fires, such as wildfire planning and fire suppression, is an important factor in maintaining the persistence of the carbon storage in natural lands over the forecast period.

Figure 11. Fire History in San Diego County



Planning and Management to Avoid Natural Land Conversion

Avoided conversion to urban is precisely that: retaining and gaining carbon and achieving other benefits by keeping the landscape natural as conservation land or working land. Land use planning and policies implemented by SANDAG, the County of San Diego, and cities and local municipalities within San Diego County influence land development and the amount of conversion of the natural lands to lower-carbon-storage land covers. Further, entities with responsibilities for land management in natural lands implement measures, such as invasive plant species management and access control, that can prevent and minimize the conversion of higher-carbon land cover types to lower-carbon land cover types.

Based on the carbon density values used in this study, urban lands have an average carbon density of 20.0 MT C/acre, which is equivalent to 73.2 MT CO_2e per acre. Avoiding the conversion of higher-carbon natural land cover types to urban uses has the potential to avoid the loss of carbon storage over time, as follows:

- Avoided Conversion of Oak Woodland: Oak woodlands in San Diego County have an average carbon density of 65.8 MT C/acre (241.3 MT CO_2e per acre). Avoiding the conversion of oak woodlands to urban has the potential to maintain 168.1 MT CO_2e per acre of carbon storage. Avoiding the conversion of 1,000 acres of oak woodland by the 2050 forecast year has the potential to maintain 168,093 MT CO_2e of carbon storage, and avoiding the conversion of 10,000 acres of oak woodland by the 2050 forecast year has the potential to maintain 1,680,928 MT CO_2e of carbon storage.
- Avoided Conversion of Riparian: Riparian communities in San Diego County have an average carbon density of 51.4 MT C/acre (188.7 MT CO_2e per acre). Avoiding the conversion of riparian to urban has the potential to maintain 115.5 MT CO_2e/acre of carbon storage. Avoiding the conversion of 1,000 acres of riparian by the 2050 forecast year has the potential to maintain 115,487 MT CO_2e of carbon storage, and avoiding the conversion of 10,000 acres of riparian by the 2050 forecast year has the potential to maintain 1,154,974 MT CO_2e of carbon storage.
- Avoided Conversion of Chaparral and Coastal Sage Scrub: Chaparral communities in San Diego County have an average carbon density of 31.1 MT C/acre (114.0 MT CO_2e per acre), and coastal sage scrub in San Diego County has an average carbon density of 24.6 MT C/acre (90.3 MT CO_2e per acre). Avoiding the conversion of chaparral to urban has the potential to maintain 40.7 MT CO_2e per acre of carbon storage, and avoiding the conversion of coastal sage scrub to urban has the potential to maintain 17.1 MT CO_2e per acre of carbon storage. Avoiding the conversion of 1,000 acres of chaparral or coastal sage scrub by the 2050 forecast year has the potential to maintain 17,096 to 40,734 MT CO_2e of carbon storage, and avoiding the conversion of 10,000 acres of chaparral or coastal sage scrub by the 2050 forecast year has the potential to maintain 170,962 to 407,342 MT CO_2e of carbon storage.

In addition to maintaining carbon in the natural landscape, avoided conversion to urban activities results in numerous positive outcomes across complementary benefits associated with agricultural quality, water quality, biodiversity, and human wellbeing and resilience.

6.1.3 Urban Land Management Activities

Urban forests come in many different shapes and sizes and can include urban parks, street trees, landscaped boulevards, gardens, coastal promenades, greenways, and wetlands. Urban trees and their urban canopy cover provide a multitude of benefits, including storing carbon, providing shade that can reduce building heating and cooling needs, providing wildlife habitat, and sequestering criteria air pollutants. Managing urban forests, specifically the planting and maintenance care of trees, can increase stored carbon within San Diego County.

Trees sequester CO_2 while they are actively growing, and the amount of CO_2 sequestered depends on the type of tree. Thereafter, the accumulation of carbon in biomass slows with age, and is assumed to be offset by losses from clipping, pruning, and death. Active growing periods are subject to, among other things, species, climate regime, and planting density. In addition, trees are subject to mortality and other types of losses, and therefore may need to be replaced and/or relocated to ensure carbon is stored and continues to be sequestered overtime.

The activity sheet for the Merced County project identifies a method to estimate activity-based CO_2 removals as a result of committing to the maintenance and increase of CO_2e in trees within the urban land cover from sequestration on existing trees and/or newly planted trees. The total estimated GHG emissions reduction/removal is based on a per-acre annual reduction/removal rate of 133.14 tons of CO_2e per acre per year multiplied by the total acreage upon which the activity is to be implemented, which is then multiplied by the duration of the activity in years. A leakage discount is also considered in the equation; however, the default is set at 0% for this activity. As an example, in applying this equation, 1 acre of urban forest over 20 years would result in 2,416 MT CO_2e removed over that time; over 50 years, which is the activity sheet's maximum duration of activity, 1 acre of urban forest would remove 6,039 MT CO_2e. Complementary benefits identified with this activity include air quality, scenic value, watershed integrity, terrestrial connectivity, natural habitat area, and terrestrial habitat area.

The California Emissions Estimator Model (CalEEMod) includes a method for estimating carbon gain from tree planting on a per-tree basis. The gain of sequestered carbon resulting from planting and growth of trees is estimated based on the carbon sequestration rate for the tree species, the number of new trees, and the growing period. CalEEMod has default carbon content values (in units of MT CO_2 per tree per year) for 10 different general tree species plus a miscellaneous tree category.[6] The miscellaneous tree species category CO_2 sequestration rate, which represents the average carbon content across the 10 tree species, is 0.0354 MT CO_2 per tree per year. Accordingly, planting one tree would generate a net gain in carbon of 0.71 MT CO_2e over the assumed active growing period of 20 years, consistent with the Intergovernmental Panel on Climate Change's assumption.[7] Scaling that up, planting and growth of 1,000 miscellaneous trees would generate a gain in carbon of 708 MT CO_2e.

Additional tools are available to more precisely estimate carbon storage and sequestration rates for trees, provided information about the specific tree is available. Tree-specific carbon storage tools includes the United States Department of Agriculture's Forest Service Center for Urban Forest Research Tree Carbon Calculator, and the Forest Service iTree tools for assessing and managing forests and community trees. Both the Tree Carbon Calculator and the iTree Planting Calculator can provide quantification of additional tree benefits, such as energy conserved, air pollutant captured and avoided, stormwater filtered, and ecosystem services, which are complementary benefits to urban tree planting for carbon storage. Using the iTree Planting Calculator Version 2.1.3, Table 6 provides examples of carbon storage calculations for various common trees in the San Diego region after 20 years and after 40 years (iTree default value) of growth on a per-tree basis. In contrast to the CalEEMod 20-year growing period assumption, the iTree model shows that substantial carbon gains can be achieved as trees continue to grow overtime, which varies by tree species.

As shown in Table 6, different trees have different carbon storage potential; however, all trees store carbon and, collectively, tree planting could result in considerable natural carbon storage for the San Diego region.

6 Aspen, soft maple, mixed hardwood, hardwood maple, juniper, cedar/larch, Douglas fir, true fir/hemlock, pine, spruce, and miscellaneous.

7 The sequestered carbon from new trees modeling does not include CO_2 emissions estimates associated with planting, care, and maintenance activities (e.g., tree planting and care vehicle travel and maintenance equipment operation).

Table 6. Example Tree Carbon Storage

Tree Type (Common Name (*Scientific Name*))	Total Carbon Storage after 20 Years (MT CO_2e per 1 Tree)	Total Carbon Storage after 40 Years (MT CO_2e per 1 Tree)
Afghan Pine (*Pinus eldarica*)	1.62	7.27
Chinese Flame Tree (*Koelreuteria bipinnata*)	1.43	2.59
Chinese Pistache (*Pistacia chinensis*)	0.75	3.28
Coastal Live Oak/California Live Oak (*Quercus agrifolia*)	0.70	3.44
Crapemyrtle (*Lagerstroemia indica*)	1.28	2.29
Deodar Cedar (*Cedrus deodara*)	1.79	7.19
Fern Pine (*Podocarpus gracilior*)	0.45	1.96
Green Acacia (*Acacia decurrens*)	0.34	0.57
Jacaranda (*Jacaranda mimosifolia*)	1.38	4.75
Paperbark (*Melaleuca quinquenervia*)	0.27	1.31
Raywood Ash (*Fraxinus oxycarpa* ‘Raywood’)	1.04	4.49
Strawberry Tree (*Arbutus unedo*)	0.78	2.41
Western Redbud (*Cercis canadensis* var. *texensis*)	1.77	2.40
Wilga/Australian Willow (*Geijera parviflora*)	2.52	3.41

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
iTree Planting Calculator Version 2.1.3. iTree assumptions include the following: the City of San Diego as the region, full sun exposure, all trees are in good condition, a 0% mortality rate, and a starting 1-inch diameter at breast height equating to an approximately 15-gallon tree pot. Assumed diameter at breast height is the size of the trunk, specifically the diameter of the truck, measured at 4.5 feet (1.5 meters) above the ground in centimeters or inches.

6.2 Development Scenarios

To evaluate the effects of development scenarios on landscape carbon storage and GHG emissions relative to the reference years and the baseline reference scenario, two scenarios were developed: a development only scenario and a moderated baseline scenario. The development only scenario was based on spatial data of projected change in urban land cover types for the 2050 forecast year and is summarized in Section 6.2.1. The moderated baseline scenario was based on moderation of the baseline reference scenario trends (25% and 50% of the reference year trends used for the baseline reference scenario from Section 4) and is summarized in Section 6.2.2.

6.2.1 Development Only Scenario

For the development only scenario, spatial data was provided by SANDAG for the projected increases in residential, mixed use, commercial, and industrial development (grouped together as urban) for the 2050 forecast year based on SANDAG’s 2021 Regional Plan and Sustainable Communities Strategy (SANDAG 2021a); these increases were not urban land covers in 2016. Based on SANDAG spatial data for 2050 urban development, this scenario used an urban land cover of 608,922 acres, which is an increase of approximately 10,722 acres of urban land cover compared to the 2016 urban land cover of 598,200 acres (Table 1). Changes in non-urban land covers were the result of losses to urban development only. Table 7 summarizes the land cover change between 2016 and 2050 for the development only scenario.

Table 7. Land Cover Change Between 2016 and 2050 for the Development Only Scenario

Land Cover Class	2016 Acres	2050 Acres	Change
Barren	348,341	348,188	-153
Forest	199,831	199,535	-296
Grassland	117,419	115,802	-1,617
Irrigated Pasture	3,295	3,293	-1
Orchard	36,781	35,970	-811
Row Crop	17,585	17,114	-471
Shrubland	1,357,890	1,350,642	-7,248
Urban	598,200	608,922	10,722
Vineyard	880	876	-4
Water	23,388	23,372	-16
Wetland	23,507	23,402	-105
Total	**2,727,116**	**2,727,116**	**0**

Notes: Totals may not sum due to rounding. Development only scenario used SANDAG spatial data for the projected increases in residential, mixed use, commercial, and industrial development (grouped together as urban) for the 2050 forecast year to project changes in land cover classes.

Using the changes in land covers from the development only scenario, the change in landscape carbon storage and GHG emissions was estimated. Table 8 summarizes the landscape carbon storage change between 2016 and 2050 for the development only scenario. Table 9 summarizes the annual GHG emissions change between 2016 and 2050 for the development only scenario.

Table 8. Landscape Carbon Storage Change Between 2016 and 2050 for the Development Only Scenario

Land Cover Class	2016 Total Carbon Storage (MT CO_2e)	2050 Total Carbon Storage (MT CO_2e)	Change
Barren	2,602,038	2,594,200	-7,837
Forest	46,830,230	46,764,854	-65,376
Grassland	7,806,193	7,680,100	-126,093
Irrigated Pasture	169,076	169,004	-72
Orchard	2,573,414	2,517,309	-56,105
Row Crop	854,521	833,340	-21,181
Shrubland	143,267,417	142,404,791	-862,626
Urban	33,064,922	33,633,012	568,090
Vineyard	49,896	49,728	-168
Water	78,740	78,590	-151
Wetland	1,203,641	1,197,521	-6,121
Total	**238,500,087**	**237,922,447**	**-577,640**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
Projected change in carbon storage based on the development only scenario, which used SANDAG spatial data for the projected increases in residential, mixed use, commercial, and industrial development (grouped together as urban) for the 2050 forecast year.

Table 9. Annual Greenhouse Gas Emissions Change Between 2016 and 2050 for the Development Only Scenario

Land Cover Class	2016 Total Annual Carbon Emissions (MT CO_2e per year)	2050 Total Annual Carbon Emissions (MT CO_2e per year)	Change
Barren	—	—	—
Forest	—	—	—
Grassland	2,854	2,814	-39
Irrigated Pasture	2,903	2,902	-1
Orchard	29,425	28,776	-649
Row Crop	18,328	17,838	-490
Shrubland	—	—	—
Urban	—	—	—
Vineyard	324	323	-1
Water	—	—	—
Wetland	35,270	35,113	-157
Total	**89,104**	**87,766**	**-1,338**

Notes: Greenhouse gas (N_2O and CH_4) emissions assigned to certain land cover types based on DOC and TNC n.d., expressed in metric tons of carbon dioxide equivalent per year (MT CO_2e per year). Projected change in greenhouse gas emissions based on the development only scenario, which used SANDAG spatial data for the projected increases in residential, mixed use, commercial, and industrial development (grouped together as urban) for the 2050 forecast year.

6.2.2 Moderated Baseline Scenario

The baseline reference scenario evaluated in Section 3 was based on extrapolating trends in the change in carbon for the land cover classes over the reference period to the 2050 forecast year. As noted in the description of the baseline reference scenario, the reference period (2001 through 2016) was characterized by several trends that lead to relatively large changes in the projected estimates for the forecast year, including substantial increases in urban development, substantial decreases in grassland and agriculture, and significant wildfires resulting in decreases in forest and increases in shrubland. To develop the moderated baseline scenario, the baseline reference trends were moderated using 25% of the reference year trend and 50% of the reference year trend to explore the carbon storage and emissions implications of more modest changes on the landscape in San Diego County. Table 10 provides a summary of landscape carbon storage of the 2050 moderated baseline scenario and Table 11 provides a summary of the annual GHG emissions of the 2050 moderated baseline scenario.

Table 10. Landscape Carbon Storage for the 2050 Moderated Baseline Scenario

Land Cover Class	Moderated Annual Trend (25% of Baseline)	2050 Moderated Scenario (25%) Total Carbon Storage (MT CO_2e)	Moderated Annual Trend (50% of Baseline)	2050 Moderated Scenario (50%) Total Carbon Storage (MT CO_2e)
Barren	1.1%	3,173,111	2.1%	3,744,185
Forest	-0.4%	37,684,144	-0.9%	28,538,057
Grassland	-0.4%	6,433,749	-0.8%	5,061,306
Irrigated Pasture	-1.4%	0	-2.8%	0
Orchard	-0.6%	1,668,255	-1.3%	763,096
Row Crop	-0.8%	454,647	-1.5%	54,773

Table 10. Landscape Carbon Storage for the 2050 Moderated Baseline Scenario

Land Cover Class	Moderated Annual Trend (25% of Baseline)	2050 Moderated Scenario (25%) Total Carbon Storage (MT CO_2e)	Moderated Annual Trend (50% of Baseline)	2050 Moderated Scenario (50%) Total Carbon Storage (MT CO_2e)
Shrubland	0.0%	140,835,390	-0.1%	138,403,364
Urban	0.1%	33,750,583	0.1%	33,750,583
Vineyard	8.0%	73,272	15.9%	96,647
Water	0.0%	78,740	0.0%	78,740
Wetland	0.0%	1,203,641	0.0%	1,203,641
	Total	**225,355,532**	**Total**	**211,694,393**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
The annual trend in total carbon storage for the water and wetland land cover classes between 2001 and 2016 was a reflection of LANDFIRE classification changes; therefore, the 2016 carbon storage values for these land cover classes were maintained for the forecast year and were not based on the trend. Change in urban land cover based on SANDAG spatial data for the projected increases in residential, mixed use, commercial, and industrial development (grouped together as urban) for the 2050 forecast year are consistent with the development only scenario described in Section 6.2.1.

Table 11. Annual Greenhouse Gas Emissions for the 2050 Moderated Baseline Scenario

Land Cover Class	Moderated Annual Trend (25% of Baseline)	2050 Moderated Scenario (25%) Total Carbon Emissions (MT CO_2e per year)	Moderated Annual Trend (50% of Baseline)	2050 Moderated Scenario (50%) Total Carbon Emissions (MT CO_2e per year)
Barren	—	—	—	—
Forest	—	—	—	—
Grassland	-0.9%	1,103	-1.7%	-648
Irrigated Pasture	-1.4%	-4,426	-2.7%	-11,754
Orchard	-0.5%	21,435	-1.1%	13,445
Row Crop	-0.7%	11,265	-1.4%	4,201
Shrubland	—	—	—	—
Urban	—	—	—	—
Vineyard	8.9%	478	17.7%	633
Water	—	—	—	—
Wetland	0.0%	35,270	0.0%	35,270
	Total	**65,126**	**Total**	**41,148**

Notes: Greenhouse gas (N_2O and CH_4) emissions assigned to certain land cover types based on DOC and TNC n.d., expressed in metric tons of carbon dioxide equivalent per year (MT CO_2e per year). As noted in regard to the land cover mapping that supports this carbon emissions accounting, the increase in wetland in 2016 is largely the result of LANDFIRE classification changes; therefore, the 2016 emissions values for wetlands were maintained for the forecast year and were not based on the trend.

6.3 Forecasting Discussion

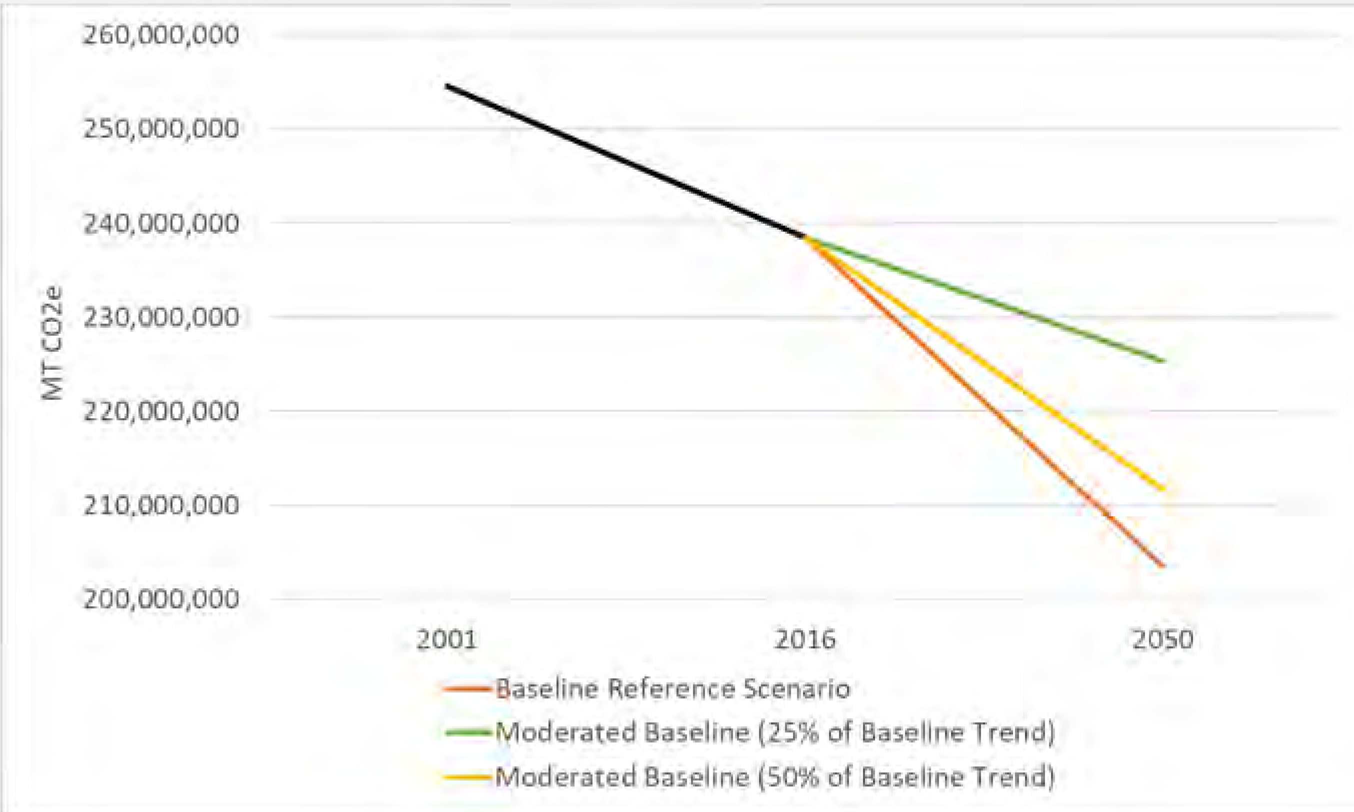
As illustrated by the land management activities described in Section 6.1 and the development scenarios outlined in Section 6.2, the carbon storage and sequestration trajectory for San Diego County can be improved above the baseline reference scenario projection in many ways.

Implementing carbon reduction/removal activities in working lands can reduce GHG emissions from agriculture. Restoring high-carbon habitats for increased carbon storage in natural lands, instituting land use policies to prevent the conversion of high carbon natural lands, and active tree planting can increase the carbon storage and sequestration in urban lands. The baseline reference scenario projection (Section 4) did not account for any of these active land management activities.

In terms of development scenarios, the development only scenario shows that projected residential, mixed use, commercial, and industrial development would increase urban land cover by 10,722 acres for the 2050 forecast year based on the 2021 Regional Plan and Sustainable Communities Strategy (SANDAG 2021a). Considering only this change in land use/land cover, carbon storage in San Diego County would decline by 0.24% (577,640 MT CO_2e) over the forecast period relative to the carbon storage in 2016. In comparison with the baseline reference scenario, the development only scenario would have a projected total carbon storage that is 16.9% above (237,922,447 MT CO_2e) that of the baseline reference scenario (203,531,831 MT CO_2e). Annual GHG emissions in the development only scenario would be 144% more (87,766 MT CO_2e per year) than the baseline reference scenario (35,921 MT CO_2e per year).

Because the baseline reference scenario was based on trends from 2001 to 2016 in San Diego County that may not be expected to continue out to the 2050 forecast year, the moderated baseline scenario was developed. Using the moderated baseline scenario at 25% of the reference period trend, total carbon storage in San Diego County would be 10.7% above (225,355,532 MT CO_2e) that of the baseline reference scenario (203,531,831 MT CO_2e). Annual GHG emissions in the moderated baseline scenario (25%) would be 81.3% more (65,126 MT CO_2e per year) than the baseline reference scenario (35,921 MT CO_2e per year). Using the moderated baseline scenario at 50% of the reference period trend, total carbon storage in San Diego County would be 4.0% above (211,694,393 MT CO_2e) that of the baseline reference scenario (203,531,831 MT CO_2e). Annual GHG emissions in the moderated baseline scenario (50%) would be 14.6% more (41,148 MT CO_2e per year) than the baseline reference scenario (35,921 MT CO_2e per year). Figure 12 provides a comparison of the total

Figure 12. Total Carbon Storage comparison between the Baseline Reference Scenario and the Moderated Baseline Trend Scenarios



7 Conclusion

This study provides an assessment of the historic and projected landscape carbon storage and GHG emissions of the natural and working lands of San Diego County for use by policy and decision makers to plan actions to meet climate goals. As this study illustrates, the historic trends show a decrease in landscape carbon storage in San Diego County due to land use changes, wildfire, drought, and other factors. Although land use changes were a major driver of the declining trend in landscape carbon storage, and this trend may not be expected to continue at this rate into the future, declines in carbon storage are projected to continue absent proactive measures to moderate these changes in the natural and working lands. Implementing carbon management activities in the working, natural, and urban lands is demonstrated to maintain and increase carbon storage and sequestration and has numerous complementary benefits for San Diego County.

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8 Limitations, Challenges, and Future Considerations

Very few carbon storage and sequestration assessments for natural and working lands have been conducted at the local or regional jurisdictional level, and the data and methods for conducting these assessments are just now becoming standardized. Due to the relatively new nature of carbon assessments, notable limitations and challenges were encountered during development of this study. In an effort to better future similar studies, key considerations and recommendations are presented herein as organized by report section.

Landscape Carbon Inventory. The carbon storage and sequestration field is growing and evolving, with new data and different methods being developed and becoming available. Landscape carbon inventories are based on two primary data and information inputs: (1) land cover and soils mapping and (2) carbon density values for the carbon pools. For this study, land cover mapping was based primarily on LANDFIRE datasets because the study approach involved developing a landscape carbon inventory for two historical years to develop the reference period trend to project to a forecast year. LANDFIRE was ideally suited for this purpose because these products are released regularly over time and are developed using consistent methods. Additionally, carbon density values for the aboveground live, aboveground dead, and belowground live carbon pools provided by CARB were linked to the LANDFIRE land cover types. Although LANDFIRE was useful for this study, this land cover data is a nationwide product collected through remote sensing and may not represent the on-the-ground conditions of the vegetation types as accurately as other available local or regional vegetation community mapping data. Additionally, carbon density values for vegetation and soils are constantly being improved, which would further improve the accuracy of landscape carbon inventories.

Baseline Reference Scenario. The 2001 to 2016 reference period used in this study to project a landscape carbon storage and sequestration trajectory for San Diego County was characterized by substantial land use change and numerous, large wildland fires. Thus, the baseline reference scenario developed using this approach for the 2050 forecast year is likely not as realistic for San Diego County as it would be for other regions or jurisdictions with less change during the reference period. Further, the land use changes and effects of wildfire during the reference period overshadow potential gains from carbon sequestration that might otherwise have been realized in the forecast year. Additionally, this study ultimately did not use the DOC TerraCount tool; therefore, a spatial model of the baseline reference scenario representing where the projected change in carbon storage would occur in San Diego County for the forecast year was not developed.

Complementary Benefits. Maintaining and managing carbon storage in natural and working lands provides a variety of complementary benefits, as described in this study; however, this study did not quantify forecasted changes in complementary benefits resulting from projected changes in carbon storage over time. Future studies that spatially model forecasted landscape carbon storage and use tools like that provided by TerraCount could provide quantification of various complementary benefits.

Forecasting. This study quantifies the carbon storage and sequestration potential of various land management activities and development scenarios; however, like the baseline reference scenario, these forecasting products are non-spatial.

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9 Acknowledgements and Preparers

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Appendix A
2001 and 2016 Itemized Carbon Inventories

SANDAG Carbon Inventory - 2001

			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil MT CO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Class**	**Land Cover Type**	**01_TotalMTCha**	**SOC_MT_Cha_1**	**01_TOTALC_MTCha**	**01_TOTALC_MTCO2eha**	**01_TOTALC_MTCO2epixel**	**Number of Pixels**	**01_TOTALC_MTCO2e**	**Acres**	**TOTAL C/Acre**
1	Barren	Barren	0.0000	0.000000	0.0000	0.0000	0.0000	159891.0000	0.0000	35558.8790	0.0000
2	Barren	Barren	0.0000	19.000000	19.0000	69.7300	6.2757	211844.0000	1329469.3908	47112.9405	28.2188
3	Barren	Barren	0.0000	38.000000	38.0000	139.4600	12.5514	15959.0000	200307.7926	3549.1938	56.4375
4	Barren	Barren	0.0000	88.000000	88.0000	322.9600	29.0664	303.0000	8807.1192	67.3855	130.6975
5	Barren	Barren	0.0000	0.0000	0.0000	0.0000	0.0000	1082241.0000	0.0000	240684.4461	0.0000
6	Barren	Mediterranean California Sparsely Vegetated Systems	3.4780	0.000000	3.4780	12.7643	1.1488	141.0000	161.9785	31.3576	5.1655
7	Barren	Mediterranean California Sparsely Vegetated Systems	3.4780	19.000000	22.4780	82.4943	7.4245	158.0000	1173.0684	35.1383	33.3843
8	Barren	Mediterranean California Sparsely Vegetated Systems	3.4780	38.000000	41.4780	152.2243	13.7002	312.0000	4274.4572	69.3871	61.6031
9	Barren	Mediterranean California Sparsely Vegetated Systems	3.4780	88.000000	91.4780	335.7243	30.2152	22.0000	664.7340	4.8927	135.8630
10	Barren	Mediterranean California Sparsely Vegetated Systems	3.4780	0.0000	3.4780	12.7643	1.1488	231.0000	265.3690	51.3731	5.1655
11	Barren	North American Warm Desert Sparsely Vegetated Systems	1.0246	0.000000	1.0246	3.7603	0.3384	2686.0000	909.0106	597.3516	1.5217
12	Barren	North American Warm Desert Sparsely Vegetated Systems	1.0246	19.000000	20.0246	73.4903	6.6141	5797.0000	38342.0848	1289.2209	29.7405
13	Barren	North American Warm Desert Sparsely Vegetated Systems	1.0246	38.000000	39.0246	143.2203	12.8898	65.0000	837.8386	14.4556	57.9593
14	Barren	North American Warm Desert Sparsely Vegetated Systems	1.0246	0.0000	1.0246	3.7603	0.3384	25201.0000	8528.6580	5604.5638	1.5217
15	Barren	Quarries-Strip Mines-Gravel Pits	0.0000	0.000000	0.0000	0.0000	0.0000	29.0000	0.0000	6.4494	0.0000
16	Barren	Quarries-Strip Mines-Gravel Pits	0.0000	19.000000	19.0000	69.7300	6.2757	5.0000	31.3785	1.1120	28.2188
17	Barren	Quarries-Strip Mines-Gravel Pits	0.0000	38.000000	38.0000	139.4600	12.5514	18.0000	225.9252	4.0031	56.4375
18	Barren	Quarries-Strip Mines-Gravel Pits	0.0000	88.000000	88.0000	322.9600	29.0664	9.0000	261.5976	2.0016	130.6975
19	Forest	California Central Valley Mixed Oak Savanna	97.9692	0.000000	97.9692	359.5468	32.3592	2.0000	64.7184	0.4448	145.5036
20	Forest	California Central Valley Mixed Oak Savanna	97.9692	38.000000	135.9692	499.0068	44.9106	1.0000	44.9106	0.2224	201.9412
21	Forest	California Coastal Live Oak Woodland and Savanna	75.8298	19.000000	94.8298	348.0254	31.3223	1.0000	31.3223	0.2224	140.8411
22	Forest	California Coastal Live Oak Woodland and Savanna	96.9364	0.000000	96.9364	355.7566	32.0181	322.0000	10309.8276	71.6110	143.9698
23	Forest	California Coastal Live Oak Woodland and Savanna	96.9364	19.000000	115.9364	425.4866	38.2938	237.0000	9075.6301	52.7075	172.1886
24	Forest	California Coastal Live Oak Woodland and Savanna	96.9364	38.000000	134.9364	495.2166	44.5695	388.0000	17292.9652	86.2891	200.4074
25	Forest	California Coastal Live Oak Woodland and Savanna	96.9364	0.0000	96.9364	355.7566	32.0181	2.0000	64.0362	0.4448	143.9698
26	Forest	California Coastal Live Oak Woodland and Savanna	123.0533	0.000000	123.0533	451.6057	40.6445	1282.0000	52106.2601	285.1097	182.7586
27	Forest	California Coastal Live Oak Woodland and Savanna	123.0533	19.000000	142.0533	521.3357	46.9202	1380.0000	64749.8880	306.9044	210.9774
28	Forest	California Coastal Live Oak Woodland and Savanna	123.0533	38.000000	161.0533	591.0657	53.1959	3026.0000	160970.8196	672.9658	239.1962
29	Forest	California Coastal Live Oak Woodland and Savanna	140.0344	19.000000	159.0344	583.6563	52.5291	2.0000	105.0581	0.4448	236.1977
30	Forest	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	76.1247	38.000000	114.1247	418.8377	37.6954	1.0000	37.6954	0.2224	169.4979
31	Forest	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	98.2553	19.000000	117.2553	430.3270	38.7294	4.0000	154.9177	0.8896	174.1474
32	Forest	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	98.2553	38.000000	136.2553	500.0570	45.0051	21.0000	945.1077	4.6703	202.3662
33	Forest	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	124.9067	38.000000	162.9067	597.8675	53.8081	6.0000	322.8485	1.3344	241.9488
34	Forest	California Montane Jeffrey Pine(-Ponderosa Pine) Woodland	87.9018	38.000000	125.9018	462.0594	41.5853	1.0000	41.5853	0.2224	186.9891
35	Forest	California Montane Jeffrey Pine(-Ponderosa Pine) Woodland	124.0213	38.000000	162.0213	594.6180	53.5156	1.0000	53.5156	0.2224	240.6337
36	Forest	California Montane Riparian Systems	85.1558	0.000000	85.1558	312.5217	28.1270	122.0000	3431.4882	27.1321	126.4732
37	Forest	California Montane Riparian Systems	85.1558	19.000000	104.1558	382.2517	34.4027	171.0000	5882.8536	38.0295	154.6920
38	Forest	California Montane Riparian Systems	85.1558	38.000000	123.1558	451.9817	40.6784	317.0000	12895.0377	70.4991	182.9108
39	Forest	California Montane Riparian Systems	99.3322	0.000000	99.3322	364.5490	32.8094	486.0000	15945.3728	108.0837	147.5280
40	Forest	California Montane Riparian Systems	99.3322	19.000000	118.3322	434.2790	39.0851	608.0000	23763.7464	135.2159	175.7467
41	Forest	California Montane Riparian Systems	99.3322	38.000000	137.3322	504.0090	45.3608	1016.0000	46086.5821	225.9528	203.9655
42	Forest	California Montane Riparian Systems	99.3322	88.000000	187.3322	687.5090	61.8758	1.0000	61.8758	0.2224	278.2254
43	Forest	California Montane Riparian Systems	99.3322	0.0000	99.3322	364.5490	32.8094	6.0000	196.8565	1.3344	147.5280
44	Forest	California Montane Riparian Systems	124.8759	0.000000	124.8759	458.2944	41.2465	23.0000	948.6695	5.1151	185.4655
45	Forest	California Montane Riparian Systems	124.8759	19.000000	143.8759	528.0244	47.5222	2.0000	95.0444	0.4448	213.6842
46	Forest	California Montane Riparian Systems	124.8759	38.000000	162.8759	597.7544	53.7979	4.0000	215.1916	0.8896	241.9030
47	Forest	California Montane Riparian Systems	124.8759	0.0000	124.8759	458.2944	41.2465	1.0000	41.2465	0.2224	185.4655
48	Forest	California Montane Riparian Systems	126.9165	0.000000	126.9165	465.7834	41.9205	216.0000	9054.8287	48.0372	188.4961
49	Forest	California Montane Riparian Systems	126.9165	19.000000	145.9165	535.5134	48.1962	124.0000	5976.3292	27.5769	216.7149
50	Forest	California Montane Riparian Systems	126.9165	38.000000	164.9165	605.2434	54.4719	451.0000	24566.8284	100.2999	244.9337
51	Forest	California Montane Riparian Systems	126.9165	0.0000	126.9165	465.7834	41.9205	12.0000	503.0460	2.6687	188.4961
52	Forest	California Montane Riparian Systems	151.1567	0.000000	151.1567	554.7451	49.9271	7133.0000	356129.7048	1586.3400	224.4977
53	Forest	California Montane Riparian Systems	151.1567	19.000000	170.1567	624.4751	56.2028	7063.0000	396960.0798	1570.7724	252.7165
54	Forest	California Montane Riparian Systems	151.1567	38.000000	189.1567	694.2051	62.4785	21861.0000	1365841.5706	4861.7662	280.9353
55	Forest	California Montane Riparian Systems	151.1567	0.0000	151.1567	554.7451	49.9271	147.0000	7339.2775	32.6920	224.4977
56	Forest	California Montane Riparian Systems	188.7739	0.000000	188.7739	692.8003	62.3520	1.0000	62.3520	0.2224	280.3668
57	Forest	California Montane Riparian Systems	188.7739	19.000000	207.7739	762.5303	68.6277	2.0000	137.2555	0.4448	308.5856
58	Forest	California Montane Riparian Systems	188.7739	38.000000	226.7739	832.2603	74.9034	4.0000	299.6137	0.8896	336.8043
59	Forest	California Montane Riparian Systems	188.7739	0.0000	188.7739	692.8003	62.3520	1.0000	62.3520	0.2224	280.3668
60	Forest	California Montane Riparian Systems	188.7739	0.000000	188.7739	692.8003	62.3520	5118.0000	319117.6905	1138.2151	280.3668
61	Forest	California Montane Riparian Systems	188.7739	19.000000	207.7739	762.5303	68.6277	4737.0000	325089.5579	1053.4827	308.5856
62	Forest	California Montane Riparian Systems	188.7739	38.000000	226.7739	832.2603	74.9034	18070.0000	1353504.9834	4018.6686	336.8043
63	Forest	California Montane Riparian Systems	188.7739	88.000000	276.7739	1015.7603	91.4184	6.0000	548.5106	1.3344	411.0643
64	Forest	California Montane Riparian Systems	188.7739	0.0000	188.7739	692.8003	62.3520	239.0000	14902.1352	53.1523	280.3668
65	Forest	California Montane Riparian Systems	307.6667	0.000000	307.6667	1129.1368	101.6223	11.0000	1117.8454	2.4463	456.9462
66	Forest	California Montane Riparian Systems	307.6667	19.000000	326.6667	1198.8668	107.8980	1.0000	107.8980	0.2224	485.1649
67	Forest	California Montane Riparian Systems	307.6667	38.000000	345.6667	1268.5968	114.1737	129.0000	14728.4087	28.6889	513.3837
68	Forest	California Montane Riparian Systems	356.2130	0.000000	356.2130	1307.3017	117.6572	1.0000	117.6572	0.2224	529.0470
69	Forest	California Montane Riparian Systems	356.2130	38.000000	394.2130	1446.7617	130.2086	2.0000	260.4171	0.4448	585.4846
70	Forest	California Montane Riparian Systems	623.6947	38.000000	661.6947	2428.4195	218.5578	3.0000	655.6733	0.6672	982.7480
71	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	0.000000	66.5226	244.1380	21.9724	1549.0000	34035.2833	344.4891	98.7993
72	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	19.000000	85.5226	313.8680	28.2481	1237.0000	34942.9282	275.1020	127.0181
73	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	38.000000	104.5226	383.5980	34.5238	7320.0000	252714.3846	1627.9277	155.2369

SANDAG Carbon Inventory - 2001

			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil MT CO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Class	Land Cover Type	01_TotalMTCha	SOC_MT_Cha_1	01_TOTALC_MTCha	01_TOTALC_MTCO2eha	01_TOTALC_MTCO2epixel	Number of Pixels	01_TOTALC_MTCO2e	Acres	TOTAL C/Acre
74	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	0.0000	66.5226	244.1380	21.9724	701.0000	15402.6685	155.8985	98.7993
75	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	0.000000	77.4067	284.0824	25.5674	5480.0000	140109.4424	1218.7219	114.9642
76	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	19.000000	96.4067	353.8124	31.8431	4889.0000	155680.9965	1087.2867	143.1830
77	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	38.000000	115.4067	423.5424	38.1188	15853.0000	604297.5979	3525.6200	171.4018
78	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	0.0000	77.4067	284.0824	25.5674	2778.0000	71026.2830	617.8119	114.9642
79	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	0.000000	90.6348	332.6297	29.9367	200.0000	5987.3349	44.4789	134.6107
80	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	19.000000	109.6348	402.3597	36.2124	85.0000	3078.0518	18.9035	162.8295
81	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	38.000000	128.6348	472.0897	42.4881	2794.0000	118711.6800	621.3702	191.0482
82	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	0.0000	90.6348	332.6297	29.9367	65.0000	1945.8838	14.4556	134.6107
83	Forest	Central and Southern California Mixed Evergreen Woodland	105.1030	0.000000	105.1030	385.7279	34.7155	15.0000	520.7326	3.3359	156.0988
84	Forest	Central and Southern California Mixed Evergreen Woodland	105.1030	19.000000	124.1030	455.4579	40.9912	13.0000	532.8857	2.8911	184.3176
85	Forest	Central and Southern California Mixed Evergreen Woodland	105.1030	38.000000	143.1030	525.1879	47.2669	172.0000	8129.9085	38.2519	212.5363
86	Forest	Central and Southern California Mixed Evergreen Woodland	105.1030	0.0000	105.1030	385.7279	34.7155	3.0000	104.1465	0.6672	156.0988
87	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	0.000000	111.2302	408.2148	36.7393	27505.0000	1010515.4108	6116.9607	165.1989
88	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	19.000000	130.2302	477.9448	43.0150	9741.0000	419009.4565	2166.3448	193.4177
89	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	38.000000	149.2302	547.6748	49.2907	159338.0000	7853887.1430	35435.8948	221.6365
90	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	0.0000	111.2302	408.2148	36.7393	5644.0000	207356.8071	1255.1946	165.1989
91	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	0.000000	150.6005	552.7040	49.7434	5761.0000	286571.4748	1281.2147	223.6717
92	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	19.000000	169.6005	622.4340	56.0191	1970.0000	110357.5406	438.1172	251.8905
93	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	38.000000	188.6005	692.1640	62.2948	46223.0000	2879450.5140	10279.7410	280.1092
94	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	0.0000	150.6005	552.7040	49.7434	234.0000	11639.9453	52.0403	223.6717
95	Forest	Central and Southern California Mixed Evergreen Woodland	191.4404	0.000000	191.4404	702.5863	63.2328	1.0000	63.2328	0.2224	284.3270
96	Forest	Central and Southern California Mixed Evergreen Woodland	237.1479	0.000000	237.1479	870.3328	78.3300	4.0000	313.3198	0.8896	352.2117
97	Forest	Central and Southern California Mixed Evergreen Woodland	237.1479	38.000000	275.1479	1009.7928	90.8814	192.0000	17449.2195	42.6997	408.6493
98	Forest	Central and Southern California Mixed Evergreen Woodland	485.6886	38.000000	523.6886	1921.9372	172.9743	10.0000	1729.7434	2.2239	777.7816
99	Forest	Central and Southern California Mixed Evergreen Woodland	485.6886	38.000000	523.6886	1921.9372	172.9743	1.0000	172.9743	0.2224	777.7816
100	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	0.000000	71.3202	261.7450	23.5570	13.0000	306.2416	2.8911	105.9246
101	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	38.000000	109.3202	401.2050	36.1084	2.0000	72.2169	0.4448	162.3621
102	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	0.0000	71.3202	261.7450	23.5570	5.0000	117.7852	1.1120	105.9246
103	Forest	Great Basin Pinyon-Juniper Woodland	76.3856	0.0000	76.3856	280.3351	25.2302	1.0000	25.2302	0.2224	113.4477
104	Forest	Great Basin Pinyon-Juniper Woodland	92.4161	0.000000	92.4161	339.1671	30.5250	3.0000	91.5751	0.6672	137.2563
105	Forest	Great Basin Pinyon-Juniper Woodland	92.4161	38.000000	130.4161	478.6271	43.0764	75.0000	3230.7328	16.6796	193.6938
106	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	0.000000	100.8879	370.2584	33.3233	27.0000	899.7279	6.0047	149.8385
107	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	38.000000	138.8879	509.7184	45.8747	1683.0000	77207.0475	374.2899	206.2760
108	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	0.0000	100.8879	370.2584	33.3233	35.0000	1166.3140	7.7838	149.8385
109	Forest	Great Basin Pinyon-Juniper Woodland	113.5739	38.000000	151.5739	556.2763	50.0649	983.0000	49213.7674	218.6138	225.1174
110	Forest	Great Basin Pinyon-Juniper Woodland	140.2175	0.000000	140.2175	514.5980	46.3138	78.0000	3612.4783	17.3468	208.2508
111	Forest	Great Basin Pinyon-Juniper Woodland	140.2175	38.000000	178.2175	654.0580	58.8652	196.0000	11537.5839	43.5893	264.6883
112	Forest	Great Basin Pinyon-Juniper Woodland	140.2175	0.0000	140.2175	514.5980	46.3138	15.0000	694.7074	3.3359	208.2508
113	Forest	Great Basin Pinyon-Juniper Woodland	151.0862	0.000000	151.0862	554.4864	49.9038	17.0000	848.3641	3.7807	224.3930
114	Forest	Great Basin Pinyon-Juniper Woodland	151.0862	38.000000	189.0862	693.9464	62.4552	146.0000	9118.4551	32.4696	280.8306
115	Forest	Great Basin Pinyon-Juniper Woodland	151.0862	0.0000	151.0862	554.4864	49.9038	19.0000	948.1717	4.2255	224.3930
116	Forest	Great Basin Pinyon-Juniper Woodland	166.8876	38.000000	204.8876	751.9375	67.6744	1.0000	67.6744	0.2224	304.2988
117	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	0.000000	68.3180	250.7272	22.5654	3221.0000	72683.2940	716.3327	101.4658
118	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	19.000000	87.3180	320.4572	28.8411	384.0000	11074.9992	85.3995	129.6846
119	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	38.000000	106.3180	390.1872	35.1168	10212.0000	358613.2074	2271.0926	157.9034
120	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	0.0000	68.3180	250.7272	22.5654	772.0000	17420.5225	171.6886	101.4658
121	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	0.000000	82.1936	301.6505	27.1485	2159.0000	58613.7110	480.1497	122.0738
122	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	19.000000	101.1936	371.3805	33.4242	124.0000	4144.6065	27.5769	150.2926
123	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	38.000000	120.1936	441.1105	39.6999	10043.0000	398706.5585	2233.5080	178.5114
124	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	0.0000	82.1936	301.6505	27.1485	766.0000	20795.7863	170.3542	122.0738
125	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	0.000000	96.4746	354.0616	31.8655	703.0000	22401.4773	156.3433	143.2839
126	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	19.000000	115.4746	423.7916	38.1412	407.0000	15523.4863	90.5146	171.5026
127	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	38.000000	134.4746	493.5216	44.4169	7015.0000	311584.8612	1560.0974	199.7214
128	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	0.0000	96.4746	354.0616	31.8655	156.0000	4971.0248	34.6935	143.2839
129	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	114.7380	0.000000	114.7380	421.0883	37.8980	3.0000	113.6939	0.6672	170.4087
130	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	114.7380	19.000000	133.7380	490.8183	44.1737	1.0000	44.1737	0.2224	198.6274
131	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	114.7380	38.000000	152.7380	560.5483	50.4494	70.0000	3531.4545	15.5676	226.8462
132	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	114.7380	0.0000	114.7380	421.0883	37.8980	3.0000	113.6939	0.6672	170.4087
133	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	0.000000	121.6313	446.3869	40.1748	30207.0000	1213560.7391	6717.8707	180.6466
134	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	19.000000	140.6313	516.1169	46.4505	6956.0000	323109.8059	1546.9761	208.8654
135	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	38.000000	159.6313	585.8469	52.7262	163258.0000	8607976.9619	36307.6813	237.0842
136	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	0.0000	121.6313	446.3869	40.1748	3516.0000	141254.6615	781.9391	180.6466
137	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	167.8182	0.000000	167.8182	615.8928	55.4304	9028.0000	500425.2130	2007.7775	249.2434
138	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	167.8182	19.000000	186.8182	685.6228	61.7061	2090.0000	128965.6476	464.8045	277.4621
139	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	167.8182	38.000000	205.8182	755.3528	67.9818	61010.0000	4147566.6566	13568.2884	305.6809
140	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	167.8182	0.0000	167.8182	615.8928	55.4304	291.0000	16130.2323	64.7168	249.2434
141	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	0.000000	205.6438	754.7127	67.9241	226.0000	15350.8573	50.2612	305.4219
142	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	19.000000	224.6438	824.4427	74.1998	208.0000	15433.5682	46.2581	333.6407
143	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	38.000000	243.6438	894.1727	80.4755	2668.0000	214708.7598	593.3485	361.8594
144	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	0.0000	205.6438	754.7127	67.9241	41.0000	2784.8900	9.1182	305.4219
145	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	0.000000	269.0092	987.2638	88.8537	3656.0000	324849.2689	813.0743	399.5321
146	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	19.000000	288.0092	1056.9938	95.1294	758.0000	72108.1146	168.5750	427.7509

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			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil MT CO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Class	Land Cover Type	01_TotalMTCha	SOC_MT_Cha_1	01_TOTALC_MTCha	01_TOTALC_MTCO2eha	01_TOTALC_MTCO2epixel	Number of Pixels	01_TOTALC_MTCO2e	Acres	TOTAL C/Acre
147	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	38.000000	307.0092	1126.7238	101.4051	35499.0000	3599781.0208	7894.7824	455.9696
148	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	0.0000	269.0092	987.2638	88.8537	12.0000	1066.2449	2.6687	399.5321
149	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	329.8977	0.0000	329.8977	1210.7246	108.9652	1.0000	108.9652	0.2224	489.9636
150	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	329.8977	38.000000	367.8977	1350.1846	121.5166	3.0000	364.5498	0.6672	546.4011
151	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	0.000000	470.4982	1726.7284	155.4056	32.0000	4972.9778	7.1166	698.7833
152	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	19.000000	489.4982	1796.4584	161.6813	97.0000	15683.0818	21.5723	727.0020
153	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	38.000000	508.4982	1866.1884	167.9570	316.0000	53074.3979	70.2767	755.2208
154	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	0.000000	560.1758	2055.8451	185.0261	151.0000	27938.9344	33.5816	831.9723
155	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	19.000000	579.1758	2125.5751	191.3018	13.0000	2486.9228	2.8911	860.1910
156	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	38.000000	598.1758	2195.3051	197.5775	726.0000	143441.2329	161.4584	888.4098
157	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	102.6198	0.000000	102.6198	376.6147	33.8953	27.0000	915.1736	6.0047	152.4108
158	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	138.0766	0.000000	138.0766	506.7411	45.6067	445.0000	20294.9819	98.9656	205.0712
159	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	138.0766	19.000000	157.0766	576.4711	51.8824	3.0000	155.6472	0.6672	233.2899
160	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	138.0766	38.000000	176.0766	646.2011	58.1581	726.0000	42222.7813	161.4584	261.5087
161	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	186.9268	0.000000	186.9268	686.0215	61.7419	243.0000	15003.2897	54.0419	277.6235
162	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	186.9268	38.000000	224.9268	825.4815	74.2933	468.0000	34769.2799	104.0806	334.0610
163	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	216.0614	0.000000	216.0614	792.9452	71.3651	943.0000	67297.2553	209.7180	320.8940
164	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	216.0614	19.000000	235.0614	862.6752	77.6408	7.0000	543.4853	1.5568	349.1128
165	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	216.0614	38.000000	254.0614	932.4052	83.9165	2798.0000	234798.2660	622.2598	377.3316
166	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	293.3944	0.000000	293.3944	1076.7573	96.9082	2991.0000	289852.3045	665.1819	435.7489
167	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	293.3944	19.000000	312.3944	1146.4873	103.1839	17.0000	1754.1256	3.7807	463.9677
168	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	293.3944	38.000000	331.3944	1216.2173	109.4596	5129.0000	561418.0797	1140.6614	492.1864
169	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	467.7111	0.000000	467.7111	1716.4997	154.4850	6.0000	926.9099	1.3344	694.6439
170	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	467.7111	38.000000	505.7111	1855.9597	167.0364	21.0000	3507.7639	4.6703	751.0814
171	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	613.2106	0.000000	613.2106	2250.4828	202.5435	72.0000	14583.1284	16.0124	910.7395
172	Forest	Mediterranean California Mesic Mixed Conifer Forest and Woodland	613.2106	38.000000	651.2106	2389.9428	215.0949	91.0000	19573.6314	20.2379	967.1770
173	Forest	Mediterranean California Mixed Oak Woodland	71.8994	0.000000	71.8994	263.8709	23.7484	397.0000	9428.1069	88.2906	106.7849
174	Forest	Mediterranean California Mixed Oak Woodland	71.8994	19.000000	90.8994	333.6009	30.0241	48.0000	1441.1558	10.6749	135.0037
175	Forest	Mediterranean California Mixed Oak Woodland	71.8994	38.000000	109.8994	403.3309	36.2998	2690.0000	97646.4084	598.2412	163.2225
176	Forest	Mediterranean California Mixed Oak Woodland	71.8994	0.0000	71.8994	263.8709	23.7484	302.0000	7172.0108	67.1631	106.7849
177	Forest	Mediterranean California Mixed Oak Woodland	85.0254	0.000000	85.0254	312.0430	28.0839	408.0000	11458.2202	90.7370	126.2795
178	Forest	Mediterranean California Mixed Oak Woodland	85.0254	19.000000	104.0254	381.7730	34.3596	10.0000	343.5957	2.2239	154.4983
179	Forest	Mediterranean California Mixed Oak Woodland	85.0254	38.000000	123.0254	451.5030	40.6353	3008.0000	122230.9015	668.9627	182.7171
180	Forest	Mediterranean California Mixed Oak Woodland	85.0254	0.0000	85.0254	312.0430	28.0839	549.0000	15418.0463	122.0946	126.2795
181	Forest	Mediterranean California Mixed Oak Woodland	96.3265	0.000000	96.3265	353.5183	31.8166	11.0000	349.9831	2.4463	143.0640
182	Forest	Mediterranean California Mixed Oak Woodland	96.3265	19.000000	115.3265	423.2483	38.0923	18.0000	685.6622	4.0031	171.2828
183	Forest	Mediterranean California Mixed Oak Woodland	96.3265	38.000000	134.3265	492.9783	44.3680	825.0000	36603.6354	183.4755	199.5015
184	Forest	Mediterranean California Mixed Oak Woodland	96.3265	0.0000	96.3265	353.5183	31.8166	4.0000	127.2666	0.8896	143.0640
185	Forest	Mediterranean California Mixed Oak Woodland	111.2843	0.000000	111.2843	408.4132	36.7572	4.0000	147.0288	0.8896	165.2792
186	Forest	Mediterranean California Mixed Oak Woodland	111.2843	38.000000	149.2843	547.8732	49.3086	20.0000	986.1718	4.4479	221.7168
187	Forest	Mediterranean California Mixed Oak Woodland	111.2843	0.0000	111.2843	408.4132	36.7572	1.0000	36.7572	0.2224	165.2792
188	Forest	Mediterranean California Mixed Oak Woodland	115.9749	0.000000	115.9749	425.6277	38.3065	2746.0000	105189.6297	610.6953	172.2457
189	Forest	Mediterranean California Mixed Oak Woodland	115.9749	19.000000	134.9749	495.3577	44.5822	186.0000	8292.2879	41.3654	200.4645
190	Forest	Mediterranean California Mixed Oak Woodland	115.9749	38.000000	153.9749	565.0877	50.8579	25370.0000	1290264.7443	5642.1485	228.6832
191	Forest	Mediterranean California Mixed Oak Woodland	115.9749	0.0000	115.9749	425.6277	38.3065	863.0000	33058.5034	191.9265	172.2457
192	Forest	Mediterranean California Mixed Oak Woodland	149.9237	0.000000	149.9237	550.2201	49.5198	1780.0000	88145.2602	395.8622	222.6665
193	Forest	Mediterranean California Mixed Oak Woodland	149.9237	19.000000	168.9237	619.9501	55.7955	157.0000	8759.8949	34.9159	250.8853
194	Forest	Mediterranean California Mixed Oak Woodland	149.9237	38.000000	187.9237	689.6801	62.0712	21180.0000	1314668.2092	4710.3155	279.1041
195	Forest	Mediterranean California Mixed Oak Woodland	149.9237	0.0000	149.9237	550.2201	49.5198	64.0000	3169.2678	14.2332	222.6665
196	Forest	Mediterranean California Mixed Oak Woodland	261.7242	38.000000	299.7242	1099.9878	98.9989	2.0000	197.9978	0.4448	445.1500
197	Forest	Mediterranean California Mixed Oak Woodland	419.3246	0.000000	419.3246	1538.9213	138.5029	5.0000	692.5146	1.1120	622.7803
198	Forest	Mediterranean California Mixed Oak Woodland	419.3246	19.000000	438.3246	1608.6513	144.7786	2.0000	289.5572	0.4448	650.9991
199	Forest	Mediterranean California Mixed Oak Woodland	419.3246	38.000000	457.3246	1678.3813	151.0543	117.0000	17673.3549	26.0202	679.2179
200	Forest	Recently Disturbed Forest	1.5040	0.000000	1.5040	5.5197	0.4968	27.0000	13.4128	6.0047	2.2337
201	Forest	Recently Disturbed Forest	1.5040	19.000000	20.5040	75.2497	6.7725	34.0000	230.2640	7.5614	30.4525
202	Forest	Recently Disturbed Forest	1.5040	38.000000	39.5040	144.9797	13.0482	28.0000	365.3488	6.2270	58.6713
203	Forest	Recently Disturbed Forest	1.5040	88.000000	89.5040	328.4797	29.5632	2.0000	59.1263	0.4448	132.9312
204	Forest	Southern California Oak Woodland and Savanna	74.1366	0.000000	74.1366	272.0814	24.4873	4730.0000	115825.0578	1051.9260	110.1076
205	Forest	Southern California Oak Woodland and Savanna	74.1366	19.000000	93.1366	341.8114	30.7630	11277.0000	346914.6582	2507.9428	138.3264
206	Forest	Southern California Oak Woodland and Savanna	74.1366	38.000000	112.1366	411.5414	37.0387	29783.0000	1103124.4133	6623.5754	166.5452
207	Forest	Southern California Oak Woodland and Savanna	74.1366	0.0000	74.1366	272.0814	24.4873	1536.0000	37612.5346	341.5980	110.1076
208	Forest	Southern California Oak Woodland and Savanna	82.6472	0.000000	82.6472	303.3150	27.2984	390.0000	10646.3579	86.7339	122.7474
209	Forest	Southern California Oak Woodland and Savanna	82.6472	19.000000	101.6472	373.0450	33.5741	1202.0000	40356.0125	267.3182	150.9662
210	Forest	Southern California Oak Woodland and Savanna	82.6472	38.000000	120.6472	442.7750	39.8498	4558.0000	181635.1771	1013.6741	179.1850
211	Forest	Southern California Oak Woodland and Savanna	82.6472	0.0000	82.6472	303.3150	27.2984	53.0000	1446.8127	11.7869	122.7474
212	Forest	Southern California Oak Woodland and Savanna	83.9444	0.000000	83.9444	308.0758	27.7268	8724.0000	241888.7673	1940.1696	124.6740
213	Forest	Southern California Oak Woodland and Savanna	83.9444	19.000000	102.9444	377.8058	34.0025	36595.0000	1244322.1757	8138.5267	152.8928
214	Forest	Southern California Oak Woodland and Savanna	83.9444	38.000000	121.9444	447.5358	40.2782	46516.0000	1873581.6259	10344.9026	181.1116
215	Forest	Southern California Oak Woodland and Savanna	83.9444	88.000000	171.9444	631.0358	56.7932	1.0000	56.7932	0.2224	255.3715
216	Forest	Southern California Oak Woodland and Savanna	83.9444	0.0000	83.9444	308.0758	27.7268	1316.0000	36488.4935	292.6712	124.6740
217	Forest	Southern California Oak Woodland and Savanna	96.8036	0.000000	96.8036	355.2690	31.9742	15953.0000	510084.6130	3547.8595	143.7725
218	Forest	Southern California Oak Woodland and Savanna	96.8036	19.000000	115.8036	424.9990	38.2499	56917.0000	2177070.2735	12658.0278	171.9913
219	Forest	Southern California Oak Woodland and Savanna	96.8036	38.000000	134.8036	494.7290	44.5256	148805.0000	6625633.7777	33093.4136	200.2100

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			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil MT CO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Class**	**Land Cover Type**	**01_TotalMTCha**	**SOC_MT_Cha_1**	**01_TOTALC_MTCha**	**01_TOTALC_MTCO2eha**	**01_TOTALC_MTCO2epixel**	**Number of Pixels**	**01_TOTALC_MTCO2e**	**Acres**	**TOTAL C/Acre**
220	Forest	Southern California Oak Woodland and Savanna	96.8036	88.000000	184.8036	678.2290	61.0406	1.0000	61.0406	0.2224	274.4700
221	Forest	Southern California Oak Woodland and Savanna	96.8036	0.0000	96.8036	355.2690	31.9742	1582.0000	50583.2043	351.8281	143.7725
222	Forest	Southern California Oak Woodland and Savanna	102.8344	0.000000	102.8344	377.4024	33.9662	27.0000	917.0878	6.0047	152.7296
223	Forest	Southern California Oak Woodland and Savanna	102.8344	19.000000	121.8344	447.1324	40.2419	341.0000	13722.4924	75.8365	180.9483
224	Forest	Southern California Oak Woodland and Savanna	102.8344	38.000000	140.8344	516.8624	46.5176	433.0000	20142.1266	96.2968	209.1671
225	Forest	Southern California Oak Woodland and Savanna	102.8344	0.0000	102.8344	377.4024	33.9662	1.0000	33.9662	0.2224	152.7296
226	Forest	Southern California Oak Woodland and Savanna	121.1347	0.000000	121.1347	444.5642	40.0108	3696.0000	147879.8444	821.9701	179.9090
227	Forest	Southern California Oak Woodland and Savanna	121.1347	19.000000	140.1347	514.2942	46.2865	13885.0000	642687.7804	3087.9476	208.1278
228	Forest	Southern California Oak Woodland and Savanna	121.1347	38.000000	159.1347	584.0242	52.5622	59808.0000	3143638.8854	13300.9703	236.3466
229	Forest	Southern California Oak Woodland and Savanna	121.1347	0.0000	121.1347	444.5642	40.0108	67.0000	2680.7223	14.9004	179.9090
230	Forest	Southern California Oak Woodland and Savanna	145.1360	0.000000	145.1360	532.6491	47.9384	10.0000	479.3842	2.2239	215.5558
231	Forest	Southern California Oak Woodland and Savanna	145.1360	19.000000	164.1360	602.3791	54.2141	45.0000	2439.6354	10.0078	243.7746
232	Forest	Southern California Oak Woodland and Savanna	145.1360	38.000000	183.1360	672.1091	60.4898	101.0000	6109.4719	22.4618	271.9933
233	Forest	Southern California Oak Woodland and Savanna	159.0339	19.000000	178.0339	653.3844	58.8046	9.0000	529.2414	2.0016	264.4157
234	Forest	Southern California Oak Woodland and Savanna	159.0339	38.000000	197.0339	723.1144	65.0803	13.0000	846.0439	2.8911	292.6345
235	Forest	Southern California Oak Woodland and Savanna	258.3183	19.000000	277.3183	1017.7580	91.5982	10.0000	915.9822	2.2239	411.8727
236	Forest	Southern California Oak Woodland and Savanna	258.3183	38.000000	296.3183	1087.4880	97.8739	60.0000	5872.4354	13.3437	440.0915
237	Grassland	California Annual Grassland	6.1476	0.000000	6.1476	22.5617	2.0306	25228.0000	51226.7729	5610.5684	9.1304
238	Grassland	California Annual Grassland	6.1476	19.000000	25.1476	92.2917	8.3063	57375.0000	476571.2246	12759.8844	37.3492
239	Grassland	California Annual Grassland	6.1476	38.000000	44.1476	162.0217	14.5820	349777.0000	5100431.5226	77788.4810	65.5680
240	Grassland	California Annual Grassland	6.1476	88.000000	94.1476	345.5217	31.0970	604.0000	18782.5592	134.3263	139.8279
241	Grassland	California Annual Grassland	6.1476	0.0000	6.1476	22.5617	2.0306	47107.0000	95653.2263	10476.3377	9.1304
242	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	0.000000	6.1476	22.5617	2.0306	1357.0000	2755.4594	301.7893	9.1304
243	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	19.000000	25.1476	92.2917	8.3063	3158.0000	26231.1447	702.3218	37.3492
244	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	38.000000	44.1476	162.0217	14.5820	19454.0000	283677.2997	4326.4626	65.5680
245	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	88.000000	94.1476	345.5217	31.0970	38.0000	1181.6842	8.4510	139.8279
246	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	0.0000	6.1476	22.5617	2.0306	305.0000	619.3184	67.8303	9.1304
247	Grassland	California Mesic Serpentine Grassland	6.1476	0.000000	6.1476	22.5617	2.0306	2.0000	4.0611	0.4448	9.1304
248	Grassland	California Mesic Serpentine Grassland	6.1476	19.000000	25.1476	92.2917	8.3063	1.0000	8.3063	0.2224	37.3492
249	Grassland	California Northern Coastal Grassland	6.1476	38.000000	44.1476	162.0217	14.5820	2.0000	29.1639	0.4448	65.5680
250	Grassland	Herbaceous Semi-dry	0.0000	0.000000	0.0000	0.0000	0.0000	26.0000	0.0000	5.7823	0.0000
251	Grassland	Herbaceous Semi-dry	0.0000	19.000000	19.0000	69.7300	6.2757	2.0000	12.5514	0.4448	28.2188
252	Grassland	Herbaceous Semi-dry	0.0000	38.000000	38.0000	139.4600	12.5514	194.0000	2434.9716	43.1445	56.4375
253	Grassland	Herbaceous Semi-wet	0.0000	0.000000	0.0000	0.0000	0.0000	8.0000	0.0000	1.7792	0.0000
254	Grassland	Herbaceous Semi-wet	0.0000	19.000000	19.0000	69.7300	6.2757	55.0000	345.1635	12.2317	28.2188
255	Grassland	Herbaceous Semi-wet	0.0000	38.000000	38.0000	139.4600	12.5514	236.0000	2962.1304	52.4851	56.4375
256	Grassland	Introduced Upland Vegetation-Annual and Biennial Forbland	6.1476	0.000000	6.1476	22.5617	2.0306	459.0000	932.0235	102.0791	9.1304
257	Grassland	Introduced Upland Vegetation-Annual and Biennial Forbland	6.1476	19.000000	25.1476	92.2917	8.3063	928.0000	7708.2021	206.3821	37.3492
258	Grassland	Introduced Upland Vegetation-Annual and Biennial Forbland	6.1476	38.000000	44.1476	162.0217	14.5820	5524.0000	80550.7044	1228.5072	65.5680
259	Grassland	Introduced Upland Vegetation-Annual and Biennial Forbland	6.1476	88.000000	94.1476	345.5217	31.0970	63.0000	1959.1080	14.0109	139.8279
260	Grassland	Introduced Upland Vegetation-Annual and Biennial Forbland	6.1476	0.0000	6.1476	22.5617	2.0306	7.0000	14.2139	1.5568	9.1304
261	Grassland	Introduced Upland Vegetation-Annual Grassland	6.1476	0.000000	6.1476	22.5617	2.0306	64306.0000	130576.6949	14301.3007	9.1304
262	Grassland	Introduced Upland Vegetation-Annual Grassland	6.1476	19.000000	25.1476	92.2917	8.3063	64290.0000	534008.9591	14297.7424	37.3492
263	Grassland	Introduced Upland Vegetation-Annual Grassland	6.1476	38.000000	44.1476	162.0217	14.5820	196398.0000	2863866.2639	43677.8350	65.5680
264	Grassland	Introduced Upland Vegetation-Annual Grassland	6.1476	0.0000	6.1476	22.5617	2.0306	261537.0000	531064.5517	58164.3903	9.1304
265	Grassland	Introduced Upland Vegetation-Perennial Grassland and Forbland	6.1476	0.000000	6.1476	22.5617	2.0306	90.0000	182.7497	20.0155	9.1304
266	Grassland	Introduced Upland Vegetation-Perennial Grassland and Forbland	6.1476	19.000000	25.1476	92.2917	8.3063	128.0000	1063.2003	28.4665	37.3492
267	Grassland	Introduced Upland Vegetation-Perennial Grassland and Forbland	6.1476	38.000000	44.1476	162.0217	14.5820	905.0000	13196.6668	201.2670	65.5680
268	Grassland	Introduced Upland Vegetation-Perennial Grassland and Forbland	6.1476	88.000000	94.1476	345.5217	31.0970	1.0000	31.0970	0.2224	139.8279
269	Grassland	NASS-Fallow/Idle Cropland	1.0000	19.000000	20.0000	73.4000	6.6060	1.0000	6.6060	0.2224	29.7040
270	Grassland	NASS-Fallow/Idle Cropland	1.0000	38.000000	39.0000	143.1300	12.8817	5.0000	64.4085	1.1120	57.9227
271	Irrigated Pasture	Agriculture-Pasture and Hay	5.7477	0.000000	5.7477	21.0942	1.8985	801.0000	1520.6800	178.1380	8.5365
272	Irrigated Pasture	Agriculture-Pasture and Hay	5.7477	19.000000	24.7477	90.8242	8.1742	4606.0000	37650.2589	1024.3491	36.7553
273	Irrigated Pasture	Agriculture-Pasture and Hay	5.7477	38.000000	43.7477	160.5542	14.4499	10305.0000	148905.9816	2291.7753	64.9741
274	Irrigated Pasture	Agriculture-Pasture and Hay	5.7477	0.0000	5.7477	21.0942	1.8985	41.0000	77.8376	9.1182	8.5365
275	Irrigated Pasture	GRAIN AND HAY CROPS	5.7477	0.000000	5.7477	21.0942	1.8985	444.0000	842.9237	98.7432	8.5365
276	Irrigated Pasture	GRAIN AND HAY CROPS	5.7477	19.000000	24.7477	90.8242	8.1742	1839.0000	15032.3113	408.9835	36.7553
277	Irrigated Pasture	GRAIN AND HAY CROPS	5.7477	38.000000	43.7477	160.5542	14.4499	34634.0000	500457.0370	7702.4111	64.9741
278	Irrigated Pasture	NASS-Pasture and Hayland	5.7477	38.000000	43.7477	160.5542	14.4499	2.0000	28.8998	0.4448	64.9741
279	Irrigated Pasture	PASTURE	5.7477	0.000000	5.7477	21.0942	1.8985	495.0000	939.7461	110.0853	8.5365
280	Irrigated Pasture	PASTURE	5.7477	19.000000	24.7477	90.8242	8.1742	5239.0000	42824.5129	1165.1248	36.7553
281	Irrigated Pasture	PASTURE	5.7477	38.000000	43.7477	160.5542	14.4499	22337.0000	322766.9006	4967.6259	64.9741
282	Irrigated Pasture	PASTURE	5.7477	0.0000	5.7477	21.0942	1.8985	72.0000	136.6903	16.0124	8.5365
283	Orchard	CITRUS AND SUBTROPICAL	24.6300	0.000000	24.6300	90.3921	8.1353	13391.0000	108939.6550	2978.0847	36.5804
284	Orchard	CITRUS AND SUBTROPICAL	24.6300	19.000000	43.6300	160.1221	14.4110	115037.0000	1657796.9416	25583.5961	64.7992
285	Orchard	CITRUS AND SUBTROPICAL	24.6300	38.000000	62.6300	229.8521	20.6867	116203.0000	2403855.3219	25842.9081	93.0180
286	Orchard	NASS-Orchard	24.6300	19.000000	43.6300	160.1221	14.4110	4.0000	57.6440	0.8896	64.7992
287	Orchard	NASS-Orchard	24.6300	38.000000	62.6300	229.8521	20.6867	5.0000	103.4334	1.1120	93.0180
288	Row Crop	Agriculture-Cultivated Crops and Irrigated Agriculture	5.0000	0.000000	5.0000	18.3500	1.6515	6452.0000	10655.4780	1434.8893	7.4260
289	Row Crop	Agriculture-Cultivated Crops and Irrigated Agriculture	5.0000	19.000000	24.0000	88.0800	7.9272	20002.0000	158559.8544	4448.3348	35.6448
290	Row Crop	Agriculture-Cultivated Crops and Irrigated Agriculture	5.0000	38.000000	43.0000	157.8100	14.2029	37282.0000	529512.5178	8291.3117	63.8635
291	Row Crop	Agriculture-Cultivated Crops and Irrigated Agriculture	5.0000	88.000000	93.0000	341.3100	30.7179	847.0000	26018.0613	188.3681	138.1235
292	Row Crop	Agriculture-Cultivated Crops and Irrigated Agriculture	5.0000	0.0000	5.0000	18.3500	1.6515	26.0000	42.9390	5.7823	7.4260

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			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil MT CO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Class	Land Cover Type	01_TotalMTCha	SOC_MT_Cha_1	01_TOTALC_MTCha	01_TOTALC_MTCO2eha	01_TOTALC_MTCO2epixel	Number of Pixels	01_TOTALC_MTCO2e	Acres	TOTAL C/Acre
293	Row Crop	FIELD CROPS	5.0000	0.000000	5.0000	18.3500	1.6515	8.0000	13.2120	1.7792	7.4260
294	Row Crop	FIELD CROPS	5.0000	19.000000	24.0000	88.0800	7.9272	258.0000	2045.2176	57.3778	35.6448
295	Row Crop	FIELD CROPS	5.0000	38.000000	43.0000	157.8100	14.2029	1887.0000	26800.8723	419.6584	63.8635
296	Row Crop	NASS-Close Grown Crop	5.0000	19.000000	24.0000	88.0800	7.9272	15.0000	118.9080	3.3359	35.6448
297	Row Crop	NASS-Close Grown Crop	5.0000	38.000000	43.0000	157.8100	14.2029	51.0000	724.3479	11.3421	63.8635
298	Row Crop	NASS-Row Crop	5.0000	0.000000	5.0000	18.3500	1.6515	2.0000	3.3030	0.4448	7.4260
299	Row Crop	NASS-Row Crop	5.0000	19.000000	24.0000	88.0800	7.9272	51.0000	404.2872	11.3421	35.6448
300	Row Crop	NASS-Row Crop	5.0000	38.000000	43.0000	157.8100	14.2029	39.0000	553.9131	8.6734	63.8635
301	Row Crop	NASS-Row Crop-Close Grown Crop	5.0000	0.000000	5.0000	18.3500	1.6515	2.0000	3.3030	0.4448	7.4260
302	Row Crop	NASS-Row Crop-Close Grown Crop	5.0000	19.000000	24.0000	88.0800	7.9272	2.0000	15.8544	0.4448	35.6448
303	Row Crop	NASS-Row Crop-Close Grown Crop	5.0000	38.000000	43.0000	157.8100	14.2029	1.0000	14.2029	0.2224	63.8635
304	Row Crop	TILLED LANDS	5.0000	0.000000	5.0000	18.3500	1.6515	1497.0000	2472.2955	332.9246	7.4260
305	Row Crop	TILLED LANDS	5.0000	19.000000	24.0000	88.0800	7.9272	18019.0000	142840.2168	4007.3265	35.6448
306	Row Crop	TILLED LANDS	5.0000	38.000000	43.0000	157.8100	14.2029	46387.0000	658829.9223	10316.2137	63.8635
307	Row Crop	TILLED LANDS	5.0000	88.000000	93.0000	341.3100	30.7179	18.0000	552.9222	4.0031	138.1235
308	Shrubland	California Maritime Chaparral	2.6477	0.000000	2.6477	9.7169	0.8745	570.0000	498.4789	126.7649	3.9323
309	Shrubland	California Maritime Chaparral	2.6477	19.000000	21.6477	79.4469	7.1502	1185.0000	8473.0158	263.5375	32.1511
310	Shrubland	California Maritime Chaparral	2.6477	38.000000	40.6477	149.1769	13.4259	2539.0000	34088.4218	564.6596	60.3699
311	Shrubland	California Mesic Chaparral	71.6797	0.000000	71.6797	263.0645	23.6758	246597.0000	5838382.4634	54841.8165	106.4586
312	Shrubland	California Mesic Chaparral	71.6797	19.000000	90.6797	332.7945	29.9515	374723.0000	11223517.7744	83336.3342	134.6774
313	Shrubland	California Mesic Chaparral	71.6797	38.000000	109.6797	402.5245	36.2272	697809.0000	25279669.6310	155188.8837	162.8961
314	Shrubland	California Mesic Chaparral	71.6797	88.000000	159.6797	586.0245	52.7422	227.0000	11972.4805	50.4836	237.1561
315	Shrubland	California Mesic Chaparral	71.6797	0.0000	71.6797	263.0645	23.6758	83299.0000	1972170.8732	18525.2395	106.4586
316	Shrubland	California Montane Woodland and Chaparral	87.8712	0.000000	87.8712	322.4873	29.0239	3440.0000	99842.0693	765.0371	130.5062
317	Shrubland	California Montane Woodland and Chaparral	87.8712	19.000000	106.8712	392.2173	35.2996	1152.0000	40665.0901	256.1985	158.7250
318	Shrubland	California Montane Woodland and Chaparral	87.8712	38.000000	125.8712	461.9473	41.5753	22610.0000	940016.5689	5028.3396	186.9437
319	Shrubland	California Montane Woodland and Chaparral	87.8712	0.0000	87.8712	322.4873	29.0239	609.0000	17675.5291	135.4383	130.5062
320	Shrubland	California Xeric Serpentine Chaparral	2.6477	0.000000	2.6477	9.7169	0.8745	3241.0000	2834.3333	720.7806	3.9323
321	Shrubland	California Xeric Serpentine Chaparral	2.6477	19.000000	21.6477	79.4469	7.1502	15716.0000	112372.9251	3495.1520	32.1511
322	Shrubland	California Xeric Serpentine Chaparral	2.6477	38.000000	40.6477	149.1769	13.4259	24678.0000	331324.9599	5488.2515	60.3699
323	Shrubland	California Xeric Serpentine Chaparral	2.6477	88.000000	90.6477	332.6769	29.9409	6.0000	179.6455	1.3344	134.6298
324	Shrubland	California Xeric Serpentine Chaparral	2.6477	0.0000	2.6477	9.7169	0.8745	1122.0000	981.2163	249.5266	3.9323
325	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	67.3393	0.000000	67.3393	247.1350	22.2422	4.0000	88.9686	0.8896	100.0122
326	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	67.3393	19.000000	86.3393	316.8650	28.5179	8.0000	228.1428	1.7792	128.2309
327	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	67.3393	38.000000	105.3393	386.5950	34.7936	18.0000	626.2840	4.0031	156.4497
328	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	67.3393	0.0000	67.3393	247.1350	22.2422	1.0000	22.2422	0.2224	100.0122
329	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	77.6170	0.000000	77.6170	284.8543	25.6369	1.0000	25.6369	0.2224	115.2766
330	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	77.6170	19.000000	96.6170	354.5843	31.9126	1.0000	31.9126	0.2224	143.4954
331	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	77.6170	38.000000	115.6170	424.3143	38.1883	2.0000	76.3766	0.4448	171.7142
332	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	99.7693	0.000000	99.7693	366.1531	32.9538	25.0000	823.8446	5.5599	148.1772
333	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	99.7693	19.000000	118.7693	435.8831	39.2295	60.0000	2353.7690	13.3437	176.3959
334	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	99.7693	38.000000	137.7693	505.6131	45.5052	231.0000	10511.6973	51.3731	204.6147
335	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	99.7693	0.0000	99.7693	366.1531	32.9538	3.0000	98.8613	0.6672	148.1772
336	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	122.5643	0.000000	122.5643	449.8108	40.4830	42.0000	1700.2848	9.3406	182.0323
337	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	122.5643	19.000000	141.5643	519.5408	46.7587	106.0000	4956.4192	23.5738	210.2510
338	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	122.5643	38.000000	160.5643	589.2708	53.0344	169.0000	8962.8088	37.5847	238.4698
339	Shrubland	Mediterranean California Mesic Serpentine Woodland and Chaparral	161.9134	38.000000	199.9134	733.6823	66.0314	3.0000	198.0942	0.6672	296.9112
340	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	0.000000	2.3101	8.4779	0.7630	44027.0000	33593.0199	9791.3627	3.4309
341	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	19.000000	21.3101	78.2079	7.0387	35079.0000	246910.8911	7801.3767	31.6497
342	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	38.000000	40.3101	147.9379	13.3144	89253.0000	1188350.9924	19849.3763	59.8684
343	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	0.0000	2.3101	8.4779	0.7630	178479.0000	136181.1752	39692.7480	3.4309
344	Shrubland	North American Warm Desert Riparian Systems	63.8636	0.000000	63.8636	234.3794	21.0941	2.0000	42.1883	0.4448	94.8501
345	Shrubland	North American Warm Desert Riparian Systems	63.8636	19.000000	82.8636	304.1094	27.3698	44.0000	1204.2733	9.7854	123.0689
346	Shrubland	North American Warm Desert Riparian Systems	63.8636	38.000000	101.8636	373.8394	33.6455	7.0000	235.5188	1.5568	151.2877
347	Shrubland	North American Warm Desert Riparian Systems	98.5567	0.000000	98.5567	361.7029	32.5533	83.0000	2701.9207	18.4587	146.3762
348	Shrubland	North American Warm Desert Riparian Systems	98.5567	19.000000	117.5567	431.4329	38.8290	332.0000	12891.2152	73.8350	174.5950
349	Shrubland	North American Warm Desert Riparian Systems	98.5567	38.000000	136.5567	501.1629	45.1047	587.0000	26476.4363	130.5456	202.8137
350	Shrubland	North American Warm Desert Riparian Systems	98.5567	0.0000	98.5567	361.7029	32.5533	2.0000	65.1065	0.4448	146.3762
351	Shrubland	North American Warm Desert Riparian Systems	142.1327	38.000000	180.1327	661.0870	59.4978	1.0000	59.4978	0.2224	267.5328
352	Shrubland	North American Warm Desert Riparian Systems	161.4372	0.000000	161.4372	592.4744	53.3227	108.0000	5758.8512	24.0186	239.7663
353	Shrubland	North American Warm Desert Riparian Systems	161.4372	19.000000	180.4372	662.2044	59.5984	309.0000	18415.9044	68.7199	267.9850
354	Shrubland	North American Warm Desert Riparian Systems	161.4372	38.000000	199.4372	731.9344	65.8741	526.0000	34649.7746	116.9795	296.2038
355	Shrubland	North American Warm Desert Riparian Systems	225.1159	19.000000	244.1159	895.9054	80.6315	2.0000	161.2630	0.4448	362.5606
356	Shrubland	Northern and Central California Dry-Mesic Chaparral	54.8678	0.000000	54.8678	201.3648	18.1228	10352.0000	187607.5811	2302.2279	81.4896
357	Shrubland	Northern and Central California Dry-Mesic Chaparral	54.8678	19.000000	73.8678	271.0948	24.3985	2901.0000	70780.1481	645.1664	109.7084
358	Shrubland	Northern and Central California Dry-Mesic Chaparral	54.8678	38.000000	92.8678	340.8248	30.6742	36076.0000	1106603.6780	8023.1040	137.9271
359	Shrubland	Northern and Central California Dry-Mesic Chaparral	54.8678	0.0000	54.8678	201.3648	18.1228	10325.0000	187118.2646	2296.2232	81.4896
360	Shrubland	Northern California Coastal Scrub	2.3798	0.000000	2.3798	8.7337	0.7860	5.0000	3.9302	1.1120	3.5344
361	Shrubland	Northern California Coastal Scrub	2.3798	19.000000	21.3798	78.4637	7.0617	2.0000	14.1235	0.4448	31.7532
362	Shrubland	Northern California Coastal Scrub	2.3798	38.000000	40.3798	148.1937	13.3374	3.0000	40.0123	0.6672	59.9720
363	Shrubland	Northern California Coastal Scrub	2.3798	88.000000	90.3798	331.6937	29.8524	2.0000	59.7049	0.4448	134.2319
364	Shrubland	Northern California Coastal Scrub	2.3798	0.0000	2.3798	8.7337	0.7860	3.0000	2.3581	0.6672	3.5344
365	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	0.000000	0.6878	2.5241	0.2272	13942.0000	3167.1948	3100.6241	1.0215

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ROW	Land Cover Class	Land Cover Type	Non-Soil C 01_TotalMTCha	Soil C SOC_MT_Cha_1	Non-soil+Soil 01_TOTALC_MTCha	Non-soil_Soil MT CO2e/ha 01_TOTALC_MTCO2eha	convert to pixels 01_TOTALC_MTCO2epixel	# of pixels Number of Pixels	Total CO2e 01_TOTALC_MTCO2e	Acres	Total CO2e/acre TOTAL C/Acre
366	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	19.000000	19.6878	72.2541	6.5029	17589.0000	114378.9686	3911.6969	29.2402
367	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	38.000000	38.6878	141.9841	12.7786	1237.0000	15807.0903	275.1020	57.4590
368	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	0.0000	0.6878	2.5241	0.2272	107652.0000	24455.2327	23941.2127	1.0215
369	Shrubland	Sonora-Mojave Mixed Salt Desert Scrub	2.2936	0.000000	2.2936	8.4175	0.7576	433.0000	328.0304	96.2968	3.4065
370	Shrubland	Sonora-Mojave Mixed Salt Desert Scrub	2.2936	19.000000	21.2936	78.1475	7.0333	608.0000	4276.2319	135.2159	31.6252
371	Shrubland	Sonora-Mojave Mixed Salt Desert Scrub	2.2936	0.0000	2.2936	8.4175	0.7576	7085.0000	5367.4265	1575.6650	3.4065
372	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	0.000000	6.2212	22.8319	2.0549	22459.0000	46150.4010	4994.7581	9.2398
373	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	19.000000	25.2212	92.5619	8.3306	3574.0000	29773.4692	794.8379	37.4585
374	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	38.000000	44.2212	162.2919	14.6063	23153.0000	338179.0473	5149.0999	65.6773
375	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	0.0000	6.2212	22.8319	2.0549	57869.0000	118913.4670	12869.7473	9.2398
376	Shrubland	Sonoran Paloverde-Mixed Cacti Desert Scrub	2.2106	0.000000	2.2106	8.1128	0.7302	22.0000	16.0633	4.8927	3.2831
377	Shrubland	Sonoran Paloverde-Mixed Cacti Desert Scrub	2.2106	0.0000	2.2106	8.1128	0.7302	2289.0000	1671.3137	509.0610	3.2831
378	Shrubland	Southern California Coastal Scrub	36.5989	0.000000	36.5989	134.3180	12.0886	122205.0000	1477289.4002	27177.7199	54.3566
379	Shrubland	Southern California Coastal Scrub	36.5989	19.000000	55.5989	204.0480	18.3643	438868.0000	8059510.9283	97601.8294	82.5754
380	Shrubland	Southern California Coastal Scrub	36.5989	38.000000	74.5989	273.7780	24.6400	663497.0000	16348577.1405	147558.0836	110.7942
381	Shrubland	Southern California Coastal Scrub	36.5989	88.000000	124.5989	457.2780	41.1550	142.0000	5844.0124	31.5800	185.0541
382	Shrubland	Southern California Coastal Scrub	36.5989	0.0000	36.5989	134.3180	12.0886	159114.0000	1923468.1528	35386.0785	54.3566
383	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	0.000000	73.4281	269.4811	24.2533	296817.0000	7198792.1705	66010.4683	109.0553
384	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	19.000000	92.4281	339.2111	30.5290	376719.0000	11500854.8897	83780.2336	137.2741
385	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	38.000000	111.4281	408.9411	36.8047	1203913.0000	44309658.5127	267743.6297	165.4929
386	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	0.0000	73.4281	269.4811	24.2533	281506.0000	6827449.8724	62605.3861	109.0553
387	Urban	Developed-High Intensity	0.0000	0.000000	0.0000	0.0000	0.0000	28340.0000	0.0000	6302.6601	0.0000
388	Urban	Developed-High Intensity	0.0000	19.000000	19.0000	69.7300	6.2757	15652.0000	98227.2564	3480.9187	28.2188
389	Urban	Developed-High Intensity	0.0000	38.000000	38.0000	139.4600	12.5514	78824.0000	989351.5536	17530.0241	56.4375
390	Urban	Developed-High Intensity	0.0000	88.000000	88.0000	322.9600	29.0664	439.0000	12760.1496	97.6312	130.6975
391	Urban	Developed-High Intensity	0.0000	0.0000	0.0000	0.0000	0.0000	31.0000	0.0000	6.8942	0.0000
392	Urban	Developed-Medium Intensity	7.6584	0.000000	7.6584	28.1065	2.5296	46921.0000	118690.6093	10434.9723	11.3743
393	Urban	Developed-Medium Intensity	7.6584	19.000000	26.6584	97.8365	8.8053	55187.0000	485937.2063	12273.2853	39.5931
394	Urban	Developed-Medium Intensity	7.6584	38.000000	45.6584	167.5665	15.0810	351763.0000	5304932.1633	78230.1565	67.8119
395	Urban	Developed-Medium Intensity	7.6584	88.000000	95.6584	351.0665	31.5960	1991.0000	62907.6041	442.7874	142.0718
396	Urban	Developed-Medium Intensity	7.6584	0.0000	7.6584	28.1065	2.5296	321.0000	811.9965	71.3886	11.3743
397	Urban	Developed-Roads	0.0000	0.000000	0.0000	0.0000	0.0000	69238.0000	0.0000	15398.1504	0.0000
398	Urban	Developed-Roads	0.0000	19.000000	19.0000	69.7300	6.2757	119009.0000	746864.7813	26466.9471	28.2188
399	Urban	Developed-Roads	0.0000	38.000000	38.0000	139.4600	12.5514	510068.0000	6402067.4952	113436.3178	56.4375
400	Urban	Developed-Roads	0.0000	88.000000	88.0000	322.9600	29.0664	503.0000	14620.3992	111.8644	130.6975
401	Urban	Developed-Roads	0.0000	0.0000	0.0000	0.0000	0.0000	15663.0000	0.0000	3483.3651	0.0000
402	Urban	Developed-Upland Deciduous Forest	7.6584	0.000000	7.6584	28.1065	2.5296	7177.0000	18154.8241	1596.1253	11.3743
403	Urban	Developed-Upland Deciduous Forest	7.6584	19.000000	26.6584	97.8365	8.8053	15651.0000	137811.4994	3480.6963	39.5931
404	Urban	Developed-Upland Deciduous Forest	7.6584	38.000000	45.6584	167.5665	15.0810	56643.0000	854232.1749	12597.0917	67.8119
405	Urban	Developed-Upland Deciduous Forest	7.6584	88.000000	95.6584	351.0665	31.5960	141.0000	4455.0337	31.3576	142.0718
406	Urban	Developed-Upland Deciduous Forest	7.6584	0.0000	7.6584	28.1065	2.5296	10.0000	25.2958	2.2239	11.3743
407	Urban	Developed-Upland Evergreen Forest	7.6584	0.000000	7.6584	28.1065	2.5296	3650.0000	9232.9815	811.7399	11.3743
408	Urban	Developed-Upland Evergreen Forest	7.6584	19.000000	26.6584	97.8365	8.8053	4495.0000	39579.7514	999.6633	39.5931
409	Urban	Developed-Upland Evergreen Forest	7.6584	38.000000	45.6584	167.5665	15.0810	12456.0000	187848.7363	2770.1459	67.8119
410	Urban	Developed-Upland Evergreen Forest	7.6584	88.000000	95.6584	351.0665	31.5960	435.0000	13744.2530	96.7416	142.0718
411	Urban	Developed-Upland Evergreen Forest	7.6584	0.0000	7.6584	28.1065	2.5296	52.0000	131.5384	11.5645	11.3743
412	Urban	Developed-Upland Herbaceous	7.6584	0.000000	7.6584	28.1065	2.5296	10083.0000	25505.7951	2242.4037	11.3743
413	Urban	Developed-Upland Herbaceous	7.6584	19.000000	26.6584	97.8365	8.8053	33368.0000	293814.7154	7420.8597	39.5931
414	Urban	Developed-Upland Herbaceous	7.6584	38.000000	45.6584	167.5665	15.0810	135719.0000	2046776.0631	30183.1591	67.8119
415	Urban	Developed-Upland Herbaceous	7.6584	88.000000	95.6584	351.0665	31.5960	1018.0000	32164.7117	226.3976	142.0718
416	Urban	Developed-Upland Herbaceous	7.6584	0.0000	7.6584	28.1065	2.5296	5720.0000	14469.2203	1272.0965	11.3743
417	Urban	Developed-Upland Mixed Forest	7.6584	0.000000	7.6584	28.1065	2.5296	9487.0000	23998.1631	2109.8566	11.3743
418	Urban	Developed-Upland Mixed Forest	7.6584	19.000000	26.6584	97.8365	8.8053	31104.0000	273879.5525	6917.3585	39.5931
419	Urban	Developed-Upland Mixed Forest	7.6584	38.000000	45.6584	167.5665	15.0810	103150.0000	1555603.4962	22939.9927	67.8119
420	Urban	Developed-Upland Mixed Forest	7.6584	88.000000	95.6584	351.0665	31.5960	795.0000	25118.8073	176.8036	142.0718
421	Urban	Developed-Upland Mixed Forest	7.6584	0.0000	7.6584	28.1065	2.5296	130.0000	328.8459	28.9113	11.3743
422	Urban	Developed-Upland Shrubland	7.6584	0.000000	7.6584	28.1065	2.5296	26541.0000	67137.6881	5902.5724	11.3743
423	Urban	Developed-Upland Shrubland	7.6584	19.000000	26.6584	97.8365	8.8053	77375.0000	681308.8470	17207.7744	39.5931
424	Urban	Developed-Upland Shrubland	7.6584	38.000000	45.6584	167.5665	15.0810	298262.0000	4498084.4401	66331.8284	67.8119
425	Urban	Developed-Upland Shrubland	7.6584	88.000000	95.6584	351.0665	31.5960	1853.0000	58547.3583	412.0970	142.0718
426	Urban	Developed-Upland Shrubland	7.6584	0.0000	7.6584	28.1065	2.5296	458.0000	1158.5495	101.8567	11.3743
427	Vineyard	VINEYARDS	6.4400	0.000000	6.4400	23.6348	2.1271	3.0000	6.3814	0.6672	9.5647
428	Vineyard	VINEYARDS	6.4400	19.000000	25.4400	93.3648	8.4028	83.0000	697.4351	18.4587	37.7835
429	Vineyard	VINEYARDS	6.4400	38.000000	44.4400	163.0948	14.6785	541.0000	7941.0858	120.3154	66.0022
430	Water	Open Water	0.0000	0.000000	0.0000	0.0000	0.0000	91598.0000	0.0000	20370.8914	0.0000
431	Water	Open Water	0.0000	19.000000	19.0000	69.7300	6.2757	1383.0000	8679.2931	307.5716	28.2188
432	Water	Open Water	0.0000	38.000000	38.0000	139.4600	12.5514	1342.0000	16843.9788	298.4534	56.4375
433	Water	Open Water	0.0000	88.000000	88.0000	322.9600	29.0664	1149.0000	33397.2936	255.5313	130.6975
434	Water	Open Water	0.0000	0.0000	0.0000	0.0000	0.0000	6026.0000	0.0000	1340.1493	0.0000
435	Wetland	Herbaceous Wetlands	4.8974	0.000000	4.8974	17.9735	1.6176	5863.0000	9484.0546	1303.8990	7.2736
436	Wetland	Herbaceous Wetlands	4.8974	19.000000	23.8974	87.7035	7.8933	1426.0000	11255.8618	317.1346	35.4924
437	Wetland	Herbaceous Wetlands	4.8974	38.000000	42.8974	157.4335	14.1690	6289.0000	89108.9116	1398.6390	63.7112
438	Wetland	Herbaceous Wetlands	4.8974	88.000000	92.8974	340.9335	30.6840	4254.0000	130529.7837	946.0662	137.9711

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			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil MT CO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Class**	**Land Cover Type**	**01_TotalMTCha**	**SOC_MT_Cha_1**	**01_TOTALC_MTCha**	**01_TOTALC_MTCO2eha**	**01_TOTALC_MTCO2epixel**	**Number of Pixels**	**01_TOTALC_MTCO2e**	**Acres**	**TOTAL C/Acre**
439	Wetland	Herbaceous Wetlands	4.8974	0.0000	4.8974	17.9735	1.6176	144.0000	232.9360	32.0248	7.2736
440	Wetland	Pacific Coastal Marsh Systems	6.1476	0.000000	6.1476	22.5617	2.0306	465.0000	944.2068	103.4134	9.1304
441	Wetland	Pacific Coastal Marsh Systems	6.1476	19.000000	25.1476	92.2917	8.3063	244.0000	2026.7256	54.2643	37.3492
442	Wetland	Pacific Coastal Marsh Systems	6.1476	38.000000	44.1476	162.0217	14.5820	1098.0000	16010.9836	244.1892	65.5680
443	Wetland	Pacific Coastal Marsh Systems	6.1476	88.000000	94.1476	345.5217	31.0970	752.0000	23384.9081	167.2407	139.8279
444	Wetland	Pacific Coastal Marsh Systems		0.0000	0.0000	0.0000	0.0000	13.0000	0.0000	2.8911	0.0000
	Total							12,262,515	254,604,968	2,727,116	

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			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Clas	Land Cover Type	16_TotalMTCha	16_SOC_MT_Cha	16_TOTALC_MCTha	16_TOTALC_MTCO2eha	16_TOTALC_MTCO2e pixel	Number of Pixels	16_TOTALC_MTCO2e	Acres	TOTAL MTCO2e/Acre
1	Barren	Mediterranean California Southern Coastal Dune	3.4780	0.000000	3.4780	12.7643	1.1488	3210.0000	3687.5947	713.8863	5.1655
2	Barren	Mediterranean California Southern Coastal Dune	3.4780	19.000000	22.4780	82.4943	7.4245	705.0000	5234.2608	156.7881	33.3843
3	Barren	Mediterranean California Southern Coastal Dune	3.4780	38.000000	41.4780	152.2243	13.7002	592.0000	8110.5086	131.6575	61.6031
4	Barren	Mediterranean California Southern Coastal Dune	3.4780	88.000000	91.4780	335.7243	30.2152	250.0000	7553.7959	55.5986	135.8630
5	Barren	Mediterranean California Southern Coastal Dune	3.4780	0.0000	3.4780	12.7643	1.1488	5.0000	5.7439	1.1120	5.1655
6	Barren	North American Warm Desert Active and Stabilized Dune	1.3203	0.000000	1.3203	4.8454	0.4361	261.0000	113.8187	58.0450	1.9609
7	Barren	North American Warm Desert Active and Stabilized Dune	1.3203	19.000000	20.3203	74.5754	6.7118	144.0000	966.4973	32.0248	30.1796
8	Barren	North American Warm Desert Active and Stabilized Dune	1.3203	0.0000	1.3203	4.8454	0.4361	867.0000	378.0874	192.8160	1.9609
9	Barren	North American Warm Desert Bedrock Cliff and Outcrop	2.6477	0.000000	2.6477	9.7169	0.8745	102251.0000	89420.9842	22740.0600	3.9323
10	Barren	North American Warm Desert Bedrock Cliff and Outcrop	2.6477	19.000000	21.6477	79.4469	7.1502	11344.0000	81112.1445	2522.8432	32.1511
11	Barren	North American Warm Desert Bedrock Cliff and Outcrop	2.6477	38.000000	40.6477	149.1769	13.4259	1636.0000	21964.8122	363.8374	60.3699
12	Barren	North American Warm Desert Bedrock Cliff and Outcrop	2.6477	0.0000	2.6477	9.7169	0.8745	731879.0000	640045.9702	162765.8643	3.9323
13	Barren	North American Warm Desert Pavement	1.3203	0.000000	1.3203	4.8454	0.4361	53875.0000	23494.1831	11981.5037	1.9609
14	Barren	North American Warm Desert Pavement	1.3203	19.000000	20.3203	74.5754	6.7118	183073.0000	1228746.9679	40714.4283	30.1796
15	Barren	North American Warm Desert Pavement	1.3203	38.000000	39.3203	144.3054	12.9875	33.0000	428.5871	7.3390	58.3984
16	Barren	North American Warm Desert Pavement	1.3203	0.0000	1.3203	4.8454	0.4361	393420.0000	171565.3184	87494.4442	1.9609
17	Barren	North American Warm Desert Playa	1.3203	0.000000	1.3203	4.8454	0.4361	6745.0000	2941.4063	1500.0509	1.9609
18	Barren	North American Warm Desert Playa	1.3203	19.000000	20.3203	74.5754	6.7118	18261.0000	122563.9411	4061.1460	30.1796
19	Barren	North American Warm Desert Playa	1.3203	0.0000	1.3203	4.8454	0.4361	35980.0000	15690.4076	8001.7541	1.9609
20	Barren	Quarries-Strip Mines-Gravel Pits-Well and Wind Pads	0.0000	0.000000	0.0000	0.0000	0.0000	307.0000	0.0000	68.2751	0.0000
21	Barren	Quarries-Strip Mines-Gravel Pits-Well and Wind Pads	0.0000	19.000000	19.0000	69.7300	6.2757	530.0000	3326.1210	117.8691	28.2188
22	Barren	Quarries-Strip Mines-Gravel Pits-Well and Wind Pads	0.0000	38.000000	38.0000	139.4600	12.5514	589.0000	7392.7746	130.9904	56.4375
23	Barren	Southern California Coast Ranges Cliff and Canyon	3.4780	0.000000	3.4780	12.7643	1.1488	5719.0000	6569.8923	1271.8741	5.1655
24	Barren	Southern California Coast Ranges Cliff and Canyon	3.4780	19.000000	22.4780	82.4943	7.4245	3004.0000	22303.1481	668.0731	33.3843
25	Barren	Southern California Coast Ranges Cliff and Canyon	3.4780	38.000000	41.4780	152.2243	13.7002	9854.0000	135001.6072	2191.4754	61.6031
26	Barren	Southern California Coast Ranges Cliff and Canyon	3.4780	88.000000	91.4780	335.7243	30.2152	47.0000	1420.1136	10.4525	135.8630
27	Barren	Southern California Coast Ranges Cliff and Canyon	3.4780	0.0000	3.4780	12.7643	1.1488	1740.0000	1998.8831	386.9664	5.1655
28	Forest	California Coastal Live Oak Woodland and Savanna	75.8298	0.000000	75.8298	278.2954	25.0466	440.0000	11020.4965	97.8536	112.6223
29	Forest	California Coastal Live Oak Woodland and Savanna	75.8298	19.000000	94.8298	348.0254	31.3223	312.0000	9772.5523	69.3871	140.8411
30	Forest	California Coastal Live Oak Woodland and Savanna	75.8298	38.000000	113.8298	417.7554	37.5980	325.0000	12219.3445	72.2782	169.0599
31	Forest	California Coastal Live Oak Woodland and Savanna	75.8298	88.000000	163.8298	601.2554	54.1130	2.0000	108.2260	0.4448	243.3198
32	Forest	California Coastal Live Oak Woodland and Savanna	75.8298	0.0000	75.8298	278.2954	25.0466	1.0000	25.0466	0.2224	112.6223
33	Forest	California Coastal Live Oak Woodland and Savanna	79.8577	0.000000	79.8577	293.0778	26.3770	839.0000	22130.3016	186.5890	118.6045
34	Forest	California Coastal Live Oak Woodland and Savanna	79.8577	19.000000	98.8577	362.8078	32.6527	1053.0000	34383.2913	234.1814	146.8233
35	Forest	California Coastal Live Oak Woodland and Savanna	79.8577	38.000000	117.8577	432.5378	38.9284	934.0000	36359.1240	207.7165	175.0421
36	Forest	California Coastal Live Oak Woodland and Savanna	79.8577	88.000000	167.8577	616.0378	55.4434	1.0000	55.4434	0.2224	249.3020
37	Forest	California Coastal Live Oak Woodland and Savanna	89.2648	0.000000	89.2648	327.6016	29.4841	108.0000	3184.2879	24.0186	132.5759
38	Forest	California Coastal Live Oak Woodland and Savanna	89.2648	19.000000	108.2648	397.3316	35.7598	231.0000	8260.5246	51.3731	160.7947
39	Forest	California Coastal Live Oak Woodland and Savanna	89.2648	38.000000	127.2648	467.0616	42.0355	351.0000	14754.4770	78.0605	189.0134
40	Forest	California Coastal Live Oak Woodland and Savanna	90.9121	0.000000	90.9121	333.6474	30.0283	191.0000	5735.3989	42.4773	135.0225
41	Forest	California Coastal Live Oak Woodland and Savanna	90.9121	19.000000	109.9121	403.3774	36.3040	357.0000	12960.5161	79.3948	163.2413
42	Forest	California Coastal Live Oak Woodland and Savanna	90.9121	38.000000	128.9121	473.1074	42.5797	560.0000	23844.6133	124.5409	191.4601
43	Forest	California Coastal Live Oak Woodland and Savanna	90.9121	88.000000	178.9121	656.6074	59.0947	3.0000	177.2840	0.6672	265.7200
44	Forest	California Coastal Live Oak Woodland and Savanna	97.9692	0.000000	97.9692	359.5468	32.3592	5420.0000	175386.9195	1205.3782	145.5036
45	Forest	California Coastal Live Oak Woodland and Savanna	97.9692	19.000000	116.9692	429.2768	38.6349	23389.0000	903631.9157	5201.5850	173.7224
46	Forest	California Coastal Live Oak Woodland and Savanna	97.9692	38.000000	135.9692	499.0068	44.9106	16807.0000	754812.6264	3737.7844	201.9412
47	Forest	California Coastal Live Oak Woodland and Savanna	97.9692	88.000000	185.9692	682.5068	61.4256	12.0000	737.1073	2.6687	276.2011
48	Forest	California Coastal Live Oak Woodland and Savanna	97.9692	0.0000	97.9692	359.5468	32.3592	10.0000	323.5921	2.2239	145.5036
49	Forest	California Coastal Live Oak Woodland and Savanna	111.7049	0.000000	111.7049	409.9570	36.8961	6995.0000	258088.4186	1555.6495	165.9040
50	Forest	California Coastal Live Oak Woodland and Savanna	111.7049	19.000000	130.7049	479.6870	43.1718	45068.0000	1945667.9655	10022.8753	194.1227
51	Forest	California Coastal Live Oak Woodland and Savanna	111.7049	38.000000	149.7049	549.4170	49.4475	32337.0000	1598984.7281	7191.5709	222.3415
52	Forest	California Coastal Live Oak Woodland and Savanna	111.7049	88.000000	199.7049	732.9170	65.9625	7.0000	461.7377	1.5568	296.6014
53	Forest	California Coastal Live Oak Woodland and Savanna	111.7049	0.0000	111.7049	409.9570	36.8961	6.0000	221.3768	1.3344	165.9040
54	Forest	California Coastal Live Oak Woodland and Savanna	118.6412	38.000000	156.6412	574.8731	51.7386	1.0000	51.7386	0.2224	232.6432
55	Forest	California Coastal Live Oak Woodland and Savanna	132.1123	0.000000	132.1123	484.8521	43.6367	26.0000	1134.5540	5.7823	196.2130
56	Forest	California Coastal Live Oak Woodland and Savanna	132.1123	19.000000	151.1123	554.5821	49.9124	40.0000	1996.4957	8.8958	224.4318
57	Forest	California Coastal Live Oak Woodland and Savanna	132.1123	38.000000	170.1123	624.3121	56.1881	37.0000	2078.9594	8.2286	252.6505
58	Forest	California Coastal Live Oak Woodland and Savanna	151.2570	0.000000	151.2570	555.1131	49.9602	555.0000	27727.8977	123.4289	224.6466
59	Forest	California Coastal Live Oak Woodland and Savanna	151.2570	19.000000	170.2570	624.8431	56.2359	1532.0000	86153.3622	340.7084	252.8654
60	Forest	California Coastal Live Oak Woodland and Savanna	151.2570	38.000000	189.2570	694.5731	62.5116	1341.0000	83828.0235	298.2310	281.0842
61	Forest	California Coastal Live Oak Woodland and Savanna	151.2570	88.000000	239.2570	878.0731	79.0266	1.0000	79.0266	0.2224	355.3441
62	Forest	California Coastal Live Oak Woodland and Savanna	202.3413	0.000000	202.3413	742.5924	66.8333	183.0000	12230.4976	40.6982	300.5170
63	Forest	California Coastal Live Oak Woodland and Savanna	202.3413	19.000000	221.3413	812.3224	73.1090	652.0000	47667.0813	145.0012	328.7357
64	Forest	California Coastal Live Oak Woodland and Savanna	202.3413	38.000000	240.3413	882.0524	79.3847	642.0000	50964.9905	142.7773	356.9545
65	Forest	California Coastal Live Oak Woodland and Savanna	202.3413	88.000000	290.3413	1065.5524	95.8997	3.0000	287.6992	0.6672	431.2144
66	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	73.2906	0.000000	73.2906	268.9766	24.2079	3.0000	72.6237	0.6672	108.8511
67	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	73.2906	19.000000	92.2906	338.7066	30.4836	1.0000	30.4836	0.2224	137.0699
68	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	73.2906	38.000000	111.2906	408.4366	36.7593	14.0000	514.6301	3.1135	165.2887
69	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	73.2906	0.0000	73.2906	268.9766	24.2079	1.0000	24.2079	0.2224	108.8511
70	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	87.9018	0.000000	87.9018	322.5994	29.0339	2.0000	58.0679	0.4448	130.5516
71	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	87.9018	38.000000	125.9018	462.0594	41.5853	19.0000	790.1216	4.2255	186.9891
72	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	101.4166	0.000000	101.4166	372.1989	33.4979	5.0000	167.4895	1.1120	150.6238
73	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	101.4166	19.000000	120.4166	441.9289	39.7736	1.0000	39.7736	0.2224	178.8426

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Clas	Land Cover Type	16_TotalMTCha	16_SOC_MT_Cha	16_TOTALC_MCTha	16_TOTALC_MTCO2eha	16_TOTALC_MTCO2e pixel	Number of Pixels	16_TOTALC_MTCO2e	Acres	TOTAL MTCO2e/Acre
74	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	101.4166	38.000000	139.4166	511.6589	46.0493	3.0000	138.1479	0.6672	207.0613
75	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	124.0213	0.000000	124.0213	455.1580	40.9642	27.0000	1106.0339	6.0047	184.1962
76	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	124.0213	38.000000	162.0213	594.6180	53.5156	57.0000	3050.3903	12.6765	240.6337
77	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	124.0213	0.0000	124.0213	455.1580	40.9642	2.0000	81.9284	0.4448	184.1962
78	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	165.8771	38.000000	203.8771	748.2290	67.3406	1.0000	67.3406	0.2224	302.7980
79	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	197.4376	0.000000	197.4376	724.5960	65.2136	1.0000	65.2136	0.2224	293.2340
80	Forest	California Montane Jeffrey Pine-(Ponderosa Pine) Woodland	197.4376	38.000000	235.4376	864.0560	77.7650	23.0000	1788.5959	5.1151	349.6716
81	Forest	Californian Ruderal Forest	62.0000	0.000000	62.0000	227.5400	20.4786	847.0000	17345.3742	188.3681	92.0823
82	Forest	Californian Ruderal Forest	62.0000	19.000000	81.0000	297.2700	26.7543	1820.0000	48692.8260	404.7580	120.3011
83	Forest	Californian Ruderal Forest	62.0000	38.000000	100.0000	367.0000	33.0300	2822.0000	93210.6600	627.5973	148.5199
84	Forest	Californian Ruderal Forest	62.0000	0.0000	62.0000	227.5400	20.4786	1.0000	20.4786	0.2224	92.0823
85	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	0.000000	66.5226	244.1380	21.9724	1549.0000	34035.2833	344.4891	98.7993
86	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	19.000000	85.5226	313.8680	28.2481	155.0000	4378.4591	34.4711	127.0181
87	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	38.000000	104.5226	383.5980	34.5238	808.0000	27895.2490	179.6948	155.2369
88	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	88.000000	154.5226	567.0980	51.0388	5.0000	255.1941	1.1120	229.4968
89	Forest	Central and Southern California Mixed Evergreen Woodland	66.5226	0.0000	66.5226	244.1380	21.9724	450.0000	9887.5904	100.0775	98.7993
90	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	0.000000	77.4067	284.0824	25.5674	1200.0000	30680.8998	266.8734	114.9642
91	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	19.000000	96.4067	353.8124	31.8431	76.0000	2420.0769	16.9020	143.1830
92	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	38.000000	115.4067	423.5424	38.1188	962.0000	36670.3015	213.9435	171.4018
93	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	88.000000	165.4067	607.0424	54.6338	12.0000	655.6058	2.6687	245.6617
94	Forest	Central and Southern California Mixed Evergreen Woodland	77.4067	0.0000	77.4067	284.0824	25.5674	514.0000	13141.6521	114.3108	114.9642
95	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	0.000000	90.6348	332.6297	29.9367	613.0000	18351.1814	136.3278	134.6107
96	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	19.000000	109.6348	402.3597	36.2124	429.0000	15535.1086	95.4072	162.8295
97	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	38.000000	128.6348	472.0897	42.4881	945.0000	40151.2303	210.1628	191.0482
98	Forest	Central and Southern California Mixed Evergreen Woodland	90.6348	0.0000	90.6348	332.6297	29.9367	18.0000	538.8601	4.0031	134.6107
99	Forest	Central and Southern California Mixed Evergreen Woodland	105.1030	0.000000	105.1030	385.7279	34.7155	1.0000	34.7155	0.2224	156.0988
100	Forest	Central and Southern California Mixed Evergreen Woodland	105.1030	38.000000	143.1030	525.1879	47.2669	4.0000	189.0676	0.8896	212.5363
101	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	0.000000	111.2302	408.2148	36.7393	6470.0000	237703.4978	1438.8924	165.1989
102	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	19.000000	130.2302	477.9448	43.0150	3748.0000	161220.3514	833.5346	193.4177
103	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	38.000000	149.2302	547.6748	49.2907	18910.0000	932087.8000	4205.4800	221.6365
104	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	88.000000	199.2302	731.1748	65.8057	5.0000	329.0287	1.1120	295.8964
105	Forest	Central and Southern California Mixed Evergreen Woodland	111.2302	0.0000	111.2302	408.2148	36.7393	529.0000	19435.1082	117.6467	165.1989
106	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	0.000000	150.6005	552.7040	49.7434	95.0000	4725.6188	21.1275	223.6717
107	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	19.000000	169.6005	622.4340	56.0191	34.0000	1904.6479	7.5614	251.8905
108	Forest	Central and Southern California Mixed Evergreen Woodland	150.6005	38.000000	188.6005	692.1640	62.2948	1222.0000	76124.1920	271.7661	280.1092
109	Forest	Central and Southern California Mixed Evergreen Woodland	158.2302	0.000000	158.2302	580.7048	52.2634	17.0000	888.4784	3.7807	235.0033
110	Forest	Central and Southern California Mixed Evergreen Woodland	158.2302	19.000000	177.2302	650.4348	58.5391	78.0000	4566.0525	17.3468	263.2220
111	Forest	Central and Southern California Mixed Evergreen Woodland	158.2302	38.000000	196.2302	720.1648	64.8148	99.0000	6416.6687	22.0171	291.4408
112	Forest	Central and Southern California Mixed Evergreen Woodland	183.4034	0.000000	183.4034	673.0905	60.5781	4987.0000	302103.1992	1109.0814	272.3905
113	Forest	Central and Southern California Mixed Evergreen Woodland	183.4034	19.000000	202.4034	742.8205	66.8538	5834.0000	390025.3202	1297.4495	300.6092
114	Forest	Central and Southern California Mixed Evergreen Woodland	183.4034	38.000000	221.4034	812.5505	73.1295	41218.0000	3014253.5042	9166.6565	328.8280
115	Forest	Central and Southern California Mixed Evergreen Woodland	183.4034	88.000000	271.4034	996.0505	89.6445	2.0000	179.2891	0.4448	403.0879
116	Forest	Central and Southern California Mixed Evergreen Woodland	183.4034	0.0000	183.4034	673.0905	60.5781	249.0000	15083.9576	55.3762	272.3905
117	Forest	Central and Southern California Mixed Evergreen Woodland	237.1479	0.000000	237.1479	870.3328	78.3300	1193.0000	93447.6320	265.3166	352.2117
118	Forest	Central and Southern California Mixed Evergreen Woodland	237.1479	19.000000	256.1479	940.0628	84.6057	1224.0000	103557.3173	272.2109	380.4305
119	Forest	Central and Southern California Mixed Evergreen Woodland	237.1479	38.000000	275.1479	1009.7928	90.8814	31050.0000	2821865.9600	6905.3492	408.6493
120	Forest	Central and Southern California Mixed Evergreen Woodland	237.1479	0.0000	237.1479	870.3328	78.3300	2.0000	156.6599	0.4448	352.2117
121	Forest	Central and Southern California Mixed Evergreen Woodland	424.2220	0.000000	424.2220	1556.8947	140.1205	176.0000	24661.2127	39.1414	630.0539
122	Forest	Central and Southern California Mixed Evergreen Woodland	424.2220	19.000000	443.2220	1626.6247	146.3962	169.0000	24740.9623	37.5847	658.2727
123	Forest	Central and Southern California Mixed Evergreen Woodland	424.2220	38.000000	462.2220	1696.3547	152.6719	3521.0000	537557.8536	783.0510	686.4915
124	Forest	Central and Southern California Mixed Evergreen Woodland	424.2220	0.0000	424.2220	1556.8947	140.1205	5.0000	700.6026	1.1120	630.0539
125	Forest	Central and Southern California Mixed Evergreen Woodland	485.6886	0.000000	485.6886	1782.4772	160.4229	175.0000	28074.0153	38.9190	721.3440
126	Forest	Central and Southern California Mixed Evergreen Woodland	485.6886	19.000000	504.6886	1852.2072	166.6986	165.0000	27505.2764	36.6951	749.5628
127	Forest	Central and Southern California Mixed Evergreen Woodland	485.6886	38.000000	523.6886	1921.9372	172.9743	5387.0000	931812.7943	1198.0392	777.7816
128	Forest	Central and Southern California Mixed Evergreen Woodland	485.6886	0.0000	485.6886	1782.4772	160.4229	4.0000	641.6918	0.8896	721.3440
129	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	0.000000	71.3202	261.7450	23.5570	6099.0000	143674.4208	1356.3841	105.9246
130	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	19.000000	90.3202	331.4750	29.8327	761.0000	22702.7194	169.2422	134.1434
131	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	38.000000	109.3202	401.2050	36.1084	5878.0000	212245.4429	1307.2349	162.3621
132	Forest	Great Basin Pinyon-Juniper Woodland	71.3202	0.0000	71.3202	261.7450	23.5570	10204.0000	240376.0927	2269.3135	105.9246
133	Forest	Great Basin Pinyon-Juniper Woodland	76.3856	0.000000	76.3856	280.3351	25.2302	2034.0000	51318.1361	452.3504	113.4477
134	Forest	Great Basin Pinyon-Juniper Woodland	76.3856	19.000000	95.3856	350.0651	31.5059	300.0000	9451.7566	66.7184	141.6665
135	Forest	Great Basin Pinyon-Juniper Woodland	76.3856	38.000000	114.3856	419.7951	37.7816	5352.0000	202206.8846	1190.2554	169.8853
136	Forest	Great Basin Pinyon-Juniper Woodland	76.3856	0.0000	76.3856	280.3351	25.2302	3393.0000	85605.9173	754.5845	113.4477
137	Forest	Great Basin Pinyon-Juniper Woodland	92.4161	0.000000	92.4161	339.1671	30.5250	1435.0000	43803.4293	319.1361	137.2563
138	Forest	Great Basin Pinyon-Juniper Woodland	92.4161	19.000000	111.4161	408.8971	36.8007	94.0000	3459.2694	20.9051	165.4750
139	Forest	Great Basin Pinyon-Juniper Woodland	92.4161	38.000000	130.4161	478.6271	43.0764	1160.0000	49968.6679	257.9776	193.6938
140	Forest	Great Basin Pinyon-Juniper Woodland	92.4161	0.0000	92.4161	339.1671	30.5250	1613.0000	49236.8860	358.7223	137.2563
141	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	0.000000	100.8879	370.2584	33.3233	831.0000	27691.6264	184.8098	149.8385
142	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	19.000000	119.8879	439.9884	39.5990	357.0000	14136.8276	79.3948	178.0573
143	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	38.000000	138.8879	509.7184	45.8747	2596.0000	119090.6092	577.3361	206.2760
144	Forest	Great Basin Pinyon-Juniper Woodland	100.8879	0.0000	100.8879	370.2584	33.3233	1236.0000	41187.5455	274.8796	149.8385
145	Forest	Great Basin Pinyon-Juniper Woodland	140.2175	38.000000	178.2175	654.0580	58.8652	2.0000	117.7304	0.4448	264.6883
146	Forest	Great Basin Pinyon-Juniper Woodland	151.0862	38.000000	189.0862	693.9464	62.4552	16.0000	999.2827	3.5583	280.8306

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Clas	Land Cover Type	16_TotalMTCha	16_SOC_MT_Cha	16_TOTALC_MCTha	16_TOTALC_MTCO2eha	16_TOTALC_MTCO2e pixel	Number of Pixels	16_TOTALC_MTCO2e	Acres	TOTAL MTCO2e/Acre
147	Forest	Great Basin Pinyon-Juniper Woodland	151.0862	0.0000	151.0862	554.4864	49.9038	1.0000	49.9038	0.2224	224.3930
148	Forest	Interior West Ruderal Riparian Forest	62.0000	0.000000	62.0000	227.5400	20.4786	6.0000	122.8716	1.3344	92.0823
149	Forest	Interior West Ruderal Riparian Forest	62.0000	19.000000	81.0000	297.2700	26.7543	362.0000	9685.0566	80.5068	120.3011
150	Forest	Interior West Ruderal Riparian Forest	62.0000	38.000000	100.0000	367.0000	33.0300	2.0000	66.0600	0.4448	148.5199
151	Forest	Interior West Ruderal Riparian Forest	62.0000	0.0000	62.0000	227.5400	20.4786	336.0000	6880.8096	74.7246	92.0823
152	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	0.000000	68.3180	250.7272	22.5654	182.0000	4106.9107	40.4758	101.4658
153	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	19.000000	87.3180	320.4572	28.8411	1.0000	28.8411	0.2224	129.6846
154	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	38.000000	106.3180	390.1872	35.1168	293.0000	10289.2352	65.1616	157.9034
155	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	68.3180	0.0000	68.3180	250.7272	22.5654	106.0000	2391.9370	23.5738	101.4658
156	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	0.000000	82.1936	301.6505	27.1485	137.0000	3719.3508	30.4680	122.0738
157	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	19.000000	101.1936	371.3805	33.4242	1.0000	33.4242	0.2224	150.2926
158	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	38.000000	120.1936	441.1105	39.6999	339.0000	13458.2817	75.3917	178.5114
159	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	82.1936	0.0000	82.1936	301.6505	27.1485	157.0000	4262.3217	34.9159	122.0738
160	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	0.000000	96.4746	354.0616	31.8655	1759.0000	56051.4917	391.1919	143.2839
161	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	19.000000	115.4746	423.7916	38.1412	3.0000	114.4237	0.6672	171.5026
162	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	38.000000	134.4746	493.5216	44.4169	1084.0000	48147.9671	241.0756	199.7214
163	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	96.4746	0.0000	96.4746	354.0616	31.8655	9.0000	286.7899	2.0016	143.2839
164	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	0.000000	121.6313	446.3869	40.1748	4180.0000	167930.7409	929.6090	180.6466
165	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	19.000000	140.6313	516.1169	46.4505	45.0000	2090.2733	10.0078	208.8654
166	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	38.000000	159.6313	585.8469	52.7262	11846.0000	624594.7830	2634.4852	237.0842
167	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	121.6313	0.0000	121.6313	446.3869	40.1748	115.0000	4620.1041	25.5754	180.6466
168	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	166.8359	0.000000	166.8359	612.2878	55.1059	45.0000	2479.7654	10.0078	247.7844
169	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	166.8359	38.000000	204.8359	751.7478	67.6573	121.0000	8186.5330	26.9097	304.2220
170	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	167.8182	0.000000	167.8182	615.8928	55.4304	9.0000	498.8732	2.0016	249.2434
171	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	167.8182	38.000000	205.8182	755.3528	67.9818	315.0000	21414.2517	70.0543	305.6809
172	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	0.000000	205.6438	754.7127	67.9241	1847.0000	125455.8998	410.7626	305.4219
173	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	19.000000	224.6438	824.4427	74.1998	109.0000	8087.7833	24.2410	333.6407
174	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	38.000000	243.6438	894.1727	80.4755	17081.0000	1374602.8207	3798.7205	361.8594
175	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	205.6438	0.0000	205.6438	754.7127	67.9241	91.0000	6181.0974	20.2379	305.4219
176	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	0.000000	269.0092	987.2638	88.8537	57.0000	5064.6631	12.6765	399.5321
177	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	19.000000	288.0092	1056.9938	95.1294	26.0000	2473.3654	5.7823	427.7509
178	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	38.000000	307.0092	1126.7238	101.4051	4026.0000	408257.0886	895.3603	455.9696
179	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	269.0092	0.0000	269.0092	987.2638	88.8537	7.0000	621.9762	1.5568	399.5321
180	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	413.0478	0.000000	413.0478	1515.8852	136.4297	1.0000	136.4297	0.2224	613.4579
181	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	0.000000	470.4982	1726.7284	155.4056	88.0000	13675.6889	19.5707	698.7833
182	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	19.000000	489.4982	1796.4584	161.6813	6.0000	970.0875	1.3344	727.0020
183	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	38.000000	508.4982	1866.1884	167.9570	1588.0000	266715.6453	353.1625	755.2208
184	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	470.4982	0.0000	470.4982	1726.7284	155.4056	14.0000	2175.6778	3.1135	698.7833
185	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	0.000000	560.1758	2055.8451	185.0261	7.0000	1295.1824	1.5568	831.9723
186	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	19.000000	579.1758	2125.5751	191.3018	5.0000	956.5088	1.1120	860.1910
187	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	38.000000	598.1758	2195.3051	197.5775	762.0000	150554.0213	169.4646	888.4098
188	Forest	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	560.1758	0.0000	560.1758	2055.8451	185.0261	6.0000	1110.1563	1.3344	831.9723
189	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	63.8636	0.000000	63.8636	234.3794	21.0941	233.0000	4914.9363	51.8179	94.8501
190	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	63.8636	19.000000	82.8636	304.1094	27.3698	93.0000	2545.3958	20.6827	123.0689
191	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	63.8636	38.000000	101.8636	373.8394	33.6455	265.0000	8916.0700	58.9345	151.2877
192	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	63.8636	88.000000	151.8636	557.3394	50.1605	8.0000	401.2844	1.7792	225.5476
193	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	63.8636	0.0000	63.8636	234.3794	21.0941	3.0000	63.2824	0.6672	94.8501
194	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	64.8224	0.000000	64.8224	237.8982	21.4108	75.0000	1605.8129	16.6796	96.2741
195	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	64.8224	19.000000	83.8224	307.6282	27.6865	21.0000	581.4173	4.6703	124.4929
196	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	64.8224	38.000000	102.8224	377.3582	33.9622	107.0000	3633.9595	23.7962	152.7117
197	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	70.8478	0.000000	70.8478	260.0114	23.4010	249.0000	5826.8561	55.3762	105.2231
198	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	70.8478	19.000000	89.8478	329.7414	29.6767	84.0000	2492.8452	18.6811	133.4418
199	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	70.8478	38.000000	108.8478	399.4714	35.9524	249.0000	8952.1547	55.3762	161.6606
200	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	70.8478	88.000000	158.8478	582.9714	52.4674	47.0000	2465.9691	10.4525	235.9205
201	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	70.8478	0.0000	70.8478	260.0114	23.4010	9.0000	210.6093	2.0016	105.2231
202	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	93.1775	0.000000	93.1775	341.9614	30.7765	2189.0000	67369.8203	486.8216	138.3871
203	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	93.1775	19.000000	112.1775	411.6914	37.0522	2090.0000	77439.1570	464.8045	166.6059
204	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	93.1775	38.000000	131.1775	481.4214	43.3279	7282.0000	315513.9735	1619.4767	194.8246
205	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	93.1775	88.000000	181.1775	664.9214	59.8429	103.0000	6163.8216	22.9066	269.0846
206	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	93.1775	0.0000	93.1775	341.9614	30.7765	20.0000	615.5306	4.4479	138.3871
207	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	98.5567	0.000000	98.5567	361.7029	32.5533	4240.0000	138025.8287	942.9527	146.3762
208	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	98.5567	19.000000	117.5567	431.4329	38.8290	2885.0000	112021.5539	641.6081	174.5950
209	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	98.5567	38.000000	136.5567	501.1629	45.1047	6591.0000	297284.8239	1465.8021	202.8137
210	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	98.5567	88.000000	186.5567	684.6629	61.6197	531.0000	32720.0403	118.0915	277.0737
211	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	98.5567	0.0000	98.5567	361.7029	32.5533	29.0000	944.0446	6.4494	146.3762
212	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	104.9299	0.000000	104.9299	385.0925	34.6583	1025.0000	35524.7877	227.9544	155.8417
213	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	104.9299	19.000000	123.9299	454.8225	40.9340	739.0000	30250.2478	164.3495	184.0604
214	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	104.9299	38.000000	142.9299	524.5525	47.2097	1520.0000	71758.7888	338.0396	212.2792
215	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	104.9299	88.000000	192.9299	708.0525	63.7247	415.0000	26445.7627	92.2937	286.5391
216	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	104.9299	0.0000	104.9299	385.0925	34.6583	17.0000	589.1916	3.7807	155.8417
217	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	157.1570	0.000000	157.1570	576.7663	51.9090	650.0000	33740.8293	144.5564	233.4094
218	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	157.1570	19.000000	176.1570	646.4963	58.1847	686.0000	39914.6823	152.5626	261.6282
219	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	157.1570	38.000000	195.1570	716.2263	64.4604	2560.0000	165018.5424	569.3299	289.8470

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Clas	Land Cover Type	16_TotalMTCha	16_SOC_MT_Cha	16_TOTALC_MCTha	16_TOTALC_MTCO2eha	16_TOTALC_MTCO2e pixel	Number of Pixels	16_TOTALC_MTCO2e	Acres	TOTAL MTCO2e/Acre
220	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	157.1570	88.000000	245.1570	899.7263	80.9754	101.0000	8178.5122	22.4618	364.1069
221	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	157.1570	0.0000	157.1570	576.7663	51.9090	8.0000	415.2717	1.7792	233.4094
222	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	159.5298	0.000000	159.5298	585.4742	52.6927	32.0000	1686.1656	7.1166	236.9334
223	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	159.5298	19.000000	178.5298	655.2042	58.9684	20.0000	1179.3675	4.4479	265.1521
224	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	159.5298	38.000000	197.5298	724.9342	65.2441	36.0000	2348.7868	8.0062	293.3709
225	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	159.5298	88.000000	247.5298	908.4342	81.7591	9.0000	735.8317	2.0016	367.6308
226	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	159.5298	0.0000	159.5298	585.4742	52.6927	1.0000	52.6927	0.2224	236.9334
227	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	161.4372	0.000000	161.4372	592.4744	53.3227	347.0000	18502.9756	77.1709	239.7663
228	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	161.4372	19.000000	180.4372	662.2044	59.5984	244.0000	14542.0087	54.2643	267.9850
229	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	161.4372	38.000000	199.4372	731.9344	65.8741	710.0000	46770.6083	157.9001	296.2038
230	Forest	Mediterranean California Foothill and Lower Montane Riparian Woodland	161.4372	88.000000	249.4372	915.4344	82.3891	94.0000	7744.5750	20.9051	370.4637
231	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	72.6397	38.000000	110.6397	406.0476	36.5443	2.0000	73.0886	0.4448	164.3219
232	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	83.0232	0.000000	83.0232	304.6950	27.4225	2.0000	54.8451	0.4448	123.3059
233	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	83.0232	38.000000	121.0232	444.1550	39.9739	11.0000	439.7134	2.4463	179.7434
234	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	110.1022	38.000000	148.1022	543.5351	48.9182	1.0000	48.9182	0.2224	219.9612
235	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	129.8610	0.000000	129.8610	476.5899	42.8931	1.0000	42.8931	0.2224	192.8694
236	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	129.8610	38.000000	167.8610	616.0499	55.4445	63.0000	3493.0028	14.0109	249.3069
237	Forest	Mediterranean California Lower Montane Black Oak Forest and Woodland	233.0848	38.000000	271.0848	994.8810	89.5393	13.0000	1164.0108	2.8911	402.6147
238	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	72.6397	0.000000	72.6397	266.5876	23.9929	33.0000	791.7652	7.3390	107.8843
239	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	72.6397	38.000000	110.6397	406.0476	36.5443	56.0000	2046.4799	12.4541	164.3219
240	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	72.6397	0.0000	72.6397	266.5876	23.9929	3.0000	71.9787	0.6672	107.8843
241	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	83.0232	0.000000	83.0232	304.6950	27.4225	21.0000	575.8735	4.6703	123.3059
242	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	83.0232	38.000000	121.0232	444.1550	39.9739	77.0000	3077.9939	17.1244	179.7434
243	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	83.0232	0.0000	83.0232	304.6950	27.4225	5.0000	137.1127	1.1120	123.3059
244	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	102.5548	38.000000	140.5548	515.8361	46.4252	3.0000	139.2757	0.6672	208.7518
245	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	110.1022	0.000000	110.1022	404.0751	36.3668	73.0000	2654.7732	16.2348	163.5236
246	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	110.1022	38.000000	148.1022	543.5351	48.9182	65.0000	3179.6802	14.4556	219.9612
247	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	110.1022	0.0000	110.1022	404.0751	36.3668	1.0000	36.3668	0.2224	163.5236
248	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	129.8610	0.000000	129.8610	476.5899	42.8931	282.0000	12095.8509	62.7152	192.8694
249	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	129.8610	19.000000	148.8610	546.3199	49.1688	4.0000	196.6752	0.8896	221.0881
250	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	129.8610	38.000000	167.8610	616.0499	55.4445	1129.0000	62596.8273	251.0834	249.3069
251	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	129.8610	0.0000	129.8610	476.5899	42.8931	38.0000	1629.9374	8.4510	192.8694
252	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	160.6491	0.000000	160.6491	589.5823	53.0624	4.0000	212.2496	0.8896	238.5959
253	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	160.6491	38.000000	198.6491	729.0423	65.6138	18.0000	1181.0486	4.0031	295.0334
254	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	202.3961	0.000000	202.3961	742.7937	66.8514	4.0000	267.4057	0.8896	300.5984
255	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	202.3961	38.000000	240.3961	882.2537	79.4028	6.0000	476.4170	1.3344	357.0360
256	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	233.0848	0.000000	233.0848	855.4210	76.9879	305.0000	23481.3073	67.8303	346.1771
257	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	233.0848	19.000000	252.0848	925.1510	83.2636	3.0000	249.7908	0.6672	374.3959
258	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	233.0848	38.000000	271.0848	994.8810	89.5393	1309.0000	117206.9344	291.1144	402.6147
259	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	233.0848	0.0000	233.0848	855.4210	76.9879	10.0000	769.8789	2.2239	346.1771
260	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	277.6462	0.000000	277.6462	1018.9617	91.7066	8.0000	733.6524	1.7792	412.3598
261	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	277.6462	38.000000	315.6462	1158.4217	104.2580	54.0000	5629.9293	12.0093	468.7973
262	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	566.6062	0.000000	566.6062	2079.4446	187.1500	21.0000	3930.1502	4.6703	841.5227
263	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	566.6062	38.000000	604.6062	2218.9046	199.7014	121.0000	24163.8708	26.9097	897.9602
264	Forest	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	630.6695	38.000000	668.6695	2454.0171	220.8615	30.0000	6625.8461	6.6718	993.1070
265	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	72.6397	0.000000	72.6397	266.5876	23.9929	124.0000	2975.1177	27.5769	107.8843
266	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	72.6397	19.000000	91.6397	336.3176	30.2686	5.0000	151.3429	1.1120	136.1031
267	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	72.6397	38.000000	110.6397	406.0476	36.5443	404.0000	14763.8910	89.8474	164.3219
268	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	72.6397	0.0000	72.6397	266.5876	23.9929	61.0000	1463.5660	13.5661	107.8843
269	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	83.0232	0.000000	83.0232	304.6950	27.4225	94.0000	2577.7194	20.9051	123.3059
270	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	83.0232	19.000000	102.0232	374.4250	33.6982	7.0000	235.8877	1.5568	151.5246
271	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	83.0232	38.000000	121.0232	444.1550	39.9739	539.0000	21545.9571	119.8706	179.7434
272	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	83.0232	0.0000	83.0232	304.6950	27.4225	129.0000	3537.5085	28.6889	123.3059
273	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	102.5548	38.000000	140.5548	515.8361	46.4252	1.0000	46.4252	0.2224	208.7518
274	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	110.1022	0.000000	110.1022	404.0751	36.3668	227.0000	8255.2538	50.4836	163.5236
275	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	110.1022	19.000000	129.1022	473.8051	42.6425	4.0000	170.5698	0.8896	191.7424
276	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	110.1022	38.000000	148.1022	543.5351	48.9182	504.0000	24654.7510	112.0868	219.9612
277	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	110.1022	0.0000	110.1022	404.0751	36.3668	7.0000	254.5673	1.5568	163.5236
278	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	129.8610	0.000000	129.8610	476.5899	42.8931	1064.0000	45638.2460	236.6277	192.8694
279	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	129.8610	19.000000	148.8610	546.3199	49.1688	50.0000	2458.4394	11.1197	221.0881
280	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	129.8610	38.000000	167.8610	616.0499	55.4445	7043.0000	390495.5311	1566.3245	249.3069
281	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	129.8610	0.0000	129.8610	476.5899	42.8931	572.0000	24534.8465	127.2097	192.8694
282	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	160.6491	0.000000	160.6491	589.5823	53.0624	1.0000	53.0624	0.2224	238.5959
283	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	160.6491	19.000000	179.6491	659.3123	59.3381	1.0000	59.3381	0.2224	266.8146
284	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	160.6491	38.000000	198.6491	729.0423	65.6138	46.0000	3018.2352	10.2301	295.0334
285	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	160.6491	0.0000	160.6491	589.5823	53.0624	2.0000	106.1248	0.4448	238.5959
286	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	202.3961	0.000000	202.3961	742.7937	66.8514	13.0000	869.0686	2.8911	300.5984
287	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	202.3961	38.000000	240.3961	882.2537	79.4028	30.0000	2382.0850	6.6718	357.0360
288	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	233.0848	0.000000	233.0848	855.4210	76.9879	724.0000	55739.2345	161.0136	346.1771
289	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	233.0848	19.000000	252.0848	925.1510	83.2636	42.0000	3497.0709	9.3406	374.3959
290	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	233.0848	38.000000	271.0848	994.8810	89.5393	8161.0000	730730.1696	1814.9615	402.6147
291	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	233.0848	0.0000	233.0848	855.4210	76.9879	198.0000	15243.6028	44.0341	346.1771
292	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	277.6462	0.000000	277.6462	1018.9617	91.7066	14.0000	1283.8917	3.1135	412.3598

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Clas**	**Land Cover Type**	**16_TotalMTCha**	**16_SOC_MT_Cha**	**16_TOTALC_MCTha**	**16_TOTALC_MTCO2eha**	**16_TOTALC_MTCO2e pixel**	**Number of Pixels**	**16_TOTALC_MTCO2e**	**Acres**	**TOTAL MTCO2e/Acre**
293	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	277.6462	19.000000	296.6462	1088.6917	97.9823	4.0000	391.9290	0.8896	440.5786
294	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	277.6462	38.000000	315.6462	1158.4217	104.2580	659.0000	68705.9896	146.5580	468.7973
295	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	277.6462	0.0000	277.6462	1018.9617	91.7066	2.0000	183.4131	0.4448	412.3598
296	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	566.6062	0.000000	566.6062	2079.4446	187.1500	25.0000	4678.7503	5.5599	841.5227
297	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	566.6062	19.000000	585.6062	2149.1746	193.4257	3.0000	580.2771	0.6672	869.7414
298	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	566.6062	38.000000	604.6062	2218.9046	199.7014	644.0000	128607.7089	143.2221	897.9602
299	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	566.6062	0.0000	566.6062	2079.4446	187.1500	8.0000	1497.2001	1.7792	841.5227
300	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	630.6695	19.000000	649.6695	2384.2871	214.5858	1.0000	214.5858	0.2224	964.8882
301	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	630.6695	38.000000	668.6695	2454.0171	220.8615	165.0000	36442.1534	36.6951	993.1070
302	Forest	Mediterranean California Lower Montane Conifer Forest and Woodland	630.6695	0.0000	630.6695	2314.5571	208.3101	2.0000	416.6203	0.4448	936.6695
303	Forest	Mediterranean California Mixed Oak Woodland	71.8994	0.000000	71.8994	263.8709	23.7484	51.0000	1211.1674	11.3421	106.7849
304	Forest	Mediterranean California Mixed Oak Woodland	71.8994	19.000000	90.8994	333.6009	30.0241	4.0000	120.0963	0.8896	135.0037
305	Forest	Mediterranean California Mixed Oak Woodland	71.8994	38.000000	109.8994	403.3309	36.2998	97.0000	3521.0787	21.5723	163.2225
306	Forest	Mediterranean California Mixed Oak Woodland	71.8994	0.0000	71.8994	263.8709	23.7484	34.0000	807.4449	7.5614	106.7849
307	Forest	Mediterranean California Mixed Oak Woodland	85.0254	0.000000	85.0254	312.0430	28.0839	123.0000	3454.3164	27.3545	126.2795
308	Forest	Mediterranean California Mixed Oak Woodland	85.0254	19.000000	104.0254	381.7730	34.3596	4.0000	137.4383	0.8896	154.4983
309	Forest	Mediterranean California Mixed Oak Woodland	85.0254	38.000000	123.0254	451.5030	40.6353	198.0000	8045.7841	44.0341	182.7171
310	Forest	Mediterranean California Mixed Oak Woodland	85.0254	0.0000	85.0254	312.0430	28.0839	71.0000	1993.9550	15.7900	126.2795
311	Forest	Mediterranean California Mixed Oak Woodland	96.3265	0.000000	96.3265	353.5183	31.8166	152.0000	4836.1297	33.8040	143.0640
312	Forest	Mediterranean California Mixed Oak Woodland	96.3265	19.000000	115.3265	423.2483	38.0923	8.0000	304.7387	1.7792	171.2828
313	Forest	Mediterranean California Mixed Oak Woodland	96.3265	38.000000	134.3265	492.9783	44.3680	165.0000	7320.7271	36.6951	199.5015
314	Forest	Mediterranean California Mixed Oak Woodland	96.3265	0.0000	96.3265	353.5183	31.8166	5.0000	159.0832	1.1120	143.0640
315	Forest	Mediterranean California Mixed Oak Woodland	115.9749	0.000000	115.9749	425.6277	38.3065	1934.0000	74084.7574	430.1110	172.2457
316	Forest	Mediterranean California Mixed Oak Woodland	115.9749	19.000000	134.9749	495.3577	44.5822	139.0000	6196.9248	30.9128	200.4645
317	Forest	Mediterranean California Mixed Oak Woodland	115.9749	38.000000	153.9749	565.0877	50.8579	5102.0000	259476.9699	1134.6567	228.6832
318	Forest	Mediterranean California Mixed Oak Woodland	115.9749	0.0000	115.9749	425.6277	38.3065	235.0000	9002.0258	52.2627	172.2457
319	Forest	Mediterranean California Mixed Oak Woodland	149.9237	0.000000	149.9237	550.2201	49.5198	13.0000	643.7575	2.8911	222.6665
320	Forest	Mediterranean California Mixed Oak Woodland	149.9237	19.000000	168.9237	619.9501	55.7955	1.0000	55.7955	0.2224	250.8853
321	Forest	Mediterranean California Mixed Oak Woodland	149.9237	38.000000	187.9237	689.6801	62.0712	45.0000	2793.2044	10.0078	279.1041
322	Forest	Mediterranean California Mixed Oak Woodland	151.9604	0.000000	151.9604	557.6947	50.1925	10.0000	501.9252	2.2239	225.6914
323	Forest	Mediterranean California Mixed Oak Woodland	151.9604	19.000000	170.9604	627.4247	56.4682	1.0000	56.4682	0.2224	253.9101
324	Forest	Mediterranean California Mixed Oak Woodland	151.9604	38.000000	189.9604	697.1547	62.7439	38.0000	2384.2690	8.4510	282.1289
325	Forest	Mediterranean California Mixed Oak Woodland	178.4614	0.000000	178.4614	654.9532	58.9458	1700.0000	100207.8326	378.0707	265.0505
326	Forest	Mediterranean California Mixed Oak Woodland	178.4614	19.000000	197.4614	724.6832	65.2215	88.0000	5739.4906	19.5707	293.2693
327	Forest	Mediterranean California Mixed Oak Woodland	178.4614	38.000000	216.4614	794.4132	71.4972	9365.0000	669571.1273	2082.7245	321.4881
328	Forest	Mediterranean California Mixed Oak Woodland	178.4614	0.0000	178.4614	654.9532	58.9458	159.0000	9372.3796	35.3607	265.0505
329	Forest	Mediterranean California Mixed Oak Woodland	221.0927	0.000000	221.0927	811.4102	73.0269	56.0000	4089.5075	12.4541	328.3666
330	Forest	Mediterranean California Mixed Oak Woodland	221.0927	19.000000	240.0927	881.1402	79.3026	15.0000	1189.5393	3.3359	356.5853
331	Forest	Mediterranean California Mixed Oak Woodland	221.0927	38.000000	259.0927	950.8702	85.5783	798.0000	68291.4984	177.4708	384.8041
332	Forest	Mediterranean California Mixed Oak Woodland	221.0927	0.0000	221.0927	811.4102	73.0269	2.0000	146.0538	0.4448	328.3666
333	Forest	Mediterranean California Mixed Oak Woodland	376.3384	0.000000	376.3384	1381.1619	124.3046	88.0000	10938.8025	19.5707	558.9373
334	Forest	Mediterranean California Mixed Oak Woodland	376.3384	19.000000	395.3384	1450.8919	130.5803	3.0000	391.7408	0.6672	587.1560
335	Forest	Mediterranean California Mixed Oak Woodland	376.3384	38.000000	414.3384	1520.6219	136.8560	1014.0000	138771.9571	225.5080	615.3748
336	Forest	Mediterranean California Mixed Oak Woodland	376.3384	0.0000	376.3384	1381.1619	124.3046	6.0000	745.8274	1.3344	558.9373
337	Forest	Mediterranean California Mixed Oak Woodland	419.3246	0.000000	419.3246	1538.9213	138.5029	12.0000	1662.0350	2.6687	622.7803
338	Forest	Mediterranean California Mixed Oak Woodland	419.3246	19.000000	438.3246	1608.6513	144.7786	3.0000	434.3358	0.6672	650.9991
339	Forest	Mediterranean California Mixed Oak Woodland	419.3246	38.000000	457.3246	1678.3813	151.0543	288.0000	43503.6428	64.0496	679.2179
340	Forest	Mediterranean California Mixed Oak Woodland	419.3246	0.0000	419.3246	1538.9213	138.5029	1.0000	138.5029	0.2224	622.7803
341	Forest	North American Warm Desert Lower Montane Riparian Woodland	63.8636	0.000000	63.8636	234.3794	21.0941	18.0000	379.6946	4.0031	94.8501
342	Forest	North American Warm Desert Lower Montane Riparian Woodland	63.8636	19.000000	82.8636	304.1094	27.3698	49.0000	1341.1225	10.8973	123.0689
343	Forest	North American Warm Desert Lower Montane Riparian Woodland	63.8636	38.000000	101.8636	373.8394	33.6455	75.0000	2523.4160	16.6796	151.2877
344	Forest	North American Warm Desert Lower Montane Riparian Woodland	63.8636	0.0000	63.8636	234.3794	21.0941	12.0000	253.1298	2.6687	94.8501
345	Forest	North American Warm Desert Lower Montane Riparian Woodland	70.8478	0.000000	70.8478	260.0114	23.4010	25.0000	585.0257	5.5599	105.2231
346	Forest	North American Warm Desert Lower Montane Riparian Woodland	70.8478	19.000000	89.8478	329.7414	29.6767	24.0000	712.2415	5.3375	133.4418
347	Forest	North American Warm Desert Lower Montane Riparian Woodland	70.8478	38.000000	108.8478	399.4714	35.9524	27.0000	970.7156	6.0047	161.6606
348	Forest	North American Warm Desert Lower Montane Riparian Woodland	70.8478	0.0000	70.8478	260.0114	23.4010	11.0000	257.4113	2.4463	105.2231
349	Forest	North American Warm Desert Lower Montane Riparian Woodland	98.5567	0.000000	98.5567	361.7029	32.5533	128.0000	4166.8175	28.4665	146.3762
350	Forest	North American Warm Desert Lower Montane Riparian Woodland	98.5567	19.000000	117.5567	431.4329	38.8290	746.0000	28966.4053	165.9063	174.5950
351	Forest	North American Warm Desert Lower Montane Riparian Woodland	98.5567	38.000000	136.5567	501.1629	45.1047	144.0000	6495.0713	32.0248	202.8137
352	Forest	North American Warm Desert Lower Montane Riparian Woodland	98.5567	0.0000	98.5567	361.7029	32.5533	47.0000	1530.0033	10.4525	146.3762
353	Forest	North American Warm Desert Lower Montane Riparian Woodland	104.9299	0.000000	104.9299	385.0925	34.6583	72.0000	2495.3997	16.0124	155.8417
354	Forest	North American Warm Desert Lower Montane Riparian Woodland	104.9299	19.000000	123.9299	454.8225	40.9340	236.0000	9660.4310	52.4851	184.0604
355	Forest	North American Warm Desert Lower Montane Riparian Woodland	104.9299	38.000000	142.9299	524.5525	47.2097	101.0000	4768.1827	22.4618	212.2792
356	Forest	North American Warm Desert Lower Montane Riparian Woodland	104.9299	0.0000	104.9299	385.0925	34.6583	18.0000	623.8499	4.0031	155.8417
357	Forest	North American Warm Desert Lower Montane Riparian Woodland	159.5298	0.000000	159.5298	585.4742	52.6927	1.0000	52.6927	0.2224	236.9334
358	Forest	North American Warm Desert Lower Montane Riparian Woodland	159.5298	19.000000	178.5298	655.2042	58.9684	1.0000	58.9684	0.2224	265.1521
359	Forest	North American Warm Desert Lower Montane Riparian Woodland	159.5298	38.000000	197.5298	724.9342	65.2441	1.0000	65.2441	0.2224	293.3709
360	Forest	North American Warm Desert Lower Montane Riparian Woodland	161.4372	0.000000	161.4372	592.4744	53.3227	26.0000	1386.3901	5.7823	239.7663
361	Forest	North American Warm Desert Lower Montane Riparian Woodland	161.4372	19.000000	180.4372	662.2044	59.5984	172.0000	10250.9241	38.2519	267.9850
362	Forest	North American Warm Desert Lower Montane Riparian Woodland	161.4372	38.000000	199.4372	731.9344	65.8741	19.0000	1251.6078	4.2255	296.2038
363	Forest	North American Warm Desert Lower Montane Riparian Woodland	161.4372	0.0000	161.4372	592.4744	53.3227	1.0000	53.3227	0.2224	239.7663
364	Forest	North American Warm Desert Riparian Mesquite Bosque Woodland	51.8470	0.000000	51.8470	190.2786	17.1251	51.0000	873.3789	11.3421	77.0031
365	Forest	North American Warm Desert Riparian Mesquite Bosque Woodland	51.8470	19.000000	70.8470	260.0086	23.4008	392.0000	9173.1042	87.1786	105.2219

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			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Clas**	**Land Cover Type**	**16_TotalMTCha**	**16_SOC_MT_Cha**	**16_TOTALC_MCTha**	**16_TOTALC_MTCO2eha**	**16_TOTALC_MTCO2e pixel**	**Number of Pixels**	**16_TOTALC_MTCO2e**	**Acres**	**TOTAL MTCO2e/Acre**
366	Forest	North American Warm Desert Riparian Mesquite Bosque Woodland	51.8470	38.000000	89.8470	329.7386	29.6765	44.0000	1305.7649	9.7854	133.4407
367	Forest	North American Warm Desert Riparian Mesquite Bosque Woodland	51.8470	0.0000	51.8470	190.2786	17.1251	98.0000	1678.2575	21.7947	77.0031
368	Forest	North American Warm Desert Riparian Woodland	63.8636	0.000000	63.8636	234.3794	21.0941	3.0000	63.2824	0.6672	94.8501
369	Forest	North American Warm Desert Riparian Woodland	63.8636	19.000000	82.8636	304.1094	27.3698	46.0000	1259.0130	10.2301	123.0689
370	Forest	North American Warm Desert Riparian Woodland	63.8636	38.000000	101.8636	373.8394	33.6455	6.0000	201.8733	1.3344	151.2877
371	Forest	North American Warm Desert Riparian Woodland	63.8636	0.0000	63.8636	234.3794	21.0941	36.0000	759.3893	8.0062	94.8501
372	Forest	North American Warm Desert Riparian Woodland	70.8478	0.000000	70.8478	260.0114	23.4010	9.0000	210.6093	2.0016	105.2231
373	Forest	North American Warm Desert Riparian Woodland	70.8478	19.000000	89.8478	329.7414	29.6767	128.0000	3798.6212	28.4665	133.4418
374	Forest	North American Warm Desert Riparian Woodland	70.8478	38.000000	108.8478	399.4714	35.9524	9.0000	323.5719	2.0016	161.6606
375	Forest	North American Warm Desert Riparian Woodland	70.8478	0.0000	70.8478	260.0114	23.4010	50.0000	1170.0514	11.1197	105.2231
376	Forest	North American Warm Desert Riparian Woodland	98.5567	0.000000	98.5567	361.7029	32.5533	18.0000	585.9587	4.0031	146.3762
377	Forest	North American Warm Desert Riparian Woodland	98.5567	19.000000	117.5567	431.4329	38.8290	428.0000	16618.7955	95.1848	174.5950
378	Forest	North American Warm Desert Riparian Woodland	98.5567	38.000000	136.5567	501.1629	45.1047	29.0000	1308.0352	6.4494	202.8137
379	Forest	North American Warm Desert Riparian Woodland	98.5567	0.0000	98.5567	361.7029	32.5533	445.0000	14486.2014	98.9656	146.3762
380	Forest	North American Warm Desert Riparian Woodland	104.9299	0.000000	104.9299	385.0925	34.6583	10.0000	346.5833	2.2239	155.8417
381	Forest	North American Warm Desert Riparian Woodland	104.9299	19.000000	123.9299	454.8225	40.9340	120.0000	4912.0835	26.6873	184.0604
382	Forest	North American Warm Desert Riparian Woodland	104.9299	38.000000	142.9299	524.5525	47.2097	12.0000	566.5168	2.6687	212.2792
383	Forest	North American Warm Desert Riparian Woodland	104.9299	0.0000	104.9299	385.0925	34.6583	76.0000	2634.0330	16.9020	155.8417
384	Forest	North American Warm Desert Riparian Woodland	161.4372	0.000000	161.4372	592.4744	53.3227	1.0000	53.3227	0.2224	239.7663
385	Forest	North American Warm Desert Riparian Woodland	161.4372	19.000000	180.4372	662.2044	59.5984	60.0000	3575.9038	13.3437	267.9850
386	Forest	North American Warm Desert Riparian Woodland	161.4372	38.000000	199.4372	731.9344	65.8741	8.0000	526.9928	1.7792	296.2038
387	Forest	North American Warm Desert Riparian Woodland	161.4372	0.0000	161.4372	592.4744	53.3227	37.0000	1972.9398	8.2286	239.7663
388	Forest	North American Warm Desert Wash Woodland	63.8636	0.0000	63.8636	234.3794	21.0941	1.0000	21.0941	0.2224	94.8501
389	Forest	North American Warm Desert Wash Woodland	70.8478	19.000000	89.8478	329.7414	29.6767	19.0000	563.8578	4.2255	133.4418
390	Forest	North American Warm Desert Wash Woodland	70.8478	38.000000	108.8478	399.4714	35.9524	3.0000	107.8573	0.6672	161.6606
391	Forest	North American Warm Desert Wash Woodland	70.8478	0.0000	70.8478	260.0114	23.4010	19.0000	444.6195	4.2255	105.2231
392	Forest	Recently Burned-Tree Cover	1.5040	0.000000	1.5040	5.5197	0.4968	4780.0000	2374.5663	1063.0457	2.2337
393	Forest	Recently Burned-Tree Cover	1.5040	19.000000	20.5040	75.2497	6.7725	9388.0000	63579.9596	2087.8396	30.4525
394	Forest	Recently Burned-Tree Cover	1.5040	38.000000	39.5040	144.9797	13.0482	33840.0000	441550.1134	7525.8299	58.6713
395	Forest	Recently Burned-Tree Cover	1.5040	0.0000	1.5040	5.5197	0.4968	165.0000	81.9672	36.6951	2.2337
396	Forest	Recently Disturbed Other-Tree Cover	1.5040	0.000000	1.5040	5.5197	0.4968	11.0000	5.4645	2.4463	2.2337
397	Forest	Recently Disturbed Other-Tree Cover	1.5040	38.000000	39.5040	144.9797	13.0482	78.0000	1017.7574	17.3468	58.6713
398	Forest	Recently Logged-Tree Cover	1.5040	19.000000	20.5040	75.2497	6.7725	57.0000	386.0309	12.6765	30.4525
399	Forest	Recently Logged-Tree Cover	1.5040	38.000000	39.5040	144.9797	13.0482	60.0000	782.8903	13.3437	58.6713
400	Forest	Southern California Oak Woodland and Savanna	74.1366	0.000000	74.1366	272.0814	24.4873	1616.0000	39571.5208	359.3895	110.1076
401	Forest	Southern California Oak Woodland and Savanna	74.1366	19.000000	93.1366	341.8114	30.7630	484.0000	14889.3052	107.6389	138.3264
402	Forest	Southern California Oak Woodland and Savanna	74.1366	38.000000	112.1366	411.5414	37.0387	1672.0000	61928.7519	371.8436	166.5452
403	Forest	Southern California Oak Woodland and Savanna	74.1366	0.0000	74.1366	272.0814	24.4873	327.0000	8007.3560	72.7230	110.1076
404	Forest	Southern California Oak Woodland and Savanna	82.6472	0.000000	82.6472	303.3150	27.2984	1258.0000	34341.3289	279.7723	122.7474
405	Forest	Southern California Oak Woodland and Savanna	82.6472	19.000000	101.6472	373.0450	33.5741	1230.0000	41296.0860	273.5452	150.9662
406	Forest	Southern California Oak Woodland and Savanna	82.6472	38.000000	120.6472	442.7750	39.8498	3467.0000	138159.0959	771.0417	179.1850
407	Forest	Southern California Oak Woodland and Savanna	82.6472	0.0000	82.6472	303.3150	27.2984	34.0000	928.1440	7.5614	122.7474
408	Forest	Southern California Oak Woodland and Savanna	83.9444	0.000000	83.9444	308.0758	27.7268	1272.0000	35268.5135	282.8858	124.6740
409	Forest	Southern California Oak Woodland and Savanna	83.9444	19.000000	102.9444	377.8058	34.0025	283.0000	9622.7128	62.9376	152.8928
410	Forest	Southern California Oak Woodland and Savanna	83.9444	38.000000	121.9444	447.5358	40.2782	1483.0000	59732.5985	329.8110	181.1116
411	Forest	Southern California Oak Woodland and Savanna	83.9444	0.0000	83.9444	308.0758	27.7268	441.0000	12227.5271	98.0760	124.6740
412	Forest	Southern California Oak Woodland and Savanna	96.8036	0.000000	96.8036	355.2690	31.9742	15513.0000	496015.9595	3450.0059	143.7725
413	Forest	Southern California Oak Woodland and Savanna	96.8036	19.000000	115.8036	424.9990	38.2499	18802.0000	719174.8560	4181.4614	171.9913
414	Forest	Southern California Oak Woodland and Savanna	96.8036	38.000000	134.8036	494.7290	44.5256	55720.0000	2480967.1321	12391.8215	200.2100
415	Forest	Southern California Oak Woodland and Savanna	96.8036	88.000000	184.8036	678.2290	61.0406	1.0000	61.0406	0.2224	274.4700
416	Forest	Southern California Oak Woodland and Savanna	96.8036	0.0000	96.8036	355.2690	31.9742	1167.0000	37313.9061	259.5344	143.7725
417	Forest	Southern California Oak Woodland and Savanna	102.8344	38.000000	140.8344	516.8624	46.5176	1.0000	46.5176	0.2224	209.1671
418	Forest	Southern California Oak Woodland and Savanna	108.3632	0.000000	108.3632	397.6929	35.7924	66.0000	2362.2961	14.6780	160.9409
419	Forest	Southern California Oak Woodland and Savanna	108.3632	19.000000	127.3632	467.4229	42.0681	300.0000	12620.4195	66.7184	189.1596
420	Forest	Southern California Oak Woodland and Savanna	108.3632	38.000000	146.3632	537.1529	48.3438	1318.0000	63717.0822	293.1160	217.3784
421	Forest	Southern California Oak Woodland and Savanna	121.1347	0.000000	121.1347	444.5642	40.0108	103.0000	4121.1104	22.9066	179.9090
422	Forest	Southern California Oak Woodland and Savanna	121.1347	19.000000	140.1347	514.2942	46.2865	22.0000	1018.3026	4.8927	208.1278
423	Forest	Southern California Oak Woodland and Savanna	121.1347	38.000000	159.1347	584.0242	52.5622	325.0000	17082.7086	72.2782	236.3466
424	Forest	Southern California Oak Woodland and Savanna	124.2140	0.000000	124.2140	455.8652	41.0279	19664.0000	806771.9902	4373.1654	184.4824
425	Forest	Southern California Oak Woodland and Savanna	124.2140	19.000000	143.2140	525.5952	47.3036	41731.0000	1974025.1831	9280.7449	212.7012
426	Forest	Southern California Oak Woodland and Savanna	124.2140	38.000000	162.2140	595.3252	53.5793	172147.0000	9223510.1942	38284.5460	240.9199
427	Forest	Southern California Oak Woodland and Savanna	124.2140	0.0000	124.2140	455.8652	41.0279	1021.0000	41889.4529	227.0648	184.4824
428	Forest	Southern California Oak Woodland and Savanna	156.3173	0.000000	156.3173	573.6845	51.6316	1107.0000	57156.1858	246.1907	232.1622
429	Forest	Southern California Oak Woodland and Savanna	156.3173	19.000000	175.3173	643.4145	57.9073	1130.0000	65435.2537	251.3058	260.3810
430	Forest	Southern California Oak Woodland and Savanna	156.3173	38.000000	194.3173	713.1445	64.1830	10541.0000	676553.0472	2344.2604	288.5998
431	Forest	Southern California Oak Woodland and Savanna	156.3173	0.0000	156.3173	573.6845	51.6316	5.0000	258.1580	1.1120	232.1622
432	Forest	Southern California Oak Woodland and Savanna	219.4430	0.000000	219.4430	805.3558	72.4820	1147.0000	83136.8803	255.0865	325.9164
433	Forest	Southern California Oak Woodland and Savanna	219.4430	19.000000	238.4430	875.0858	78.7577	2894.0000	227924.8501	643.6097	354.1352
434	Forest	Southern California Oak Woodland and Savanna	219.4430	38.000000	257.4430	944.8158	85.0334	27394.0000	2329405.5869	6092.2749	382.3540
435	Forest	Southern California Oak Woodland and Savanna	219.4430	0.0000	219.4430	805.3558	72.4820	30.0000	2174.4607	6.6718	325.9164
436	Forest	Southern California Oak Woodland and Savanna	258.3183	0.000000	258.3183	948.0280	85.3225	379.0000	32337.2364	84.2875	383.6539
437	Forest	Southern California Oak Woodland and Savanna	258.3183	19.000000	277.3183	1017.7580	91.5982	430.0000	39387.2361	95.6296	411.8727
438	Forest	Southern California Oak Woodland and Savanna	258.3183	38.000000	296.3183	1087.4880	97.8739	4255.0000	416453.5444	946.2886	440.0915

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Clas	Land Cover Type	16_TotalMTCha	16_SOC_MT_Cha	16_TOTALC_MCTha	16_TOTALC_MTCO2eha	16_TOTALC_MTCO2e pixel	Number of Pixels	16_TOTALC_MTCO2e	Acres	TOTAL MTCO2e/Acre
439	Forest	Southern California Oak Woodland and Savanna	258.3183	0.0000	258.3183	948.0280	85.3225	4.0000	341.2901	0.8896	383.6539
440	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	0.000000	6.1476	22.5617	2.0306	6399.0000	12993.5040	1423.1024	9.1304
441	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	19.000000	25.1476	92.2917	8.3063	17686.0000	146904.3778	3933.2691	37.3492
442	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	38.000000	44.1476	162.0217	14.5820	58739.0000	856529.2950	13063.2305	65.5680
443	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	88.000000	94.1476	345.5217	31.0970	2.0000	62.1939	0.4448	139.8279
444	Grassland	California Central Valley and Southern Coastal Grassland	6.1476	0.0000	6.1476	22.5617	2.0306	95.0000	192.9025	21.1275	9.1304
445	Grassland	California Central Valley and Southern Coastal Grassland	6.9654	0.000000	6.9654	25.5630	2.3007	352.0000	809.8364	78.2829	10.3450
446	Grassland	California Central Valley and Southern Coastal Grassland	6.9654	19.000000	25.9654	95.2930	8.5764	1891.0000	16217.9187	420.5480	38.5638
447	Grassland	California Central Valley and Southern Coastal Grassland	6.9654	38.000000	44.9654	165.0230	14.8521	4886.0000	72567.2219	1086.6195	66.7825
448	Grassland	California Central Valley and Southern Coastal Grassland	6.9654	0.0000	6.9654	25.5630	2.3007	1.0000	2.3007	0.2224	10.3450
449	Grassland	California Central Valley and Southern Coastal Grassland	7.2850	0.000000	7.2850	26.7360	2.4062	1804.0000	4340.8488	401.1997	10.8197
450	Grassland	California Central Valley and Southern Coastal Grassland	7.2850	19.000000	26.2850	96.4660	8.6819	1474.0000	12797.1729	327.8095	39.0384
451	Grassland	California Central Valley and Southern Coastal Grassland	7.2850	38.000000	45.2850	166.1960	14.9576	3674.0000	54954.3528	817.0774	67.2572
452	Grassland	California Central Valley and Southern Coastal Grassland	7.2850	0.0000	7.2850	26.7360	2.4062	416.0000	1000.9940	92.5161	10.8197
453	Grassland	California Ruderal Grassland and Meadow	17.7000	0.000000	17.7000	64.9590	5.8463	14149.0000	82719.4402	3146.6598	26.2880
454	Grassland	California Ruderal Grassland and Meadow	17.7000	19.000000	36.7000	134.6890	12.1220	44556.0000	540108.2776	9909.0093	54.5068
455	Grassland	California Ruderal Grassland and Meadow	17.7000	38.000000	55.7000	204.4190	18.3977	279686.0000	5145581.9191	62200.6281	82.7256
456	Grassland	California Ruderal Grassland and Meadow	17.7000	88.000000	105.7000	387.9190	34.9127	57.0000	1990.0245	12.6765	156.9855
457	Grassland	California Ruderal Grassland and Meadow	17.7000	0.0000	17.7000	64.9590	5.8463	458.0000	2677.6100	101.8567	26.2880
458	Grassland	North American Warm Desert Riparian Herbaceous	51.8470	0.000000	51.8470	190.2786	17.1251	105.0000	1798.1330	23.3514	77.0031
459	Grassland	North American Warm Desert Riparian Herbaceous	51.8470	19.000000	70.8470	260.0086	23.4008	619.0000	14485.0804	137.6622	105.2219
460	Grassland	North American Warm Desert Riparian Herbaceous	51.8470	38.000000	89.8470	329.7386	29.6765	27.0000	801.2649	6.0047	133.4407
461	Grassland	North American Warm Desert Riparian Herbaceous	51.8470	0.0000	51.8470	190.2786	17.1251	272.0000	4658.0207	60.4913	77.0031
462	Grassland	North American Warm Desert Ruderal & Planted Grassland	17.7000	0.000000	17.7000	64.9590	5.8463	12953.0000	75727.2534	2880.6760	26.2880
463	Grassland	North American Warm Desert Ruderal & Planted Grassland	17.7000	19.000000	36.7000	134.6890	12.1220	20825.0000	252440.8583	4631.3655	54.5068
464	Grassland	North American Warm Desert Ruderal & Planted Grassland	17.7000	38.000000	55.7000	204.4190	18.3977	3220.0000	59240.6262	716.1103	82.7256
465	Grassland	North American Warm Desert Ruderal & Planted Grassland	17.7000	0.0000	17.7000	64.9590	5.8463	26719.0000	156207.5569	5942.1586	26.2880
466	Grassland	Recently Burned-Herb and Grass Cover	6.9654	0.000000	6.9654	25.5630	2.3007	2698.0000	6207.2120	600.0204	10.3450
467	Grassland	Recently Burned-Herb and Grass Cover	6.9654	19.000000	25.9654	95.2930	8.5764	6615.0000	56732.6983	1471.1396	38.5638
468	Grassland	Recently Burned-Herb and Grass Cover	6.9654	38.000000	44.9654	165.0230	14.8521	11241.0000	166952.1371	2499.9366	66.7825
469	Grassland	Recently Burned-Herb and Grass Cover	6.9654	0.0000	6.9654	25.5630	2.3007	684.0000	1573.6594	152.1178	10.3450
470	Grassland	Recently Disturbed Other-Herb and Grass Cover	1.5040	19.000000	20.5040	75.2497	6.7725	6.0000	40.6348	1.3344	30.4525
471	Grassland	Recently Disturbed Other-Herb and Grass Cover	1.5040	38.000000	39.5040	144.9797	13.0482	570.0000	7437.4576	126.7649	58.6713
472	Grassland	Recently Logged-Herb and Grass Cover	1.5040	0.000000	1.5040	5.5197	0.4968	4.0000	1.9871	0.8896	2.2337
473	Grassland	Recently Logged-Herb and Grass Cover	1.5040	19.000000	20.5040	75.2497	6.7725	62.0000	419.8932	13.7885	30.4525
474	Grassland	Recently Logged-Herb and Grass Cover	1.5040	38.000000	39.5040	144.9797	13.0482	41.0000	534.9750	9.1182	58.6713
475	Grassland	Western Warm Temperate Fallow/Idle Cropland	1.0000	0.000000	1.0000	3.6700	0.3303	364.0000	120.2292	80.9516	1.4852
476	Grassland	Western Warm Temperate Fallow/Idle Cropland	1.0000	19.000000	20.0000	73.4000	6.6060	1769.0000	11686.0140	393.4159	29.7040
477	Grassland	Western Warm Temperate Fallow/Idle Cropland	1.0000	38.000000	39.0000	143.1300	12.8817	2847.0000	36674.1999	633.1571	57.9227
478	Grassland	Western Warm Temperate Fallow/Idle Cropland	1.0000	0.0000	1.0000	3.6700	0.3303	8.0000	2.6424	1.7792	1.4852
479	Irrigated Pastur	Miscellaneous Grain and Hay	5.7477	0.000000	5.7477	21.0942	1.8985	48.0000	91.1269	10.6749	8.5365
480	Irrigated Pastur	Miscellaneous Grain and Hay	5.7477	19.000000	24.7477	90.8242	8.1742	133.0000	1087.1655	29.5785	36.7553
481	Irrigated Pastur	Miscellaneous Grain and Hay	5.7477	38.000000	43.7477	160.5542	14.4499	3195.0000	46167.3567	710.5504	64.9741
482	Irrigated Pastur	Miscellaneous Grasses	5.7477	0.000000	5.7477	21.0942	1.8985	5.0000	9.4924	1.1120	8.5365
483	Irrigated Pastur	Miscellaneous Grasses	5.7477	19.000000	24.7477	90.8242	8.1742	3201.0000	26165.5403	711.8848	36.7553
484	Irrigated Pastur	Miscellaneous Grasses	5.7477	38.000000	43.7477	160.5542	14.4499	2770.0000	40026.1591	616.0328	64.9741
485	Irrigated Pastur	Mixed Pasture	5.7477	0.000000	5.7477	21.0942	1.8985	59.0000	112.0101	13.1213	8.5365
486	Irrigated Pastur	Mixed Pasture	5.7477	19.000000	24.7477	90.8242	8.1742	692.0000	5656.5304	153.8970	36.7553
487	Irrigated Pastur	Mixed Pasture	5.7477	38.000000	43.7477	160.5542	14.4499	1905.0000	27527.0155	423.6615	64.9741
488	Irrigated Pastur	Western Warm Temperate Pasture and Hayland	5.7477	0.000000	5.7477	21.0942	1.8985	92.0000	174.6599	20.4603	8.5365
489	Irrigated Pastur	Western Warm Temperate Pasture and Hayland	5.7477	19.000000	24.7477	90.8242	8.1742	2650.0000	21661.5688	589.3454	36.7553
490	Irrigated Pastur	Western Warm Temperate Pasture and Hayland	5.7477	38.000000	43.7477	160.5542	14.4499	22.0000	317.8973	4.8927	64.9741
491	Irrigated Pastur	Western Warm Temperate Pasture and Hayland	5.7477	0.0000	5.7477	21.0942	1.8985	41.0000	77.8376	9.1182	8.5365
492	Irrigated Pastur	Western Warm Temperate Wheat	5.4656	0.000000	5.4656	20.0587	1.8053	1.0000	1.8053	0.2224	8.1175
493	Orchard	Apples	7.5200	0.000000	7.5200	27.5984	2.4839	1.0000	2.4839	0.2224	11.1687
494	Orchard	Apples	7.5200	19.000000	26.5200	97.3284	8.7596	79.0000	692.0049	17.5692	39.3875
495	Orchard	Apples	7.5200	38.000000	45.5200	167.0584	15.0353	557.0000	8374.6376	123.8737	67.6062
496	Orchard	Avocados	20.3300	0.000000	20.3300	74.6111	6.7150	3684.0000	24738.0563	819.3013	30.1941
497	Orchard	Avocados	20.3300	19.000000	39.3300	144.3411	12.9907	50839.0000	660434.1465	11306.3140	58.4129
498	Orchard	Avocados	20.3300	38.000000	58.3300	214.0711	19.2664	32780.0000	631552.5592	7290.0917	86.6316
499	Orchard	Citrus	24.6300	19.000000	43.6300	160.1221	14.4110	76.0000	1095.2352	16.9020	64.7992
500	Orchard	Citrus	24.6300	0.000000	24.6300	90.3921	8.1353	1161.0000	9445.0705	258.2000	36.5804
501	Orchard	Citrus	24.6300	19.000000	43.6300	160.1221	14.4110	21600.0000	311277.3624	4803.7212	64.7992
502	Orchard	Citrus	24.6300	38.000000	62.6300	229.8521	20.6867	17140.0000	354569.8495	3811.8417	93.0180
503	Orchard	Citrus	24.6300	0.0000	24.6300	90.3921	8.1353	6.0000	48.8117	1.3344	36.5804
504	Orchard	Dates	7.5200	19.000000	26.5200	97.3284	8.7596	334.0000	2925.6917	74.2798	39.3875
505	Orchard	Miscellaneous Deciduous	5.0000	0.000000	5.0000	18.3500	1.6515	27.0000	44.5905	6.0047	7.4260
506	Orchard	Miscellaneous Deciduous	5.0000	19.000000	24.0000	88.0800	7.9272	242.0000	1918.3824	53.8195	35.6448
507	Orchard	Miscellaneous Deciduous	5.0000	38.000000	43.0000	157.8100	14.2029	716.0000	10169.2764	159.2345	63.8635
508	Orchard	Olives	2.6900	0.000000	2.6900	9.8723	0.8885	4.0000	3.5540	0.8896	3.9952
509	Orchard	Olives	2.6900	19.000000	21.6900	79.6023	7.1642	122.0000	874.0333	27.1321	32.2140
510	Orchard	Olives	2.6900	38.000000	40.6900	149.3323	13.4399	312.0000	4193.2510	69.3871	60.4327
511	Orchard	Pomegranates	7.5200	19.000000	26.5200	97.3284	8.7596	11.0000	96.3551	2.4463	39.3875

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	Land Cover Clas	Land Cover Type	16_TotalMTCha	16_SOC_MT_Cha	16_TOTALC_MCTha	16_TOTALC_MTCO2eha	16_TOTALC_MTCO2e pixel	Number of Pixels	16_TOTALC_MTCO2e	Acres	TOTAL MTCO2e/Acre
512	Orchard	Pomegranates	7.5200	38.000000	45.5200	167.0584	15.0353	60.0000	902.1154	13.3437	67.6062
513	Orchard	Western Warm Temperate Orchard	20.3300	0.000000	20.3300	74.6111	6.7150	2769.0000	18593.8322	615.8104	30.1941
514	Orchard	Western Warm Temperate Orchard	20.3300	19.000000	39.3300	144.3411	12.9907	16157.0000	209890.7237	3593.2279	58.4129
515	Orchard	Western Warm Temperate Orchard	20.3300	38.000000	58.3300	214.0711	19.2664	16680.0000	321363.5353	3709.5403	86.6316
516	Orchard	Western Warm Temperate Orchard	20.3300	0.0000	20.3300	74.6111	6.7150	31.0000	208.1650	6.8942	30.1941
517	Row Crop	Alfalfa and Alfalfa Mixtures	6.2949	19.000000	25.2949	92.8323	8.3549	233.0000	1946.6936	51.8179	37.5680
518	Row Crop	Alfalfa and Alfalfa Mixtures	6.2949	38.000000	44.2949	162.5623	14.6306	475.0000	6949.5388	105.6374	65.7867
519	Row Crop	Bush Berries	6.4531	0.000000	6.4531	23.6829	2.1315	19.0000	40.4977	4.2255	9.5841
520	Row Crop	Bush Berries	6.4531	19.000000	25.4531	93.4129	8.4072	267.0000	2244.7114	59.3793	37.8029
521	Row Crop	Bush Berries	6.4531	38.000000	44.4531	163.1429	14.6829	1279.0000	18779.3766	284.4426	66.0217
522	Row Crop	Cole Crops	8.6934	38.000000	46.6934	171.3646	15.4228	19.0000	293.0335	4.2255	69.3489
523	Row Crop	Flowers, Nursery and Christmas Tree Farms	2.1400	0.000000	2.1400	7.8538	0.7068	1160.0000	819.9367	257.9776	3.1783
524	Row Crop	Flowers, Nursery and Christmas Tree Farms	2.1400	19.000000	21.1400	77.5838	6.9825	9029.0000	63045.3717	2007.9999	31.3971
525	Row Crop	Flowers, Nursery and Christmas Tree Farms	2.1400	38.000000	40.1400	147.3138	13.2582	17208.0000	228147.8283	3826.9646	59.6159
526	Row Crop	Greenhouse	2.1400	0.000000	2.1400	7.8538	0.7068	1.0000	0.7068	0.2224	3.1783
527	Row Crop	Greenhouse	2.1400	19.000000	21.1400	77.5838	6.9825	69.0000	481.7954	15.3452	31.3971
528	Row Crop	Greenhouse	2.1400	38.000000	40.1400	147.3138	13.2582	261.0000	3460.4012	58.0450	59.6159
529	Row Crop	Idle	1.0000	0.000000	1.0000	3.6700	0.3303	1716.0000	566.7948	381.6290	1.4852
530	Row Crop	Idle	1.0000	19.000000	20.0000	73.4000	6.6060	15403.0000	101752.2180	3425.5425	29.7040
531	Row Crop	Idle	1.0000	38.000000	39.0000	143.1300	12.8817	18457.0000	237757.5369	4104.7353	57.9227
532	Row Crop	Melons, Squash and Cucumbers	19.3186	0.000000	19.3186	70.8991	6.3809	4.0000	25.5237	0.8896	28.6919
533	Row Crop	Melons, Squash and Cucumbers	19.3186	19.000000	38.3186	140.6291	12.6566	78.0000	987.2166	17.3468	56.9107
534	Row Crop	Melons, Squash and Cucumbers	19.3186	38.000000	57.3186	210.3591	18.9323	262.0000	4960.2685	58.2674	85.1295
535	Row Crop	Miscellaneous Subtropical Fruits	24.6300	0.000000	24.6300	90.3921	8.1353	202.0000	1643.3284	44.9237	36.5804
536	Row Crop	Miscellaneous Subtropical Fruits	24.6300	19.000000	43.6300	160.1221	14.4110	1589.0000	22899.0615	353.3849	64.7992
537	Row Crop	Miscellaneous Subtropical Fruits	24.6300	38.000000	62.6300	229.8521	20.6867	2057.0000	42552.5193	457.4655	93.0180
538	Row Crop	Miscellaneous Truck Crops	6.4531	0.000000	6.4531	23.6829	2.1315	132.0000	281.3526	29.3561	9.5841
539	Row Crop	Miscellaneous Truck Crops	6.4531	19.000000	25.4531	93.4129	8.4072	384.0000	3228.3490	85.3995	37.8029
540	Row Crop	Miscellaneous Truck Crops	6.4531	38.000000	44.4531	163.1429	14.6829	2059.0000	30232.0065	457.9103	66.0217
541	Row Crop	Strawberries	35.0369	0.000000	35.0369	128.5853	11.5727	5.0000	57.8634	1.1120	52.0367
542	Row Crop	Strawberries	35.0369	19.000000	54.0369	198.3153	17.8484	145.0000	2588.0141	32.2472	80.2555
543	Row Crop	Strawberries	35.0369	38.000000	73.0369	268.0453	24.1241	274.0000	6609.9961	60.9361	108.4742
544	Row Crop	Tomatoes	5.0000	0.000000	5.0000	18.3500	1.6515	144.0000	237.8160	32.0248	7.4260
545	Row Crop	Tomatoes	5.0000	19.000000	24.0000	88.0800	7.9272	765.0000	6064.3080	170.1318	35.6448
546	Row Crop	Tomatoes	5.0000	38.000000	43.0000	157.8100	14.2029	1766.0000	25082.3214	392.7487	63.8635
547	Row Crop	Western Warm Temperate Bush fruit and berries	6.4531	0.000000	6.4531	23.6829	2.1315	17.0000	36.2348	3.7807	9.5841
548	Row Crop	Western Warm Temperate Bush fruit and berries	6.4531	19.000000	25.4531	93.4129	8.4072	82.0000	689.3870	18.2363	37.8029
549	Row Crop	Western Warm Temperate Bush fruit and berries	6.4531	38.000000	44.4531	163.1429	14.6829	183.0000	2686.9632	40.6982	66.0217
550	Row Crop	Western Warm Temperate Close Grown Crop	6.4531	19.000000	25.4531	93.4129	8.4072	26.0000	218.5861	5.7823	37.8029
551	Row Crop	Western Warm Temperate Row Crop	7.5241	0.000000	7.5241	27.6133	2.4852	186.0000	462.2472	41.3654	11.1747
552	Row Crop	Western Warm Temperate Row Crop	7.5241	19.000000	26.5241	97.3433	8.7609	703.0000	6158.9126	156.3433	39.3935
553	Row Crop	Western Warm Temperate Row Crop	7.5241	38.000000	45.5241	167.0733	15.0366	1080.0000	16239.5278	240.1861	67.6123
554	Row Crop	Western Warm Temperate Row Crop	7.5241	0.0000	7.5241	27.6133	2.4852	2.0000	4.9704	0.4448	11.1747
555	Row Crop	Young Perennials	5.0000	0.000000	5.0000	18.3500	1.6515	52.0000	85.8780	11.5645	7.4260
556	Row Crop	Young Perennials	5.0000	19.000000	24.0000	88.0800	7.9272	627.0000	4970.3544	139.4414	35.6448
557	Row Crop	Young Perennials	5.0000	38.000000	43.0000	157.8100	14.2029	650.0000	9231.8850	144.5564	63.8635
558	Shrubland	California Maritime Chaparral	2.6477	0.000000	2.6477	9.7169	0.8745	536.0000	468.7450	119.2035	3.9323
559	Shrubland	California Maritime Chaparral	2.6477	19.000000	21.6477	79.4469	7.1502	765.0000	5469.9216	170.1318	32.1511
560	Shrubland	California Maritime Chaparral	2.6477	38.000000	40.6477	149.1769	13.4259	1302.0000	17480.5534	289.5576	60.3699
561	Shrubland	California Mesic Chaparral	71.6797	0.000000	71.6797	263.0645	23.6758	46589.0000	1103032.0750	10361.1374	106.4586
562	Shrubland	California Mesic Chaparral	71.6797	19.000000	90.6797	332.7945	29.9515	51498.0000	1542442.5999	11452.8720	134.6774
563	Shrubland	California Mesic Chaparral	71.6797	38.000000	109.6797	402.5245	36.2272	197894.0000	7169146.4885	44010.5372	162.8961
564	Shrubland	California Mesic Chaparral	71.6797	0.0000	71.6797	263.0645	23.6758	3481.0000	82415.4769	774.1553	106.4586
565	Shrubland	California Montane Woodland and Chaparral	87.8712	0.000000	87.8712	322.4873	29.0239	404.0000	11725.6384	89.8474	130.5062
566	Shrubland	California Montane Woodland and Chaparral	87.8712	19.000000	106.8712	392.2173	35.2996	75.0000	2647.4668	16.6796	158.7250
567	Shrubland	California Montane Woodland and Chaparral	87.8712	38.000000	125.8712	461.9473	41.5753	4886.0000	203136.7075	1086.6195	186.9437
568	Shrubland	California Montane Woodland and Chaparral	87.8712	0.0000	87.8712	322.4873	29.0239	57.0000	1654.3599	12.6765	130.5062
569	Shrubland	California Ruderal Scrub	7.4000	0.000000	7.4000	27.1580	2.4442	8883.0000	21712.0063	1975.5303	10.9905
570	Shrubland	California Ruderal Scrub	7.4000	19.000000	26.4000	96.8880	8.7199	32567.0000	283981.6346	7242.7217	39.2092
571	Shrubland	California Ruderal Scrub	7.4000	38.000000	45.4000	166.6180	14.9956	68437.0000	1026255.2459	15220.0124	67.4280
572	Shrubland	California Ruderal Scrub	7.4000	88.000000	95.4000	350.1180	31.5106	230.0000	7247.4426	51.1507	141.6879
573	Shrubland	California Ruderal Scrub	7.4000	0.0000	7.4000	27.1580	2.4442	237.0000	579.2801	52.7075	10.9905
574	Shrubland	California Xeric Serpentine Chaparral	2.6477	0.000000	2.6477	9.7169	0.8745	854.0000	746.8438	189.9249	3.9323
575	Shrubland	California Xeric Serpentine Chaparral	2.6477	19.000000	21.6477	79.4469	7.1502	78.0000	557.7175	17.3468	32.1511
576	Shrubland	California Xeric Serpentine Chaparral	2.6477	38.000000	40.6477	149.1769	13.4259	4002.0000	53730.5490	890.0228	60.3699
577	Shrubland	Interior West Ruderal Riparian Scrub	62.0000	19.000000	81.0000	297.2700	26.7543	23.0000	615.3489	5.1151	120.3011
578	Shrubland	Interior West Ruderal Riparian Scrub	62.0000	0.0000	62.0000	227.5400	20.4786	218.0000	4464.3348	48.4820	92.0823
579	Shrubland	Mediterranean California Foothill and Lower Montane Riparian Shrubland	51.8470	0.000000	51.8470	190.2786	17.1251	16431.0000	281382.1252	3654.1640	77.0031
580	Shrubland	Mediterranean California Foothill and Lower Montane Riparian Shrubland	51.8470	19.000000	70.8470	260.0086	23.4008	8021.0000	187697.6250	1783.8263	105.2219
581	Shrubland	Mediterranean California Foothill and Lower Montane Riparian Shrubland	51.8470	38.000000	89.8470	329.7386	29.6765	42189.0000	1252020.8496	9382.6016	133.4407
582	Shrubland	Mediterranean California Foothill and Lower Montane Riparian Shrubland	51.8470	0.0000	51.8470	190.2786	17.1251	129.0000	2209.1348	28.6889	77.0031
583	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	0.000000	2.3101	8.4779	0.7630	37122.0000	28324.4392	8255.7286	3.4309
584	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	19.000000	21.3101	78.2079	7.0387	4234.0000	29801.8961	941.6183	31.6497

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Clas**	**Land Cover Type**	**16_TotalMTCha**	**16_SOC_MT_Cha**	**16_TOTALC_MCTha**	**16_TOTALC_MTCO2eha**	**16_TOTALC_MTCO2e pixel**	**Number of Pixels**	**16_TOTALC_MTCO2e**	**Acres**	**TOTAL MTCO2e/Acre**
585	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	38.000000	40.3101	147.9379	13.3144	108398.0000	1443255.3626	24107.1190	59.8684
586	Shrubland	Mojave Mid-Elevation Mixed Desert Scrub	2.3101	0.0000	2.3101	8.4779	0.7630	110523.0000	84330.1006	24579.7073	3.4309
587	Shrubland	North American Warm Desert Lower Montane Riparian Shrubland	51.8470	0.000000	51.8470	190.2786	17.1251	26.0000	445.2520	5.7823	77.0031
588	Shrubland	North American Warm Desert Lower Montane Riparian Shrubland	51.8470	19.000000	70.8470	260.0086	23.4008	191.0000	4469.5482	42.4773	105.2219
589	Shrubland	North American Warm Desert Lower Montane Riparian Shrubland	51.8470	38.000000	89.8470	329.7386	29.6765	71.0000	2107.0298	15.7900	133.4407
590	Shrubland	North American Warm Desert Lower Montane Riparian Shrubland	51.8470	0.0000	51.8470	190.2786	17.1251	14.0000	239.7511	3.1135	77.0031
591	Shrubland	North American Warm Desert Riparian Mesquite Bosque Shrubland	51.8470	0.000000	51.8470	190.2786	17.1251	311.0000	5325.8987	69.1647	77.0031
592	Shrubland	North American Warm Desert Riparian Mesquite Bosque Shrubland	51.8470	19.000000	70.8470	260.0086	23.4008	1719.0000	40225.9341	382.2961	105.2219
593	Shrubland	North American Warm Desert Riparian Mesquite Bosque Shrubland	51.8470	38.000000	89.8470	329.7386	29.6765	86.0000	2552.1769	19.1259	133.4407
594	Shrubland	North American Warm Desert Riparian Mesquite Bosque Shrubland	51.8470	0.0000	51.8470	190.2786	17.1251	62.0000	1061.7547	13.7885	77.0031
595	Shrubland	North American Warm Desert Riparian Shrubland	51.8470	0.000000	51.8470	190.2786	17.1251	176.0000	3014.0134	39.1414	77.0031
596	Shrubland	North American Warm Desert Riparian Shrubland	51.8470	19.000000	70.8470	260.0086	23.4008	1523.0000	35639.3820	338.7068	105.2219
597	Shrubland	North American Warm Desert Riparian Shrubland	51.8470	38.000000	89.8470	329.7386	29.6765	36.0000	1068.3531	8.0062	133.4407
598	Shrubland	North American Warm Desert Riparian Shrubland	51.8470	0.0000	51.8470	190.2786	17.1251	764.0000	13083.5581	169.9094	77.0031
599	Shrubland	North American Warm Desert Ruderal & Planted Scrub	7.4000	0.000000	7.4000	27.1580	2.4442	61138.0000	149434.7224	13596.7549	10.9905
600	Shrubland	North American Warm Desert Ruderal & Planted Scrub	7.4000	19.000000	26.4000	96.8880	8.7199	59736.0000	520893.1411	13284.9579	39.2092
601	Shrubland	North American Warm Desert Ruderal & Planted Scrub	7.4000	38.000000	45.4000	166.6180	14.9956	9884.0000	148216.7081	2198.1472	67.4280
602	Shrubland	North American Warm Desert Ruderal & Planted Scrub	7.4000	0.0000	7.4000	27.1580	2.4442	312645.0000	764173.1619	69530.5285	10.9905
603	Shrubland	North American Warm Desert Wash Shrubland	70.8478	19.000000	89.8478	329.7414	29.6767	3.0000	89.0302	0.6672	133.4418
604	Shrubland	North American Warm Desert Wash Shrubland	70.8478	38.000000	108.8478	399.4714	35.9524	2.0000	71.9049	0.4448	161.6606
605	Shrubland	North American Warm Desert Wash Shrubland	70.8478	0.0000	70.8478	260.0114	23.4010	599.0000	14017.2160	133.2143	105.2231
606	Shrubland	North American Warm Desert Wash Shrubland	104.9299	19.000000	123.9299	454.8225	40.9340	24.0000	982.4167	5.3375	184.0604
607	Shrubland	North American Warm Desert Wash Shrubland	104.9299	38.000000	142.9299	524.5525	47.2097	7.0000	330.4681	1.5568	212.2792
608	Shrubland	North American Warm Desert Wash Shrubland	104.9299	0.0000	104.9299	385.0925	34.6583	130.0000	4505.5828	28.9113	155.8417
609	Shrubland	Recently Burned-Shrub Cover	1.5040	0.000000	1.5040	5.5197	0.4968	9756.0000	4846.4998	2169.6807	2.2337
610	Shrubland	Recently Burned-Shrub Cover	1.5040	19.000000	20.5040	75.2497	6.7725	15906.0000	107722.9269	3537.4069	30.4525
611	Shrubland	Recently Burned-Shrub Cover	1.5040	38.000000	39.5040	144.9797	13.0482	34856.0000	454807.0553	7751.7827	58.6713
612	Shrubland	Recently Burned-Shrub Cover	1.5040	0.0000	1.5040	5.5197	0.4968	1858.0000	923.0009	413.2090	2.2337
613	Shrubland	Recently Disturbed Other-Shrub Cover	1.5040	0.000000	1.5040	5.5197	0.4968	96.0000	47.6900	21.3499	2.2337
614	Shrubland	Recently Disturbed Other-Shrub Cover	1.5040	38.000000	39.5040	144.9797	13.0482	383.0000	4997.4496	85.1771	58.6713
615	Shrubland	Recently Logged-Shrub Cover	1.5040	0.000000	1.5040	5.5197	0.4968	4.0000	1.9871	0.8896	2.2337
616	Shrubland	Recently Logged-Shrub Cover	1.5040	19.000000	20.5040	75.2497	6.7725	88.0000	595.9775	19.5707	30.4525
617	Shrubland	Recently Logged-Shrub Cover	1.5040	38.000000	39.5040	144.9797	13.0482	130.0000	1696.2623	28.9113	58.6713
618	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	0.000000	0.6878	2.5241	0.2272	29707.0000	6748.5193	6606.6734	1.0215
619	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	19.000000	19.6878	72.2541	6.5029	24430.0000	158865.0977	5433.0976	29.2402
620	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	38.000000	38.6878	141.9841	12.7786	772.0000	9865.0555	171.6886	57.4590
621	Shrubland	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.6878	0.0000	0.6878	2.5241	0.2272	365055.0000	82929.2998	81186.2242	1.0215
622	Shrubland	Sonora-Mojave Mixed Salt Desert Scrub	2.2936	0.000000	2.2936	8.4175	0.7576	146.0000	110.6061	32.4696	3.4065
623	Shrubland	Sonora-Mojave Mixed Salt Desert Scrub	2.2936	19.000000	21.2936	78.1475	7.0333	13317.0000	93662.1376	2961.6276	31.6252
624	Shrubland	Sonora-Mojave Mixed Salt Desert Scrub	2.2936	0.0000	2.2936	8.4175	0.7576	1083.0000	820.4549	240.8532	3.4065
625	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	0.000000	6.2212	22.8319	2.0549	14437.0000	29666.2068	3210.7094	9.2398
626	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	19.000000	25.2212	92.5619	8.3306	1420.0000	11829.4142	315.8002	37.4585
627	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	38.000000	44.2212	162.2919	14.6063	70777.0000	1033788.2103	15740.4155	65.6773
628	Shrubland	Sonora-Mojave Semi-Desert Chaparral	6.2212	0.0000	6.2212	22.8319	2.0549	20696.0000	42527.6593	4602.6766	9.2398
629	Shrubland	Sonoran Granite Outcrop Desert Scrub	2.6477	0.0000	2.6477	9.7169	0.8745	8.0000	6.9962	1.7792	3.9323
630	Shrubland	Southern California Coastal Scrub	36.5989	0.000000	36.5989	134.3180	12.0886	148210.0000	1791653.8767	32961.0888	54.3566
631	Shrubland	Southern California Coastal Scrub	36.5989	19.000000	55.5989	204.0480	18.3643	319433.0000	5866168.7668	71040.1423	82.5754
632	Shrubland	Southern California Coastal Scrub	36.5989	38.000000	74.5989	273.7780	24.6400	709308.0000	17477360.9442	157746.1980	110.7942
633	Shrubland	Southern California Coastal Scrub	36.5989	88.000000	124.5989	457.2780	41.1550	324.0000	13334.2254	72.0558	185.0541
634	Shrubland	Southern California Coastal Scrub	36.5989	0.0000	36.5989	134.3180	12.0886	187187.0000	2262831.8886	41629.3593	54.3566
635	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	0.000000	73.4281	269.4811	24.2533	437436.0000	10609267.1643	97283.3605	109.0553
636	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	19.000000	92.4281	339.2111	30.5290	645092.0000	19694014.5905	143464.9128	137.2741
637	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	38.000000	111.4281	408.9411	36.8047	1749965.0000	64406939.3380	389182.5912	165.4929
638	Shrubland	Southern California Dry-Mesic Chaparral	73.4281	0.0000	73.4281	269.4811	24.2533	104683.0000	2538908.3536	23280.9234	109.0553
639	Urban	Developed-High Intensity	0.0000	0.000000	0.0000	0.0000	0.0000	30362.0000	0.0000	6752.3418	0.0000
640	Urban	Developed-High Intensity	0.0000	19.000000	19.0000	69.7300	6.2757	17825.0000	111864.3525	3964.1820	28.2188
641	Urban	Developed-High Intensity	0.0000	38.000000	38.0000	139.4600	12.5514	96766.0000	1214548.7724	21520.2262	56.4375
642	Urban	Developed-High Intensity	0.0000	88.000000	88.0000	322.9600	29.0664	506.0000	14707.5984	112.5316	130.6975
643	Urban	Developed-High Intensity	0.0000	0.0000	0.0000	0.0000	0.0000	69.0000	0.0000	15.3452	0.0000
644	Urban	Developed-Low Intensity	7.6584	0.000000	7.6584	28.1065	2.5296	24186.0000	61180.5178	5378.8334	11.3743
645	Urban	Developed-Low Intensity	7.6584	19.000000	26.6584	97.8365	8.8053	68918.0000	606842.5605	15326.9842	39.5931
646	Urban	Developed-Low Intensity	7.6584	38.000000	45.6584	167.5665	15.0810	307997.0000	4644897.8190	68496.8388	67.8119
647	Urban	Developed-Low Intensity	7.6584	88.000000	95.6584	351.0665	31.5960	2531.0000	79969.4354	562.8805	142.0718
648	Urban	Developed-Low Intensity	7.6584	0.0000	7.6584	28.1065	2.5296	1349.0000	3412.4088	300.0102	11.3743
649	Urban	Developed-Medium Intensity	7.6584	0.000000	7.6584	28.1065	2.5296	45421.0000	114896.2334	10101.3806	11.3743
650	Urban	Developed-Medium Intensity	7.6584	19.000000	26.6584	97.8365	8.8053	56611.0000	498475.9307	12589.9750	39.5931
651	Urban	Developed-Medium Intensity	7.6584	38.000000	45.6584	167.5665	15.0810	370521.0000	5587821.2606	82401.8325	67.8119
652	Urban	Developed-Medium Intensity	7.6584	88.000000	95.6584	351.0665	31.5960	1919.0000	60632.6932	426.7750	142.0718
653	Urban	Developed-Medium Intensity	7.6584	0.0000	7.6584	28.1065	2.5296	347.0000	877.7656	77.1709	11.3743
654	Urban	Developed-Roads	0.0000	0.000000	0.0000	0.0000	0.0000	69259.0000	0.0000	15402.8207	0.0000
655	Urban	Developed-Roads	0.0000	19.000000	19.0000	69.7300	6.2757	117014.0000	734344.7598	26023.2700	28.2188
656	Urban	Developed-Roads	0.0000	38.000000	38.0000	139.4600	12.5514	508199.0000	6378608.9286	113020.6625	56.4375
657	Urban	Developed-Roads	0.0000	88.000000	88.0000	322.9600	29.0664	505.0000	14678.5320	112.3092	130.6975

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ROW	Land Cover Clas	Land Cover Type	Non-Soil C 16_TotalMTCha	Soil C 16_SOC_MT_Cha	Non-soil+Soil 16_TOTALC_MCTha	Non-soil_Soil_MTCO2e/ha 16_TOTALC_MTCO2eha	convert to pixels 16_TOTALC_MTCO2e pixel	# of pixels Number of Pixels	Total CO2e 16_TOTALC_MTCO2e	Acres	Total CO2e/acre TOTAL MTCO2e/Acre
658	Urban	Developed-Roads	0.0000	0.0000	0.0000	0.0000	0.0000	15662.0000	0.0000	3483.1427	0.0000
659	Urban	Western Warm Temperate Developed Ruderal Deciduous Forest	62.0000	0.000000	62.0000	227.5400	20.4786	1007.0000	20621.9502	223.9513	92.0823
660	Urban	Western Warm Temperate Developed Ruderal Deciduous Forest	62.0000	19.000000	81.0000	297.2700	26.7543	10104.0000	270325.4472	2247.0740	120.3011
661	Urban	Western Warm Temperate Developed Ruderal Deciduous Forest	62.0000	38.000000	100.0000	367.0000	33.0300	16026.0000	529338.7800	3564.0943	148.5199
662	Urban	Western Warm Temperate Developed Ruderal Evergreen Forest	59.0000	0.000000	59.0000	216.5300	19.4877	21.0000	409.2417	4.6703	87.6267
663	Urban	Western Warm Temperate Developed Ruderal Evergreen Forest	59.0000	19.000000	78.0000	286.2600	25.7634	543.0000	13989.5262	120.7602	115.8455
664	Urban	Western Warm Temperate Developed Ruderal Evergreen Forest	59.0000	38.000000	97.0000	355.9900	32.0391	1174.0000	37613.9034	261.0911	144.0643
665	Urban	Western Warm Temperate Developed Ruderal Grassland	17.7000	0.000000	17.7000	64.9590	5.8463	1510.0000	8827.9281	335.8157	26.2880
666	Urban	Western Warm Temperate Developed Ruderal Grassland	17.7000	19.000000	36.7000	134.6890	12.1220	9163.0000	111073.9776	2037.8008	54.5068
667	Urban	Western Warm Temperate Developed Ruderal Grassland	17.7000	38.000000	55.7000	204.4190	18.3977	83808.0000	1541875.2797	18638.4383	82.7256
668	Urban	Western Warm Temperate Developed Ruderal Grassland	17.7000	88.000000	105.7000	387.9190	34.9127	46.0000	1605.9847	10.2301	156.9855
669	Urban	Western Warm Temperate Developed Ruderal Grassland	17.7000	0.0000	17.7000	64.9590	5.8463	8.0000	46.7705	1.7792	26.2880
670	Urban	Western Warm Temperate Developed Ruderal Herbaceous Wetland	4.8974	0.000000	4.8974	17.9735	1.6176	471.0000	761.8949	104.7478	7.2736
671	Urban	Western Warm Temperate Developed Ruderal Herbaceous Wetland	4.8974	19.000000	23.8974	87.7035	7.8933	939.0000	7411.8192	208.8284	35.4924
672	Urban	Western Warm Temperate Developed Ruderal Herbaceous Wetland	4.8974	38.000000	42.8974	157.4335	14.1690	7357.0000	104241.4155	1636.1563	63.7112
673	Urban	Western Warm Temperate Developed Ruderal Mixed Forest	66.0000	0.000000	66.0000	242.2200	21.7998	593.0000	12927.2814	131.8799	98.0231
674	Urban	Western Warm Temperate Developed Ruderal Mixed Forest	66.0000	19.000000	85.0000	311.9500	28.0755	1925.0000	54045.3375	428.1094	126.2419
675	Urban	Western Warm Temperate Developed Ruderal Mixed Forest	66.0000	38.000000	104.0000	381.6800	34.3512	6170.0000	211946.9040	1372.1741	154.4607
676	Urban	Western Warm Temperate Developed Ruderal Mixed Forested Wetland	66.0000	0.000000	66.0000	242.2200	21.7998	738.0000	16088.2524	164.1271	98.0231
677	Urban	Western Warm Temperate Developed Ruderal Mixed Forested Wetland	66.0000	19.000000	85.0000	311.9500	28.0755	682.0000	19147.4910	151.6730	126.2419
678	Urban	Western Warm Temperate Developed Ruderal Mixed Forested Wetland	66.0000	38.000000	104.0000	381.6800	34.3512	2442.0000	83885.6304	543.0874	154.4607
679	Urban	Western Warm Temperate Developed Ruderal Mixed Forested Wetland	66.0000	88.000000	154.0000	565.1800	50.8662	25.0000	1271.6550	5.5599	228.7206
680	Urban	Western Warm Temperate Developed Ruderal Mixed Forested Wetland	66.0000	0.0000	66.0000	242.2200	21.7998	5.0000	108.9990	1.1120	98.0231
681	Urban	Western Warm Temperate Developed Ruderal Shrub Wetland	7.4000	0.000000	7.4000	27.1580	2.4442	665.0000	1625.4063	147.8923	10.9905
682	Urban	Western Warm Temperate Developed Ruderal Shrub Wetland	7.4000	19.000000	26.4000	96.8880	8.7199	1385.0000	12077.0892	308.0164	39.2092
683	Urban	Western Warm Temperate Developed Ruderal Shrub Wetland	7.4000	38.000000	45.4000	166.6180	14.9956	2427.0000	36394.3697	539.7515	67.4280
684	Urban	Western Warm Temperate Developed Ruderal Shrub Wetland	7.4000	88.000000	95.4000	350.1180	31.5106	16.0000	504.1699	3.5583	141.6879
685	Urban	Western Warm Temperate Developed Ruderal Shrub Wetland	7.4000	0.0000	7.4000	27.1580	2.4442	1.0000	2.4442	0.2224	10.9905
686	Urban	Western Warm Temperate Developed Ruderal Shrubland	7.4000	0.000000	7.4000	27.1580	2.4442	10238.0000	25023.9244	2276.8749	10.9905
687	Urban	Western Warm Temperate Developed Ruderal Shrubland	7.4000	19.000000	26.4000	96.8880	8.7199	90922.0000	792832.5662	20220.5527	39.2092
688	Urban	Western Warm Temperate Developed Ruderal Shrubland	7.4000	38.000000	45.4000	166.6180	14.9956	180072.0000	2700291.2846	40047.0224	67.4280
689	Urban	Western Warm Temperate Developed Ruderal Shrubland	7.4000	88.000000	95.4000	350.1180	31.5106	22.0000	693.2336	4.8927	141.6879
690	Urban	Western Warm Temperate Developed Ruderal Shrubland	7.4000	0.0000	7.4000	27.1580	2.4442	784.0000	1916.2685	174.3573	10.9905
691	Urban	Western Warm Temperate Urban Deciduous Forest	0.0000	0.000000	0.0000	0.0000	0.0000	1640.0000	0.0000	364.7270	0.0000
692	Urban	Western Warm Temperate Urban Deciduous Forest	0.0000	19.000000	19.0000	69.7300	6.2757	2687.0000	16862.8059	597.5740	28.2188
693	Urban	Western Warm Temperate Urban Deciduous Forest	0.0000	38.000000	38.0000	139.4600	12.5514	8101.0000	101678.8914	1801.6178	56.4375
694	Urban	Western Warm Temperate Urban Deciduous Forest	0.0000	88.000000	88.0000	322.9600	29.0664	61.0000	1773.0504	13.5661	130.6975
695	Urban	Western Warm Temperate Urban Deciduous Forest	0.0000	0.0000	0.0000	0.0000	0.0000	90.0000	0.0000	20.0155	0.0000
696	Urban	Western Warm Temperate Urban Evergreen Forest	0.0000	0.000000	0.0000	0.0000	0.0000	4473.0000	0.0000	994.7706	0.0000
697	Urban	Western Warm Temperate Urban Evergreen Forest	0.0000	19.000000	19.0000	69.7300	6.2757	10253.0000	64344.7521	2280.2108	28.2188
698	Urban	Western Warm Temperate Urban Evergreen Forest	0.0000	38.000000	38.0000	139.4600	12.5514	30917.0000	388051.6338	6875.7708	56.4375
699	Urban	Western Warm Temperate Urban Evergreen Forest	0.0000	88.000000	88.0000	322.9600	29.0664	209.0000	6074.8776	46.4805	130.6975
700	Urban	Western Warm Temperate Urban Evergreen Forest	0.0000	0.0000	0.0000	0.0000	0.0000	93.0000	0.0000	20.6827	0.0000
701	Urban	Western Warm Temperate Urban Herbaceous	5.0000	0.000000	5.0000	18.3500	1.6515	10480.0000	17307.7200	2330.6944	7.4260
702	Urban	Western Warm Temperate Urban Herbaceous	5.0000	19.000000	24.0000	88.0800	7.9272	28717.0000	227645.4024	6386.5029	35.6448
703	Urban	Western Warm Temperate Urban Herbaceous	5.0000	38.000000	43.0000	157.8100	14.2029	110191.0000	1565031.7539	24505.8723	63.8635
704	Urban	Western Warm Temperate Urban Herbaceous	5.0000	88.000000	93.0000	341.3100	30.7179	591.0000	18154.2789	131.4351	138.1235
705	Urban	Western Warm Temperate Urban Herbaceous	5.0000	0.0000	5.0000	18.3500	1.6515	2377.0000	3925.6155	528.6317	7.4260
706	Urban	Western Warm Temperate Urban Mixed Forest	0.0000	0.000000	0.0000	0.0000	0.0000	3556.0000	0.0000	790.8348	0.0000
707	Urban	Western Warm Temperate Urban Mixed Forest	0.0000	19.000000	19.0000	69.7300	6.2757	6208.0000	38959.5456	1380.6251	28.2188
708	Urban	Western Warm Temperate Urban Mixed Forest	0.0000	38.000000	38.0000	139.4600	12.5514	16170.0000	202956.1380	3596.1191	56.4375
709	Urban	Western Warm Temperate Urban Mixed Forest	0.0000	88.000000	88.0000	322.9600	29.0664	53.0000	1540.5192	11.7869	130.6975
710	Urban	Western Warm Temperate Urban Mixed Forest	0.0000	0.0000	0.0000	0.0000	0.0000	52.0000	0.0000	11.5645	0.0000
711	Urban	Western Warm Temperate Urban Shrubland	7.4000	0.000000	7.4000	27.1580	2.4442	17351.0000	42409.6612	3858.7670	10.9905
712	Urban	Western Warm Temperate Urban Shrubland	7.4000	19.000000	26.4000	96.8880	8.7199	61369.0000	535132.7705	13648.1281	39.2092
713	Urban	Western Warm Temperate Urban Shrubland	7.4000	38.000000	45.4000	166.6180	14.9956	203572.0000	3052688.3546	45273.2932	67.4280
714	Urban	Western Warm Temperate Urban Shrubland	7.4000	88.000000	95.4000	350.1180	31.5106	878.0000	27666.3244	195.2624	141.6879
715	Urban	Western Warm Temperate Urban Shrubland	7.4000	0.0000	7.4000	27.1580	2.4442	2468.0000	6032.3350	548.8696	10.9905
716	Vineyard	Grapes	6.4400	0.000000	6.4400	23.6348	2.1271	53.0000	112.7380	11.7869	9.5647
717	Vineyard	Grapes	6.4400	19.000000	25.4400	93.3648	8.4028	679.0000	5705.5229	151.0059	37.7835
718	Vineyard	Grapes	6.4400	38.000000	44.4400	163.0948	14.6785	2208.0000	32410.1987	491.0471	66.0022
719	Vineyard	Western Warm Temperate Vineyard	4.0050	0.000000	4.0050	14.6984	1.3229	36.0000	47.6229	8.0062	5.9482
720	Vineyard	Western Warm Temperate Vineyard	4.0050	19.000000	23.0050	84.4284	7.5986	315.0000	2393.5456	70.0543	34.1670
721	Vineyard	Western Warm Temperate Vineyard	4.0050	38.000000	42.0050	154.1584	13.8743	665.0000	9226.3812	147.8923	62.3858
722	Water	Open Water	0.0000	0.000000	0.0000	0.0000	0.0000	92954.0000	0.0000	20672.4584	0.0000
723	Water	Open Water	0.0000	19.000000	19.0000	69.7300	6.2757	2960.0000	18576.0720	658.2877	28.2188
724	Water	Open Water	0.0000	38.000000	38.0000	139.4600	12.5514	1989.0000	24964.7346	442.3427	56.4375
725	Water	Open Water	0.0000	88.000000	88.0000	322.9600	29.0664	1211.0000	35199.4104	269.3197	130.6975
726	Water	Open Water	0.0000	0.0000	0.0000	0.0000	0.0000	6051.0000	0.0000	1345.7091	0.0000
727	Wetland	North American Warm Desert Cienega	51.8470	0.000000	51.8470	190.2786	17.1251	127.0000	2174.8847	28.2441	77.0031
728	Wetland	North American Warm Desert Cienega	51.8470	19.000000	70.8470	260.0086	23.4008	510.0000	11934.3958	113.4212	105.2219
729	Wetland	North American Warm Desert Cienega	51.8470	38.000000	89.8470	329.7386	29.6765	49.0000	1454.1473	10.8973	133.4407
730	Wetland	North American Warm Desert Cienega	51.8470	0.0000	51.8470	190.2786	17.1251	8.0000	137.0006	1.7792	77.0031

SANDAG Carbon Inventory - 2016			Non-Soil C	Soil C	Non-soil+Soil	Non-soil_Soil_MTCO2e/ha	convert to pixels	# of pixels	Total CO2e		Total CO2e/acre
ROW	**Land Cover Clas**	**Land Cover Type**	**16_TotalMTCha**	**16_SOC_MT_Cha**	**16_TOTALC_MCTha**	**16_TOTALC_MTCO2eha**	**16_TOTALC_MTCO2e pixel**	**Number of Pixels**	**16_TOTALC_MTCO2e**	**Acres**	**TOTAL MTCO2e/Acre**
731	Wetland	Temperate Pacific Freshwater Emergent Marsh	4.8974	0.000000	4.8974	17.9735	1.6176	3474.0000	5619.5814	772.5985	7.2736
732	Wetland	Temperate Pacific Freshwater Emergent Marsh	4.8974	19.000000	23.8974	87.7035	7.8933	1615.0000	12747.6976	359.1671	35.4924
733	Wetland	Temperate Pacific Freshwater Emergent Marsh	4.8974	38.000000	42.8974	157.4335	14.1690	7333.0000	103901.3593	1630.8189	63.7112
734	Wetland	Temperate Pacific Freshwater Emergent Marsh	4.8974	88.000000	92.8974	340.9335	30.6840	1.0000	30.6840	0.2224	137.9711
735	Wetland	Temperate Pacific Freshwater Emergent Marsh	4.8974	0.0000	4.8974	17.9735	1.6176	1.0000	1.6176	0.2224	7.2736
736	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	6.1476	0.000000	6.1476	22.5617	2.0306	1087.0000	2207.2103	241.7428	9.1304
737	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	6.1476	19.000000	25.1476	92.2917	8.3063	530.0000	4402.3137	117.8691	37.3492
738	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	6.1476	38.000000	44.1476	162.0217	14.5820	7076.0000	103181.8943	1573.6635	65.5680
739	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	6.9654	0.000000	6.9654	25.5630	2.3007	424.0000	975.4848	94.2953	10.3450
740	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	6.9654	19.000000	25.9654	95.2930	8.5764	498.0000	4271.0331	110.7525	38.5638
741	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	6.9654	38.000000	44.9654	165.0230	14.8521	4130.0000	61339.0558	918.4893	66.7825
742	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	7.2850	0.000000	7.2850	26.7360	2.4062	28.0000	67.3746	6.2270	10.8197
743	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	7.2850	19.000000	26.2850	96.4660	8.6819	12.0000	104.1832	2.6687	39.0384
744	Wetland	Temperate Pacific Subalpine-Montane Wet Meadow	7.2850	38.000000	45.2850	166.1960	14.9576	204.0000	3051.3576	45.3685	67.2572
745	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.1476	0.000000	6.1476	22.5617	2.0306	1449.0000	2942.2703	322.2496	9.1304
746	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.1476	19.000000	25.1476	92.2917	8.3063	777.0000	6453.9580	172.8005	37.3492
747	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.1476	38.000000	44.1476	162.0217	14.5820	3159.0000	46064.3873	702.5442	65.5680
748	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.1476	88.000000	94.1476	345.5217	31.0970	2862.0000	88999.4774	636.4931	139.8279
749	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.1476	0.0000	6.1476	22.5617	2.0306	76.0000	154.3220	16.9020	9.1304
750	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.9654	0.000000	6.9654	25.5630	2.3007	149.0000	342.8001	33.1368	10.3450
751	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.9654	19.000000	25.9654	95.2930	8.5764	265.0000	2272.7385	58.9345	38.5638
752	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.9654	38.000000	44.9654	165.0230	14.8521	475.0000	7054.7340	105.6374	66.7825
753	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.9654	88.000000	94.9654	348.5230	31.3671	179.0000	5614.7058	39.8086	141.0425
754	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	6.9654	0.0000	6.9654	25.5630	2.3007	19.0000	43.7128	4.2255	10.3450
755	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	7.2850	0.000000	7.2850	26.7360	2.4062	205.0000	493.2783	45.5909	10.8197
756	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	7.2850	19.000000	26.2850	96.4660	8.6819	89.0000	772.6923	19.7931	39.0384
757	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	7.2850	38.000000	45.2850	166.1960	14.9576	145.0000	2168.8571	32.2472	67.2572
758	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	7.2850	88.000000	95.2850	349.6960	31.4726	253.0000	7962.5768	56.2658	141.5171
759	Wetland	Temperate Pacific Tidal Salt and Brackish Marsh	7.2850	0.0000	7.2850	26.7360	2.4062	8.0000	19.2499	1.7792	10.8197
760	Wetland	Western North American Ruderal Wet Meadow & Marsh	5.0000	0.000000	5.0000	18.3500	1.6515	13147.0000	21712.2705	2923.8205	7.4260
761	Wetland	Western North American Ruderal Wet Meadow & Marsh	5.0000	19.000000	24.0000	88.0800	7.9272	6839.0000	54214.1208	1520.9560	35.6448
762	Wetland	Western North American Ruderal Wet Meadow & Marsh	5.0000	38.000000	43.0000	157.8100	14.2029	31968.0000	454038.3072	7109.5074	63.8635
763	Wetland	Western North American Ruderal Wet Meadow & Marsh	5.0000	88.000000	93.0000	341.3100	30.7179	3.0000	92.1537	0.6672	138.1235
764	Wetland	Western North American Ruderal Wet Meadow & Marsh	5.0000	0.0000	5.0000	18.3500	1.6515	203.0000	335.2545	45.1461	7.4260
765	Wetland	Western North American Ruderal Wet Shrubland	7.4000	0.000000	7.4000	27.1580	2.4442	5061.0000	12370.1974	1125.5386	10.9905
766	Wetland	Western North American Ruderal Wet Shrubland	7.4000	19.000000	26.4000	96.8880	8.7199	3386.0000	29525.6491	753.0278	39.2092
767	Wetland	Western North American Ruderal Wet Shrubland	7.4000	38.000000	45.4000	166.6180	14.9956	6384.0000	95732.0381	1419.7665	67.4280
768	Wetland	Western North American Ruderal Wet Shrubland	7.4000	88.000000	95.4000	350.1180	31.5106	1480.0000	46635.7176	329.1439	141.6879
769	Wetland	Western North American Ruderal Wet Shrubland	7.4000	0.0000	7.4000	27.1580	2.4442	10.0000	24.4422	2.2239	10.9905
	Total							12,262,515	238,500,087	2,727,116	

County of Riverside

Climate Action Plan

UPDATE

RIVERSIDE COUNTY
PLANNING DEPARTMENT

November 2019

County of Riverside | Transportation and Land Management Agency | Planning Department
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- Southern California Gas Company, Cynthia Fox
- Southern California Gas Company, Ana Aceves

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ACRONYMS

°C	degrees Celsius
°F	degrees Fahrenheit
AB 32	Assembly Bill 32, The California Global Warming Solutions Act of 2006
ABAU	Adjusted Business-As-Usual
AEP	Association of Environmental Professionals
Anza	Anza Electric Cooperative, Inc.
ARRA	American Recovery & Reinvestment Act
BAU	Business- As- Usual
BTU	British Thermal Unit
C_2F_6	hexafluoroethane
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal EPA	California Environmental Protection Agency
CalGreen	California's Green Building Standard Code
Cal Recycle	California Department of Resources Recycling and Recovery
CAP	Climate Action Plan
CAP Update	Riverside County Climate Action Plan Update
CARB	California Air Resources Board
CAS	California Climate Adaption Strategy
CCA	Community Choice Aggregation
CCAR	California Climate Action Registry
CCAT	California Climate Action Team
CCR	California Code of Regulations
CCTP	Climate Change Technology Program
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CF_4	carbon tetrafluoride
CFC	chlorofluorocarbons
CH_4	methane
CIWMB	California Integrated Waste Management Board
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
County	County of Riverside
CSI	California Solar Initiative
CTC	California Transportation Commission

CWSRF	Clean Water State Revolving Funds
DPM	diesel particulate matter
EECBG	Energy Efficiency Community Block Grant
eGRID	Emissions and Generation Resource Integrated Database
EMFAC2007	On-Road Emission Factors (published by CARB in 2007)
EO	Executive Order
EVs	all-electric vehicles
GCC	Global Climate Change
GHG	Greenhouse Gas
GMS	Grants Management System
GWh	gigawatt hours
GWP	Global Warming Potential
HFC	hydrofluorocarbons
HFC-134	hydrofluorocarbon 134
HFC-152a	difluoroethane
HFC-23	trifluoromethane
HERO	Home Energy Renovation Opportunity
I-10	Interstate 10
I-15	Interstate 15
I-215	Interstate 215
ICLEI	International Council of Local Environmental Initiatives
IFT	Inventory, Forecasting, and Target-Setting
IID	Imperial Irrigation District
IIP	Interregional Improvement Program
IM	Implementation Measures
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transportation Systems
LCFS	low carbon fuel standard
LEED	Leadership in Energy and Environmental Design
LEV	low-emission vehicle
LGOP	Local Government Operations Protocol
MBTU	million British Thermal Units
MMT	million metric tons
mpg	miles per gallon
MT	metric tons
MWh	megawatt hours
N_2O	nitrous oxide

NSHP	New Solar Home Program
O_3	ozone
PACE	Property Assessed Clean Energy
PFCs	perfluorocarbons
ppb	parts per billion
ppm	parts per million
RCTC	Riverside County Transportation Commission
RIP	Regional Improvement Program
RIVTAM	Riverside County Traffic Analysis Model
RPS	Renewable Portfolio Standard
RTIP	Regional Transportation Improvement Program
RTPs	Regional Transportation Plans
SB	Senate Bill
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCS	Sustainable Communities Strategy
SoCalGas	Southern California Gas Company
SF_6	sulfur hexafluoride
SIP	State Implementation Plan
STIP	State Transportation Improvement Plan
TLMA	Transportation Land Management Agency
URBEMIS 2007	Urban Emissions Model, Version 9.2 (published in June 2007)
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
VOCs	volatile organic compounds
WRCOG	Western Riverside Council of Governments
ZEVs	zero-emission vehicles

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Executive Summary

Riverside County (County) is committed to planning sustainably for the future while ensuring a livable, equitable, and economically vibrant community. Planning sustainably includes acknowledging the local role in climate change and the ways in which the County can mitigate the greenhouse gas (GHG) emissions resulting from the County's growth and development in different economic sectors. By using energy more efficiently, harnessing renewable energy to power buildings, recycling waste, and enhancing access to sustainable transportation modes, Riverside County can keep dollars in its local economy, create new green jobs, and improve the community's health, safety, and welfare in addition to addressing climate change. To that end, Riverside County has implemented a number of sustainability and conservation efforts and seeks to continue those efforts through local planning and partnerships. This Riverside County Climate Action Plan (CAP) Update (CAP Update) integrates the County's past and current efforts with its future efforts to grow and thrive sustainably.

Following the State's adoption of Assembly Bill (AB) 32in 2006,[1] the California Air Resources Board (ARB) developed a climate change scoping plan that included directives for local governments to reduce GHG emissions associated with land use 15 percent below baseline levels by 2020. The County adopted its first Climate Action Plan (CAP) in 2015 that included GHG inventories of community-wide and municipal sources using the baseline data for the year 2008. The 2015 CAP included the GHG reduction target of 15 percent below 2008 levels by 2020. The inventory baseline year 2008, was established as a starting point against which other inventories may be compared and targets may be set, and was the earliest year with a full emissions inventory. As recommended in the AB 32 Scoping Plan, the County had set a target to reduce emissions back to 1990 levels by the year 2020. Based on the County's socio-economic growth projections per the 2015 General Plan Update, this target was calculated as a 15 percent decrease from 2008 levels by 2020 and was determined sufficient for the County to meet the AB 32 target. The most recent inventory has the most relevant data for planning purposes, whereas multiple inventory years provide context and may help identify trends or anomalies in the community emissions.

In 2016 the Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society, and respondents challenged particular aspects of the CAP related to commitments to solar, electric vehicles (EV), energy efficient traffic signals, and future updates of the CAP. In 2017 the County and the Petitioners entered into a Settlement

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1 The passage of AB 32, the California Global Warming Solutions Act of 2006, marked a watershed moment in California's history. By requiring in law a sharp reduction of greenhouse gas (GHG) emissions, California set the stage for its transition to a sustainable, low-carbon future. AB 32 is the first program in the country to take a comprehensive, long-term approach to addressing climate change, and does so in a way that aims to improve the environment and natural resources while maintaining a robust economy (website: https://www.arb.ca.gov/cc/ab32/ab32.htm).

Agreement[2] with commitments to solar, EV chargers, LED traffic signals and periodic updates that enhances the CAP goals and maintains the County's Land Use authority.

Since the 2015 CAP adoption and 2017 Settlement Agreement, new legislation and several policies have been proposed, such as Executive Order (EO) B-30-15[3] and SB 32[4] that extended the goals of AB 32 and set a 2030 goal of reducing emissions to 40 percent below 1990 levels by 2030. Further, the emissions reduction target of 40 percent below 1990 levels by 2030 is an interim-year goal to make it possible to reach the ultimate goal of reducing emissions 80 percent below 1990 levels by 2050. This action keeps California on target to achieve the level of reductions scientists say is necessary to meet the Paris Agreement goals[5]. The ARB was directed to develop a climate change scoping plan update that would provide the regulations and policies to achieve the 2030 reduction target. On December 14, 2017, the ARB finalized California's 2017 Climate Change Scoping Plan, providing quantitative summaries of the regulation needed to achieve the 2030 reduction target. This CAP Update re-evaluates the County's GHG reduction targets and existing reduction strategies. The new goals and supporting measures are proposed to reflect and ensure compliance with changes in the local and State policies and regulations such as SB 32 and California's 2017 Climate Change Scoping Plan. The GHG inventories, based on the most recent data available for the year 2017, are calculated, and the future growth in emissions for the Business-As-Usual (BAU) and Adjusted BAU (ABAU) scenarios (the ABAU scenario takes into account the State policies) for the years 2020, 2030, and 2050 are projected. Sources of emissions include on-road and off-road transportation, agriculture, electricity and natural gas use, landscaping, water and wastewater pumping and treatment, and treatment and decomposition of solid waste.

Per the CAP Update, Riverside County's 2017 GHG emissions totaled 4,905,518 metric tons (MT) of carbon dioxide equivalent (CO_2e) for that year. Under the BAU forecast, emissions will be 5,158,305 MT CO_2e in 2020; 6,368,781 MT CO_2e in 2030; and 11,305,026 MT CO_2e in 2050. These emissions levels are 5.1 percent higher in 2020 than 2017, 29.8 percent higher in 2030 than 2017, and more than double 2017 emissions by 2050. Under the ABAU forecast (which represents State efforts in reducing GHG emissions within the County), emissions will be 4,861,256 MT CO_2e in 2020; 4,102,109 MT CO_2e in 2030; and 4,175,146 MT CO_2e in 2050. Compared to 2017, these emissions levels are 0.9 percent lower in 2020, 16.0 percent lower in 2030, and 14.8 percent lower in 2050. This CAP Update assesses the previous GHG reduction targets identified in the 2015 CAP and proposes new targets that are consistent with the State policies in order to meet the requirements of SB 32. The State recommends a 15 percent reduction below 2005–2008 baseline levels[6] by 2020, a 49 percent reduction below 2008 levels by 2030, and an 80 percent reduction below 2008 levels by 2050.[7] To continue reductions consistent with the State's long-term emissions reduction goals, the County would need to reduce emissions in 2030 by

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2 Partial Settlement Agreement, 2017. Petitioners: Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society and Respondents: County of Riverside and Riverside County Board of Supervisors.

3 On April 29, 2015, California Governor Jerry Brown announced through EO B-30-15 that by 2030, California shall reduce GHG emissions to 40 percent below 1990 levels. The emissions reduction target of 40 percent below 1990 levels by 2030 is an interim-year goal to make it possible to reach the ultimate goal of reducing emissions 80 percent under 1990 levels by 2050 (website: https://www.climatechange.ca.gov/state/executive_orders.html).

4 Senate Bill 32 was signed by Sen. Jerry Brown on September 8, 2016 and requires that there be a reduction in GHG emissions to 40% below the 1990 levels by 2030.

5 California's 2017 Climate Change Scoping Plan Executive Summary. California Air Resources Board (website: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017_es.pdf).

6 For Riverside County, the baseline year was identified as 2008 per the 2015 Climate Action Plan.

7 State goals are to achieve 1990 levels of emissions by 2020 (15 percent below 2008 baseline levels), 40 percent below 1990 levels of emissions by 2030 (49 percent below 2008 baseline levels) and 80 percent below 1990 levels of emissions by 2050 (83 percent below 2008 baseline levels).

525,511 MT CO_2e from an ABAU forecast and by 2,982,947 MT CO_2e from an ABAU forecast by 2050. Table ES-1 (2017 and 2020 GHG Emissions Comparison), below, summarizes the community-wide emissions for 2017 and 2020, and the reduced, ABAU 2020 inventory.

The CAP Update summarizes various State and local policies that will contribute to reduced GHG emissions in Riverside County by the year 2020 and beyond. Some of these policies include updated building codes for energy efficiency, the low carbon fuel standard, Pavley (California Assembly Bill) vehicle emissions standards, and the Renewable Portfolio Standards for utility companies. By supporting the State in the implementation of these measures, Riverside County will experience substantial GHG emissions reductions. In order to reach the reduction target, the County of Riverside would also need to implement the additional local reduction measures described in this report. These measures encourage energy efficiency and renewable energy, development and penetration of zero-emission vehicles (ZEVs), water conservation, and increased waste diversion. In addition to local government, efforts at the local business and community level would be required to achieve these targets. Public education and outreach would play a crucial role in educating stakeholders about the importance of implementing these measures.

It is important to note that the post 2030 reduction targets identified in this CAP Update may need adjustments based on State updates and guidance when the State sets new reduction goals. As 2030 approaches, Riverside County would have implemented the first two phases of this CAP Update and would have a better understanding of the effectiveness and efficiency of the reduction strategies toward achieving the current 2050 GHG reduction target and may need to make adjustments. Furthermore, the federal, State, and local (County level) programs and policies for GHG reductions in the near term (2020-2030) are likely to be well underway; and continuing technological change in the fields of energy efficiency, alternative energy generation, vehicles, fuels, methane capture, and other areas will occur. Riverside County will then be able to take the local, regional, State, and federal context into account and may consider updating the GHG reduction targets for the period between 2030 and 2050.

Table ES-1 2017 and 2020 GHG Emissions Comparison

Source Category	Metric Tons of CO_2e			
	2017	2020 BAU	Reduced 2020 (ABAU)	% Change (2017-2020 ABAU)
Transportation (on-road)	1,766,784	1,999,268	1,835,938	3.9
Agriculture	1,670,954	1,565,873	1,565,873	-6.2
Electricity	712,928	774,289	653,541	-8.3
Natural Gas	475,211	515,845	510,268	7.3
Solid Waste	204,365	223,448	223,448	9.3
Water and Waster	44,606	48,771	41,377	-7.2
Aviation	26,786	26,786	26,786	0
Off-Road Sources	3,883	4,024	4,024	3.6
Total	4,905,518	5,158,305	4,861,256	-0.9
Emissions Reduction Target[1]	-	15% below 2008 levels	5,960,997 (Target met)	-

Note: Mass emissions of CO_2e shown in the table are rounded to the nearest whole number. Totals shown may not add up due to rounding.

1 The reduction target for 2020 is based on a 15% decrease from Riverside County's 2008 emissions inventory.

BAU = Business-As-Usual

ABAU = Adjusted Business-As-Usual

CO_2e = carbon dioxide equivalent

GHG = greenhouse gas

Table ES-2 (Projected 2030 and 2050 GHG Emissions Comparison) summarizes the 2030 and 2050 emissions for Riverside County based on the anticipated growth rates included in Riverside County's General Plan update. The reductions needed to meet the County's 2030 and 2050 goals are also summarized. After 2020, GHG emissions would continue to increase; however, the growth in Riverside County's future emissions would be offset by the reductions from incorporation of the State and local policies identified in this CAP Update. The additional, reduction measures included in the CAP Update have been developed to meet the reduction targets for the year 2020 and beyond; however, the implementation of the CAP Update would require periodic updates to ensure that Riverside County is continually tracking GHG emissions and making adjustments as necessary to ensure that future targets are met. It is important to note that post 2030, the amount of reductions needed to meet the 2050 targets would be 73 percent below BAU. The proposed State and local measures that will continue beyond 2030 are expected to yield significant reductions. However, as discussed above, the policy and regulatory landscape beyond 2030 (for example, Senate Bill 100[8], which requires 100 percent renewables by 2045) and technological innovations will require a re-consideration of the future GHG reduction targets.

Table ES-2 Projected 2030 and 2050 GHG Emissions Comparison

Source Category	Metric Tons of CO_2e						
	2017	2030 BAU	2030 ABAU	% Change (2017-2030 ABAU)	2050 BAU	2050 ABAU	% Change (2017-2050 ABAU)
Transportation (on-road)	1,766,784	3,018,767	1,361,200	-22.9	6,882,509	1,174,310	-33.5
Agriculture	1,670,954	1,262,044	1,261,044	-24.5	817,858	817,858	-51.0
Electricity	712,928	1,017,153	466,971	-34.5	1,756,843	480,289	-32.6
Natural Gas	475,211	676,742	652,578	37.3	1,165,761	1,104,421	132.0
Solid Waste	204,365	298,585	298,585	46.1	533,154	533,154	160.8
Water and Waste Water	44,606	65,171	30,413	-31.8	116,370	32,584	-26.9
Aviation	26,786	26,786	26,786	0.0	26,786	26,786	0.0
Off-Road Sources	3,883	4,531	4,531	16.6	5,744	5,744	47.9
Total	4,905,518	6,368,781	4,102,109	-16.3	11,305,026	4,175,146	-14.8
Reduction Target[1]	-	49% below 2008 levels	525,511 (Reductions needed)	-	83% below 2008 levels	2,982,947 (Reductions needed)	-

Note: Mass emissions of CO_2e shown in the table are rounded to the nearest whole number. Totals shown may not add up due to rounding.
1 The reduction targets for 2030 and 2050 are based on 49% and 83% decreases from Riverside County's 2008 emissions inventory, respectively.
BAU = Business-as-Usual
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas

This CAP Update describes Riverside County's GHG emissions for the year 2017, projects how these emissions will increase into 2020, 2030, and 2050, and includes strategies to reduce emissions to a level consistent with the State of California's emissions reduction targets. These strategies complement Riverside County's General Plan policies and are consistent with Riverside County's vision for a more sustainable community.

8 SB 100 California Renewables Portfolio Standard Program (website: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100, accessed February 2019).

Chapter 1 Introduction

The County of Riverside (County) is committed to planning sustainably for the future while ensuring a livable, equitable, and economically vibrant community. Planning sustainably includes acknowledging the local role in climate change and the ways in which the County can mitigate the greenhouse gas (GHG) emissions resulting from the County's growth and development in different economic sectors. By using energy more efficiently, harnessing renewable energy to power buildings, recycling waste, and enhancing access to sustainable transportation modes, the County can keep dollars in its local economy, create new green jobs, and improve the community's health, safety, and welfare in addition to addressing climate change. To that end, the County has implemented a number of sustainability and conservation efforts and seeks to continue those efforts through local planning and partnerships. This Riverside County Climate Action Plan (CAP) Update (CAP Update) integrates the County's past and current efforts with future efforts to grow and thrive sustainably.

1.1 Purpose

The County of Riverside CAP Update has three primary purposes:

- Present the County's Updated GHG inventory, forecasts, and target setting for achieving sustainability by utilizing resources effectively, reducing GHG emissions, and preparing for potential climate-related impacts.
- Identify how the County will effectively implement this CAP Update to comply with the State and local GHG reduction policies by promoting economic competiveness, obtaining funding for program implementation, and tracking and monitoring the progress of Plan implementation over time.
- Allow streamlined California Environmental Quality Act (CEQA) compliance for new development by completing CEQA compliance for the CAP Update and developing screening tools that provide clear guidance to developers and other project proponents.

1.2 Climate Change Science

Climate change is a term used to describe large-scale shifts in historically observed patterns in the Earth's climate system. Although the climate has historically responded to natural drivers, recent climate change has been unequivocally linked to increasing concentrations of greenhouse gases (GHGs) in the Earth's atmosphere.

Gases that trap heat in the atmosphere are called "greenhouse gases" because they transform the light of the sun into heat, similar to the glass walls of a greenhouse. Human-generated GHG emissions significantly contribute to the changes in the global climate, which have a number of physical and environmental effects. Effects associated with global climate change include sea level rise, an increase in the frequency and intensity of droughts, and increased temperatures. Increased GHG emissions are largely the result of increasing energy consumption, particularly through the combustion of fossil fuels.

The Intergovernmental Panel on Climate Change (IPCC) assesses scientific, technical, and socioeconomic information relevant to the understanding of climate change, its potential impacts, and options for adaptation and mitigation. The IPCC identifies six key GHG compounds: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and hydrofluorocarbons (HFCs). Each GHG has a different capacity to trap heat and therefore GHG emissions are generally reported in metric tons (MT) of carbon dioxide equivalents (CO_2e). Non-CO_2 emissions are converted to CO_2e using each GHG's Global Warming Potential (GWP). IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2e, which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). Common GHGs included in the CAP Update are CO_2, CH_4, and N_2O, which are the GHGs that most commonly result from human activities, and are detailed below.[9]

- **Carbon Dioxide** is the most important anthropogenic GHG and accounts for more than 75 percent of all GHG emissions caused by humans. Its atmospheric lifetime of 50–200 years ensures that atmospheric concentrations of CO_2 will remain elevated for decades, even after mitigation efforts to reduce GHG concentrations are implemented. The primary sources of anthropogenic CO_2 in the atmosphere include the burning of fossil fuels (including motor vehicles), gas flaring, cement production, and land use changes (e.g., deforestation and oxidation of elemental carbon). CO_2 can be removed from the atmosphere by photosynthetic organisms (e.g., plants and certain bacteria). Atmospheric CO_2 has increased from a pre-industrial concentration of 280 parts per million (ppm) to 408 ppm in 2018.[10]
- **Methane (CH_4)**, the main component of natural gas, is the second most abundant GHG, and has a GWP of 25. Sources of anthropogenic emissions of CH_4 include using natural gas, burning fossil fuels, landfill outgassing, certain agricultural practices, and mining coal. Certain land uses also function as both sources and sinks for CH_4. For example, the primary terrestrial source of CH_4 is wetlands, whereas undisturbed, aerobic soils act as a CH_4 sink (i.e., they remove CH_4 from the atmosphere). Atmospheric CH_4 has increased from a pre-industrial concentration of 715 parts per billion (ppb) to 1,860 ppb in 2018.[11]
- **Nitrous Oxide (N_2O)** is a powerful GHG, with a GWP of 298. Anthropogenic sources of N_2O include combustion of fossil fuels, agricultural processes (e.g., fertilizer application), and nylon production. In the United States, more than 70 percent of N_2O emissions are related to agricultural soil management practices, particularly fertilizer applications. N_2O concentrations in the atmosphere have increased nearly 21 percent, from pre-industrial levels of 270 ppb to 330 ppb in 2018.[12]

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9 Intergovernmental Panel on Climate Change (IPCC). Website: https://www.ipcc.ch/ (accessed November 15, 2018).

10 National Oceanographic and Atmospheric Administration (NOAA). Earth System Research Laboratory, Global Monitoring Division. Trends in Atmospheric Carbon Dioxide. Annual Greenhouse Gas Index (AGGI). Website: https://www.esrl.noaa.gov/gmd/ccgg/trends/ (accessed December 26, 2018).

11 NOAA. Earth System Research Laboratory, Global Monitoring Division. Trends in Atmospheric Methane. Annual Greenhouse Gas Index (AGGI). Website: https://www.esrl.noaa.gov/gmd/ccgg/trends_ch4/ (accessed December 26, 2018).

12 NOAA. Earth System Research Laboratory, Global Monitoring Division. Annual Greenhouse Gas Index (AGGI). Website: https://www.esrl.noaa.gov/gmd/aggi/aggi.fig2.png (accessed December 26, 2018).

1.3 Benefits of the CAP Update

This CAP Update, while addressing climate change, also benefits the County in many direct ways:

- **Local Control**: This CAP Update allows the County to identify strategies to reduce resource consumption, costs, and GHG emissions in all economic sectors in a way that maintains local control over the issues and fits the character of the community. It also may position the County for funding to implement programs tied to climate goals.
- **Energy and Resource Efficiency**: This CAP Update identifies opportunities for the County to increase energy efficiency and lower GHG emissions in a manner that is most feasible in the community. Reducing energy consumption through increasing the efficiency of energy technologies, reducing energy use, and using alternative sustainable sources of energy are effective ways to reduce GHG emissions. Energy efficiency also provides opportunities for cost savings.
- **Increased Public Health**: Many of the GHG reduction strategies identified in this CAP Update also have local public health benefits. Benefits include local air quality improvements, creating a more active community through implementing sustainable living practices, and reducing health risks such as heat stroke, which is elevated by climate change impacts such as increased extreme heat days.
- **Demonstrating Consistency with State GHG Reduction Goals**: A GHG reduction plan may be used as GHG mitigation in a General Plan to demonstrate that the County is aligned with State goals for reducing GHG emissions to a level considered less than cumulatively considerable.
- **Meeting California Environmental Quality Act Requirements**: CEQA requires impacts from GHG emissions to be reviewed. A qualified GHG reduction plan may be used in future development projects as the GHG analysis for their CEQA document, resulting in greater certainty for developers and cost-effectiveness for developers and County staff.

1.4 Regulatory Setting

In an effort to stabilize GHG emissions and reduce impacts associated with climate change, international agreements, as well as federal and State actions, were implemented beginning as early as 1988. The government agencies discussed below work jointly, as well as individually, to address GHG emissions through legislation, regulations, planning, policy-making, education, and a variety of programs.

A. Federal

Clean Air Act

In 2007, through *Massachusetts v. Environmental Protection Agency* (Docket No. 05–1120), the United States Supreme Court held that the United States Environmental Protection Agency (USEPA) has authority to regulate GHGs. As such, the United States Supreme Court ruled that the USEPA should be required to regulate CO_2 and other GHGs as pollutants under Section 202(a)(1) of the federal Clean Air Act.

B. State

California Air Resources Board Standards and Programs

The California Air Resources Board (CARB), a part of the California Environmental Protection Agency (CalEPA) is responsible for the coordination and administration of both federal and State air pollution control and climate change programs within California. In this capacity, CARB conducts research, sets California ambient air quality standards (CAAQS), compiles emission inventories, develops suggested control measures, and provides oversight of local programs. CARB establishes emissions standards for motor vehicles sold in California, consumer products, and various types of commercial equipment.

Executive Order S-3-05

On June 1, 2005, California Governor Arnold Schwarzenegger announced through Executive Order (EO) S-3-05, the following GHG emissions targets:

- By 2010, California shall reduce GHG emissions to 2000 levels.
- By 2020, California shall reduce GHG emissions to 1990 levels.
- By 2050, California shall reduce GHG emissions to 80 percent below 1990 levels.
- EO S-3-05 also laid out responsibilities among the State agencies for implementation and for reporting on progress toward the targets.

Executive Order B-30-15

On April 29, 2015, California Governor Jerry Brown announced through EO B-30-15 the following GHG emissions target:

- By 2030, California shall reduce GHG emissions to 40 percent below 1990 levels.

The emissions reduction target of 40 percent below 1990 levels by 2030 is an interim-year goal to make it possible to reach the ultimate goal of reducing emissions 80 percent under 1990 levels by 2050. The order directs CARB to provide a plan with specific regulations to reduce State-wide sources of GHG emissions. EO B-30-15 does not include a specific guideline for local governments.

Assembly Bill 1493, Clean Car Standards

Also known as "Pavley I," Assembly Bill (AB) 1493 standards were the nation's first GHG standards for automobiles. AB 1493 requires CARB to adopt vehicle standards that will lower GHG emissions from new light-duty automobiles to the maximum extent feasible. In January 2012, CARB adopted the Advanced Clean Cars Program to achieve additional GHG emission reductions for passenger vehicles for model years 2017–2025. That Program includes low-emission vehicle (LEV) regulations and zero-emission vehicle (ZEV) regulations. Together, the two standards are expected to increase average fuel economy to roughly 43 miles per gallon (mpg) by 2020 (and more for years beyond 2020).

Assembly Bill 32 (AB 32) and Senate Bill 32 (SB 32), California Global Warming Solutions Act

AB 32 requires CARB to reduce State-wide GHG emissions to 1990 levels by 2020. As part of this legislation, CARB was required to prepare a "Scoping Plan" that demonstrates how the State will achieve this goal. The Scoping Plan was adopted in 2011, and in it, local governments were described as "essential partners" in meeting the State-wide goal, recommending a GHG reduction level 15 percent below 2005–2008 levels (depending on when a full emissions inventory is available) by 2020.

CARB released the 2017 Scoping Plan Update on January 20, 2017. The 2017 Scoping Plan Update provides strategies for achieving the 2030 target established by EO B-30-15 and codified in Senate Bill (SB) 32 (40 percent below 1990 levels by 2030). The 2017 Scoping Plan Update recommends local plan-level GHG emissions reduction goals. CARB recommends that local governments aim to achieve emissions of no more than 6 MT CO_2e per capita by 2030 and no more than 2 MT CO_2e per capita by 2050.

Assembly Bill 341, Commercial Recycling

AB 341 sets a State-wide goal of 75 percent recycling, composting, or source reduction of solid waste by the year 2020. As required by AB 341, the California Department of Resources Recycling and Recovery (CalRecycle) adopted the Mandatory Commercial Recycling Regulation on January 17, 2012. The regulation was approved by the Office of Administrative Law on May 7, 2012. It became effective immediately and clarifies the responsibilities in implementing mandatory commercial recycling. The Mandatory Commercial Recycling Regulation focuses on increased commercial waste diversion as a method to reduce GHG emissions. The regulation is designed to achieve a reduction in GHG emissions of 5 million MT CO_2, which equates to roughly an additional 2–3 MT of currently disposed commercial solid waste being recycled by 2020 and thereafter.

Senate Bill 97

SB 97, enacted in 2007, amends the CEQA statute to clearly establish that GHG emissions and the effects of GHG emissions are appropriate subjects for CEQA analysis. The legislation directed the California Office of Planning and Research to develop draft CEQA Guidelines "for the mitigation of GHG emissions or the effects of GHG emissions" and directed the Resources Agency to certify and adopt the State CEQA Guidelines. CEQA Guidelines Section 15183.5, Tiering and Streamlining the Analysis of GHG Emissions, was added as part of the CEQA Guideline amendments that became effective in 2010 and describes the criteria needed in a GHG reduction plan that would allow for the tiering and streamlining of CEQA analysis for development projects.

Executive Order S-1-07, Low Carbon Fuel Standard

California EO S-01-07 mandates (1) that a State-wide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020, and (2) that a low carbon fuel standard (LCFS) for transportation fuels be established in California. CARB developed the LCFS regulation pursuant to the State's authority under AB 32 and the Federal Clean Air Act and adopted it in 2009.

Executive Order S-13-08, The Climate Adaptation and Sea Level Rise Planning Directive

EO S-13-08 provides clear direction on how the State should plan for future climate impacts. EO S-13-08 calls for the implementation of four key actions to reduce the vulnerability of California to climate change:

- Initiate California's first State-wide Climate Adaptation Strategy that will assess the State's expected climate change impacts, identify where California is most vulnerable, and recommend climate adaptation policies.
- Request that the National Academy of Sciences establish an expert panel to report on sea level rise impacts in California in order to inform State planning and development efforts.
- Issue interim guidance to State agencies on how to plan for sea level rise in designated coastal and floodplain areas for new and existing projects.
- Initiate studies on critical infrastructure and land use policies that are vulnerable to sea level rise.

California Code of Regulations Title 24, Part 6

California Code of Regulations (CCR) Title 24, Part 6 (California's Energy Efficiency Standards for Residential and Nonresidential Buildings) (Title 24), was established in 1978 to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. Although it was not originally intended to reduce GHG emissions, electricity production by fossil fuels and natural gas use result in GHG emissions, and energy-efficient buildings require less electricity and natural gas. Therefore, increased energy efficiency will result in decreased GHG emissions.

The California Energy Commission (CEC) adopted 2008 Standards on April 23, 2008, in response to AB 32. The 2008 Standards were adopted to (a) provide California with an adequate, reasonably priced, and environmentally sound supply of energy; (b) pursue California energy policy, which states that energy efficiency is the resource of first choice for meeting California's energy needs; (c) meet the West Coast Governors' Global Warming Initiative commitment to include aggressive energy efficiency measures into updates of State building codes every 3 years; and (d) meet the Executive Order in the Green Building Initiative to improve the energy efficiency of nonresidential buildings through aggressive standards. The latest update of CCR Title 24, Part 6, went into effect on January 1, 2017, which will significantly increase the energy efficiency of new residential buildings.

CALGreen Building Code

CCR Title 24, Part 11 (California's Green Building Standard Code [CALGreen]), was adopted in 2010 and went into effect on January 1, 2011. Further updates to CALGreen went into effect on January 1, 2017. CALGreen is the first State-wide mandatory green building code and significantly raises the minimum environmental standards for construction of new buildings in California. The mandatory provisions in CALGreen will reduce the use of volatile organic compounds (VOCs) emitting materials, will strengthen water conservation, and will require construction waste recycling.

Senate Bill x7-7

SB x7-7 requires water suppliers to reduce urban per capita water consumption 20 percent from a baseline level by 2020.

Senate Bill 375, Sustainable Communities Strategy

SB 375 provides for a new planning process that coordinates land use planning, regional transportation plans, and funding priorities in order to help California meet the GHG reduction goals established in AB 32. SB 375 requires regional transportation plans, developed by Metropolitan Planning Organizations (MPOs) to incorporate a

Sustainable Communities Strategy (SCS) in their Regional Transportation Plans (RTPs). The goal of the SCS is to reduce regional vehicle miles traveled (VMT) through land use planning and consequent transportation patterns. SB 375 also includes provisions for streamlined CEQA review for some infill projects such as transit-oriented development.

Renewable Portfolio Standard

The Renewable Portfolio Standard (RPS) requires energy providers to derive 33 percent of their electricity from qualified renewable sources by 2020. In August 2018, the State Assembly passed SB 100, which requires energy providers to derive 60 percent of their electricity from qualified renewable sources by 2030 and 100 percent by 2045. The bill is anticipated to be passed by the Senate and signed by the Governor. The RPS is anticipated to lower emission factors (i.e., fewer GHG emissions per kilowatt-hour used) from utilities across the State, including Southern California Edison (SCE).

1.5 County Setting

Riverside County is located in the Riverside-San Bernardino-Ontario Metropolitan Statistical Area, also known as the Inland Empire, and is the fourth largest county in the State. Roughly rectangular, the County covers 7,208 square miles in Southern California, spanning from the Greater Los Angeles area to the Arizona border. Interstate 10 (I-10), Interstate 15 (I-15) and Interstate 215 (I-215) are the major freeways in the County. More than three quarters of the County's land area, and one quarter of the County's population, lie in an unincorporated County region.

The unincorporated area of Riverside County has approximately 364,413 residents (SCAG 2017). The population is diverse in age. The ethnicity is approximately 50 percent Latino, 38 percent White, and 12 percent other ethnicities. The unincorporated area of Riverside County has 112,292 households and provides a total of 81,754 jobs.

2015 CAP

Following the State's adoption of Assembly Bill (AB) 32in 2006,[13] the California Air Resources Board (ARB) developed a climate change scoping plan that included directives for local governments to reduce GHG emissions associated with land use 15 percent below baseline levels by 2020. The County adopted its first Climate Action Plan (CAP) in conjunction with a comprehensive General Plan Update (GPA No. 960) in 2015. The CAP included GHG inventories of community-wide and municipal sources using the baseline data for the year 2008. The 2015 CAP included the GHG reduction target of 15 percent below 2008 levels by 2020 and a set of reduction measures to achieve the 2020 target.

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[13] The passage of AB 32, the California Global Warming Solutions Act of 2006, marked a watershed moment in California's history. By requiring in law a sharp reduction of greenhouse gas (GHG) emissions, California set the stage for its transition to a sustainable, low-carbon future. AB 32 is the first program in the country to take a comprehensive, long-term approach to addressing climate change, and does so in a way that aims to improve the environment and natural resources while maintaining a robust economy (website: https://www.arb.ca.gov/cc/ab32/ab32.htm).

Partial Settlement Agreement

In 2016 the Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society, and respondents (Petitioners) challenged particular aspects of the CAP related to commitments to solar, electric vehicles, energy efficient traffic signals, and future updates of the CAP. In 2017 the County and the Petitioners entered into a Settlement Agreement[14] that enhances the County CAP and maintains the County's Land Use authority. In the Settlement Agreement, the County agreed to update the CAP with the following enhancements:

- The County requires all new residential development to install EV charging stations in the garages of the residential units. The Settlement Agreement further states that the capacity and circuits for installation of EV charging stations to be provided in the garages of residential units and all new large-scale commercial buildings that are over 162,000 square feet.
- The County requires that on-site renewable energy production (including but not limited to rooftop photovoltaic solar panels) shall apply to any tentative tract map, plot plan, or conditional use permit that proposes to add more than 75 new dwelling units of residential development or one or more new buildings totaling more than 100,000 gross square feet of commercial, office, industrial, or manufacturing development.
- Consideration of a policy to require the use of high-efficiency bulbs at all new traffic signal lights and converting 100 percent existing traffic signal lights to high-efficiency bulbs by 2020.
- Every four years, the County must update the GHG inventory, review the effectiveness of specific measures in the CAP, and revise associated point values in the screening tables according to the available evidence. If measures included in this CAP are found to be ineffective, those measures will be removed or revised in the update.

1.6 Plan Structure

The remainder of this CAP Update includes four additional chapters:

- **Chapter 2** summarizes the methodologies used to calculate the County's GHG emissions and forecasts.
- **Chapter 3** summarizes the County's historic and future GHG emissions and the reduction targets the County has established.
- **Chapter 4** details the reduction strategies that will be implemented to meet the reduction targets identified in Chapter 3. Measures also include the potential energy savings and local co-benefits of the measures.
- **Chapter 5** includes the implementation of the measures, potential funding sources, and how the CAP Update will be monitored and updated over time. It also summarizes the outreach and CEQA review process conducted as part of this CAP Update.

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[14] Partial Settlement Agreement, 2017. Petitioners: Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society and Respondents: County of Riverside and Riverside County Board of Supervisors.

Chapter 2 Methodology

2.1 Overview

The Climate Action Plan (CAP) is a comprehensive roadmap that outlines the specific activities that the County, will undertake to reduce GHG emissions. The CAP Update builds upon the information gathered by the GHG inventories and forecasts emissions for 2030 and 2050. These forecasts of emissions using the inventory and anticipated growth in population and the economy are called Business As Usual (BAU) forecasts. Since the inventories are derived from emissions data, they are the most accurate foundation to develop forecasts. Therefore, BAU forecasts are used as the first step in the forecasting process. Once the BAU forecasts were completed, the next step was to forecast anticipated future State actions that will reduce GHG emissions. These forecasts that include future State actions are called Adjusted BAU (ABAU). The CAP Update uses ABAU to determine the additional amount of GHG emissions reductions that are needed to achieve the reduction targets. The CAP Update focuses on those activities that can achieve the greatest emission reductions in the most cost effective manner in achieving the reduction targets. For these reasons GHG emissions inventories are the foundation of the CAP Update[15]. Establishing an inventory of emissions helps to identify and categorize the major sources of emissions produced over a single calendar year[16.] A community-wide inventory includes GHG emissions that result from the activities by residents and businesses within the unincorporated communities, and County government operations within Riverside County. The inventories identify the major sources of GHGs emissions caused by activities in sectors that are specific to community activities.

The County prepared community inventories for the years 2008 and 2017. The 2008 inventory is considered the baseline year. A baseline year is established as a starting point against which other inventories may be compared and targets may be set, and is generally the earliest year with a full emissions inventory. The most recent inventory (2017) has the most relevant data for planning purposes, while multiple inventory years provide context and may help identify trends or anomalies in the community emissions. The County prepared a detailed GHG Inventory, Forecasting, and Target-Setting (IFT) Report, included as Appendix A, which contains detailed methodology of the information summarized in this chapter.

The GHG inventories include all major sources of emissions attributable directly or indirectly to activities within the unincorporated communities served by the County of Riverside, as well as County government operations. The methodology for preparing the GHG inventories incorporates the protocols and methods, and emission

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15 Institute for Local Government: Climate Action Plans (website: https://www.ca-ilg.org/climate-action-plans).

16 Importance of Climate Action Planning (CAP) for cities (website: http://e-lib.iclei.org/wp-content/uploads/2016/02/Guiding-Principles-for-City-Climate-Action-Planning.pdf).

factors found in the International Council of Local Environmental Initiatives' (ICLEI) United States Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol, U.S. Community GHG Protocol Version 1.0, 2012), the Association of Environmental Professionals (AEP) California Supplement to the U.S, Community GHG Protocol (2013), The Climate Registry General Reporting Protocol (Version 2.1, 2016), and the Climate Registry Local Government Operations Protocol (LGOP, Version 1.1, 2010). The analysis herein is tailored to include all existing and projected emission sources within the unincorporated areas of Riverside County to provide, to the fullest extent feasible, a comprehensive analysis of GHG reductions. The AB 32 Scoping Plan establishes a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of GHG emissions.

2.2 Calculation of GHGs

The coefficients, modeling inputs, and other assumptions, used in the calculations of GHGs are included in Appendix B of this report. GHG emissions are typically segregated into direct and indirect sources. However, it is important to note that direct and indirect sources are not completely independent of each other and are often combined into other more encompassing categories. For example, although natural gas combustion is a direct source and electricity generation is an indirect source, they both are typically discussed under a heading of "Energy" when policies are put in place to reduce emissions. Therefore, this CAP Update discusses emissions with respect to the general source categories of on-road and off-road transportation, energy, water and wastewater, solid waste, aviation, and agriculture sources.

A. Energy

Electricity

Emissions of CO_2, CH_4, and N_2O within Riverside County result from the use of electricity. Annual electricity usage in 2017, obtained from SCE, Imperial Irrigation District (IID), and Anza Electric Cooperative, Inc. (Anza), the three major commercial electricity providers serving Riverside County, was used in determining community-wide electricity consumption and generation emission estimates for the existing inventory. For 2020, 2030, and 2050, emissions forecasts were calculated based on the anticipated growth in population, housing, and employment for the County of Riverside. The growth projections were interpolated from the County's General Plan Update Land Use Element[17] growth rates.

Emissions from electricity were determined by multiplying annual usage in megawatt hours per year (MWh/year) by the SCE emission factors for CO_2e obtained from SCE's Corporate Responsibility & Sustainability Report[18] while CO_2, CH_4, and N_2O were obtained from the USEPA's Emissions and Generation Resource Integrated Database[19] (eGRID).

The 2008 inventory included two gas-to-energy facilities, one at the Badlands Landfill and one at the El Sobrante Landfill. However, these landfills no longer send their landfill gas to these facilities but to a flare station.[20] Flare

17 County of Riverside. 2015. *General Plan*. December.
18 Southern California Edison (SCE). 2016. *Corporate Responsibility & Sustainability Report*.
19 USEPA. 2016. Emissions and Generation Resource Integrated Database (eGRID) Summary Tables.
20 Email correspondence with Riverside County Department of Waste Resources on August 13, 2018.

burning does not contribute to GHG emissions or provide any carbon credit to the energy sector. Therefore, neither the gas-to-energy facilities nor the flare station are included in the 2017 inventory.

Natural Gas Combustion

The residents and businesses in Riverside County emit GHGs from the combustion of natural gas, most often used for heating. The annual natural gas usage for the unincorporated areas of Riverside County measured in million British Thermal Units (MBTUs) was multiplied by the respective emissions factors for CO_2, CH_4, and N_2O to determine the emissions from natural gas combustion. Existing inventory consumption levels for the community as a whole were obtained from the Southern California Gas Company (SoCalGas), and future community-wide consumption estimates were based on anticipated population and economic growth in Riverside County. These growth rates came from the Southern California Association of Governments (SCAG) statistics and the County of Riverside General Plan Update Land Use Element.

B. Water Supply

Water-related emissions are indirectly produced as a result of electrical consumption to pump and treat water imported from outside Riverside County. There are many water agencies that operate in Riverside County providing both potable and non-potable water to customers in unincorporated areas. Refer to Appendix A for a full list of agencies that provided data used in determining water-related energy consumption emission estimates for the existing inventory.

The category, "Water Supply," addresses the GHG emissions resulting from energy used to collect, treat, convey, and distribute imported sources of water from their sources to Riverside County. This separate category is necessary, as the energy used is accrued across a variety of providers and is not included in the data collected from SCE, IID, or Anza. For local water sources, the data collected from SCE and IID include associated electricity usage and, hence GHG emissions are included under the "Electricity" category described above. Showing GHG emissions associated with local water sources in the "Electricity" category avoided double counting as the electricity used to pump local water supplies was embedded in the SCE reported electrical consumption data for unincorporated Riverside County.

C. Wastewater Treatment

As with the local water supply, GHG emissions associated with wastewater (that is, sewage, urban runoff, and, in some cases, industrial or manufacturing runoff) are based on the electricity needed to pump and treat the wastewater. Again, since wastewater treatment occurs locally within Riverside County, these emissions are also accounted for under the "Electricity" section of the community-wide inventory to avoid double counting of GHG emissions identical to how the locally pumped water supply was treated.

D. Solid Waste Management

The Riverside County Waste Management Department is responsible for managing the County's landfills, including both active and closed landfills, with one exception – the El Sobrante Landfill, which is privately owned and operated. The County of Riverside collects fees and has control over the portion of the El Sobrante Landfill waste collected from within Riverside County. Therefore, the emissions associated with solid waste within the inventory are limited to the portion of waste collected within Riverside County.

Emissions from solid waste result from three different waste-related sources: transportation from its source to the landfill, operation of the equipment used at the landfill, and the fugitive emissions from waste decomposition. Emissions from the transportation of solid waste are included in the transportation sector, and emissions from operation of the equipment are included in the off-road sector. Emissions from waste decomposition at all landfills located in the unincorporated areas of Riverside County are included in the solid waste sector. The operational information was collected from the Riverside County Waste Management Department.

Fugitive methane emissions from the decomposition of solid waste (typically buried) are calculated based on the annual waste generation multiplied by the applicable emission factors for waste production for CH_4. Many landfills now have a methane capture system in place; depending on the type of system, not all of the methane generated from the decomposition is included in the inventory. In Riverside County, three of the existing seven active landfills have such systems. The Community Protocol recommends using an average factor of 75 percent recovery from landfill gas, although some landfills have much higher gas recovery systems, and other landfills have lower gas recovery systems. Although CO_2 is also a by-product of organic waste decomposition, the USEPA considers these emissions to be natural and not anthropogenic. Therefore, they are not included in the emissions inventory. N_2O is not a by-product of decomposition and, therefore, no fugitive emissions of N_2O are anticipated or calculated from solid waste sources.

E. Transportation

On-Road Vehicles

For the community-wide inventory, emissions from on-road vehicles include emissions generated from trips attributable to activities taking place in the unincorporated parts of Riverside County. Carbon dioxide emissions from vehicles were calculated utilizing EMFAC2017 emission factors for the 2017 inventory and 2020, 2030, and 2050 forecasts. The Emission Factors (EMFAC) model[21] was developed by the California Air Resources Board (CARB) and is used to calculate CO_2 emission rates for on-road motor vehicles, from light-duty passenger vehicles to heavy-duty trucks that operate on highways, freeways, and local roads in California. Motor vehicle emissions of CH_4 and N_2O were calculated using USEPA emission factors for on-road vehicles based on the total annual mileage driven multiplied by their respective emission factors by year. Vehicle miles traveled (VMT) were modeled using the Riverside County Traffic Analysis Model (RIVTAM). VMT data were derived from transportation modeling of the trips entering Riverside County, trips leaving Riverside County, and trips within Riverside County. Pass-through traffic (that is, trips beginning and ending outside of Riverside County) was not included in this analysis. Since trips entering and leaving Riverside County have only one end in Riverside County, only half of these miles were included in the emissions analysis, in order to reflect the split jurisdiction of these trips.

Off-Road Sources

Off-road emissions include emissions from agriculture, construction, industrial, lawn and garden, light commercial, and recreational equipment. Annual emissions of CO_2, CH_4, and N_2O are available at the County

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[21] California Air Resources Board (CARB). 2017. EMFAC Model.

level from the State's OFFROAD model.[22] County-level indicator data were obtained from SCAG's Local Profile for the County of Riverside.

Aviation Emissions

Riverside County owns and operates four airports: Blythe Airport, Jacqueline Cochran Regional Airport, Hemet-Ryan Airport, and French Valley Airport. The GHG emissions associated with aircraft trips within Riverside County were calculated based on annual fuel consumption (extrapolated from airport aviation fuel sales) and emission factors for jet fuel and aviation fuel for CO_2, CH_4, and N_2O.

F. Agriculture

Riverside County has a large amount of agricultural land with a variety of cultivation uses. Assessment of non-carbon-dioxide emissions are from the following source categories: enteric fermentation in domestic livestock, livestock manure management, crop cultivation, and field burning of agricultural residues. The use of agricultural equipment was accounted for in the off-road sources sector. Agricultural-related emissions for 2017 were based on data from SCAG and the Riverside County Agricultural Commissioner.

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22 CARB. 2007. OFFROAD Model.

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Chapter 3 GHG Emissions Inventory

The following sections describe Riverside County's 2017 community-wide GHG emissions inventory. The community-wide emissions inventory identifies and categorizes the major sources and quantities of GHG emissions produced by residents, businesses, and municipal operations in the unincorporated areas of Riverside County using the best available data.

3.1 2017 Community-Wide Emissions Inventory

The community-wide inventory represents all emissions from sources located within the unincorporated areas of Riverside County. Therefore, the government operations emissions are a subset of the community-wide inventory presented here. In Riverside County in 2017, a total of 4,905,518 MT CO_2e emissions were emitted in the community as a whole. The following sections describe the data inputs, emissions by source, and emissions by land use in 2017.

A. Data Inputs

Data for the community-wide inventory were gathered from various Riverside County departments, SCE, IID, Anza, SoCalGas, and additional reports. Table 3-1 (2017 Community-Wide Data Inputs), below, summarizes the data inputs and sources for each of the emission categories included in the inventory. Each data input was then multiplied by the associated emission factor to calculate the emissions associated with each source.

Table 3-1 2017 Community-Wide Data Inputs

Category	Data Input	Data Source
Electricity		
SCE (kWh)	2,080,338,050	SCE
IID (kWh)	829,657,212	IID
Anza (kWh)	59,236,020	Anza
Natural Gas (therms)	89,469,089	SoCalGas
Transportation		
Annual VMT	4,284,955,458	County of Riverside RIVTAM Model
Off-Road Equipment (Total County) (MT CO_2e)	12,613	CARB OFFROAD Model
Jet Fuel (gallons)	2,781,219	Riverside County Economic Development Agency
Aviation Fuel (gallons)	431,069	Riverside County Economic Development Agency
Solid Waste (tons)	389,687	Riverside County Waste Management
Water and Wastewater (Imported) (million gallons)	27,462	Water Districts

Category	Data Input	Data Source
Agriculture (acres)		
Hay	45,353	
Corn	740	
Oats	833	
Sorghum	130	
Wheat	18,394	Riverside County Agricultural Commissioner
Cotton	7,291	SCAG
Vegetable & Fruit Trees	78,688	
Animals (heads)		
Dairy Cow	21,900	
Poultry	1,893,394	
Sheep	8,300	

Anza = Anza Electric Cooperative, Inc.
CARB = California Air Resources Board
IID = Imperial Irrigation District
kWh = kilowatts
MT CO_2e = metric tons carbon dioxide equivalent
RIVTAM = Riverside County Traffic Analysis Model
SCAG = Southern California Association of Governments
SCE = Southern California Edison
SoCalGas = Southern California Gas
VMT = vehicle miles traveled

B. Emissions by Source

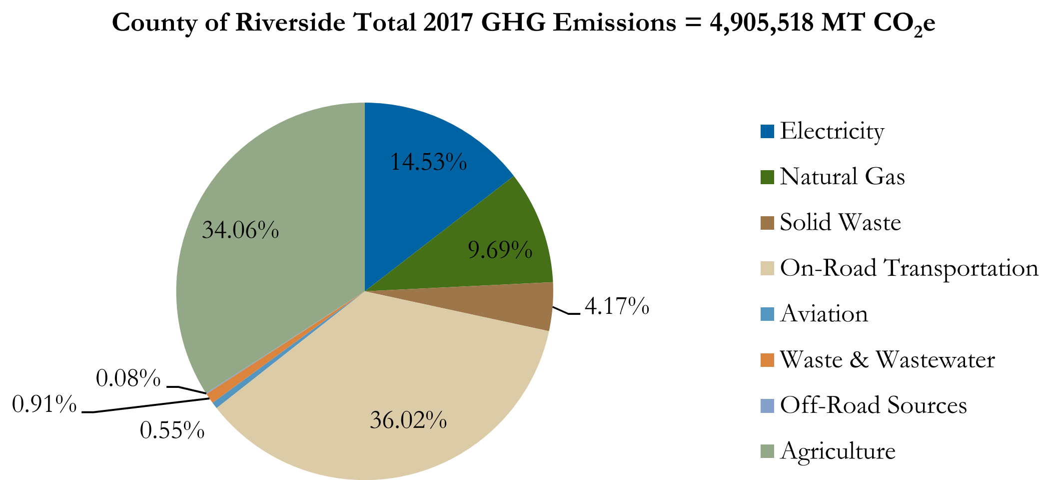
Table 3-2 (2017 Community-Wide GHG Emissions by Source) summarizes net 2017 County emissions of CO_2e as broken down by emissions category. Riverside County as a whole emitted 4,905,518 MT CO_2e in 2017. The largest portion of Riverside County's 2017 emissions were from transportation (36 percent), followed by agriculture (34 percent), and electricity and natural gas use in buildings (24 percent). Figure 3-1 (2017 Emissions Generated by Emissions Category) provides a comparison of GHG emissions by category.

Table 3-2 2017 Community-Wide GHG Emissions by Source

Emissions Category	Metric Tons of CO_2e
On-Road Transportation	1,766,784
Agriculture	1,670,954
Energy (Electricity and Natural Gas)	1,188,138
Solid Waste	204,365
Water and Wastewater	44,606
Aviation	26,786
Off-Road Sources	3,883
Total	4,905,518

CO_2e = carbon dioxide equivalent
GHG = greenhouse gas

Figure 3-1 2017 Emissions Generated by Emissions Category (Metric Tons CO_2e)



3.2 Business-As-Usual Community-Wide GHG Emissions Forecasts

The Business-As-Usual (BAU) forecasts describe emissions based on projected growth in population and employment and do not consider policies that will reduce emissions in the future (that is, the policies in place in 2017 that would remain constant through 2050). The County developed GHG reduction measures in the 2015 County of Riverside Climate Action Plan (2015 CAP) that constitute policies in place in 2017. These measures have been implemented and are reflected in the 2017 GHG emissions inventory, and will continue reducing emissions through 2020.

The BAU forecasts estimate future emissions using current (2017) consumption patterns and emission factors with the anticipated growth in the County. Anticipated growth is estimated using data from the County's 2015 General Plan and other relevant sources. The most relevant growth factors are used to project emissions by sector. For example, future Residential Energy emissions were developed using current energy use per household (from the 2017 inventory) and the anticipated number of households in 2035. Actual energy use is a function of several variables, not only the number of households; however, this approach is supported by current protocols and best practices within the State and provides a consistent approach to forecasting. Compound annual growth rates were developed using the growth projections from 2010 to 2020 and 2035. Growth rates beyond 2035 are assumed to be the same as between 2020 and 2035. In general, the County is expecting modest growth as population, housing, jobs, and vehicle miles traveled are all expected to increase.

A. Data Inputs

Data for the BAU community-wide GHG emissions forecasts were estimated based on the growth rates from Riverside County General Plan Update Land Use Element. Table 3-3 (BAU Forecasts Data Inputs), below, summarizes Riverside County's growth rates.

Table 3-3 BAU Forecasts Data Inputs

Sector	Demographic Indicator	2010	2020	2010–2020 CAGR[1] (%)	2035	2020–2035 CAGR[1] (%)
Residential Energy	Households	171,380	219,917	2.53	324,021	2.62
Commercial/ Industrial Energy	Jobs	97,210	151,034	4.50	265,688	3.84
N/A[2]	Population	467,105	608,857	2.69	908,100	2.70
Solid Waste, Water, Wastewater, and Off-Road Sources	Service Population (Population + Jobs)	564,315	759,891	3.02	1,173,788	2.94
Transportation	Vehicle Miles Traveled[3]	4,284,955,458	25,203,928,090	4.21	--	--

1 Compound annual growth rate.
2 Not Applicable. Population data are shown for informational purposes but are not used for forecasting any sector.
3 VMT was modeled for 2017 and 2060. The CAGR was calculated between 2017 and 2060 and was used for all forecast years.
BAU = Business- As- Usual
CAGR = compound annual growth rate
N/A = not applicable
VMT = vehicle miles traveled

B. BAU Forecast Emissions by Source

The County's BAU emissions in 2020 are estimated to be 5,158,305 MT CO_2e, or a 5.1 percent increase from baseline (2017) emissions. By 2030, emissions are estimated to increase 29.8 percent from the baseline level to 6,368,781 MT CO_2e. By 2050, emissions are estimated to increase 130.4 percent from the baseline level to 11,305,026 MT CO_2e. Table 3-4 (BAU Forecast Emissions by Source) shows BAU forecast emissions by source.

Table 3-4 BAU Forecast Emissions by Source

Sector	2017 (MT CO_2e)	2020 (MT CO_2e)	% Change 2017–2020	2030 (MT CO_2e)	% Change 2017–2030	2050 (MT CO_2e)	% Change 2017–2050
On-Road Transportation	1,766,784	1,999,268	13.1	3,018,767	70.0	6,882,509	289.5
Agriculture	1,670,954	1,565,873	-6.2	1,261,044	-24.5	817,858	-51.0
Electricity	712,928	774,289	8.6	1,017,153	42.6	1,756,843	146.4
Natural Gas	475,211	515,845	8.5	676,742	42.4	1,165,761	145.3
Solid Waste	204,365	223,448	9.3	298,585	46.1	533,154	160.0
Water & Wastewater	44,606	48,771	9.3	65,171	46.1	116,370	160.0
Aviation	26,786	26,786	0.0	26,786	0.0	26,786	0.0
Off-Road Sources	3,883	4,024	3.6	4531	16.6	5744	47.9
Total	4,905,518	5,158,305	5.1	6,368,781	29.8	11,305,026	130.4

BAU = Business-as-Usual
MT CO_2e = metric tons carbon dioxide equivalent

3.3 Adjusted Business-As-Usual Community-Wide GHG Emissions Forecasts

The Adjusted BAU scenario describes emissions based on projected growth *and* considers policies that will achieve GHG reductions in the future. State legislation has been approved and/or adopted that will reduce GHG emissions in the County. These policies do not require additional local action, but should be accounted for in the County's emissions forecasts to provide a more accurate picture of future emissions and the level of local action needed to reduce emissions to levels consistent with State recommendations. This forecast is called the Adjusted BAU forecast. The measures include Low Carbon Fuel Standard, Advanced Clean Cars, California Building Code Title 24, and Renewable Portfolio Standard. These measures are described in detail in Appendix A.

A. Adjusted BAU Forecast Emissions by Source

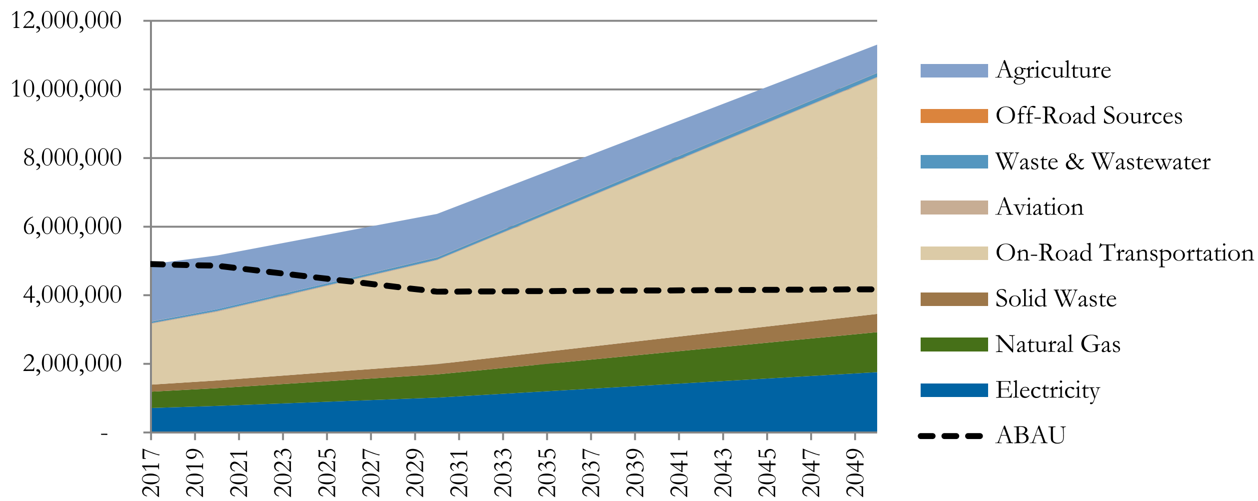
The County's Adjusted BAU emissions in 2020 are estimated to be 4,861,256 MT CO_2e, 4,102,109 MT CO_2e in 2030, and 4,175,146 MT CO_2e in 2050 (Table 9). This change represents a 0.9 percent reduction from 2017 by 2020, 16.3 percent reduction by 2030, and 14.8 percent reduction by 2050. Due to the State's stringent vehicle standards, emissions from the transportation sector are expected to decrease significantly over time. The proportion of emissions from electricity consumption is expected to decrease over time, whereas natural gas-related emissions are expected to increase. The emissions from the agriculture sector are also expected to reduce by almost half over time, mainly due to a decline in agricultural activities. The emissions from the solid waste sector are expected to increase because of the increase of population and employment. Table 3-5 (Adjusted BAU Forecast Emissions by Source) shows Adjusted BAU forecast emissions by source, and Figure 3-2 (Community BAU and Adjusted BAU Forecasts) shows the details of the community BAU and Adjusted BAU forecasts in MT CO_2e.

Table 3-5 Adjusted BAU Forecast Emissions by Source

Sector	2017 (MT CO_2e)	2020 (MT CO_2e)	% Change 2017–2020	2030 (MT CO_2e)	% Change 2017–2030	2050 (MT CO_2e)	% Change 2017–2050
On Road Transportation	1,766,784	1,835,938	3.9	1,361,200	-22.9	1,174,310	-33.5
Agriculture	1,670,954	1,565,873	-6.2	1,261,044	-24.5	817,858	-51.0
Electricity	712,928	653,541	-8.3	466,971	-34.4	480,289	-32.6
Natural Gas	475,211	510,268	7.3	652,578	37.3	1,104,421	132.0
Solid Waste	204,365	223,448	9.3	298,585	46.1	533,154	160.8
Water & Wastewater	44,606	41,377	-7.2	30,413	-31.8	32,584	-26.9
Aviation	26,786	26,786	0.0	26,786	0.0	26,786	0.0
Off-Road Sources	3,883	4,024	3.6	4,531	16.6	5,744	47.9
Total	4,905,518	4,861,256	-0.9	4,102,109	-16.3	4,175,146	-14.8

BAU = Business-as-Usual
MT CO_2e = metric tons carbon dioxide equivalent

Figure 3-2 Community Business-as-Usual (BAU) and Adjusted BAU (ABAU) Forecasts (MT CO_2e)



3.4 Reduction Targets

The State has set goals for reducing GHG emissions by the year 2020, 2030, and 2050 through AB 32, EO S-3-05, and EO B-30-15, respectively. The State has also provided guidance to local jurisdictions as "essential partners" in achieving the State's goals by identifying a 2020 recommended reduction goal. That goal, stated in the AB 32 Scoping Plan, was for local governments to achieve a 15 percent reduction below 2005 to 2008 annual emissions levels by year 2020, which aligns with the State's goal of not exceeding 1990 annual emissions levels by year 2020[23]. The State's long-term target is to emit no more than 20 percent of 1990 annual emissions levels by year 2050 (or, a reduction of 80 percent below 1990 annual emissions levels by year 2050). The State has also provided an interim target, which is 40 percent below 1990 annual emissions levels by year 2030. It is clear that the issue of climate change will not end in 2030 and continued reduction goals should be implemented to keep the State on a path toward the 2050 goal.

In order to keep the County CAP in line with the State's reduction goals the following targets are set for Riverside County. In the year 2020, the County would not need to make any additional CO_2e emissions reductions, as State and local policies will be sufficient to meet the targets. In the year 2030, the County would need to reduce emissions by 525,511 MT CO_2e annually below the ABAU scenario to meet the State-aligned target. In 2050, the County would need to reduce emissions by 2,982,947 MT CO_2e annually below the ABAU scenario to meet the State-aligned target. Table 3-6 (State-Aligned GHG Emissions Reduction Targets by Year) and Figure 3-3 (Community Emissions Inventories, Forecasts, and Targets) show reduction targets and additional reduction needed to meet the targets.

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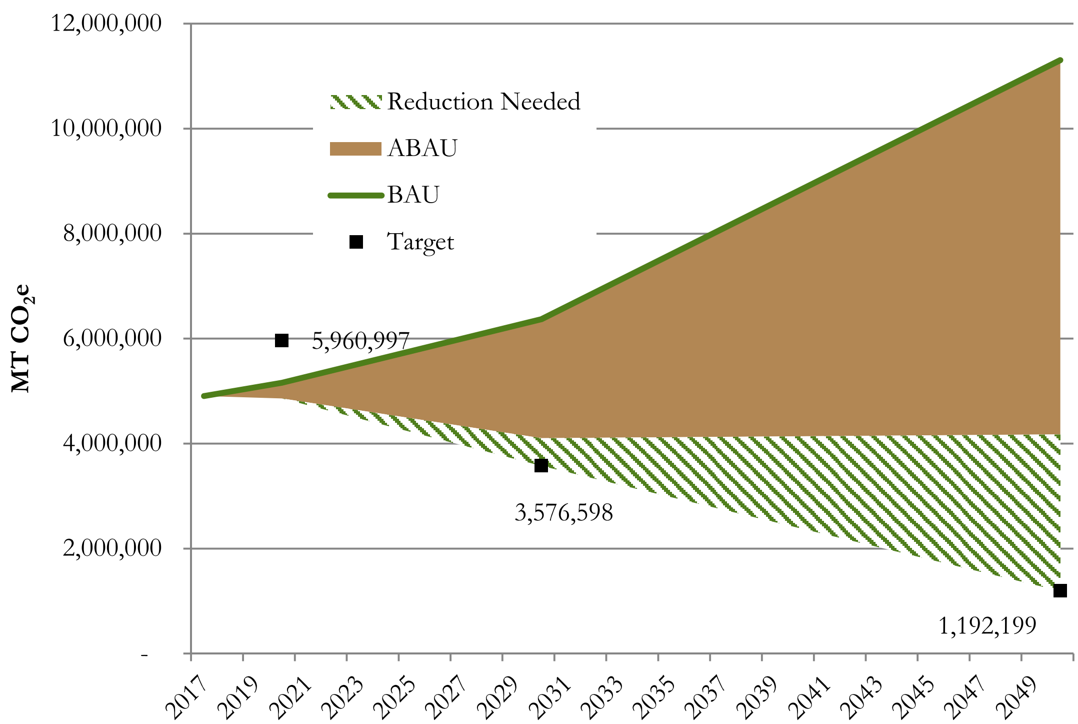
23 In an analysis, the State concluded that a 15 percent reduction in emissions from 2005 to 2008 levels by 2020 would be equivalent to achieving 1990 emissions levels.

Table 3-6 State-Aligned GHG Emissions Reduction Targets by Year

Sector	2008	2017	2020	2030	2050
BAU Emissions (MT CO_2e)	7,012,938	4,905,518	5,185,305	6,368,781	11,305,026
ABAU Emissions (MT CO_2e)	-	-	4,861,256	4,102,109	4,175,146
State-Aligned Target (% change from 1990)	-	-	0	-40	-80
State-Aligned Target (% change from 2008)	-	-	-15	-49	-83
State-Aligned Target (MT CO_2e)	-	-	5,960,997	3,576,598	1,192,199
Reductions from ABAU needed to meet the Target (MT CO_2e)	-	-	Target Met	525,511	2,982,947

Note: [1] Baseline (2008) emissions are from the County of Riverside's 2015 Climate Action Plan GHG inventory.
[2] Reduction targets calculation details are provided in Appendix A.
ABAU = Adjusted Business-as-Usual
BAU = Business-as-Usual
GHG = greenhouse gas
MT CO_2e = metric tons of carbon dioxide equivalent

Figure 3-3 Community Emissions Inventories, Forecasts, and Targets



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Chapter 4 GHG Emissions Reduction Programs and Regulations

The GHG reduction programs and measures presented in this report build on the previous 2015 CAP and are revised and updated to reflect changes in the GHG emissions inventories and policies. The GHG reduction measures focus on different sectors including transportation, energy efficiency, clean energy, water efficiency, advanced measures, and solid waste. The measures include revisions based upon the County's input and are either new or enhancement and continuation of reduction measures proposed in the 2015 CAP. These measures would help the County achieve GHG reduction targets in 2030 and 2050.

The State of California has set specific targets for reducing GHG emissions from the burning of fossil fuels in both power plants and vehicles by adopting various regulations. In addition, State energy efficiency and renewable requirements provide another level of reductions. In order to provide credit to Riverside County for regulatory actions already taken or planned by the State of California, this CAP Update first evaluates the GHG reductions that will occur within Riverside County as a result of these actions. These are identified in the CAP as R1 reduction measures. The R1 measures do not require additional local actions but should be accounted for in the County's emissions forecasts to provide a more accurate picture of future emissions and the level of local actions needed to reduce emissions to the State-aligned target levels. The R1 measures described in this chapter have been included and accounted for in ABAU forecasts as discussed in Chapter 3. It is also important to note that some R1 measures from the 2015 CAP are no longer included in this document either because they have been fully implemented or are not applicable beyond 2020.

The R2 reduction measures will be incorporated at the County level to provide additional reductions in GHG emissions. R2 measures are those measures that either can be quantified to show the value of the reduction from the incorporation of those measures, or the supportive measures or methods of implementation for the quantifiable measures. The R2 measures correspond to the Implementation Measures (IM) included in Appendix K of the General Plan. The R3 measures proposed in the 2015 CAP are combined with R2 measures and are no longer shown as an individual category in this document. A complete list of assumptions and reductions for each of the R2 measures is included in Appendix C of this CAP Update.

The following reduction measures are organized herein by source category (transportation, energy efficiency, clean energy, advanced measures, water efficiency, and solid waste), and then by R1 and R2 measures. The method used for numbering the mitigation measures will be to list the R designation (R1 or R2) then an abbreviation of the source category, followed by the order number. Therefore, R1-EE1 is the first R1 measure within the energy efficiency category, R1-EE2 is the second measure within the energy efficiency category, and so on. The source category abbreviations are as follows: T – transportation, EE – energy efficiency, CE – clean energy, L – advanced measures, W – water efficiency, and S – solid waste.

4.1 Existing Riverside County General Plan Policies Related to GHGs

Policies to reduce GHG emissions often overlap with policies addressing energy conservation, reduced automobile use, water conservation, and many other issues. In addition to policies specifically targeting GHG emissions, Riverside County has many General Plan policies that help reduce GHG emissions while targeting other policies applicable to Riverside County. For example; the Air Quality Element of the General Plan was updated in July 2018 and specifically includes GHG reduction categories and policies. It also summarizes GHG emission reduction focus areas as a key to achieving General Pan and CAP milestones. The General Plan also includes policies that contribute indirectly to GHG emissions reductions, such as Land Use strategies for improving air quality by emphasizing alternative transportation options for communities to help improve air quality. Table 4-1 (General Plan Policies Related to Reducing GHG Emissions) below summarizes these General Plan policies that directly or indirectly contribute to GHG emissions reductions. The R-2 measures included in this CAP Update support and help implement most of these General Plan policies.

Table 4-1 General Plan Policies Related to Reducing GHG Emissions

Sector	Element	Section	Policies
Energy Efficiency in Buildings	Land Use	Project Design	LU-4.1
	Multipurpose Open Space	Energy Conservation	OS-16.1 through OS-16.10
	Air Quality	Stationary Emissions	AQ-4.1 through AQ-4.4, AQ-4.6, and AQ-4.7
		Energy Efficiency and Conservation Objectives	AQ-4.1 through AQ-4.*4*, AQ-5.1, AQ-5.2, AQ-5.4, and AQ-20.10 through AQ-20.12
Regional Agency Coordination/Education and Outreach	Land Use	Administration	LU-1.5, LU-1.6, and LU-8.6
	Air Quality	Multi-Jurisdictional Cooperation, Education and Outreach	AQ-1.1 through AQ-1.4, AQ-1.6, AQ-1.10, AQ-3.2, AQ-3.3, AQ-7.1, AQ-7.5, AQ-17.6, and AQ-20.1 through AQ-20.6
Smart Growth	Land Use	Efficient Use of Land	LU-2.1
		Economic Development	LU-7.12
		Air Quality	LU-11.1 through LU-11.5
	Air Quality	Business Development	AQ-7.1 and AQ-7.3
		Job-to-Housing Ratio	AQ-8.4 through AQ-8.9
		Land Use Related Objectives	AQ-20.7 through AQ-20.9
Water Conservation	Land Use	Project Design	LU-4.1
	Circulation	Transportation System Landscaping	C-5.2
	Multipurpose Open Space	Water Conservation	OS-1.4, and OS-2.1 through OS-2.5
	Air Quality	Water Conservation Objectives	AQ-20.13 through AQ-20.17

Sector	Element	Section	Policies
Reduce Automobile Use	Land Use	Efficient Use of Land	LU-2.1
		Project Design	LU-4.1 and LU-4.2
		Air Quality	LU-11.1 through LU-11.4 and AQ-20.7 through AQ-20.9
		Circulation	LU-13.1 through LU-13.7
	Circulation	Planned Circulation Systems	C-1.2 and C-1.7
		Pedestrian Facilities	C-4.1 and C-4.9
		Transportation System Landscaping	C-5.2
		Public Transportation System	C-9.2
		Fixed Route Transit Service	C-11.2 and C-11.4 through C-11.7
		Transit Oasis and Transit Centers	C-12.1 through C-12.3
		Passenger Rail	C-13.1 through C-13.3
		Bikeways	C-17.3 and C-17.4
		Environmental Considerations	C-20.12
		Transportation Systems Management	C-21.1
	Multipurpose Open Space	Energy Conservation	OS-16.3 and OS-16.8
	Air Quality	Mobile Pollution Sources	AQ-3.2 and AQ-3.4
		Trip Reduction and Transportation Related Objectives	AQ-10.1 through AQ-10.4, and AQ-20.1 through AQ-20.6
Renewable Energy/Alternative Fuel	Multipurpose Open Space	Renewable Energy	OS-10.1, OS-11.1 through OS-11.3, OS-12.1, OS-12.4, and OS-13.1
	Air Quality	Transportation System Management Improvements	AQ-13.1 through AQ-13.3
		Alternative Energy Objectives	AQ-20.18 and AQ-20.19
	Land Use	Solar Energy Resources	LU-17.1 and LU-17.2
Reduce Waste	Air Quality	Energy Efficiency and Conservation	AQ-5.1
		Waste Reduction Objectives	AQ-20.20

Source: Riverside County General Plan and Elements Revised on various dates. Website: https://planning.rctlma.org/ZoningInformation/General Plan.aspx.
GHGs = greenhouse gases

4.2 Transportation

A. R1 Transportation Measures

The following list of R1 transportation-related measures are those measures that the State of California has identified in the AB 32 Scoping Plan. These measures are accounted for in the County's ABAU emissions forecasts to provide a more accurate picture of future emissions and the level of local actions needed to reduce emissions to levels consistent with the State requirements..

R1-T1: Assembly Bill 1493: Pavley I

Assembly Bill (AB) 1493 (Pavley) required CARB to adopt GHG standards for motor vehicles through model year 2015 that would result in reductions in GHG emissions by up to 25 percent in 2030.

R1-T2: Assembly Bill 1493: Pavley II

The State of California committed to further strengthening the AB 1493 standards by introducing additional components to the State's Advanced Clean Cars Program that will further reduce GHG emissions State-wide, including more stringent fuel efficiency standards for model years 2017 through 2025 and support infrastructure for the commercialization of zero-emission vehicles. CARB anticipates additional GHG reductions of 3 percent by 2020, 27 percent by 2035, and 33 percent by 2050.[24]

R1-T3: Executive Order S-1-07 (Low Carbon Fuel Standard)

The Low Carbon Fuel Standard (LCFS) will require a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. The State is currently implementing this standard, which is being phased in and will achieve full implementation in 2020. The LCFS target would be maintained beyond 2020.

B. R2 Transportation Measures

The following list of R2 measures are measures which Riverside County can incorporate into the existing land uses and new development projects for the reduction of transportation-related emissions to achieve a State-aligned reduction target. These R2 measures also support the implementation of General Plan policies related to smart growth and reducing automobile use as shown in Table 4-1, including LU-11.1 through LU-11.5, C-1.2, C-1.7, C-4.1, C-4.9, C-9.2, C-17.3, C-17.14, AQ-10.1 through 10.4, AQ 20.1 through 20.6.

R2-T1: Alternative Transportation Options

Alternative transportation includes taking transit and non-motorized transportation options, among them walking and bicycling, and variants such as small-wheeled transport such as skates, skateboards, push scooters and hand carts, and wheelchair travel. These modes provide both recreation and transportation, and can reduce VMT by removing automobiles from the road. This is an enhancement of Measures R2-T2, R2-T3, R2-T6, R2-T9, and R3-T1 proposed in the 2015 CAP. Potential actions for this measure include:

- Work with SCAG and the community to remove barriers to alternative transportation.
- Create a "bike to work day" or "car-free zone day" and other County sponsored events to promote bicycling and other non-motorized transportation.
- Create additional active transportation routes from transit centers to surrounding residential areas.
- Implement reduced parking requirement in areas served by transit.

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[24] CARB. 2010. Advanced Clean Cars Summary Sheet. Website: https://www.arb.ca.gov/msprog/ clean_cars/acc%20summary-final.pdf (accessed November 10, 2018).

R2-T2: Adopt and Implement a Bicycle Master Plan to Expand Bike Routes around the County

Bicycle-friendly roads are crucial to promoting bicycle use as a transportation method. People tend to bicycle if routes are available to separate them from motor vehicles and bicyclists' safety can be ensured. Currently, Riverside County has not adopted a bicycle master plan. Thus, adopting and implementing a bicycle master plan and constructing more bicycle routes would encourage more bicycle rides and would help to reduce VMT. This is a new measure for the County's consideration. Potential action for this measure includes:

- Adopt and implement a bicycle master plan.
- Expand bicycle routes and prioritize funding for Class I bicycle lanes to improve bike transit.

R2-T3: Ride-Sharing and Bike-to-Work Programs within Businesses

Approximately 81 percent of people living in unincorporated area of Riverside County drive alone to work every day (SCAG 2017). A higher ride-sharing rate or bike-to-work rate would mean fewer VMT and GHG emissions, so encouraging carpooling and bicycling by providing incentive programs and necessary facilities can reduce GHG emissions. This is an enhancement of Measures R2-T1, R2-T4, and R2-T6 proposed in the 2015 CAP. Potential actions for this measure include:

- Promote ride-sharing and facilitate air district incentives for ride-sharing.
- Provide reserved preferential parking spaces for ride-sharing, carpooling, and ultra-low- or zero-emission vehicles.
- Zoning code update that requires businesses of a certain size to provide facilities such as bicycle racks.

R2-T4: Electrify the Fleet

Hybrid electric vehicles, plug-in hybrid electric vehicles, and all-electric vehicles (EVs) produce lower emissions than conventional vehicles. Any type of electrified vehicle emits less GHG than conventional vehicles by at least 40 percent. However, more than 95 percent of people still drive conventional gasoline or diesel vehicles, so programs to encourage the use of EV or hybrid vehicle ownership are highly needed. With the Statewide EV ownership goal and the implementation of this measure, EV ownership in Riverside County could reach 13 percent by 2030. Per the Settlement Agreement[25], for all new residential development, the County requires installation of EV charging stations in the garages of the residential units. The Settlement Agreement further states that the capacity and circuits for installation of EV charging stations to be provided in the garages of residential units and all new large-scale commercial buildings that are over 162,000 square feet. This is an enhancement of Measures R2-T7 and R3-T2 proposed in the 2015 CAP. Potential actions for this measure include:

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[25] Partial Settlement Agreement, 2017. Petitioners: Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society and Respondents: County of Riverside and Riverside County Board of Supervisors.

- Require all new residential development to include EV chargers in the garages of residential units.
- Promote EV incentive programs at outreach meetings.
- Promote Neighborhood Electric Vehicle (NEV).
- Support application for grants to install e-chargers at public facilities.
- Work with community groups and businesses to install e-chargers.
- Comply with State Title 24 energy efficiency requirements for new commercial development to install e-chargers starting in 2020.

4.3 Energy Efficiency

A. R1 Energy Efficiency Measures

The following list of R1 energy efficiency related measures are those measures that California has identified in the regulations that will result in emission reductions within Riverside County and are included in the ABAU forecasts.

R1-EE1: California Building Code Title 24

California's building efficiency standards are updated regularly to incorporate new energy efficiency technologies. The code was most recently updated in 2016 and went into effect for new development in 2017. For projects implemented after January 1, 2017, the California Energy Commission estimates that the 2016 Title 24 energy efficiency standards will reduce consumption by an estimated 28 percent for residential buildings and 5 percent for commercial buildings, relative to the 2013 standards. These percentage savings relate to heating, cooling, lighting, and water heating only; therefore, these percentage savings were applied to the estimated percentage of energy use by Title 24.

B. R2 Energy Measures

The following list of R2 measures are measures related to energy efficiency Riverside County can incorporate into the existing residential and non-residential buildings or new development projects to achieve a State-aligned reduction target. These R2 energy measures also support the General Plan policies as shown in Table 4-1, particularly related to energy efficiency in buildings, regional agency coordination/education and outreach, including LU-4.1, OS-16.1 through OS-16.10, AQ-4.1 through AQ-4.4, AQ-5.2, AQ-5.4, and AQ-20.10 through AQ-20.12.

R2-EE1: Energy Efficiency Training, Education, and Recognition in the Residential Sector

Opportunities for residents to improve energy efficiency in their homes include changes to their behaviors and physical modifications or improvements to their homes. Education of the public is at the core of attaining energy efficiency goals. While most of the measures include an outreach component, creating a specific education measure would emphasize the critical role of education in achieving energy efficiency. An education measure would also provide County staff with a framework to educate community members about behavioral and technological changes that can increase energy efficiency. This is an enhancement of Measure R3-E2 proposed in the 2015 CAP. Potential actions for this measure include:

- Post energy efficiency information or links on websites and/or social media and provide materials at public events.
- Set up an email list for blasts of new information or training sessions.
- Encourage homeowners to use the SCE Energy Education Centers for energy-efficiency resources.
- Promote and manage energy-efficiency programs which are not already in the purview of Energy Service Providers.
- Require building inspectors to hold trainings semi-annually on energy efficiency and Title 24 requirements.

R2-EE2: Increase Community Participation in Existing Energy-Efficiency Programs

There are many energy efficiency opportunities that are low-cost for residents to initiate and would result in cost savings over time. These opportunities are generally from existing programs, such as SCE and SoCalGas, which offer rebates and incentives to purchase energy-efficient appliances and lights. Through this measure, the County would work to increase residents' participation in existing energy efficiency programs that are low-cost and would provide a financial benefit to the residents. As programs change over time, continued and up-to-date outreach would be necessary. This is an enhancement of Measure R3-E4 proposed in the 2015 CAP. Potential action for this measure includes:

- Partner with the Southern California Association of Governments (SCAG), Western Riverside Council of Governments (WRCOG), SCE, and SoCalGas for outreach events, such as annual energy-efficiency fair.

R2-EE3: Home Energy Evaluations

Home energy evaluations are necessary to identify cost-effective opportunities for energy savings and for residents to take practical actions to achieve energy efficiency. Home energy evaluations can be established or promoted by a variety of existing programs. This is a new measure for the County's consideration. Potential action for this measure includes:

- Promote SCE energy audits program for residents within the SCE service area and the Home Energy Saver Do It Yourself online energy audits for the IID service area.

R2-EE4: Residential Home Energy Renovations

Approximately 31 percent of the residential buildings in the unincorporated area of Riverside County were constructed before the adoption of Title 24 (SCAG 2017). Renovations to buildings constructed before the adoption of Title 24 would evidently improve energy efficiency. Many federal and State programs and incentives support home energy renovations, including County-supervised funding, permit process improvements, and County ordinances. This is an enhancement of Measures R1-E4, R1-E5, R2-E3, and R2-E4 proposed in the 2015 CAP. Potential actions for this measure include:

- Review Title 24 code compliance for existing residential buildings during code enforcement inspections of residential properties.
- Promote existing home energy-renovation programs.
- Promote participation in green building programs, such as Leadership in Energy and Environmental Design (LEED) and Energy Upgrade California.
- Promote financing programs for home upgrades, such as Home Energy Renovation Opportunity (HERO) program sponsored by the Western Riverside County Council of Governments (WRCOG) and other Property Assessed Clean Energy (PACE) programs in the IID service area.
- Establish online permitting to facilitate upgrades.

R2-EE5: Exceed Energy Efficiency Standards in New Residential Units

County planners have a unique opportunity to encourage or inform developers of new energy efficiency opportunities for new development. This measure would educate County staff to encourage and implement energy efficiency measures beyond those required in current Title 24 standards. This measure would also ensure that as Title 24 standards are updated, County staff are well informed and can implement updates quickly and effectively. This is an enhancement of Measures R2-E1 and R2-E2 proposed in the 2015 CAP. Potential actions for this measure include:

- Educate County staff and developers on future Title 24 updates and new energy efficiency opportunities for new residential development.
- Promote Tier 1 and Tier 2 green building ratings such as LEED, Build It Green, or Energy Star®-certified buildings.
- Establish online permitting to facilitate new residential building energy-efficiency programs.
- Comply with State Title 24 energy efficiency requirements on new residential buildings, such as zero net energy homes that require all new residential construction projects to achieve zero net-energy use by 2020.

R2-EE6: Energy Efficiency Training, Education and Recognition in the Commercial Sector

Education is at the core of attaining energy efficiency goals. A specific education measure would emphasize the critical role of education in achieving energy efficiency. This measure would provide County staff with a framework to interact with and educate the community about behavioral and technological changes that can increase energy efficiency in commercial buildings. This is an enhancement of Measure R3-E2 proposed in the 2015 CAP. Potential actions for this measure include:

- Post energy-efficiency information or links on websites and/or social media and provide materials at public events
- Set up an email list for blasts of new information or training sessions.
- Encourage business owners to visit SCE Energy Education Centers for energy efficiency resources.
- Promote and manage energy efficiency programs which are not already in the purview of Energy Service Providers.
- Invite building inspectors to hold trainings semi-annually on energy efficiency and Title 24.

R2-EE7: Increase Business Participation in Existing Energy Efficiency Programs

There are many energy efficiency opportunities that are low-cost for businesses to initiate that would result in cost-savings over time. SCE and SoCalGas offer many rebates and incentives to purchasing energy-efficient appliances and lights. As many business owners may be unaware that the opportunities exist, this measure would allow for the County to increase the participation of businesses in existing energy-efficiency programs that are low-cost and would provide financial benefits. This is an enhancement of Measure R3-E4 proposed in the 2015 CAP. Potential action for this measure includes:

- Partner with SCAG, WRCOG, SCE, and SoCalGas for outreach events.

R2-EE8: Non-Residential Building Energy Audits

Commercial energy audits are necessary to identify cost-effective opportunities for energy savings and for business owners to take practical actions to increase energy efficiency. The audits can be established or promoted by various existing programs. This is a new measure for the County's consideration. The potential action for this measure is:

- Promote the SCE energy audit program for residents within the SCE service area and the Home Energy Saver Do It Yourself online energy audits for the IID service area.

R2-EE9: Non-Residential Building Retrofits

As many of commercial buildings in unincorporated area of Riverside County were constructed before the adoption of Title 24, their facilities and equipment are not considered energy efficient. Therefore, retrofits are necessary to achieve higher energy efficiency. Many federal and State programs and incentives support non-residential building energy retrofits, including County-supervised funding, permit process improvements, and County ordinances. This is an enhancement of Measures R1-E4, R1-E5, and R2-E7 proposed in the 2015 CAP. Potential actions for this measure include:

- Review Title 24 code compliance for existing non-residential buildings during code enforcement inspections.

- Promote existing non-residential building retrofits programs.
- Promote participation in green building programs, such as California Solar Initiative.
- Promote energy efficiency retrofit financing programs for non-residential buildings such as Property Assessed Clean Energy (PACE).
- Establish online permitting to facilitate retrofits.

R2-EE10: Energy Efficiency Enhancement of Existing and New Infrastructure

Enhancing energy efficiency of existing and new infrastructure presents an opportunity for energy and cost savings for the County. The County could achieve energy savings by deploying high-efficiency lighting in new traffic signals and retrofitting existing traffic signals with energy-efficient lighting. Conventional traffic signals employ incandescent lamps. They are not energy-efficient and the on-going energy charge contributes a high proportion of the recurrent cost. Comparing with the conventional traffic signals, high-efficiency traffic signals consume much less electricity (about one-third or less) and have longer design life (over 10 years). The Settlement Agreement[26] calls for consideration of a policy to require the use of high-efficiency bulbs at all new traffic signal lights and converting 100 percent existing traffic signal lights to high-efficiency bulbs by 2020. Per the Settlement Agreement, caution should be exercised while retrofitting the signals in the Mt. Palomar area to ensure the high-efficiency bulbs do not cause any interference with the night sky viewing at Palomar Observatory. The potential actions for this measure include:

- Retrofit existing traffic signals with high-efficiency Light Emitting diodes (LEDs).
- Use high-efficiency LEDs for all new traffic signals.

R2-EE11: Exceed Energy Efficiency Standards in New Commercial Units

County planners have a unique opportunity to inform and encourage developers to apply new energy efficiency opportunities in new development. This measure would educate County staff to encourage and implement energy efficiency beyond that required by current Title 24 standards. This measure would also ensure that as Title 24 standards are updated, County staff would be well informed and could implement updates quickly and effectively. This is an enhancement of Measures R2-E5 and R2-E6 proposed in the 2015 CAP. Potential actions for this measure include:

- Educate County staff and developers on future Title 24 updates and additional energy efficiency opportunities for new non-residential development.
- Promote Tier 1 and Tier 2 Green Building Ratings such as LEED, Build It Green, or Energy Star®-certified buildings.

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[26] Partial Settlement Agreement, 2017. Petitioners: Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society and Respondents: County of Riverside and Riverside County Board of Supervisors.

- Establish online permitting to facilitate new non-residential building energy efficiency programs.
- Comply with State requirements on new non-residential buildings, such as Net-Zero Energy Buildings for all new non-residential development meeting zero net-energy use by 2030.

4.4 Clean Energy

A. R1 Clean Energy Measure

The following list of R1 clean energy related measures are those measures that California has identified in the regulations that will result in emission reductions within Riverside County and are included in the ABAU forecasts.

R1-CE1: Renewable Portfolio Standard

Senate Bills (SBs) 1075 (2002) and 107 (2006) created the State's Renewable Portfolio Standard (RPS), and SB 100 (2018) further requires the energy providers to derive 33 percent, 60 percent, and 100 percent of electricity from qualified renewable sources by 2020, 2030, and 2045, respectively. The RPS is anticipated to lower emission factors (i.e., fewer GHG emissions per kWh used) State-wide. Therefore, reductions from RPS are taken for energy embedded in water, as well as commercial/industrial and residential electricity.

B. R2 Clean Energy Measure

The following list of R2 measures are measures related to clean energy Riverside County can incorporate into the existing residential and non-residential buildings or new development projects to achieve a State-aligned reduction target. These R2 Clean Energy Measures also support the implementation of General Plan policies related to Renewable/Alternative Energy as shown in Table 4-1, including LU-16.1, OS 11.1 through OS 11.3, OS-12.1, OS-12.4, OS-13.1, AQ-20.18, and AQ-20.19.

R2-CE1: Clean Energy

Clean energy includes energy efficiency and clean energy supply options such as highly efficient combined heat and power as well as renewable energy sources. Installing solar photovoltaics panels on residential and commercial building rooftops is an effective way to produce renewable energy on-site. Moreover, when combined with energy storage systems, solar panels could continuously meet residential and commercial energy demand. The Riverside County Settlement Agreement[27] requires that on-site renewable energy production (including but not limited to solar) shall apply to any tentative tract map, plot plan, or conditional use permit that proposes to add more than 75 new dwelling units of residential development or one or more new buildings totaling more than 100,000 gross square feet of commercial, office, industrial, or manufacturing development. Renewable energy production shall be onsite generation of at least 20 percent of energy demand for commercial, office, industrial or

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27 Partial Settlement Agreement, 2017. Petitioners: Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society and Respondents: County of Riverside and Riverside County Board of Supervisors.

manufacturing development, meet or exceed 20 percent of energy demand for multi-family residential development, and meet or exceed 30 percent of energy demand for single-family residential development. These renewable energy requirements should be updated with every CAP Update by the County based on most recent technology advancements.

By identifying, designing, and implementing the clean energy measures and technology solutions, Riverside County would receive environmental and economic benefits, including reductions in GHG emissions. This is an enhancement of Measures R1-E6 and R3-E3 proposed in the 2015 CAP. Potential action for this measure includes:

- Outreach to the community to promote clean energy incentives.
- Require solar panel installation on new residential buildings (per conditions of the Settlement agreement described above).
- Require solar panel installation on new commercial buildings and commercial parking lots (per conditions of the Settlement Agreement described above).
- Encourage energy storage system installation with solar panels.

R2-CE2: Community Choice Aggregation Program

Assembly Bill 117, which was signed into law in 2002, allows California cities and counties to either individually or collectively supply electricity to customers within their borders through the establishment of a Community Choice Aggregation (CCA) program. The County could assess the feasibility of initiating a CCA program. CCA programs that are currently operating have renewable energy percentages between 33 and 100, and the national opt-out rates for these programs range from 3 to 8 percent with most programs at or below 5 percent.[28] Participation in a CCA program could provide a significant source of future emission reductions to the County. The first step is to conduct a feasibility analysis to assess the benefits, costs, risks, and obstacles of a CCA program. Then the County could make a decision to whether or not implement a local CCA program or opt for a regional CCA. The advantages of regional CCAs that include participation from multiple local jurisdictions would be the creation of efficiencies. The County could seek opportunities for collaboration with other local jurisdictions to develop and implement a CCA that would produce mutually beneficial results. Developing a CCA would require a detailed analysis of energy demand, efficiency opportunities, and available clean electricity sources for purchase. Per the Settlement Agreement,[29] the County must update the CAP every four years. This allows enough time to conduct a feasibility analysis on initiating a CCA program and provide details on the reduction potential based upon the decisions of the County.

Potential action for this measure includes:

- Evaluate the potential for implementing a CCA program to meet GHG reduction targets

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[28] There are 17 operational CCA programs in California as of September 2018. Source: Local Energy Aggregation Network. Website: http://leanenergyus.org/cca-by-state/california/ (accessed September 2018).

[29] Partial Settlement Agreement, 2017. Petitioners: Sierra Club, Center for Biological Diversity, San Bernardino Audubon Society and Respondents: County of Riverside and Riverside County Board of Supervisors.

- Conduct feasibility analysis to initiate a CCA program at the County level or in cooperation with other jurisdictions.

4.5 Advanced Measures

The following measures are focused on reducing urban heat island effect and therefore indirectly reduce energy use throughout unincorporated area of Riverside County. These measures can be incorporated into development projects without additional costs.

A. R2 Advanced Measures

The following R2 measures are related to landscape strategies that will help reduce GHG emissions. These measures strategically place trees and other landscape mechanisms that create shade to reduce the heat island effect within parking lots and adjacent to buildings, which in turn, reduces the temperature of buildings and cars during the summer. The General Plan includes some of these advanced measures as part of the Municipal Operational Objectives, included in the Air Quality Element.

R2-L1: Tree Planting for Shading and Energy Saving

Trees and vegetation lower surface and air temperatures by providing shade and through evapotranspiration, making vegetation a simple and effective way to reduce urban heat islands. Shaded surfaces may be 20 to 45 degrees Fahrenheit ([°F], equal to 11 to 25 degrees Celsius [°C]) cooler than the peak temperatures of unshaded materials. In addition, evapotranspiration, alone or in combination with shading, can help reduce peak summer temperatures by 2 to 9 °F (or 1 to 5 °C). Trees and vegetation that directly shade buildings can reduce energy use by decreasing demand for air conditioning. This is an enhancement of Measure R3-L1 proposed in the 2015 CAP. Potential actions for this measure include:

- Work with the community to support nonprofit tree-planting groups within the County consisting of volunteers to plant and care for trees correctly and safely.
- Develop and promote a County tree-planting program for new development at plan check.

R2-L2: Light Reflecting Surfaces for Energy Saving

Replacing surface areas with light-reflecting materials can decrease heat absorption and lower outside air temperature. Both roofs and pavements are ideal surfaces for taking advantage of this advanced technology.

A cool roof is built from materials with high thermal emittance and high solar reflectance, or albedo, to help reflect sunlight and the associated energy away from a building. These properties help roofs absorb less heat and stay up to 50 to 60 °F (or 28 to 33 °C) cooler than conventional materials during peak summer weather. Cool roofs may be installed on low-slope roofs (such as the flat or gently sloping roofs typically found on commercial, industrial, and office buildings) or the steep-sloped roofs used in many residences and retail buildings.

Cool pavement is built from materials that reflect more solar energy, enhance water evaporation, or have been otherwise modified to remain cooler than conventional pavements. Cool pavement can be created with existing paving technologies as well as newer approaches such as the use of coatings, permeable paving, or grass paving. Cool pavements save energy by lowering the outside air temperature, allowing air conditioners to cool buildings with less energy, and reducing the need for electric street lighting at night.

This is an enhancement of Measure R3-L2 proposed in the 2015 CAP. Potential actions for this measure include:

- Comply with Title 24 requirements on installing enhanced cool roofs.
- Comply with Title 24 requirements on installing cool pavements.

4.6 Water Efficiency

While GHG emissions from consumer water use and wastewater treatment in the unincorporated area of Riverside County accounted for a very small percent of the total community emissions in 2017, water efficiency strategies assist in extending current water supplies (LSA 2018). GHG emissions are generated in the transport and consumption of water due to the energy needed to supply water to the end user. Note that the various water districts throughout the County enforce the water conservation programs. However, there are still many opportunities to reduce water consumption throughout the County during the land use approval process.

A. R1 Water Efficiency Measures

The following list of R1 water efficiency related measures are based on the State of California regulations that will result in emission reductions within Riverside County and are included in the ABAU forecasts.

R1-W1: Renewable Portfolio Standard Related to Water Supply and Conveyance

This measure would increase electricity production from eligible renewable power sources to 33 percent by 2020, 60 percent by 2030, and 100 percent by 2045. A reduction in GHG emissions results from replacing natural gas-fired electricity production with zero GHG-emitting renewable sources of power.

B. R2 Water Efficiency Measures

The following list of R2 measures are measures related to water efficiency that Riverside County can incorporate into the water management practices to achieve a State-aligned reduction target. These R2 measures also support the implementation of General Plan Policies related to Water Conservation as shown in Table 4-1, including LU-4.1, C-5.2, OS-1.4, OS-2.1 through 2.5, and AQ-20.13 through AQ-20.17.

R2-W1: Water Efficiency through Enhanced Implementation of Senate Bill X7-7

SB X7-7, or The Water Conservation Act of 2009, requires all water suppliers to increase water use efficiency. The legislation set an overall goal of reducing per capita urban water consumption by 20 percent from a baseline level by 2020. While water districts are responsible for implementation of SB X7-7, the County can provide a meaningful supporting role in the implementation of water conservation. This goal can be met by taking a variety of actions, including supporting targeted public outreach by water districts and promoting water efficiency measures such as low-irrigation landscaping. This is an enhancement of Measure R2-W1 proposed in the 2015 CAP. Potential actions for this measure include:

- Provide general water efficiency information and links to water district conservation webpages on the County's website.
- Implement the low-irrigation landscaping requirements..

R2-W2: Exceed Water Efficiency Standards

In addition to SB X7-7, more actions are being studied or have been taken to exceed water efficiency standards. These efforts include education and outreach practices that could be combined with residential and commercial actions that promote reuse or recycled water, use of grey water, and the collection and use of harvested rainwater. This is an enhancement of Measures R2-W1 and R2-W2 proposed in the 2015 CAP. Potential actions for this measure include:

- Support water districts in direct outreach to homeowner associations, businesses, and other community groups to inform them on water efficiency standards
- Promote recycled or grey water for community uses such as residential landscaping.
- Promote rainwater harvesting rebates and demonstrations.

4.7 Solid Waste

GHG emissions from unincorporated area of Riverside County's solid waste generation are the third largest emission source of the total community emissions in 2017 (LSA 2018). There are many opportunities to reduce waste disposal and increase waste recycling and composting. The R2 measures presented here also support the General Plan policies related to waste reduction as shown in Table 4-1, including AQ-5.1 and AQ-20.20.

A. R2 Solid Waste Measure

The following list of R2 measures are measures related to solid waste that Riverside County can incorporate into the waste management practices to achieve a State-aligned reduction target.

R2-S1: Reduce Waste to Landfills

According to 2014 Statewide Waste Characterization data (CalRecycle 2015), much of the waste disposed in landfills is readily recyclable. Increasing the recovery of recyclable materials will directly reduce GHG emissions. In particular, recycled materials can reduce the GHG emissions from multiple phases of product production, including extraction of raw materials, preprocessing, and manufacturing. This is an enhancement of Measures R1-S1, R2-S1, R3-S2, and R3-S3 proposed in the 2015 CAP. Potential actions for this measure include:

- Outreach to the community to promote waste recycling and diversion.
- Add additional recycling containers in public places.
- Comply with Statewide waste reduction, recycling, and composting requirements.
- Promote community clean-up days by providing commercial containers for trash and recycling.

Chapter 5
Total Estimated Reductions

Riverside County is projected to emit a total of 5,158,305 MT CO_2e in 2020, 6,368,781 MT CO_2e in 2030, and 11,305,026 MT CO_2e in 2050 without the incorporation of reduction measures under the BAU forecast. As discussed in Chapter 3, under the ABAU forecast, the State-wide reduction measures would reduce the GHG emissions to 4,861,256 MT CO_2e in 2020, 4,102,109 MT CO_2e in 2030, and 4,175,146 MT CO_2e in 2050. Because the 2020 ABAU emissions are below the State-aligned target, no local reduction measures were proposed or quantified for 2020. With implementation of the local reduction measures (R2 measures) discussed in Chapter 4, Riverside County emissions would be reduced to 2,434,649 MT CO_2e in 2030 and 562,730 MT CO_2e in 2050.

5.1 Reductions from Local Measures

The local reduction measures (R2 measures) discussed in Chapter 4 would be implemented primarily through the Screening Tables for New Development and with General Plan policies. These measures go beyond the State measures to reduce GHG emissions in order to meet the 2030 and 2050 reduction targets. Table 5-1 (R2 Measures and Associated Emissions Reduced from 2030 and 2050 Inventories) summarizes the MT CO_2e and the corresponding percentage of emissions reduced for each of the R2 measures.

Table 5-1 R2 Measures and Associated Emissions Reduced from 2030 and 2050 Inventories

	2030 MT CO_2e Reductions	2030 % of BAU Emissions	2050 MT CO_2e Reductions	2050 % of BAU Emissions
Transportation				
R2-T1: Alternative Transportation Options	161,932	2.5	368,711	3.3
R2-T2: Adopt and Implement A Bicycle Master Plan to Expand Bike Routes Around the County	2,234	<0.1	5,086	<0.1
R2-T3: Ride-Sharing and Bike-to-Work Programs within Businesses	182,846	2.9	416,332	3.7
R2-T4: Electrify the Fleet	274,370	4.3	624,729	5.5
Transportation Total	621,382	9.8	1,414,858	12.5
Energy				
R2-EE1: Energy Efficiency Training, Education, and Recognition in the Residential Sector	-[1]	-	-	-
R2-EE2: Increase Community Participation in Existing Energy Efficiency Programs	16,845	0.3	28,091	0.2
R2-EE3: Home Energy Evaluations	-[1]	-	-	-
R2-EE4: Residential Home Energy Renovations	11,749	0.2	19,592	0.2
R2-EE5: Exceed Energy Efficiency in New Residential Units	39,408	0.6	318,632	2.8
R2-EE6: Energy Efficiency Training, Education, and Recognition in Commercial Sector	-[1]	-	-	-

	2030 MT CO_2e Reductions	2030 % of BAU Emissions	2050 MT CO_2e Reductions	2050 % of BAU Emissions
R2-EE7: Increase Business Participation in Existing Energy Efficiency Programs	31,878	0.5	67,730	0.6
R2-EE8: Non-Residential Building Energy Audits	-[1]	-	-	-
R2-EE9: Non-Residential Building Retrofits	173,554	2.7	368,747	3.3
R2-EE10: Energy Efficiency Enhancement of Existing and New Infrastructure	-[1]	-	-	-
R2-EE11: Exceed Energy Efficiency in New Commercial Units	33,418	0.5	580,161	5.1
Energy Total	306,851	4.8	1,382,953	12.2
Clean Energy				
R2-CE1: Clean Energy	34,204	0.5	34,204	0.3
R2-CE2: Community Choice Aggregation Program Reductions (If Implemented)	609,022	9.6	609,022	5.4
Clean Energy Total	643,226	10.1	643,226	5.7
Advanced Measures				
R2-L1: Tree Planting for Shading and Energy Saving	13	<0.1	22	<0.1
R2-L2: Light-Reflecting Surfaces for Energy Saving	1,845	<0.1	3,294	<0.1
Advanced Measures Total	13	<0.1	22	<0.1
Water Efficiency				
R2-W1: Water Efficiency through Enhanced Implementation of Senate Bill X7-7	5,666	0.1	10,114	0.1
R2-W2: Exceed Water Efficiency Standards	116	<0.1	206	<0.1
Water Efficiency Total	5,781	0.1	10,320	0.1
Solid Waste				
R2-W1: Reduce Waste to Landfills	88,362	1.4	157,742	1.4
Solid Waste Total	88,362	1.4	157,742	1.4
Total Reductions	1,667,460	26.2	3,612,416	32.0

[1] Supportive measure. No GHG reductions were calculated.
BAU = business-as-usual
MT CO_2e = metric ton carbon dioxide equivalent

5.2 Reduced Community-Wide Emissions Inventory

By 2030, the State-wide and local measures together would reduce the Riverside County's community GHG emissions from the 2030 BAU level to 2,434,649 MT CO_2e, which exceeds the 49 percent below 2008 levels reduction target of 3,576,598 MT CO_2e for 2030. In 2050, implementation of State-wide and local measures together would reduce emissions from the 2050 BAU level to 562,730 MT CO_2e, which exceeds the 83 percent below 2008 levels reduction target of 1,192,199 MT CO_2e for 2050. Table 5-2 (Community-Wide Emissions and Targets Comparison) summarizes the baseline 2008 community-wide emissions, the projected 2020, 2030, and 2050 emission inventories, as well as the reduced 2030 and 2050 inventories after implementation of the reduction measures for community operations.

Table 5-2 Community-Wide Emissions and Targets Comparison

	2008 MT CO_2e	2017 MT CO_2e	2020 MT CO_2e	2030 MT CO_2e	2050 MT CO_2e
BAU Emissions	7,012,938	4,905,518	5,158,305	6,368,781	11,305,026
Reduction Target	--	--	5,960,997	3,576,598	1,192,199
State and Federal Reductions	--	--	297,049	2,266,672	7,129,879
Local Measures Reductions	--	--	--	1,667,460	3,612,416
Total Adjusted Emissions	--	--	4,861,256	2,434,649	562,730
Additional Reductions Needed	--	--	Target Met	Target Met	Target Met

BAU = Business-as-Usual
MT CO_2e = metric tons of carbon dioxide equivalent

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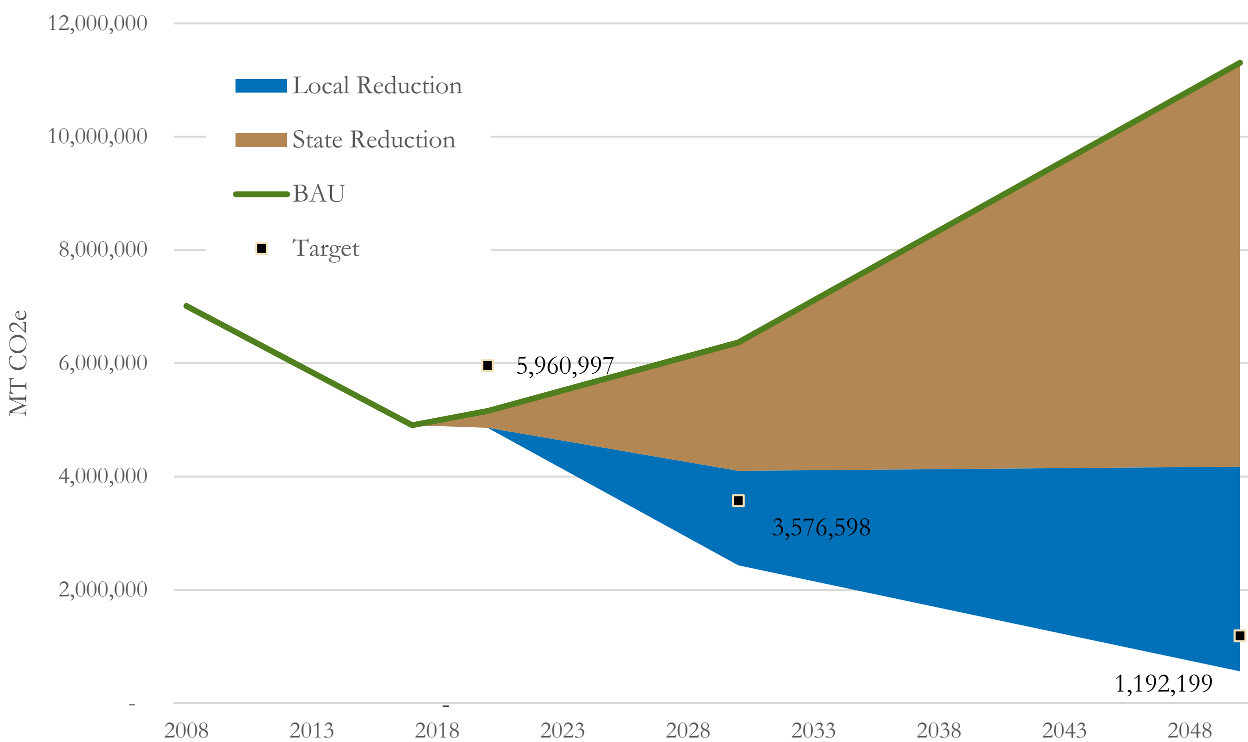
Chapter 6
Conclusions

This CAP Update serves as a guide to help Riverside County implement the objectives of conserving resources and reducing GHG emissions. This document also serves as a technical resource for the proposed update of Riverside County's current General Plan and other land use related documents that may require evaluation and documentation of GHG emissions. Figure 6-1 (State and Local Reductions Comparison with Targets for Riverside County) shows a comparison between the emission inventories, including the reduced 2020, 2030, and 2050 inventories. The green line represents the GHG inventories for 2008 and 2017, and the BAU forecasts for 2020, 2030, and 2050. The brown area represents the State reductions, while the blue area shows the local reductions (R2 measures) described in Chapter 4.

Figure 6-1 State and Local Reductions Comparison with Targets for Riverside County



This CAP Update sets a target to reduce community-wide GHG emission emissions by 15 percent from 2008 levels by 2020, 49 percent by 2030, and 83 percent by 2050. The CARB Scoping Plan outlines the reduction strategies designed to meet the State-wide reduction goal of AB 32. Reduction measures provided herein would ensure that Riverside County meets the reduction target of reducing to 49 percent below 2008 levels (3,576,598 MT CO_2e) by 2030 and 83 percent below 2008 levels (1,192,199 MT CO_2e) by 2050. Such programs include strengthening Riverside County's existing programs as well as implementing the Screening Tables for New Development. In some cases, implementation will require the cooperation of other agencies, private businesses, and residents. The success of these measures will be tracked using indicators and targets such as those described in this CAP Update. Even with the anticipated growth, the modernization of vehicle fleets, combined with the continued implementation of the proposed measures, will reduce GHG emissions by approximately 3,934,131 MT CO_2e from 2030 levels and 10,742,295 MT CO_2e from 2050 levels. Therefore, the implementation of the State measures combined with Riverside County's R2 measures will reduce GHG emissions down to 2,434,649 MT CO_2e by year 2030, which is 1,141,949 MT CO_2e below the reduction target, and 562,730 MT CO_2e by 2050, which is 629,469 MT CO_2e below the reduction target.

Through 2050, Riverside County would continue implementation of the Screening Tables. During this time, the reduction measures implemented through the Screening Tables would continue to reduce GHG emissions from new development. Additionally, it is assumed that the State measures would keep being updated and reinforced to further reduce emissions. With these assumptions, Riverside County's emissions would decrease to a level below the reduction target by 2050. Continued implementation of this CAP Update is discussed in Chapter 7.

Chapter 7 Implementation

The 2015 CAP, adopted by the Riverside County included the GHG reduction target of 15 percent below 2008 levels by 2020. This entailed reducing annual emissions from 7,012,938 MT CO_2e down to 5,960,998 MT CO_2e by year 2020[30]. The County is well underway towards meeting the 2020 target and is expected to exceed the target.

This CAP Update includes reduction targets for year 2030 and year 2050. These reduction targets require the County to reduce emissions by at least 525,511 MT CO_2e below the ABAU scenario by 2030 and at least 2,982,948 MT CO_2e below the ABAU scenario by 2050. The reduction measures described in Chapter 5 are designed to meet the 2030 and 2050 reduction targets. This section describes the steps required to implement the strategies identified in the CAP Update to support the achievement of GHG reduction goals for the community at large. Success in meeting Riverside County's GHG emission reduction goals will depend on cooperation, innovation, and participation by Riverside County and residents, businesses, and government entities in Riverside County's land use jurisdictions. This section outlines key steps that the County of Riverside will follow for the implementation of this CAP Update.

7.1 STEP 1 – Administration and Staffing

The County will oversee and document implementation of the reduction measures and provide periodic monitoring of emissions with participation of the following departments, but will be expanded as needed to ensure coordinated leadership in plan implementation:

- Riverside County Executive Office – The executive office can provide economic, financial and administrative guidance and support to the Implementation Coordinator.
- Transportation Land Management Agency (TLMA) – Riverside County's Land Use umbrella agency will provide coordination between the various land use divisions, including, but not limited to Building & Safety and Transportation and will assist in the implementation of New Development Implementation Measures.

[30] Riverside County Climate Action Plan (CAP), 2015. Website: https://planning.rctlma.org/CAP.aspx.

- Riverside County Economic Development Agency-Facilities Management Division – This County division administers the energy-efficiency improvements to Riverside County-owned facilities being constructed as a result of the Energy Efficiency and Conservation Block Grant (EECBG) funding.
- Planning Division – Planning can provide expertise in the project entitlement process and provide long-term planning support.
- Interagency/Entity Coordination – Considering the multiple agencies involved in the implementation of different aspects of CAP Update. It will be essential for the County to ensure interagency coordination for effective implementation of the reduction measures and strategies.

7.2 STEP 2 – Financing and Budgeting

Implementation of the CAP Update will require creative, continuing, and committed financing. Local, regional, State, and federal public sources of funding will be needed along with the substantial involvement of the private sector. The Riverside County CAP Implementation Plan will take into account the costs and staff resources throughout implementation of the plan as well as the financial benefits and cost savings. The following different financing options will be explored by the County of Riverside:

- State and Federal Grants and Low-Interest Loans – As described below, there are a variety of grant and loan programs that exist in various sectoral areas.
- Support from Local Businesses, Non-Profits, and Agencies – Opportunities for public/private partnerships (like the SCE partnerships) exist to provide cooperation on many aspects of the CAP including energy efficiency retrofits, waste minimization, transit promotion and education.
- Self-Funding and Revolving Fund Programs – Innovative programs to fund residential solar investments.
- Agreements with Private Investors – Energy service companies and other private companies can finance up-front investments in energy efficiency and then be reimbursed through revenues from energy savings.
- Taxes and Bonds – Various local governments have used targeted finance instruments for solar, transportation, vehicle improvements and landfill methane controls.

Given that financing is vital to implementing many of the CAP measures, a review of current and potential funding sources was completed for the different sectors covered in this CAP Update and is presented below to help early phase implementation of the CAP. Whether at the federal, western regional or State level, it appears likely that there will be some form of a "cap and trade" system in place within several years. This system, depending on its particular character, is likely to influence energy prices (such as for electricity, natural gas, and vehicle fuels), and may make currently cost-ineffective measures more economically feasible in the medium term and allow the financing of a broader range of plan measures.

A. Energy Efficiency and Renewable Energy Financing

Federal Energy Efficiency Community Block Grants (EECBG). As part of the stimulus package (the "American Recovery and Reinvestment Act" or ARRA), signed into law by President Obama in spring 2009, block grants are available for energy efficiency planning and improvements in the building, transportation and other sectors[31]. The purpose of the EECBG Program is to assist eligible jurisdictions in creating and implementing strategies to: reduce fossil fuel emissions in a manner that is environmentally sustainable and that maximizes, to the greatest extent practicable, benefits for local and regional communities; reduce the total energy use of the eligible entities; and improve energy efficiency in the building sector, the transportation sector and other appropriate sectors. Eligible activities include: development of an energy efficiency and conservation strategy; technical consultant services; residential and commercial building energy audits; financial incentive programs; energy efficiency retrofits; energy efficiency and conservation programs for buildings and facilities; development and implementation of certain transportation programs; building codes and inspections; certain distributed energy projects; material conservation programs; reduction and capture of methane and greenhouse gases from landfills and dairies; efficiency traffic signals and street lighting; renewable energy technologies on government buildings; and other appropriate activity.

Federal Tax Credits for Energy Efficiency. On October 3, 2008, President Bush signed into law the "Emergency Economic Stabilization Act of 2008." This bill extended tax credits for energy efficient home improvements (windows, doors, roofs, insulation, HVAC and non-solar water heaters). These residential products during 2008 were not eligible for a tax credit, as previous tax credits had expired at the end of 2007. The bill also extended tax credits for solar energy systems and fuel cells to 2016. New tax credits were established for small wind energy systems and plug-in hybrid electric vehicles. Tax credits for builders of new energy-efficient homes and tax deductions for owners and designers of energy efficient commercial buildings were also extended. Under the Bipartisan Budget Act of 2018[32] which was signed in February 2018, a number of tax credits for residential energy efficiency that had expired at the end of 2016 were renewed. Tax credits for non-business energy property are now available retroactive to purchases made through December 31, 2017. Tax credits for all residential renewable energy products have been extended through December 31, 2021, and feature a gradual step down in the credit value.

SCE Energy Efficiency / Renewable Energy Incentives

The majority of the County's electricity consumption came from SCE, therefore, SCE energy efficiency and renewable energy incentives would be the main source for the County. The SCE energy efficiency and renewable energy incentives are listed below:

- Online or mail-in Home Energy Efficiency Survey. This 15-minute survey gives helpful energy-saving tips that will also help the environment. The questions and tips are tailored for residential energy usage.
- Rebate programs for residential use include lighting, appliances, heating and cooling, multifamily housing, pool, solar leadership and customer generation.

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31 Federal Energy Efficiency Community Block Grants (EECBG). Website: https://www.energy.gov/eere/wipo/energy-efficiency-and-conservation-block-grant-program (accessed December 27, 2018).

32 Federal Tax Credits. Website: https://www.energystar.gov/about/federal_tax_credits (accessed December 27, 2018).

- Energy Centers provide free information, training and support to make important Energy Management and energy efficiency choices.
- SCE Energy Manager offers online access to usage information and detailed cost analyses business energy use.
- Financial Offerings include on-Bill Financing, Zero-interest financing towards the purchase and installation of qualifying energy efficient equipment for commercial, industrial and agricultural customers.
- Regulation & Compliance Support "The Cool Planet Project" assists customers with recent installations or efficiency projects resulting in excess of one million kWh of energy in joining the Climate Registry.
- Solar Leadership helps create a cleaner energy future with innovative solutions that make it possible for you to join the solar movement.
- Self-Generation provides financial incentives for installing self-generation equipment to meet all or a portion of a facility's energy needs.
- Specialized Services for Facilities:
  - New Buildings – Receive technical assistance in the design and construction of new energy efficient buildings.
  - Savings by Design: New construction builders and buyers can receive design assistance, owner incentives, and design team incentives.
  - California Advanced Homes - Incentives, design assistance, and technical education and services to encourage homebuilders to build homes that exceed California's Title 24 code standards by at least 15 percent.
  - Full-service solutions are available to qualifying customers to receive assistance in identifying and evaluating energy efficiency opportunities within existing buildings.
  - Retro Commissioning - Receive assistance to improve the bottom line in existing building's operations through specialized services to detect inefficiencies in complex building systems, and to determine optimum operating conditions.
- Heating, Ventilation & Air Conditioning - Lower operating costs and increase equipment life through proper HVAC installation and regular maintenance. Future programs will focus on two key components:
  - A/C Quality Maintenance, and
  - A/Q Quality Installation.

AB 811 Financing Districts. AB 811 permits the creation of assessment districts to finance installation of distributed generation renewable energy sources or energy efficiency improvements that are permanently fixed to residential, commercial, industrial, or other real property. Riverside County's partnership with WRCOG in creation of the Energy Efficiency and Water Conservation Program allows home and business owners to utilize this type of financing program and avoid upfront costs associated with energy system installations. Financing is repaid through the property tax bill and repayment obligations remain with the property when it is sold to a new owner.

California Energy Commission (CEC) Energy Efficiency Financing. The CEC offers up to $3 million per application in energy efficiency financing and low interest loans to cities and counties for installing energy-saving projects[33]. Examples of projects include: lighting systems, pumps and motors, streetlights and LED traffic signals, automated energy management systems/controls, building insulation, energy generation including renewable and combined heat and power projects, heating and air conditioning modifications and wastewater treatment equipment.

California Energy Commission Bright Schools Program. This is a collaborative project of the CEC, California Conservation Corps, local utility companies and other qualifying energy service companies to assist schools in undertaking energy efficiency projects[34]. Project staff guides schools through identifying and determining a project's feasibility, securing financing for the project, and purchasing and installing the new energy efficient equipment.

B. Transportation Financing

Federal Energy Efficiency Community Block Grants (EECBG). As described above, eligible activities include development and implementation of certain transportation programs and efficient traffic signals and street lighting.

Regional Transportation Improvement Program (RTIP). The Regional Transportation Improvement Program (RTIP) is funded from 75 percent of the funds made available for transportation capital improvement projects under the State Transportation Improvement Program (STIP). This program targets urban projects that are needed to improve transportation within the region. SCAG and the Riverside County Transportation Commission (RCTC) recommend to the California Transportation Commission (CTC) the selection of these projects, which can include State highway improvements, local roads, public transit, intercity rail, grade separations, and more.

Interregional Improvement Program (IIP). The Interregional Improvement Program (IIP) is funded from 25 percent of the funds made available for transportation capital improvement projects under the State Transportation Improvement Program (STIP). This program targets projects that are needed to improve interregional movement of people and goods. Caltrans recommends to the CTC the selection of these projects, which can include State highway improvements, intercity passenger rail, mass transit guide ways, or grade separation projects.

C. Waste Reduction Financing

California Department of Resources Recycling and Recovery (CalRecycle) Funding. The CalRecycle offers funding opportunities authorized by legislation to assist public and private entities in the safe and effective management of the waste stream. Applicants can apply online for many of CalRecycle's grant programs by using

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33 California Energy Commission (CEC) Energy Efficiency Financing. Website: http://www.energy.ca.gov/efficiency/financing/ (accessed December 27, 2018).

34 California Energy Commission Bright Schools Program. Website: http://www.energy.ca.gov/efficiency/brightschools/index.html (accessed December 27, 2018).

the Grants Management System (GMS).[35] Besides many funding opportunities for waste prevention, GHG Reduction Loan Program[36] particularly focuses on supporting the purposes of the AB 32, reducing methane emissions from landfills and further GHG reductions in upstream resource management and manufacturing processes; benefiting disadvantaged communities by upgrading existing facilities and, where warranted, establishing new facilities that reduce GHG emissions; improving air and water quality; and creating jobs.

D. Water Conservation and Treatment Financing

Clean Water State Revolving Funds (CWSRF). CWSRFs program is a federal-State partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. CWSRFs fund water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management[37]. Building on a federal investment of $42 billion, the State CWSRFs have provided more than $126 billion to communities through 2017. Some key highlights of the CWSRFs program are summarized below:

- Low Interest Rates, Flexible Terms – Nationally, interest rates for CWSRF loans average 2.3 percent, compared to market rates that average 5 percent. For a CWSRF program offering this rate, a CWSRF funded project would cost 22 percent less than projects funded at the market rate. CWSRFs can fund 100 percent of the project cost and provide flexible repayment terms up to 20 years.
- Funding for Nonpoint Source Pollution Control and Estuary Protection – CWSRFs provided more than $167 million in 2009 to control pollution from nonpoint sources and for estuary protection, more than $3 billion to date.
- Assistance to a Variety of Borrowers – The CWSRF program has assisted a range of borrowers including municipalities, communities of all sizes, farmers, homeowners, small businesses, and nonprofit organizations.
- Partnerships with Other Funding Sources – CWSRFs partner with banks, nonprofits, local governments, and other federal and State agencies to provide the best water quality financing source for their communities.

7.3 STEP 3 – Timeline and Prioritization

The County of Riverside will develop an implementation schedule based on the completion of the full cost effectiveness analysis. Prioritization will be based on the following factors:

- Cost effectiveness;
- GHG reduction efficiency;

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35 California Department of Resource Recycling and Recovery (CalRecycle) Funding Opportunities. Website: https://www.calrecycle.ca.gov/funding (accessed December 27, 2018).

36 CalRecycle. Greenhouse Gas Reduction Loan Program. Website: https://www.calrecycle.ca.gov/climate/grantsloans/ghgloans/ (accessed December 27, 2018).

37 USEPA. Clean Water State Revolving Funds. Website: https://www.epa.gov/cwsrf.

- Availability of funding;
- Level of county control;
- Ease of implementation; and
- Time to implement.

In general consideration of these factors, the following is an outline of key priorities for three phases (also referenced in Table 7-1) starting in 2020 through 2030.

- Phase 1 (2020–2023): Development of key ordinances, completion of key planning efforts, implementation of most cost-effective measures, and support of voluntary efforts.
- Phase 2 (2023–2026): Continued implementation of reduction measures and implementation of key planning outcomes from Phase 1.

Phase 3 (2026–2030): Continued implementation of reduction measures and implementation of key planning outcomes from Phase 1 and 2. Because the goals of this CAP Update are aggressive, success in meeting the CAP Update goals depend on some flexibility in the GHG reduction actions. The County of Riverside is committed to flexibility in implementing the reduction measures and meeting the goals of this CAP Update. Many of the reduction measures in this CAP Update may be implemented through a menu of options. The goals of each reduction measure can often be achieved through a variety of means, especially those related to building energy efficiency. For example, the County of Riverside will promote residential home energy renovations (Measure R2-EE4). The implementation of this measure can be achieved through a series of potential actions such as promoting Title 24 code compliance, promoting existing home energy renovation programs, promoting participation in green building programs such as LEED and Energy Upgrade California, promoting financing programs for home upgrades such as HERO and PACE, and establishing online permitting to facilitate upgrades. Table 7-1 (GHG Reduction Measures Timeline and Phasing Schedule) presents the potential timeline and phasing schedule for the GHG reduction measures.

Table 7-1 GHG Reduction Measures Timeline and Phasing Schedule

Reduction Measure	Phase
Transportation	
R2-T1: Alternative Transportation Options	1, 2, 3
R2-T2: Adopt and Implement a Bicycle Master Plan to expand Bike Routes around the County	1, 2
R2-T3: Ride Sharing and Bike to Work Programs within Businesses	1, 2
R2-T4: Electrify the Fleet	1, 2, 3
Energy Efficiency	
R2-EE1: Energy Efficiency Training, Education, and Recognition in the Residential Sector	1, 2, 3
R2-EE2: Increase Community Participation in Existing Energy Efficiency Programs	1, 2, 3
R2-EE3: Home Energy Evaluations	1, 2
R2-EE4: Residential Home Energy Renovations	1, 2, 3
R2-EE5: Exceed Energy Efficiency Standards in New Residential Units	1, 2, 3
R2-EE6: Energy Efficiency Training, Education and Recognition in the Commercial Sector	1, 2, 3
R2-EE7: Increase Business Participation in Existing Energy Efficiency Programs	1, 2, 3
R2-EE8:Non-Residential Building Energy Audits	1, 2
R2-EE9: Non Residential Building Retrofits	1, 2, 3
R2-EE10: Exceed Energy Efficiency Standards in New Commercial Units	1, 2, 3

Reduction Measure	Phase
Clean Energy	
R2-CE1: Clean Energy	1, 2, 3
R2-CE2: Community Choice Aggregation Program	1, 2, 3
Advanced Measures	
R2-L1: Tree Planting for Shading and Energy Saving	1, 2, 3
R2-L2: Light Reflecting Surfaces for Energy Saving	1, 2, 3
Water Efficiency	
R2-W1: Water Efficiency through Enhanced Implementation of Senate Bill X7-7	1, 2
R2-W2: Exceed Water Efficiency Standards	1, 2, 3
Solid Waste	
R2-S1: Reduce Waste to Landfills	1, 2, 3

7.4 STEP 4 – Public Participation

The active participation of citizens and businesses in Riverside County is integral to the success of GHG reduction efforts. Their involvement is essential in order to reach the reduction goals because this CAP Update depends on a combination of State and local government efforts, public and private sources of funding and the voluntary commitment, creativity, and participation of the community at large. The County of Riverside must strike a balance between development and environmental stewardship to keep the economy strong and, at the same time, protect the environment. The County of Riverside will educate stakeholders such as businesses, business groups, residents, developers, and property owners about the CAP Update and encourage participation in efforts to reduce GHG emissions in all possible sectors.

7.5 STEP 5 – Project Review

Projects that lower the carbon footprint of new development, and encourage programmatic mitigation strategies that may include reliance on adopted regional blueprint plans, CAPs and general plans that meet regional and local GHG emissions targets and that have also undergone CEQA review or streamlined under CEQA. The criteria needed to use adopted plans in evaluating impacts of GHG emissions from subsequent development projects is found in CEQA Guidelines Section 15183.5. Once adopted, this CAP Update fulfills these requirements. The County of Riverside is responsible for ensuring that new projects conform to these guidelines and meet the goals and requirements outlined in this CAP Update.

The County of Riverside will implement the reduction measures for new development during the CEQA review through the use of a Riverside County GHG Screening Tables document based upon the CAP Update. The Riverside County GHG Screening Tables document provides guidance for the analysis of development projects and divide projects into two broad categories based upon the CEQA review they are going through. The screening tables provide a menu of reduction options. If a project can obtain 100 points from the screening table, the mitigated project will implement pertinent reduction measures such that it meets the reduction goals of the CAP and a less than significant finding can be made for the project. The menu of options in the screening table is tied to the R2 Measures in the CAP Update and the Implementation Measures (IMs) in the General Plan such that 100 points would meet the emission reductions associated with the R2 Measures and IMs. This menu allows for maximum flexibility for projects to meet its reduction allocation.

The methodology discussed above is described in more detail in the Riverside County GHG Screening Tables document, presented in Appendix F of the CAP Update and is consistent with the analysis and quantification methodology used in the CAP Update.

The Screening Tables also serve to document the implementation of reduction measures. Using the screening tables as a reduction measure monitoring tool is described in more detail in Section 7.6 below.

7.6 STEP 6 – Monitoring and Inventorying

The County of Riverside will create a system for monitoring the implementation of this CAP Update and adjusting the plan as opportunities arise. As the plan is implemented and as technology changes, the CAP should be revised to take advantage of new and emerging technology. If promising new strategies emerge, the County of Riverside will evaluate how to incorporate these strategies into the CAP. Further, future State and federal actions may also result in changes which will influence the level of Riverside County emissions.

Screening tables completed during project review, as described in Section 7.5 above, will serve as documentation of the implementation of reduction measures. The County of Riverside shall retain the completed screening tables in order to maintain a record of the types and levels of implementation of each of the R2 measures. The point values in the completed screening tables also document the estimated levels of emission reductions anticipated during implementation. By maintaining these records, the County of Riverside can monitor the CAP reduction measure implementation and compare the anticipated emission reductions with the goals for the CAP over time.

The GHG inventory will be periodically updated in coordination with the three phases noted above: 2023 (to update with the Phase 1 progress); 2026 (to review Phase 2 progress, allow for course corrections to keep progress on target for 2030, and to develop post-2030 forecasts for use in planning for after 2030); and 2030 (to establish baseline for post-2030 GHG reduction planning).

To provide periodic updates to the CAP inventory of GHG emissions, Riverside County will use a Microsoft (MS) Excel format emissions inventory tool developed by the CAP consultant. This tool will include all the emission factors and emission sources specific to Riverside County. The tool will be designed such that Riverside County staff can input VMT, water use, solid waste, and energy consumption data and the tool will quantify emissions for the unincorporated areas.

The County of Riverside will also implement a monitoring and reporting program to evaluate the effectiveness of reduction measures with regards to progress towards meeting the goals of the CAP Update. This program will ensure that the effectiveness of all implementation measures are reviewed in advance of 2030 and adjustments to assigned point values accounting for actual effectiveness are made in the post-2030 CAP. If measures included in this CAP Update are found to be ineffective, those measures will be removed or revised in the post-2030 CAP.

The CAP Implementation Coordinator shall be responsible for maintaining records of reduction measure implementation and insuring that the periodic updates to the emissions inventory are completed using the MS Excel based emission inventory tool.

7.7 STEP 7 – Beyond 2030

As described above under the discussion of Reduction Goals, 2030 is only a milestone in GHG reduction planning. EO S-03-05 calls for a reduction of GHG emissions to a level 80 percent below 1990 levels by 2050, and this level is consistent with the estimated reductions needed to stabilize atmospheric levels of CO_2 at 450 parts per million (ppm) (CARB 2017a). The County of Riverside has already set targets for 2050 GHG reductions in this CAP Update at approximately 83 percent below baseline (2008) by 2050. However, it is important to note that the post 2030 reduction targets might need to be adjusted based on inventory updates and resultant GHG emission reductions achieved through implementation of measures identified in the three phases above from year 2020-2030. At the approximate midway point when Riverside County will have implemented the first two phases of this CAP Update and will have a better understanding of the effectiveness and efficiency of different reduction strategies and approaches, the current 2050 GHG reduction target and measures may need adjustments. Further the federal, State and local (County level) programs and policies for the GHG reductions for the near term (2020-2030) are likely to be well underway; and continuing technological change in the fields of energy efficiency, alternative energy generation, vehicles, fuels, methane capture and other areas will have occurred. Riverside County will then be able to take the local, regional, State and federal context into account and may consider updating the GHG reduction targets post 2030. The potential new CAP will include a specific target for GHG reductions for 2050. The targets will be consistent with broader State and federal reduction targets and will take into consideration the effectiveness and applicability of the reduction measures identified in this CAP Update.

The potential new CAP that can be adopted on or before January 1, 2030 will keep on track through 2050 to meet the 2050 GHG reduction goals by implementing the measures discussed in Chapter 4 (Reduction Measures) or potential new measures identified at the time of the future CAP Update. The measures described in Chapter 4, would produce reductions to bring the region's GHG emissions to an estimated 562,730 MT CO_2e by 2050. While the potential mix and implementation level of future GHG reduction measures is preliminary, it serves to demonstrate that the current measures in the CARB Scoping Plan and the County's CAP Update can not only move the region to its short term, 2020 and 2030 goal, but can also provide an expandable framework for much greater long-term GHG emissions reductions toward the ultimate 2050 goal.

Riverside County will develop the post-2030 CAP so that it can be ready for full implementation, including potential new policies, revisions to the General Plan (as necessary), programs, ordinances, and financing by 2030. The post-2030 CAP will update the target for GHG reductions for 2050. The target will be consistent with broader State and federal reduction targets including EO S-3-05 and with the scientific understanding of the needed reductions by 2050. The County of Riverside will adopt the new post-2030 CAP by January 1, 2030.

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APPENDIX A

GHG INVENTORY, FORECASTING, AND TARGET-SETTING REPORT

FINAL

COUNTY OF RIVERSIDE GHG INVENTORY, FORECASTING, AND TARGET-SETTING REPORT FOR THE CLIMATE ACTION PLAN UPDATE

RIVERSIDE COUNTY, CALIFORNIA

LSA

November 2018

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FINAL

COUNTY OF RIVERSIDE GHG INVENTORY, FORECASTING, AND TARGET-SETTING REPORT FOR THE CLIMATE ACTION PLAN UPDATE

RIVERSIDE COUNTY, CALIFORNIA

Prepared for:

Prepared by:

LSA

1500 Iowa Avenue, Suite 200
Riverside, California 92507

Project No. COR1801

November 2018

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LIST OF ABBREVIATIONS AND ACRONYMS

AB	Assembly Bill
AEP	Association of Environmental Professionals
Anza	Anza Electric Cooperative
BAU	Business-as-Usual
CAP	Climate Action Plan
CARB	California Air Resources Board
CEC	California Energy Commission
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
Community Protocol	United States Community Protocol for Accounting and Reporting Greenhouse Gas Emissions
County	County of Riverside
EMFAC2017	California Emission Factor Model, Version 2017
EO	Executive Order
EPA	United States Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
I	Interstate
IFT	Inventory, Long-Term Forecasts, and Target-Setting
IID	Imperial Irrigation District
IPCC	Intergovernmental Panel on Climate Change
kWh	kilowatt-hour(s)
LCFS	Low Carbon Fuel Standard
MG	million gallons
MT	metric ton(s)
N/DN	nitrification/denitrification
N_2O	nitrous oxide
RPS	Renewable Portfolio Standard
RTP	Regional Transportation Plan

SCAG	Southern California Association of Governments
SCE	Southern California Edison
VMT	vehicle miles traveled
WECC	Western Electricity Coordinating Council

KEY FINDINGS

The GHG Inventory, Forecasting, and Target-Setting (IFT) Report was developed to summarize the review of the greenhouse gas (GHG) emissions inventory and forecasts update and, based on that review, to recommend GHG reduction targets for the County of Riverside (County) to incorporate into a Climate Action Plan (CAP) Update. Key findings are summarized below.

- Riverside County's 2017 GHG emissions totaled 4,905,518 metric tons (MT) of carbon dioxide equivalent (CO_2e).
- On-road transportation was the largest contributor of emissions, representing 36 percent (1,766,784 MT CO_2e) of total emissions.
- Energy-related emissions, including residential and nonresidential electricity use and natural gas combustion, accounted for 14.5 percent (712,928 MT CO_2e) and 9.6 percent (475,211 MT CO_2e) of the total community emissions, respectively.
- The agriculture sector was the second largest contributor of carbon dioxide (CO_2) emissions, representing 34 percent (1,670,954 MT CO_2e) of total emissions.
- Under the Business-as-Usual (BAU) forecast, emissions will be 5,158,305 MT CO_2e in 2020; 6,368,781 MT CO_2e in 2030; and 11,305,026 MT CO_2e in 2050. These emissions levels are 5.1 percent higher in 2020 than 2017, 29.8 percent higher in 2030 than 2017, and more than double 2017 emissions by 2050.
- Under the Adjusted BAU forecast, emissions will be 4,861,256 MT CO_2e in 2020; 4,102,109 MT CO_2e in 2030; and 4,175,146 MT CO_2e in 2050. Compared to 2017, these emissions levels are 0.9 percent lower in 2020, 16.0 percent lower in 2030, and 14.8 percent lower in 2050. These reductions represent State efforts in reducing GHG emissions within the County.
- The County should choose a reduction target that is ambitious but feasible. The State recommends a 15 percent reduction below 2005–2008 baseline levels[1] by 2020, a 49 percent reduction below 2008 levels by 2030, and an 80 percent reduction below 2008 levels by 2050[2]. To continue reductions consistent with the State's long-term emissions reduction goals, the County would need to reduce emissions in 2030 by 525,511 MT CO_2e from an Adjusted BAU forecast and by 2,982,947 MT CO_2e from an Adjusted BAU forecast by 2050.

[1] For Riverside County, the baseline year was identified as 2008 per the 2015 Climate Action Plan.

[2] State goals are to achieve 1990 levels of emissions by 2020 (15 percent below 2008 baseline levels), 40 percent below 1990 levels of emissions by 2030 (49 percent below 2008 baseline levels) and 80 percent below 1990 levels of emissions by 2050 (83 percent below 2008 baseline levels).

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INTRODUCTION

This IFT Report presents Riverside County's community-wide GHG emissions inventory. The purpose of this inventory is to provide data in order to identify GHG reduction measures for the CAP update. The GHG inventory section describes historic energy use and GHG emissions, and the forecasts describe projected future emissions for the County. The Reduction Targets section describes GHG reduction recommendations that are consistent with State goals and may assist the County in establishing local GHG reduction targets. The inventories and recommended reduction targets will help the County in the next step of the CAP update, which is to identify GHG reduction measures that are relevant, meaningful, and feasible.

Specifically, this IFT Report includes the following (words and phrases in **bold** are described in Table 1):

- Historic GHG emissions in the **community inventory** for 2017;
- Future GHG emissions for 2020, 2030, and 2050 under **BAU** and **Adjusted BAU** forecast scenarios; and
- Recommended GHG **reduction targets** for 2020, 2030, and 2050.

Table 1. Key Terms in the IFT Report

Term	Definition
Adjusted Business-as-Usual	A GHG forecast scenario that accounts for known policies and regulations that will affect future emissions. Generally, these are State and federal initiatives that will reduce emissions from the Business-as-Usual scenario.
Baseline Year	The inventory year used for setting targets and against which future inventories are compared.
Business-as-Usual	A GHG forecast scenario that assumes no change in policy affecting emissions since the most recent inventory. Changes in emissions are driven primarily by changes in demographics.
Community Inventory	GHG emissions that result from the activities of residents and businesses in Riverside County. An inventory reports emissions that occur over a single calendar year.
Emission Factors	The GHG intensity of an activity.
Reduction Targets	GHG emissions levels not to be exceeded by a specific date. Local reduction targets are often informed by State recommendations, and different targets may be established for different years.
Sector	A subset of the emissions inventory classified by a logical grouping, such as an economic or municipal-specific category.

Source: *Forecasting Community-wide GHG Emissions and Setting Reduction Targets* (AEP, May 2012).
Note: A glossary of terms is also included as Appendix A.
AEP = Association of Environmental Professionals
GHG = greenhouse gas
IFT = inventory, forecasting, and target-setting

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GHG EMISSIONS INVENTORY

GHG emissions inventories are the foundation of planning for future emission reductions. Establishing an existing inventory of emissions helps to identify and categorize the major sources of emissions currently being produced. The baseline year was identified as 2008 in the County's 2015 CAP. A baseline year is established as a starting point against which other inventories may be compared and targets may be set, and is generally the earliest year with a full emissions inventory. In this report, 2017 is presented for the community inventory to show the major sources of emissions in Riverside County and the County's progress toward meeting the reduction targets from the previous CAP. This section describes the emissions reporting for economic sectors and presents the 2017 community inventory.

EMISSIONS REPORTING

The primary GHGs from the community are CO_2, methane (CH_4), and nitrous oxide (N_2O). Because each of these gases has a different capacity for trapping heat in the atmosphere (i.e., Global Warming Potential [GWP]), a method of reporting is needed to be able to compare gases in the same terms. As a result, emissions are reported in carbon dioxide equivalents, or CO_2e, with each GHG normalized and calculated relative to CO_2 using its GWP. Table 2 describes the GHGs analyzed in this report, as well as their symbol, GWP, and primary community sources of emissions. While N_2O has the highest GWP and may be considered the most dangerous on a per-molecule basis, CO_2 is by far the most prevalent, accounting for 83 percent of statewide emissions in 2016 (CARB 2018).

Table 2. Greenhouse Gases Analyzed in the Inventory

Greenhouse Gas	Symbol	Global Warming Potential	Primary Community Sources
Carbon Dioxide	CO_2	1	Fossil fuel combustion
Methane	CH_4	28	Fossil fuel combustion, landfills, wastewater treatment
Nitrous Oxide	N_2O	265	Fossil fuel combustion, wastewater treatment

Source: Fifth Assessment Report (Intergovernmental Panel on Climate Change 2014).

Emissions Sectors

The inventory identifies the major sources of GHG emissions caused by activities in sectors that are specific to community activities. A sector is a subset of the economy or society whose components share similar characteristics. An emissions sector can also contain subsectors that provide more specificity about the source of emissions (e.g., natural gas and electricity are subsectors of the energy sector).

The community inventory is categorized by sectors based on a sector's ability to be affected through regional and local programs, incentives, zoning, and other policies. The County's community inventory was divided into the following sectors:

- **Energy**, which is further broken down into two subsectors:
  - **Electricity** includes emissions from electricity consumption in nonresidential buildings and facilities (including outdoor lighting) as well as residential buildings in Riverside County.
  - **Natural Gas** includes emissions from natural gas consumption in nonresidential buildings and facilities, as well as residential buildings in Riverside County.
- **On-Road Transportation** includes emissions from vehicle fuel use in trips wholly within Riverside County ("in-boundary") and trips that either originate or end in Riverside County ("cross-boundary"). Emissions from in-boundary trips are fully accounted for in the inventory, whereas only half of the emissions from cross-boundary trips are accounted for. Trips that pass through Riverside County, (such as those on Interstate [I] 10 or I-15) are not accounted for in the inventory because the County has little or no control over these emissions. As a result, this methodology reflects only trips or parts of trips within Riverside County borders that the County has the ability to affect.
- **Solid Waste** includes emissions from waste that is generated in the community and sent to landfills.
- **Aviation** includes emissions from all aviation activities at Blythe Airport, Jacqueline Cochran Regional Airport, Hemet-Ryan Airport, and French Valley Airport.
- **Agriculture** includes emissions from enteric fermentation in domestic livestock, livestock manure management, crop cultivation, and field burning of agricultural residues.
- **Water and Wastewater** includes emissions from the electricity used to source, treat, and deliver imported water in the community that is not accounted for in the community utility data. Wastewater includes emissions from treating wastewater generated in the community.
- **Off-Road Sources** include emissions from operating equipment for construction, commercial, light industrial, and agricultural activities; lawn and garden equipment; and recreational vehicles, such as all-terrain vehicles.

Calculation Methodology

GHG emissions were calculated using available activity data (e.g., kilowatt-hours of electricity) and then follows protocols for converting activity data to emissions output using relevant emission factors. Emission factors relate the activity to GHG emissions and may vary by year (e.g., for electricity). Unlike activity data, they often are not affected by local actions or behavior. The United States Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol; ICLEI 2012) was the primary protocol used for developing the community inventory. Activity data are reported in the community emissions subsection below, and emission factors are detailed in Appendix B.

COMMUNITY EMISSIONS

The community inventory includes the GHG emissions that result from activities within Riverside County boundaries. This section presents the findings of the community inventory for the baseline year 2017, as well as more specific detail and findings on the energy sectors.

2017 Emissions Summary

As shown in Figure 1 and Table 3, the on-road transportation sector was the largest contributor to emissions in 2017 (36.02 percent), producing 1,766,784 MT CO_2e. The agriculture sector is the second-largest source of emissions at 34 percent (1, 670,954 MT CO_2e). Electricity consumption contributes 14.5 percent (712,928 MT CO_2e), and natural gas combustion accounts for 9.6 percent (475,211 MT CO_2e). Solid waste comprised 4.17 percent of the total (204,365 MT CO_2e) in 2017. Water, wastewater, and off-road sources made up the remaining emissions. Water and wastewater emissions accounted for 0.9 percent of the total emissions, while off-road sources comprised a very small percentage of overall emissions.

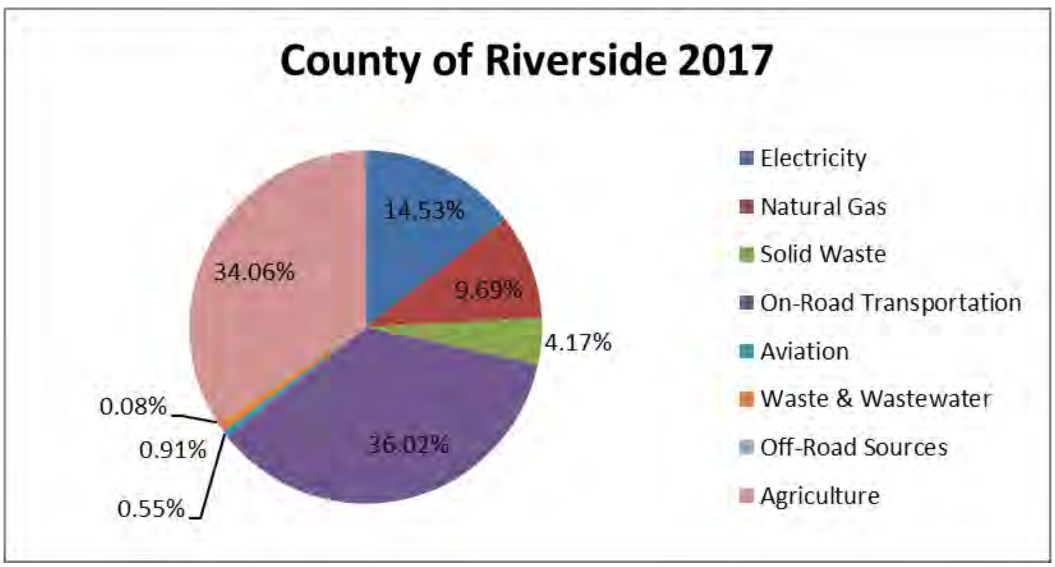

Figure 1. Communitywide Greenhouse Gas Emissions by Sector for 2017

Table 3. Communitywide Greenhouse Gas Emissions by Sector for 2017

Sector	2017 (MT CO_2e)	Percent of Total
On-Road Transportation	1,766,784	36.02
Agriculture	1,670,954	34.06
Electricity	712,928	14.53
Natural Gas	475,211	9.69
Solid Waste	204,365	4.17
Water and Wastewater	44,606	0.91
Aviation	26,786	0.55
Off-Road Sources	3,883	<1.00
Total	**4,905,518**	**100.00**

Source: Compiled by LSA (2018).
MT CO_2e = metric tons of carbon dioxide equivalent

Activity data can provide insight into behavioral choices in the community, as these data are not affected by emission factors. Table 4 summarizes activity data for each sector and subsector. Wastewater and off-road emissions were calculated based on countywide data and then proportioned to unincorporated Riverside County. These data are also shown in Table 4.

Demographic data also provide perspective to the potential changes in emissions over time. Table 5 shows the number of households, jobs, population, and service population (jobs + population) for 2016, the most recent year for which data are available.

Energy

Energy is an area over which local agencies often have the greatest opportunities for effecting change. Energy use consists of electricity and natural gas. Emissions from commercial/industrial and residential energy use account for approximately 24 percent of the total community emissions in 2017. Table 6 shows the breakdown in activity (in kilowatt-hours [kWh] or therms) and GHG emissions by sector and energy source. Figure 2 shows electricity and natural gas emissions for the commercial/industrial and residential sectors.

Table 4. Activity Data Used in 2017 Community Inventory

Sector	2017
On-Road Transportation	
Total Vehicle Miles Traveled	4,284,955,457.9
Aviation	
Jet Fuel (gallons)	2,781,219
Aviation Fuel (gallons)	431,069
Commercial/Industrial Energy	
Electricity (kWh)	1,463,821,482
Natural Gas (therms)	40,618,482
Residential Energy	
Electricity (kWh)	1,505,409,800
Natural Gas (therms)	48,850,607
Solid Waste	
Landfilled (tons)	389,687
Water and Wastewater	
Imported Water (million gallons)	27,642
Off-Road Sources[1] (% of Riverside County emissions attributed to unincorporated Riverside County)	
Lawn and Garden (% of households)	15.7
Construction (% of building permits)	29.4
Industrial (% of manufacturing jobs)	3.5
Light Commercial (% of other jobs)	11.7
Recreation (population weighted by income)	13.6
Agriculture (% of agriculture jobs)	77.2
Agriculture	
Hay (acres)	45,353
Corn (acres)	740
Oats (acres)	833
Sorghum (acres)	130
Wheat (acres)	18,394
Cotton (acres)	7,291
Vegetable and Fruit Trees (acres)	78,688
Dairy Cows (heads)	21,900
Poultry (heads)	1,893,394
Sheep (heads)	8,300

1 Off-road emissions are available at the county (including unincorporated areas and incorporated cities) level through CARB's OFFROAD model. Emissions attributable to unincorporated Riverside County were derived using indicator data related to the off-road source. For example, the percentage of households in unincorporated Riverside County compared to the entire county (including unincorporated areas and incorporated areas) was used to attribute the same percentage of lawn and garden equipment emissions to the county. See Appendix B for more methodology details.

CARB = California Air Resources Board
kWh = kilowatt-hours

Table 5. Demographic Data for 2016

	2016
Households	112,292
Jobs[1]	81,754
Population	364,413
Service Population (Population + Jobs)	446,167

Source: *Profile of the Unincorporated Area of Riverside County* (SCAG 2017).
[1] The number of jobs is for 2015.
SCAG = Southern California Association of Governments

Table 6. Activity Data and Greenhouse Gas Emissions of Energy in 2017

Sector	2017	
	Activity (kWh or therms)	Emissions (MT CO_2e)
Commercial/Industrial Energy		
Electricity	1,463,821,482	351,463.5
Natural Gas	40,618,482	215,743.0
Residential Energy		
Electricity	1,505,409,800	361,464.0
Natural Gas	48,850,607	259,467.5
Total (MT CO_2e)		**1,188,138.0**

Source: Compiled by LSA (2018).
kWh = kilowatt-hours MT CO_2e = metric tons of carbon dioxide equivalent

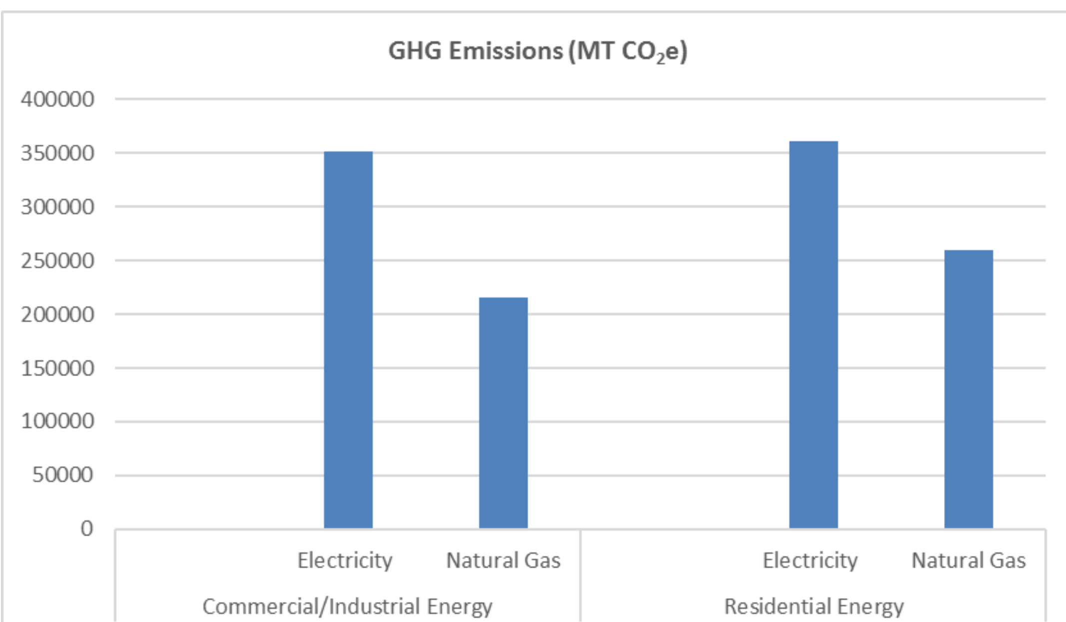

Figure 2. Greenhouse Gas Emissions for Community Electricity and Natural Gas by Sector in 2017

INVENTORY FORECASTS

The County developed two forecast scenarios for GHG emissions: a BAU scenario and an Adjusted BAU scenario. The BAU scenario describes emissions based on projected growth in population and employment and does not consider policies that will reduce emissions in the future (that is, the policies in place in 2017 would remain constant through 2050). The County developed GHG reduction measures in the 2015 CAP that constitute policies in place in 2017. These measures have been implemented and are reflected in the 2017 GHG emissions inventory, and they will continue to reduce emissions through 2020. Therefore, the BAU and Adjusted BAU forecasts included reductions from the 2015 CAP GHG reduction measures. The Adjusted BAU scenario describes emissions based on projected growth and considers policies that will achieve GHG reductions in the future. These policies, described in detail below, include State-adopted or approved legislation that will affect future emissions.

By evaluating the two forecasts, the County can determine the effect that existing policies may have on future emissions and assess what local measures can provide additional reductions. Three future years were forecasted for each scenario: 2020, 2030, and 2050. All forecast years are consistent with the goals identified in Assembly Bill (AB) 32 and the corresponding Scoping Plan (CARB 2017), which identifies Statewide GHG reduction targets for 2020, 2030, and 2050.

BUSINESS-AS-USUAL FORECAST

The BAU forecast estimated future emissions using current (2017) consumption patterns and emission factors with the anticipated growth in Riverside County. Anticipated growth is estimated using data from the County's 2015 General Plan and other relevant sources (Table 7). The most relevant growth factors are used to project emissions by sector. For example, future residential energy emissions were developed using current energy use per household (from the 2017 inventory) and the anticipated number of households in 2035. Actual energy use is a function of several variables, not only the number of households; however, this approach is supported by current protocols and best practices within the State and provides a consistent approach to forecasting. Compound annual growth rates were developed using the growth projections from 2010 to 2020 and from 2020 to 2035, as shown Table 7. Growth rates beyond 2035 are assumed to be the same as between 2020 and 2035. In general, the County is expect modest growth as population, housing, jobs, and vehicle miles traveled are all expected to moderately increase.

Community Business-as-Usual Forecast

The County's BAU Forecast emissions in 2020 are estimated to be 5,158,305 MT CO_2e, a 5 percent increase from baseline (2017) emissions. By 2030, emissions are estimated to increase 29.8 percent from the baseline level to 6,368,781 MT CO_2e. By 2050, emissions are estimated to increase 130 percent from the baseline level to 11,305,026 MT CO_2e (Table 8).

Table 7. Growth Factors for 2010, 2020, and 2035

Sector	Demographic Indicator	2010	2020	2010–2020 CAGR (percent)	2035	2020–2035 CAGR (percent)
Residential Energy	Households	171,380	220,794	2.57	324,021	2.59
Commercial/Industrial Energy	Jobs	97,210	151,034	4.50	265,688	3.84
N/A[1]	Population	467,105	608,857	2.69	908,100	2.70
Solid Waste, Water, Wastewater, and Off-road Sources	Service Population (Population + Jobs)	564,315	759,891	3.02	1,173,788	2.94

Source: County of Riverside General Plan (2015)

[1] Not Applicable. Population data are shown for informational purposes but are not used for forecasting any sector.

CAGR = compound annual growth rate

Table 8. Community Business-as-Usual Forecast Emissions

Sector	2017 (MT CO_2e)	2020 (MT CO_2e)	Percent Change 2017–2020	2030 (MT CO_2e)	Percent Change 2017–2030	2050 (MT CO_2e)	Percent Change 2017–2050
On-Road Transportation	1,766,784	1,999,268	13.1	3,018,767	70.0	6,882,509	289.5
Agriculture	1,670,954	1,565,873	-6.2	1,261,044	-24.5	817,858	-51.0
Electricity	712,928	774,289	8.6	1,017,153	42.6	1,756,843	146.4
Natural Gas	475,211	515,845	8.5	676,742	42.4	1,165,761	145.3
Solid Waste	204,365	223,448	9.3	298,585	46.1	533,154	160.0
Water and Wastewater	44,606	48,771	9.3	65,171	46.1	116,370	160.0
Aviation	26,786	26,786	0.0	26,786	0.0	26,786	0.0
Off-Road Sources	3,883	4,024	3.6	4,531	16.6	5,744	47.9
Total	**4,905,518**	**5,158,305**	**5.1**	**6,368,781**	**29.8**	**11,305,026**	**130.4**

Source: Compiled by LSA (2018).

MT CO_2e = metric tons of carbon dioxide equivalent

Adjusted Business-as-Usual Forecast

State legislation has been approved and/or adopted that will reduce GHG emissions in Riverside County. These policies do not require additional local action but should be accounted for in the County's emissions forecasts to provide a more accurate picture of future emissions and the level of local action needed to reduce emissions to levels consistent with State recommendations. This forecast is called the Adjusted BAU forecast. The measures are described briefly below.

Low Carbon Fuel Standard

The Low Carbon Fuel Standard (LCFS) was developed as a result of Executive Order (EO) S-1-07, which mandates that the carbon intensity of transportation fuels in California be lowered 10 percent by 2020. The State is currently implementing this standard, which is being phased in and will achieve full implementation in 2020. The LCFS target would be maintained beyond 2020.

Assembly Bill 1493 and Advanced Clean Cars

AB 1493 directed the California Air Resources Board (CARB) to adopt GHG standards for motor vehicles through model year 2015 that would result in reductions in GHG emissions by up to 25 percent in 2030. In addition, the State's Advanced Clean Cars Program includes additional components that will further reduce GHG emissions statewide, including more stringent fuel efficiency standards for model years 2017 through 2025 and support infrastructure for the commercialization of zero-emission vehicles. CARB anticipates additional GHG reductions of 3 percent by 2020, 27 percent by 2035, and 33 percent by 2050.[3] These are also known as "Pavley I" and "Pavley II" regulations.

California Building Code Title 24

California's building efficiency standards are updated regularly to incorporate new energy efficiency technologies. The code was most recently updated in 2016 and went into effect for new development in 2017. For projects implemented after January 1, 2017, the California Energy Commission estimates that the 2016 Title 24 energy efficiency standards will reduce consumption by an estimated 28 percent for residential buildings and 5 percent for commercial buildings, relative to the 2013 standards. These percentage savings relate to heating, cooling, lighting, and water heating only; therefore, these percentage savings were applied to the estimated percentage of energy use by Title 24.

Renewable Portfolio Standard

The Renewable Portfolio Standard (RPS) requires energy providers to derive 33 percent, 60 percent, and 100 percent of their electricity from qualified renewable sources by 2020, 2030, and 2045, respectively. This is anticipated to lower emission factors (i.e., fewer GHG emissions per kWh used) statewide. Therefore, reductions from RPS are taken for energy embedded in water, as well as commercial/industrial and residential electricity.

Community Adjusted Business-as-Usual Forecast

The County's Adjusted BAU forecast emissions are estimated to be 4,861,256 MT CO_2e in 2020; 4,102,109 MT CO_2e in 2030; and 4,175,146 MT CO_2e in 2050 (Table 9). This change represents a 0.9 percent reduction from 2017 by 2020, a 16.3 percent reduction by 2030, and a 14.8 percent reduction by 2050. Due to the State's stringent vehicle standards, emissions from the transportation sector are expected to decrease significantly over time. The proportion of emissions from electricity consumption are expected to decrease over time, whereas natural gas-related emissions are expected to increase over time. The emissions from the agriculture sector are also expected to reduce by almost half over time, mainly due to a decline in agricultural activities. Figure 3 shows community Business-As-Usual (BAU) and Adjusted BAU forecasts.

3 CARB Advanced Clean Cars Summary Sheet. Accessed on November 10, 2018 https://www.arb.ca.gov/msprog/clean_cars/acc%20summary-final.pdf?_ga=2.39593376.248736436.1543349769-1056020676.1542733892.

Table 9. Community Adjusted Business-as-Usual Emissions

Sector	2017 (MT CO_2e)	2020 (MT CO_2e)	Percent Change 2017–2020	2030 (MT CO_2e)	Percent Change 2017–2030	2050 (MT CO_2e)	Percent Change 2017–2050
On-Road Transportation	1,766,784	1,835,938	3.9	1,361,200	-22.9	1,174,310	-33.5
Agriculture	1,670,954	1,565,873	-6.2	1,261,044	-24.5	817,858	-51.0
Electricity	712,928	653,541	-8.3	466,971	-34.4	480,289	-32.6
Natural Gas	475,211	510,268	7.3	652,578	37.3	1,104,421	132.0
Solid Waste	204,365	223,448	9.3	298,585	46.1	533,154	160.8
Water and Wastewater	44,606	41,377	-7.2	30,413	-31.8	32,584	-26.9
Aviation	26,786	26,786	0.0	26,786	0.0	26,786	0.0
Off-Road Sources	3,883	4,024	3.6	4,531	16.6	5,744	47.9
Total	**4,905,518**	**4,861,256**	**-0.9**	**4,102,109**	**-16.3**	**4,175,146**	**-14.8**

Source: Compiled by LSA (2018).
MT CO_2e = metric tons of carbon dioxide equivalent

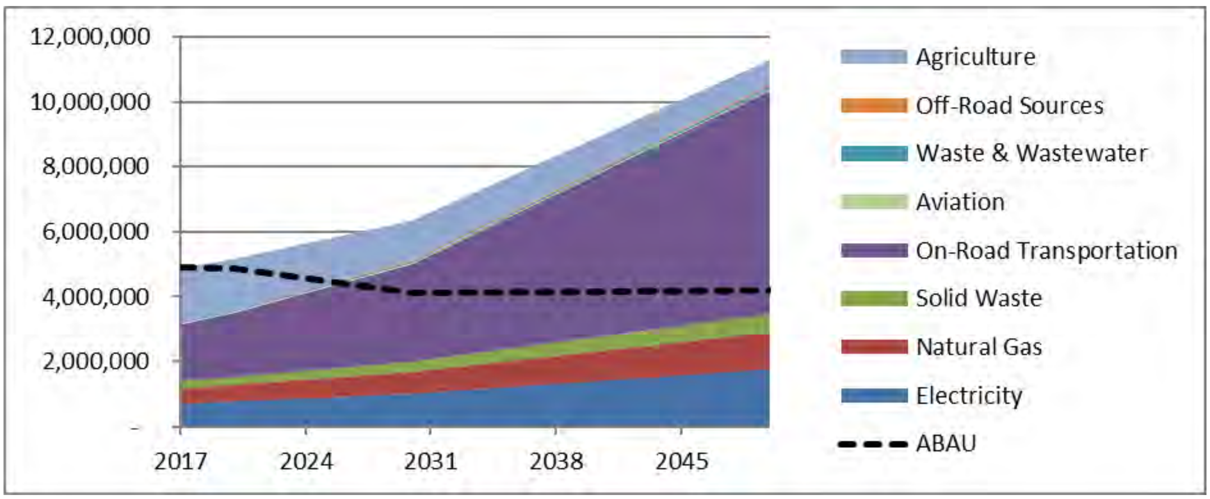

Figure 3. Community Business-as-Usual and Adjusted Business-as-Usual (ABAU) Forecasts

REDUCTION TARGETS

The State has set goals for reducing GHG emissions by 2020, 2030, and 2050 through AB 32, EO S-3-05, and EO B-30-15, respectively. The State has also provided guidance to local jurisdictions as "essential partners" in achieving the State's goals by identifying a 2020 recommended reduction goal. That goal, stated in the AB 32 Scoping Plan, was for local governments to achieve a 15 percent reduction below 2005–2008 levels by 2020, which aligns with the State's goal of not exceeding 1990 emissions levels by 2020.[4] The State's long-term target is to emit no more than 20 percent of 1990 levels by 2050 (or, a reduction of 80 percent below 1990 levels by 2050). The State has also provided an interim target, which is 40 percent below 1990 levels by 2030. It is clear that the issue of climate change will not end in 2030 and continued reduction goals should be implemented to keep the State on a path toward the 2050 goal.

Ultimately, the County will determine the level of reductions that it can feasibly achieve. The recommended targets provided below are guidelines based on consistency with the State's goals.

RECOMMENDED COMMUNITY TARGETS

The following targets are recommended to keep the County CAP in line with the State's reduction goals. In 2020, the County would not need to make any additional CO_2e emissions reductions, as State and local policies will be sufficient to meet the targets. In 2030, the County would need to reduce emissions by 525,511 MT CO_2e below the Adjusted BAU scenario to meet the State-aligned target. In 2050, the County would need to reduce emissions by 2,982,947 MT CO_2e below the Adjusted BAU scenario to meet the State-aligned target (see Table 10 and Figure 4).

Table 10. State-Aligned Emission GHG Reduction Targets by Year

Sector	2008[1]	2017	2020	2030	2050
BAU Emissions (MT CO_2e)	7,012,938	4,905,518	5,158,305	6,368,781	11,305,026
Adjusted BAU Emissions (MT CO_2e)	-	-	4,861,256	4,102,109	4,175,146
State-Aligned Target (% change from 1990)	-	-	0	-40	-80
State-Aligned Target (% change from 2008)[2]	-	-	-15	-49	-83
Reductions from Adjusted BAU Needed to Meet the Target (MT CO_2e)	-	-	-	525,511	2,982,947

Source: Compiled by LSA (2018).
[1] Baseline (2008) emissions are from the County's 2015 Climate Action Plan GHG inventory.
[2] Reduction target calculation details are provided in Appendix B.
BAU = Business-as-Usual
County = County of Riverside
GHG = greenhouse gas
MT CO_2e = metric tons of carbon dioxide equivalent
NA= Not Applicable

[4] In an analysis, the State concluded that a 15 percent reduction in emissions from 2005–2008 levels by 2020 would be equivalent to achieving 1990 emissions levels.

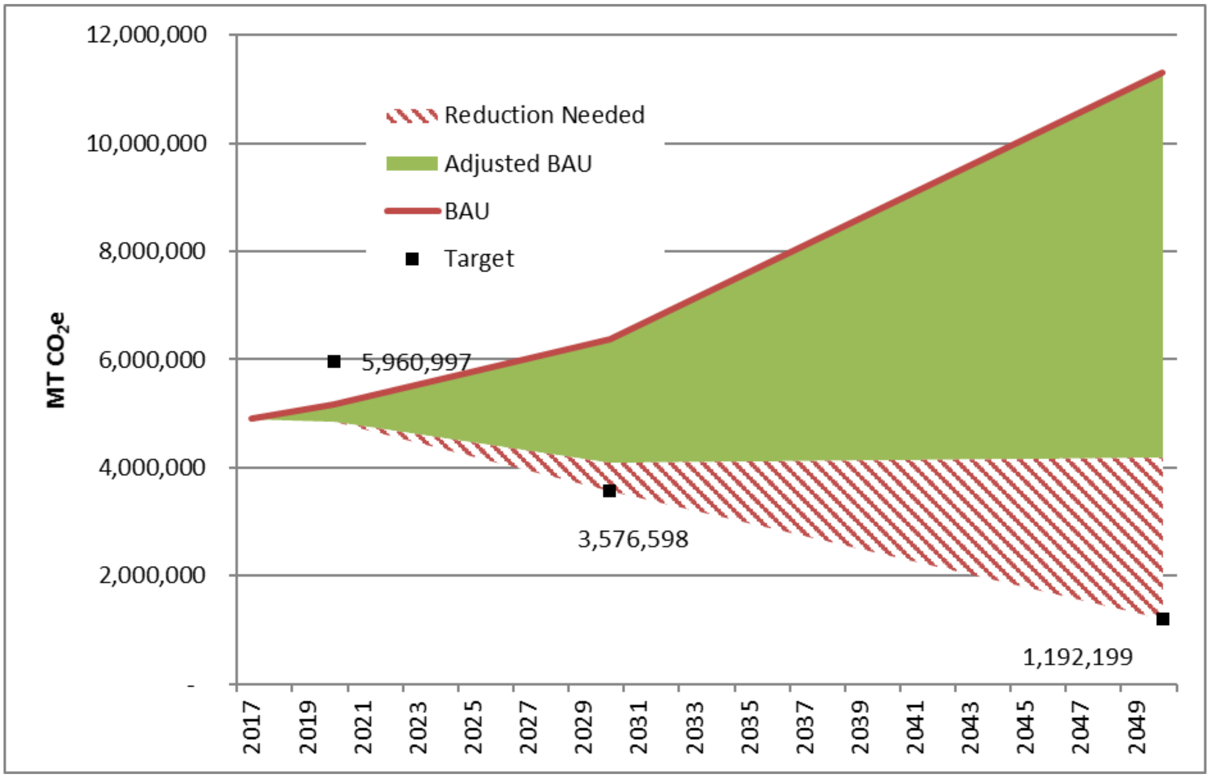

Figure 4. Community Emissions Inventories, Forecasts, and Targets

CONCLUSIONS AND NEXT STEPS

This IFT Report presents the County's community inventory, provides forecasts, and describes recommended reduction targets. It is the foundation of the CAP Update and provides the County a first look at what will be needed to meet emissions reduction targets that are aligned with State goals and would mitigate the County's impacts on climate change. This report is also intended to guide the County in determining feasible GHG reduction opportunities by detailing the sources of emissions by sector.

The next steps in the CAP process are to review the information provided in this IFT Report and to determine preliminary GHG reduction targets for community operations. The County should also begin to identify local GHG reduction measures that could be implemented to reach its emissions targets.

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APPENDIX A

GLOSSARY OF TERMS

Adjusted Business-as-Usual: A greenhouse gas forecast scenario that accounts for known policies and regulations that will affect future emissions. Generally, these are State and federal initiatives that will reduce emissions from the Business-as-Usual scenario.

Baseline Year: The inventory year used for setting targets and against which future inventories are compared.

Business-as-Usual (BAU): A greenhouse gas forecast scenario used for the estimation of greenhouse gas emissions at a future date based on current technologies and regulatory requirements and in the absence of other reduction strategies.

Carbon Dioxide Equivalent (CO_2e): A common unit for normalizing greenhouse gases with different levels of heat trapping potential. For carbon dioxide itself, emissions in tons of CO_2 and tons of CO_2e are the same, whereas 1 ton of nitrous oxide equates to 265 tons of CO_2e and 1 ton of methane equates to 28 tons of CO_2e. The values are based on the gases' global warming potentials.

Community Inventory: Greenhouse gas emissions that result from the activities of residents and businesses in the county. An inventory reports emissions that occur over a single calendar year.

Emissions Factor: A coefficient used to convert activity data into greenhouse gas emissions. The factor is a measure of the greenhouse gas intensity of an activity, such as the amount of CO_2 in 1 kilowatt-hour of electricity.

Global Warming Potential (GWP): The relative effectiveness of a molecule of a greenhouse gas at trapping heat compared with one molecule of CO_2.

Metric Ton (MT): Common international measurement for the quantity of greenhouse gas emissions. A metric ton is equal to 2,205 pounds or 1.1 short tons.

Reduction Targets: Greenhouse gas emissions levels not to be exceeded by a specific date. Reduction targets are often informed by State recommendations, and different targets may be established for different years.

Sector: A subset of the emissions inventory classified by a logical grouping, such as an economic or municipal-specific category.

State-Aligned Targets: The State's goals for reducing greenhouse gas emissions by 2020, 2030, and 2050 through Assembly Bill 32, Executive Order S-3-05, and Executive Order B-30-15, respectively.

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APPENDIX B

METHODOLOGY

This appendix provides a detailed description of the data sources, emission factors, policies, and assumptions used to develop the greenhouse gas (GHG) emissions inventories, forecasts under a Business-as-Usual (BAU) scenario, forecasts under an Adjusted BAU scenario, and the State-aligned GHG reduction targets.

PROTOCOLS

The GHG inventories were developed using tools and guidance documents developed or supported by government agencies, such as the Environmental Protection Agency. Calculation protocols have been developed to ensure consistency among community inventories. Specifically, the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol; ICLEI 2012) and the California Supplement (AEP 2013) were used for the community inventory. These protocols often have multiple calculation methods for a single emission source depending on the data available. There are two broad approaches for calculating emissions: "bottom-up" and "top-down." A bottom-up approach relies on end-use data, such as county-level electricity usage. A top-down approach relies on aggregated data that is allocated to the county based on population, employment, or another relevant indicator. Bottom-up calculations were performed whenever possible to provide the most detailed and likely accurate picture of emissions within a jurisdiction; however, when detailed data were not available, other appropriate methods were used and are described in this appendix.

GLOBAL WARMING POTENTIAL FACTORS

The inventory includes the three GHGs most relevant to community emissions—carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)—since they are most relevant to human activities (IPCC 2014). Each GHG differs in its ability to absorb heat in the atmosphere based on its molecular properties and expected lifetime in the atmosphere, and it is useful to describe emissions in one unit of measurement. That unit of measurement is carbon dioxide equivalent, or CO_2e, and Global Warming Potential (GWP) factors are used to standardize emissions from various GHGs. GWP factors, developed by the Intergovernmental Panel on Climate Change (IPCC), represent the heat-trapping ability of each GHG relative to that of CO_2. For example, the GWP factor of CH_4 is 28 because 1 metric ton (MT) of CH_4 has 28 times the heat-trapping capacity as 1 MT CO_2 (over a 100-year period). IPCC periodically updates the GWP factors of GHGs based on new science and updated background mixing ratios of CO_2. CO_2 always has a GWP factor of 1 and the other GHGs are calculated relative to CO_2. The GWP factors are shown in Table B-1. GWP factors are unitless. Emissions in the inventory are reported in units of CO_2e.

Table B-1. Global Warming Potentials

	CO_2	CH_4	N_2O
GWP	1	25	298

Source: *Fifth Assessment Report* (Intergovernmental Panel on Climate Change2014).

ACTIVITY DATA

Activity data is the end-use consumption amount of a sector, such as kilowatt-hours of electricity, therms of natural gas, and vehicle miles traveled for on-road transportation. In estimating the County's historical GHG emissions, activity data for unincorporated Riverside County were obtained when possible (a "bottom-up" approach). When not available, other data sources were used, generally at the county level (a "top-down" approach). Activity data were provided by the sources identified in Table B-2.

Table B-2. Activity Data Sources

Data	Data Source	Notes
Electricity	Southern California Edison, Anza Electric Cooperative, and Imperial Irrigation District	Unincorporated County area data
Natural Gas	Southern California Gas Company	Unincorporated County area data
Water	Fern Valley Water District, High Valleys Water District, Rancho California Water District, Temescal Valley Water District, Cabazon Water District, Chiriaco Summit Water District, Coachella Valley Water District, Home Gardens County Water District, Idyllwild Water District, Mission Springs Water District, Pine Cove Water District, Pinyon Pines County Water District, Yucaipa Valley Water District, Beaumont-Cherry Valley Water District, Palo Verde Irrigation District, Eastern Municipal Water District, Elsinore Valley Municipal Water District, Lake Hemet Municipal Water District, Western Municipal Water District, and Desert Water Agency	Unincorporated County area data
Vehicle Miles Traveled	County of Riverside RIVTAM Model	Origin-destination approach, described below
Aviation	Riverside County Economic Development Agency	Unincorporated County area data
Demographic Data	County of Riverside General Plan and SCAG	Unincorporated County area data
Off-Road Emissions	OFFROAD Model	County-level data
Solid Waste	Riverside County Department of Waste Resources	Unincorporated County area data
Agriculture	SCAG and Riverside County Agricultural Commissioner	Unincorporated County area data

County = County of Riverside
RIVTAM = Riverside Traffic Analysis Model)
SCAG = Southern California Association of Governments

Origin-Destination Vehicle Miles Traveled

For the community inventory, activity data—in this case, vehicle miles traveled (VMT)—were based on an origin-destination approach used by the State in developing an emissions target for metropolitan planning organizations under Senate Bill 375. This approach has also been the typical approach used in estimating emission within a county. This approach accounts for:

- All of the emissions where a trip begins and ends within the county;
- Half of the emissions where one endpoint is in the county (i.e., either the origin or destination of the trip); and
- None of the emissions that are “pass-through” (i.e., a trip passes through the county but does not begin or end within its boundary).

This approach is used to account for trips or portions of trips that the County of Riverside may have some control over. The County does not have any control over pass-through trips because both the origin and destination that generated the trip are outside of the County’s jurisdiction.

Community Activity Data

Community activity data are shown in Table B-3, with the exception of off-road emissions, which are shown as the County’s proportion of countywide emissions. Total countywide off-road emissions by GHG are shown in Table B-4.

EMISSION FACTORS

Emissions factors are used to convert activity data to GHG emissions. An emission factor is defined as the average emission rate of a given GHG for a given source, relative to units of activity. By definition, an emission factor is related to activity data. The emission factors used in the inventories are described by sector below.

Electricity

California utilities report the average CO_2 content per output of electricity on an intermittent basis. The CO_2 intensity of electricity varies by utility and year due to changes in supply, renewable generation, and other factors. The community within the unincorporated County area uses electricity provided by Southern California Edison (SCE), Anza Electric Cooperative (Anza), and the Imperial Irrigation District (IID), except for embedded energy in water, which travels throughout the State and therefore utilizes electricity from multiple utilities (as described in the Water and Wastewater discussion below).

Table B-3. Community Inventory Activity Data

Sector	2017
On-Road Transportation	
Total Vehicle Miles Traveled	4,284,955,458
Aviation	
Jet Fuel (gallons)	2,781,219
Aviation Fuel (gallons)	431,069
Electricity (kWh)	
Commercial	1,463,821,482
Residential	1,505,409,800
Natural Gas (therms)	
Commercial	40,618,482
Residential	48,850,607
Solid Waste	
Landfill (tons)	389,687
Water and Wastewater	
Imported Water (million gallons)	27,642
Off-Road Sources[1] (% of Riverside County emissions attributed to unincorporated Riverside County)	
Lawn and Garden (% of households)	15.7
Construction (% of building permits)	29.4
Industrial (% of manufacturing jobs)	3.5
Light Commercial (% of other jobs)	11.7
Recreation (population weighted by income)	13.6
Agriculture (% of agriculture jobs)	77.2
Agriculture	
Hay (acres)	45,353
Corn (acres)	740
Oats (acres)	833
Sorghum (acres)	130
Wheat (acres)	18,394
Cotton (acres)	7,291
Vegetable and Fruit Trees (acres)	78,688
Dairy Cow (heads)	21,900
Poultry (heads)	1,893,394
Sheep (heads)	8,300

[1] Off-road emissions are available at the county (including unincorporated areas and incorporated cities) level through CARB's OFFROAD model. Emissions attributable to unincorporated Riverside County were derived using indicator data related to the off-road source. For example, the percentage of households in unincorporated Riverside County compared to the entire County (including unincorporated areas and incorporated areas) was used to attribute the same percentage of lawn and garden equipment emissions to the County. See below for more methodology details.

CARB = California Air Resources Board
kWh = kilowatt-hours

Table B-4. Emissions from Off-Road Categories for Riverside County

Off-Road Class	GHG Type	2017 (MT CO_2e/yr)
Agricultural Equipment	CO_2	1,580
	CH_4	0.019
	N_2O	0.143
Construction and Mining Equipment	CO_2	7,438
	CH_4	0.040
	N_2O	0.634
Industrial Equipment	CO_2	728
	CH_4	0.037
	N_2O	0.245
Lawn and Garden Equipment	CO_2	790
	CH_4	0.506
	N_2O	1.154
Light Commercial Equipment	CO_2	502
	CH_4	0.080
	N_2O	0.131
Recreational Equipment	CO_2	436
	CH_4	0.659
	N_2O	1.865

Source: OFFROAD Model (CARB 2007)
CARB = California Air Resources Board
CH_4 = methane
CO_2 = carbon dioxide
GHG = greenhouse gas
MT CO_2e/yr. = metric tons of carbon dioxide equivalent per year
N_2O = nitrous oxide

Since the County obtains its electricity from multiple providers (as shown in Table B-5), multiple emission factors were used. Western Electricity Coordinating Council (WECC) California subregion emissions rates from the Environmental Protection Agency's (EPA) eGRID2016 Summary Tables (EPA 2016) were used for both Anza and IID data. SCE reported CO_2 factors for 2016 through its Corporate Responsibility and Sustainability Report (SCE 2016).

Table B-5. Electricity Emission Factors

Source	CO_2 (lbs/MWh)	CH_4 (lbs/MWh)	N_2O (lbs/MWh)	CO_2e (lbs/MWh)
EPA	527.9	0.033	0.004	-
SCE[1]	-	-	-	529.11

Sources: Emissions & Generation Resource Integrated Database (eGRID) Summary Tables (EPA 2016); *2016 Corporate Responsibility and Sustainability Report* (SCE 2016).
[1] SCE only reported CO_2e.

CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
EPA = United States Environmental Protection Agency
lbs/MWh = pounds per megawatt-hour
N_2O = nitrous oxide
SCE = Southern California Edison

Natural Gas Combustion

Emission factors for natural gas do not vary greatly over time or by supplier. Therefore, natural gas emission factors from the United States Community Protocol for Accounting and Reporting GHG Emissions, which are U.S. averages, were used (Table B-6).

Table B-6. Natural Gas Emission Factors

	CO_2	CH_4	N_2O
kg/MMBtu	53.02	0.005	0.0001

Source: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (ICLEI 2012).
CH_4 = methane
CO_2 = carbon dioxide
ICLEI = Local Governments for Sustainability
kg/MMBtu = kilograms per million British thermal units
N_2O = nitrous oxide

Transportation and Mobile Sources

EMFAC Model

CO_2 emission factors for transportation and mobile sources are calculated using the State-developed Emissions Factor (EMFAC) model, version 2017, which can be accessed at http://www.arb.ca.gov/emfac/. Emissions are available at the county level, and emission factors were developed and applied to VMT for 2017. Data are aggregated as annual emissions for all vehicle model years and speeds, but are separated by vehicle class. Emission factors were developed using total CO_2 exhaust, which includes emissions from vehicles in motion, idling, and ignition. While emissions from idling and ignitions are not directly related to mileage, they were included so that reductions from measures that may decrease idling could be accounted for in future inventories.

On-Road Transportation

Emissions were converted to emission factors as grams of CO_2 per mile for gasoline, diesel, and natural gas vehicles using EMFAC and a three-step process:

1. Calculate VMT percentage for each vehicle class using EMFAC VMT.

2. Calculate CO_2 emission factor for each vehicle class using EMFAC CO_2 emissions[1] and VMT for Riverside County;

CH_4 and N_2O emission factors for gasoline, diesel, and natural gas vehicles were derived from Emission Factors for Greenhouse Gas Inventories developed by the EPA (Table B-7).

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1 The emissions factors take into account existing policies (e.g., Pavley and Low Carbon Fuel Standard).

Table B-7. On-Road Vehicle Emission Factors

Vehicle Class	Fuel Type	VMT Percentage	CO_2 Emission Factor (grams/mile)	CH_4 Emission Factor (grams/mile)	N_2O Emission Factor (grams/mile)
Passenger Cars	Gasoline	54.64	335.185	0.017	0.004
	Diesel	0.3998	242.843	0.0005	0.001
Light-Duty Trucks (ETW <= 3,750 pounds)	Gasoline	5.4589	397.184	0.016	0.007
	Diesel	0.0028	450.764	0.001	0.002
Light-Duty Trucks (ETW > 3,750 pounds)	Gasoline	17.96	437.784	0.016	0.007
	Diesel	0.0573	335.147	0.001	0.002
Light-Heavy-Duty Trucks (GVWR < 10,000 pounds)	Gasoline	1.530	914.724	0.033	0.013
	Diesel	1.451	562.207	0.005	0.005
Light-Heavy-Duty Trucks (GVWR > 10,000 pounds)	Gasoline	0.2306	1,047.891	0.033	0.013
	Diesel	0.5467	613.029	0.005	0.005
Motorcycles	Gasoline	0.5452	246.515	0.017	0.004
Medium-Duty Trucks	Gasoline	16.11	528.437	0.033	0.013
	Diesel	0.2423	441.921	0.005	0.005
Motor Homes	Gasoline	0.1273	1,897.190	0.016	0.007
	Diesel	0.0490	1,053.958	0.001	0.002
Motor Coaches	Diesel	0.0148	1,797.703	0.001	0.002
Other Buses	Gasoline	0.0615	1,926.349	0.016	0.007
Power Take-Off	Diesel	0.0706	2,337.179	0.001	0.002
School Buses	Gasoline	0.0351	1,073.062	0.016	0.007
	Diesel	0.0658	1,537.071	0.001	0.002
Urban Buses	Gasoline	0.0445	1,632.671	0.016	0.007
	Diesel	0.0001	1,314.437	0.001	0.002
	Natural Gas	0.0811	1,921.904	1.966	0.175
All Other Buses	Diesel	0.0268	1,136.311	0.001	0.002

Source: EMFAC2017 Web Database. EPA Emission Factors for Greenhouse Gas Inventories (CARB 2018).

CARB = California Air Resources Board
CH_4 = methane
CO_2 = carbon dioxide
ETW = equivalent test weight
GVWR = gross vehicle weight rating
N_2O = nitrous oxide
VMT = vehicle miles traveled

Off-Road Emissions Sources

Off-road emissions include emissions from agriculture, construction, industrial, lawn and garden, light commercial, and recreational equipment. Annual emissions of CO_2, CH_4, and N_2O are available at the county (including unincorporated areas and incorporated cities) level from the State's OFFROAD model. To estimate values for unincorporated Riverside County, relevant indicator data are used to estimate the proportion of county-level emissions attributable to unincorporated Riverside County.[1] Table B-8 lists the indicator data used to estimate unincorporated Riverside

[1] For example, the indicator for off-road emissions from construction equipment is building permits. Communities in unincorporated Riverside County issued 1,512 building permits in 2017, and 5,136 building permits were issued countywide. As such, building permits issued in unincorporated Riverside County account for 29.4 percent of the County's total building permits. It is assumed that the unincorporated area of the County's proportion of building permits is equal to the unincorporated area of the County's proportion of the entire County's off-road emissions. Based on this assumption, 29.4 percent of Riverside County's 2017 off-road CO_2 emissions are attributable to unincorporated Riverside County. Similar methodology applies to the remaining year and off-road emissions sources.

Table B-8. Off-Road Emissions Indicators

Category	Indicator
Agriculture Equipment	Agriculture Jobs
Construction Equipment	Building Permits Issued
Industrial Equipment	Manufacturing Jobs
Lawn and Garden Equipment	Households
Light Commercial Equipment	Nonmanufacturing or Agriculture Jobs
Recreational Equipment	Population, Weighted by Median Income

Sources: Profile of the Unincorporated Area of Riverside County and Profile of Riverside County (SCAG 2017).
SCAG = Southern California Association of Governments

County's portion of emissions for each category, and Table B-9 shows the data specific to unincorporated Riverside County. Indicator data were obtained from the Southern California Association of Governments' (SCAG) *Profile of the Unincorporated Area of Riverside County and Profile of Riverside County.*

Table B-9. Off-Road Emissions Indicator Data

	Agriculture Jobs	Building Permits	Manufacturing Jobs	Households	Other Jobs[1]	Population	Income ($)
Riverside County (Unincorporated Area)	8,257	1,512	3,613	112,292	69,884	364,413	50,394
Riverside County	10,700	5,136	103,633	713,205	595,607	2,347,828	57,367
% Unincorporated area of Entire County	77.2	29.4	3.5	15.7	11.7	13.6	

Source: *Profile of the Unincorporated Area of Riverside County and Profile of Riverside County* (SCAG 2017).
Note: Some percentages may appear off due to rounding.
[1] Other indicates nonmanufacturing and non-agricultural.
SCAG = Southern California Association of Governments

Water and Wastewater

Emissions from water are indirect. Water requires energy to move from its source to final treatment, and the energy used for most of these processes is not captured in local utility data (i.e., the portion that is used in a home or business and therefore contained in the owner's utility bill). This portion is termed the "embedded energy" in water. For southern California in particular, the energy embedded in water is high and should be accounted for in a community inventory. The California Energy Commission (CEC) developed a report that estimates the energy required to supply, convey, distribute, and treat water in northern and southern California (CEC 2006b). Outdoor water infiltrates the ground and therefore does not have the wastewater energy treatment component. Therefore, the emission factors are different for indoor and outdoor water. The amount of water used for indoor or outdoor use was not available at the county level. It is assumed that 50 percent of water is for outdoor use. The embedded energy in 1 million gallons (MG) of indoor and outdoor water in Riverside County is shown in Table B-10.

Table B-10. Energy Embedded in Water

	Indoor Use[1] (kWh/MG)	Outdoor Use[1] (kWh/MG)
Supply and Conveyance	9,727	9,727
Treatment	111	111
Distribution	1,272	1,272
Wastewater Treatment	1,911	–
Total	**13,022**	**11,111**

Source: *Refining Estimates for Water-Related Energy Use in California* (CEC, September 2006).
CEC = California Energy Commission   kWh/MG = kilowatt-hours per million gallons

Water districts obtain water from various sources. For local water sources, the data collected from SCE, Anza, and IID include associated electricity usage; hence, GHG emissions are included under the electricity sector discussion above. Showing GHG emissions associated with local water sources in the electricity sector avoided double-counting because the electricity used to pump local water supplies was embedded in the SCE, Anza, and IID reported electrical consumption data for unincorporated Riverside County. For this reason, the percentage of imported water data for each water district was collected along with the water consumption data. Table B-11 shows water consumption and percentage of imported water data for all water districts serving unincorporated Riverside County.

Table B-11. Water Consumption and Imported Water Data

Water District	Annual Water Consumption (million gallons)	Imported Water Percentage
Fern Valley Water District	38.12	0
High Valleys Water District	24.45	100
Rancho California Water District	8,233.13	40
Temescal Valley Water District	938.78	74
Cabazon Water District	148.34	0
Chiriaco Summit Water District	9.31	100
Coachella Valley Water District	N/A[1]	0
Home Gardens County Water District	120.89	57
Idyllwild Water District	86.68	0
Mission Springs Water District	N/A[1]	0
Pine Cove Water District	29.14	0
Pinyon Pines County Water District	5.76	0
Yucaipa Valley Water District	88.31	48
Beaumont-Cherry Valley Water District	3,190.73	59
Palo Verde Irrigation District	N/A[1]	0
Eastern Municipal Water District	4,081.28	54
Elsinore Valley Municipal Water District	1,022.98	68
Lake Hemet Municipal Water District	4,056.52	70
Western Municipal Water District	5,295.52	68
Desert Water Agency	92.09	27

Source: Compiled by LSA (2018).
[1] Data are not available. However, since 100 percent of the district's water is from local sources, missing data do not affect calculation results.

For energy embedded in water, a statewide average emission factor is applied because water in Riverside County is supplied from various regions in the State. These emissions factors are listed in Table B-12.

Table B-12. California Statewide Electricity Emission Factors

Year	CO_2 (lbs/MWh)	CH_4 (lbs/MWh)	N_2O (lbs/MWh)
2016[1]	527.9	0.033	0.004

Source: Emissions & Generation Resource Integrated Database (eGRID) (EPA 2016).
[1] 2016 data is the most recent year available and is used as a proxy for 2017 inventory.
CH_4 = methane
CO_2 = carbon dioxide
EPA = United States Environmental Protection Agency
lbs/MWh = pounds per megawatt-hour
N_2O = nitrous oxide

Solid Waste

Emissions from solid waste are primarily in the form of fugitive emissions of CH_4 from decomposition, and only organic waste may decompose. Emission factors are derived from the Community Protocol based on the type of waste disposed. For the community inventory, the emission factor for mixed municipal solid waste was used. The emission factor to determine CH_4 generation varies if the landfill has a CH_4 capture system and if it operates a CH_4 flare or generates electricity from CH_4 capture. The Community Protocol recommends using an average factor of 75 percent recovery from landfill gas, although some landfills with have much higher gas recovery systems and other landfills have lower gas recovery systems. CO_2 generated by the decomposition of waste in landfills is not considered anthropogenic because it would be produced through the natural decomposition process regardless of its disposition in the landfill. N_2O is not a byproduct of decomposition; therefore, no fugitive emissions of N_2O are anticipated from this source. Table B-13 shows the waste disposal amount for all landfills that serve unincorporated Riverside County and whether each landfill has a CH_4 capture system.

Table B-13. Solid Waste Disposal

Landfill Name	Annual Waste Disposal (tons)	Has Methane Recovery System?
Badlands Landfill	77,845.00	Yes
Blythe	6,283.47	No
Desert Center	32.11	No
Lamb Canyon	92,731.44	Yes
Mecca II	3.60	No
Oasis	1,092.00	No
El Sobrante	168,791.00	Yes
Transfer Stations[1]	42,909.21	No
TOTAL	**389,687.83**	-

Source: County of Riverside, Department of Waste Resources (2018).
[1] There are multiple transfer stations serving unincorporated Riverside County. As a worst-case scenario, it is assumed that the landfills that the transfer stations send waste to do not have methane capture systems.

FORECASTS

The forecasts are an estimate of what emissions in Riverside County may be in 2020, 2030, and 2050. The forecasts were developed using standard methodologies under two scenarios: BAU and Adjusted BAU.

Business-as-Usual Forecasts

The BAU scenario uses current (2017) consumption patterns and predicted growth in Riverside County in the absence of State and federal legislation that would reduce future emissions. The growth assumptions are based on County of Riverside General Plan estimates (County of Riverside 2015b) and are applied to emissions sectors based on their relevance. For example, future residential energy emissions were developed using current energy use per household (from the 2017 inventory) and the anticipated number of households in the future. Table B-14 shows the growth factors used to project emissions in Riverside County.

Table B-14. Emissions Sectors and Demographic Growth Indicators

Sector	Demographic Indicator
Residential Energy	Households
Commercial/Industrial Energy	Jobs
Solid Waste, Water, Wastewater, and Off-Road Sources	Service Population (Population + Jobs)
Transportation	VMT
Agriculture	Change in agriculture sector between 2008 and 2017

Source: *AEP White Paper: California Community-Wide GHG Baseline Inventory Protocol* (AEP, June 2011).
AEP = Association of Environmental Professionals
VMT = vehicle miles traveled

Adjusted Business-as-Usual Forecasts

The Adjusted BAU scenario also uses growth estimates for the County but accounts for legislation that will reduce emissions in the future regardless of County actions. The legislation is detailed in the IFT Report under the Adjusted Business-as-Usual Forecast section and summarized below in Table B-15.

Low Carbon Fuel Standard, Assembly Bill 1493, and Advanced Clean Cars

Changes in on-road emissions in Riverside County were modeled using EMFAC2017, which models both the emissions with and without the Low Carbon Fuel Standard and Pavley I. Additional modeling was conducted to estimate the change in emissions due to the State's Advanced Clean Cars Program, which includes additional components that will further reduce GHG emissions statewide, including more stringent fuel efficiency standards for model years 2017–2025 and support infrastructure for the commercialization of zero-emission vehicles. The emission factors with the reductions from on-road transportation measures in 2020, 2030, and 2050 were modeled from EMFAC2017.

Table B-15. Legislation Applied to Adjusted BAU Forecasts

Legislation	Description	Emissions Sector(s) Affected
Low Carbon Fuel Standard	Reduce carbon intensity of transportation fuels 10 percent by 2020 and maintain the target beyond 2020.	On-Road Transportation, Employee Commute, and Vehicle Fleet
AB 1493 and Advanced Clean Cars	Implement GHG standards for passenger vehicles, implement a zero-emission vehicle program, and support clean fuels outlet regulation.	On-Road Transportation
California Building Code Title 24	Improved energy efficiency standards for new residential and nonresidential construction.	Residential Energy and Nonresidential Energy
Renewable Portfolio Standard	Provide 33 percent, 60 percent, and 100 percent of electricity from renewable sources by 2020, 2030, and 2045, respectively.	Residential Energy, Nonresidential Energy, and Water Energy

Sources: California Air Resources Board Low Carbon Fuel Standard Webpage: https://www.arb.ca.gov/fuels/lcfs/lcfs.htm (accessed August 13, 2018).
California Air Resources Board Clean Car Standards (AB 1493) Webpage: https://www.arb.ca.gov/cc/ccms/ccms.htm (accessed August 13, 2018).
California Air Resources Board California Green Building Standards Code Webpage: https://www.arb.ca.gov/research/indoor/greenbuildings.htm (accessed August 13, 2018).
California Air Resources Board Renewable Portfolio Standard Webpage: https://www.arb.ca.gov/energy/rps/rps.htm (accessed August 13, 2018).

Assembly Bill
BAU = Business-as-Usual
GHG = greenhouse gas

California Building Code Title 24

Title 24 updates will raise the minimum energy-efficiency standards for new buildings, thereby decreasing the expected energy consumption of future development in Riverside County. Under the Adjusted BAU scenario, it was assumed that the 2016 Title 24 standards that went into effect in 2017 will make new residential and nonresidential buildings more efficient than they would be under the 2013 Title 24 standards for new residential and nonresidential buildings. The energy savings were estimated using analyses developed by the CEC and applied to the expected new development in Riverside County from 2017 to 2050. The rate of reductions was applied to the County's 2017 energy use (kWh or therms) per household (for residential energy) or per job (for commercial/industrial energy). Savings were then applied to new development anticipated in Riverside County. Detailed energy savings assumptions are provided below.

Residential

Residential electricity is estimated to be 13.3 percent lower under the new standards (CEC 2015). This percentage savings is relative to heating, cooling, lighting, and water heating only; it does not include other appliances, outdoor lighting that is not attached to buildings, plug loads, or other energy uses. Electricity consumption due to heating, cooling, lighting, and water heating accounts for 34 percent of total household electricity use (CEC 2009). Therefore, the percentage of total residential electricity that will be reduced as a result of the 2016 Title 24 standards is 4.5 percent.

Residential natural gas savings under the new standards are estimated to be 25.1 percent. Again, this percentage savings pertains only to the energy sources affected by Title 24 standards. Natural gas consumption due to space and water heating accounts for 86 percent of total household natural gas use (CEC 2009). Therefore, the percentage of total residential natural gas that will be reduced as a result of the 2016 Title 24 standards is 21.6 percent.

Commercial

Commercial Electricity savings were estimated to be 4.6 percent lower under the new standards. Title 24-related measures would impact 77.2 percent of total electricity use in commercial buildings (CEC 2006a); therefore, a 3.6 percent reduction in electricity consumption may be expected in new commercial development.

Natural gas savings were estimated to be 0.5 percent under the new standards compared to the previous standards. Heating and cooling account for 69.7 percent of natural gas consumption in commercial facilities; therefore, a 0.35 percent reduction in natural gas consumption may be expected from the 2016 Title 24 standards applied to new commercial development.

Renewable Portfolio Standard

The Renewable Portfolio Standard (RPS) requires energy providers to derive 33 percent, 60 percent, and 100 percent of their electricity from qualified renewable sources by 2020, 2030, and 2045, respectively. The level of implementation varies by utility. As the largest electricity provider for the County, SCE's implementation of the RPS was assumed to represent the County. As reported in SCE's 2016 Corporate Responsibility and Sustainability Report, approximately 28 percent of the electricity SCE provided to customers in 2016 came from eligible renewable sources. Therefore, to achieve the RPS goals, the emission factors in 2020, 2030, and 2050 would decrease by 15.2 percent, 53.3 percent, and 72.0 percent, respectively. The reduction is taken for electricity used within Riverside County, as well as the delivery and treatment of water.

TARGET SETTING

The State-aligned targets are provided to assist the County in determining appropriate emission reduction goals. Recommended targets are based on existing California climate change legislation and State guidance relevant to establishing a GHG reduction target. While State goals are based on a 1990 baseline year, the County's baseline year is 2008. Therefore, the reduction targets are expressed as a percentage reduction below 2008 levels. Targets are recommended for 2020 and 2050 to align with AB 32 and for 2030 to align with EO B-30-15.

Table B-16 provides a summary of the State's goals and guidance to local governments regarding GHG reduction targets. This guidance applies to communitywide emissions reductions efforts.

Table B-17 demonstrates how the recommendations for local targets that do not have a 1990 emissions inventory were derived and how they align with State targets.

Table B-16. Summary of State Reduction Targets and Guidance on Local Government Targets Aligned with State Targets

	2020	2030	2050
State Targets (AB 32 and EO B-30-15)	1990 levels	40 percent below 1990 levels	80 percent below 1990 levels
State Guidance on Local Government Targets (AB 32 Scoping Plan)	15 percent below current levels	Demonstrate a trajectory toward statewide 2050 levels	N/A

Sources: AB 32 Scoping Plan Update (California Air Resources Board 2013); California's 2017 Climate Change Scoping Plan (CARB 2017); EO B-30-15 (Office of Governor Edmund G. Brown Jr. 2015)

AB = Assembly Bill
EO = Executive Order
CARB = California Air Resources Board
N/A = not available

Table B-17. Comparison of 1990 Baseline Targets vs. 2008 Baseline Targets

Target Year	Percent Below 1990 Emission Levels	Percent Below 2008 Emission Levels
2020	**0.0**	**15.0**
2021	4.0	18.4
2022	8.0	21.8
2023	12.0	25.2
2024	16.0	28.6
2025	20.0	32.0
2026	24.0	35.4
2027	28.0	38.8
2028	32.0	42.2
2029	36.0	45.6
2030	**40.0**	**49.0**
2031	42.0	50.7
2032	44.0	52.4
2033	46.0	54.1
2034	48.0	55.8
2035	50.0	57.5
2036	52.0	59.2
2037	54.0	60.9
2038	56.0	62.6
2039	58.0	64.3
2040	60.0	66.0
2041	62.0	67.7
2042	64.0	69.4
2043	66.0	71.1
2044	68.0	72.8
2045	70.0	74.5
2046	72.0	76.2
2047	74.0	77.9
2048	76.0	79.6
2049	78.0	81.3
2050	**80.0**	**83.0**

Source: Compiled by LSA (2018).

APPENDIX B

GHG INVENTORY AND FORECASTS CALCULATIONS

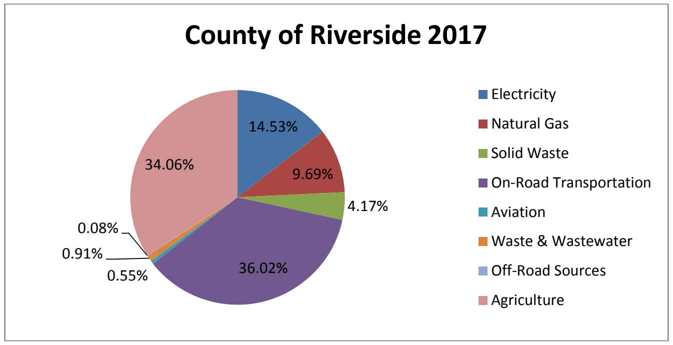
County of Riverside GHG Inventory

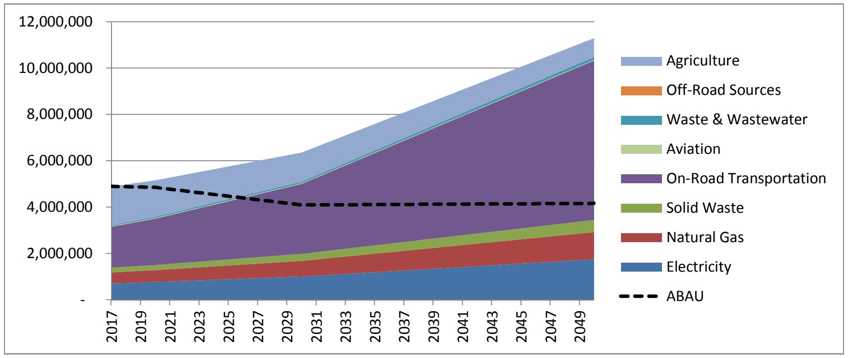
Breakdown of Emissions (BAU)

	2017	2020	2030	2050
Source	**MT CO2e**	**MT CO2e**	**MT CO2e**	**MT CO2e**
Electricity	712,928	774,289	1,017,153	1,756,843
Natural Gas	475,211	515,845	676,742	1,165,761
Solid Waste	204,365	223,448	298,585	533,154
On-Road Transportation	1,766,784	1,999,268	3,018,767	6,882,509
Aviation	26,786	26,786	26,786	26,786
Waste & Wastewater	44,606	48,771	65,171	116,370
Off-Road Sources	3,883	4,024	4,531	5,744
Agriculture	1,670,954	1,565,873	1,261,044	817,858
Total	4,905,518	5,158,305	6,368,781	11,305,026

Breakdown of Emissions (ABAU)

	2017	2020	2030	2050
Source	**MT CO2e**	**MT CO2e**	**MT CO2e**	**MT CO2e**
Electricity	712,928	653,541	466,971	480,289
Natural Gas	475,211	510,268	652,578	1,104,421
Solid Waste	204,365	223,448	298,585	533,154
On-Road Transportation	1,766,784	1,835,938	1,361,200	1,174,310
Aviation	26,786	26,786	26,786	26,786
Waste & Wastewater	44,606	41,377	30,413	32,584
Off-Road Sources	3,883	4,024	4,531	5,744
Agriculture	1,670,954	1,565,873	1,261,044	817,858
Total	4,905,518	4,861,256	4,102,109	4,175,146





Electricity

Emissions Coefficients

	CO2	CH4	N2O				GWP (5th Assessment)
IID	2.39E-04	1.50E-08	1.81E-09	metric tons/kWh	*EPA 2016 Data - h29*	CH4	28
SCE	2.40E-04	0.00E+00	0.00E+00	metric tons/kWh	*SCE 2016 Data - https://www.edison.com/content/dam/eix/documents/investors/corporate_responsibility/2016-eix-corpo*	N2O	265
ANZA	2.39E-04	1.50E-08	1.81E-09	metric tons/kWh	*EPA 2016 Data - hhttps://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf*		

Inventory

		Metric Tons				
Utility Provider		Annual kWh	CO2	CH4	N2O	CO2e
IID	Residential	424,752,054	101,707.49	6.36	0.77	102,089.73
IID	Non-Residential	404,905,158	96,955.12	6.06	0.73	97,319.50
SCE	Residential	1,033,261,556	247,982.77	-	-	247,982.77
SCE	Non-Residential	1,047,076,494	251,298.36	-	-	251,298.36
ANZA	Residential	47,396,190.00	11,349.09	0.71	0.09	11,391.74
ANZA	Non-Residential	11,839,830.00	2,835.06	0.18	0.02	2,845.72
TOTAL	**Residential**	**1,505,409,800**	**361,039.34**	**7.07**	**0.86**	**361,464.24**
	Non-Residential	**1,463,821,482**	**351,088.54**	**6.24**	**0.76**	**351,463.58**
	All	**2,969,231,282**	**712,127.89**	**13.31**	**1.61**	**712,927.83**

Forecast

	Forecast Indicator	**2017 (MT CO2e)**	**2017-2020 CAGR**	**2020 (MT CO2e)**	**2020-2035 CAGR**	**2030 (MT CO2e)**	**2050 (MT CO2e)**
Residential	Households	361,464.24	0.025658333	390,007.97	0.025901645	503,652.21	839,934.20
Non-Residential	Service Population	351,463.58	0.030203381	384,281.29	0.029411995	513,501.23	916,908.44
Total		**712,927.83**		**774,289.26**		**1,017,153.43**	**1,756,842.64**

	CO2	CH4	N2O	
IID	527.9	0.033	0.004	lbs/MWh
SCE	529.11			lbs/MWh
ANZA	527.9	0.033	0.004	lbs/MWh

1 lb 0.0004535924 metric ton
1 MWh 1000 kWh

	CO2e	
SCE	0.24	MT CO2e/MWh
	529.1093942	lbs CO2e/Mwh

	2008 kWh	2017 kWh	Growth Rate
SCE	2,593,455,382	2,080,338,050.00	0.80215
IID Residential	529,517,547	424,752,054.27	
IID Non-Residential	504,775,395	404,905,157.89	

Note: 2008 kWh data is from 2015 CAP inventory spreadsheet.

Electricity Reduction

	2010-2020 CAGR	2010	2017	2035
Households	0.025658333	171,380	204,635	324,021
Jobs	0.045048336	97,210	132,332	265,688

	2017 (kWh)	2017-2020 CAGR	2020 (kWh)	2020-2035 CAGR	2030 (kWh)	2050 (kWh)
Residential	1,505,409,800	0.025658333	1,624,287,408	0.025901645	2,097,587,750	3,498,119,640
Non-Residential	1,463,821,482	0.030203381	1,600,504,974	0.029411995	2,138,697,054	3,818,860,173

SCE	0.00024	MT CO2e/kWh

Title 24

kWh per household x 4.5% (residential savings from Title 24)	331.05	Impact Analysis, California Energy Commission
kWh per job x 3.6% (commercial savings from Title 24)	398.22	2016 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings
Primary Driver_Household_2017-2035 (units/yr)	6,633	
Primary Driver_Total Jobs_2017-2035 (jobs/yr)	7,409	

RPS

Renewable Portfolio Standards_2017-2020 (Change Carbon Intensity)	84.8%	28% renewable in 2016 based on SCE report, 33% goal by 2020
Renewable Portfolio Standards_2020-2030 (Change Carbon Intensity)	46.7%	Renewable energy 60% by 2030
Renewable Portfolio Standards_2030-2050 (Change Carbon Intensity)	28.0%	Renewable energy 100% by 2045

	2020	2030	2050
Title 24 Residential Reduction (kWh)	6,587,060	28,543,927	72,457,661
Title 24 Non-Residential Reduction (kWh)	8,850,863	38,353,741	97,359,495

	2020	2030	2050
BAU	774,289	1,017,153	1,756,843
ABAU	653,541	466,971	480,289

Natural Gas

Emissions Coefficients

	CO2	CH4	N2O	
SCG	53.06	0.001	0.0001	kg/MMBTU

CO2 weighted national average- https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

GWP (5th Assessment)

CH4	28
N2O	265

Inventory

			Metric Tons			
Utility Provider	Land Use	Annual Therms	CO2	CH4	N2O	CO2e
SCG	Residential	48,850,607	259,201.32	4.89	0.49	259,467.55
SCG	Non-residential	40,618,482	215,521.67	4.06	0.41	215,743.04
TOTAL		**89,469,088.72**	**474,722.98**	**8.95**	**0.89**	**475,210.59**

Forecast

	Forecast Indicator	**2017 (MT CO2e)**	**2017-2020 CAGR**	**2020 (MT CO2e)**	**2020-2035 CAGR**	**2030 (MT CO2e)**	**2050 (MT CO2e)**
Residential	Households	259,467.55	0.025658333	279,956.91	0.025901645	361,533.43	602,924.57
Non-Residential	Service Population	215,743.04	0.030203381	235,887.92	0.029411995	315,208.52	562,836.73
Total		**475,210.59**		**515,844.83**		**676,741.94**	**1,165,761.29**

1 lb	0.4535924	kg
1 therm	0.1	MMBTU
	10000	kg/MMBTU to MT/therm

Natural Gas Reduction

	2010-2020 CAGR	2010	2017	2035
Households	0.025658333	171,380	204,635	324,021
Jobs	0.045048336	97,210	132,332	265,688

	2017 (therms)	2017-2020 CAGR	2020 (therms)	2020-2035 CAGR	2030 (therms)	2050 (therms)
Residential	48,850,607	0.025658333	52,708,190	0.025901645	68,066,804	113,514,119
Non-Residential	40,618,482	0.030203381	44,411,210	0.029411995	59,345,097	105,966,681

	CO2	CH4	N2O	
SCG	53.06	0.001	0.0001	kg/MMBTU

Title 24

therm per household x 21.6% (residential savings from Title 24)	51.56	Impact Analysis, California Energy Commission
therm per job x 0.35% (commercial savings from Title 24)	1.07	2016 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings
Primary Driver_Household_2017-2035 (units/yr)	6,633	
Primary Driver_Total Jobs_2017-2035 (jobs/yr)	7,409	

	2020	2030	2050
Title 24 Residential Reduction (therms)	1,026,002	4,446,007	11,286,019
Title 24 Non-Residential Reduction (therms)	23,877	103,469	262,651

	2020	2030	2050
BAU	515,845	676,742	1,165,761
ABAU	510,268	652,578	1,104,421

Transportation

On-Road Transportation

Inventory

Vehicle Category	Fuel	VMT %	CO2 (g/mile)	CH4 (g/mile)	N2O (g/mile)	VMT (mile)	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)
All Other Buses	DSL	0.0268%	1136.310911	0.001	0.0015	1149102.184	1305.73735	0.001149102	0.001723653	1306.226293
LDA	GAS	54.6410%	335.1849048	0.0173	0.0036	2341343607	784783.034	40.50524441	8.428836986	788150.8227
LDA	DSL	0.3998%	242.8427106	0.0005	0.001	17130113.09	4159.923096	0.008565057	0.017130113	4164.702397
LDA	ELEC	0.2242%	0	0	0	9606438.542	0	0	0	0
LDT1	GAS	5.4589%	397.1838452	0.0163	0.0066	233912061.2	92906.09193	3.812766598	1.543819604	93421.96159
LDT1	DSL	0.0028%	450.7642356	0.001	0.0015	118468.9705	53.40157492	0.000118469	0.000177703	53.45198347
LDT1	ELEC	0.0025%	0	0	0	107635.9053	0	0	0	0
LDT2	GAS	17.9605%	437.7843688	0.0163	0.0066	769597904.6	336917.9329	12.54444584	5.07934617	338615.2041
LDT2	DSL	0.0573%	335.1468908	0.001	0.0015	2454135.929	822.496026	0.002454136	0.003681204	823.5402608
LDT2	ELEC	0.0215%	0	0	0	919916.9092	0	0	0	0
LHD1	GAS	1.5298%	914.7238407	0.0333	0.0134	65549815.77	59959.97924	2.182808865	0.878367531	60253.86528
LHD1	DSL	1.4508%	562.2074067	0.0051	0.0048	62166943.31	34950.71598	0.317051411	0.298401328	35038.66977
LHD2	GAS	0.2306%	1047.891406	0.0333	0.0134	9879189.314	10352.31758	0.328977004	0.132381137	10396.60994
LHD2	DSL	0.5467%	613.0286826	0.0051	0.0048	23426792.33	14361.29564	0.119476641	0.112448603	14394.43987
MCY	GAS	0.5452%	246.5148793	0.0173	0.0036	23362638.83	5759.238092	0.404173652	0.0841055	5792.842911
MDV	GAS	16.1063%	528.4366685	0.0333	0.0134	690148155.7	364699.5921	22.98193358	9.247985286	367793.8024
MDV	DSL	0.2423%	441.921389	0.0051	0.0048	10384478.57	4589.123194	0.052960841	0.049845497	4603.815154
MDV	ELEC	0.0027%	0	0	0	115999.8889	0	0	0	0
MH	GAS	0.1273%	1897.189821	0.0163	0.0066	5453507.054	10346.33807	0.088892165	0.035993147	10358.36523
MH	DSL	0.0490%	1053.95778	0.001	0.0015	2098762.596	2212.007167	0.002098763	0.003148144	2212.90019
Motor Coach	DSL	0.0148%	1797.702614	0.001	0.0015	633211.1006	1138.325251	0.000633211	0.000949817	1138.594682
OBUS	GAS	0.0615%	1926.348783	0.0163	0.0066	2637056.57	5079.890714	0.042984022	0.017404573	5085.706479
PTO	DSL	0.0706%	2337.179307	0.001	0.0015	3024593.133	7069.016481	0.003024593	0.00453689	7070.303446
SBUS	GAS	0.0351%	1073.061844	0.0163	0.0066	1505788.761	1615.804465	0.024544357	0.009938206	1619.125331
SBUS	DSL	0.0658%	1537.071186	0.001	0.0015	2819337.329	4333.522173	0.002819337	0.004229006	4334.721802
UBUS	GAS	0.0445%	1632.671346	0.0163	0.0066	1906112.486	3112.055239	0.031069634	0.012580342	3116.25898
UBUS	DSL	0.0001%	1314.437251	0.001	0.0015	6361.092159	8.361256491	6.36109E-06	9.54164E-06	8.363963136
UBUS	ELEC	0.0005%	0	0	0	23011.83773	0	0	0	0
UBUS	NG	0.0811%	1921.904328	1.966	0.175	3474317.694	6677.306211	6.830508586	0.608005596	7029.681934
Total						4284955458	**1757213.506**	**90.28870664**	**26.57504558**	**1766783.977**

Forecast

	2017 (MT CO2e)	2017-2060 CAGR	2020 (MT CO2e)	2030 (MT CO2e)	2050 (MT CO2e)	2017 VMT	2060 VMT
Total	1,766,783.98	0.0420675	1,999,268.06	3,018,767.14	6,882,508.97	4,284,955,457.91	25,203,928,089.77

2030 VMT
7321371995

Aviation

CO2	8.31 kg/gallon	*EPA Emission Factors for Greenhouse Gas Inventories - https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf*
CH4	0.36 g/gallon	
N2O	0.07 g/gallon	

Metric Tons

	Annual Gallons	CO2	CH4	N2O	CO2e
Jet Fuel	2,781,219	23,111.93	1.00	0.19	23,191.56
Aviation Fuel	431,069	3,582.18	0.16	0.03	3,594.52
Total	**3,212,288**	**26,694.11**	**1.16**	**0.22**	**26,786.08**

Emission Coefficients

	GWP (5th Assessment)
CH4	28
N2O	265

CH4	g/mile	
Passenger Car	Gasoline	0.0173
Passenger Car	Diesel	0.0005
Light-Duty Truck	Gasoline	0.0163
Light-Duty Truck	Diesel	0.001
Heavy-Duty Truck	Gasoline	0.0333
Heavy-Duty Truck	Diesel	0.0051
Buses	CNG	1.966

N2O	g/mile	
Passenger Car	Gasoline	0.0036
Passenger Car	Diesel	0.001
Light-Duty Truck	Gasoline	0.0066
Light-Duty Truck	Diesel	0.0015
Heavy-Duty Truck	Gasoline	0.0134
Heavy-Duty Truck	Diesel	0.0048
Buses	CNG	0.175

EPA Emission Factors for Greenhouse Gas Inventories - https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Transportation Reduction

2020 ABAU

Vehicle Category	Fuel	VMT %	CO2 (g/mile)	CH4 (g/mile)	N2O (g/mile)	VMT (mile)	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)
All Other Buses	DSL	0.0302%	1085.676537	0.001	0.0015	1462807.405	1588.13568	0.001462807	0.002194211	1588.7581
LDA	GAS	55.5738%	312.2848118	0.0173	0.0036	2694658441	841500.904	46.61759103	9.700770388	845376.901
LDA	DSL	0.5031%	225.5701497	0.0005	0.001	24396689.26	5503.16485	0.012198345	0.024396689	5509.97152
LDA	ELEC	0.5838%	0	0	0	28309357.98	0	0	0	0
LDT1	GAS	5.6057%	368.5351479	0.0163	0.0066	271807788.2	100170.723	4.430466947	1.793931402	100770.168
LDT1	DSL	0.0019%	442.4649996	0.001	0.0015	93714.20537	41.4652558	9.37142E-05	0.000140571	41.5051312
LDT1	ELEC	0.0129%	0	0	0	626172.0581	0	0	0	0
LDT2	GAS	18.0063%	398.3884857	0.0163	0.0066	873090642.6	347829.259	14.23137747	5.762398241	349754.773
LDT2	DSL	0.0981%	304.7201361	0.001	0.0015	4754687.687	1448.84908	0.004754688	0.007132032	1450.8722
LDT2	ELEC	0.0741%	0	0	0	3592374.749	0	0	0	0
LHD1	GAS	1.3435%	895.1683233	0.0333	0.0134	65141484.63	58312.5936	2.169211438	0.872895894	58604.6489
LHD1	DSL	1.3332%	545.8221175	0.0051	0.0048	64644015.82	35284.1336	0.329684481	0.310291276	35375.592
LHD2	GAS	0.2093%	1025.787333	0.0333	0.0134	10150776.32	10412.5378	0.338020851	0.136020403	10458.0478
LHD2	DSL	0.5108%	595.5254904	0.0051	0.0048	24766733.21	14749.2209	0.126310339	0.118880319	14784.2609
MCY	GAS	0.5096%	246.9361868	0.0173	0.0036	24707143.75	6101.08786	0.427433587	0.088945718	6136.62662
MDV	GAS	14.7566%	493.01707	0.0333	0.0134	715515954.2	352761.579	23.82668127	9.587913786	355969.523
MDV	DSL	0.3041%	411.3825709	0.0051	0.0048	14744289.84	6065.54386	0.075195878	0.070772591	6086.40408
MDV	ELEC	0.0261%	0	0	0	1266064.937	0	0	0	0
MH	GAS	0.1016%	1870.732594	0.0163	0.0066	4924879.639	9213.13286	0.080275538	0.032504206	9223.99419
MH	DSL	0.0420%	1044.886575	0.001	0.0015	2037612.914	2129.07438	0.002037613	0.003056419	2129.94138
Motor Coach	DSL	0.0153%	1721.823799	0.001	0.0015	741842.3504	1277.32181	0.000741842	0.001112764	1277.63747
OBUS	GAS	0.0531%	1888.093453	0.0163	0.0066	2574765.21	4861.39734	0.041968673	0.01699345	4867.07573
PTO	DSL	0.0790%	2278.313122	0.001	0.0015	3828160.056	8721.74729	0.00382816	0.00574224	8723.37617
SBUS	GAS	0.0357%	1065.419723	0.0163	0.0066	1731751.702	1845.04242	0.028227553	0.011429561	1848.86162
SBUS	DSL	0.0669%	1506.648397	0.001	0.0015	3241955.247	4884.48668	0.003241955	0.004862933	4885.86613
UBUS	GAS	0.0435%	1536.934409	0.0163	0.0066	2108996.262	3241.38892	0.034376639	0.013919375	3246.0401
UBUS	DSL	0.0001%	1257.891569	0.001	0.0015	5398.664839	6.79093499	5.39866E-06	8.098E-06	6.79323212
UBUS	ELEC	0.0005%	0	0	0	25027.38542	0	0	0	0
UBUS	NG	0.0793%	1931.862443	1.966	0.175	3846192.188	7430.31424	7.561613841	0.673083633	7820.40659
Total						4,848,795,719.53	**1825379.9**	**100.3468001**	**29.2393962**	**1835938.05**

2030 ABAU

Vehicle Category	Fuel	VMT %	CO2 (g/mile)	CH4 (g/mile)	N2O (g/mile)	VMT (mile)	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)
All Other Buses	DSL	0.0369%	893.3998319	0.001	0.0015	1791263.858	1600.31483	0.001791264	0.002686896	1601.07701
LDA	GAS	55.4282%	244.3691056	0.0173	0.0036	2687601174	656766.695	46.49550031	9.675364227	660632.541
LDA	DSL	0.6556%	179.8926099	0.0005	0.001	31787992.69	5718.42497	0.015893996	0.031787993	5727.29382
LDA	ELEC	2.6151%	0	0	0	126801262.6	0	0	0	0
LDT1	GAS	5.8392%	289.4321659	0.0163	0.0066	283128613.6	81946.5279	4.614996401	1.86864885	82570.9397
LDT1	DSL	0.0007%	343.7193606	0.001	0.0015	35272.2483	12.1237546	3.52722E-05	5.29084E-05	12.138763
LDT1	ELEC	0.1517%	0	0	0	7356529.039	0	0	0	0
LDT2	GAS	18.0764%	292.2394867	0.0163	0.0066	876488991.3	256144.693	14.28677056	5.784827343	258077.702
LDT2	DSL	0.1679%	240.0300016	0.001	0.0015	8142435.141	1954.42872	0.008142435	0.012213653	1957.89333
LDT2	ELEC	0.3994%	0	0	0	19364474.72	0	0	0	0
LHD1	GAS	1.0696%	783.2496262	0.0333	0.0134	51864757.51	40623.0519	1.727096425	0.694987751	40855.5824
LHD1	DSL	1.1204%	471.3010344	0.0051	0.0048	54326999.28	25604.371	0.277067696	0.260769597	25681.2328
LHD2	GAS	0.1695%	902.9127779	0.0333	0.0134	8219338.033	7421.34534	0.273703956	0.11013913	7458.19592
LHD2	DSL	0.4411%	517.0721919	0.0051	0.0048	21389130.34	11059.7245	0.109084565	0.102667826	11089.9858
MCY	GAS	0.4527%	248.5075292	0.0173	0.0036	21951481.81	5455.10851	0.379760635	0.079025335	5486.68352
MDV	GAS	12.2269%	364.2269632	0.0333	0.0134	592857401.6	215934.651	19.74215147	7.944289181	218592.668
MDV	DSL	0.3990%	321.033346	0.0051	0.0048	19345476.28	6210.54298	0.098661929	0.092858286	6237.91296
MDV	ELEC	0.2858%	0	0	0	13856714.84	0	0	0	0
MH	GAS	0.0613%	1630.55243	0.0163	0.0066	2973536.096	4848.50651	0.048468638	0.019625338	4855.06434
MH	DSL	0.0298%	950.9374066	0.001	0.0015	1446243.413	1375.28696	0.001446243	0.002169365	1375.90234
Motor Coach	DSL	0.0156%	1437.906085	0.001	0.0015	756116.4465	1087.22444	0.000756116	0.001134175	1087.54617
OBUS	GAS	0.0411%	1603.539026	0.0163	0.0066	1994504.627	3198.26601	0.032510425	0.013163731	3202.66469
PTO	DSL	0.0933%	1938.320407	0.001	0.0015	4525344.437	8771.56747	0.004525344	0.006788017	8773.49301
SBUS	GAS	0.0382%	999.7292236	0.0163	0.0066	1853761.28	1853.25932	0.030216309	0.012234824	1857.34761
SBUS	DSL	0.0701%	1324.587338	0.001	0.0015	3396797.595	4499.35508	0.003396798	0.005095196	4500.80042
UBUS	GAS	0.0403%	1367.24777	0.0163	0.0066	1952024.188	2668.90072	0.031817994	0.01288336	2673.20571
UBUS	NG	0.0740%	1920.425423	0.001	0.0015	3588082.494	6890.64484	0.003588082	0.005382124	6892.17157
Total						7,321,371,994.74	**1351645.01**	**88.18738287**	**26.7387951**	**1361200.04**

2050 ABAU

Vehicle Category	Fuel	VMT %	CO2 (g/mile)	CH4 (g/mile)	N2O (g/mile)	VMT (mile)	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)
All Other Buses	DSL	0.0412%	822.3565464	0.001	0.0015	1999744.306	1644.50282	0.001999744	0.002999616	1645.35371
LDA	GAS	54.6425%	219.0783546	0.0173	0.0036	2649501859	580448.508	45.83638216	9.538206692	584259.551
LDA	DSL	0.6816%	163.7588653	0.0005	0.001	33048923.29	5412.05418	0.016524462	0.033048923	5421.27483
LDA	ELEC	3.4540%	0	0	0	167477615.5	0	0	0	0
LDT1	GAS	6.0597%	252.1884794	0.0163	0.0066	293821534.9	74098.4061	4.789291018	1.93922213	74746.4001
LDT1	DSL	0.0008%	310.0937713	0.001	0.0015	40989.20048	12.7104958	4.09892E-05	6.14838E-05	12.7279367
LDT1	ELEC	0.2283%	0	0	0	11067894.41	0	0	0	0
LDT2	GAS	18.1324%	249.3901861	0.0163	0.0066	879203742	219264.785	14.33102099	5.802744697	221203.781
LDT2	DSL	0.1882%	217.214917	0.001	0.0015	9124804.955	1982.04375	0.009124805	0.013687207	1985.92636
LDT2	ELEC	0.5534%	0	0	0	26830836.57	0	0	0	0
LHD1	GAS	1.0244%	699.9014162	0.0333	0.0134	49669239.45	34763.571	1.653985674	0.665567809	34986.2581
LHD1	DSL	1.0574%	412.1765481	0.0051	0.0048	51270958.94	21132.6869	0.261481891	0.246100603	21205.225
LHD2	GAS	0.1591%	802.7750214	0.0333	0.0134	7715293.613	6193.645	0.256919277	0.103384934	6228.23574
LHD2	DSL	0.4193%	454.2069155	0.0051	0.0048	20329564.51	9233.82879	0.103680779	0.09758191	9262.59106
MCY	GAS	0.4360%	250.9743194	0.0173	0.0036	21140542.96	5305.73338	0.365731393	0.076105955	5336.14194
MDV	GAS	11.6436%	301.3800882	0.0333	0.0134	564576484.6	170152.111	18.80039694	7.565324894	172683.333
MDV	DSL	0.4244%	281.7292936	0.0051	0.0048	20578052.49	5797.44019	0.104948068	0.098774652	5826.55402
MDV	ELEC	0.4169%	0	0	0	20215676.62	0	0	0	0
MH	GAS	0.0499%	1415.362346	0.0163	0.0066	2420444.807	3425.80644	0.03945325	0.015974936	3431.14449
MH	DSL	0.0223%	817.4728382	0.001	0.0015	1082707.934	885.084328	0.001082708	0.001624062	885.54502
Motor Coach	DSL	0.0161%	1270.690317	0.001	0.0015	781105.882	992.543681	0.000781106	0.001171659	992.876041
OBUS	GAS	0.0388%	1438.519807	0.0163	0.0066	1883156.324	2708.95767	0.030695448	0.012428832	2713.11078
PTO	DSL	0.1027%	1625.315816	0.001	0.0015	4980309.455	8094.57573	0.004980309	0.007470464	8096.69485
SBUS	GAS	0.0305%	824.2936259	0.0163	0.0066	1480454.432	1220.32915	0.024131407	0.009770999	1223.59415
SBUS	DSL	0.0697%	1041.52683	0.001	0.0015	3380725.691	3521.11651	0.003380726	0.005071089	3522.55501
UBUS	GAS	0.0376%	1211.29407	0.0163	0.0066	1822696.72	2207.82173	0.029709957	0.012029798	2211.8415
UBUS	NG	0.0691%	1918.54007	0.001	0.0015	3350361.249	6427.8023	0.003350361	0.005025542	6429.22788
Total						16,692,048,802.44	**1164926.06**	**86.66909346**	**26.25337889**	**1174309.94**

2017 VMT	2060 VMT	2017-2060 CAGR	2020 VMT	2030 VMT	2050 VMT
4,284,955,457.91	25,203,928,089.77	0.0420675	4,848,795,719.53	7,321,371,994.74	16,692,048,802.44

Solid Waste

Inventory

Landfill Name	Tons Waste/Year	Methane Recovery System	CH4 Emissions Coefficient (metric tons CH4/ton waste)	Total CH4 Emissions (metric tons)	Total CO2e (metric tons)	Sources
Badlands Landfill	77,845.00	Yes	0.0135	1,050.91	29,425.41	http://www.rcwaste.org/disposal/hours
Blythe	6,283.47	No	0.054	339.31	9,500.61	https://www.epa.gov/lmop/landfill-gas-energy-project-data
Desert Center	32.11	No	0.054	1.73	48.55	
Lamb Canyon	92,731.44	Yes	0.0135	1,251.87	35,052.48	
Mecca II	3.60	No	0.054	0.19	5.44	
Oasis	1,092.00	No	0.054	58.97	1,651.10	
El Sobrante	168,791.00	Yes	0.0135	2,278.68	63,803.00	
Transfer Stations	42,909.21	No	0.054	2,317.10	64,878.73	
TOTAL	**389,687.83**			**7,298.76**	**204,365.32**	

Forecast

	Forecast Indicator	**2017 (MT CO2e)**	**2017-2020 CAGR**	**2020 (MT CO2e)**	**2020-2035 CAGR**	**2030 (MT CO2e)**	**2050 (MT CO2e)**
Total	Service population	204,365.32	0.03020338	223,447.82	0.02941199	298,585.26	533,154.21

Emission Coefficients

ICLEI 2012 - U.S. Community Protocol

Methane Recovery Systems	metric tons CH4/ton waste
No	0.054
Yes	0.0135

*MT CH4/ton = Emission Factor for Mixed Municipal Solid Waste * (1-Collection Efficiency) * (1-Oxidation Rate)*
Assumes 75% recovery rate and 100% mixed municipal solid waste
U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, October 2012, Appendix E

GWP (5th Assessment)

CH4	28
N2O	265

Water & Wastewater

Emissions Coefficients

	CO2	CH4	N2O	
State-wide	2.39E-04	1.50E-08	1.81E-09	metric tons/kWh

	GWP (5th Assessment)
CH4	28
N2O	265

Inventory

Water District	Annual Water Usage (million gallons)	Imported Water Percentage	Imported Water Volume (million gallons)	Indoor Water Use Intensity Factor (kWh/MG)	Outdoor Water Use Intensity Factor (kWh/MG)	Indoor Water Energy (kWh)	Outdoor Water Energy (kWh)	Total Energy (kWh)	Metric Tons CO2	CH4	N2O	CO2e	Sources
Fern Valley Water District	38.12	0%	-	13,022	11,111	-	-	-	-	-	-	-	
High Valleys Water District	24.45	100%	24.45	13,022	11,111	159,193.95	135,831.98	295,025.93	70.64	0.00	0.00	70.91	
Rancho California Water District	8,233.13	40%	3,293.25	13,022	11,111	21,442,363.77	18,295,661.49	39,738,025.26	9,515.33	0.59	0.07	9,551.09	
Temescal Valley Water District	938.78	74%	694.70	13,022	11,111	4,523,173.47	3,859,390.29	8,382,563.76	2,007.22	0.13	0.02	2,014.76	
Cabazon County Water District	148.34	0%	-	13,022	11,111	-	-	-	-	-	-	-	
Chiriaco Summit Water District	9.31	100%	9.31	13,022	11,111	60,617.41	51,721.71	112,339.12	26.90	0.00	0.00	27.00	
Coachella Valley Water District		0%	-	13,022	11,111	-	-	-	-	-	-	-	
Home Gardens County Water District	120.89	57%	68.91	13,022	11,111	448,655.43	382,814.51	831,469.94	199.10	0.01	0.00	199.84	
Idyllwild Water District	86.68	0%	-	13,022	11,111	-	-	-	-	-	-	-	https://www.idyllwildwater.com/solar
Mission Springs Water District		0%	-	13,022	11,111	-	-	-	-	-	-	-	
Pine Cove Water District	29.14	0%	-	13,022	11,111	-	-	-	-	-	-	-	https://www.idyllwildwater.com/solar
Pinyon Pines County Water District	5.76	0%	-	13,022	11,111	-	-	-	-	-	-	-	
Yucaipa Valley Water District	88.31	48%	42.39	13,022	11,111	275,987.23	235,485.65	511,472.87	122.47	0.01	0.00	122.93	http://documents.yvwd.dst.ca.us/programs/uwmp/sbv_ruwmp.pdf
Beaumont-Cherry Valley Water District	3,190.73	59%	1,882.53	13,022	11,111	12,257,157.39	10,458,399.30	22,715,556.69	5,439.27	0.34	0.04	5,459.71	https://bcvwd.org/wp-content/uploads/2017/09/January-2017-Urban-Water-Management-Plan-Final.pdf
Palo Verde Irrigation District		0%	-	13,022	11,111	-	-	-	-	-	-	-	
Eastern Municipal Water District	4,081.28	54%	2,203.89	13,022	11,111	14,349,535.60	12,243,717.56	26,593,253.16	6,367.79	0.40	0.05	6,391.72	
Elsinore Valley Municipal Water District	1,022.98	68%	695.63	13,022	11,111	4,529,223.49	3,864,552.47	8,393,775.96	2,009.90	0.13	0.02	2,017.46	
Lake Hemet Municipal Water District	4,056.52	70%	2,839.56	13,022	11,111	18,488,401.20	15,775,197.80	34,263,599.01	8,204.47	0.51	0.06	8,235.30	
Western Municipal Water District	5,295.52	68%	3,600.95	13,022	11,111	23,445,808.89	20,005,097.72	43,450,906.61	10,404.38	0.65	0.08	10,443.48	
Desert Water Agency	92.09	27%	24.86	13,022	11,111	161,891.46	138,133.62	300,025.08	71.84	0.00	0.00	72.11	
TOTAL			**27,462.03**					185,588,013.38	**44,439.31**	**2.78**	**0.34**	**44,606.33**	

Forecast

	Forecast Indicator	2017 (MT CO2e)	2017-2020 CAGR	2020 (MT CO2e)	2020-2035 CAGR	2030 (MT CO2e)	2050 (MT CO2e)
Total	Service population	44,606.33	0.03020338	48,771.42	0.02941199	65,171.49	116,370.30

AF	325,851	Gallon
AF	435	CCF
CCF	748	Gallon

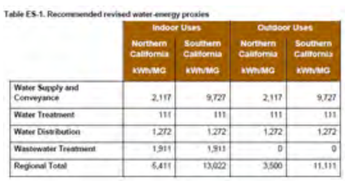


Table ES-1. Recommended revised water-energy proxies

	Indoor Uses		Outdoor Uses	
	Northern California kWh/MG	Southern California kWh/MG	Northern California kWh/MG	Southern California kWh/MG
Water Supply and Conveyance	2,117	9,727	2,117	9,727
Water Treatment	111	111	111	111
Water Distribution	1,272	1,272	1,272	1,272
Wastewater Treatment	1,911	1,911	0	0
Regional Total	5,411	13,022	3,500	11,111

General Southern California energy intensity can be used if there is no available information from water district
CEC, Refining Estimates of Water-related Energy Use in California, December 2006

Water & Wastewater Reduction

	2017 (kWh)	2017-2020 CAGR	2020 (kWh)	2020-2035 CAGR	2030 (kWh)	2050 (kWh)
Residential	185,588,013	0.030203381	202,917,188	0.029411995	271,150,917	484,167,422

	CO2	CH4	N2O	
State-wide	2.39E-04	1.50E-08	1.81E-09	metric tons/kWh

RPS

Renewable Portfolio Standards_2017-2020 (Change Carbon Intensity)	84.8%	28% renewable in 2016 based on SCE report, 33% goal by 2020
Renewable Portfolio Standards_2020-2030 (Change Carbon Intensity)	46.7%	Renewable energy 60% by 2030
Renewable Portfolio Standards_2030-2050 (Change Carbon Intensity)	28.0%	Renewable energy 100% by 2045

	2020	2030	2050
BAU	48,771	65,171	116,370
ABAU	41,377	30,413	32,584

Off-Road

Inventory

	CO_2	CH_4	N_2O	MT CO_2e
Agricultural Equipment	1,219	0.0147	0.1102	1,248.88
Construction and Mining Equipment	2,190	0.0116	0.1866	2,240
Industrial Equipment	25	0.0013	0.0085	28
Lawn and Garden Equipment	124	0.0797	0.1817	175
Light Commercial Equipment	59	0.0094	0.0154	63
Recreational Equipment	59	0.0898	0.2543	129
	3,677	***0.2066***	***0.7567***	***3,883***

	GWP (5th Assessment)
CH4	28
N2O	265

Forecast

	2017 (MT CO2e)	2017-2035 CAGR	2020 (MT CO2e)	2030 (MT CO2e)	2050 (MT CO2e)
Total	3,883.50	0.011934	4,024.20	4,531.06	5,744.36

Class	Values	2017	2035
Agricultural Equipment	Sum of Annual_MT_CO2 Exhaust	1579.970	1444.740194
	Sum of Annual_MT_CH4 Exhaust	0.019	0.057473649
	Sum of Annual_MT_N2O Exhaust	0.143	0.019883643
Construction and Mining Equipment	Sum of Annual_MT_CO2 Exhaust	7438.485	9319.949865
	Sum of Annual_MT_CH4 Exhaust	0.040	0.39051232
	Sum of Annual_MT_N2O Exhaust	0.634	0.042840813
Industrial Equipment	Sum of Annual_MT_CO2 Exhaust	727.996	922.6096656
	Sum of Annual_MT_CH4 Exhaust	0.037	0.342661552
	Sum of Annual_MT_N2O Exhaust	0.245	0.040977154
Lawn and Garden Equipment	Sum of Annual_MT_CO2 Exhaust	789.819	1878.01504681
	Sum of Annual_MT_CH4 Exhaust	0.506	2.70208787
	Sum of Annual_MT_N2O Exhaust	1.154	1.19115217
Light Commercial Equipment	Sum of Annual_MT_CO2 Exhaust	502.421	561.35075861
	Sum of Annual_MT_CH4 Exhaust	0.080	0.11382673
	Sum of Annual_MT_N2O Exhaust	0.131	0.08487068
Recreational Equipment	Sum of Annual_MT_CO2 Exhaust	435.736	658.25561230
	Sum of Annual_MT_CH4 Exhaust	0.659	3.42918678
	Sum of Annual_MT_N2O Exhaust	1.865	1.09256148

For Projections	2017 MT	2035 MT
Sum of Annual_MT_CO2 Exhaust	1579.970313	1444.740194
Sum of Annual_MT_CH4 Exhaust	0.019096789	0.057473649
Sum of Annual_MT_N2O Exhaust	0.142820075	0.019883643
Sum of Annual_MT_CO2 Exhaust	7438.484758	9319.949865
Sum of Annual_MT_CH4 Exhaust	0.039509247	0.39051232
Sum of Annual_MT_N2O Exhaust	0.633786559	0.042840813
Sum of Annual_MT_CO2 Exhaust	727.9961887	922.6096656
Sum of Annual_MT_CH4 Exhaust	0.036877734	0.342661552
Sum of Annual_MT_N2O Exhaust	0.244674703	0.040977154
Sum of Annual_MT_CO2 Exhaust	789.8193644	1878.015047
Sum of Annual_MT_CH4 Exhaust	0.506337835	2.702087873
Sum of Annual_MT_N2O Exhaust	1.153857547	1.191152172
Sum of Annual_MT_CO2 Exhaust	502.4208143	561.3507586
Sum of Annual_MT_CH4 Exhaust	0.080141009	0.113826727
Sum of Annual_MT_N2O Exhaust	0.131122241	0.084870677
Sum of Annual_MT_CO2 Exhaust	435.7356939	658.2556123
Sum of Annual_MT_CH4 Exhaust	0.658586568	3.429186777
Sum of Annual_MT_N2O Exhaust	1.865233757	1.092561476
Total MT CO2e	12613.38701	15615.97064
CAGR_Offroad_2017-2035	0.011933725	

	Unincorporated County	County	Sources:
BuildingPermits	1512	5,136	US Census Bureau https://www2.census.gov/econ/bps/
Population	364,413	2,347,828	SCAG 2017 Local Profile
Portion Population weighted by Inco	13.63%		
Households	112,292	713,205	SCAG 2017 Local Profile
Portion Households	15.74%		
Jobs_Total	81,754	709,940	SCAG 2017 Local Profile (2015 Number of Jobs)
Portion Other Jobs	11.73%		
Jobs_Agriculture	8,257	10,700	SCAG 2017 Local Profile (2015 Jobs in Agriculture 10.1%)
Portion Ag jobs	77.17%		
Jobs_Manufacturing	3,613	103,633	SCAG 2017 Local Profile (2015 Jobs in Manufacturing)
Portion Manufacturing Jobs	3.49%		
Median_Income	50,394	57,367	SCAG 2017 Local Profile
Portion Building Permits	29.44%		
Other Jobs	69,884	595,607	

		Unincorporated County
Offroad_Agriculture_2017	CO2	1219.25777486
	CH4	0.01473693
	N2O	0.11021377
Offroad_Construction_2017	CO2	2189.83429802
	CH4	0.01163123
	N2O	0.18658202
Offroad_Industrial_2017	CO2	25.38043123
	CH4	0.00128568
	N2O	0.00853020
Offroad_Lawn&Garden_2017	CO2	124.35470316
	CH4	0.07972138
	N2O	0.18167143
Offroad_Commercial_2017	CO2	58.95011109
	CH4	0.00940312
	N2O	0.01538485
Offroad_Recreation_2017	CO2	59.41107541
	CH4	0.08979603
	N2O	0.25431826

Agriculture

Annual Crop Growth

	Acres Harvested	Annual Yield (tons)
Hay (including Alfalfa)	45,353	306,199
Corn	740	19,936
Oats	833	2,318
Sorghum	130	1,943
Wheat	18,394	91,937
Cotton	7,291	9,041
Vegetable Crops & Fruit Trees	78,688	1,005,572

Annual Animal head

	#
Dairy Cow	21,900
Poultry	1,893,394
Sheep	8,300

GWP (5th Assessment)

CH4	28
N2O	265

Inventory

	CO_2	CH_4	N_2O	MT CO_2e
Enteric Fermentation	-	2,769	-	77,539
Manure Management	-	3,886	99	135,152
Rice Cultivation	-	-	-	-
Agriculture ResidueBurning	-	8	0	289
Annimals and Runoff	-	-	713	188,951
Fertilizer Use	-	-	794	210,428
Crop Growth	-	-	3,995	1,058,594
	-	***6,664***	***5,601***	***1,670,954***

Forecast

	Forecast Indicator	2008 (MT CO2e)	2017 (MT CO2e)	2008-2017 CAGR	2020 (MT CO2e)	2030 (MT CO2e)	2050 (MT CO2e)
Total	2008-2017 Growth	2,030,430.81	1,670,954.14	-0.02141767	1,565,873.39	1,261,044.33	817,857.74

Sources:

EPA. 2015. State Inventory Tool - Methane and Nitrous Oxide Emissions from Agricultural Model. Website: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool (accessed August 20, 2018)
State of California Department of Conservation. 2016. Important Farmland GIS Data for Riverside County. Website: ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/2016/ (accessed August 20, 2018)
Riverside County Agricultural Comissioner's Office. 2017. Riverside County Agricultural Production Report. Website: http://www.rivcoawm.org/Resources/Publications.aspx (accessed August 20, 2018).
California Department of Food and Agriculture. California Agricultural Statistics Review 2016-2017. Website: https://www.cdfa.ca.gov/statistics/

APPENDIX C

REDUCTION MEASURES, ASSUMPTIONS, AND ATTRIBUTED REDUCTIONS

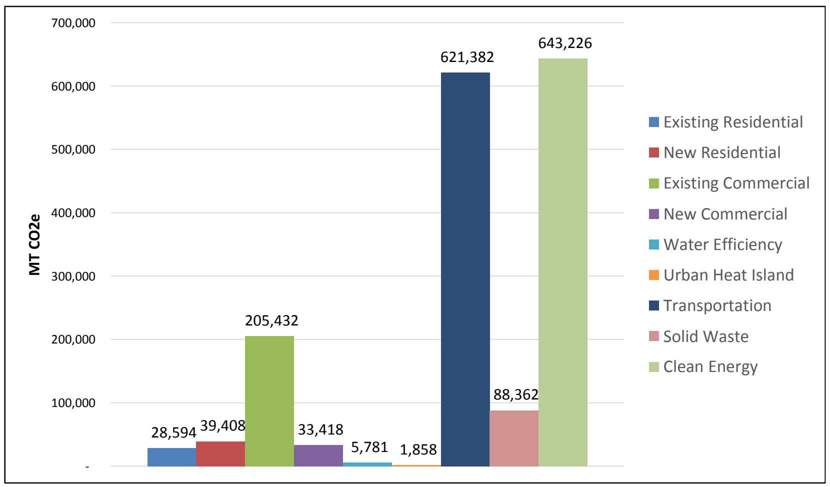
County of Riverside Community Reduction Measures

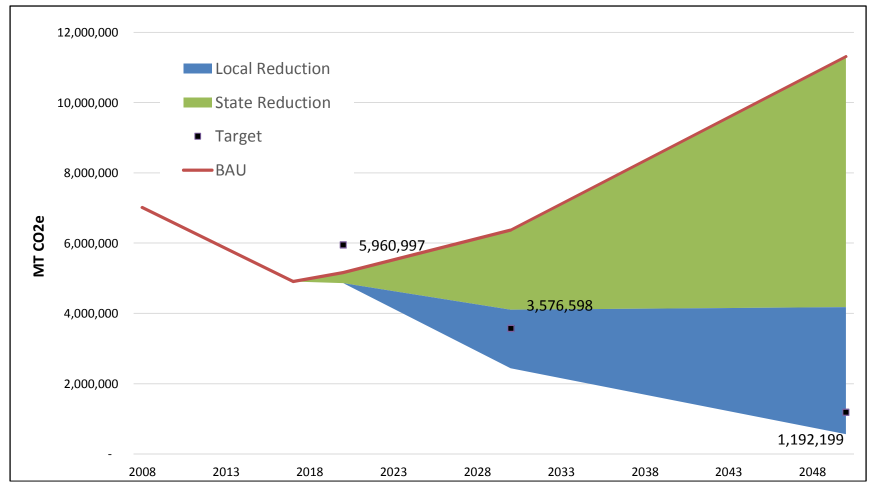
Goal	Measure	Action		Level of Participation	2030 GHG Reductions Achieved (MT CO2e) No Enhancing	2030 With Enhancing	2050 GHG Reductions Achieved (MT CO2e) No Enhancing	2050 With Enhancing	GHG Reduction Potential
Goal 1.	Increase Energy Efficiency in Existing Residential								
	Measure 1.1	Energy Efficiency Training, Education, and Recognition in the Residential Sector			The actions taken by the County can increase participation levels of other measures.				Supporting Measure
		Actions	Post energy efficiency information links on website and/or social media and provide materials at public events	High					
			Set up email list for email blasts of new information or trainings	Medium					
			~~Establish an annual energy efficiency fair~~	Not Selected					
			Encourage Homeowners to use the SCE Energy Education Centers for energy efficiency resources	Medium					
			Designate an energy advocate to promote and manage energy efficiency programs	High					
			Invite building inspectors to hold trainings semi-annually on energy efficiency and Title 24 requirements	High					
	Measure 1.2	Increase Community Participation in Existing Energy Efficiency Programs			16,844.9	16,845	28,091	28,091	Low
		Actions	Partner with SCAG, WRCOG, SCE, and SoCalGas for outreach events such as annual energy efficiency fair.	High					
	Measure 1.3	Home Energy Evaluations			The actions taken by the County can increase participation levels of other measures.				Supporting Measure
		Actions	Promote SCE energy audits program for residents within the SCE service area and promote similar programs through the Energy Upgrade California for the IID service area	Medium					
			~~Present to the City Council for consideration of a residential Energy Conservation and Disclosure Ordinance~~	Not Selected					
	Measure 1.4	Residential Home Energy Renovations			7,839.7	11,749	13,074	19,592	Medium-High
		Actions	Promote Title 24 code compliance for exisitng residential buildings during code enforcement inspections of residential properties	High					
			Promote existing home energy renovation programs	High					
			Promote participation in green building programs, such as Leadership in Energy and Environmental Design (LEED) and Energy Upgrade California	High					
			Promote financing programs for home upgrades, such as Home Energy Renovation Opportunity (HERO) program sponsored by the Western Riverside Couny Council of Governments (WRCOG) and other Property Assessed Clean Energy (PACE) programs in the IID srvice area.	Medium					
			Establish online permitting to facilitate upgrades	Medium					
			~~Reduce or waive permit fees for upgrades~~	Not Selected					
			~~Establish a Residential Energy Conservation Ordinance (RECO) requiring time-of-sale energy rating~~	Not Selected					
Goal 2.	Increase Energy Efficiency in New Residential Units								
	Measure 2.1	Exceed Energy Efficiency Standards			37,532	39,408	303,459	318,632	Medium-High
		Actions	Educate City staff and developers on future Title 24 updates and new energy efficiency opportunities for new residential development	Low					
			Promote Tier 1 and Tier 2 green building ratings such as LEED, Build It Green, or Energy Star® certified buildings	Medium					
			~~Waive or reduce permit fees for new energy efficiency opportunities~~	Not Selected					
			Establish online permitting to facilitate new residential building energy efficiency programs.	High					
			~~Create an energy award program for zero-net-energy homes~~	Not Selected					
			Comply with State Title 24 energy efficiency requiremenst on new residential buildings, such as zero net energy homes that require all new residential construction projects to achieve zero net-energy use by 2020	Low					

Goal	Measure	Action		Level of Participation	2030 GHG Reductions Achieved (MT CO2e)		2050 GHG Reductions Achieved (MT CO2e)		GHG Reduction Potential
Goal 3.	**Increase Energy Efficiency in Existing Commercial Units**								
	Measure 3.1	**Energy Efficiency Training, Education, and Recognition in Commercial Sector**			The actions taken by the County may increase participation levels of other programs by up to 85%				Supporting Measure
		Actions	Post links on website and/or social media and provide materials at public events	High					
			Set up email list for email blasts of new information or trainings	Medium					
			~~Establish an annual energy efficiency fair~~	Not Selected					
			Encourage buisness owners to visit SCE Energy Education Centers for energy efficiency resources	Low					
			Designate an Energy Advocate to promote and manage energy efficiency programs	High					
			Invite building inspectors to hold trainings semi-annually on energy efficiency and Title 24	Medium					
	Measure 3.2	**Increase Business Participation in Existing Energy Efficiency Programs**			31,877.5	31,878	67,730	67,730	Medium
		Actions	Partner with SCAG, WROG, SCE, and SoCalGas for outreach events	High					
	Measure 3.3	**Non-Residential Building Energy Audits**			The actions taken by the County can increase participation levels of other measures.				Supporting Measure
		Actions	Promote the SCE energy audit program for residents within the SCE service aea and promote similar programs through the Energy Upgrade California for the Imperial	Medium					
			~~Require energy disclosure for small buildings (5,000 – 10,000 square feet)~~	Not Selected					
	Measure 3.4	**Non-Residential Building Retrofits**			90,973.3	173,554	193,289	368,747	Medium-High
		Actions	Promote Title 24 compliance for existing non-residential buildings during code enforcement inspections	Medium					
			Promote existing non-residential building retrofits programs	Medium					
			Promote participation in green building programs, such as California Solar Initiative	Medium					
			Promote energy efficiency retrofit financing programs for non-residential buildings such as PACE	Medium					
			Establish online permitting to facilitate retrofits	Medium					
			~~Reduce or waive permit fees for retrofits~~	Not Selected					
			~~Establish a Commercial Energy Conservation Ordinance (CECO)~~	Not Selected					
Goal 4.	**Increase Energy Efficiency in New Commercial Units**								
	Measure 4.1	**Exceed Energy Efficiency Standards**			33,567	33,418	554,274	580,161	Medium-High
		Actions	Educate City staff and developers on future Title 24 updates and additional energy efficiency opportunities for new non-residential development	Low					
			Promote Tier 1 and Tier 2 Green Building Ratings such as LEED, Build It Green, or Energy Star® certified buildings	Medium					
			~~Waive or reduce permit fees for new energy efficiency opportunities~~	Not Selected					
			Establish online permitting to facilitate new non residential building energy efficiency programs	High					
			~~Create an energy award program for zero-net-energy businesses~~	Not Selected					
			~~Adopt a local ordinance to exceed Title 24~~	Not Selected					
			Comply with State requirements on new non-residential buildings, such as Net-Zero Energy Buildings for all new non-residential constructions zero-net-energy by 2030	Low					

Goal	Measure		Action	Level of Participation	2030 GHG Reductions Achieved (MT CO2e)		2050 GHG Reductions Achieved (MT CO2e)		GHG Reduction Potential
Goal 5.	Reduce Energy Use through Increased Water Efficiency								
	Measure 5.1	Water Efficiency through Enhanced Implementation of SB X7-7			4,091.8	5,666	7,305	10,114	Medium
		Actions	Provide general water efficiency information and links to water district conservation webpages on the county's website	High					
			~~Set up email list for email blasts of new information or trainings~~	Not Selected					
			Implement the low-irrigation landscaping requirements as part of plan check	Medium					
	Measure 5.2	Exceed Water Efficiency Standards			63.6	116	114	206	Low-Medium
		Actions	Support water districts in direct outreach to HOA, businesses, and other community groups	Medium					
			Promote recycled or grey water for community uses	Low					
			Promote rainwater harvesting rebates and demonstrations	Medium					
Goal 6.	Decrease Energy Demand through Reducing Urban Heat Island Effect								
	Measure 6.1	Tree Planting for Shading and Energy Saving			6.5	13	12	22	Low
		Actions	~~Promote tree planting at plan check~~	Not Selected					
			Work with community to support nonprofit tree-planting groups within the county consisiting of volunteers to plant and care for tress correctly and safely	Medium					
			Develop and promote a County tree-planting program for new development at plan check	Medium					
	Measure 6.2	Light-Reflecting Surfaces for Energy Saving			1,537.5	1,845	2,745	3,294	Medium
		Actions	Comply with Title 24 requirements on installing enhanced cool roofs	Low					
			Comply with Title 24 requirements on installing cool pavements	Low					
Goal 7.	Decrease GHG Emissions through Reducing Vehicle Miles Traveled								
	Measure 7.1	Alternative Transportation Options			129,545	161,932	294,969	368,711	Low-Medium
		Actions							
			Work with SCAG and the community to remove barriers to alternative transportation	High					
			Create a "bike to work day" or "car free zone day" and other sponsored events to promote biking and other non-motorized transportation	Medium					
			Create additional active transportation routes from Corona Transit Center to surrounding residential areas	Medium					
			Implement reduced parking requirement in areas served by transit	Low					
			~~Replace stop signs with roundabouts at selected intersections~~	Not Selected					
	Measure 7.2	Adopt & Implement Bicycle Master Plan to Expand Bike Routes around the County			2,234	2,234	5,086	5,086	Low-Medium
		Action	Expand bicycle routes and prioritize funding for Class I bicycle lanes to improve bike transit.	High					
	Measure 7.3	Ride-Sharing and Bike-to-Work Programs within Businesses			182,846	182,846	416,332	416,332	Low-Medium
		Action	Promote ride-sharing and facilitate air district incentives for ride-sharing	Medium					
			Provide reserved preferential parking spaces for ride-sharing, carpooling, and ultra-low or zero-emission vehicles	Medium					
			Require businesses of a certain size to provide facilities such as bike racks	Low					
	Measure 7.4	Electrify the Fleet			268,025	274,370	610,281	624,729	Medium-High
		Actions	Promote electrical vehicle incentive programs at outreach meetings	Low					
			Promote neighborhood electric vehicles (NEV)	Low					
			Support application for grants to install e-chargers at public facilities	Low					
			Work with community groups and businesses to install e-chargers	Low					
			Comply with State Title 24 energy efficiency requirements that require new commercial development to install e-chargers starting 2020	Medium					

Goal	Measure	Action		Level of Participation	2030 GHG Reductions Achieved (MT CO2e)		2050 GHG Reductions Achieved (MT CO2e)		GHG Reduction Potential
Goal 8.	**Decrease GHG Emissions through Reducing Solid Waste Generation**								
	Measure 8.1	**Reduce Waste to Landfills**			88,362	88,362	157,742	157,742	Low-Medium
		Actions	Outreach to community to promote waste recycling and diversion	Medium					
			Add additional recycling containers in public places	Low					
			Comply with Statewide waste reduction, recycling, and composting requirements	High					
Goal 9.	**Decrease GHG Emissions through Increasing Clean Energy Use**								
	Measure 9.1	**Promote Clean Energy**			24,431	34,204	24,431	34,204	Medium-High
		Actions	Outreach to the community to promote clean energy incentives	Low					
			~~Reduce or waive permit fees for solar permits~~	Not Selected					
			Encourage solar panels installation on existing residential buildings	Medium					
			Encourage solar panels installation on existing commercial buildings and commercial parking lots	Medium					
			Encourage energy storage systems installation with solar panels	Medium					
	Measure 9.2	**Join Community Choice Aggregation Program**			624,955	609,022	624,955	609,022	Medium-High
		Action	Explore opportunities to join a regional CCA program	Low					
				Total	**1,544,732**	**1,667,460**	**3,303,889**	**3,612,416**	





APPENDIX D

SCREENING TABLES

GREENHOUSE GAS EMISSIONS

Screening Tables
County of Riverside, California

March 2019

Prepared for:

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CONTENTS

TABLES

Introduction

The County of Riverside Climate Action Plan Update (CAP Update) includes reducing 525,511 metric tons of carbon dioxide equivalents (MT CO_2e) by 2030 and 2,982,947 MT CO_2e by 2050 from an Adjusted Business As Usual (ABAU) forecast.[1] These targets are consistent with the State's recommended emission reduction goals of 40 percent reduction below 2008 levels by 2030, and an 83 percent reduction below 2008 levels by 2050. Reductions related to transportation, water, solid waste, energy, and renewable energy sources all play a part in gaining the level of efficiency needed within new development.

Mitigation of greenhouse gas (GHG) emissions impacts during the development review process of projects provides one cost-effective way of implementing the GHG reduction strategies for reducing community-wide emissions associated with new development. The development review process procedures for evaluating GHG impacts and determining significance for California Environmental Quality Act (CEQA) purposes will be streamlined by (1) applying an emissions level that is determined to be less than significant for small projects, and (2) utilizing Screening Tables to mitigate project GHG emissions that exceed the threshold level. Projects will have the option of preparing a project-specific technical analysis to quantify and mitigate GHG emissions. A threshold level above 3,000 MT CO_2e per year will be used to identify projects that require the use of Screening Tables or a project-specific technical analysis to quantify and mitigate project emissions.

CEQA requires the assessment of environmental impacts for proposed projects, including the assessment of GHG emissions. The purpose of this document is to provide guidance on how to analyze GHG emissions and determine the significance of those emissions during CEQA review of proposed development projects within the County of Riverside (County). The analysis, methodology, and significance determination (thresholds) are based upon the County of Riverside GHG Inventory, Forecasting, and Target-Setting (IFT) Report, the GHG emission inventory within the IFT Report, and the GHG reduction measures that reduce emissions to the Assembly Bill (AB) 32, Senate Bill (SB) 32, and Executive Order (EO) S-3-05 compliant reduction targets in the CAP Update. The Screening Tables can be used by the County of Riverside Planning Department for review of development projects in order to ensure that the specific implementation measures in the CAP Update are applied as part of the CEQA process for development projects. The Screening Tables provide a menu of options that ensures both implementation of the measures and flexibility on how development projects will implement the measures to achieve an overall reduction of emissions, consistent with the reduction targets in the CAP Update.

[1] An Adjusted Business As Usual Forecast (ABAU) refers to the emissions that include State policies and measures. The County of Riverside will be required to reduce additional emissions to meet the State goals. These reduction measures are detailed in the CAP Update, Chapter 4, GHG Emissions Reduction Programs and Regulations.

California Environmental Quality Act

CEQA Mandates for Analysis of Impacts

CEQA requires that Lead Agencies inform decision makers and the public regarding the following: potential significant environmental effects of proposed projects; feasible ways that environmental damage can be avoided or reduced through the use of feasible mitigation measures and/or project alternatives; and the reasons why the Lead Agency approved a project if significant environmental effects are involved (CEQA Guidelines §15002). CEQA also requires Lead Agencies to evaluate potential environmental effects based to the fullest extent possible on scientific and factual data (CEQA Guidelines §15064[b]). A determination of whether or not a particular environmental impact would be significant shall be based on substantial evidence, which includes facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts (CEQA Guidelines §15064f[5]).

The recently amended CEQA Guidelines (CEQA Guidelines §15064.4[a] [b]) explicitly require Lead Agencies to evaluate GHG emissions during CEQA review of potential environmental impacts generated by a proposed project. To assist in this effort, two questions were added to Appendix G of the CEQA Guidelines:

- Would the project generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?
- Would the project conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs?

Finally, under the “rule of reason,” an Environmental Impact Report (EIR) is required to evaluate impacts to the extent that is reasonably feasible (CEQA Guidelines § 15151; *San Francisco Ecology Center v. City and County of San Francisco* [1975] 48 Cal.App.3rd 584). While CEQA does require Lead Agencies to make a good faith effort to disclose what they reasonably can, CEQA does not demand what is not realistically possible (*Residents at Hawks Stadium Committee v. Board of Trustees* [1979] 89 Cal.App.3rd 274, 286).

Greenhouse Gas Impact Determination

Statewide or Regional Thresholds of Significance

There are currently no published Statewide or regional thresholds of significance for measuring the impact of GHG emissions generated by a proposed project. CEQA Guidelines §15064.7 indicates only that, “each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects.” The County of Riverside CAP Update addresses cumulative GHG emissions, has reduction targets that reduce the cumulative GHG impacts to less than significant, has a set of reduction measures that achieves the reduction targets, and provides an implementation plan to implement the reduction measures. This document provides guidance in how to address GHG emissions in CEQA analysis and determine the significance of project-generated GHG emissions.

Quantitative Analysis Relative to the Riverside County Climate Action Plan Update

METHODOLOGY OVERVIEW

An individual project cannot generate enough GHG emissions to influence global climate change. The project participates in this potential impact by its incremental contribution combined with the cumulative increase of all other sources of GHGs, which when taken together may have a significant impact on global climate change (AEP 2007). To address the State's requirements to reduce GHG emissions, the County of Riverside adopted the CAP in 2015 with the target of reducing GHG emissions within the unincorporated County by 15 percent below 2008 levels by the year 2020. The CAP Update sets new targets of 49 percent below 2008 baseline levels by year 2030 and 83 percent below the 2008 baseline levels by 2050. The County's GHG reduction targets are consistent with the AB 32, SB 32, and EO S-3-05, and ensure that the County is providing GHG reductions locally that will complement the State and international efforts of stabilizing climate change.

Because the County's CAP Update addresses GHG emissions reduction, in concert with AB 32, SB 32, EO S-3-05, and international efforts to address global climate change, and includes specific local requirements that would substantially lessen the cumulative problem, the CAP Update fulfills the description of mitigation found in CEQA Guidelines §15130(a)(3) and §15183.5.

No single project has the ability to generate GHG emissions in sufficient quantities to change the global climate. Rather, it is the incremental contribution of all past, present, and future projects that when combined with all other anthropogenic sources of GHG emissions globally generates climate change impacts. Because GHG emissions are only important in the context of cumulative emissions, the focus of the analysis is on answering the question of whether incremental contributions of GHGs are a cumulatively considerable contribution to climate change impacts. The CAP Update includes a set of mitigation measures designed to substantially lessen cumulative impacts associated with GHG emissions as described in CEQA Guidelines §15130(a)(3), in determining if a project's effects would result in significant impacts. The CAP Update has the following components that fulfill cumulative mitigation for GHG emissions:

1. Provides community-wide GHG emissions reduction targets that would substantially lessen the cumulative impact;
2. Provides measures that new development projects shall follow to meet the County's reduction targets and substantially lessen the cumulative impact;

3. Provides a set of GHG emission inventories that provide quantitative facts and analysis for how the measures within the CAP Update meet the reduction targets that substantially lessen the cumulative impact; and
4. Provides an implementation, monitoring, and update program to ensure that the reduction targets are met.

The CAP Update satisfies the first condition by adopting targets of reducing GHG emissions down to 15 percent below 2008 baseline levels within the County of Riverside by 2020, 49 percent below 2008 levels by 2030, and 83 percent below 2008 levels by 2050. These reduction targets are compliant with AB 32. The AB 32 Climate Change Scoping Plan states: “In recognition of the critical role local governments will play in the successful implementation of AB 32, ARB recommended a greenhouse gas reduction goal for local governments of 15 percent below today’s levels by 2020 to ensure that their municipal and community-wide emissions match the State’s reduction target” (Scoping Plan page ES-5, CARB, December 2008). The 2030 and 2050 reduction targets are compliant with SB 32 and EO S-3-05 and continue the GHG reduction trends (AEP 2012). In this way, the County is teaming with the State’s efforts to reduce GHG emissions globally and substantially lessen cumulative emissions.

The CAP Update satisfies the second condition through the implementation of the reduction measures for new development. This document supplies the specific criteria that new development shall follow to ensure that the reduction measures associated with new development are implemented and the reduction targets are met.

The CAP Update satisfies the third criteria by providing an update of community-wide GHG emissions inventory for existing conditions (2017); and future 2020, 2030, and 2050 GHG emissions that are anticipated with Statewide reduction measures that are already in place but without the local reduction measures (ABAU). The CAP Update also supports reduced levels of 2030 and 2050 GHG emissions, which demonstrate how the implementation of local reduction measures helps to achieve the reduction targets.

The CAP Update satisfies the fourth criteria through the implementation and monitoring program described in detail in Chapter 7 of the CAP Update.

The Development Review Process

Integrating the reduction measures of the CAP Update into the CEQA development review process is the first step in determining how a proposed project will implement the GHG reduction measures within the CAP Update. The GHG emissions development review process is predicated on responses to several identified questions. Appendix A of this document contains a flow chart that diagrams this development review process. The questions are as follows:

Question 1: Is the project exempt under CEQA? If so, then the South Coast Air Quality Management District (SCAQMD) and the County would determine that GHG emissions are less than significant, and no additional GHG reductions are needed. A list of CEQA Exemptions are found in CEQA Guidelines §15300 through §15332. There are exemption opportunities associated with transit-oriented development (TOD) associated with the Sustainable Communities Strategy (SCS) for the region developed by the Southern California Association of Governments (SCAG) and first introduced in the 2012 Regional Transportation Plan (RTP). Exemptions associated with TOD are divided into two categories: transit priority projects (TPP) and Sustainable Community Projects (SCP). A TPP and SCP Checklist is provided in Appendix B of this document to assist project applicants in determining if a project qualifies for these Exemptions under CEQA. If the project does not qualify for a CEQA exemption, then the applicant can move on to Question 2.

Question 2: Are project GHG emissions less than 3,000 MT CO_2e per year? To assist applicants in answering this question, Appendix C of this document includes a table showing various sizes of typical land use development projects that are typically at or below that level of emissions threshold. Applicants can also calculate emissions using the methodology described below to answer this question. Additional information is provided below on how this level of emissions was determined and the next steps to take if a project is at or below this level. If the project's emissions are above 3,000 MT CO_2e, then the applicant needs to either use the Screening Tables or analyze the GHG emissions and provide additional mitigation as shown in Appendix A.

3,000 MT CO_2e Emission Level

The County has determined the development size that would be too small to be able to provide the level of GHG emission reductions expected from the Screening Tables or the alternative emission analysis method. To do this the County determined the GHG emissions allowed by a project such that 90 percent of the emissions on average from all projects would exceed that level and be "captured" by the Screening Tables or alternative emission analysis method.

In determining this level of emissions, SCAQMD used the database of projects kept by the Governor's Office of Planning and Research (OPR). That database contained 798 projects, 60 of which were extremely large General Plan Updates, Master Plans, or Specific Plan Projects. The 60 very large projects were removed from the database in order not to skew the emissions value, leaving a net of 738 projects. In addition, 27 projects were found to be outliers that would skew the emission value too high, leaving 711 as the sample population to use in determining the 90th percentile capture rate.

The analysis of the 711 projects within the sample population combined commercial, residential, and mixed-use projects. Also, note that the sample of projects included warehouses and other light industrial land uses but did not include industrial processes (i.e., oil refineries, heavy manufacturing, electric generating stations, mining operations, etc.). Emissions from each of these projects were calculated by SCAQMD to provide a consistent method of emissions calculations across the sample population and further reduce potential errors in the statistical analysis. In calculating the emissions from projects within the sample population, construction period GHG emissions were amortized over 30 years (the average economic life of a development project).

This analysis determined that the 90th percentile ranged from 2,983 to 3,143 MT CO_2e per year. The 3,000 MT CO_2e per year value is the low end value within that range rounded to the nearest hundred tons of emissions and is used in defining small projects that are considered less than significant and do not need to use the Screening Tables or alternative GHG mitigation analysis described below.

The 3,000 MT CO_2e per year value is used in defining small projects that, when combined with the modest efficiency measures shown in the bullet points below are considered less than significant and do not need to use the Screening Tables or alternative GHG mitigation analysis described below. The efficiency measures required of small projects are summarized below:

- Energy efficiency matching or exceeding the Title 24 requirements in effect as of January 2017, and
- Water conservation measures that match the California Green Building Standards Code in effect as of January 2017.

Projects that Exceed 3,000 MT CO_2e Emission Level

Methodology for the Calculation of GHG Emissions

Development projects that are determined to be above the 3,000 MT CO_2e emissions level shall quantify and disclose the anticipated GHG emissions of the proposed development.

Total GHG emissions are the sum of emissions from both direct and indirect sources. Direct sources include mobile sources such as construction equipment, motor vehicles, landscape equipment; and stationary sources such as cooling and heating equipment. Indirect sources are comprised of electrical and potable water use, and the generation of solid waste and wastewater.

Direct GHG emissions from mobile and stationary sources are determined as the sum of the annual GHG emissions from construction equipment, motor vehicles, landscape equipment, and heating and cooling equipment.

Indirect sources are determined based on source as follows. Electrical usage is reported as annual emissions from electrical usage. Potable water usage is reported as the annual emissions from electricity used for potable water treatment and transportation. Solid waste is reported as the sum of annual emissions from solid waste disposal treatment, transportation, and fugitive emissions of methane at the solid waste facilities. Wastewater usage is reported as the annual emissions from wastewater transport and treatment.

Analysis of development projects not using the Screening Tables should use the emission factors found in the latest version of the California Climate Action Registry (CCAR) General Reporting Protocol (CCAR, January 2009) and guidance in the Association of Environment Professionals' (AEP) *White Paper: Community-Wide Greenhouse Gas Emissions Inventory Protocols* (AEP 2010). Quantification of emissions from electricity used for potable water treatment and transportation as well as wastewater transport and treatment can be found in the California Energy Commission (CEC) document titled *Refining Estimates of Water-Related Energy Use in California* (CEC, December 2006).

Analysis of development projects not using the Screening Tables should use the latest version of the California Emissions Estimator Model (CalEEMod). Two modeling runs should be completed. The first modeling run calculates GHG emissions at 2017 levels of efficiency using energy efficiency standards (2016 Title 24, in effect January 2017) and the California Air Resources Board (CARB) on-road vehicle emissions factors (EMFAC 2017) set at 2017. A second modeling run calculates GHG emissions at project buildout year levels of efficiency and includes project design features and/or mitigation measures to reduce GHG emissions.

For analysis of development projects using the Screening Tables, please refer to the process described below.

Screening Tables

The purpose of the Screening Tables is to provide guidance in measuring the reduction of GHG emissions attributable to certain design and construction measures incorporated into development projects. The analysis, methodology, and significance determination (thresholds) are based upon the County of Riverside CAP Update, which includes GHG emission inventory updates; the 2020, 2030, and 2050 emission reduction targets; and the reduction measures to reach the targets. The methodology for the development and application of the Screening Tables is set forth in Appendix D, attached hereto.

Instructions for Project Application

The Screening Tables assign points for each option incorporated into a project as mitigation or a project design feature (collectively referred to as "feature"). The point values correspond to the minimum emissions reduction expected from each feature. The menu of features allows maximum flexibility and options for how development projects can implement the GHG reduction measures. Projects that garner at least 100 points will be consistent with the reduction quantities anticipated in the County's CAP Update. Consistent with CEQA Guidelines, such projects would be determined to have a less than significant individual and cumulative impact for GHG emissions.

Those projects that do not garner 100 points using the Screening Tables will need to provide additional analysis to determine the significance of GHG emissions. Nothing in this guidance shall be construed as limiting the County's authority to adopt a statement of overriding consideration for projects that require the preparation of an EIR due to significant GHG impacts. The following tables provide a menu of performance standards/options related to GHG mitigation measures and design features that can be used to demonstrate consistency with the implementation measures and GHG reduction quantities in the CAP Update.

Mixed-use projects provide additional opportunities to reduce emissions by combining complementary land uses in a manner that can reduce vehicle trips. Mixed-use projects also have the potential to complement energy-efficient infrastructure in a way that reduces emissions. For mixed-use projects, both Table 1 and Table 2 should be filled out, but the points should be proportionally identical to the proportioning of the mix of uses. For example, a mixed-use project that is 50 percent commercial uses and 50 percent residential uses will show ½ point for each assigned point value in Table 1 and Table 2, and the points will be added from both tables. Mixed-use projects that garner at least 100 points will be consistent with the reduction quantities in the County's CAP Update and would be considered less than significant for GHG emissions.

Table 1: Screening Table for GHG Implementation Measures for Residential Development

Feature	Description	Assigned Point Values	Project Points
Reduction Measure R2-EE5: Exceed Energy Efficiency Standards in New Residential Units			
EE5.A Building Envelope			
EE5.A.1 Insulation	• 2016 Title 24 Requirements (walls R-13, roof/attic R-30) • Modestly Enhanced Insulation (walls R-15, roof/attic R-38) • Enhanced Insulation (rigid wall insulation R-13, roof/attic R-38) • Greatly Enhanced Insulation (spray foam wall insulated walls R-18 or higher, roof/attic R-38 or higher)	0 points 7 points 9 points 11 points	
EE5.A.2 Windows	• 2016 Title 24 Windows (0.57 U-factor, 0.4 solar heat gain coefficient [SHGC]) • Modestly Enhanced Window (0.4 U-Factor, 0.32 SHGC) • Enhanced Window (0.32 U-Factor, 0.25 SHGC) • Greatly Enhanced Window (0.28 or less U-Factor, 0.22 or less SHGC)	0 points 3 points 4 points 5 points	
EE5.A.3 Cool Roofs	• Modest Cool Roof (CRRC Rated 0.15 aged solar reflectance, 0.75 thermal emittance) • Enhanced Cool Roof (CRRC Rated 0.2 aged solar reflectance, 0.75 thermal emittance) • Greatly Enhanced Cool Roof (CRRC Rated 0.35 aged solar reflectance, 0.75 thermal emittance)	6 points 7 points 8 points	
EE5.A.4 Air Infiltration	Minimizing leaks in the building envelope is as important as the insulation properties of the building. Insulation does not work effectively if there is excess air leakage. • Air barrier applied to exterior walls, caulking, and visual inspection such as the HERS Verified Quality Insulation Installation (QII or equivalent) • Blower Door HERS Verified Envelope Leakage or equivalent	6 points 5 points	
EE5.A.5 Thermal Storage of Building	Thermal storage is a design characteristic that helps keep a constant temperature in the building. Common thermal storage devices include strategically placed water filled columns, water storage tanks, and thick masonry walls. • Modest Thermal Mass (10% of floor or 10% of walls 12" or more thick exposed concrete or masonry with no permanently installed floor covering such as carpet, linoleum, wood, or other insulating materials) • Enhanced Thermal Mass (20% of floor or 20% of walls 12" or more thick exposed concrete or masonry with no permanently installed floor covering such as carpet, linoleum, wood, or other insulating materials)	1 points 2 points	

Feature	Description	Assigned Point Values	Project Points
EE5.B Indoor Space Efficiencies			
EE5.B.1 Heating/ Cooling Distribution System	• Minimum Duct Insulation (R-4.2 required) • Modest Duct insulation (R-6) • Enhanced Duct Insulation (R-8) • Distribution loss reduction with inspection (HERS Verified Duct Leakage or equivalent)	0 points 4 points 5 points 7 points	
EE5.B.2 Space Heating/ Cooling Equipment	• 2016 Title 24 Minimum HVAC Efficiency (SEER 13/75% AFUE or 7.7 HSPF) • Improved Efficiency HVAC (SEER 14/78% AFUE or 8 HSPF) • High Efficiency HVAC (SEER 15/80% AFUE or 8.5 HSPF) • Very High Efficiency HVAC (SEER 16/82% AFUE or 9 HSPF)	0 points 2 points 4 points 5 points	
EE5.B.3 Water Heaters	• 2016 Title 24 Minimum Efficiency (0.57 Energy Factor) • Improved Efficiency Water Heater (0.675 Energy Factor) • High Efficiency Water Heater (0.72 Energy Factor) • Very High Efficiency Water Heater (0.92 Energy Factor) • Solar Pre-heat System (0.2 Net Solar Fraction) • Enhanced Solar Pre-heat System (0.35 Net Solar Fraction)	0 points 7 points 9 points 11 points 2 points 5 points	
EE5.B.4 Daylighting	Daylighting is the ability of each room within the building to provide outside light during the day reducing the need for artificial lighting during daylight hours. • All peripheral rooms within the living space have at least one window (required) • All rooms within the living space have daylight (through use of windows, solar tubes, skylights, etc.) • All rooms daylighted	0 points 1 point 1 point	
EE5.B.5 Artificial Lighting	• Efficient Lights (25% of in-unit fixtures considered high efficacy. High efficiency is defined as 40 lumens/watt for 15 watt or less fixtures; 50 lumens/watt for 15-40 watt fixtures, 60 lumens/watt for fixtures >40watt) • High Efficiency Lights (50% of in-unit fixtures are high efficiency) • Very High Efficiency Lights (100% of in-unit fixtures are high efficiency)	5 points 6 points 7 points	
EE5.B.6 Appliances	• Energy Star Refrigerator (new) • Energy Star Dishwasher (new) • Energy Star Washing Machine (new)	1 point 1 point 1 point	
EE5.C Miscellaneous Residential Building Efficiencies			
EE5.C.1 Building Placement	North/south alignment of building or other building placement such that the orientation of the buildings optimizes natural heating, cooling, and lighting.	3 points	
EE5.C2 Shading	At least 90% of south-facing glazing will be shaded by vegetation or overhangs at noon on June 21st.	2 points	
EE5.C3 Energy Star Homes	EPA Energy Star for Homes (version 3 or above)	15 points	
EE5.C.4 Independent Energy Efficiency Calculations	Provide point values based upon energy efficiency modeling of the project. Note that engineering data will be required documenting the energy efficiency and point values based upon the proven efficiency beyond Title 24 Energy Efficiency Standards.	TBD	
EE5.C.5 Other	This allows innovation by the applicant to provide design features that increase the energy efficiency of the project not provided in the table. Note that engineering data will be required documenting the energy efficiency of innovative designs and point values given based upon the proven efficiency beyond Title 24 Energy Efficiency Standards.	TBD	

Feature	Description	Assigned Point Values	Project Points
EE5.C.6 Existing Residential Retrofits	The applicant may wish to provide energy efficiency retrofit projects to existing residential dwelling units to further the point value of their project. Retrofitting existing residential dwelling units within the unincorporated County is a key reduction measure that is needed to reach the reduction goal. The potential for an applicant to take advantage of this program will be decided on a case-by-case basis and shall have the approval of the Riverside County Planning Department. The decision to allow applicants the ability to participate in this program will be evaluated based upon, but not limited to, the following: • Will the energy efficiency retrofit project benefit low income or disadvantaged residents? • Does the energy efficiency retrofit project provide co-benefits important to the County? • Point value will be determined based upon engineering and design criteria of the energy efficiency retrofit project.	TBD	
Reduction Measure R2-CE1: Clean Energy			
CE1.A Residential Renewable Energy Generation			
CE1.A.1 Photovoltaic	Solar Photovoltaic panels installed on individual homes or in collective neighborhood arrangements such that the total power provided augments: • 30 percent of the power needs of the project • 40 percent of the power needs of the project • 50 percent of the power needs of the project • 60 percent of the power needs of the project • 70 percent of the power needs of the project • 80 percent of the power needs of the project • 90 percent of the power needs of the project • 100 percent of the power needs of the project	9 points 12 points 17 points 20 points 23 points 25 points 28 points 31 points	
CE1.A.2 Wind Turbines	Some areas of the County lend themselves to wind turbine applications. Analysis of the areas' capability to support wind turbines should be evaluated prior to choosing this feature. Individual wind turbines at homes or collective neighborhood arrangements of wind turbines such that the total power provided augments: • 30 percent of the power needs of the project • 40 percent of the power needs of the project • 50 percent of the power needs of the project • 60 percent of the power needs of the project • 70 percent of the power needs of the project • 80 percent of the power needs of the project • 90 percent of the power needs of the project • 100 percent of the power needs of the project	9 points 12 points 17 points 21 points 23 points 25 points 28 points 31 points	
CE1.A.3 Off-site Renewable Energy Project	The applicant may submit a proposal to supply an off-site renewable energy project such as renewable energy retrofits of existing homes. These off-site renewable energy retrofit project proposals will be determined on a case-by-case basis and shall be accompanied by a detailed plan that documents the quantity of renewable energy the proposal will generate. Point values will be determined based upon the energy generated by the proposal.	TBD	
CE1.A.4 Other Renewable Energy Generation	The applicant may have innovative designs or unique site circumstances (such as geothermal) that allow the project to generate electricity from renewable energy not provided in the table. The ability to supply other renewable energy and the point values allowed will be decided based upon engineering data documenting the ability to generate electricity.	TBD	

Feature	Description	Assigned Point Values	Project Points
Reduction Measure R2-W2: Exceed Water Efficiency Standards			
W2.A Residential Irrigation and Landscaping			
W2.A.1 Water Efficient Landscaping	• Limit conventional turf to < 25% of required landscape area • Limit conventional turf to < 50% of required landscape area • No conventional turf (warm season turf to < 50% of required landscape area and/or low water using plants are allowed) • Only California Native Plants that requires no irrigation or some supplemental irrigation	0 points 2 points 4 points 5 points	
W2.A.2 Water Efficient irrigation systems	• Low precipitation spray heads < .75"/hr or drip irrigation • Weather based irrigation control systems or moisture sensors (demonstrate 20% reduced water use)	1 point 2 points	
W2.A.3 Storm water Reuse Systems	Innovative on-site stormwater collection, filtration, and reuse systems are being developed that provide supplemental irrigation water and provide vector control. These systems can greatly reduce the irrigation needs of a project. Point values for these types of systems will be determined based upon design and engineering data documenting the water savings.	TBD	
W2.B Residential Potable Water			
W2.B.1 Showers	Water Efficient Showerheads (2.0 gpm)	2 points	
W2.B.2 Toilets	Water Efficient Toilets (1.5 gpm)	2 points	
W2.B.3 Faucets	Water Efficient faucets (1.28 gpm)	2 points	
W2.B.4 Dishwasher	Water Efficient Dishwasher (6 gallons per cycle or less)	1 point	
W2.B.5 Washing Machine	Water Efficient Washing Machine (Water factor <5.5)	1 point	
W2.B.6 WaterSense	EPA WaterSense Certification	7 points	
W2.C Increase Residential Reclaimed Water Use			
W2.C.1 Recycled Water	5% of the total project's water use comes from recycled/reclaimed water	5 points	
Reduction Measure R2-T1: Alternative Transportation Options			
T1.A Increase Residential Density			
T1.A.1 Residential Density	Designing the project with increased densities, where allowed by the General Plan and/or Zoning Ordinance, reduces GHG emissions associated with traffic in several ways. Increased densities affect the distance people travel and provide greater options for the modes of travel they choose. This strategy also provides a foundation for implementation of many other strategies which would benefit from increased densities. • 1 point is allowed for each 10% increase in density beyond 7 units/acre, up to 500% (50 points)	1–50 points	

Feature	Description	Assigned Point Values	Project Points
T1.B Mixed-Use Development			
T1.B.1 Mixed-Use	Mixes of land uses that complement one another in a way that reduces the need for vehicle trips can greatly reduce GHG emissions. The point value of mixed-use projects will be determined based upon a Transportation Impact Analysis (TIA) demonstrating trip reductions and/or reductions in vehicle miles traveled. Suggested ranges: • Diversity of land uses complementing each other (2–28 points) • Increased destination accessibility other than transit (1–18 points) • Increased Transit Accessibility (1–25 points) • Infill location that reduces vehicle trips or VMT beyond the measures described above (points TBD based on traffic data).	TBD	
T1.B.2 Residential Near Local Retail (Residential only Projects)	Having residential developments within walking and biking distances of local retail helps to reduce vehicle trips and/or vehicle miles traveled. The point value of residential projects in close proximity to local retail will be determined based upon traffic studies that demonstrate trip reductions and/or reductions in vehicle miles traveled (VMT) The suburban project will have at least three of the following on site and/or off site within ¼-mile: Residential Development, Retail Development, Park, Open Space, or Office. The mixed-use development should encourage walking and other non-auto modes of transport from residential to office/commercial locations (and vice versa). The project should minimize the need for external trips by including services/facilities for daycare, banking/ATM, restaurants, vehicle refueling, and shopping.	1–16 points	
T1.C Traffic Flow Management Improvements			
T1.C.1 Signal Synchronization	Techniques for improving traffic flow include: traffic signal coordination to reduce delay, incident management to increase response time to breakdowns and collisions, Intelligent Transportation Systems (ITS) to provide real-time information regarding road conditions and directions, and speed management to reduce high free-flow speeds. • Signal synchronization • Traffic signals connected to existing ITS	 1 point/signal 3 points/signal	
T1.D Increase Public Transit			
T1.D.1 Public Transit Access	The point value of a projects ability to increase public transit use will be determined based upon a Transportation Impact Analysis (TIA) demonstrating decreased use of private vehicles and increased use of public transportation. • Increased transit accessibility (1–15 points)	TBD	
Reduction Measure R2-T2: Adopt and Implement a Bicycle Master Plan to Expand Bike Routes around the County			
T2.A.1 Sidewalks	• Provide sidewalks on one side of the street (required) • Provide sidewalks on both sides of the street • Provide pedestrian linkage between residential and commercial uses within 1 mile	0 points 1 point 3 points	
T2.A.2 Bicycle paths	• Provide bicycle paths within project boundaries • Provide bicycle path linkages between residential and other land uses • Provide bicycle path linkages between residential and transit	TBD 2 points 5 points	

Feature	Description	Assigned Point Values	Project Points
Reduction Measure R2-T4: Electrify the Fleet			
T4.A.1 Electric Vehicle Recharging	• Provide circuit and capacity in garages of residential units for use by an electric vehicle. Charging stations are for on-road electric vehicles legally able to drive on all roadways including Interstate Highways and freeways. • Install electric vehicle charging stations for each residential unit included in the project. Projects that include charging stations for fewer than all units shall receive points on a proportional basis.	1 point 8 points	
T4.A.2 Neighborhood Electric Vehicle (NEV) Infrastructure	NEVs are electric vehicles usually built to have a top speed of 25 miles per hour, and a maximum loaded weight of 3,000 pounds. • Provide NEV safe routes within project site. • Provide NEV safe routes between the project site and other land uses.	4 points 5 points	
Reduction Measure R2-S1: Reduce Waste to Landfills			
S1.A.1 Recycling	County initiated recycling program diverting 100% of waste requires coordination in neighborhoods to realize this goal. The following recycling features will help the County fulfill this goal: • Provide green waste composting bins at each residential unit • Multi-family residential projects that provide dedicated recycling bins separated by types of recyclables combined with instructions/education program explaining how to use the bins and the importance or recycling	4 points 3 points	
Other GHG Reduction Feature Implementation			
O.A.1 Other GHG Emissions Reduction Features	This allows innovation by the applicant to provide residential design features for the GHG emissions from construction and/or operation of the project not provided in the table. Note that engineering data will be required documenting the GHG reduction amount and point values given based upon emission reductions calculations using approved models, methods, and protocols.	TBD	
Total Points Earned by Residential Project:			

Table 2: Screening Table for GHG Implementation Measures for Commercial Development and Public Facilities

Feature	Description	Assigned Point Values	Project Points
Reduction Measure R2-EE10: Exceed Energy Efficiency Standards in New Commercial Units			
EE10.A Building Envelope			
EE10.A.1 Insulation	• 2017 Title 24 Requirements (walls R-13; roof/attic R-30) • Modestly Enhanced Insulation (walls R-13, roof/attic R-38) • Enhanced Insulation (rigid wall insulation R-13, roof/attic R-38) • Greatly Enhanced Insulation (spray foam insulated walls R-15 or higher, roof/attic R-38 or higher)	0 points 9 points 11 points 12 points	
EE10.A.2 Windows	• 2016 Title 24 Windows (0.57 U-factor, 0.4 SHGC) • Modestly Enhanced Window Insulation (0.4 U-factor, 0.32 SHGC) • Enhanced Window Insulation (0.32 U-factor, 0.25 SHGC) • Greatly Enhanced Window Insulation (0.28 or less U-factor, 0.22 or less SHGC)	0 points 4 points 5 points 7 points	
EE10.A.3 Cool Roofs	• Modest Cool Roof (CRRC Rated 0.15 aged solar reflectance, 0.75 thermal emittance) • Enhanced Cool Roof (CRRC Rated 0.2 aged solar reflectance, 0.75 thermal emittance) • Greatly Enhanced Cool Roof (CRRC Rated 0.35 aged solar reflectance, 0.75 thermal emittance)	7 points 8 points 10 points	
EE10.A.4 Air Infiltration	Minimizing leaks in the building envelope is as important as the insulation properties of the building. Insulation does not work effectively if there is excess air leakage. • Air barrier applied to exterior walls, calking, and visual inspection such as the HERS Verified Quality Insulation Installation (QII or equivalent) • Blower Door HERS Verified Envelope Leakage or equivalent	7 points 6 points	
EE10.A.5 Thermal Storage of Building	Thermal storage is a design characteristic that helps keep a constant temperature in the building. Common thermal storage devices include strategically placed water filled columns, water storage tanks, and thick masonry walls. • Modest Thermal Mass (10% of floor or 10% of walls 12" or more thick exposed concrete or masonry with no permanently installed floor covering such as carpet, linoleum, wood, or other insulating materials) • Enhanced Thermal Mass (20% of floor or 20% of walls 12" or more thick exposed concrete or masonry with no permanently installed floor covering such as carpet, linoleum, wood, or other insulating materials) • Enhanced Thermal Mass (80% of floor or 80% of walls 12" or more thick exposed concrete or masonry with no permanently installed floor covering such as carpet, linoleum, wood, or other insulating materials)	2 points 4 points 14 points	

Feature	Description	Assigned Point Values	Project Points
EE10.B Indoor Space Efficiencies			
EE10.B.1 Heating/ Cooling Distribution System	• Minimum Duct Insulation (R-4.2 required) • Modest Duct insulation (R-6) • Enhanced Duct Insulation (R-8) • Distribution loss reduction with inspection (HERS Verified Duct Leakage or equivalent)	0 points 5 points 6 points 8 points	
EE10.B.2 Space Heating/ Cooling Equipment	• 2016 Title 24 Minimum HVAC Efficiency (EER 13/75% AFUE or 7.7 HSPF) • Improved Efficiency HVAC (EER 14/78% AFUE or 8 HSPF) • High Efficiency HVAC (EER 15/80% AFUE or 8.5 HSPF) • Very High Efficiency HVAC (EER 16/82% AFUE or 9 HSPF)	0 points 4 points 5 points 7 points	
EE10.B.3 Commercial Heat Recovery Systems	Heat recovery strategies employed with commercial laundry, cooking equipment, and other commercial heat sources for reuse in HVAC air intake or other appropriate heat recovery technology. Point values for these types of systems will be determined based upon design and engineering data documenting the energy savings.	TBD	
EE10.B.4 Water Heaters	• 2016 Title 24 Minimum Efficiency (0.57 Energy Factor) • Improved Efficiency Water Heater (0.675 Energy Factor) • High Efficiency Water Heater (0.72 Energy Factor) • Very High Efficiency Water Heater (0.92 Energy Factor) • Solar Pre-heat System (0.2 Net Solar Fraction) • Enhanced Solar Pre-heat System (0.35 Net Solar Fraction)	0 points 8 points 10 points 11 points 2 points 5 points	
EE10.B.5 Daylighting	Daylighting is the ability of each room within the building to provide outside light during the day reducing the need for artificial lighting during daylight hours. • All peripheral rooms within building have at least one window or skylight • All rooms within building have daylight (through use of windows, solar tubes, skylights, etc.) • All rooms daylighted	0 points 1 point 1 point	
EE10.B.6 Artificial Lighting	• Efficient Lights (25% of in-unit fixtures considered high efficiency. High efficiency is defined as 40 lumens/watt for 15 watt or less fixtures; 50 lumens/watt for 15-40 watt fixtures, 60 lumens/watt for fixtures >40watt) • High Efficiency Lights (50% of in-unit fixtures are high efficiency) • Very High Efficiency Lights (100% of in-unit fixtures are high efficiency)	5 points 7 points 8 points	
EE10.B.7 Appliances	• Energy Star Commercial Refrigerator (new) • Energy Star Commercial Dishwasher (new) • Energy Star Commercial Clothes Washer	2 points 2 points 2 points	
EE10.C Miscellaneous Commercial Building Efficiencies			
EE10.C.1 Building Placement	North/south alignment of building or other building placement such that the orientation of the buildings optimizes conditions for natural heating, cooling, and lighting.	4 points	
EE10.C.2 Shading	At least 90% of south-facing glazing will be shaded by vegetation or overhangs at noon on Jun 21st.	6 points	
EE10.C.3 Other	This allows innovation by the applicant to provide design features that increase the energy efficiency of the project not provided in the table. Note that engineering data will be required documenting the energy efficiency of innovative designs and point values given based upon the proven efficiency beyond Title 24 Energy Efficiency Standards.	TBD	

Feature	Description	Assigned Point Values	Project Points
EE10.C.4 Existing Commercial Buildings Retrofits	The applicant may wish to provide energy efficiency retrofit projects to existing commercial buildings to further the point value of their project. Retrofitting existing commercial buildings within the unincorporated County is a key reduction measure that is needed to reach the reduction goal. The potential for an applicant to take advantage of this program will be decided on a case-by-case basis and shall have the approval of the Riverside County Planning Department. The decision to allow applicants to participate in this program will be evaluated based upon, but not limited to, the following: • Will the energy efficiency retrofit project benefit low income or disadvantaged communities? • Does the energy efficiency retrofit project provide co-benefits important to the County? • Point value will be determined based upon engineering and design criteria of the energy efficiency retrofit project.	TBD	
Reduction Measure R2-CE1: Clean Energy			
CE1.B Commercial/Industrial Renewable Energy Generation			
CE1.B.1 Photovoltaic	Solar Photovoltaic panels installed on commercial buildings or in collective arrangements within a commercial development such that the total power provided augments: • 30 percent of the power needs of the project • 40 percent of the power needs of the project • 50 percent of the power needs of the project • 60 percent of the power needs of the project • 70 percent of the power needs of the project • 80 percent of the power needs of the project • 90 percent of the power needs of the project • 100 percent of the power needs of the project	8 points 12 points 16 points 19 points 23 points 26 points 30 points 34 points	
CE1.B.2 Wind Turbines	Some areas of the County lend themselves to wind turbine applications. Analysis of the areas capability to support wind turbines should be evaluated prior to choosing this feature. Wind turbines as part of the commercial development such that the total power provided augments: • 30 percent of the power needs of the project • 40 percent of the power needs of the project • 50 percent of the power needs of the project • 60 percent of the power needs of the project • 70 percent of the power needs of the project • 80 percent of the power needs of the project • 90 percent of the power needs of the project • 100 percent of the power needs of the project	8 points 12 points 16 points 19 points 23 points 26 points 30 points 34 points	
CE1.B.3 Off-site Renewable Energy Project	The applicant may submit a proposal to supply an off-site renewable energy project such as renewable energy retrofits of existing residential or existing commercial/industrial. These off-site renewable energy retrofit project proposals will be determined on a case-by-case basis accompanied by a detailed plan documenting the quantity of renewable energy the proposal will generate. Point values will be based upon the energy generated by the proposal.	TBD	

Feature	Description	Assigned Point Values	Project Points
CE1.A.4 Other Renewable Energy Generation	The applicant may have innovative designs or unique site circumstances (such as geothermal) that allow the project to generate electricity from renewable energy not provided in the table. The ability to supply other renewable energy and the point values allowed will be decided based upon engineering data documenting the ability to generate electricity.	TBD	
Reduction Measure R2-W2: Exceed Water Efficiency Standards			
W2.D Irrigation and Landscaping			
W2.D.1 Water Efficient Landscaping	• Eliminate conventional turf from landscaping • Only moderate water using plants • Only low water using plants • Only California Native landscape that requires no or only supplemental irrigation	0 points 2 points 3 points 5 points	
W2.D.2 Water Efficient Irrigation Systems	• Low precipitation spray heads< .75”/hr or drip irrigation • Weather based irrigation control systems combined with drip irrigation (demonstrate 20% reduced water use)	1 point 3 points	
W2.D.3 Stormwater Reuse Systems	Innovative on-site stormwater collection, filtration, and reuse systems are being developed that provide supplemental irrigation water and provide vector control. These systems can greatly reduce the irrigation needs of a project. Point values for these types of systems will be determined based upon design and engineering data documenting the water savings.	TBD	
W2.E Potable Water			
W2.E.1 Showers	Water Efficient Showerheads (2.0 gpm)	2 points	
W2.E.2 Toilets	• Water Efficient Toilets/Urinals (1.5 gpm) • Waterless Urinals (note that commercial buildings having both waterless urinals and high efficiency toilets will have a combined point value of 6 points)	3 points 3 points	
W2.E.3 Faucets	Water Efficient faucets (1.28 gpm)	2 points	
W2.E.4 Commercial Dishwashers	Water Efficient dishwashers (20% water savings)	2 points	
W2.E.5 Commercial Laundry Washers	• Water Efficient laundry (15% water savings) • High Efficiency laundry Equipment that captures and reuses rinse water (30% water savings)	2 points 4 points	
W2.E.6 Commercial Water Operations Program	Establish an operational program to reduce water loss from pools, water features, etc., by covering pools, adjusting fountain operational hours, and using water treatment to reduce draw down and replacement of water. Point values for these types of plans will be determined based upon design and engineering data documenting the water savings.	TBD	
W2.F Increase Commercial/Industrial Reclaimed Water Use			
W2.F.1 Recycled Water	Graywater (purple pipe) irrigation system on site	5 points	

Feature	Description	Assigned Point Values	Project Points
Reduction Measure R2-T3: Ride-Sharing and Bike-to-Work Programs within Businesses			
T3.A.1 Alternative Scheduling	Encouraging telecommuting and alternative work schedules reduces the number of commute trips and therefore VMT traveled by employees. Alternative work schedules could take the form of staggered starting times, flexible schedules, or compressed work weeks. • Provide flexibility in scheduling such that at least 30% of employees participate in 9/80 work week, 4-day/40-hour work week, or telecommuting 1.5 days/week.	5 points	
T3.A.2 Car/Vanpools	• Car/vanpool program • Car/vanpool program with preferred parking • Car/vanpool with guaranteed ride home program • Subsidized employee incentive car/vanpool program *Note: combine all applicable points for total value*	1 point 2 points 3 points 5 points	
T3.A.3 Employee Bicycle/ Pedestrian Programs	• Complete sidewalk to residential within ½ mile • Complete bike path to residential within 3 miles • Bike lockers and secure racks • Showers and changing facilities • Subsidized employee walk/bike program *Note: combine all applicable points for total value*	1 point 1 point 1 point 2 points 3 points	
T3.A.4 Shuttle/Transit Programs	• Local transit within ¼ mile • Light rail transit within ½ mile • Shuttle service to light rail transit station • Guaranteed ride home program • Subsidized Transit passes *Note: combine all applicable points for total value*	1 point 3 points 5 points 1 points 2 points	
T3.A.5 Commute Trip Reduction	Employer based Commute Trip Reduction (CTR). CTRs apply to commercial, offices, or industrial projects that include a reduction of vehicle trip or VMT goal using a variety of employee commutes trip reduction methods. The point value will be determined based upon a TIA that demonstrates the trip/VMT reductions. Suggested point ranges: • Incentive based CTR Programs (1–8 points) • Mandatory CTR programs (5–20 points)	TBD	
T3.A.6 Other Trip Reduction Measures	Point values for other trip or VMT reduction measures not listed above may be calculated based on a TIA and/or other traffic data supporting the trip and/or VMT reductions.	TBD	
Reduction Measure R2-T1: Alternative Transportation Options			
T1.E Mixed-Use Development			
T1.E.1 Mixed-Use	Mixes of land uses that complement one another in a way that reduces the need for vehicle trips can greatly reduce GHG emissions. The point value of mixed-use projects will be determined based upon traffic studies that demonstrate trip reductions and/or reductions in vehicle miles traveled.	TBD	
T1.E.2 Local Retail Near Residential (Commercial only Projects)	Having residential developments within walking and biking distance of local retail helps to reduce vehicle trips and/or vehicle miles traveled. The point value of residential projects in close proximity to local retail will be determined based upon traffic studies that demonstrate trip reductions and/or reductions in vehicle miles traveled.	TBD	

Feature	Description	Assigned Point Values	Project Points
T1.F Preferential Parking			
T1.F.1 Parking	• Provide reserved preferential parking spaces for car-share, carpool, and ultra-low or zero emission vehicles. • Provide larger parking spaces that can accommodate vans used for ride-sharing programs and reserve them for vanpools and include adequate passenger waiting/loading areas.	1 point 1 point	
T1.G Signal Synchronization and Intelligent Traffic Systems			
T1.G.1 Signal Improvements	Techniques for improving traffic flow include: traffic signal coordination to reduce delay, incident management to increase response time to breakdowns and collisions, Intelligent Transportation Systems (ITS) to provide real-time information regarding road conditions and directions, and speed management to reduce high free-flow speeds. • Synchronize signals along arterials used by project. • Connect signals along arterials to existing ITS.	1 point/signal 3 points/signal	
T1.H Increase Public Transit			
T1.H.1 Public Transit	The point value of a projects ability to increase public transit use will be determined based upon a Transportation Impact Analysis (TIA) demonstrating decreased use of private vehicles and increased use of public transportation. • Increased transit accessibility (1-15 points)	TBD	
Reduction Measure R2-T2: Adopt and Implement a Bicycle Master Plan to Expand Bike Routes around the County			
T2.B.1 Sidewalks	• Provide sidewalks on one side of the street (required) • Provide sidewalks on both sides of the street • Provide pedestrian linkage between commercial and residential land uses within 1 mile	0 points 1 point 3 points	
T2.B.2 Bicycle Paths	• Provide bicycle paths within project boundaries • Provide bicycle path linkages between commercial and other land uses • Provide bicycle path linkages between commercial and transit	1 point 2 points 5 points	
Reduction Measure R2-T4: Electrify the Fleet			
T4.B.1 Electric Vehicle Recharging	• Provide circuit and capacity in garages/parking areas for installation of electric vehicle charging stations. • Install electric vehicle charging stations in garages/parking areas	2 points/area 8 points/station	
T4.B.2 Neighborhood Electric Vehicle (NEV) Infrastructure	NEVs are electric vehicles usually built to have a top speed of 25 miles per hour, and a maximum loaded weight of 3,000 pounds. • Provide NEV safe routes within the project site. • Provide NEV safe routes between the project site and other land uses.	3 points 5 points	
Reduction Measure R2-S1: Reduce Waste to Landfills			
S1.B.1 Recycling	County initiated recycling program diverting 80% of waste requires coordination with commercial development to realize this goal. The following recycling features will help the County fulfill this goal: • Provide separated recycling bins within each commercial building/floor and provide large external recycling collection bins at central location for collection truck pick-up • Provide commercial/industrial recycling programs that fulfills an on-site goal of 80% diversion of solid waste	2 points 5 points	

Feature	Description	Assigned Point Values	Project Points
Other GHG Reduction Feature Implementation			
O.B.1 Other GHG Emissions Reduction Features	This allows innovation by the applicant to provide commercial design features that the GHG emissions from construction and/or operation of the project not provided in the table. Note that engineering data will be required documenting the GHG reduction amount and point values given based upon emission reductions calculations using approved models, methods, and protocols.	TBD	
Total Points Earned by Commercial/Industrial Project:			

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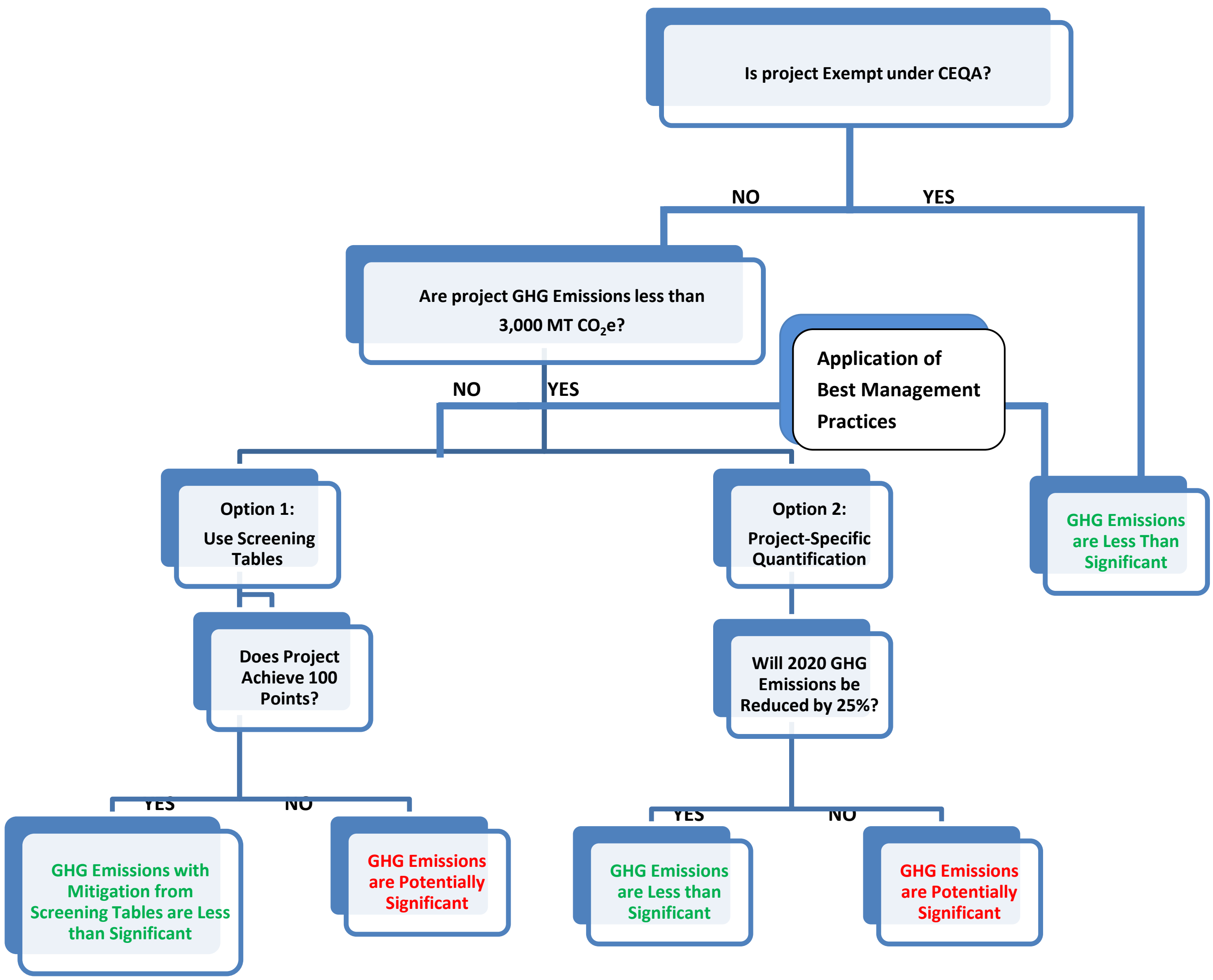
APPENDIX A: GHG DEVELOPMENT REVIEW PROCESS FLOW CHART DIAGRAM

Approach to Implementation of GHG Development Review



APPENDIX B: TRANSIT PRIORITY PROJECT AND SUSTAINABLE COMMUNITY PROJECT CHECKLIST

COUNTY OF RIVERSIDE TRANSIT PRIORITY PROJECT CHECKLIST

The following checklist will assist in determining if your project qualifies as a Transit Priority Project (TPP) and a Sustainable Community Project (SCP) as defined in PRC 21155(a), (b), and PRC 21152.

Yes	No		**Is the project:**
☐	☐	1.	Located within ½ mile of an existing or future Metrolink Station?
☐	☐	2.	At least 50% residential use, based upon total square footage, and non-residential use within the project between 26% and 50% of total square footage with FAR of not less than 0.75?
☐	☐	3.	At or above a minimum net density of at least 20 dwelling units per acre?
☐	☐	4.	Is your project consistent with the general land use designations in the SCP (if you answered Yes to questions 1 through 3, then answer yes to this one)?

If you answered **Yes** to questions 1 through 4 then your project is a Transit Priority Project (TPP) as defined by PRC Section 21155(b). Continue with the next list of environmental questions:

Yes	No		**Does the project:**
☐	☐	5.	Contain sites on the Cortese List?
☐	☐	6.	Site contain any hazardous substances, contaminated soil, or hazardous material?
☐	☐	7.	Site include historical resources?
☐	☐	8.	Have an unusually high risk of fire or explosion from material stored or used at properties within ¼ mile of the project site?
☐	☐	9.	Site currently include areas developed as Open Space (parks, habitat, etc.)?

Continue with the next list of land use questions below:

Yes	No		
☐	☐	10.	Does the project design have all the buildings at least 15% more efficient than Title 24 energy standards and uses 25% or less water than average households?
☐	☐	11.	Is the project site eight acres or less in size?
☐	☐	12.	The project does not include any single level of a building exceeding 75 TSF?
☐	☐	13.	The project does not conflict with nearby industrial uses?
☐	☐	14.	The project will sell at least 20% of housing to families of moderate income, or 10% of housing will be rented to families of low income, or at least 5% of housing will be rented to families of very low income, or the project provides open space equal or greater than 5 acres per 1,000 residents, or the developer will pay in-lieu fees sufficient to result in the development of affordable housing meeting one of the criteria described above?

Determining Eligibility based upon the answers:

Full CEQA Exemption for Sustainable Community Projects (SCPs)

If you answered **Yes** to all the TPP questions 1 through 4, **No** to all the environmental questions 5 through 9, and **Yes** to all the land use questions 10 through 14, then your project is an SCP and is eligible for a full CEQA Exemption under SB 375.

Transit Priority Projects (TPP)

If you answered **Yes** to all the TPP questions 1 through 4, but did not qualify as an SCP then your project is a TPP. Your TPP needs to incorporate all appropriate mitigation measures required by an applicable prior CEQA document (such as an adopted EIR for a Specific Plan) for your project location. If your TPP meets these two criteria then your TPP does not need to analyze the following impacts in the Sustainable Communities Environmental Assessment (SCEA) or CEQA analysis:

- Growth-inducing impacts,
- Regional transportation impacts, and
- GHG emissions related to passenger cars and light-duty trucks.

The impacts listed above are considered less than significant because the project is a TPP and the SCEA or CEQA document should reference PRC Section 21155.2(c)

Other Residential and Mixed-Use Projects

If you answered Yes to question 4, but did not qualify as an SCP or TPP, your project may not need to analyze some of the impacts in the CEQA analysis <u>if your project</u> is a **residential project or mixed-use project with 75%** of the total building square footage of the project is residential units. In addition, your project needs to incorporate all appropriate mitigation measures required by an applicable prior CEQA document (such as an adopted EIR for a Specific Plan) for your project location. If your project meets these criteria, then the CEQA analysis of your project does not need to analyze the following impacts:

- Growth-inducing impacts,
- Regional transportation impacts, and
- GHG emissions related to passenger cars and light-duty trucks.

The impacts listed above are considered less than significant because the project meets the criteria in PRC Section 21155.2(c)

APPENDIX C:
LAND USE DEVELOPMENT TABLES

Table C-A: Sample Project Sizes by Land Use Category that are below 3,000 MT CO_2e

Project Type	Project Size that Generates 3,000 Metric Tons of CO_2e
Single Family Residential (Single Family Detached)	80 units
Apartments/Condominiums/Townhouse	120 units
Retirement Community (Senior Housing Age 50 or older)	150 units
General Commercial/Retail/Office (refrigeration not to exceed 10% of total square footage)	160,000 square feet
Supermarket/Grocery/Discount Club (refrigeration exceed 10% of total square footage)	36,000 square feet
Restaurants (sit down)	8,200 square feet
Fast-Food Restaurants (Fast Food with or without /drive thru)	5,300 square feet
Gas Station	7,200 square feet
Industrial	53,000 square feet
Wireless Communication Towers	2,400 kw
Passive Park	200 acres
Active Park	60 acres

Note: Based upon statistical analysis of projects run in the CalEEMod model. Definitions are provided below in Table C-B.

Table C-B: Sample Project Sizes by Land Use Category that are below 3,000 MT CO_2e Definitions

Single Family Residential
Apartments/Condominiums/Townhouse Apartments High Rise: High-rise apartments are units located in rental buildings that have more than 10 levels and most likely have one or more elevators. Apartments Low Rise: Low-rise apartments are units located in rental buildings that have 1-2 levels. Apartments Mid Rise: Mid-rise apartments in rental buildings that have between 3 and 10 levels. Condo/Townhouse: These are ownership units that have at least one other owned unit within the same building structure.
Retirement Community Senior Housing (age 50 or older) These communities provide multiple elements of senior adult living. Housing options may include various combinations of senior adult housing single-family and/or multi-family, in support of assisted living, and skilled nursing care aimed at allowing the residents to live in one community as their medical needs change.
General Commercial/Retail/Office (refrigeration not to exceed 10% of total square footage) Home Improvement Super Store, Auto Care Center, Electronic Superstore, Hardware store, Pharmacy/Drugstore with & without drive thru, General Office Building, Bank with & without drive thru, Gov. Civic Center, Gov. Office Building, Medical Office, Office Park, Health Club, and Strip Mall (small strip shopping centers contain a variety of retail shops and specialize in quality apparel, hard goods and services such as real estate offices, dance studios, florists, and small restaurants) or Convenience Store not to exceed 5,000 square feet.
Supermarket/Grocery/Discount Club (refrigeration exceeds 10% of total square footage) Supermarkets: free-standing retail stores selling a complete assortment of food: food preparation and wrapping materials; and household, cleaning items. Supermarkets may also contain the following products and services: ATMs, automobile supplies, bakeries, books and magazines, dry cleaning, floral arrangements, greeting cards, limited-service banks, photo centers, pharmacies and video rental areas. Discount Club: a discount or warehouse store where shoppers pay a membership fee in order to take advantage of discounted prices on a wide variety of items such as food, clothing, tires, and appliances. Many items are sold in large quantities or in bulk.
Restaurants (sit down) Full-service eating establishments with typical turnover rates of at least one hour or longer. Patrons commonly wait to be seated, are served by a waiter, order from menus and pay for meals after they eat.

Fast-Food Restaurants (with or without drive thru)
Gas Station Gas Station includes the building square footage and excludes the canopy. Gas/Service Stations Projects that include "One building" with two to three ancillary uses: Fast Food with drive thru, Convenience Market 24-hour.
Industrial Warehouse with or without refrigeration, storage, distribution, manufacturing, research and development with exception to those uses that require Title 5 Permit from the AQMD (i.e., paint booths).
Wireless Communication Towers Cell Towers-freestanding
Passive Park Amenities include tot lots, picnic tables, and non-programmed open space.
Active Park Amenities include one of the following: game fields lighted, pool facility, and community center (as per the Comprehensive Park and Recreation Master Plan for Old Model Colony).

APPENDIX D: METHODOLOGY FOR THE DEVELOPMENT AND APPLICATION OF THE SCREENING TABLES

METHODS SUMMARY

The point values in the Screening Tables were derived from the projected emissions reductions that each of the Reduction Measures within the Riverside County CAP Update would achieve. The total emission reductions offered by each measure are based on both changes in existing land use activities as well as how new development is designed and built. In order to correctly allocate the emission reductions within the Screening Tables, the amount of emission reductions afforded new development had to be segregated from the aggregate total in a manner that is described below. Once the process of segregating new development from the aggregate reduction totals was completed, the points were then proportioned by residential unit or square footage of commercial/industrial uses. This was accomplished by taking the predicted growth in households and commercial/industrial uses by the year 2030 and proportioning the appropriate measures reduction quantities for new development to the residential and commercial/industrial land use sectors within the Screening Tables. These calculations result in point values that are allocated by residential unit or commercial/industrial square footage (measured in 1,000 square feet). Because of this outcome, the size of the project is not relevant to the Screening Tables. Regardless of size, each project needs to garner 100 points to demonstrate consistency with the CAP Update. Efficiency, not size of the project is critical. The following emission factors can be used in determining the amount of emissions reduced per point in the Screening Tables:

The respective calculated emission values are in metric tons of carbon dioxide equivalents (MT CO_2e)

For Residential Projects:

0.0389 MT CO_2e per Point per Residential Unit

For Commercial and Industrial Projects:

0.0322 MT CO_2e per Point per 1,000 Square Feet of Gross Commercial/Industrial Building Area

Note that the Screening Tables and point values are best used for typical development projects processed by the County. Examples of typical development projects include residential subdivisions, multi-family residential apartments, condominiums and townhouses, retail commercial, big box retail, office buildings, business parks, and typical warehousing. Mixed-use projects can use the Screening Tables following the instructions. Transit-oriented development (TOD), and infill projects are able to use the Screening Tables; however, the Screening Table points are likely to underestimate total emission reductions afforded these types of projects. Note that the Screening Tables include the opportunity to custom develop points (using the formula above) in order to account for the predicted reductions in vehicle trips and vehicle miles traveled within a project-specific traffic study and GHG analysis. TOD and infill projects can be more accurately assessed and points allocated using this method.

However, more unusual types of industrial projects, such as cement manufacturing, metal foundries, refrigerant manufacturing, electric generating stations, and oil refineries, cannot use the Screening Tables because the emission sources for those types of uses were not contemplated in the CAP Update.

DEVELOPMENT OF THE POINT VALUES

The first step in developing the point system is the need to determine the total reductions afforded the CAP Update. Figure D-1 below shows the total emission reductions achieved by the CAP Update. In total, 1,667,460 MT CO_2e would be reduced by the County's local measures as a result of the CAP Update by 2030. This amount includes reductions afforded existing building retrofits and other changes to activities associated with existing land uses, as well as reductions associated with new development.

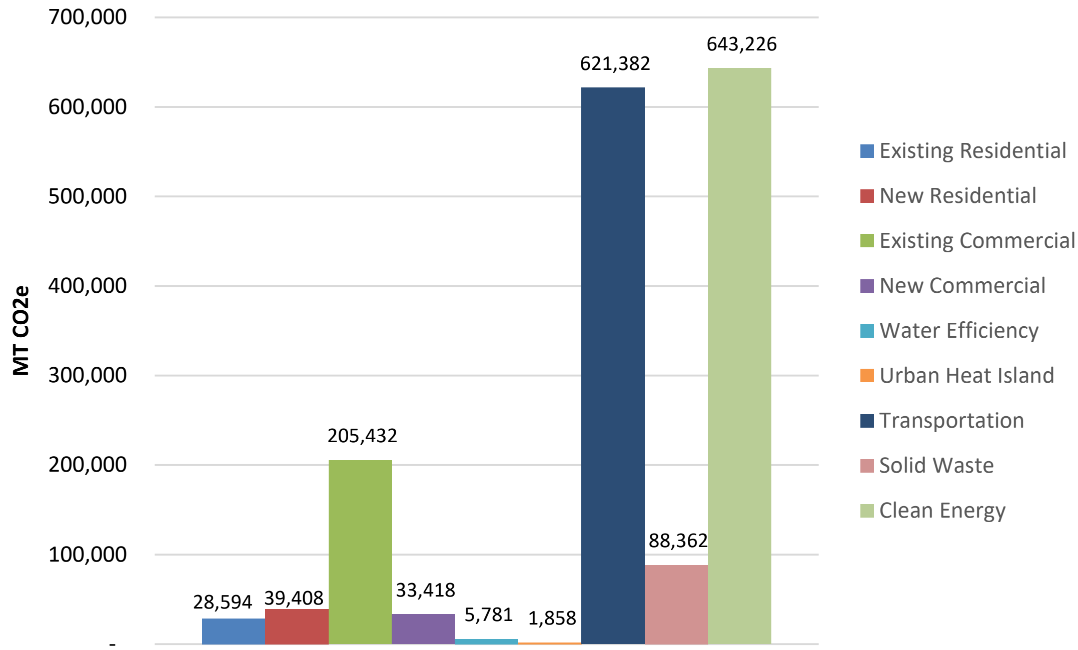


Figure D-1: GHG Emission Reductions by Sector in 2030

The next step is to segregate the amount of emissions that would be reduced within new development from the County strategies total.

Table D-A summarizes the reduction in emissions afforded new development from the reduction measures. Table D-A shows 752,217 MT CO_2e being reduced from new development as a result of the County strategies. Within the 752,217 MT CO_2e of new development reductions afforded County strategies, 439,023 MT CO_2e of emissions reduced is accomplished through new commercial and industrial projects, and 313,194 MT CO_2e of emissions reduced is accomplished through new residential projects.

The next step in allocating point values is to determine the number of new homes and commercial buildings that are anticipated by year 2030. The County predicts that 80,491 new residential units will be needed by 2030 to accommodate the population growth by 2030. A total of approximately 136,414,585 square feet of new commercial and industrial buildings within the unincorporated County area is needed

Table D-A: GHG Reductions from New Development

Reduction Number	Reduced Emissions (MT CO_2e)		
	Reduction Measure Name	Commercial/ Industrial	Residential
R2-EE5	Exceed Energy Efficiency Standards in New Residential Units		39,408
R2-EE10	Exceed Energy Efficiency Standards in New Commercial Units	33,418	
R2-W1	Water Efficiency through Enhanced Implementation of Senate Bill X7-7	1,689	1,140
R2-W2	Exceed Water Efficiency Standards	34	23
R2-L1	Tree Planting for Shading and Energy Saving	4	3
R2-L2	Light Reflecting Surfaces for Energy Saving	550	371
R2-T1	Alternative Transportation Options	48,273	32,584
R2-T2	Adopt and Implement a Bicycle Master Plan to Expand Bike Routes around the County	666	449
R2-T3	Ride-Sharing and Bike-to-Work Programs within Businesses	54,507	36,793
R2-T4	Electrify the Fleet	81,791	55,210
R2-S1	Reduce Waste to Landfills	26,341	17,780
R2-CE1	Clean Energy	10,196	6,883
R2-CE3	Community Choice Aggregation Program	181,553	122,549
Total Reductions for New Development		**439,023**	**313,194**

Source: Compiled by LSA (March 2019).
County = County of Riverside
GHG = greenhouse gases
MT CO_2e = metric tons of carbon dioxide equivalents

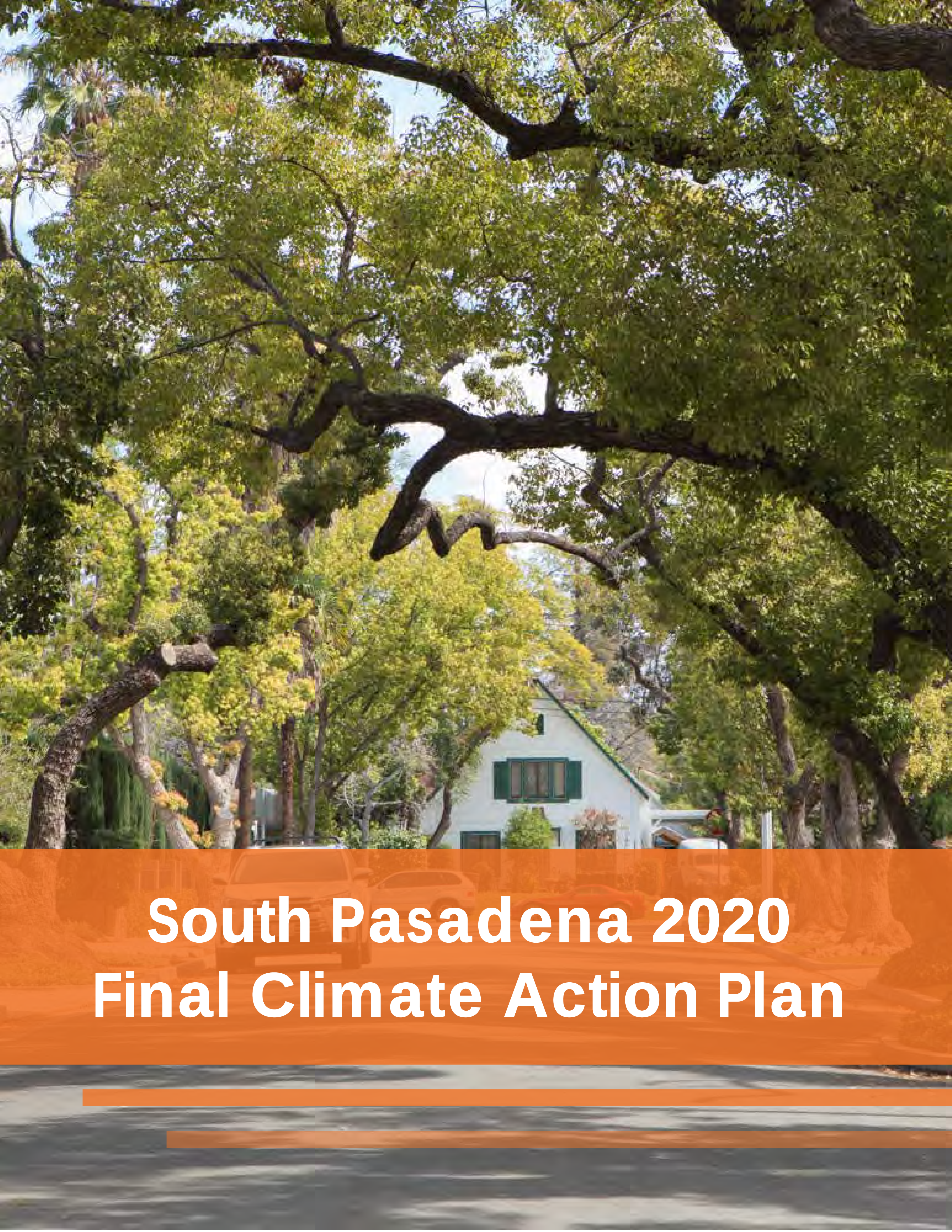
to accommodate anticipated job growth. This estimate is based on the relationship between past growth in employment and the average growth in commercial/industrial building area for Riverside County.

Dividing the 313,194 MT CO_2e reductions of emissions afforded the reduction measures for new residential development by the anticipated 80,491 new residential units that will be built yields 3.89 MT CO_2e per residential unit that needs to be reduced to fulfill the anticipated reductions of the CAP Update. That amount equals 100 points, producing the following for the point values:

0.0389 MT CO_2e per Point per Residential Unit

A similar process was used to derive the point value for new commercial/Industrial development. Because commercial/industrial land uses are typically described in thousand square feet of building space, the point value was calculated as follows:

0.0322 MT CO_2e per Point per 1,000 Square Feet of Gross Commercial/Industrial Building Area



South Pasadena 2020 Final Climate Action Plan

Appendix E:

Funding Strategy

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Funding Strategy

Full implementation of the Climate Action Plan (CAP) will require investments on the part of the City of South Pasadena, local households and businesses, and property owners. In many cases, the expenditures will not only help to reduce greenhouse gas (GHG) emissions, but will also bring other valuable co-benefits such as cleaner air, water conservation, off-setting savings on energy and utility expenditures, more robust and flexible transportation systems, improved public health, and enhanced local quality of life.

Some expenditures will not represent net-cost increases, but instead will involve substituting investments on climate-friendly equipment, materials, and technologies for expenditures that would otherwise have been made on less climate-friendly options. For example, residents and businesses are encouraged to make investments in water and energy conservation improvements; the initial expenditure on the improvements will be offset by long-term savings from reduced water or energy usage. Further, the City and local partners such as Southern California Edison (SCE), Southern California Gas (SoCalGas), and/or water providers can help households and businesses make these transitions by promoting available low-cost financing programs.

In some cases, expenditures may represent net-cost increases compared to a "status quo" approach to climate change. As such, these costs represent an accounting for the costs to address the negative externalities[1] associated with current practices that are now recognized as not sustainable.

Below are general descriptions of principles that will guide the City's approach to funding the CAP and descriptions of key funding sources that the City may use. A more detailed matching of specific CAP actions with potential funding sources and tools is included in the Climate Action Plan and Table 1 below (The Funding Matrix).

Funding Strategy Principles

The CAP will be implemented over time. Funding sources for some actions can be identified at the outset, while the best means to fund other actions will be determined at the time the City is ready to implement them, depending on the resources available at the time. Several principles will help the City to determine the best approach to funding various actions, as follows:

Equity

The costs of implementing the CAP should be spread as equitably as possible, taking care to limit the imposition of new costs on the segments of the community that have the least ability to shoulder increased costs. Where certain segments of the community will benefit disproportionately from an action, the costs should be spread accordingly. Where possible, funding options and resources have been included which target assistance to low- and moderate-income households.

1 "A negative externality is a cost that is suffered by a third party as a result of an economic transaction. In a transaction, the producer and consumer are the first and second parties, and third parties include any individual, organization, property owner, or resource that is indirectly affected." Accessed August 12, 2020 at: https://www.economicsonline.co.uk/Market_failures/Externalities.html

Cost-Effectiveness

The CAP prioritizes cost-effective Plays and Moves which can generate cost savings that will offset the costs to those who are required to pay for implementation. While some Plays and Moves may require some initial capital outlay, whenever possible these actions should generate long-term cost savings that will repay and even generate a return on investment (ROI). The City will prioritize the use of available local resources to implement those Moves that have the highest GHG reduction potential.

Leveraging Local Resources

Leveraging local resources will involve using outside sources of funding to augment local resources to fund implementation of the CAP. The City will leverage General Fund resources and in-kind staff time to aggressively seek grants, matching funds, in-kind contributions, and other resources from state, federal, and philanthropic sources to help pay for actions and limit the cost to the City, residents, and local businesses. The CAP also includes actions through which City staff will monitor and publicize grants and incentives that will help households and businesses make the necessary climate-friendly investments.

Types of Funding Sources

The CAP will rely on a variety of funding sources for implementation. Below are general descriptions of some key funding sources identified that can be used to pay for climate-friendly actions:

Grants

From time to time, the City is able to secure funds for specific projects through grant programs provided by state and federal agencies. This includes various grant programs funded through the State of California's Cap and Trade program, which generates money for the State's Greenhouse Gas Reduction Fund, some of which is granted to local governments. State and federal grants may be a useful source of funding to pay for the portion of mitigation programs or actions that is attributable to the City's existing residential and non-residential development, which cannot be funded through impact fees collected on new development. State and federal grants can also be used to fund climate-friendly actions and programs that have broad community benefits, or to help defray costs that might otherwise have been too burdensome for lower-income households or small businesses. Additionally, utility companies may also provide grants within their service areas through various programs designed to incentivize energy conservation.

Pros and Cons

Grants are beneficial because they represent an opportunity to reduce the cost burden for implementation programs and projects on the City itself and the burden on local residents and businesses. Grants are one funding source that the City can use to pay existing development's share of project costs when the costs must be split between new development and existing development.

The primary disadvantages of grants are that the availability of funds is not certain due to competition for limited funds, timing of funding availability may not match with necessary implementation timelines, and grants are not always available for the types of projects which need funding. Exceptions to this include the Transportation Development Act (TDA) Article 3 Bicycle and Pedestrian Funds from Metro and upcoming Senate Bill (SB) 2 allocations from the state that are allocated to cities in a formulaic manner. The City will need to prioritize the funds for CAP implementation projects from these sources along with other eligible uses that may be of community interest.

General City Funds

The City's General Fund receives the revenues over which the City Council exercises discretionary funding authority. The General Fund receives major funding sources including sales tax revenues, property tax revenues, property tax in-lieu of vehicle license fees, and many other smaller revenue streams. The City Council spends these monies on public services that broadly benefit the community at large. While balancing all of its budgetary needs, the City Council may elect to spend some General Fund money on CAP implementation, such as providing staff support for climate-friendly programs or actions.

The CAP contains numerous Moves that are likely to be implemented through in-kind City staff efforts; however, it is not likely that existing City staff will have adequate capacity to take on all the responsibilities of CAP implementation that are identified as "Staff in-kind." To leverage the available staff resources, the City will seek to partner with other agencies and/or contract out certain services (e.g. using consultants for specialized studies), when that is more cost-effective. One such potential opportunity that is not tied to any single CAP Move is to apply to host a Civic Spark fellow who could work under the direction of the City's Sustainability Staff to help with CAP implementation activities. Civic Spark Fellows are provided through an AmeriCorps program that places fellows with local governments and other entities that are engaged in sustainability projects. The Civic Spark program covers most of the cost to host a Fellow so the City's General Fund can leverage this opportunity to acquire more staff than the City could otherwise afford to support.

Pros and Cons

A benefit of using General Fund monies to fund climate-friendly actions is that the City Council already has authority to allocate General Fund monies to implement climate-friendly actions. Therefore, reallocation of General Fund dollars to such actions is not restricted by governmental approval or outside agencies. However, it must also be recognized that the General Fund supports many other critical public services, such as law enforcement and fire protection, as well as parks and roadway maintenance. The City likely has little ability to allocate General Fund monies to new programs without impacting existing programs. The COVID-19 pandemic has significantly reduced the General Fund through decreases in revenue sources such as sales tax, property tax, and increases in health-related expenses. These reductions to the City's General funds will make it more difficult to directly fund implementation of some CAP Plays and Moves.

Restricted Funds

Restricted funds are monies that the City receives, but which can only be used for specified purposes. This is often the case with funds that are passed through to the City from other governmental entities, such as state or federal agencies. Relevant examples of such restricted funds include money allocated to the City from regional funding sources such as: transportation development funds received from the Local Return Program which is administered by Los Angeles Metro from Los Angeles County sales tax Measures A, C, R, and M; the local subvention funds that the City receives from the Southern California Air Quality Management District (SCAQMD)[2] and from Assembly Bill (AB) 2766[3] vehicle license fees for air quality improvement projects; and the TDA Article 3 funds which are distributed by Metro.[4] For these revenue examples, the City receives

2 https://www.metro.net/projects/local_return_pgm/

3 http://www.aqmd.gov/docs/default-source/transportation/ab2766-motor-vehicle-subvention-fund-program/ab2766-resource-guide.pdf?sfvrsn=8

4 https://www.metro.net/projects/tda/

annual allocations of funds on a per-capita basis and the City can use those funds consistent with the relevant program guidelines, which include many purposes that align with the overall CAP goals as well as the objectives of specific transportation-related Moves.

Pros and Cons

A benefit of the Local Return Program and Local Subvention funds is that they are existing funding sources which will continue to accrue annually at fairly predictable levels. Given the alignment of these two programs' goals with the goals of the CAP, many of the Moves included in the CAP could be eligible for the use of these monies. The challenge with using these funds is that they are typically fully allocated and directing funds towards CAP projects will require prioritizing CAP projects over other potentially worthy uses of the funds.

<u>Fees for Service/User Fees</u>

The City operates some services on a cost recovery basis. The City collects funds in the form of user fees to provide specific services to various user groups and the fees charged are designed to offset the cost of the services provided. An example of user fees that support services provided to a specific segment of the community includes building permit fees, which are charged to cover the cost of reviewing plans and conducting inspections to verify that buildings are constructed properly. To the extent that these types of services incorporate climate-friendly actions, the costs of these actions can be recovered through user fees. User fees and ratepayer charges can also be applicable to utilities such as SCE, SoCalGas, water providers, and other businesses that provide goods and services that come under the auspices of the CAP.

Pros and Cons

Implementation projects and actions that are funded via fees for service, user fees, or ratepayer charges are similar to actions that are funded directly via household or business income, in that they uphold the "user pays" principle. They are also similar in that a disadvantage is that they could disproportionately burden lower income households or small and disadvantaged businesses that have more limited resources. The City will want to be particularly careful where users of affected services have limited ability to change their behavior to limit their exposure to increased costs. For example, some utility incentive programs can be structured to provide relatively low rates for "baseline" consumption then charging higher rates for consumption above established baseline levels to incentivize the minimization of consumption.

<u>Financing Tools</u>

Financing tools are not funding sources per se; however, while many climate-friendly actions may generate long-term cost savings, they may also require significant up-front expenditures which could be a challenge for the City, households, or businesses to finance. There are various financing tools that can be used to essentially borrow the funds needed "up front" for CAP implementation, to be paid back over time using one or more funding sources that will generate money over time. Examples of such tools include home mortgages and equity lines, Property Assessed Clean Energy (PACE) programs, on-bill financing programs sponsored by utilities, various state or federal financing programs, "green bond" programs used in places such as San Francisco, and private financing innovations such as the Metered Energy Efficiency Transaction Structure (MEETS) pioneered in Seattle. Another option to be considered for municipal expenditures is "interfund borrowing" whereby the City could self-finance certain improvements by using money from idle fund balances, and then repay those funds over time with other revenue streams. In particular, the City should consider using financing mechanisms to pay for up-front costs of large capital projects that will yield long-term annual budget savings that can offset the annual debt service from the financings. In this way, the City can benefit from long-term costs savings of investments such as solar power generation facilities on City property and water and energy conservation improvements. The City should consider the possibility of undertaking a "green bond" issuance to finance a package of such investments, to be repaid using annual budget expenditures that otherwise would have been spent in the absence of the cost savings created by the investments. Additionally, if the City identifies the use of Los Angeles County Measure A, C, R, and M funds (Local Return Program) to help pay for transportation-related CAP projects, the City can consider utilizing borrowing options outlined in Metro's program guidelines[5] to obtain up-front funds for investments, to be repaid using the City's future Local Return Program formulaic allocations.

Pros and Cons

As described above, various financing tools can be beneficial because they can help make large expenditures achievable by providing funds up-front and then allowing the cost to be repaid over an extended period of time. The disadvantage of most financing programs is that the cost of financing (e.g., interest charged on the outstanding balance while the financing is being repaid) adds to overall project costs. It will be beneficial for the City to fund its CAP implementation activities on a pay-as-you-go basis whenever practical and to reserve financing techniques for those situations where funds are needed up-front but are not available without using financing tools, or where long-term annual operational cost savings are sufficient to offset the necessary debt service payments.

5 http://media.metro.net.s3.amazonaws.com/projects_studies/local_return/images/borrowing_guidelines_prop_a_c_measure_r_m.pdf

Table 1 Detailed Funding Matrix

Move	Cost	City Lead Department	Potential Funding Source	Notes
Play C.1 Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.				
C.1.a Support South Pasadena Unified School District by providing students with information on climate change and the beneficial role of trees.	Low	Public Works and Community Services	U.S. EPA - Environmental Education Grants (Need to Partner with a qualified education agency)	Grants support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.
C.1.b Utilize South Pasadena's historic neighborhoods to demonstrate to students the importance of mature urban trees in providing shade and reducing the urban heat island effect.	Low	Public Works and Community Services		
C.1.c Identify grant funding opportunities and engage with local nurseries and tree planting programs to identify appropriate and cost-effective California native plants/trees that can be both planted in the ground or remain potted for students living in rental/multi-family homes.	Low	Public Works and Community Services	General Fund	Staff in-kind
Play E.1. Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.				
E.1.a Monitor progress and perform public outreach and education campaigns highlighting the benefits of 100% renewable energy, including: ✓ Monitoring opt-out rates on an annual basis ✓ Tabling at community events ✓ Establishing an informational resource page on the City website ✓ Regular social media posts ✓ Energy bill inserts	Low	Public Works	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
Play E.2 Electrify 100% of newly constructed buildings.				
E.2.a Develop a webpage and materials for display at City Hall promoting the benefits of electrification and resources that can assist with the fuel-switching process.	Low	Public Works and Planning and Building	General Fund	Staff in-kind or contractor
E.2.b Provide financial and technical resources, including hosting workforce development trainings for installers and building owners/operators to discuss benefits and technical requirements of electrification.	Med	Planning and Building	Foothill Workforce Development Board – job training	Possibility to recruit vendors to assist with training and provide sponsorships and seek to partner with Foothill Workforce Development Board to arrange training – Workforce Development Board partners with businesses to provide job training to upgrade employee skills.
E.2.c Perform regular internal trainings with planners and building officials on current state decarbonization goals and incentives available for electric homes.	Low	Planning and Building	General Fund	Staff in-kind or contractor
E.2.d Provide education around cooking with electric appliances, including demonstrations from chefs and/or local restaurants, as available.	Low	Planning and Building	General Fund	Staff in-kind or contractor; could charge registration fees to off-set costs
E.2.e Adopt an Electrification Readiness Reach Code per California Energy Commission (CEC) reach code requirements for all new buildings and accessory dwelling units which eliminates the piping of natural gas. In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as City staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	Low/ Med	Planning and Building	Grant Funding	Consultant

Move	Cost	City Lead Department	Potential Funding Source	Notes
E.2.f Adopt an ordinance that allows granting of minor allowances for certain site development standards when there is no practical ways to design a project to be all electric.	Low/ Med	Planning and Building	Grant Funding	Consultant
Play E.3 Electrify 5% of existing buildings by 2030 and 80% by 2045.				
E.3.a Develop an existing building electrification permit tracking program to track annual progress in achieving the targeted electrification goal.	Low	Planning and Building	General Fund	Staff in-kind; potentially include costs of tracking in building permit fees.
E.3.b Keep an updated list of rebates and incentives available to residents who would like to convert their buildings to electric power.	Low	Public Works and Planning and Building	General Fund	Staff in-kind; partner with SCE
E.3.c Provide education on the potential energy savings and benefits of electric heat pumps for water heating and space heating when permits for replacement are obtained.	Low	Public Works and Planning and Building	General Fund	Staff in-kind; partner with SCE
E.3.d Work with Southern California Edison (SCE) and/or the Clean Power Alliance to provide rebates for residential replacement of natural gas-powered air and water heating appliances with electric-powered.	Low	Public Works	1. General Fund 2. SCE 3. Clean Power Alliance for rebate funding	Partner with SCE and/or Clean Power Alliance
E.3.e Promote water heater, space heating, and appliance (electric stoves/dryers) replacement programs and incentives (residential) at time of construction permit.	Low	Public Works and Planning and Building	General Fund	Staff in-kind - Could partner with local contractors, retailers, and building supply companies to host a building electrification expo to educate consumers. Vendors could also provide sponsorships to defray costs.
E.3.f Perform an existing buildings analysis in order to understand the potential for electrification retrofitting in South Pasadena and establish a roadmap for eliminating natural gas from existing buildings.	Med/ High	Planning and Building	California Energy Commission – Energy Partnership Program	This would likely require consultant contract and would also likely need General Fund support. Depending on level of detail of retrofit analysis, study cost could be significantly above $50,000. This program offers services to help identify the most cost-effective, energy-

Move	Cost	City Lead Department	Potential Funding Source	Notes
				saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is a continuously open with no final filing date.
E.3.g Establish a comprehensive, coordinated education campaign focused towards property owners, landlords, property management companies, and occupants for reducing the use of natural gas in homes and businesses. Establish a shared understanding of existing incentives for electric appliances and upgrades, and how to access them, including SCE incentive programs and rebates.	Med	Public Works and Planning and Building	1. Southern California Edison, SoCalGas – rebates, incentives, and financing programs or 2. U.S. EPA - Environmental Education Grants (Need to Partner with a qualified education agency)	Staff in-kind and/or consultant contract – would likely need General Fund support SCE and SoCalGas offer a range of incentives, rebates, and financing programs for residential and non-residential customers. Grants support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.
E.3.h Perform a cost-effectiveness study for electrification retrofitting, including requirements for newly permitted HVAC/hot water heaters and other appliances to be electric.	Low	Planning and Building	California Energy Commission	This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a

Move	Cost	City Lead Department	Potential Funding Source	Notes
				consultant's costs. The program is a continuously open with no final filing date. See studies completed by Sacramento Municipal Utility District and other utilities on the same topic.
E.3.i Develop a best practices model based on the progress electrifying existing buildings in South Pasadena and outside of South Pasadena to significantly increase electrification post-2030.	Low	Planning and Building	Grant Funding	Consultant
Play E.4 Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.				
E.4.a Conduct a Feasibility Study to assess cost and applicable locations for installation of battery back-up systems or generators throughout the City in support of the General Plan.	Med	Public Works	California Energy Commission - Energy Partnership Program	The Feasibility Study would likely require a consultant contract, which may need General Fund support. This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is a continuously open with no final filing date.
E.4.b Promote installation of storage technology in concert with renewable energy infrastructure through educational programs, outreach, and information provided via City platforms.	Low	Public Works	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
E.4.c Conduct "micro-grid" Feasibility/Pilot Study in support of the General Plan.	Med	Public Works	California Energy Commission - Energy Partnership Program	The Feasibility Study/Pilot Study would likely require a consultant contract, which may need General Fund support. This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is a continuously open with no final filing date.
E.4.d In support of the General Plan, develop and implement a Solar Action Plan with a goal of meeting 50% of South Pasadena's power demand through solar by 2040.	Med/ High	Public Works and Planning and Building	Private Solar Dealers/Installers - End-users buy or lease systems with costs offset by long-term energy savings. Solar developers construct and manage new solar systems to supply end-users pursuant to a power purchase agreement.	The Move would likely require a consultant contract, which may need General Fund support. Implementation of the Solar Action Plan would cost many millions of dollars; however, costs would be mostly absorbed by end users who would benefit from the renewable energy savings. Private companies offer their customers financing programs for purchasing and installing systems, lease programs, and power purchase agreements to convert to solar energy.
E.4.e In support of the 2018-2019 City Strategic Plan, develop a strategy and implementation schedule for the Renewable Energy Plan, after completion of the feasibility study.	Med	Public Works and Planning and Building	Grant Funding	The Move would likely require a consultant contract, which may need General Fund support.
E.4.f Adopt a PV (Solar) Ordinance requiring newly constructed and majorly renovated multi-family and	Low/ Med	Planning and Building	Grant Funding	Consultant

Move	Cost	City Lead Department	Potential Funding Source	Notes
commercial buildings to install PV systems with an annual output greater or equal to 25% of buildings electricity demand. Ensure consistency of ordinance with the City General Plan.				
E.4.g Require all new structures or major retrofits to be pre-wired for solar panels, consistent with the General Plan.	Low	Planning and Building	General Fund	Staff in-kind
E.4.h Work with various City departments to establish and streamline battery storage requirements to allow for easier implementation of these technologies throughout the City.	Low	Public Works and Planning and Building	General Fund	Staff in-kind
E.4.i Work with home and business owners, including those in the historic districts, to identify and promote renewable energy demonstration projects to showcase the benefits.	Low	Public Works and Planning and Building	General Fund	Staff in-kind
E.4.j Work with SCE and the CPA to develop a program and timeline for increasing resilience to power losses, including Public Safety Power Shutoffs (PSPS), and climate-driven extreme weather events for low-income, medically dependent, and elderly populations through installation of renewable energy and onsite energy storage with islanding capabilities, following appropriate project-level environmental review.	High	Public Works	1. SCE 2. CPA	Staff in-kind; work with SCE and CPA to determine if there is potential to create a program similar to Search Results Web results Low Income Home Energy Assistance Program (LIHEAP) that utilizes funds collected from ratepayers at large to fund assistance for vulnerable populations. Implementation costs could be substantially over $50,000, depending on the number of sites served.
Play T.1 Increase use of zero-emission vehicle and equipment 13% by 2030 and 25% by 2045.				
T.1.a Develop an EV Readiness Plan to establish a path forward to increase EV infrastructure within the City and promote mode shift to EVs that is consistent with the City General Plan. In conjunction with an EV Readiness Plan, conduct a community EV Feasibility Study to assess infrastructure needs and challenges.	Med	Public Works and Planning and Building	1. Moving California, California Climate Investments - Sustainable Transportation Equity Project (STEP) 2. California Air Resources Board -	The EV Readiness Plan would likely require a consultant contract, which may need General Fund support. STEP is a new pilot with $2 million for Clean Transportation Planning & Capacity Building Grants, and $20 million for Implementation Grants. Eligible Planning projects include mobility plans and needs assessments. Eligible implementation

Move	Cost	City Lead Department	Potential Funding Source	Notes
			Clean Vehicle Rebate Program	projects include infrastructure, capital, operations, planning, policy-making, and outreach projects. The Clean Vehicle Rebate Program provides rebates for income eligible-consumers. Enhanced rebates for lower-income consumers.
T.1.b Adopt an EV Charging Retrofits in Existing Commercial and Multifamily Buildings reach code requiring major retrofits, with either a permit value over $200,000 or including modification of parking surfaces or electric panels, to meet CalGreen requirements for "EV Ready" charging spaces and infrastructure.	Low/ Med	Public Works and Planning and Building	1. Moving California, California Climate Investments - Sustainable Transportation Equity Project (STEP) 2. CAL eVIP - Southern California Incentive Project (SCIP)	The Southern California Incentive Project (SCIP) offers rebates for the purchase and installation of eligible public electric vehicle (EV) chargers in Los Angeles, Orange, Riverside and San Bernardino counties – with a total of $29 million in available funds. Eligible rebates include up to $70,000 per DC fast charger (DCFC) for installations at new sites and sites with stub-outs and up to $40,000 per DC fast charger for installations at replacement and make-ready sites. Installations in designated disadvantaged communities (DACs) are eligible for rebates up to $80,000 per DC fast charger regardless of installation site type" Consultant to develop reach code.
T.1.c Streamline permit processes (city, county, state, utility) for electric vehicle charging infrastructure and alternative fuel stations.	Low	Planning and Building	General Fund	Staff in-kind
T.1.d Enhance promotion of public and private conversion to zero-emission vehicles through implementation of the City General Plan; including use of City events, social media, and	Low	Public Works	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
the City website to educate on benefits of zero-emission vehicles and available incentives.				
T.1.e Establish an ordinance that restricts use of gas-powered lawn equipment, including leaf blowers, and provide information on the City website outlining available incentives.	Low/ Med	Public Works	General Fund	Staff in-kind
T.1.f Adopt an EV Readiness Reach Code requiring new commercial construction to provide the minimum number of EV capable spaces to meet Tier 2 requirements (20% of total). In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as local government staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	Low/ Med	Public Works and Planning and Building	1. Grant Funding 2. AB 2766 funds	The EV Readiness Reach Code would require a consultant contract, which may need General Fund support. Funding from the South Coast Air Quality Management District (SCAQMD) to support air pollution reduction projects.
T.1.g Earmark and identify additional funding for implementation of the EV Readiness Plan to include public charging infrastructure in key locations.	Low	Public Works	1. General Fund 2. AB 2766 – local subventions 3. Funding from EV charging station companies	Staff in-kind; potential partnership with commercial EV charging station companies. Funding from the South Coast Air Quality Management District (SCAQMD) to support air pollution reduction projects.
T.2 Implement programs for public and shared transit that decrease passenger car VMT 3% by 2030 and 6% by 2045.				
T.2.a Conduct a Feasibility and Community Interest Study on the four transit improvement options of the City's General Plan.	Med	Planning and Building	1. Southern California Association of Governments (SCAG)	The Move would require a consultant contract

Move	Cost	City Lead Department	Potential Funding Source	Notes
			- Sustainable Communities Program 2. AB 2766 - Local Subventions 3. Los Angeles County Measures A, C, R, M - Local Return Program	SCAG - Non-infrastructure funding for projects that help to implement the regional SCS AB 2766 - Annual allocations of funds can be used on projects that reduce air pollution. LA Metro - Annual formulaic grants to local jurisdictions from LA County voter-approved sales tax measures. Can fund numerous transportation improvement projects, including planning, capital investments, and services.
T.2.b Pursue a community car, bike, or e-scooter "micro-transit" share pilot consistent with the City General Plan.	Low	Planning and Building	AB2766 - Local Subventions	Staff in-kind; potential partnership with commercial shared mobility provider, San Gabriel Valley Council of Governments (SVGCOG) Annual allocations of funds can be used on projects that reduce air pollution.
T.2.c Conduct local transportation surveys to better understand the community's needs and motivation for travelling by car versus other alternatives such as bus or Metro Gold Line light rail. Use survey results to inform transit expansion and improvement projects.	Low/ Med	Public Works and Planning and Building	General Fund	The Move would likely require staff in-kind time or a consultant contract, which may need General Fund support.
T.2.d Adopt a Transportation Demand Management (TDM) Plan for the City that includes a transit system focus. Provide incentives for implementation of TDM measures at local businesses and new developments.	Med/ High	Planning and Building	Los Angeles County Measures A, C, R, M – Local Return Program	Form local Transportation Management Association (TMA); potential funding from TMA dues/assessments and grant funding to offset eligible services. The Move may also require staff in-kind time Annual formulaic grants to local jurisdictions from LA County voter-approved sales tax measures. Can fund numerous transportation improvement

Move	Cost	City Lead Department	Potential Funding Source	Notes
				projects, including planning, capital investments, and services.
T.2.e Facilitate transportation equity through targeted provision of programs that encourage minority, low-income, disabled, and senior populations to take transit, walk, bike, use rideshare or car share.	Low	Public Works and Community Services	Los Angeles County Measures A, C, R, M – Local Return Program	Staff in-kind; incorporate equity considerations into other actions. Annual formulaic grants to local jurisdictions from LA County voter-approved sales tax measures. Can fund numerous transportation improvement projects, including planning, capital investments, and services.
Play T.3 Develop and implement an Active Transportation Plan to shift 3% of passenger car VMT to active transportation by 2030, and 5% by 2045.				
Play T.3.a Develop and adopt an Active Transportation Plan consistent with SCAG 2016 RTP/SCS that will identify funding strategies and policies for development of pedestrian, bicycle, and other alternative modes of transportation projects. Establish citywide events, outreach, educational programs, and platforms to promote active transportation in the community in support of the General Plan.	High	Public Works and Planning and Building	1. California Transportation Commission (CTC) - Active Transportation Program (ATP) 2. LA Metro - TDA Article 3	contractor; cost may be well over $50,000 CTC ATP - The goals of the ATP include increasing the proportion of trips accomplished by biking and walking and increasing the safety and mobility for nonmotorized users. Each ATP programming cycle will include four years of funding. New programming capacity for the 2021 ATP will be for state fiscal years 2021-22, 2022-23, 2023-24 and 2024-25 Funding from the ATP may be used to fund the development of community-wide active transportation plans within or, for area-wide plans, encompassing disadvantaged communities, including bicycle, pedestrian, safe routes to schools, or comprehensive active transportation plans LA Metro - Metro Administers Transportation Development Act Article 3 funds for cities within LA County. Funds

Move	Cost	City Lead Department	Potential Funding Source	Notes
				are allocated annually on a per capita basis and can be used for bicycle and pedestrian improvement projects.
Play T.3.b In conjunction with the City's Compete Streets Policy conduct a Street/Intersection Study to identify streets and intersections that can be improved for pedestrians and bicyclists through traffic calming measures and/or where multi-use pathway opportunities exist to increase active transportation.	Low/ Med	Public Works	1. California Transportation Commission (CTC) - Local Partnership Program (LPP) 2. Mitigation fees paid by new development projects that contribute to VMT - Local VMT-based transportation impact fee or local/regional VMT bank/exchange program 3. LA Metro - TDA Article 3	contractor; potential grant funding CTC LPP - The primary objective of this program is to provide funding to counties, cities, districts, and regional transportation agencies in which voters have approved fees or taxes dedicated solely to transportation improvements or that have imposed fees, including uniform developer fees, dedicated solely to transportation improvements. The Local Partnership Program provides funding to local and regional agencies to improve Aging Infrastructure, Road Conditions, Active Transportation, Transit and rail, Health and Safety Benefits. The Local Partnership Program funds are distributed through a 40% statewide competitive component and a 60% formulaic component. FY20 Funding deadline for 2020 applications was June 30, 2020. Development projects would pay impact fees to offset VMT impacts or pay into a VMT bank or exchange program to offset their contributions to VMT. Funds collected in this manner would be spent on VMT-reducing projects. This can be implemented in tandem with the switch from LOS-based to VMT-based mitigations for CEQA traffic impacts.

Move	Cost	City Lead Department	Potential Funding Source	Notes
				Metro TDA Article 3 - Metro Administers Transportation Development Act Article 3 funds for cities within LA County. Funds are allocated annually on a per capita basis and can be used for bicycle and pedestrian improvement projects.
Play T.3.c Periodically review and update the City's Bicycle and Pedestrian Network Map and post throughout City.	Low	Planning and Building	General Fund	Staff in-kind; additionally, potential sponsorships from local bike shops and other businesses may be pursued
Play T.3.d Work with South Pasadena Active, Active San Gabriel Valley (ActiveSGV), and/or Metro to develop programs and classes to teach and promote bicycle riding education and safety to residents of all ages and skill levels, as well as educate drivers.	Low	Public Works	General Fund	Staff in-kind
Play T.3.e Conduct a nexus study and develop an ordinance requiring payment of fees from development projects to implement safe active transportation routes and infrastructure citywide.	Low/ Med	Public Works	Mitigation fees paid by new development projects that contribute to VMT	Local VMT-based transportation impact fee or local/regional VMT bank/exchange program. Development projects would pay impact fees to offset VMT impacts or pay into a VMT bank or exchange program to offset their contributions to VMT. Funds collected in this manner would be spent on VMT-reducing projects. This can be implemented in tandem with the switch from LOS-based to VMT-based mitigations for CEQA traffic impacts.
Play T.3.f Amend zoning code to require installation of bike stalls or lockers at new developments, "mobility hubs", and during change of use of existing buildings, consistent with the General Plan.	Low	Public Works and Planning and Building	General Fund, combine with Play T.3.g	Staff in-kind New developments would incorporate costs; costs could be offset by reducing vehicle parking requirements commensurately.

Move	Cost	City Lead Department	Potential Funding Source	Notes
Play T.3.g Adopt a Trip Reduction Ordinance that incudes requirements in the Zoning Code to require end-of-trip facilities for cyclists (e.g., showers, bike repair kiosks, and lockers) in new, non-residential building projects of a specified size.	Low/ Med	Public Works and Planning and Building	General Fund	Staff in-kind New developments would incorporate costs; costs could be offset by reducing vehicle parking requirements commensurately.
W.1 Reduce per capita water consumption by 10% by 2030 and 35% by 2045.				
W.1.a Continue to enforce the Model Water Efficient Landscapes Ordinance.	Low	Public Works and Planning and Building	Water Conservation Funds	Staff in-kind (existing program)
W.1.b Work with the Los Angeles County Sanitation District (LACSD) and/or the Upper San Gabriel Valley Municipal Water District to bring recycled water lines and infrastructure to the City.	High	Public Works	1. User Fees 2. Water Resources Control Board- Water Recycling Funding Program - Construction Grant	Staff in-kind; implementation costs could be in the multiple millions of dollars. User fees could potentially reimburse costs; partner with Upper San Gabriel Valley Municipal Water District to conduct the study. Integrated Water & Wastewater Resources Management Plan (currently being studied) will address recycled water feasibility. Water recycling construction projects must offset or augment state or local fresh water supplies. Eligible projects include construction of recycled water treatment facilities, storage facilities, pumping facilities, groundwater recharge facilities, and recycled water distribution systems, including onsite improvements.
W.1.c In conjunction with the Downtown Specific Plan and City General Plan actions, adopt an ordinance restricting the use of potable water for non-potable uses and requiring	Low/ Med	Public Works	Water Conservation Funds	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
greywater capture for land uses that are excess water users (e.g. golf courses, car washes, large fields, etc.).				
W.1.d Implement Plays 1 through 4 under Goal II of the Green Action Plan on the provided implementation timeline, aiming to provide education and promotion of greywater systems. (See the City's Green Action Plan for more information).	Low	Public Works	Water Conservation Funds	Staff in-kind
W.1.e In conjunction with Move II.1.1 of the City Green Action Plan, develop a Recycled Water Use Master Plan that identifies access to recycled water and quantity of recycled water available to the City, as well as establishes an implementation plan. The implementation plan shall identify land use types (i.e., landscaping, gold courses, fields) and specific projects that will switch from potable to recycled water use allowing for a goal of 20% of City's potable water use to be replaced with recycled water.	High	Public Works	Water Resources Control Board - Water Recycling Funding Program - Planning Grant	Contractor; costs to implement could be in the multiple millions of dollars; combine with W.1.b; potentially reimburse up-front costs through user fees. WRFP Planning Grants encourage Local Public Agencies to investigate the feasibility of recycling wastewater and assist them with completing planning for water recycling projects by supplementing local funds. Applications are accepted continuously.
W.1.f Implement 100% renewable power for all pumping and treatment of water.	Low	Public Works	General Fund	Marginal cost increase above current costs; incorporate costs into rate structure
Play SW.1 Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.				
SW.1.a Adopt procurement policies to comply with SB 1383 requirements for jurisdictions to purchase recovered organic waste products.	Low	Public Works	General Fund	Possible marginal cost increase above standard products that are already purchased
SW.1.b Adopt an ordinance requiring compliance with SB 1383. Ensure ordinances established through the City General Plan are consistent with SB 1383 requirements; and revise ordinances if necessary.	Low/ Med	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.

Move	Cost	City Lead Department	Potential Funding Source	Notes
SW.1.c Adopt an Edible Food Recovery Ordinance for edible food generators, food recovery services, or organization that are required to comply with SB 1383.	Low/ Med	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.
SW.1.d Partner with the City's waste hauler, to provide organic waste collection and recycling services to all commercial and residential generators of organic waste.	Low	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.
SW.1.e Adopt an ordinance requiring all residential and commercial customers to subscribe to an organic waste collection program and/or report self-hauling or backhauling of organics.	Low/ Med	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.
SW.1.f Conduct a Feasibility Study and prepare an action plan to ensure edible food reuse infrastructure is sufficient to accept capacity needed to recover 20% of edible food disposed or identify proposed new or expanded food recovery capacity.	Low/ Med	Public Works	CalRecycle - Food Waste Prevention and Rescue Grant Program	Staff in-kind or contractor; potential grant funding The purpose of this competitive grant program is to lower overall greenhouse gas emissions by expanding existing or establishing new food waste prevention and/or rescue projects in California to reduce the amount of food being disposed in landfills. Eligible projects include food waste prevention projects that prevent food waste and from being generated Food rescue projects that result in edible food being rescued and distributed to people Availability of application materials for fiscal year (FY) 2019-20 is to be determined
SW.1.g Establish an education and outreach program for school children and adults around food waste prevention, nutrition education, and the importance of edible food	Low	Public Works	U.S. EPA - Environmental Education Grants	Staff in-kind Grants support environmental education projects that promote environmental

Move	Cost	City Lead Department	Potential Funding Source	Notes
recovery. Support City Green Action Plan Play III identified educational goals (Move III.1.3., Move III.1.4., Move III1.6., Move III.2.1, Move III. 3.3, and Move III.4.2) through an established educational program.				awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques. 2020 grant applications were announced in October 2019 and due January 6, 2020.
SW.1.h Establish an edible food recovery program supporting the City General Plan and the City Green Action Plan Move III.1.2 to minimize food waste.	Low	Public Works	CalRecycle - Food Waste Prevention and Rescue Grant Program	Staff in-kind; partner with local food bank or similar organization to implement The purpose of this competitive grant program is to lower overall greenhouse gas emissions by expanding existing or establishing new food waste prevention and/or rescue projects in California to reduce the amount of food being disposed in landfills. Eligible projects include food waste prevention projects that prevent food waste and from being generated Food rescue projects that result in edible food being rescued and distributed to people Availability of application materials for fiscal year (FY) 2019-20 is to be determined
SW.1.i Adopt an ordinance or enforceable mechanism to regulate haulers collecting organic waste, including collection program requirements and identification of organic waste receiving facilities.	Low/ Med	Public Works	General Fund, possibly incorporate costs into franchise agreement.	Staff in-kind
SW.1.j Partner with City waste services to:	Low	Public Works	User fees for solid waste services; incorporate into	Staff in-kind; incorporate costs in user fees for waste hauler

Move	Cost	City Lead Department	Potential Funding Source	Notes
✓ Ensure organic waste collection from mixed waste containers are transported to a high diversion organic waste processing facility. ✓ Provide quarterly route reviews to identify prohibited contaminants potentially found in containers that are collected along route. ✓ Clearly label all new containers indicating which materials are accepted in each container, and by January 1, 2025, place or replace labels on all containers.			agreement with Athens Services	
Play SW.2 Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.				
SW.2.a Develop and implement a Zero Waste Plan, consistent with the General Plan, in order to reach South Pasadena's goal of zero waste by 2040.	Low/ Med	Public Works	User fees	Contractor - Incorporate costs of study and implementation into solid waste user fees.
SW.2.b Provide ongoing education to residents, business owners, and South Pasadena School District regarding waste reduction, composting, and recycling.	Low	Public Works	U.S. EPA - Environmental Education Grants	Staff in-kind; partner with waste hauler Grants support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques. 2020 grant applications were announced in October 2019 and due January 6, 2020.
SW.2.c Increase reuse, recycling, and composting at temporary public events by mandating the installation of public recycling and composting containers and collection service; and encouraging reusable food ware, when relevant, according to the California State Retail Food Code.	Low	Public Works	CalRecycle - Beverage Container Recycling Grants	Staff in-kind Provides funding to assist organizations with establishing convenient beverage container recycling and litter abatement

Move	Cost	City Lead Department	Potential Funding Source	Notes
				projects. The next application cycle is expected in Fall 2020.
SW.2.d Develop a waste department or working group to enhance recycling and composting outreach and provide technical assistance or information in support of City Green Action Plan Move III. Additionally, implement and share a Recycle and Reuse Directory through City platforms, in support of Green Action Plan Move I.2.5.	Low/ Med	Public Works	General Fund	Staff in-kind; costs would increase if new staff needed
SW.2.e Adopt an ordinance requiring compliance with Sections 4.410.2, 5.410.1, 4.408.1, and 5.408.1 of the California Green Building Standards Code related to construction of buildings with adequate space for recycling containers and construction and demolition (C&D) recycling.	Low/ Med	Planning and Building	General Fund, planning and building permit fees.	Consultant Costs for implementation could be recovered through planning and building plan review fees charged to projects subject to requirements.
SW.2.f Implement the City General Plan, requiring construction sites to separate waste for proper diversion and reuse or recycling.	Low	Public Works and Planning and Building	General Fund, planning and building permit fees.	Staff in-kind; possible cost recovery through permit surcharge Costs for implementation could be recovered through planning and building plan review fees charged to projects subject to requirements.
SW.2.g Develop and implement a Waste Stream Education Program targeting property managers of multi-family residences and the commercial sector, in support of Goal III of the City Green Action Plan.	Low	Public Works	General Fund	Staff in-kind; partner with property owner organizations and/or Chamber of Commerce for outreach and education.
SW.2.h Develop policies to mandate/encourage reduction of waste and reuse in the food industry (e.g. facilities serving prepared food and prepackaged food; home meal delivery services), hospitality industry, and other commercial industries. Efforts may include developing ordinances for food service ware and a ban on single-use individual toiletry bottles in hotels/motels, grant/discount programs for switching to reusables, fast food champion pilot project, and working with home meal delivery services (e.g., Blue Apron),	Low/ Med	Public Works	General Fund, affected businesses	Staff in-kind; partner with Chamber of Commerce to gain business input on policy and to educate affected businesses. Possible regulatory fees charged to affected businesses.

Move	Cost	City Lead Department	Potential Funding Source	Notes
etc. to explore opportunities to reduce single-use packaging and encourage reuse.				
SW.2.i Encourage reusable foodware; or if reusable foodware is not a feasible option, explore opportunities to mandate/encourage a switch to more environmentally friendly alternatives for various products in the commercial industry, when relevant.	Low	Public Works	General Fund	Staff in-kind; partner with Chamber of Commerce to gain business input on policy and to educate affected businesses.
Play CS.1 Increase carbon sequestration through increased tree planting and green space.				
CS.1.a Identify and map public spaces that can be converted to green space, including public parking that can be converted to parklets, freeway airspace that can be made into green space, vertical walls that can be planted with vines, and rooftops of public buildings that can be developed into gardens.	Low	Public Works	CalFire - Urban and Community Forestry	Staff in-kind or contractor to identify and map; implementation could be funded with combination of grants and private property owner investments Funds projects to expand and manage urban forests. 2019-20 concept proposals were due 11-27-2019. The next round of funding has not yet been announced.
CS.1.b Adopt a Greenscaping Ordinance that has a street tree requirement for all zoning districts, has a shade tree requirement for new development, requires greening of parking lots, and increases permeable surfaces in new development.	Low/ Med	Public Works and Planning and Building	General Fund	Staff in-kind; property owners fund improvements Implementation costs would be covered by building permit fees charged to construction projects.
CS.1.c Prepare and adopt an Urban Forest Management Plan for the City that includes an inventory of existing trees, identifies future tree planting opportunities, and a climate-ready tree palette, as well as ongoing operations and maintenance needs.	High	Public Works	CalFire - Urban and Community Forestry	Consultant; costs for implementation and long-term maintenance would likely be in the multiple millions of dollars; possible grant funding and funding from private property owners to plant trees; maintenance costs could potentially be incorporated into a lighting and landscaping assessment district. Funds projects to expand and manage urban forests. 2019-20 concept proposals

Move	Cost	City Lead Department	Potential Funding Source	Notes
				were due 11-27-2019. The next round of funding has not yet been announced.
CS.1.d Adopt a standard policy and set of practices for expanding urban tree canopy and placing vegetative barriers between busy roadways and developments to reduce exposure to air pollutants from traffic.	Low	Public Works	General Fund	Staff in-kind
M.1 Reduce carbon intensity of City operations.				
M.1.a As recommended in the 2016 Renewable Energy Council Report, complete energy audits for all City facilities and implement all feasible recommendations for decarbonization and efficiency upgrades.	High	Public Works	California Energy Commission Energy Partnership Program	Consultant; costs for implementation could be substantially over $50,000; offset by potential long-term savings from improvements This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is continuously open with no final filing date.
M.1.b As recommended in the 2016 Renewable Energy Council Report, purchase renewable natural gas (RNG) for applicable City fleet vehicles.	Low	Public Works	General Fund	Marginal costs for substitution of fuels
M.1.c Establish an employee rideshare program.	Low	Public Works	General Fund	Staff in-kind
M.1.d As recommended in the 2016 Renewable Energy Council Report, install PV solar systems at the City Hall and at Wilson Reservoir.	High	Public Works	Grant Funding	Up-front costs are likely substantially over $50,000, but offset by long-term electricity cost savings. Solar generation facilities would be a candidate for Green Bond financing, to be

Move	Cost	City Lead Department	Potential Funding Source	Notes
				repaid using General Fund monies that otherwise would have been spent on purchasing electricity.
M.1.e Adopt retrofitting policy for City owned buildings such that energy efficient and electrification retrofits are incorporated into City buildings as they become available.	Low	Public Works	General Fund	Staff in-kind Energy efficiency projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs.
M.1.f Develop a policy for the City which would require all new building RFP's to include life cycle costing over 30 years and tie this directly to energy consumption and building electrification. This would include the buildings operational and maintenance costs and ensure that the City has the most cost effective (and sustainable) building possible.	Low	Public Works	General Fund	Staff in-kind to develop policy; City benefits from lifecycle savings Lifecycle costing will help the City to identify potential for long-term cost savings. Green Bond financing could be used to make the necessary up-front investment in efficient buildings.
M.1.g As recommended in the 2016 Renewable Energy Council Report, invest all savings from City energy efficiency projects into a new revolving green fund that can be used to fund additional energy efficiency and GHG reduction projects.	Low	Finance	General Fund	Calls for using energy efficiency dividends to fund new projects The Green Fund could help to repay Green Bond financings.
M.2 Electrify the municipal vehicle fleet and mobile equipment.				
M.2.a Develop a suite of transportation demand management tools to incentivize alternative transportation methods for employees, including telecommute options.	Low	Management Services	General Fund	Staff in-kind City is adapting to telecommuting for COVID-19. Develop continuing telecommuting policies for post-pandemic.
M.2.b Provide bicycles and bicycle storage for employees to use during work hours for short business or personal trips.	Low	Public Works	General Fund	Limited capital expenditure and maintenance costs

Move	Cost	City Lead Department	Potential Funding Source	Notes
M.2.c Develop and adopt a policy to apply lifecycle assessment to all new vehicle and equipment purchases.	Low	Public Works	General Fund	Staff in-kind to develop policy; City benefits from lifecycle savings Lifecycle costing will help the City to identify potential for long-term cost savings. Green Bond financing could be used to make the necessary up-front investment in efficient buildings.
M.2.d Implement the City Fleet Alternative Fuel Conversion Policy developed under the City General Plan, electrifying the City vehicle fleet and using it to encourage residents to convert as well.	Low	Public Works	Southern California Air Quality Management District (SCAQMD) - Carl Moyer Program	Long-term savings from reduced maintenance and fuel costs Replacement of older heavy duty diesel vehicles and equipment with clean technologies. Eligible equipment includes trucks, public agency utility vehicles, emergency vehicles.
M.2.e Install EV charging stations at municipal buildings.	Med	Public Works and Planning and Building	1. Moving California, California Climate Investments, CARB - Sustainable Transportation Equity Project (STEP) 2. CAL eVIP, CA Energy Commission - Southern California Incentive Project (SCIP)	Possible low to no-cost of partnered with commercial EV charging company STEP - is a new pilot with $2 million for Clean Transportation Planning & Capacity Building Grants, and $20 millions for Implementation Grants. Eligible Planning projects include mobility plans and needs assessments. Eligible implementation projects include infrastructure, capital, operations, planning, policy-making, and outreach projects. The Southern California Incentive Project (SCIP) offers rebates for the purchase and installation of eligible public electric vehicle (EV) chargers in Los Angeles, Orange, Riverside and San Bernardino counties – with a total of $29 million in available funds.

Move	Cost	City Lead Department	Potential Funding Source	Notes
				Eligible rebates include up to $70,000 per DC fast charger (DCFC) for installations at new sites and sites with stub-outs and up to $40,000 per DC fast charger for installations at replacement and make-ready sites. Installations in designated disadvantaged communities (DACs) are eligible for rebates up to $80,000 per DC fast charger regardless of installation site type. Applications accepted on an ongoing basis while funds available.
M.3 Increase City's renewable energy production and energy resilience.				
M.3.a Conduct a Feasibility Study to determine which City buildings would serve as ideal resilience centers including solar and battery installations.	Low	Public Works	General Fund	Consultant
M.3.b Convert all streetlights to light emitting diode (LED) bulbs.	High	Public Works	General Fund	Up-front costs are potentially over $1 million, but offset by long-term electricity cost savings. Energy efficiency projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs.
M.3.c Work with SCE to identify and develop local solar projects to connect to the grid.	Low	Public Works	General Fund, possibly incorporate costs into Lighting and Landscaping Assessment District	Staff in-kind; solar development funded by sale of power generated Solar projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs.

Move	Cost	City Lead Department	Potential Funding Source	Notes
M.3.d Install solar arrays at facilities that currently do not have solar arrays and work with emergency services to add solar and battery storage at priority locations. Review options for potential to combine multiple buildings into micro-grid systems.	High	Public Works	General Fund	Up-front costs would be substantially over $50,000, but offset by long-term electricity cost savings. Solar projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs. Coordinate with Move E.4.c.
M.3.e Explore opportunities and partnerships to develop renewable-powered fuel cell micro-grids to provide back-up or primary power for critical facilities such as facilities providing essential services (e.g. water pumping facilities) and schools as a clean alternative to diesel generators.	Low	Public Works	General Fund	Staff in-kind Coordinate with Move E.4.c.

DELTA FLOOD RISK MANAGEMENT ASSESSMENT DISTRICT FEASIBILITY STUDY AND DELTA LEVEE FINANCING OPTIONS

A Consultant Report

Prepared for:
Delta Protection Commission State of California

Prepared by:
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MAY 17, 2018

Delta Protection Commission

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DELTA PROTECTION COMMISSION TRANSMITTAL STATEMENT TO DEPARTMENT OF WATER RESOURCES

May 17, 2018

Existing reclamation district property assessments and State budget appropriations should continue to be the financing mechanisms used to collect revenues from Delta landowners and the State for levee operation, maintenance and improvement. Any additional mechanism(s) for funding Delta levee work should supplement, not replace, the amounts provided by existing State and local financing mechanisms.

The State General Fund and general obligation bonds should continue to be the source of funding for the public benefits derived from the maintenance and improvement of Delta levees. The Governor and Legislature should commit to appropriating a consistent amount, at least $72 million annually, to achieve and maintain a minimum levee standard (DWR Bulletin 192-82) throughout the Delta. Subsequent to attaining a minimum levee standard throughout the Delta, funding for Delta Special Projects could be scaled back and Subventions program funding continued. Further levee improvements above a Bulletin 192-82 standard should be the responsibility of beneficiaries that require a higher level of flood protection.

State funding for Delta levees should include:

$12-$15 million annually for the Delta Levees Maintenance Subvention program, with a continued 75%-25% (State-local) cost share in excess of $1,000 per levee mile. The Delta Levees Maintenance Subvention program should recognize the significant drainage expenses for Delta reclamation districts as an essential component of maintaining levee stability and preserving the ability to pay for lands which would be inundated or otherwise suffer from a high water table.

$30-$60 million annually for the Delta Special Projects program dedicated to improving all Delta levees (other than the eight western Delta islands) to a base level of protection (DWR Bulletin 192-82 standard with a 22-foot crown). Until this standard is achieved, habitat mitigation consistent with Delta Levees Programs requirements should continue, but the funding of habitat enhancement or endangered species act mitigation shall be limited to no more than 5% of funds provided for levee improvement projects.

$30 million annually for the Delta Special Projects program dedicated to improving the eight western islands and other levees determined by DWR to merit a higher standard that is more resilient to seismic risk.

Consistent with the levee financing recommendations in the 2017 update of the Central Valley Flood Protection Plan, additional flood protection bond fund measures to provide the State's cost-share should be promoted and supported.

The State Legislature and Congress should eliminate all existing statutory exemptions from assessments, unless it can be shown that such parcels do not receive any benefits from the network of Delta levees. The State could also request that federal property owners voluntarily contribute funding to pay for the benefits they receive from Delta levees.

The conceptual financing mechanisms analyzed in this Study face potential political opposition based on concerns expressed by farming, water exporter, and flood protection agency stakeholders. Further discussion among affected stakeholders is necessary to advance consideration of these mechanisms. It should be noted a stakeholder process is identified to develop levee financing mechanisms pursuant to recommendations in the 2017 update of the Central Valley Flood Protection Plan. The Delta Protection Commission should participate in this effort to ensure that the unique Delta values are represented in the discussion.

While the Delta Protection Commission was responsible for managing the consultant team's work and facilitating a public process for receiving stakeholder input, this Study represents the conclusions of the consultant team, not the Commission. The Commission is approving the delivery of this Study to the Department of Water Resources in accordance with the provisions of an interagency agreement, but the Commissioners have not endorsed any of the proposed fee mechanisms, conclusions, or recommendations developed by the consultant team.

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
AJE	alternative justifiable expenditure
BBA	benefits-based allocation
BDCP	Bay-Delta Conservation Plan
BiOps	Biological Opinions
Cal OES	California Office of Emergency Services
Caltrans	California Department of Transportation
CCED	California Conservation Easement Database
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CFA	Mello-Roos Community Facilities Act of 1982
CFD	community facility district
CM	conservation measure
Commission	Delta Protection Commission
CSFMRA	California Chapter of the American Society of Farm Managers and Rural Appraisers
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
Delta	Sacramento-San Joaquin River Delta
Delta Conservancy	Sacramento-San Joaquin Delta Conservancy
Delta ER Program	Delta Flood Emergency Preparedness, Response, and Recovery Program
DLIS	Delta Stewardship Council's Delta Levee Investment Strategy
DRMS	California Department of Water Resources' Delta Risk Management Study
DSC	Delta Stewardship Council
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EIP	Early Implementation Program
EPMC	equal percentage marginal costs

ERP	Ecosystem Restoration Program
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FESSRO	FloodSAFE Environmental Stewardship and Statewide Resources Office
FSRP	Flood System Repair Project
GHAD	Geologic Hazard Abatement District
GIS	geographic information system
GRR	General Re-Evaluation Report
HMP	Hazard Mitigation Plan
I	Interstate
LMA	Local Maintaining Agency
MHHW	mean higher high water
MW	megawatts
NFIP	National Flood Insurance Program
PG&E	Pacific Gas and Electric Company
PL	Public Law (Federal)
PUOF	proportionate use of facilities
RD	Reclamation District
SCFRRP	Small Community Flood Risk Reduction Program
SCO	State Controller's Office
SCRB	separable-cost, remaining benefits
Special Projects Program	Delta Special Flood Control Projects Program
SPFC	State Plan of Flood Control
SSIA	State System-wide Investment Approach
Subventions Program	Delta Levees Maintenance Subventions Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
UFRRP	Urban Flood Risk Reduction Program
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
VSL	Value of a Statistical Life

EXECUTIVE SUMMARY

The purpose of the Delta Flood Risk Management Assessment District Feasibility Study and Delta Levee Financing Options Study was to address the Delta Stewardship Council's Delta Plan Recommendation RR R2 in Chapter 7 which provides:

"The Legislature should create a Delta Flood Risk Management Assessment District with fee assessment authority (including over State infrastructure) to provide adequate flood control protection and emergency response for the regional benefit of all beneficiaries, including landowners, infrastructure owners, and other entities that benefit from the maintenance and improvement of Delta levees, such as water users who rely on the levees to protect water quality."

The team of Delta Protection Commission staff and consultants determined that such an assessment district is likely infeasible, and more importantly, inadequate for covering all beneficiaries from Delta levees.[1]

Given the broad range of Delta flood risk management beneficiaries, the analysis moved toward identifying the most feasible finance mechanisms that could be deployed to generate revenues to supplement the funding raised by assessments of the local maintaining agencies and the funding provided by the State through appropriation of general fund and general obligation bond revenues by the Legislature.[2] Feasibility is considered here by looking at the overall potential for a mechanism to collect revenue from beneficiaries who are not now directly contributing funding for Delta levees, and working within the current legal constraints.[3]

The desired objective is to provide an ongoing, reliable and sufficient amount of funding to pay for maintenance, repair, rehabilitation and improvements (levee projects) and emergency response for Delta levees. Implementing one or more new funding mechanisms could help to assure that levee beneficiaries pay for the share of flood protection costs that matches their received benefits. The "beneficiary-pays" principle is predicated on the concept that no Delta levee beneficiary will contribute more than the total benefit received. In other words, in-Delta parties should not be required to bear the financial burden of public and out-of-region

[1] For the purpose of this feasibility study, we do not distinguish between benefit of levee maintenance and levee improvements.

[2] This report does not look at whether State financing from the General Fund should come from continuing taxes or from bonds – those choices are about cash management, not financing, because they are both paid from state tax sources. It is mainly the timing of those payments and extra costs of long-term debt repayment of bonds that differs.

[3] This feasibility report is based on a "fatal flaw" analysis—after eliminating those potential mechanisms that are infeasible, we are left with those that might work best in various situations to capture net revenues from Delta levee beneficiaries. The authors recognize that given the complex political environment, there can be no simple "yes or no" answers to the question of whether any particular mechanism is feasible. Feasibility is considered here by looking at the overall potential for a mechanism to collect revenue from beneficiaries, and working within the current constitutional framework.

interests who receive multi-benefits provided by Delta levees and drainage. And alternatively, the public and out-of-region interests should bear only those costs justified by the benefits provided.

The Study considered several potential new revenue collection mechanisms. After evaluating and screening each mechanism based on criteria developed by the consultant team, the analysis examined new fees to collect from specific categories of beneficiaries who have likely not paid directly or proportionately to the benefits delivered from flood management measures in the Delta: Delta Flood Protection Fee on infrastructure facilities and a Delta Water User and Conveyance Fee on water diverted from, conveyed through, or discharged into Delta channels.

We emphasize that this analysis is not intended as a recommendation to replace the current funding programs or cost shares under the Delta Levees Subventions or Special Projects programs. It is also not a recommendation for implementation of any of the mechanisms. Rather, this study describes the results of a "beneficiary-pays"-based analysis that screened various revenue collection mechanisms for general feasibility. These mechanisms could be considered among the menu of existing and potential funding sources to balance levee financing in the Delta. This study concludes by describing one path forward to explore these options further.

The Study reviewed the current approach to paying for Delta levee projects that recovers associated costs from local landowners and the State. The existing approach relies primarily on:

- Reclamation districts that collect property assessment revenues from landowners within the district boundaries based on their proportionate share of providing drainage and levee operation, maintenance and improvement benefits; and
- State budget appropriation of General Fund and General Obligation Bond revenues to partially cover the State's interests and broad public benefits from operation, maintenance and improvement of levees.

Key Findings

1. This report contains an initial feasibility study that narrows the menu of feasible financing mechanisms. Still, the conceptual financing mechanisms analyzed in this Study each have technical and legal issues that affect the ability to collect revenues from beneficiaries as anticipated.
2. The new financing mechanisms analyzed in this Study are still conceptual and require stakeholder endorsement and support before considering implementation. Gaining stakeholder support would require further development in order to provide details regarding who will pay, fee amounts, overlap with other fees and assessments, and what flood protection activities would be funded.

3. The Delta is the hub for water supply, energy, and transportation infrastructure of statewide importance that is protected from flood damage and disruption by a network of Delta levees that operate as a system.
4. A full list of benefits and beneficiaries of flood protection and ancillary activities includes many entities and individuals who reside outside of the Delta. In some cases, the benefits of those outside of the Delta exceed the benefits to in-Delta parties.
5. Although the original purpose for levees was flood protection, that has since expanded to serve other purposes; this expansion of purpose does not absolve the new beneficiaries from contributing to the continuing maintenance and additional investment in existing levees.
6. Local assessment districts, such as reclamation districts, rely on property-based assessments, which cannot reach the beneficiaries that do not own property within the district. Such local assessments are subject to Proposition 218 and associated case law.
7. Although a Delta-wide assessment district as proposed in the Delta Plan (RR R2) and the 2017 CVFPP Update might improve governance issues, this Study documents that it will not advance the beneficiary-pays approach, nor generate additional revenue over that which is currently collected by the existing reclamation districts for the following reasons:
    - It cannot collect revenues from all beneficiaries of levee flood protection because many of them do not own assessable property in the Delta;
    - Reclamation districts are already assessing benefitted property for levee and drainage services and a Delta-wide district is unlikely to create truly additive value to the funding already flowing through those districts; and
    - Establishing a well-functioning governance structure across the multitude of special districts and general government agencies in the region and then allocating collected funds across the implementing agencies would be politically difficult.
8. Reclamation district assessments can continue to be the primary means of collecting revenues from local property owners for levee and drainage services.
9. Significant public benefits accrue from maintaining and improving Delta levees including "the protection of public highways and roads, utility lines and conduits, and other public facilities, and the protection of urbanized areas, water quality, recreation, navigation, and fish and wildlife habitats, and other public benefits. " (Water Code §12311). Maintaining and enhancing the Delta as a place, sustaining the Delta and regional economy, and protecting and enhancing the unique cultural, recreational, natural resources, and agricultural values of the Delta are also significant statewide benefits.
10. State general fund and general obligation bond funds are the sources for paying the cost share associated with public benefits and State's interests, and continued provision is consistent with the beneficiaries-pay principle so long as it is proportional to the public benefits accrued.

11. In those parts of the Delta where islands form the water conveyance corridor for the State Water Project (SWP) and Central Valley Project (CVP), prevent evaporation water loss, or provide a salinity barrier to protect export water supply, the water exporters derive significant benefits from the levees originally constructed for flood protection. They derive significant benefits from levee stability due to drainage and protection of habitat. However, the SWP/CVP exporters do not currently pay directly to maintain those levees, and whether their indirect contributions through public funding are proportional to the benefits accrued cannot be readily determined at this time.
12. Linear infrastructure owners (e.g., pipelines, railroads, and electrical transmission lines) that benefit from levees are generally assessed on reclamation district rolls. However, those assessments do not cover the additional network benefits that accrue from maintaining the integrity of that infrastructure. Further, federal facilities are exempted under federal law from paying State or local assessments, fees, or taxes.
13. Recent suspension of the State Responsibility Area (SRA) fire prevention fee through 2030 by the Legislature raises additional concerns regarding the legal and political feasibility of proposing any new revenue collection mechanisms that are modeled after the SRA fee.
14. The CVFPB and DWR will be initiating a stakeholder engagement process to evaluate potential new financing mechanisms to provide additional funding for levee projects and other flood protection measures, including those identified in the 2017 update of the CVFPP.

A Potential Path Forward

Implementation is not recommended at this time. Instead, as part of the financing sources currently being considered by DWR and the Central Valley Flood Protection Board, these mechanisms could be considered for further evaluation in the stakeholder process established to develop levee financing mechanisms pursuant to recommendations in the 2017 update of the *Central Valley Flood Protection Plan*.[4] This study should be only used to frame future analyses and deliberations, and not for implementing any mechanisms deemed potentially feasible here. This report can provide documentation of further considerations for each mechanism and eliminating unnecessary work on infeasible proposals. Regardless, adopting any of the new mechanisms will require agreement among key stakeholders that the resulting portfolio of mechanisms will be preferred to the current system.

[4] CVFPB, "2017 Central Valley Flood Protection Plan Update: Public Draft," http://www.water.ca.gov/cvfmp/2017-cvfpp-docs-public-draft.cfm

CHAPTER 1 INTRODUCTION

Since the early 20th century, the Delta levee system has provided flood control protection that allows productive agricultural and urban uses of land, channels water for statewide municipal and agricultural use, protects critical infrastructure (energy, transportation, water), and creates a desirable setting for boating and water-based recreation. These interconnected levees operate as a single multi-function flood control system. A further-improved levee system will make a significant contribution to achieving the coequal goals adopted in the 2009 Delta Reform Act.[5]

Delta levees benefit a full range of users ("beneficiaries") other than Delta property owners.[6] In addition to protecting property from flooding, Delta levees form the backbone of the regional road system, ensure the continued existence of Delta towns and communities, and protect habitat for wildlife, including threatened and endangered species. They form a network of channels that entice boaters to explore the inner reaches of the Delta and support a long-standing tradition of hunting and fishing. And they carry fresh water to the pumps that supply water to the farmers of the San Joaquin Valley and to residents of the Bay Area and southern California. They also bear stress from these users, including damage from ship and boat wake, and increased flood flows from upstream communities, water level drawdown from export pumping, scour and sedimentation, and storm water runoff.

However, the maintenance of this network of levees has largely been paid for by local land owners and state funds. This funding arrangement does not align well with the benefits conferred by Delta levees because some significant beneficiaries do not contribute (other than to the extent that sales, property, personal or corporate income taxes support California's General Fund). Nor has funding been adequate or consistently available to enable long-term planning for levee maintenance and improvements. Not surprisingly, there has been a long-standing interest in adopting a "beneficiaries pay" basis for Delta levee maintenance and improvements. This Delta Flood Risk Management Assessment District Feasibility Study (DFRMADFS, or the Study) is a first step in evaluating how such a financial arrangement might work.

The State relies on reclamation districts to implement levee maintenance and improvement, but provides funding in recognition of its long-term interests and obligations, which started when the State applied for and accepted title to two million acres of marshland under the federal Swamp and Overflowed Land Act under the condition that the lands would be reclaimed for agricultural production and other economic development.

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[5] DPC Economic Sustainability Study, Executive Summary, January 2012.

[6] "Delta" in this report means the Legal Delta, unless designated otherwise, as specified in Section 12220 of the Water Code.

Origins of This Study

The study originated in the long-standing policy discussion about how to pay for Delta levees. The CALFED Record of Decision (August 2000) called for a benefits-based cost allocation for CALFED programs, as reflected in the CALFED Bay-Delta Finance Plan (2005).[7] The Department of Water Resources (DWR) has expressed its interest in a beneficiary-pays system for Delta levee improvement and maintenance by funding this Study. In addition, the Delta Stewardship Council's Delta Plan (2013)[8] and Governor Brown's *California Water Action Plan* (2014),[9] call for a "…flood risk management assessment district … to provide adequate flood control protection and emergency response for the regional benefit of all beneficiaries, including landowners, infrastructure owners, and other entities that benefit from the maintenance and improvement of Delta levees, such as water users who rely on the levees to protect water quality." Regardless, although the principle of beneficiary-pays has long been discussed as a basis for paying for water infrastructure, the State has not adopted policies or principles for funding sources as alternatives to local finances and bond funding for Delta levees.

This "Delta Flood Risk Management Assessment District Feasibility Study" (the Study) took a broad look at all the beneficiaries of Delta levees. It then identified feasible financing mechanisms that could implement a beneficiary-pays approach to flood protection and emergency preparedness in the Sacramento-San Joaquin River Delta (Delta).

Levee improvements create intangible benefits that are not subject to assessment and which accrue to entities that lie outside the boundaries of the reclamation districts. These include the reliable conveyance of fresh water to state and federal water contractors. The State of California benefits from Delta levees by avoiding economic losses caused by floods and disruptions of the water supply. The State relies on Delta levees to support the continued existence of threatened and endangered species, to protect the scenic Delta landscape, and to benefit residents that recreate on Delta roads and waterways. The Legislature defined the discrete and identifiable public benefits protected by Delta levees in the statutes governing the Delta Special Project levee funding program: urbanized areas, water quality, recreation, navigation, fish and wildlife habitats, public highways and roads, utility lines and conduits, and other public facilities (Water Code §12311). These public benefits justify continued State expenditures to maintain and improve Delta levees. However, Delta levees create private benefits that accrue to individuals who do not now pay directly for levee maintenance and improvements.

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[7] California Bay-Delta Authority, "Draft Finance Options Report," Sacramento, California, May 2004.

[8] Delta Plan Chapter 7, Recommendation RR R2. See also Appendix N, "Funding and Financing Options," http://deltacouncil.ca.gov/sites/default/files/documents/files/AppN_Funding%20and%20Finance_2013.pdf.

[9] See CNRA, CalEPA and CDFA, "California Water Action Plan 2016 Update," Sacramento, CA, http://resources.ca.gov/california_water_action_plan/, 2016.

When the study began, it quickly became evident that assessment districts, while an important mechanism in paying for levees, could not reach many of the significant Delta levee beneficiaries—both public and private—to achieve the goal of beneficiary-pays. Consequently, the study examined many other potential financing mechanisms, including special taxes, user fees, and regulatory fees.

Current Levee Funding

Delta levees depend on a mix of funding. For project levees (which are federal authorized projects within the State Plan of Flood Control (SPFC), for which the State is the local sponsor), some funding comes from the United States Army Corps of Engineers (USACE), with state cost-sharing requirements. However, the USACE recently found that structural flood risk management projects throughout much of the Delta were not economically justified.[10] This, combined with increasing federal restrictions in a post-Hurricane Katrina environment, creates uncertainty about future federal funding for levee improvements.[11] State funding for project and non-project levees comes primarily from general obligation bonds (currently Propositions 1 and 1E), but these have a limited life span. DWR estimates that sufficient funds exist for approximately seven years' worth of Subventions and Special Projects funding, though possibly at less than current levels.[12] Local maintaining agencies, such as reclamation districts (RDs), assess local property owners for the costs of maintaining and improving levees.

Under current levee funding programs, law and regulation set the share of levee project costs borne by state, federal, and local entities. These formulas implicitly value the public benefits—including protection of life and property, habitat, indirect economic impacts, and water supply—at between 50 and 100 percent of total costs for those projects where the state or federal governments participate. Consequently, general tax revenues pay for the state shares (and federal shares where applicable) on some levees. The local maintaining agencies (LMAs) typically pay for the remaining costs through assessments on property owners. Proposition 218 and associated case law require property assessments to be based on the special benefits derived from a project and to be proportional to the benefits received.

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[10] U.S. Army Corps of Engineers, *Delta Islands and Levees Feasibility Study*, April 2014.

[11] Note that recent changes in USACE policy, discussed below, now make it much more difficult for projects levees in the Delta to qualify for federal funding.

[12] Personal communication, David Mraz, DWR, September 8, 2016.

Concurrent Planning Efforts

This Study coincides with two other related planning efforts.

Delta Levee Investment Strategy (DLIS): Over the last two years, the Delta Stewardship Council has developed a planning tool to identify the priorities for state investments in Delta levees. Grouped in three tiers, the priority tracts and islands represent the Council's determination of those levees that pose the greatest risk to state interests – people, property, water supply, ecosystem protection, and the Delta-as-an-evolving place. In 2013, the Council adopted the Delta Plan which included RR R2 recommending the creation of a Delta flood risk management assessment district "with the authority to charge all beneficiaries."[13]

This Study as originally envisioned was intended to run concurrently with the DSC's DLIS study. To keep the two projects consistent, the DLIS study was to provide Delta levee data for this Study, and this Study would provide guidance on cost allocation and available means of financing the DLIS' proposed investments. The DLIS study encountered issues that delayed release of products critical to this Study, and ultimately altered the approach of the DLIS. For this reason, we did not receive project cost estimates and a complete set of benefits values. Instead this Study relied on older cost estimates from the DRMS study, with some specific supplements, and reasonable approximations of benefit values.

Central Valley Flood Protection Plan (CVFPP) Update 2017: The 2012 Central Valley Flood Protection Plan (CVFPP) proposed an investment approach for flood management in the areas protected by the State Plan of Flood Control (SFPC), which includes project levees in the Delta. The CVFPP called for identifying potential beneficiaries of flood risk management projects, and for equitably distributing project costs among beneficiaries, within the constraints of state and federal cost sharing rules.[14] The 2017 update focuses on identifying the fiscal resources needed to fund SPFC levee construction and maintenance projects and development of financing mechanisms to provide the additional funding evaluated in technical memoranda.[15] The plan includes a finance plan that outlines options for funding the estimated $14 to $17 billion of investments in system maintenance and improvements needed, including two new property assessment proposals (Sacramento-San Joaquin Drainage District and River Basin) and establishment of a State Flood Insurance Program.

[13] Available at http://deltacouncil.ca.gov/docs/delta-flood-management-investment-strategy-principles

[14] 2012 CVFPP, Public Draft, December 2011, page 4-37.

[15] 2017 CVFPP, http://www.water.ca.gov/cvfmp/2017-cvfpp-docs.cfm, August 2017.

CHAPTER 2 OVERVIEW OF ANALYTICAL APPROACH

This Study evaluated the feasibility of new financing mechanisms, including an assessment district, to pay for Delta levees based on the "beneficiary-pays" principle, which means that levee beneficiaries should pay for the share of flood protection costs that reflects their received benefits.

According to the beneficiary-pays principle, beneficiaries should bear responsibility for project costs in some proportionate manner to the benefit they receive from the project. This Study defines beneficiaries as people or organizations who own, use, or control assets for specific purposes (i.e., activities) that benefit from flood control measures in the Delta. For example, growers on Delta islands benefit from the levees that protect farming activities from flooding. Some purposes consist of individual or private transactions from which economic value can be readily estimated (e.g., sale of agricultural products from protected lands); others create broad public benefits for which a price is not easily determined (e.g., protection of ecosystems or the existence of the Delta as a unique place).

Consequently, the study took the following approach to evaluating revenue collection mechanisms:

1. Identify the broad range of Delta levees beneficiaries;
2. Estimate the value of benefits received from Delta levees and assign those values to various categories of beneficiaries;
3. Assess methods for allocating beneficiaries' share of levee improvement costs; and
4. Identify financial mechanisms that could generate revenues from each category of beneficiaries.

The results include broad conclusions about the feasibility of several financial mechanisms.

This Chapter provides an overview of the methods used in this Study. More detailed descriptions may be found in the appendices to this report.[16]

[16] Many of the appendices were presented in earlier drafts as Project Memoranda to a multistakeholder group recruited from a large list of stakeholders identified by the DPC that advised the team by providing feedback on work products and the results of the feasibility analysis. Summaries were presented in a series of four workshops covering the building blocks and then findings of the Study. Additional appendices include technical discussions and analyses that were the supporting background and basis for those Project Memoranda.

Delta Levee Beneficiaries

By casting a wide net for beneficiaries, this Study maximized the number of potential beneficiary/financial mechanism combinations, which were then screened for legal, political, economic, and institutional feasibility.

The categories of beneficiaries used in this Study are as follows:

- Community Beneficiaries;
- Agricultural Land Owners, Producers, and Water Users;
- Municipal Water Providers and End Users;
- Infrastructure Owners and End Users;
- Upstream Dischargers;
- Instream Water Diverters;
- General Public Beneficiaries (including recreation);
- State and Local Governments and Special Districts;
- State Economy; and
- Other Indirect Beneficiaries.

Allocating Costs

Flood protection, like national defense, creates benefits that cannot be easily divided among beneficiaries. Levees that protect one resident or parcel from floods also protect neighboring residents and parcels. Some levees form a fresh water conveyance corridor, or control salinity levels in Delta waters. Such broad benefits accrue to most of the beneficiaries listed above, but are difficult to apportion to beneficiaries because they are not explicitly valued, as there are no transactions to set market prices. As a result, a different mechanism must be used to allocate the total costs of flood protection to the various beneficiaries (both local and remote).

This Study evaluated several methods available for allocating costs consistent with the beneficiary-pays principle.[17] Some methods use *alternative costs* or *physical measures of use* to allocate *costs* of levee improvements, while others use measures of the *benefits* derived therefrom for allocation, and a third uses a combination of these. Selecting a cost allocation method requires considering equity, feasibility of implementation, and the legal constraints that apply to the associated finance mechanism (fees, assessments, taxes, etc.).

Where legal constraints create inconsistencies in cost allocation methods, structured stakeholder negotiation may be needed to determine how to resolve the inconsistencies, possibly through legislation. Applying a beneficiary-pays-based approach raises the important policy question of whether the State should adjust its cost share formulas to be consistent with the cost allocation and financial mechanisms that can be used at the local level. A more detailed analysis will need to

[17] Cost allocation methods and issues are described in detail in Appendix B.

be conducted and the outcome examined by stakeholders and decision makers to determine which cost allocation methods best meet these guidelines.

Screening Finance Mechanisms

The project team used a screening process to identify the most promising financial mechanisms. This entailed selecting candidate financing mechanisms that covered the range of beneficiaries and evaluating each mechanism for institutional, legal, economic, and political viability: [18]

Institutional Considerations: This screen identified the candidate organizations that could implement the financing mechanism, including development, legislative approval, regulatory activities, assessment, collection, and reporting.

Legal Requirements: This screen considered whether the financing mechanism could be applied under current law, and what legal restrictions or requirements must be met (such as a nexus study or voter approval requirements). If the mechanism would require new legislation, we identified the authority (State legislature, Congress, or local district) and vote requirement needed. In some cases, the legal screen eliminated a mechanism from further consideration due to conflicts with constitutional or federal requirements that would be difficult to overcome.

Economic Issues: This screening evaluated the cost responsibility and revenue limits of the most promising mechanisms that had passed the institutional and legal screening. Several candidate mechanisms, such as a recreational fee, were dropped because the amount of potential revenues would not justify the effort to implement the measure.

Stakeholder and Political Support: We considered the basic political feasibility of those mechanisms that survived the first three screens, as well as the rationale for initial support or resistance to various mechanisms. We acknowledge that stakeholders may have different perspectives on the feasibility of the mechanisms; this will need to be addressed in any future implementation efforts through a stakeholder process and in the legislative arena.

[18] The screening process is described in greater detail in Chapter 7.

CHAPTER 3 CATEGORIES OF AVAILABLE FINANCING MECHANISMS

This Study considered all general categories of beneficiary-pays financing mechanisms as candidates. This chapter describes the available options for Delta levee financing, outlining constraints on existing state and local revenue collection mechanisms.

Propositions 13, 218, 26, and associated case law have imposed significant limitations and procedural requirements on government's ability to raise revenue. This section summarizes the state and local revenue generation mechanisms most commonly used in California to finance infrastructure and describes how these mechanisms may be employed to finance levee maintenance and/or improvements (this Study uses the term "levee work" to include both maintenance and improvements). The mechanisms are organized into the following broad categories:

- Assessments
- General and special taxes
- Impact fees
- Property-related fees and charges
- Regulatory charges
- User fees

Different constraints apply to each of these categories, depending on whether they are employed by state, regional, or local government agencies. Consequently, each type of funding varies in how it may be applied to levee maintenance and improvements.[19]

Financing Mechanisms Defined

The following definitions generally describe state and local government revenue options. Voter-enacted initiatives—Propositions 13, 218, and 26—have used these terms or phrases inconsistently, thus blurring the guidelines for how and for what purpose a particular revenue measure should be categorized. The initiatives, associated case law, and statutes sometimes provide more particular or varied definitions.[20]

"Assessments" refer to any levies or charges imposed on real property by an agency. They include, but are not limited to, special assessments, benefit assessments, maintenance assessments, and

[19] A summary of specific legal issues and constraints is provided in Appendix C. The key considerations for each category are shown in a table format in the appendix.

[20] The impact of Propositions 13, 218, and 26, along with associated statutes and case law, is a complex area of law and legal practice, which is greatly simplified for the purposes of this chapter.

special assessment taxes.[21] Assessments are levied based on the benefits to assessed real property created by a government service or public improvement.[22]

"Impact Fees" are charges imposed as a condition of land development (e.g., building permit, rezoning or conditional use permit or subdivision approval), intended to fund public facilities and services necessary to serve the new development. Common examples include city park and road impact fees. Impact fees are not for general revenue purposes, and they must be based on a reasonable relationship between the development project and the facility or service to be provided. This reasonable relationship is commonly referred to as the "nexus." [23]

"Property-Related Fees and Charges" lack a precise definition, but as result of Proposition 218 are broadly considered to be any fees or charges *other than* an ad valorem tax,[24] special tax, or assessment that an agency imposes upon a parcel or person as an incidence of (i.e., connected directly to) property ownership. An example of such a fee would be a groundwater augmentation charge collected from overlying property owners.[25]

"Regulatory Charges" are charges imposed by a public agency in conjunction with implementing a regulatory effort such as required monitoring of air and water quality, or a charge imposed on an entire industry to fund a mitigation program, such as a fee to pay for lead paint removal.

"Taxes" (general and special) are charges on real property that historically are not tied to any particular service or benefit provided by the public agency. As a result of voter-approved initiatives, a "general tax" is any tax imposed for general governmental purposes. A "special tax" is any tax imposed for specific purposes, including taxes placed into the general fund for particular purposes. Taxes by special districts are now considered to be "special taxes."

"User Fees" are fees collected in response to the use of a governmental service or facility, such as application processing charges or rental of public property such as a sports facility. These services must be separable from direct use of the property itself. Utilities, such as water, sewer and electricity, fall into this category because use varies without direct relationship to the property's characteristics.

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[21] California Constitution, Art. XIII D, Sec. 2.

[22] Note that there is not a requirement that benefits exceed costs; however, "ability to pay" studies, such as those usually conducted as part of levee project planning and financing, typically incorporate such a requirement.

[23] "Local Agency" ordinarily includes cities, counties, special districts, and any other local or regional governmental entity. (California Constitution, Art. XIIIC, sec. 1.)

[24] "Ad valorem" refers to a tax determined as a proportion of property value.

[25] Pajaro Valley Water Management Agency v. Amrhein (2007) 150 Cal.App. 4th 1364.

Applications and Limits of Financing Mechanisms

Assessments

Assessments are used by cities, counties, and special districts to fund a variety of government activities. Funded activities include parks and recreational improvements, landscaping, and street lighting. Assessments can be utilized to fund ongoing and recurring expenses, as well as the repayment of bonds sold to finance long-term capital expenditures.

Assessments have historically served reclamation districts (RDs) as the primary tool for local funding of levee improvements and maintenance. RDs are local public agencies, formed to protect distinct geographic areas, and are administered by an independent governing body of elected landowners. RDs are some of the oldest forms of government recognized under California law and are formed under general statutory authority or by special legislative acts.[26] Typical district functions include operation, maintenance and improvement of levee and drainage systems.

Assessments are based on and levied in accordance with the benefits provided to affected properties by a governmental service or activity. Proposition 218 (1996) requirements apply to "local agencies," which includes cities, counties, special districts, and regional governmental agencies. Proposition 218 constrained local agencies' use of assessments by imposing both procedural and substantive requirements for new assessments by amending the California Constitution.[27] First, Proposition 218 requires majority vote approval prior to imposition or increase of general taxes, assessments, and certain user fees and provides landowners the ability to also repeal or reduce charges by voter initiative. Fees or assessment may not exceed the cost of providing the services and fees or charges based on potential or future use of a service are not permitted.[28] These include a requirement that only special benefits (and not general benefits) may be assessed, and that assessments must be based on a detailed engineer's report. This report must quantify the proportional special benefit derived by each parcel.[29] Special benefits are identified as separable from those conferred generally to the surrounding community or beneficiaries outside of the assessment district.

Revenues derived from the assessment may not be used for any purpose other than that for which the assessment was imposed and approved by landowner vote. In addition, Proposition 218

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[26] Water Code sections 51320-51349.

[27] Prop. 218 added Articles XIII C and XIII D to the California Constitution.

[28] Legislative Analyst's Office, "Understanding Proposition 218," http://www.lao.ca.gov/1996/120196_prop_218/understanding_prop218_1296.html, December 1996.

[29] For a recent example of an engineer's report that calculates the special and general benefits, see Chapter 5 of the Sacramento Area Flood Control Agency's "Engineers Report, SAFCA Consolidated Capital Assessment District No. 2, June 13, 2016." Available at http://www.safca.org/assessments.html .

requires all state and local government agencies owning land subject to a benefit assessment to pay their proportional share for benefits received, unless is can “demonstrate by clear and convincing evidence that those publicly owned parcels in fact receive no special benefit.”[30]

Procedural steps added by Proposition 218 require the agency proposing the assessment to conduct a hearing with notice to the property owner and to conduct a vote by landowner ballot. If the ballots opposing the measure exceed those in support, the assessment may not be imposed. Ballots are weighted in accordance with the proportional financial obligation of each parcel. Thus, property owners have a direct role in determining whether or not a locally imposed assessment is approved.

The State has limited assessment authority for levee improvements that it has rarely exercised. DWR’s ability to form maintenance areas and collect assessments from landowners, and the CVFPB’s existing statutory authority (currently dormant) to collect assessments via the Sacramento-San Joaquin Drainage District, is discussed in the 2017 update of the CVFPP. Were the State to create a new regional agency for purposes of imposing assessments to fund levee improvements, it would be challenging to determine the special benefit for each parcel in the region, and to establish the nexus between the cost and the amount to be assessed.

General and Special Taxes

The law pertaining to general and special taxes has evolved over the last four decades, starting with the enactment of Proposition 13 in 1978, followed by Propositions 218 in 1996 and 26 in 2010. Combined, these initiatives created the following framework for the imposition of taxes, both general and special.

Proposition 13 added Article XIIIA to the California Constitution, capping, and in many situations lowering, the property tax revenues collected by cities, counties, and school and special districts. This measure established a maximum cumulative ad valorem tax rate of one percent based on assessed value of the property, with annual reassessment escalation limited to no more than two percent until a property is sold or ownership is significantly modified.

Proposition 13 also required local voter approval for special taxes and restricted the California Legislature’s ability to enact new taxes by imposing a requirement of a two-thirds vote in both legislative houses. Proposition 13 authorized cities, counties, and special districts to enact “special taxes” following a two-thirds vote of the qualified electors, although the measure did not define “special” taxes.

Proposition 218 supplemented Proposition 13. Under Proposition 218, a majority of voters must approve new general taxes, and two-thirds of the qualified voters must approve local special taxes. The voter approval requirement limited the ability of local agencies to rely on new tax

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[30] California Constitution, Article XIII D, Section 4(a).

measures to generate new revenue to pay for services or infrastructure. The measure also clarified the use of the initiative process to repeal locally imposed taxes, assessments, fees, and charges, adding a level of uncertainty regarding the long-term reliability of new revenue measures.[31]

Proposition 26 took a sweeping approach to taxes, defining "taxes" to include any local levy, charge, or exaction, effectively expanding the voter approval requirement to more local government actions. Proposition 26 exempted some fees and charges—those potentially relevant to levee funding are:

- Charges imposed for a specific benefit conferred to the payor that is not provided to those not charged, or for services provided, subject to a limitation that the charge not exceed the reasonable cost to the government of providing the benefit or service.[32] Levee maintenance could fall within the scope of "benefits" conferred or "services" provided and would not be curtailed by Proposition 26, although the scope of the proposition has not been fully litigated.
- A charge imposed as a condition of property development, as is the case with impact fees (discussed below).
- Assessments and property-related fees imposed in compliance with the provisions of Proposition 218 discussed above (i.e., engineer's report, protest, and/or voter requirements).[33]

Thus, Proposition 26 leaves in place local options for levee financing through assessments (discussed above) or impact fees (discussed below) but constrains the use of new taxes through its two-thirds voter approval requirement.

Proposition 26 also affected the State's ability to raise revenue by compelling a two-thirds vote in both houses of the Legislature for new taxes.[34] The proposition contains broad language expansively defining State taxes, similar to the language used for local government taxes, and contains similar exemptions from the definition of "taxes." State-imposed charges for levee maintenance (again based on the reasonable cost to the State) may similarly qualify as a benefit or service to the payor that would not be treated as a tax (and thus would not trigger the supermajority vote in both houses). The supermajority requirement could be a significant hurdle to employing a State-imposed charge for levee improvements, depending on how the courts interpret Proposition 26.

[31] Repealing such charges related to repaying bond indebtedness is restricted.

[32] Traditionally, special benefits of levees have been viewed as accruing entirely to the parcels directly protected by those levees. The expansion of the list of beneficiaries of flood control is a recent innovation, and has not yet been addressed by the courts.

[33] California Constitution Article XIIID, sec. 1.

[34] California Constitution Article XIIIA, sec. 3.

Special taxes are a feature of community facility districts (CFDs), which are taxing districts administered by government agencies but not independent special districts. Special taxes are frequently used in conjunction with new development to finance infrastructure and maintenance, authorized by the Mello-Roos Community Facilities Act of 1982 (CFA).[35] The reason for the more frequent use of special taxes in new development is that the initial property developer controls the voting power in the district before residents move in and can readily satisfy any required voting/protest provisions. A significant distinction between CFA special taxes and other revenue tools is that CFA taxes are not limited by the rigors of the benefit analysis (assessments), nexus (impact fees), or reasonableness (user charges). Special taxes (except those used to retire bonded debt) can be repealed by the voters in future years as a result of Proposition 218. As these special taxes are closely linked to new land development, the utility of CFD special taxes in the Delta Primary Zone is very limited, although they may apply to urban development in the Secondary Zone.

General taxes can be used to repay debt from general obligation bonds issued for flood protection improvements, such as those described in Chapter 2.

Impact Fees

In 1986, the California Legislature enacted the Mitigation Fee Act, Assembly Bill (AB) 1600, which created a uniform process governing the adoption, collection, and accounting for "impact fees."[36] These fees are defined as those imposed either on the basis of broadly based legislative enactments that establish a uniform fee applicable to a type of development activity (for example, a city's impact fees for major roadways) or on an ad hoc basis, as determined by the specifics of a particular development project. These fees are used to finance the construction or rehabilitation of public capital facilities. When adopting or imposing a fee obligation as a condition of approval, a local agency must make certain findings as to the purpose of the funds, the use of the funds, and the reasonableness of the fee considering the relationship between the project and the public facility. AB 1600 codified the constitutional doctrine that impact fees must be reasonably related, or have a "nexus" between the project or activity upon which the fee is imposed and the facility to be financed. As a general proposition, impact fees collected from new development cannot be used to remedy existing facility deficiencies. For example, impact fees probably cannot be used to address levee maintenance shortfalls, but such fees could be used to upgrade or replace a levee, or build a new levee. Once fees are collected, a local agency must periodically affirm the purpose of the fee and reasonable relationship between the fee and facility to be constructed.

The Mitigation Fee Act applies to locally imposed impact fees assessed against new land development activities in which fee revenues are used for levee construction or rehabilitation.

[35] Government Code section 53311 et seq.

[36] Gov. Code section 66000 et seq.

Cities and counties have the inherent constitutional authority to adopt and impose impact fees, but special districts may only do so if they are granted specific legislative authorization by the California Legislature.

As impact fees are tied to new land development activities, restrictions on development within the Delta's Primary Zone reduce the potential for impact fees to serve as a significant revenue source, although they may apply in the Secondary Zone.

Property-Related Fees and Charges

The controlling legal authority pertaining to property-related fees and charges was added by Proposition 218.[37][43] This proposition established, among other provisions, new procedural and substantive rules applicable to local agencies when imposing charges based on property ownership. Generally, the following limitations apply to property-related charges for services:

- Certain property-related charges must be preceded by mailed notice to the property owners coupled with a right of protest. This step allows the property owners to veto the proposed charge by majority protest. This voting is weighted, based on the relative potential assessment that would be applied to each property owner. Thus, a property owner potentially subject to a greater property-related charge has more voting power as compared to another property owner facing a lower charge.
- Revenues cannot exceed the proportional costs required to provide the property-related service.
- Fees cannot be charged for general government services (e.g., police, fire) that are otherwise available to the public.
- Services for which fees are charged must be readily available to the property.
- New property-related fees and charges[38] would be subject to approval by either a majority of the property owners or two-thirds of the registered voters.

Note that in contrast to assessments, in which costs are allocated in proportion to the *benefits* accruing to the property from the service or activity, property-related fees and charges are allocated based on the *costs* of providing those services or activities to each particular property.

As a funding option for new levee improvements, the requirement that the service "be readily available to a property" may function as a constraint on the use of locally imposed property-related charges for levee-related work, as the connection between the service and the parcel is less tangible and apparent as compared to other services such as water delivery. Future improvements by definition may not be "readily available now," whereas ongoing levee

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[37] California Constitution Article XIII D, Section 6.

[38] Other than charges for sewer, water, and refuse collection.

maintenance would be a current activity with current benefits. The court cases have dealt with active services like turning on a spigot for water; the "service" of reduced flood risk is less tangible and immediate.

Regulatory Charges

These charges typically occur in conjunction with a regulatory endeavor and would not include revenue collected for general purposes. Proposition 26, passed by California voters in 2010, comprehensively defined as a tax "any levy, charge or exaction,"[39] triggering voter approval at the local government level (or passage by a two-thirds vote in the legislature for state-imposed charges) unless the tax was specifically exempted from the scope of the proposition. These exemptions include charges for regulatory programs subject to the limitation that the charge cannot exceed the reasonable cost of the benefit, service, or activity provided,[40] and the revenues cannot be used for general fund purposes. The State Legislature can delegate the authority to raise such fees to state and subordinate regional agencies.

As an example, the State Water Resources Control Board uses several regulatory fees for a variety of programs,[41] as do the Regional Water Quality Control Boards. Such fees typically pay for administrative costs, but have been used for specific projects.

User Fees

As a general proposition, user fees cannot exceed the reasonable cost of providing the benefit, service, or regulation, and thus cannot be relied on for general revenue purposes.[42] Typically, user fees are limited to utility, permitting, or access fees that involve one-on-one transactions between a client and the government agency. User fees are also covered by the limitations of Proposition 26, as discussed above under General and Special Taxes. User fees and charges for services delivered to a property may be subject to Propositions 218 and 26 as property-related charges. User fees would have a narrowly defined role as a financing tool in the Delta; they are typically associated with the use of public facilities such as boating facilities.

[39] California Constitution Article XIII C, sec. 1 (local agencies) and Article XIIIA, sec. 3 (state).

[40] California Constitution, Articles XIIIC Section 1(e) and XIIIA sec. 3.

[41] See http://www.waterboards.ca.gov/resources/fees/.

[42] Proposition 26 does not include a "reasonable cost" limitation on use of property.

CHAPTER 4 BENEFICIARIES OF DELTA LEVEES

Identifying and evaluating the beneficiaries to which benefits accrue required describing how beneficiaries are linked to purposes and how benefits are estimated by analyzing the economics associated with those purposes.

Types of Beneficiaries and Benefits

Linking benefits, and therefore beneficiaries, to flood protection activities involves tracing economic relationships that may not be immediately obvious. As described in the DWR's *Handbook for Assessing Value of State Flood Management Investments*[43] categories of benefits of flood risk management include inundation-reduction benefits, intensification benefits, and location benefits. Typically, a benefit analysis for a flood risk management program focuses on evaluating the inundation-reduction benefits, which include the benefits associated with reducing damages (property, natural resources, or human health) associated with existing or future land uses. Reduced damages are most often reported in annualized terms (expected annual damages). Intensification benefits measure the potential value associated with improving the suitability of a particular land use for development (without changing the land use), whereas locational benefits can occur if flood protection measures result in the potential changing (presumably increasing the value) of a particular land use. Each of these benefits may then induce other economic benefits.

Flood protection benefits to beneficiaries can be differentiated and categorized in many ways, depending on program purpose or the types of actions subject to a benefits analysis. We used the following categories as a means to capture all of the potential beneficiaries of investments in Delta levees and their relationships as follows:[44]

- ***Primary and secondary benefits –*** As an economic concept, *primary benefits* are the increased value of goods and services to beneficiaries immediately affected by a flood control project or program. Benefit categories include flood risk management, water supply, water quality, and recreation. *Secondary benefits* of constructing flood control facilities are the values of goods and services that subsequently accrue to other parties (beneficiaries) that interact with the primary beneficiaries. Secondary benefits can include changes in economic activity (e.g., regional or state-level jobs and income) and fiscal effects, such as taxes or other revenues, that are important to local stakeholders.[45]

[43] California Department of Water Resources. *Handbook for Assessing Value of State Flood Management Investments*. 2014.

[44] These categories are based on DWR's approach to characterizing categories of levee benefits, California Department of Water Resources. Economic Analysis Guidebook, January 2008. Appendix D describes how these categories are applied to the beneficiaries used in this Study.

[45] This typology follows regional economic input-output analysis. In that framework, *direct* effects (akin to primary) arise from immediate economic activity. The secondary benefits are broken down further into *indirect* effects derive from transactions with

- Benefits can be separated geographically into ***direct, extended, and peripheral***.[46] *Direct* benefits are primary benefits realized in the immediate locality that is being protected against flooding, e.g., agricultural land next to a levee. *Extended* benefits are benefits affecting neighboring beneficiaries connected in some networked fashion but directly impacted by a flood event. Highways and pipelines are examples where the impacts are felt elsewhere directly. *Peripheral* benefits can be primary (e.g., water exports) or secondary (e.g., state economy) but outside of the Delta.
- ***Private and public goods realized as benefits*** – "Goods" are commodities or services that can be used to satisfy human wants and that have exchange value. Characteristics of *public goods* are non-excludability (i.e., it is not possible to exclude non-payers from consuming the good) and non-rivalry in consumption (i.e., consumption of a good by one consumer does not diminish the benefit to other consumers). If a "good" does not have both of these characteristics, it is considered a *private good*. Goods can fall across the spectrum of these definitions; for example, fishing in the Delta can diminish the availability of the fish to others, but it can be difficult to restrict access to the fishery. This myriad of goods confers benefits on beneficiaries who use them.
- ***Tangible and intangible benefits*** – *Tangible benefits* can be quantified in monetary or other quantifiable units (such as loss of Delta smelt habitat), whereas *intangible benefits* cannot be directly expressed in quantifiable terms or metrics (for example, trauma or reduced peace of mind resulting from a flood event).

A Note on Public Beneficiaries

Generally, the project team strived to use categories of beneficiaries, terms, and definitions consistent with the principles and approaches used in recent flood protection studies conducted for the DWR.[47] However, this Study uses the term "public" to convey that the benefits (or costs) cannot be easily assigned to specific individuals or entities. In this context, "public" does *not* refer to publicly-owned enterprises such as municipal water agencies or utility districts—those are considered "private" entities because the benefits can be assigned to specific individuals who privately enjoy them; that is why those enterprise agencies are able to charge utility rates.

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directly-affected parties, and *induced* effects are more broad, general economy-wide impacts from changes in direct and indirect activity.

[46] We emphasize that two of these terms which were included in the requested scope of work for this Study, "extended" and "peripheral" benefits, do not have applicable definitions in the flood protection or economic impacts literature that we have reviewed. Consequently, we have defined these terms specifically for use in this Study.

[47] We use the DLIS Technical Memorandum 2.1 as the starting point for constructing categories of beneficiaries, as directed in our scope of work. Then, to better meet the economic valuation needs of our study, we have expanded the categories identified in the DLIS Technical Memorandum 2.1. In the original contractual scope, estimates of expected annual damages in the Delta from flooding events were to be developed in the DLIS. However, these estimates were not available in sufficient time to use in this Study.

Summary of Potential Beneficiaries

Beneficiaries are entities that generally own, use, or control assets used for specific purposes (i.e., activities) that benefit from Delta flood control measures. For example, farmers (beneficiaries) avoid flood damages (benefit) to their fields where they grow crops (purpose or activity) through the protection of Delta levees. Some of these purposes are part of individual or private transactions or activities for which economic value can be readily estimated (such as land values or the buying and selling of agricultural products); other purposes create more broad public benefits for which a price is not easily determined (such as the value of public enjoyment of habitat, as well as the various concurrent benefits from enjoying species existence and recreation). The benefits that beneficiaries derive from flood control and levees are described in detail in Appendix D. The list is not exhaustive but captures the most significant benefits and beneficiaries who might contribute to funding levee work.

This Study considered ten broad categories of beneficiaries:

- Community Beneficiaries
- Agricultural Land Owners, Producers, and Water Users
- Municipal Water Providers and End Users
- Infrastructure Owners and End Users
- Upstream and In-Delta Dischargers
- Instream Water Diverters
- General Public Beneficiaries (including recreation)
- State and Local Governments and Special Districts
- State Economy
- Other Indirect Beneficiaries

Table 4-1 lists the complete set of beneficiaries used in this Study, including subcategories of beneficiaries and the types of flood protection benefits received from Delta levees. The Table also indicates the geographic location of beneficiaries as follows:

- In-Delta, as defined by the legal boundaries of the Delta (ID)
- Other areas within the Bay-Delta region but outside of the Legal Delta (OBD)
- Upstream of the (legal) Delta (UD)
- Downstream of the Delta (DD)

Table 4-1 Beneficiaries of Flood Protection in the Sacramento/San Joaquin River Delta

Category of Beneficiary/Entity	Type of Benefit(s)	Primary Regions*
Community Beneficiaries		
Delta Residents	Avoid/reduce potential for loss of life.	ID
Delta Commercial and Residential Property Owners	Avoid/reduce potential for property damage.	ID
Delta Public Facilities	Avoid/reduce potential for property damage.	ID
Delta Schools	Avoid/reduce potential for property damage.	ID
Local economy	Avoid/reduce disruptions on local economic activity. These are secondary beneficiaries.	ID
Agricultural Land Owners, Producers, and Water Users		
In-Delta Agricultural Operators	Avoid/reduce potential loss of revenue; avoid/reduce potential loss of property value.	ID
South of Delta and North Bay Agricultural Water Users	Avoid/reduce potential for water supply disruption.	OBD, DD
Municipal Water Providers and End Users		
In-Delta Municipal Water Users	Avoid/reduce potential for water supply disruption.	ID
South of Delta Municipal Water Users	Avoid/reduce potential for water supply disruption.	DD
Infrastructure Owners and End		
EBMUD	Avoid/reduce potential for damage to Mokelumne Aqueduct; avoid/reduce potential for water supply disruption.	ID, OBD
Oil and Gas Companies	Avoid/reduce potential for damage to in-Delta property; avoid/reduce potential for supply interruptions to Bay Area and Northern California.	ID, OBD
Power Plant Owners	Avoid/reduce potential damage to in-Delta property; avoid/reduce potential for supply interruptions to the electricity market.	ID
Electricity Infrastructure Owners	Avoid/reduce potential for damage to in-Delta property; avoid/reduce potential for supply interruptions to the electricity market.	ID, OBD

Table 4-1 Beneficiaries of Flood Protection in the Sacramento/San Joaquin River Delta

Category of Beneficiary/Entity	Type of Benefit(s)	Primary Regions*
Telecommunications Companies	Avoid/reduce potential for damage to in-Delta property; avoid/reduce potential for service interruptions to local users.	ID, OBD
Railroad companies	Avoid/reduce potential for damage to in-Delta property; avoid/reduce potential for freight interruptions to agricultural markets and Ports of Stockton and West Sacramento; avoid/reduce potential for service interruptions in passenger rail lines.	ID, OBD
Caltrans and State Highway Users	Avoid/reduce potential for damage to in-Delta property; avoid/reduce potential for disruptions to truck freight operations.	ID, OBD
Ports of Stockton and West Sacramento	Avoid/reduce potential for disruptions to port operations and businesses that utilize port services.	ID
Upstream and In-Delta Dischargers		
Wastewater dischargers	Avoid/reduce potential for costs of alternative storage, treatment, and discharge methods.	ID, UD
Storm water dischargers	Avoid/reduce potential for incurring costs of alternative storage, treatment, and discharge methods.	ID, UD
Other Indirect Beneficiaries		
Hydropower owners and operators	Avoid or reduce potential reductions in hydropower production on water bodies that would be affected by flood protection and water supply operations, through requirements for greater flood control storage requirements.	UD, OBD
General Public Beneficiaries		
Public concerned for the protection/restoration of Delta ecosystem resources (as indicated by their willingness to pay)	Avoid/reduce negative impacts on aquatic and terrestrial resources that provide a wide array of goods and services supported by functioning ecosystem resources.	ID, OBD, UD, DD

Table 4-1 Beneficiaries of Flood Protection in the Sacramento/San Joaquin River Delta

Category of Beneficiary/Entity	Type of Benefit(s)	Primary Regions*
Commercial and recreational fishing	Avoid/reduce potential harm to aquatic and aquatic-related terrestrial habitat that support fisheries.	ID, OBD, UD
Recreational participants (water contact and non-contact water-based activities), including Delta residents and out-of-area visitors	Maintain high quality recreation conditions by protecting the quantity and quality of water resources and other resources that support recreation opportunities and activities.	ID, OBD, UD
Delta as Place beneficiaries (visitors and residents)	Maintain Delta-as-Place values by protecting the Delta's geography of low-lying islands and tracts, rural heritage, agricultural economy, coexistence of unique native ecosystem with expanding cities in a region characterized by maritime ports, commercial agriculture associated with maintaining rural life- style, opportunities for recreation and tourism, and a multicultural tradition, legacy communities and family farms.	ID, OBD
State and Local Government and Special Districts		
State government	Avoid/reduce secondary impacts from disruptions to services and revenues through the Delta; reduce long-term system maintenance costs.	ID, OBD, UD, DD
Local government	Avoid/reduce secondary impacts on local government entities from disruptions to services and revenues in the Delta region; reduce long-term system maintenance costs.	ID, OBD, UD
Special districts (e.g., reclamation and flood protection)	Avoid/reduce potential cost impacts from unexpected disruptions to services and revenue losses; reduce long-term system maintenance costs.	ID, OBD, UD
State Economy		
Ripple effects	Avoid or reduce disruptions to statewide economic activity, as measured by industrial output, jobs, and personal income. These are secondary beneficiaries.	ID, OBD, UD, DD

Key:
Caltrans = California Department of Transportation
EBMUD = East Bay Municipal Utility District

Geographic Context and Risk Considerations

The value of benefits of flood protection from Delta levee investments depends on the geographic location of the beneficiary. For example, the indirect benefits received from Delta levees by upstream beneficiaries such as the Sacramento Regional County Sanitation District or Sacramento Area Flood Control Agency depend on these agencies' ability to discharge treated wastewater or stormwater into Delta waters. If these entities could not move the floodwaters downstream they would be inundated; if the Delta levees are not high enough to accommodate those flows, those agencies would have to pay damages to the Delta landowners for diverting floodwaters onto Delta islands. The value of a fully functioning Delta levee system to these beneficiaries depends on the costs of alternative disposal options and methods of reducing river discharges. These indirect benefits to upstream beneficiaries fundamentally differ from the more direct flood protection benefits received by agricultural operations and landowners in the Delta.

Geographic location helped to determine appropriate monetary (and non-monetary) values for Delta levee beneficiaries. Location was also critical in assessing the feasibility of different funding mechanisms for different types of beneficiaries. Although Delta levees provide flood protection benefits to state and national beneficiaries, this Study did not attempt to include the value to potential beneficiaries outside of the State.

These geographic distinctions correlate to some degree with the primary/secondary and direct/extended/peripheral distinctions of benefits and beneficiaries. Beneficiaries in the Delta are more likely to receive direct and primary benefits, while those outside of the Delta are more likely to be peripheral and secondary.

CHAPTER 5 LINKING FINANCING MECHANISMS AND COST ALLOCATION

This feasibility study has adopted the following guidelines for selecting a beneficiary-pays cost allocation method:

- Follow a benefits-based approach as applicable under current law or consistent with economic principles where federal or state law does not set specific guidelines;
- Promote cost allocations that encourage participation; and
- Promote cost allocations that avoid or minimize unintended subsidies.

Other criteria for selecting a cost allocation method would need to be considered in implementing a beneficiary-pays approach. These could include:

- Achieving equitable allocations that reflect the circumstances of beneficiaries and other parties;
- Ease of application and administration; and
- Reliability of revenue collection over time.

Determining whether allocations are equitable is fairly subjective and may not be resolved until a more detailed analysis can be conducted and the outcome examined by stakeholders and decision makers. Ease of application and administration will depend on data and resources available when a mechanism is implemented (ease of understanding by decision makers and affected parties falls into this category). Reliability of revenue collection will depend on the underlying economics of the asset or activity being charged—for example, does agricultural land value remain steady? How much do water deliveries vary?

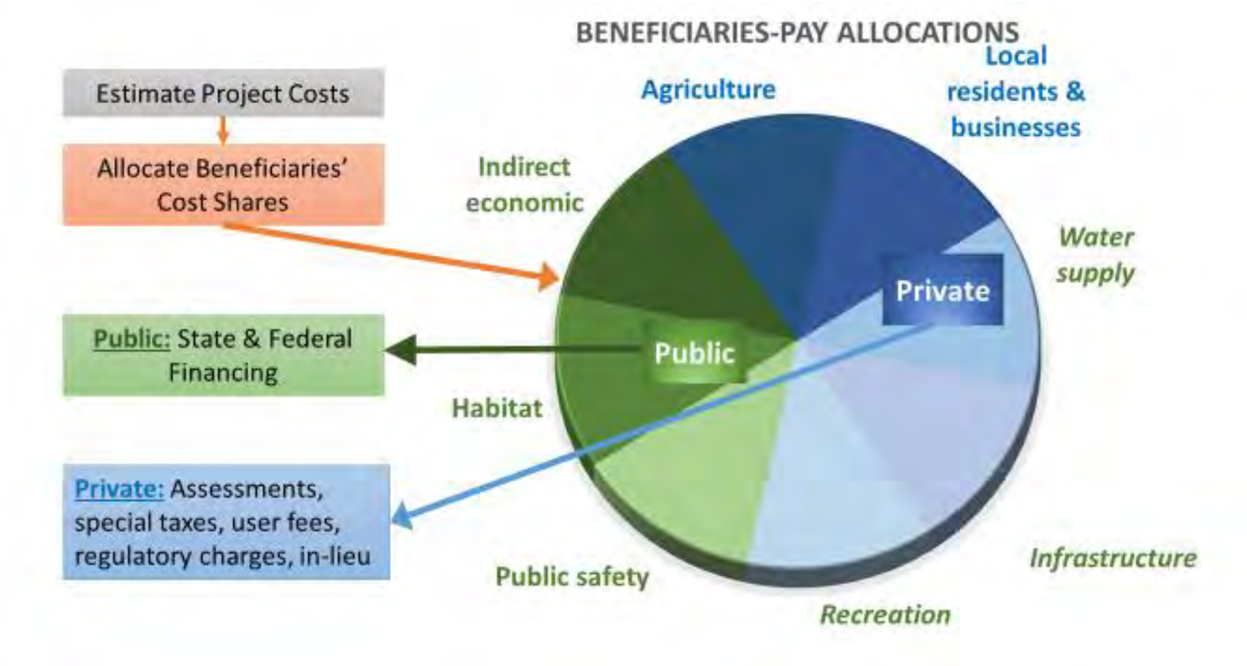
Using "Beneficiary-Pays" Principle for Cost Allocation

Figure 5-1 illustrates the potential outcome of a shift to a beneficiary-pays approach.[48] Rather than starting with the allocations among government agencies embedded in law and practice, the beneficiary-pays approach identifies the benefits accruing to various beneficiaries and matches financing mechanisms with those beneficiaries. Public benefits and indirect benefits to the state economy (shown as green wedges in Figure 5-1 below) accrue to large groups of beneficiaries, against whom it is difficult to apply a specific levy or charge. Such beneficiaries currently pay some of their share of levee costs through public funds, such as the State General Fund or bonds. Private benefits, such as flood protection to land and structures, accrue to beneficiaries that can be

[48] The size of the pie slices do not represent economic value or cost responsibility—this figure simply represents how cost shares might be covered by the different financial mechanisms.

identified and could be directly charged a tax or user fee. Major categories of private beneficiaries who now pay indirectly through state and federal contributions include water suppliers and users, cross-Delta infrastructure, and recreationists (indicated as blue wedges with green labels in the pie chart in Figure 5-1).

Figure 5-1 Beneficiary-Pays Flood Protection Cost Allocation Process



A key focus of this Study is to be more explicit in delineating the "general" and "public" benefits, as well as the federal and state cost shares implied by those types of benefits. Currently, those benefits are often not rigorously identified and quantified.

Additional Issues in Implementing Beneficiary-Pays Cost Allocations

In addition to the challenges of identifying the complete range of beneficiaries and selecting an allocation method, other issues will arise in developing a beneficiary-pays approach to paying for Delta levees. These issues are outside the scope of this feasibility study and will need to be addressed in a more detailed implementation analysis:

- **Establish agreement on baseline value and incremental benefit from additional flood protection projects.** Where beneficiaries and/or stakeholders do not agree on how to characterize the benefit of a project, and no objective test is available to resolve the disagreement, the analytic team should develop a range of cost allocation examples that incorporates differing views. Such scenarios can inform policymakers about the range of potential benefits and associated costs to beneficiaries.

  For example, beneficiaries often hold different views on acceptable flood risk and the need for improved flood protection, as well as the baseline (point in time) by which to measure the benefits of a project. A farmer may view current flood protection as sufficient, while a developer of a new housing project may want a higher level. There may be no objective test to resolve this disagreement; various projects and cost allocations should be considered to illustrate the financial impacts of the different views.

- **Include only beneficiaries above a specified threshold.** If a beneficiary group receives very small benefits from a flood protection program or levee project, it can be removed from the cost allocation for that program or project. Any implementation studies should document the determination of incidental beneficiaries, however. For example, hydropower users could be expected to receive some benefit from improved downstream flood protection because it relieves them of some flood control storage obligation. However, the expected benefits to this group are very small relative to total program benefits, and highly uncertain. They could therefore be classified an incidental beneficiary and not allocated any costs for a specific project.

Financing Mechanisms and Corresponding Cost Allocation Methods

Determining cost responsibility among beneficiaries and taxpayers occurs primarily within a local jurisdiction, e.g., a reclamation district or a county. However, some beneficiaries such as water contractors benefit from the channels created by the levees, but they do not own property or assets within the jurisdiction of the reclamation districts that maintain those levees. This Study explores the mechanisms that may be appropriate for collecting revenues from each category of beneficiaries.

Chapter 3 described the various local and State government financing mechanisms available in California. In applying a beneficiary-pays approach, the law governing the type of financing mechanism would determine the cost allocation method. For example, assessments are based on relative *benefits,* while property-related fees are based on relative *costs of service*.

Available local and State government financing mechanisms and their implications for cost allocation are as follows:

Assessments are based on and levied in accordance with benefits to the affected property by the governmental service or activity funded by the assessment. Most relevant to cost allocation, *Proposition 218 requires that only special benefits (and not general benefits) may be subject to assessment*. The required engineer's report quantifies the proportional special benefit derived by each parcel. Special benefits are identified as separable from those conferred generally to the surrounding community. For example, a set of parcels may derive a lower risk from flood protection or may be more susceptible to a flood hazard than surrounding parcels. The assessment cannot exceed the reasonable cost of the special benefit conferred upon the parcel.

"Taxes" (General and Special) are charges on real property that historically are not tied to any particular service or benefit provided by the public agency and require a two- thirds vote of the electorate. In this case, *costs are allocated on the basis of the average tax burden incurred rather* *than in relation to either benefits or costs for flood protection*. Proposition 26 exempted some fees and charges from the definition of "taxes" (and thus the two-thirds vote approval requirement). Exemptions that may pertain to levee funding include charges imposed for a specific benefit conferred to the payor that is not provided to those not charged, or charges imposed for services provided, subject to a limitation that the charge not exceed the reasonable cost to the government of providing the benefit or service. Levee maintenance could fall within the scope of "benefits" conferred or "services" provided and would not be curtailed by Proposition 26, although the scope of the Proposition has not been fully litigated.

Property-Related Fees and Charges are considered to be any fees or charges *other than* an ad valorem tax,[49] special tax, or assessment, which are imposed by an agency upon a parcel or person as an incidence of (i.e., connected directly to) property ownership. An example is a groundwater augmentation fee collected from overlying property owners. Again, the controlling legal authority pertaining to property-related fees and charges was added by Proposition 218. In contrast to assessments, *these fees and charges are allocated based on the costs of providing those services or activities to each particular property*.

For **User Fees**, these services must be separable from direct use of the property itself. Utilities, such as water, sewer and electricity, fall into this category because use varies without direct relationship to the property's characteristics. An example of a user fee in this situation would be a charge per acre-foot diverted or a kilowatt-hour transmitted using facilities that are benefited by a levee. As a general proposition under Proposition 26, user fees cannot exceed the reasonable cost of providing the benefit, service, or regulation, and thus cannot be relied upon for general revenue purposes.

[49] "Ad valorem" refers to a tax determined as a proportion of property value.

CHAPTER 6 Evaluating Financial Mechanisms

This chapter describes how the Study selected candidate financial mechanisms and evaluated their feasibility.

Candidate Financial Mechanisms

The study worked from a comprehensive set of possible financial mechanisms, grouping the mechanisms according to whether they were property-based, part of public financing, user fees, or regulatory charges linked to utilities or infrastructure. Table 6-1 displays the initial 50 candidate mechanisms, by beneficiary group and type of mechanism. Each of these mechanisms was considered in the context of legal requirements and restrictions (as described below under "Financial Mechanism Screening Process"). Candidate agencies for implementation were identified based on past practices or legal authority; these are only feasible choices and are not recommendations or preferences. The table denotes matches between mechanism and beneficiary with an "X." Due to the wide reach of general taxes, all beneficiaries are shown as paying some portion with grey shading. General public beneficiaries paying general taxes are shown in green shading.

Table 6-1 Candidate Revenue Collection Measures by Beneficiary

MECHANISMS	Property-related	Assessment district	Delta-wide assessment district	State assessment district	Geological hazard district	Incremental tax district (e.g., Mello-Roos)	Delta Flood Prevention Fee	User Fees	Delta water user fee / AF	Agricultural discharge fee / AF	Groundwater pumping fee / AF	Delta gas severance fee	Delta boat registration tag	Fishing/licenses	Motorboat use fee	SWP/CVP Water Conveyance Fee	Water conveyance "capacity" pricing	Cross Delta infrastructure flood protection fee	Earmark illegal diversion fines	Highway-related fees and tolls	Truck fees	Electronic tolls	Pollution fee (e.g. oil, braking particles)	Vehicle licensing fees	Regulatory charges	Delta Rail line use fee	CPUC fee on PG&E	Franchise fees	Oil and Gas severance fee	Commodity /Made in Delta fee
BENEFICIARIES																														
Community Beneficiaries																														
Delta Resident Personal Safety							X																							
Commercial & Residential Property Owners		X	X	X	X	X	X																							
Delta Public Facilities							X																							
Delta Schools																														
Local Economy																														
Agricultural Water Users																														
In-Delta Ag Operators		X	X	X	X	X	X			X									X											
South of Delta Ag Water Users							X		X							X	X		X											
Municipal Water Users																														
In-Delta Muni. Water Users							X		X								X		X											
South of Delta Muni. Water Users							X		X							X	X													
Infrastructure Owners & Users																														
EBMUD							X		X							X	X	X												
Oil and Gas Companies		X	X	X	X	X	X					X																	X	
Power plant Owners		X	X	X	X	X	X																							
Electricity Infrastructure Owners		X	X	X	X	X	X											X									X	X		
Telecommunications Companies		X	X	X	X	X	X											X										X		
Railroad Companies		X	X	X	X	X	X											X								X				
State Highway Users							X											X			X	X	X	X						
Ports							X		X																					
Upstream and In-Delta Dischargers																														
Wastewater Dischargers																														
Stormwater Dischargers																														
Hydropower owners and operators																														
General Public																														
Public concerned for ecosystem																														
Commercial /recreational fishers									X				X	X																
Recreation participants									X				X	X																
Delta as Place beneficiaries																														
State and Local Government																														
State Government																														
Local Government																														
Special Districts																														
State Economy																														
Ripple Effect																														

Table 6-1 Candidate Revenue Collection Measures by Beneficiary

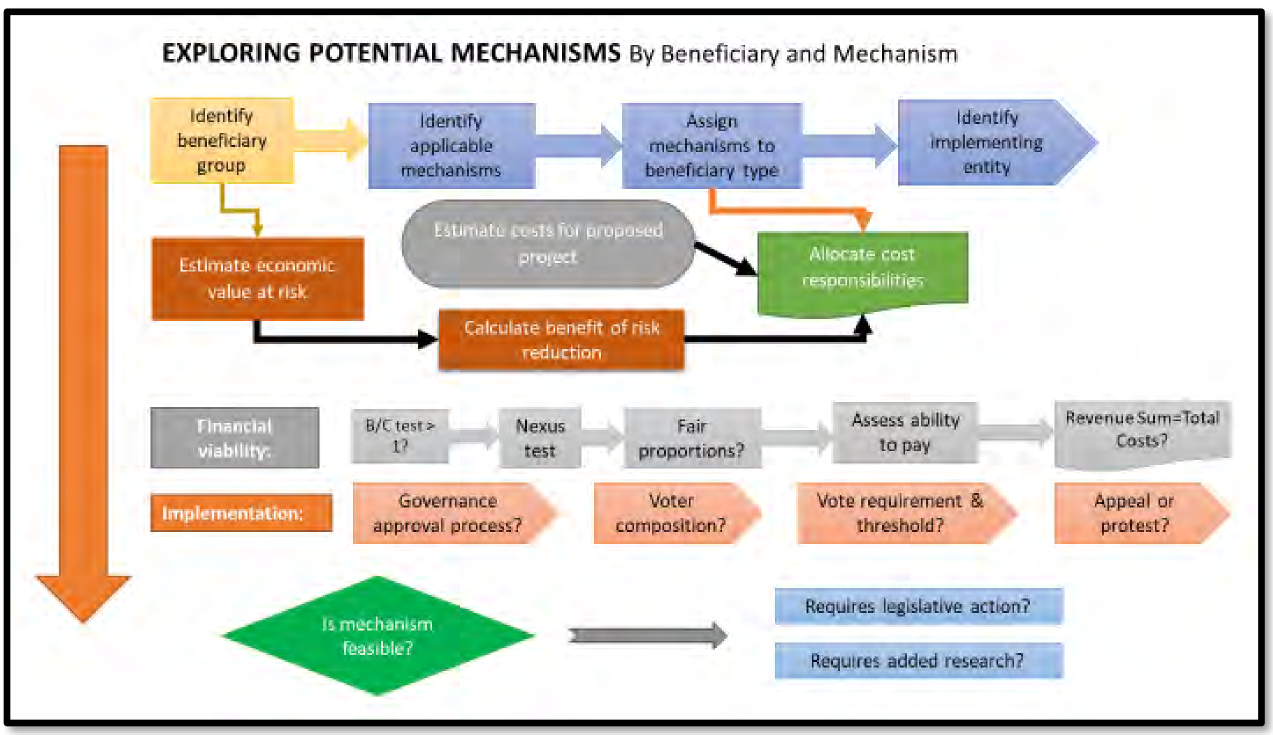
MECHANISMS	Impact fees	Groundwater pumping assessment	Groundwater pumping parcel tax	Development impact fees	Habitat conservation plan	Flood control plan akin to HCP	Habitat mitigation for SWP/CVP	Land trust support	Property covenants/set asides in exchange for investment	Delta periphery levees upgrade fee	Carbon sequestration/ capture	CATP Allowance Funds	Public benefits financing tools	General Fund	General/revenue bonds	Subventions	Regional financing agency	Sales Tax	Certificate of Participation	Tax dedicated zones, with revenues redirected to Delta (e.g. sales; tobacco)	Agricultural property tax redirection	Federal financing	Federal/UN heritage site
BENEFICIARIES																							
Community Beneficiaries																							
Delta Resident Personal Safety																							
Commercial & Residential Property Owners				X	X	X	X			X													
Delta Public Facilities						X				X													
Delta Schools																							
Local Economy																							
Agricultural Water Users																							
In-Delta Ag Operators						X				X													
South of Delta Ag Water Users		X	X		X	X	X																
Municipal Water Users																							
In-Delta Muni. Water Users		X	X		X	X																	
South of Delta Muni. Water Users		X	X		X	X	X			X	X	X											
Infrastructure Owners & Users																							
EBMUD		X	X		X	X	X																
Oil and Gas Companies		X	X	X	X	X					X	X											
Power plant Owners		X	X			X	X			X	X	X											
Electricity Infrastructure Owners		X	X		X	X	X			X	X	X											
Telecommunications Companies		X	X	X			X																
Railroad Companies		X	X		X	X	X			X	X	X											
State Highway Users		X	X		X	X	X			X	X	X											
Ports		X	X			X				X	X	X											
Upstream and In-Delta Dischargers																							
Wastewater Dischargers																							
Stormwater Dischargers																							
Hydropower owners and operators																							
General Public																							
Public concerned for ecosystem						X																	
Commercial /recreational fishers					X	X																	
Recreation participants					X	X																	
Delta as Place beneficiaries				X		X																	
State and Local Government																							
State Government																							
Local Government																							
Special Districts																							
State Economy																							
Ripple Effect																							

Financial Mechanism Screening Process

The screening process selected the most promising financial mechanisms. Figure 6-1 displays the screening process, and Appendix E describes it in detail. In brief, the screening process follows the following steps:

1) Identify beneficiary groups;
2) Identify applicable mechanisms;
3) Assign mechanisms to beneficiary type;
4) Identify the implementing entities;
5) Estimate economic value at risk and the benefits of reducing that risk;
6) Estimate costs of proposed project;
7) Allocate cost responsibility;
8) Check financial viability; and
9) Set out the implementation steps.

Figure 6-1 Financing Mechanism Screening Process



This screening reduced the pool of 50 candidate financial mechanisms to eight. The surviving eight were then evaluated to determine their feasibility.

Evaluation of Candidate Financing Mechanisms

We evaluated the candidate financial mechanisms for feasibility based on four criteria: institutional, legal, cost responsibility, and political/stakeholder support. These criteria elicited the opportunities, challenges, and barriers associated with each candidate mechanism. This section describes how the surviving mechanisms[50] fared in this evaluation.

This feasibility evaluation is a "fatal flaw" analysis—after eliminating those potential mechanisms that are infeasible, we are left with those that might work best in various situations to capture Delta levee beneficiaries. This section highlights some key considerations for the mechanisms that passed the feasibility screen, and recommends more refined analysis to determine whether and how they could be implemented. Feasibility is considered here by looking at the overall potential for a mechanism to collect revenue from beneficiaries, including the technical and political difficulties of designing and implementing the mechanism, identifying and collecting revenues from specific beneficiaries (collectively known at "transaction costs"), and whether there are any conflicts with current constitutional and statutory framework.

We emphasize that this analysis is not intended as a recommendation to replace the current funding programs or cost shares under the Delta levees subventions or special projects programs. It is also not a recommendation to proceed immediately to implementation of the identified mechanisms. This report can be used to set the stage for future deliberations among stakeholders.

Tables 6-2A and 6-2B depict how the criteria from the multi-step process were used to screen candidate mechanisms for feasibility based on the criteria specified in this report. The tables are organized in the same manner as Table 6-1, with mechanisms broadly grouped by legal categories. Tables 6-2A and 6-2B show the mechanisms deemed sufficiently feasible to advance for further research and discussion among stakeholders.[51] Table 6-2A shows the first half of the evaluation process and lists likely responsible agencies or entities that could potentially implement the mechanism, and the legal requirements that must be satisfied to adopt and implement it. Table 6-2B shows the second half, which includes the determination of cost responsibility and relative revenue potential, and political considerations that are likely to arise before adopting the mechanism.

Appendix F includes all 50 of the mechanisms evaluated, and indicates at least one reason (highlighted in red) why a mechanism was eliminated from further consideration. Mechanisms that would require a change to the State Constitution were eliminated; other reasons for

[50] The eight mechanisms deemed sufficiently feasible in this analysis are described in more detail in Chapter 7. These mechanisms will require further research and discussion among stakeholders.

[51] Certain mechanisms list references to other mechanisms; notations are provided to facilitate cross references. These are alternatives to each other that target similar populations of beneficiaries, but may have different characteristics.

elimination included low potential for additional revenues, and high transaction costs relative to revenues.

Table 6-2A - Revenue Collection Mechanisms: Opportunities, Barriers, and Challenges

	Funding Mechanism/Groupings	**Institutional** *Implementing entities with legal authority / potential capacity*	**Legal** Governing statutes and/or key restrictions / requirements	Governance approval	Voter composition	Vote requirement	Appeal or protest	Benefit-cost test
	Property-related							
1	Local assessment district *[e.g. existing reclamation districts]*	Local	Proposition 218	City/County/ district	Local board	Majority	Weighted by financial obligation	Only special benefits can be assessed. Costs must be reasonably related to special benefits
2	Delta Flood Protection Fee	State or delegated regional agency	Requires state legislation	California Legislature	Legislature	Majority or two-thirds, depending on outcome of ongoing litigation	Yes, depending on legislation	No
	User Fees							
3	Delta water user fee / acre-feet	State or delegated regional agency	Federal/State water contracts; Prop. 26	California Legislature; possible contract modification	Legislature	Majority	No	Charge must be reasonably related to cost
4	State Water Project (SWP)/Central Valley Project (CVP) water conveyance fee;	California Department of Water Resources (CDWR); or SWRCB	Federal/State water contracts; Prop. 26	Legislature; possible contract modification	Legislature	Majority	No	Property use rates tied to fair market value
5	State Water Project (SWP)/Central Valley Project (CVP) water conveyance lease; i.e., transmission capacity pricing	State Lands Commission	Federal/State water contracts; Prop. 26 does not apply to use of government property	Legislature; possible contract modification	Legislature	Majority	No	Property use rates tied to fair market value
	Public benefits financing tools							
6	General Fund	State; Local	Requires legislation	California Legislature	Legislature	Majority	No	No
7	General/revenue bonds	State	Requires legislation; public vote	California Legislature / Electorate	Legislature / state voters	Majority	No	No
8	Federal financing	U.S. Army Corps of Engineers	Requires legislation	U.S. Congress	Legislature	Majority	No	Per USACE guidance

Table 6-2A - Revenue Collection Mechanisms: Opportunities, Barriers, and Challenges

Table 6-2B - Revenue Collection Mechanisms: Opportunities, Barriers, and Challenges

Funding Mechanism/Groupings	Cost Responsibility & Limits *Cost allocation method*	*Revenue capacity*	*Revenue-generating potential, including timing; risks*	Stakeholder / Political Support *Potential Feasibility/Prospects for Successful Implementation*
Property-related				
Local assessment district *[e.g. existing reclamation districts]*	Benefits-based/Alternative justifiable expenditures	High	Low, unlikely to generate significant new revenues	Current practice under status quo; problematic if state subvention significantly reduced and/or need for substantially greater revenue levels
Delta Flood Protection Fee	Could be assessed on a per structure basis per the FPF. Must be net of existing contributions.	Medium	Medium, based on Assembly Bill 29X1, fire prevention fee. More likely to pay for operations and maintenance than capital expenses	Requires similar motivation as Rural Fire Prevention Fee. FPF presents precedential model passed by the Legislature; however it was rescinded in the 2017 session, reducing its viability.
User fees				
Delta water user fee / acre-feet	Proportionate use of facilities /Alternative justifiable expenditures	High	Bay-Delta Finance Plan (2004) proposed that SWP/CVP fund 15% of levee costs.	Similar to Bay-Delta Financing Plan user fee proposed in 2005, which identified levee financing as one component.
State Water Project (SWP)/Central Valley Project (CVP) water conveyance fee;	Proportionate use of facilities /Alternative justifiable expenditures	HIgh	Bay-Delta Finance Plan (2004) proposed that SWP/CVP fund 15% of levee costs.	Similar to Bay-Delta Financing Plan user fee proposed in 2005, which identified levee financing as one component.
State Water Project (SWP)/Central Valley Project (CVP) water conveyance lease; i.e., transmission capacity pricing	To be determined, e.g., could use FERC-based pricing model	HIgh	Channel basin lease akin to gas pipeline pricing. Could be priced at WaterFix cost net of "leakage."	Legal basis similar to Tideland Oil & Gas Lease. Structured as contractual relationship rather than intergovernmental.
Public benefits financing tools				
General Fund	Separable costs / remaining benefits	High	High	Recent funding has been displaced by bonds.
General/revenue bonds	Separable costs / remaining benefits	High	High	Episodic issuances, usually tied to a broad range of issues.
Federal financing	Separable costs / remaining benefits	High	High	Funding reductions in recent years; USACE ruled many levees ineligible indefinitely in 2012

Evaluation Steps

We highlight some key considerations here for the mechanisms that passed the feasibility screen. Those mechanisms will require a more detailed analysis to determine whether and how they could be implemented.

Institutional Feasibility. Table 6-2A begins by listing the candidate mechanism and the type of entity that would use the mechanism. If the entity already exists, this eases implementation. If a new entity must be assigned or created, this adds a barrier. If no previous institutional and governance model exists for this new entity, then we deemed the mechanism infeasible. For four of the mechanisms, if they were to be implemented, existing agencies would likely be assigned new revenue collection responsibilities, but each already collects fees or similar types of revenue.

Legal Feasibility. Columns 2 through 6 of Table 6-2A describe the key statutes, constitutional provisions, and voting requirements applicable to each mechanism. In most cases, these mechanisms are subject to either Proposition 218 or 26, but the water conveyance lease fee falls outside of specific constitutional limits on cost allocation and governance, which eases institutional barriers. The waterway lease has several precedents, including leases to marinas in the Delta for using space in the channels. The State Lands Commission has already asserted its ownership of the channel bottoms.[52] None of the other mechanisms are prohibited by legal provisions.

The next three columns list the mechanism approval requirements, to highlight the relative ease of or obstacles to such approval. An initial consideration is whether it goes through a governing entity or to the electorate—the eight surviving mechanisms all rely on approval of a board or the Legislature. None of these appear to face insurmountable barriers to approval.

The next consideration is whether adoption of a mechanism can be challenged.

Finally, the question of whether benefits must exceed assigned cost responsibility is addressed. Benefit-cost and cost responsibility analysis requirements can be an obstacle to feasibility, insofar as they require significant additional analysis and associated expense. In the case of assessments, only special benefits beyond general benefits can be assessed and cost responsibility must be assigned in proportion to those special benefits. However, this requirement already exists, so should not be a significant additional barrier. The fees require that responsibility be assigned in proportion to costs incurred, but without the additional benefit test. Public funds face none of these tests in statute, but may in practice as agencies often perform benefit-cost analyses as part of decision making.

[52] Public Resources Code Section 6501.

Cost Responsibility and Limits. Table 6-2B addresses criteria related to fiscal and political viability. The table begins with the cost responsibility allocation method dictated in statute. The legally-directed method leads to the estimates of revenue capacity and potential for new revenues.

Table 6-2B then includes a qualitative ranking of the capacity to generate a significant share of total revenues. In screening the 50 proposed mechanisms, if any had low revenue capacity, then it could not have any other significant barriers, such as high collection costs, to be viable. All of the surviving mechanisms are considered to provide medium or high revenue capacities.

The subsequent step is a qualitative appraisal of the potential additional revenues from the mechanism. We note that assessments are an existing mechanism; consequently, they are unlikely to add more revenue. However, they will continue to be a cornerstone of a full portfolio of financial mechanisms. Several of the new mechanisms could increase revenues because they bring in new beneficiaries to the pool.

Stakeholder and Political Support: The final criterion is the potential feasibility and prospects for successful implementation given stakeholder and political support. Table 6-2B lists aspects of implementing each measure such as whether it is the current practice, if other models exist, and notes certain unique features.

CHAPTER 7 OBSERVATIONS AND FINDINGS

This Study demonstrated that the existing approach to paying for Delta levee work can effectively recover associated costs from most—but not all— beneficiaries in rough proportion to the benefits and/or costs of providing flood risk reduction and protecting California's interests (such as supporting the State's economy and ecosystem restoration). The existing levee financing mechanisms rely primarily on:

- Reclamation districts that collect property assessment revenues from landowners within the district boundaries based on their proportionate share of providing drainage and levee operation, maintenance and improvement benefits; and
- State budget appropriation of General Fund and General Obligation Bond revenues to partially cover the State's interests and broad public benefits from operation, maintenance and improvement of levees. However, General Obligation Bonds have been authorized episodically and may not be entirely reliable for future financing.

Existing mechanisms still fall short. They do not generate revenues from beneficiaries that receive significant private benefits and that are located primarily outside of the Delta— namely, water exporters and linear infrastructure owners and users. Moving forward with the beneficiary-pays principle would require collecting specifically-allocated revenues from these two groups of beneficiaries for the first time. Pursuing this policy choice would necessitate implementing *new* financing mechanisms, which could be challenging. In addition, the current approach to funding levees lacks revenue stability and reliability, which should motivate further exploration of potential financing strategies to increase the level of certainty of levee funding.

General Observations and Findings

We arrived at a series of observations and findings over the course of this Study that appear to be broadly applicable across all mechanisms reviewed.

1. The Delta is the hub for water supply, energy, and transportation infrastructure of statewide importance that is protected from flood damage and disruption by a network of Delta levees that operate as a system.
2. This report contains an initial feasibility study that narrows the menu of feasible financing mechanisms based on the beneficiary-pays principle. Still, the conceptual financing mechanisms analyzed in this Study each have technical and legal issues that affect the ability to collect revenues from beneficiaries as anticipated. And importantly, no single financial mechanism can meet the requirements of a beneficiary-pays approach to address the full range of beneficiaries and financing needs. Consequently, a portfolio of mechanisms will be needed. Regardless, no existing agency has the full governance capacity or authority to guide and administer the full range of finance mechanisms that may be needed.
3. The new financing mechanisms analyzed in this Study are still conceptual and require stakeholder endorsement and support before considering implementation. Gaining stakeholder support would require further development in order to provide details regarding

who will pay, fee amounts, overlap with other fees and assessments, and what flood protection activities would be funded.

4. A full list of benefits and beneficiaries of flood protection and ancillary activities includes many entities and individuals who reside outside of the Delta. In some cases, the benefits of those outside of the Delta exceed the benefits to in-Delta parties.
5. Although the original purpose for levees was flood protection, that has since expanded to serve other purposes; this expansion of purpose does not absolve the new beneficiaries from contributing to the continuing maintenance and additional investment in existing levees.
6. Local assessment districts, such as reclamation districts, rely on property-based assessments, which cannot reach the beneficiaries that do not own property within the district. Such local assessments are subject to Proposition 218 and associated case law.
7. Although a Delta-wide assessment district as proposed in the Delta Plan (RR R2) and the 2017 CVFPP Update might improve governance issues, this Study documents that it will not advance the beneficiary-pays approach, nor generate additional revenue over that which is currently collected by the existing reclamation districts for the following reasons:
    a. It cannot collect revenues from all beneficiaries of levee flood protection because many of them do not own assessable property in the Delta;
    b. Reclamation districts are already assessing benefitted property for levee and drainage services and a Delta-wide district is unlikely to create truly additive value to the funding already flowing through those districts; and
    c. Establishing a well-functioning governance structure across the multitude of special districts and general government agencies in the region and then allocating collected funds across the implementing agencies would be politically difficult.
8. Reclamation district assessments can continue to be the primary means of collecting revenues from local property owners for levee and drainage services.
9. Significant public benefits accrue from maintaining and improving Delta levees including “the protection of public highways and roads, utility lines and conduits, and other public facilities, and the protection of urbanized areas, water quality, recreation, navigation, and fish and wildlife habitats, and other public benefits.” (Water Code §12311). Maintaining and enhancing the Delta as a place, sustaining the Delta and regional economy, and protecting and enhancing the unique cultural, recreational, natural resources, and agricultural values of the Delta are also significant statewide benefits.
10. State general fund and general obligation bond funds are the sources for paying the cost share associated with public benefits and State’s interests, and continued provision is consistent with the beneficiaries-pay principle so long as it is proportional to the public benefits accrued.
11. In those parts of the Delta where islands form the water conveyance corridor for the State Water Project (SWP) and Central Valley Project (CVP), prevent evaporation water loss, or provide a salinity barrier to protect export water supply, the water exporters derive significant benefits from the levees originally constructed for flood protection. They derive significant benefits from levee stability due to drainage and protection of habitat. However, the SWP/CVP exporters do not currently pay directly to maintain those levees, and whether their indirect contributions through public funding are proportional to the benefits accrued cannot be readily determined at this time.
12. Linear infrastructure owners (e.g., pipelines, railroads, and electrical transmission lines) that benefit from levees are generally assessed on reclamation district rolls. However, those

assessments do not cover the additional network benefits that accrue from maintaining the integrity of that infrastructure. Further, federal facilities are exempted under federal law from paying State or local assessments, fees, or taxes.

13. Recent suspension of the State Responsibility Area (SRA) fire prevention fee through 2030 by the Legislature raises additional concerns regarding the legal and political feasibility of proposing any new revenue collection mechanisms that are modeled after the SRA fee.
14. The CVFPB and DWR will be initiating a stakeholder engagement process to evaluate potential new financing mechanisms to provide additional funding for levee projects and other flood protection measures, including those identified in the 2017 update of the CVFPP.

Financial Mechanisms Analyzed

This Study concluded with detailed analysis of the mechanisms discussed in this section. This analysis evaluated their viability based on the strengths and weaknesses of each mechanisms in terms of the legal, technical, economic, and political opportunities and challenges.

No single mechanism such as the assessment district proposed in the Delta Plan (RR R1) can reach all beneficiaries of Delta levees in a manner that reflects the proportion of benefits received. For this reason, the candidate financing mechanisms are organized so as to cover the entire range of beneficiaries with multiple mechanisms. Again, we emphasize that these candidate mechanisms lack sufficient technical detail to determine feasibility; therefore, this study is not recommending implementation of these measures.

Delta Property Owners

Beneficiaries that are assessed under existing law within reclamation districts include owners of lands within the district boundaries. These landowners benefit from reduced flood damage risk to their property which is fixed on the specific island or tract and are already contributing funding for Delta levee projects. Public agencies that own lands within reclamation districts—including federal agencies, school districts, roads and highways, and State agencies—are included in this group of beneficiaries, although for various reasons some do not pay assessments as discussed previously.

Local reclamation districts can continue to be the primary entities responsible for collecting revenues from local landowners who benefit from district activities and purposes.

Local assessment district—Assessments are imposed and collected by a local agency, such as a city, county or special district (including reclamation districts), under a process governed by statute, Proposition 218, and associated case law. The assessed landowners must approve the assessment methodology defined in the Engineer's Report and changes in the base rate for parcels by a majority vote which is weighted by their proportional assessment amount. Assessments on owners of property and linear infrastructure within the district are already in effect and the opportunity to generate significant new revenues is uncertain.[53]

Proposition 218's cost allocation requirements limit the amount of revenue that can be collected to cover only the amount proportional to the benefits provided by the assessment district. Only special benefits can be included in the assessment. Costs must be reasonably related to special benefits conferred. The cost allocation method used must be described in an Engineer's Report; the exact method is not specified.

This local assessment district mechanism does not reach beneficiaries that are not landowners within the district boundaries. Consequently, only local property owners pay for the local share of state-sponsored projects (such as DWR's Subventions and Special Projects programs), as well as the entirety of any other levee work costs. Because public roads and school districts are statutorily exempt from assessment, other mechanisms are needed to collect contributions from these agencies under a beneficiary-pays approach. Continued dependence on local assessments could become problematic if state funds are significantly reduced and/or if the need arises for substantially greater revenues.

General Public Beneficiaries

Broadly speaking, public benefits are defined as those that cannot be assigned explicitly to individuals or entities. Beneficiaries cannot be easily excluded from enjoying those benefits, nor can they be charged a price or an entry fee to enjoy them. The classic example of a public benefit is the neighborhood park enjoyed by any visitor or waterways that all boaters can recreate on. The Legislature has defined discrete and identifiable public benefits to be protected by levee projects funded by the Delta Special Projects program (Water Code Section 12311(a)) as: urbanized areas, water quality, recreation, navigation, fish and wildlife habitats, highways and roads, utility lines and conduits, and other public facilities.

Delta levees provide significant statewide public benefits by maintaining and protecting habitat, by ensuring the continued existence of the Delta as a place, and by protecting the ripple effects of regional economic activity on the state economy.[54] The economic ripple effects arise from preventing disruptions to the State's economic activity, and from the Delta's role as a hub for water, energy, and transportation infrastructure networks. Financial contributions reflecting these benefits, which generally accrue to all residents of the State, are best collected through general taxes, and by use of the General Fund and general obligation bonds (and ideally federal appropriations as well) to pay for benefits.

[53] However, linear infrastructure owners may not be paying in proportion to the benefits accrued due to the nature of its interconnection with other islands and with the State's economy.

[54] The DLIS Peer Review panel describes the broader economic impacts outside of the Delta in James Mitchell, et al, "Methodology and Scientific Basis to Support the Delta Levee Investment Strategy," Report of the Independent Science Panel Review to the Delta Science Program, July 2, 2015.

The financial mechanisms that target the general public beneficiaries derive revenues from general taxes and general obligation bonds. Consequently, *all* beneficiaries will contribute to these mechanisms. However, the general public would pay the largest share, even if the revenues collected may not be proportionate to cost responsibility for individuals.

Existing Modes of Passing through Public Benefits Funding to Levees Financing

As a conduit for State funding raised through general taxes for public benefits provided by Delta levees, the Legislature established the Delta Special Projects program (Water Code §12310-12318) which provides up to 100 percent state cost share, depending on the level of public benefits.[55] The program is authorized to fund work on all non-project levees in the Delta, but is limited to only funding work on SPFC project levees located in the Primary Zone. Project levees in the urbanized Secondary Zone are provided State cost share through the Urban Flood Risk Reduction (UFRR) program. The types of projects authorized to be funded in the program is the improvement, rehabilitation, or modification of existing levees.

The program statute requires DWR to "seek a sharing of costs with the beneficiaries or owners or operators of the public facilities benefited by the flood protection projects."[56] The Legislature appropriates General Fund or bond funding to the Special Projects program through the annual State Budget process, which is then distributed to local RDs to implement construction of levee projects.

In addition to the protection of the discrete and identifiable public benefits identified above, the Special Projects program also directs DWR to implement flood control projects on the eight western islands (Bethel, Bradford, Holland, Hotchkiss, Jersey, Sherman, Twitchell, and Webb) and for the towns of Thornton and Walnut Grove.

For some beneficiary groups, such as recreationists or telecommunications infrastructure, the imposition of new fees may be so technically complex and politically tenuous that it is not worthwhile to pursue new mechanisms to collect from these beneficiaries. This applies to upstream beneficiaries such as stormwater and flood control agencies, hydropower operators, and groundwater users in regions receiving water exports. Transaction costs (i.e., design, implementation, collection) would be too high to justify adopting specific mechanisms to recover costs from these beneficiaries. When allocating cost responsibility, it would make sense to consolidate these beneficiaries into the general public beneficiaries' category as a "next best" solution.

The State's cost share for these public benefits would therefore be provided through annual budget appropriations of either General Fund or general obligation bonds to various levee

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[55] The criteria for determining the level of state cost share based on public benefits of each levee project is defined in the Guidelines for the Delta Special Projects program which were updated by DWR in 2014. (See http://www.water.ca.gov/floodsafe/fessro/deltalevees/special_projects/.)

[56] Water Code §12312, added by the Legislature in 1996, Chapter 601.

programs established in the California Water Code (UFRRP, SCFRRP, FSRP, Delta Subventions and Special Projects).

General Fund

California receives income from several sources, including taxes, revenue from the sale of bonds, and from the federal government. The General Fund is essentially the State's checking account and is the source of funding for most State agencies and their programs. The annual State Budget process is the financing mechanism by which the Legislature appropriates taxpayer revenues from the General Fund or approved bonds. The three largest sources of revenue to the General Fund are personal income taxes, sales and use taxes, and corporate income taxes.[57] The State manages the cash needs of the General Fund through a combination of external and internal borrowing,[58]

The amount of revenues collected is determined through statutes and ballot measures approved by statewide voters. The fiscal year 2017-18 budget signed into law by the Governor anticipates collecting $125 billion in tax revenues.[59] According to the State Controller, the corporate income and sales and use tax revenues have been fairly steady since 2004, but personal income taxes have been more variable.[60]

Cost allocation between the State and local districts most likely would rely on the method currently used for state contributions, the separable costs / remaining benefits approach. Revenue capacity and generation potential are high given that the funds come from the entire state economy, but is unreliable in terms of receiving consistent amounts due to changes in political priorities as new legislators and Governors are elected.

General or revenue bonds

Bond financing is a type of long-term financing that the State and local governments use to raise money, primarily for long-lived infrastructure assets and major capital outlay projects, such as levees. This is done mainly because these facilities are difficult to pay for all at once and provide services over many years, thus benefitting multiple generations of taxpayers over the life of the infrastructure. In contrast, funds to operate facilities or deliver services to the public are typically paid out of current revenues (General Fund).[61]

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[57] State Controller, "State Finances 101," http://www.sco.ca.gov/state_finances_101_state_taxes.html, describes state taxes and General Fund.

[58] State Controller, "Cash Management and General Fund Borrowing," http://www.sco.ca.gov/Files-ARD/Cash_Management_June_2012.pdf June 2012.

[59] Department of Finance, "FY 2017-18 Budget Overview," http://www.ebudget.ca.gov/budget/2017-18EN/#/Home.

[60] Ibid.

[61] California Legislative Analyst's Office, "Frequently Asked Questions About Bond Financing," http://www.lao.ca.gov/2007/bond_financing/bond_financing_020507.pdf, February 2007.

The State Treasurer is the State's banker, investor, and lead asset manager, responsible for selling State bonds, including voter-approved bonds, and administers the State's bond program.[62]

The State has traditionally sold two types of bonds: General Fund-supported bonds and traditional revenue bonds. Both are used to finance infrastructure projects, but the difference between the two is that the former are paid off by the General Fund, while the latter are paid off by a designated revenue stream, usually generated by the projects they finance, such as bridge tolls, parking garage fees, or water contract payments.[63] State-issued revenue bonds for the State Water Project to be repaid from water contract payments.

There are two types of General Fund-supported bonds: general obligation (GO) and lease-revenue bonds, which are both applicable to funding levee projects. GO bonds must be approved by a majority vote of statewide voters and repayment is guaranteed by the State's general taxing powers and directly paid for by the General Fund. In other words, the Legislature must make room in the annual budget to pay the added debt service of GO bonds; therefore, each new dollar of bond debt payment comes at the expense of State funding that would otherwise be allocated to another program area such as education, health, social services, transportation, fish and wildlife, prisons, and other statewide interests. Lease-revenue bonds are approved by the Legislature and paid off by lease payments. They do not require voter approval and are not guaranteed by the State Budget (General Fund), so require higher interest rates to be paid to investors buying these bonds. Historically, lease-revenue bonds have been used to finance higher education facilities, prisons, and state office buildings.[64]

Funding infrastructure projects through bonds is costlier than approving a large General Fund appropriation due to the additional costs of paying interest to bond investors, but these additional costs vary depending on interest rate and period over which bonds must be repaid. Paying the extra cost of using bond financing is often the most fiscally prudent option because the greater expense is outweighed by the benefits of having projects in place sooner.[65] This is particularly true in the case of Delta levees which protect lives, property, statewide interests such as export water supply, utility production and distribution, transportation (vehicles and vessels), recreation, and other public benefits.

A down-side is that bond funding as a source of financing for the State's cost share is not always reliable because it is intermittent and dependent on approval by a majority of statewide voters, which may be difficult if voters are reluctant to incur more State debt. There is additional fiscal uncertainty due to the fact that flood protection bonds must compete for voter approval with other State interests such as schools, parks, prisons, water quality, and wildlife habitat.

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[62] *California Roster*, "Constitutional Officers"http://admin.cdn.sos.ca.gov/ca-roster/2015/pdf/01b-constitutional-officers.pdf, 2015.

[63] Ibid.

[64] Ibid.

[65] Ibid.

Recent bond acts have been issued with little predictive regularity, and with the exception of Proposition 1E approved in 2006,[66] have been directed at a broad range of water, habitat, and other natural resource issues, of which flood control is one small element.[67] As a consequence, funding for flood protection has been contingent on either impending disaster or public support for other issues such as water supply, water quality, and open space preservation.

Unless qualified under the initiative process, placing a bond act on the statewide ballot requires a majority vote of the California Legislature. All general obligation bonds must also be approved by a majority of statewide California voters.

Over the last 15 years or so, general obligation bonds have replaced the General Fund as a source of the State's cost share for levee projects; however, the bonds are paid off through annual appropriations from the General Fund.[68] During this time, multiple water bonds with funding included for flood protection have been approved by voters. The most recent is the passage of Proposition 1, a $7.5 billion water bond with $395 million dedicated to Statewide Flood Management, of which $295 million is specifically allocated for Delta levees. Motivated by levee failures in Louisiana after Hurricane Katrina, in 2006 California voters approved the largest amount for flood protection in two bond measures, $4 billion in Proposition 1E and another $800,000 in Proposition 84. Currently, there is still Proposition 1E bond funding available for Delta levees for another two to three years, with the $395 million in Prop. 1 available after that.

Revenue capacity and generation potential are high given that the funds come from the entire state economy, but are not reliable because placement on the ballot requires action by the Legislature or collection of initiative signatures, and obtaining approval of statewide voters.

Federal financing

This financing mechanism is similar to the State's funding contribution because it requires an annual appropriation by Congress to the U.S Army Corps of Engineers (USACE) through the federal budget process. Funding for Civil Works levee construction program come from the annual Energy and Water Development Appropriation, not the Defense budget, and requires a cost-share from a non-federal sponsor which is the CVFPB in the case of Delta project levees. The process for developing and receiving Congressional approval for levee construction projects is a two-step process that requires three separate votes of Congress and begins when citizens see a need for flood protection, navigation, or other water-related infrastructure and ask the USACE for help. To receive USACE Civil Works funding requires Congress to first vote to authorize and appropriate funding for a feasibility study to examine alternatives and select the levee project that best meets

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[66] CDWR, "Infrastructure Bonds of 2006 (Prop 1E / Prop 84)," http://www.water.ca.gov/sbe/about/ibonds.cfm, retrieved December 1, 2016.

[67] For flood protection allocations, see CNRA, "Proposition 1E Overview," http://bondaccountability.resources.ca.gov/p1e.aspx, retrieved December 1, 2016.

[68] Legislative Analyst, "Frequently Asked Questions About Bond Financing," http://www.lao.ca.gov/2007/bond_financing/bond_financing_020507.pdf, February 2007.

local and national flood protection needs. Once a levee project meets the USACE criteria in a feasibility study that includes a benefit-cost test,[69] then Congress must authorize the project by approval of Water Resources Development Act (WRDA) legislation and then gain subsequent approval for appropriation to fund the federal cost-share for construction in the annual budget process. Federal funding for levee projects would reflect the broad national public interest, including public safety, navigation, the national economy, the ecosystem, and recreation.[70] Once the levee improvement project is completed, the USACE turns over responsibility for maintenance, operation, and liability to the non-federal sponsor (CVFPB).

For the repair of levees damaged in flood events, Congress also approves funding in the annual budget process through an appropriation for Flood Control and Coastal Emergencies.[71] In contrast to the multi-step Congressional authorization of civil works construction projects, non-federal sponsors simply need to apply for emergency repair funding when project levees are damaged in a storm event.

Federal funding for SPFC levee improvement projects or repairs after a flood event has waned in recent years as the USACE has not found that flood protection benefits exceed costs for most project levee improvement.

Revenue capacity and generation potential are high given that federal funds come from the entire national economy, but can be inconsistent due to changing political priorities during the federal budget process.

Water Users and Exporters

Water deliveries through SWP and CVP infrastructure in the Delta rely on the Delta levee system to convey water through Delta channels, to protect the projects' pumping infrastructure, and to act as a barrier against seawater intrusion into the Delta, which protects water quality. There are approximately 1,800 individual diversion intakes in the Delta and approximately 1,100 miles of navigable waterways in the Delta, some of which are used to convey water to the SWP and CVP water export pumps in the South Delta. According to USGS, the Sacramento River Basin typically generates approximately 22 million acre-feet (MAF) annually, with about 11.6 MAF historically used in basin and 6 MAF exported through the SWP and CVP project;[72] however this export volume has been reduced since the implementation of federal biological opinions beginning in 2005. In those parts of the Delta where leveed channels are part of the fresh water conveyance corridor or islands provide a salinity barrier, agricultural and municipal water exporters receive significant

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[69] U.S. Army Corps of Engineers, "Principles and Guidelines," Retrieved June 9, 2016, http://planning.usace.army.mil/toolbox/guidance.cfm?Id=269&Option=Principles%20and%20Guidelines, 2016.

[70] USACE, "Fiscal Year 2017: Civil Works Budget of the U.S. Army Corps of Engineers," http://cdm16021.contentdm.oclc.org/utils/getfile/collection/p16021coll6/id/1571/filename/1572.pdf, February 2016, pp. 58-59.

[71] USACE, "USACE Disaster Operations Public Law 84-99: Flood Control and Coastal Emergency Act (PL 84-99)," http://www.iwr.usace.army.mil/Portals/70/docs/frmp/PL84-99factsheet.pdf, retrieved December 6, 2017.

[72] DPC, Economic Sustainability Plan, Section 4.5 Conclusions.

benefits from levees. Both in-Delta and out-of-Delta water users benefit from Delta levees, although according to the DLIS study, most of the consumptive water use occurs outside of the Delta.

A conveyance channel is a Delta waterway in which a significant amount of water from upstream reservoirs flows through to the SWP and CVP project water export pumps. The State owns all rights to lands comprising natural waterways and channels. The State Lands Commission leases use of those lands for various purposes including for marinas in the Delta.[73] Natural watercourses in the Delta would flow in the natural direction; conveyance from the reservoirs to the export pumps has changed the direction of the flow, changing the natural water course.

Flood protection benefits to water users located outside of the Delta take the form of avoided economic damages. Depending on the duration of disruption and the availability of alternative water supplies, levee breeches can disrupt water exports, which can have impacts outside of the Delta (damaged crops, reduced municipal supplies, and overdrafting of groundwater supplies). Both hydrologic modeling and real-world events such as the Jones Tract levee failure in 2004 indicate that the benefits of avoiding expected economic losses outside the Delta are large relative to the benefits to Delta island residents.

Flooding of Delta islands has the potential to increase evaporative losses of fresh water and increase salinity to levels unsuitable for agricultural and municipal use, which could disrupt water deliveries through the Delta. Therefore, agricultural and municipal water exporters receive significant benefits from levees and drainage.

Water exporters do not currently pay directly to maintain Delta levees; however, the Delta Special Projects program specifically requires DWR to seek cost-share funding from public facility owners or operators,[74] such as the SWP and CVP. Because water exporters generally do not own property within reclamation districts,[75] they do not make direct payments to reclamation districts. Their customers (who are the actual beneficiaries, not the agencies conveying the water because they do not have an independent economic stake) make the same contributions as the rest of the general public through state and federal funding. Financing mechanisms other than assessment districts would be needed in order to collect the requisite revenues from water exporters and their customers. The magnitude of the potential benefits should be further evaluated with specific analysis of the different ways that levees affect water quality and exports before determining the amount of any user fee or impact charge.

In-Delta water users and dischargers also benefit because they use the water moving through the channels to either irrigate crops or consume for municipal purposes, or to receive excess seepage, floodwaters or wastewater discharges, but they are already contributing funding for levee projects and drainage through property assessments paid to RDs. Nevertheless, one step in the

[73] Public Resources Code Section 6501.

[74] Water Code Section 12312.

[75] And even when they do, the assessed value likely is substantially less than the benefits to water exports from the levees.

implementation phase will be disentangling the flood and water-use benefits, and determining if it is feasible and/or desirable to charge these beneficiaries separately from existing assessments.

Upstream dischargers and flood management agencies also benefit from the use of Delta levees, which receive their flood flows and stormwater discharges. As discussed previously, measuring their benefits through impacts on Delta levees may be too technically difficult to justify imposing a water-use fee.

Delta water user fee: This fee would reflect benefits received by *in-Delta water users, water exporters, and upstream dischargers*.[76] To capture these benefits, all significant users of Delta water could be charged a fee based on the amount of water diverted from or discharged into Delta waters. The user fee would be for general use of Delta waters. Notably, in-Delta water users already pay for drainage and levee operation, maintenance, and improvements; and also return water into the system from drainage pumping, so any such fee would have account for those payments. This would be consistent with SWRCB practice to charge diverters in specified situations.[77] Revenue could be distributed to DWR for disbursal, similar to the Special Projects and Subventions programs, or could be distributed directly to the appropriate RDs.

The State Legislature would establish the fee through a majority vote. Imposing the fee may require amendments to the Federal and State water project contracts.

Recognizing the exclusion of in-Delta water users, determining the amount of this fee would require an in-depth understanding of exporting agencies' water contracts and collection of information from the SWRCB regarding the number and size of water supply intakes and discharge pipes in the Delta as well as information regarding their annual diversion or discharge amount.

A Delta Water User Fee would be subject to the requirements of Proposition 26 which requires the charge to be reasonably related to the underlying costs of providing the service.

State Water Project (SWP)/Central Valley Project (CVP) Water Conveyance Fee or Charge

The conveyance fee is for moving water through the Delta from the Sacramento River watershed to the Clifton Court Forebay and Barker Slough. A conveyance fee would be for providing the passage of water from project reservoirs to the California Aqueduct, Delta-Mendota Canal and North Bay Aqueduct, just as a natural gas pipeline charges for conveying gas from wells to a city-gate. The fee or charge would be imposed only for certain channels deemed important to conveyance; it would not be Delta-wide. The channels important to conveyance would be identified through empirical analysis. The fees or charges likely would vary among channels.

This water conveyance fee or charge can take one of two forms, a user fee or a lease payment, which differ in their legal basis and institutional treatment. Creation of either the user fee or the

[76] To the extent benefits can be evaluated and measured.

[77] SWRCB, "Fiscal Year 2016-17 Fee Schedule Summary," Water Lease Annual Fee and Water Least Application, http://www.waterboards.ca.gov/waterrights/water_issues/programs/fees/docs/fy1617_finalfeeschedulesummary.pdf, retrieved December 1, 2016.

lease payment would require a majority vote of the State Legislature. The Federal and State Water Project contracts would also likely need to be amended. The revenue capacity and generating potential could be large, given the economic value associated with water exports.

Export Conveyance Fee

A user fee is simply a state-imposed charge for the use of a resource without specific linkage to how resources relate to each other. The State may not be explicitly claiming a property right to the resource and the State is not establishing a contractual relationship with the user of the resource.

As a user fee, it would be subject to Proposition 26. Cost allocation would be based on the cost of service, per Proposition 26, rather than on relative benefits.

Export Conveyance Lease Payment

A lease payment is a rental payment specified in a contractual agreement—a lease—for use of a resource. In this case, the resource is the Delta channels and the supporting levees on both sides of the path SWP and CVP water travels to the export pumps in the South Delta. Both the SWP and CVP have reservoirs upstream and the California Aqueduct/Delta Mendota Canal downstream, for which they have paid, but they have not directly invested in the infrastructure in the middle, namely the Delta channel levees.[78]

The State owns the natural channels in the Delta, including the channel bottoms. The levees are owned by the RDs in general, although there is a mix of ownership, including private landowners and the CVFPB. Since the State Lands Commission manages state lands under the Public Trust Doctrine, it could potentially administer a Delta channel lease payment for the maintenance of levees on both sides of channels SWP and CVP water travels to the export pumps in the South Delta.[79] The legal basis for this lease would be the same as that for the existing Tideland Oil & Gas Lease administered by the State Lands Commission.[80] Similar examples include Delta marinas, which currently pay leasing fees to the Commission for use of their docks and berths, and Diablo Canyon Power Plant, which pays for a tidelands lease for its cooling structure. As with leases to Delta marinas, power plant cooling systems and oil producing tidelands, the lease would be for use of the channel bottoms up to the State's property line, as defined in statute. A lease payment for use of the Delta channels would be structured as contractual relationship rather than an intergovernmental transfer.

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[78] The current situation is analogous to a natural gas utility buying gas from various wells in Texas or Alberta and delivering that gas through its distribution system in California, but not paying the pipeline owners, which are separate corporations that ship the gas to California.

[79] "The lands under the Commission's jurisdiction are primarily sovereign (the beds of tidal and navigable waters acquired at statehood in 1850) and school lands (lands granted by the United States to California in 1853 to support the public school system)." See SLC, "Frequently Asked Questions," http://www.slc.ca.gov/About/FAQs.html, retrieved September 8, 2016. See also SLC, "Land Classifications," http://www.slc.ca.gov/Info/Land_Class.html, retrieved September 8, 2016.

[80] See for example, SLC, "Leases and Permits," http://www.slc.ca.gov/Leases-Permits/Leases-Permits.html.

As a lease payment for the use of government property, the Proposition 26 restrictions on fees would not apply. Instead, property-use rates would be tied to fair market value. Lease price could be determined using several methods, with some examples listed in the cost allocation section of the report, or using natural gas utility pricing models such as the one in common use at the Federal Energy Regulatory Commission (FERC).[81] State Lands also has its pricing models for leases. Pricing models would be part and parcel of the next phase of negotiating and choosing which mechanisms are part of the financing portfolio.

Infrastructure Owners and Users

The Delta's contribution to the state's energy network is comparable to its importance to the statewide water delivery systems.[82] Owners of essential infrastructure (e.g., pipelines, railroads and highways) are beneficiaries from levees on certain interconnected islands in the Delta as well as the levee system as a whole. Many contribute funding to Delta RDs, but some do not.

The Delta and Suisun Marsh levees and lands support vehicle and train traffic through a network of crisscrossing inter- and intra-state and state highways, more than 500 miles of major electrical transmission lines, 60 substations, and more than 400 miles of major natural gas pipelines that provide energy throughout Northern California.[83] The Stockton and Sacramento shipping ports are also important to the international delivery of commercial products and agricultural commodities produced in California. The Delta produces 20 percent of California's natural gas-powered electricity and contains the largest natural gas field in the state, as well as the largest natural gas storage facility below McDonald Island. Major electricity transmission lines in the Delta interconnect California and the Pacific Northwest and carry about 10 percent of the peak summer load. Gasoline and aviation fuel pipelines crossing the Delta supply large portions of Northern California and Nevada.[84] These infrastructure facilities are vulnerable to floods, earthquakes, and sea level rise, and require the continued maintenance and improvement of Delta levees.[85]

Owners and end users of these physical infrastructure assets benefit from Delta flood protection in the form of service reliability and avoided infrastructure downtime. The loss of product or service revenues is potentially of greater financial consequence to infrastructure owners than the direct loss of the physical infrastructure; only the latter is recognized in land-based assessments. Because these facilities typically span several islands and tracts, the full benefits may not be fully reflected in the benefits-based assessments administered by local reclamation districts.

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[81] This cost allocation method is not described directly in Appendix B because it is such a narrow application, but it is considered a cost-based method by FERC. See FERC, "Cost-of-Service Rates Manual," Washington, D.C., https://www.ferc.gov/industries/gas/gen-info/cost-of-service-manual.doc, June 1999.

[82] DPC, *Economic Sustainability Plan for the Sacramento-San Joaquin Delta*,, Executive Summary, http://delta.ca.gov/regional_economy/economic_sustainability, January 2012.

[83] DSC, *The Delta Plan*, Chapter 1 Introduction, "Delta by the Numbers,", http://deltacouncil.ca.gov/delta-plan-0, 2013.

[84] Ibid.

[85] DPC (2012), op. cit.

On the other hand, ownership and regulation of these facilities varies, so that each type of infrastructure would require a different user fee. Additional challenges to imposing comparable fees across different forms of linear infrastructure (e.g., electricity transmission lines, natural gas pipelines, roads, and railroads) include creating commensurate metrics (e.g., is a mile of railroad equal to a mile of transmission?) and coordinating fees across multiple reclamation district jurisdictions. The California Public Utilities Commission (CPUC) regulates privately owned electric, natural gas, communications, water, railroad, rail transit, and passenger transportation providers. Their revenue collection mechanisms could be used as models; however, pursuing such a complex portfolio of mechanisms when the prospect for additional revenue generation potential is relatively small given that most of these entities already pay assessments to the RDs would require further analysis of the relative net benefits if this mechanism was explored.

For publicly-owned facilities such as highways, the added challenge of collecting fees from millions of individual users suggests that these beneficiaries may need to be covered by additional State funding. For transmission lines and pipelines, further research is needed to examine the additional revenue potential from a user fee compared to the revenues collected from assessments, as well as to evaluate the transaction costs of developing and administering such a fee.

Delta Flood Protection Fee

One potential solution to collecting revenues from linear infrastructure beneficiaries could be to impose a Delta Flood Protection Fee. This prospective mechanism would be a State-administered property-based charge that would apply to a broader set of beneficiaries including all users of Delta water, and infrastructure owners that are not currently paying reclamation district assessments. The basis for the fee could depend on the beneficiary type and be implemented in a manner akin to the State Responsibility Area Fire Protection Fee.[86] Most importantly, an equitable approach would suggest that property owners' payments of assessments or other water user fees would be deducted from the Delta Flood Protection Fee, as is done with the Fire Prevention Fee.[87] Consequently, landowners within reclamation district boundaries would be exempt. The agency that could administer such a fee has not been determined, but the disbursement of levee project funding would probably be similar to the role CalFire has in addressing fire risk reduction projects.

As with the SRA Fire Prevention Fee, this revenue collection mechanism would require the approval of new state legislation adopted by either a majority or two-thirds vote.[89] A Flood Protection Fee could be subject to a protest by property owners, as provided by Proposition 218, depending on how the fee was adopted by the Legislature.

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[86] The State Responsibility Area (SRA) Fire Prevention Fee was enacted by Assembly Bill X1 29 in July 2011 after several destructive wildfires. The law approved the new annual Fire Prevention Fee, which applies to all habitable structures within the SRA. The fee is charged to property owners in the rural foothills that are considered to be particularly vulnerable to wildfires, but often do not have sufficient local resources to fight these fires effectively. The fee was a $152.33 per habitable structure before being rescinded in the state's Fiscal Year 2017-18 budget. See "About the Fire Prevention Fee," http://www.firepreventionfee.org/

[87] The exemption is implemented in the Fire Prevention Fee as a fixed amount per structure. The Delta Flood Protection Fee could use a more precise method that differentiates between individual contributions.

The Delta Flood Protection Fee could be assessed on a structure or parcel basis. Cost allocation most likely would follow the cost-based method mandated by Proposition 26. The Flood Protection Fee would generate moderate additional revenue, based on the experience to date with the Fire Prevention Fee.

If mechanism is designed to be similar to the SRA fee, then there is significant exposure to legal challenge from property owners and the Howard Jarvis Taxpayer Association (HJTA) which filed a lawsuit against implementation of the SRA fee.[88] In addition, local fire districts have expressed concern that the statewide fire prevention tax has harmed their efforts to raise property assessments for local fire protection services if landowners vote no on Proposition 218 ballot measures due to their false perception that the SRA fee revenues are distributed to local fire districts.[89] However, recent enactment of the Fire Prevention Fee and the adoption of the San Francisco Bay Restoration Authority parcel tax in June 2016 demonstrate the political feasibility of these types of parcel taxes.

Summary of Potential Mechanisms and Associated Beneficiaries

Table 7-1 summarizes the set of feasible financing mechanisms that resulted from the screening process conducted in this Study. The table indicates which beneficiaries would be paying the levy or charge under each mechanism.

- An “X” highlighted in pink indicates that a mechanism is directly applicable to that beneficiary group and could feasibly collect funds in a proportionate manner to cost responsibility.
- An “AB” highlighted in aqua indicates that a feasible mechanism is directly applicable to that beneficiary group, but that it may be too administratively burdensome to collect fees from that specific group; due to the transaction costs of implementing the mechanisms and collecting the revenues likely being too high to justify adopting such a mechanism for these beneficiaries.[90] Instead, cost responsibility for these groups would be allocated to the general public funds.
- The grey-highlighted squares indicate that under the public benefits financing mechanisms, all beneficiaries would pay some amount due to the broad revenue base of those mechanisms, but that amount is not proportionate to the beneficiary-pays principle; and
- The green-highlighted cells with a “%” indicate the beneficiaries targeted with general tax mechanisms that would pay a large share relative to their realized benefits, but that

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[88] The basis of the HJTA lawsuit is revenues paid by landowners is used to fund fire prevention activities on other properties and is therefore a tax, not a fee. A tax requires approval by 2/3 of the Legislature, but the SRA fee was only approved by a simple majority. This issue has not been resolved because the state rescinded the SRA fee in the 2017-18 budget.

[89] FireTaxProtest.org.

[90] The rationale for the rejection of these mechanisms is discussed further in Appendix F.

the revenues collected may not be proportionate to cost responsibility for specific individuals due to the issues surrounding public goods discussed earlier in this report.

Table 7-1 Identified Feasible Financing Mechanisms Matched to Beneficiaries

MECHANISMS / BENEFICIARIES	Property-related	Assessment district	Delta Flood Prevention Fee	User Fees	Delta water user fee / AF	SWP/CVP Water Conveyance	Water conveyance "capacity"	Public benefits financing tools	General Fund	General/revenue bonds	Federal financing
Delta Resident Personal			AB						%	%	%
Delta Commercial & Residential Property Owners		X	X								
Delta Public Facilities		X	X								
Delta Schools											
Local Economy									%	%	%
Agricultural Water Users											
In-Delta Ag Operators		X	X		X						
Out of Delta Ag Water			X		X	X	X				
Municipal Water Users											
In-Delta Muni. Water		X	X		X						
Out of Delta Muni.			X		X	X	X				
Infrastructure Owners & Users											
EBMUD		X	X								
Oil and Gas Companies		X	X								
Power plant Owners		X	X								
Electricity Infrastructure Owners		X	X								
Telecommunications Companies		X	X								
Railroad Companies		X	X								
State Highway Users			X								
Ports			X								
Upstream & In-Delta Dischargers											
Wastewater Dischargers					AB						
Stormwater Dischargers					AB						
Hydropower owners									AB	AB	AB
General Public											
Public concerned for									%	%	%
Commercial									AB	AB	AB
Recreation participants									AB	AB	AB
Delta as Place									%	%	%
State and Local Government											
State Government									%	%	%
Local Government									%	%	%
Special Districts									%	%	%
State Economy											
Ripple Effect									%	%	%

Conclusion

Other efforts[91] have documented the major issues and challenges to implementing a long-term funding strategy for flood risk reduction, not only in the Delta, but throughout the State. Recent studies—DWR's *Water Plan*, the *Central Valley Flood Protection Plan*, and DWR's *California's Flood Future Report*—identified the statewide need for more than $50 billion to complete flood management improvements and projects. The 2017 update of the Central Valley Flood Protection Plan includes new revenue collection mechanisms to fund maintenance of SPFC project levees in the Sacramento Valley and Delta, although it does not estimate the expected revenues from those mechanisms.

Currently, only local landowners pay directly for levee improvements and maintenance by assessments or taxes paid on their property. Other beneficiaries of Delta levees are not explicitly recognized, and only pay indirectly for levee benefits to the extent that their taxes contribute to the General Fund. To move to a beneficiary-pays approach, the State would need to estimate the different public and private benefits and collect fees or taxes from the beneficiaries where administratively feasible. As a result, some beneficiaries that currently receive private benefits but do not directly pay for levees could be required to pay. These include water suppliers and users, as well as owners and users of cross-Delta infrastructure.

This Study demonstrates that no single financing mechanism is likely to generate sufficient revenues to pay for the Delta's flood risk management needs consistent with the beneficiary-pays principle. In addition, none is consistent with the recommendation in the Delta Plan to establish a Delta Flood Risk Management Assessment District. It also illustrates the complex challenges of developing revenue-raising approaches within California's existing web of legal and regulatory constraints on fees, taxes, and assessments.

These challenges include identifying the beneficiaries, determining the economic values of their benefits, and finding the best set of financial mechanisms that can collect revenues. The new mechanisms identified in this Study were evaluated at a high level, sufficient to draw broad conclusions about feasibility, but lacking sufficient details to be considered more than conceptual at this point. Additional challenges lie ahead if the State moves forward with further development and evaluation—these include determining the levee improvements needed and associated costs, the benefits derived from such improvements, the time frame of the investments and revenue stream needed to pay for those investments, how to disburse revenues in a manner that ensures those that paid receive benefits commensurate with their level of contribution, and the appropriate government agencies to implement the various financial mechanisms.

Although the principle of "beneficiary-pays" has long been discussed as a basis for paying for water infrastructure (and is the motivation for this Study), the State has not adopted policies or principles for an alternative to bond funding for Delta levees. This Study describes the concept of a beneficiary-pays funding system, with a focus on legal constraints and cost allocation issues, and identifies feasible financial mechanisms for further study.

Figure 7-1 below shows the current financing approach with the existing mechanisms as they apply to the main categories of beneficiaries. Figure 7-2 shows how a beneficiary-pays system could add one of three new fees to the current financing approach to cover more beneficiaries directly. Further quantitative analysis and deliberation among stakeholders will be needed to determine the most appropriate portfolio of mechanisms and how they should be implemented.

Figure 7-1

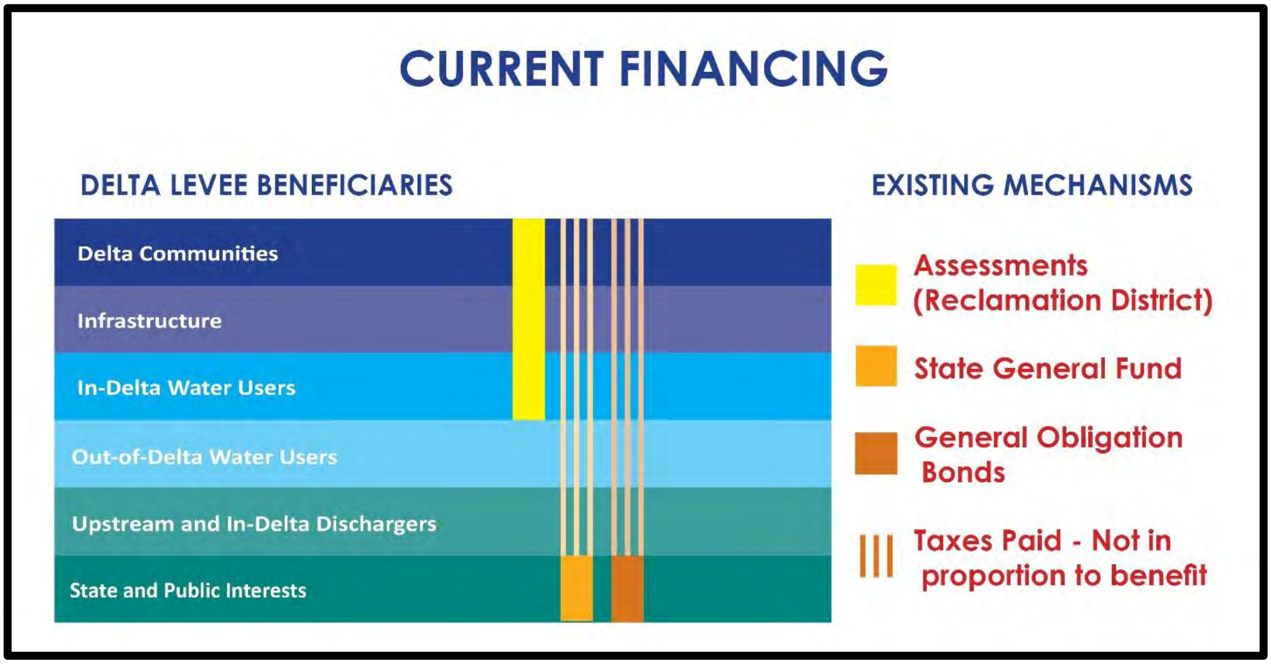
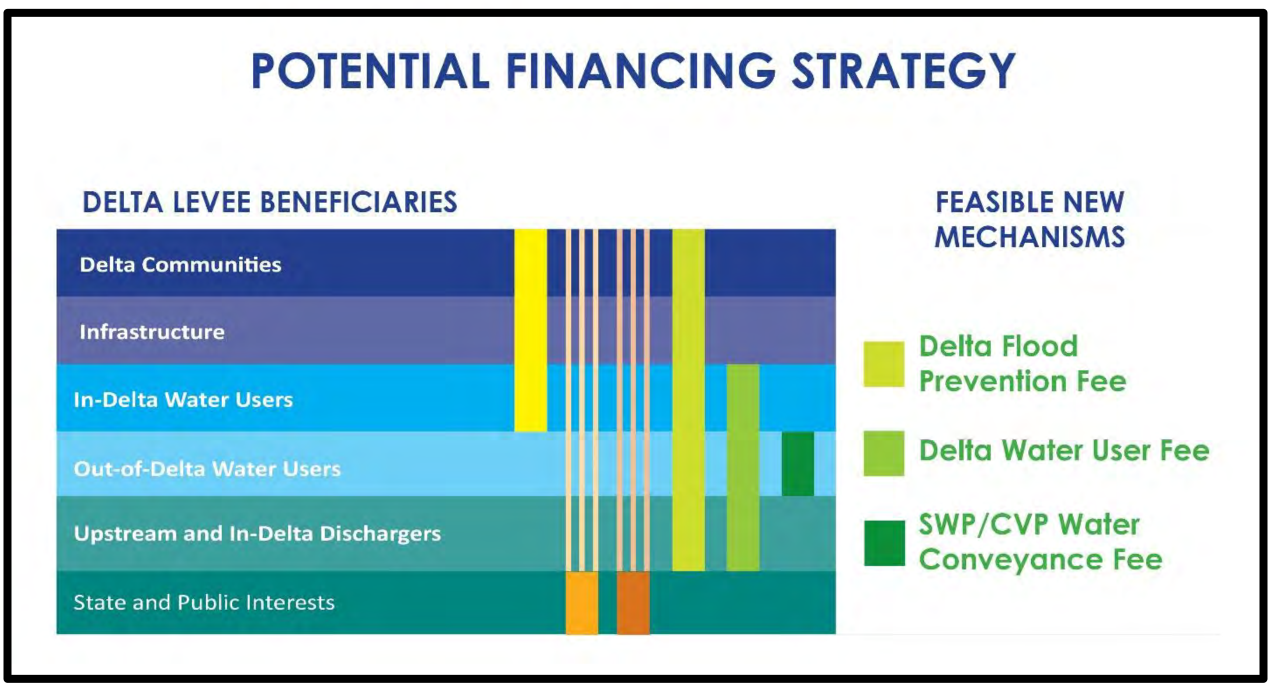


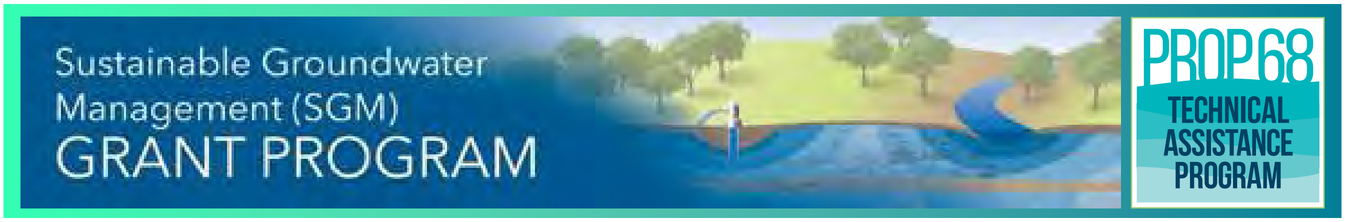
Figure 7-2



This Study does not recommend implementation of any of the preferred mechanisms. Rather, based on the assessment of mechanisms determined to be most feasible to implement a beneficiary-pays-based approach to funding levee work, it identifies the issues which would need further analysis to move forward with implementation. As part of the financing sources currently being evaluated by DWR and the CVFPB, these mechanisms should be considered for further evaluation in the stakeholder process established to develop levee financing mechanisms pursuant to recommendations in the 2017 update of the *Central Valley Flood Protection Plan*. Regardless, adopting any of the new mechanisms will require agreement among key stakeholders that the resulting portfolio of mechanisms will be preferred to the current system.

Plan de Comunicación y Participación

Para la Implementación del Programa de Asistencia Técnica de la Proposición 68 para las Comunidades Tribales y las Comunidades Subrepresentadas



Departmento de Recursos Hídricos de California

PROGRAMA DE SUBVENCIONES PARA LA GESTIÓN SOSTENIBLE DE AGUAS SUBTERRÁNEAS (SGM)

CNRA HQ Building, 715 P Street
Sacramento, CA 95814-0001

Preparado por:

DUDEK
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Santa Barbara, CA 93101
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Propósito del Programa de Asistencia Técnica:

Ayudar al Departamento de Recursos Hídricos de California *(California Department of Water Resources, DWR)* **a implementar la Proposición 68 que incluye las necesidades elegibles, riesgos, evaluaciones de vulnerabilidad y otros servicios de asistencia técnica para las tribus, las comunidades tribales y las comunidades subrepresentadas. Históricamente, no han incluido a las tribus, comunidades tribales y subrepresentadas en los procesos de toma de decisiones. Para los propósitos del programa, las tribus y comunidades tribales incluyen a las tribus nativas americanas reconocidas a nivel federal y a las tribus nativas del estado de California mencionadas en la Lista de Consultas Tribales de California de la Comisión de Patrimonio Nativo Americano** *(Native American Heritage Commission, NAHC)*. **En este documento, se les denomina de forma colectiva como "tribu" o "tribus". (***Las definiciones se analizan a detalle más adelante***). Las comunidades subrepresentadas incluyen a las comunidades desfavorecidas** *(disadvantaged communities, DAC)* **en las que el ingreso medio del grupo familiar** *(median household income, MHI)* **es menor que el 80% del MHI a nivel estatal, a las comunidades gravemente desfavorecidas** *(severely disadvantaged communities, SDAC)* **en las que el MHI es menor que el 60% del MHI a nivel estatal, a los propietarios de pozos domésticos privados, pequeños granjeros/productores, y miembros de las comunidades suburbanas. Las DAC, SDAC, áreas afectadas económicamente, tribus, comunidades desfavorecidas en términos ambientales y áreas suburbanas se denominarán de forma colectiva "comunidades subrepresentadas" y se analizan a continuación.**

Comunidad Disfavorecida

Aquellas con un MHI anual < que el 80% del ingreso medio anual del grupo familiar a nivel estatal (artículo 80002[e] del Código de Recursos Públicos [Public Resources Code]).

Comunidad Gravemente Disfavorecida

Aquellas con un MHI anual < que el 60% del promedio a nivel estatal (artículo 80002[n] del Código de Recursos Públicos).

Área Afectada Económicamente

- Un distrito con una población < a 20,000 personas.
- Un condado rural.
- Una porción razonablemente divisible y aislada de un distrito más grande donde la porción de la población es < a 20,000 personas, con un MHI anual < que el 85% del MHI a nivel estatal y con una o más de las siguientes condiciones:
  1. Dificultad financiera
  2. Tasa de desempleo al menos 2% más alta que el promedio a nivel estatal
  3. Baja densidad poblacional (artículo 79702[k] del Código de Aguas [Water Code])

TRIBUS: Tribus nativas americanas reconocidas a nivel federal y tribus nativas del estado de California mencionadas en la lista de consultas tribales de California de la NAHC se les denomina, de forma colectiva, "tribu" o "tribus".

Tribu Nativa Americana de California

El término "tribus indias estatales" (artículo 79712[a] del Código de Aguas) se refiere a las comunidades indígenas de California, las cuales están en la lista de contacto gestionada por la NAHC, incluidas aquellas comunidades que no están reconocidas a nivel federal, aquellas que sí están reconocidas a nivel federal y aquellas que tienen parcelas, sin importar si son propietarias o no de esos terrenos. Además, debido a que algunas masas de agua y algunos límites tribales cruzan las fronteras estatales, este término puede incluir a las comunidades indígenas de Oregón, Nevada y Arizona que estén afectadas por el agua de California.

Tribus Nativas Americanas Reconocidas a Nivel Federal

Son entidades tribales nativas de Alaska o india americana reconocidas por tener una relación de gobierno a gobierno con los Estados Unidos, con las responsabilidades, poderes, limitaciones y obligaciones que conlleva esa designación, y son elegibles para recibir fondos y servicios de la Oficina de Asuntos Indígenas (Bureau of Indian Affairs).

Comunidades Desfavorecidas en Términos Ambientales

La Agencia de Protección Ambiental de California (California Environmental Protection Agency) designa a las zonas censales que obtienen un puntaje máximo del 25% como DAC. Las zonas censales que obtienen el 5% más alto del puntaje de la carga de contaminación, pero que no tienen un puntaje general en CalEnviroScreen debido a los datos socioeconómicos y médicos imprecisos, también se les designa como DAC (22 zonas censales en la versión 3.0 de CalEnviroScreen de 2018).

Comunidades Suburbanas

Son las que no se ajustan a las definiciones establecidas para las DAC, SDAC o las áreas afectadas económicamente, pero que pueden obtener un puntaje máximo del 25 % en el puntaje de la carga de contaminación o en el de las características de la población con la versión 3.0 de CalEnviroScreen.

Este Programa tiene el objetivo específico de aumentar el contacto, la interacción con estas comunidades y darles oportunidades para tomar decisiones y reducir las necesidades relacionadas con las aguas subterráneas.

1 https://water.ca.gov/work-with-us/grants-and-loans/sustainable-groundwater

Indice

PERSONAL DEL DWR

Kelley List, P.G., Ingeniera Geológica Senior
Programa de Subcención para la Gestión Sostenible de Agua Subterránea

Derek Cheung, Ingeniero Geológico,
División de Asistencia Regional, Oficina de Asistencia Financiera

1. Contexto

En el estado de California, las tribus, las comunidades tribales y las comunidades subrepresentadas se enfrentan a varios retos en relación con el acceso a aguas subterráneas y recursos hídricos limpios, asequibles y sostenibles. Las comunidades tribales y comunidades subrepresentadas se ven afectadas de manera desproporcionada por los retos relacionados con el suministro y la calidad del agua, como la sobreexplotación de las cuencas y la contaminación, que ocurren ya sea por el ser humano o por la naturaleza. Además, los gobiernos locales, estatales y federales no suelen reconocer la importancia cultural tribal del agua y las masas de agua, lo que presenta un reto.

Un fragmento de la Ley de Gestión Sostenible de las Aguas Subterráneas (Sustainable Groundwater Management Act, SGMA) destaca la marginalización y la falta de participación de estas partes interesadas (tribus, comunidades tribales y comunidades subrepresentadas), en particular en relación con las comunidades que dependen principalmente o en gran medida de los suministros locales de agua (como de aguas subterráneas para las necesidades diarias, por ejemplo, beber, cocinar y bañarse) y que están aisladas en áreas del estado que no tienen servicios municipales ni distritos de recursos hídricos. Como reconocimiento de este reto, el Departamento de Recursos Hídricos de California (DWR) lanzó este Programa de Asistencia Técnica ("Programa") para brindar capacitación, contactar y prestar servicios a las tribus, a las comunidades tribales y a las comunidades subrepresentadas. Además, el Programa apoya la implementación de la legislación sobre el derecho humano de acceso al agua del proyecto de ley 685 (Assembly Bill 685), que declara que "es política establecida del estado que cada ser humano tiene derecho al agua segura, limpia, asequible y accesible adecuada para el consumo humano, la cocina y propósitos higiénicos".

Los obstáculos para la inclusión de las tribus, las comunidades tribales y las comunidades subrepresentadas se pueden deber a las barreras en el idioma, a las percepciones culturales sobre las estructuras de gobernación y al conocimiento de las aguas subterráneas, así como también a la incapacidad de las agencias de evaluar e interactuar de forma eficaz con las comunidades por la falta de conocimiento institucional. Por lo tanto, las metas del Programa son identificar a las comunidades que necesitan apoyo y que las contacten, inducir participar a las comunidades para evaluar sus necesidades hídricas y brindar asistencia técnica según las necesidades identificadas.

2. Límites Geográficos

Los límites geográficos de este Programa incluyen cuatro regiones de California, según lo definido por el DWR, de la siguiente manera (véase la figura 1, área del proyecto):

- La región norte de California, que incluye las áreas con los límites de la Oficina Regional del Norte (Northern Regional Office) y la Oficina Regional del Centro Norte (North Central Regional Office) del DWR.
- La región central de California, que incluye las áreas dentro de los límites de los condados de San Joaquín, Stanislaus, Merced, Madera, Fresno, Kings, Tulare y Kern.
- La región costera central, que incluye los límites de los condados de Santa Cruz, Monterrey, San Luis Obispo, Santa Barbara y Ventura.
- La región tribal, que abarcará todo el territorio dentro de California que sea propiedad o esté sujeto a los derechos posesorios de una tribu, el territorio definido como "territorios indios" por el artículo 81(a)(1) del título 25 del Código de Estados Unidos (United States Code) y el territorio que sea propiedad de una entidad tribal o una tribu fuera de la frontera de tales territorios indios.

Figura 1. Área del Proyecto

3. Propósito del Programa

El propósito del Programa es ayudar al DWR a implementar la Proposición 68 que incluye las necesidades elegibles, los riesgos, las evaluaciones de vulnerabilidad y otros servicios de asistencia técnica para las tribus, las comunidades tribales y las comunidades subrepresentadas. Históricamente, no se ha incluido a las tribus, comunidades tribales y comunidades subrepresentadas en los procesos donde se toman decisiones. Para los propósitos de este Programa, las tribus y comunidades tribales incluyen a las tribus nativas americanas reconocidas a nivel federal y a las tribus nativas americanas de California mencionadas en la Lista de Consultas Tribales de California de la Comisión de Patrimonio Nativo Americano (NAHC). En este documento, se las denomina, de forma colectiva, “tribu” o “tribus”. Hay un análisis más profundo sobre estas definiciones abajo. Las comunidades subrepresentadas incluyen a las comunidades desfavorecidas (DAC) en las que el ingreso medio del grupo familiar (MHI) es menor que el 80% del MHI a nivel estatal, a las comunidades gravemente desfavorecidas (SDAC) en las que el MHI es menor que el 60% del MHI a nivel estatal, a los propietarios de pozos domésticos privados, a los pequeños granjeros o productores, y a los miembros de las comunidades suburbanas. Las DAC, SDAC, áreas afectadas económicamente, tribus, comunidades desfavorecidas por el medio ambiente y áreas suburbanas se denominarán en este documento, de forma colectiva, “comunidades subrepresentadas” y se analizarán a continuación.

Comunidad Desfavorecida

Una comunidad con un MHI anual menor que el 80 % del MHI anual a nivel estatal (artículo 80002[e] del Código de Recursos Públicos).

Comunidad Gravemente Desfavorecida

Una comunidad con un MHI anual menor que el 60% del promedio a nivel estatal (artículo 80002[n] del Código de Recursos Públicos).

Área Afectada Económicamente

- Un distrito con una población menor a 20,000 personas
- Un condado rural
- Una porción razonablemente divisible y aislada de un distrito más grande donde la porción de la población es menor a 20,000 personas, con un MHI anual menor que el 85% del MHI a nivel estatal y con una o más de las siguientes condiciones:
  1. Dificultad financiera.
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Tribus Indias Reconocidas a Nivel Federal

Una tribu reconocida a nivel federal es una entidad tribal nativa de Alaska o nativa americana reconocida por tener una relación de gobierno a gobierno con los Estados Unidos, con las responsabilidades, los poderes, las limitaciones y las obligaciones que conlleva esa designación, y es elegible para recibir fondos y servicios de la Oficina de Asuntos Indígenas.

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Comunidades Suburbanas

Las comunidades suburbanas son aquellas comunidades que no se ajustan a las definiciones establecidas para las DAC, las SDAC o las áreas afectadas económicamente, pero que pueden obtener un puntaje máximo del 25% en el puntaje de la carga de contaminación o en el de las características de la población con la versión 3.0 de CalEnviroScreen.

Este Programa tiene el objetivo específico de aumentar el contacto y la interacción con estas comunidades y el apoyo para darles oportunidades para tomar decisiones y reducir las necesidades relacionadas con las aguas subterráneas.

2 https://water.ca.gov/work-with-us/grants-and-loans/sustainable-groundwater

4. Objetivos y Resultados de la Participación de la Comunidad

Este plan de comunicación y participación es una parte del proceso de participación de la comunidad y es un documento vivo. Se actualizará a lo largo del curso del Programa.

Objectivos y Resultados

La participación efectiva e inclusiva del público es vital para que la implementación y los procesos del programa tengan éxito. El objetivo del contacto para este programa es ofrecer, con respeto de la diversidad cultural y en el idioma adecuado, comunicación, contacto e interacción con las comunidades tribales y minoritarias en el área del programa para lograr los siguientes resultados:

1. Identificar y priorizar a las tribus, las comunidades tribales y las comunidades subrepresentadas que necesiten apoyo, y dirigir evaluaciones de necesidades.
2. Contactar e inducir participación de las tribus, las comunidades tribales y las comunidades subrepresentadas para educarlas en los conceptos básicos de la SGMA, sus funciones y las responsabilidades de la Agencia de Sostenibilidad de Aguas Subterráneas (Groundwater Sustainability Agency, GSA) que gobierne su área geográfica. Esto incluirá información sobre la función del Plan de Sostenibilidad de las Aguas Subterráneas o una opción alternativa aprobada que planifique sobre las aguas subterráneas sostenibles en su área geográfica.
3. Contactar e inducir participación de las comunidades tribales y sobrepresentadas para evaluar sus necesidades hídricas en las cuencas designadas por la SGMA.
4. Prestar servicios eficientes, efectivos y que respondan a las comunidades tribales y minoritarias según los resultados de las evaluaciones de necesidades, visitas a los lugares, la información existente y los datos relevantes del DWR y otras agencias locales y estatales, organizaciones no gubernamentales (ONG) y organizaciones basadas en la comunidad (Community-Based Organizations, CBO).

5. Contacto Inicial con las Tribus y Comunidades Tribales

Comunidades Tribales

Sitio Web

El sitio web del DWR es **https://water.ca.gov/Work-With-Us/Grants-And-Loans/Sustainable-Groundwater**. Este es el principal centro de información y material relacionado con este Programa. El sitio web del DWR incluirá una pestaña para que las tribus se comuniquen con la Oficina del Asesor de Políticas Tribales (Office of Tribal Policy Advisor) del DWR en caso de que un gobierno tribal o una comunidad tribal elija participar en las consultas de gobierno a gobierno en cualquier momento de su comunicación con el DWR. El DWR también usará su Gestión Integrada de Aguas Regionales (Integrated Regional Water Management, IRWM), el Programa de Subvención de la SGMA y las listas de suscripción de correo electrónico de la SGMA para enviar actualizaciones e información.

El Equipo del Programa

El equipo del Programa dirigirá el contacto de diferentes maneras, y ha recopilado una variedad de listas de contacto para enviar los correos electrónicos, realizar las llamadas o enviar los correos convencionales iniciales. Estas listas se componen de lo siguiente:

1. Todos los contactos del departamento de salud del condado y de la ciudad.
2. Todos los departamentos de planificación y desarrollo comunitario de la ciudad y el condado.
3. Las CBO y ONG que trabajan con las comunidades minoritarias, incluidas las comunidades de trabajadores agricultores, comunidades de inmigrantes y asociaciones sindicales.
4. Las CBO y ONG ambientales.
5. Las CBO y ONG que trabajan con los problemas y preocupaciones relacionados con el suministro y la calidad del agua.
6. Todos los contactos de la IRWM en el área del Programa.
7. Todos los contactos principales de la GSA (directores ejecutivos, funcionarios electos, líderes asignados) en el área del Programa.
8. Todos los contactos de los distritos escolares en el área del Programa.
9. Todos los contactos de las juntas escolares en el área del Programa.
10. Los funcionarios electos en el área del Programa.
11. Las listas tribales que sirven para comunicarse con las tribus, las comunidades tribales y las ONG tribales.
12. Funcionarios electos por las tribus a nivel estatal.

Contacto Inicial por Escrito

El DWR estableció un proceso de contacto con tribus nativas americanas alineado con sus políticas de interacción tribal, que permiten la comunicación de gobierno a gobierno y la realización de consultas con los gobiernos y las comunidades tribales. De conformidad con el proyecto de ley 52, el DWR gestiona una lista de todas las tribus que han solicitado recibir una notificación de los proyectos en su área geográfica cultural tradicional. Entonces, según lo solicitado, el DWR realiza una consulta con cualquier tribu, proyecto a proyecto. Además, el DWR tiene un proceso de interacción tribal definido, que incluye la notificación de un proyecto de las tribus asociadas de forma cultural y tradicional que se mencionan en la lista de contacto general de la NAHC para áreas geográficas específicas. Por lo general, esta lista coincide con la lista usada en el proyecto de ley 18 del Senado. El objetivo del proceso de interacción tribal del DWR es garantizar que todas las tribus asociadas de forma cultural y tradicional y todas aquellas que la NAHC menciona en la lista tengan la oportunidad de hacer aportes sobre los recursos con importancia para los nativos americanos, que pueden incluir consideraciones sobre los recursos ambientales y culturales.

El enfoque de contacto, comunicación y participación de este Programa es en tres partes. Primero, el equipo del Programa iniciará el contacto con los líderes en las regiones pertinentes de la IRWM para verificar si hay representantes tribales activos con los que el equipo está trabajando y recopilar una lista de los contactos tribales con el propósito de ponerse en contacto e incluirlos en el proceso. Segundo, el equipo del Programa se pondrá en contacto con las GSA y, de forma similar, verificará si hay representantes tribales activos con los que el equipo está trabajando y recopilará una lista de contactos tribales con el propósito de ponerse en e incluirlos en el proceso. Tercero, el equipo del Programa tendrá en cuenta las relaciones existentes con las comunidades tribales y partirá desde los logros conseguidos hasta la fecha con respecto a la comunicación.

Al comienzo de este Programa, el equipo del Programa envió una solicitud para obtener la lista de contacto de las personas y organizaciones tribales de la NAHC que pudieran tener información sobre los recursos de los nativos americanos en toda California. Aunque la NAHC suele brindar información limitada con respecto al área geográfica tradicional de los contactos individuales, se entiende que puede enviar la lista solicitada de forma que los contactos se puedan organizar por condado, lo que permitirá al equipo dirigir un contacto personalizado. La lista de la NAHC y las otras dos listas recopiladas mediante el contacto con la IRWM y la GSA se auditarán, coordinarán y usarán como el área geográfica de referencia para organizar los contactos y para preparar una lista de contacto primaria en Microsoft Excel. Esta lista incluirá la información de contacto pertinente para cada persona u organización al nivel del condado, corroborada con las listas recopiladas mediante el contacto con la IRWM y la GSA. La lista de contacto primaria se usará para facilitar el envío de los correos iniciales sobre las encuestas y el material de contacto, así como también los correos electrónicos y las llamadas telefónicas iniciales y de seguimiento. El equipo del Programa iniciará el contacto con las tribus usando la lista primaria en las áreas geográficas del Programa. El contacto incluirá tres tipos de comunicación: una carta, un correo electrónico y una llamada. Estos medios notificarán activamente a las comunidades tribales sobre el Programa (dirección del sitio web, número de teléfono y correo electrónico de contacto: **SGM_TA@water.ca.gov**, personas de contacto) y sobre el proceso. Las tribus tendrán la oportunidad de solicitar una consulta formal presencial o por Zoom, analizar con el equipo del Programa la Encuesta de necesidades hídricas (que se incluye en la carta, se adjunta mediante un enlace en el correo electrónico y se menciona en la llamada telefónica) o brindar información, identificar las necesidades, dar oportunidades y recomendaciones para sus áreas asociadas tradicionalmente.

El equipo del Programa controlará y mantendrá un registro de los comentarios aportados por las personas y las tribus que respondan. Una vez que el contacto y la comunicación se hayan iniciado, el equipo del Programa dará el tiempo suficiente para que el representante de la comunidad tribal responda; el equipo del Programa hará un seguimiento con una segunda carta, un correo electrónico y una llamada dirigidos al mismo representante después de un periodo de 3 a 4 semanas. Después del segundo contacto, el equipo del Programa dejará pasar 2 semanas y, si todavía no hay una respuesta, identificará un contacto secundario de la NAHC, las regiones de la IRWM, las GSA y cualquier ONG, según lo obtenido en la medida de lo posible. El equipo comenzará el proceso de enviar una carta, un correo electrónico y de hacer una llamada con la misma información y las mismas oportunidades para hablar o, si se prefiere, hacer una consulta formal. Después de esta tercera ronda de contacto (dos al contacto inmediato y una a un posible contacto secundario, o tres al mismo contacto), el equipo del Programa esperará 3 semanas antes del cuarto seguimiento mediante una llamada y un correo electrónico. Para las comunidades tribales que sí elijan un proceso de consulta formal, se prevé que algunos de estos registros de consulta se consideren confidenciales.

6. Contacto Inicial con las Comunidades Subrepresentadas

Comunidades Subrepresentadas

Las comunidades subrepresentadas no suelen formar parte de una ciudad registrada, pero son parte de un área del condado y de una GSA, y lo más probable es que sean parte de una región de la IRWM. Es posible que las comunidades minoritarias no usen el inglés como idioma de comunicación. Para alcanzar a las comunidades subrepresentadas, el equipo del Programa creará material de contacto, que incluye publicaciones en redes sociales, videos (en YouTube y en otras redes sociales), publicidad en radio y material escrito, en diferentes idiomas o dialectos (español, chino tradicional, chino simplificado, tagalo, mixteco, hmong y hmong mien). Algunas lenguas como el mixteco, el hmong y el hmong-mien, no se usarán para la comunicación escrita, como correos electrónicos y cartas, porque el equipo del Programa determinó que se atiende mejor a las comunidades de mixteco, hmong y hmong-mien de otros métodos, como la radio, redes sociales y videos en YouTube (entre otras plataformas de interacción social), junto con el trabajo de la CBO y ONG y las organizaciones religiosas para los anuncios verbales en reuniones habituales o en eventos comunitarios y de contacto que se realizan en las comunidades subrepresentadas.

El equipo del Programa se comunicará de diferentes maneras, dependiendo de la comunidad a la que se esté contactando, el idioma primario y secundario de esa comunidad y sus niveles de educación y alfabetización. Para dirigirse de forma metódica y completa a estas comunidades y usar los sistemas que ya existen, el equipo del Programa ha recopilado una variedad de listas de contactos para el área del Programa que contienen los contactos para enviar los correos electrónicos, realizar las llamadas o enviar los correos convencionales iniciales. Estas listas se componen de lo siguiente:

1. Todos los contactos del departamento de salud del condado y de la ciudad.
2. Todos los departamentos de planificación y Desarrollo comunitario de la ciudad y el condado.
3. Las CBO y ONG que trabajan con las comunidades subrepresentadas s, incluidas las comunidades de trabajadores agricultores, comunidades de inmigrantes y asociaciones sindicales.
4. Las CBO y ONG ambientales.
5. Las CBO y ONG que trabajan con los problemas y preocupaciones relacionados con el suministro y la calidad del agua.
6. Todos los contactos de la IRWM en el área del Programa.
7. Todos los contactos principales de la GSA (directores ejecutivos, funcionarios electos, líderes asignados) en el área del Programa.
8. Todos los contactos de los distritos escolares en el área del Programa.
9. Todos los contactos de las juntas escolares en el área del Programa.
10. Los funcionarios electos en el área del Programa.

Sitio Web

El sitio web del DWR es **https://water.ca.gov/Work-With-Us/Grants-And-Loans/Sustainable-Groundwater.** Este es el principal centro de información y material relacionado con el Programa. El DWR también usará su IRWM, el Programa de Subvención de la SGMA y las listas de suscripción de correo electrónico de la SGMA para enviar actualizaciones e información.

Llamadas Telefónicas Iniciales

La comunicación verbal precederá a la difusión del material escrito mediante llamadas telefónicas a todas las listas mencionadas anteriormente (1 a 9, arriba). La información brindada mediante las llamadas estará relacionada con el propósito del Programa y con el intercambio de la información de contacto. El equipo del Programa controlará y registrará en una hoja de cálculo la siguiente información: la fecha en la que se hizo el contacto por teléfono, independientemente de si alguien contestó o no, el contenido de la charla, el idioma de preferencia, el interés en el Programa y si se hicieron y se respondieron preguntas. La llamada también se usará para medir la relevancia del Programa para la comunidad y para brindar información sobre el sitio web, un contacto de correo electrónico (**SGM_TA@water.ca.gov**), un número de teléfono e información sobre la encuesta. En la medida en que se tenga la intención de tener entrevistas más personalizadas para reunir información y perfeccionar e informar del contacto y la participación, el equipo del Programa organizará entrevistas específicas por Zoom.

Contacto Inicial por Escrito

Después de las llamadas iniciales, se enviará el material escrito a todas las listas (1 a 9). El contacto inicial por escrito implicará la siguiente información:

– Logotipos, carteles, colores e iconografía para cada correo electrónico, volante y publicación de redes sociales
– El contenido del correo electrónico o del volante (en inglés, español, tagalo y chino tradicional y simplificado) dirigido a cada comunidad minoritaria; la coloración y la iconografía serán

claras y respetuosas de la diversidad cultural

– Publicaciones de redes sociales en el idioma adecuado con coloración e iconografía respetuosas de la diversidad cultural

Todo contacto inicial incluirá el anuncio sobre el propósito del Programa, el enlace al sitio web, el contacto de correo electrónico, el número de teléfono y el enlace a la encuesta en el idioma adecuado.

Contacto Inicial por Radio y Video

Se crearán videos para anunciar el Programa (en inglés, español, tagalo, chino tradicional y simplificado, mixteco, hmong y hmong-mien) y se publicarán en redes sociales relevantes y adecuadas (YouTube, Facebook, Twitter, TikTok e Instagram). El equipo del Programa también se comunicará con las estaciones de radio adecuadas en el área del Programa, en particular para las comunidades de español, tagalo, chino tradicional y simplificado, hmong y hmong-mien, para analizar y colocar los anuncios de servicios públicos (public service announcements, PSA) durante los horarios clave de programación. Los PSA iniciales tendrán lugar durante un periodo de 2 meses.

El equipo del Programa supone que el contacto inicial ocurrirá durante 1 mes. Este contacto inicial incluirá lo siguiente:

1. Una ronda de llamadas iniciales y una ronda de llamadas de seguimiento.
2. Dos correos electrónicos de seguimiento
3. Publicaciones de redes sociales actualizadas semanalmente durante 2 meses.
4. Publicaciones de videos actualizadas dos veces por semana durante 2 meses.
5. Publicidades de radio emitidas 30 veces durante 2 meses.

7. Herramientas Actuales de Comunicación para el Contacto y Lugares para Participar

Contacto y Comunicación

Talleres

El contacto y la comunicación persistirán durante todo el Programa y los lugares para participar y las herramientas cambiarán con el tiempo, dependiendo de una serie de factores y del resultado de la encuesta, la cual estará abierta por 2 meses, pero se puede reabrir o reformular según la evaluación y los comentarios. Los factores que influencian los tipos y el cronograma de la comunicación y las oportunidades de participación (por ej., talleres por Zoom frente a talleres presenciales) también dependerán del momento y del contenido de las respuestas de la encuesta, de la necesidad de incluir otros idiomas o dirigirse a más comunidades, de los comentarios de los miembros de la comunidad sobre el tipo y la urgencia de la necesidad, y de los comentarios de las agencias o las CBO u ONG en relación con las necesidades diferenciales y preferenciales.

Al cierre de las encuestas, el equipo del Programa evaluará los resultados y priorizará los talleres presenciales y por Zoom en cada una de las áreas del Programa. Es posible que algunas áreas del Programa no hayan respondido la encuesta y, en estos casos, el equipo del Programa trabajará con el contacto tribal, la GSA u otro representante gubernamental (es decir, gobierno del condado, distrito de recursos hídricos, distrito de servicio comunitario, ONG o CBO) adecuados para programar talleres presenciales o por Zoom en horarios y lugares que consigan un mayor aporte de la comunidad para difundir la información y escuchar los comentarios de la comunidad, y hacer visitas a los lugares.

En las áreas donde se hayan recibido las encuestas, el equipo del Programa preparará un análisis de prioridad y luego trabajará con el contacto apropiado dentro de la comunidad tribal o minoritaria para programar talleres presenciales o por Zoom en horarios y lugares que consigan un mayor aporte de la comunidad para difundir la información y escuchar los comentarios de la comunidad, y hacer visitas a los lugares.

Dependiendo del tamaño y de la ubicación geográfica, puede haber hasta tres talleres presenciales o por Zoom en una comunidad tribal o minoritaria particular. Todos los talleres incluirán hojas informativas y material que respeten la diversidad cultural y de idioma, así como también interpretación simultánea para los idiomas hablados en las comunidades. Todos los talleres presenciales y por Zoom se grabarán y se publicarán en el sitio web del DWR.

Al mismo tiempo que los talleres, el equipo del Programa coordinará visitas a los lugares para recopilar mejor la información y evaluar la necesidad y el alcance de la necesidad de recibir apoyo técnico.

Herramientas de Comunicación

AVISOS PÚBLICOS

Mediante el trabajo con los departamentos de la ciudad y del condado y con las GSA, el equipo del Programa preparará avisos públicos para todos los talleres que se lleven a cabo por Zoom y en persona. Los avisos públicos se publicarán en el idioma adecuado en papel, en línea y en el sitio web del DWR. Los avisos públicos para la publicación en papel o en línea se harán dos veces; el primer aviso se publicará 1 semana antes del taller.

Según la comunidad, los avisos públicos estarán en inglés, español, tagalo o chino tradicional o simplificado.

Redes Sociales y Publicaciones

Las redes sociales se usarán durante todo el Programa. Las publicaciones incluirán contenido por video e información relacionada con el Programa, la encuesta y los anuncios de los talleres. Cuando se usen las redes sociales para anunciar los talleres presenciales o por Zoom, se comenzará con videos y las publicaciones 10 días antes del taller y se actualizarán con la siguiente frecuencia: 1 semana antes del taller, 3 días antes del taller, 1 día antes del taller y el día del taller. Las publicaciones por video en redes sociales estarán en inglés, español, tagalo, chino tradicional y simplificado, mixteco, hmong y hmong-mien. Las publicaciones por Twitter estarán disponibles en español, tagalo y chino tradicional y simplificado.

Material Informativo

El material informativo para el Programa acompañará a todos los talleres públicos, lo que incluye presentaciones, preguntas frecuentes, folletos, diagramas de flujo, material ilustrativo, avisos públicos, volantes y artículos impresos que en su mayoría son iconografías y están dirigidos a las comunidades donde los niveles de alfabetización son diferenciales. Todo el material seguirá la guía de estilo, la coloración, los carteles y el logo estándares acordados para el Programa y todos los logos y colores se usarán de manera tal que se respete la diversidad cultural. Todo el material informativo se traducirá al idioma adecuado: español, tagalo y chino tradicional y simplificado. El equipo del Programa acordó que para las comunidades de mixteco, hmong y hmong-mien serán más útiles los videos y el material pictográfico, así como también los PSA de radio.

Publicidad de Radio

La radio se usará en las etapas iniciales de contacto para comunicar el propósito del Programa y para dar información de contacto, información sobre la encuesta y oportunidades de participación. Los PSA iniciales se realizarán durante 2 meses en las estaciones que sirvan a las comunidades de español, tagalo, chino tradicional y simplificado, hmong y hmong-mien. Los PSA se usarán durante todo el Programa para anunciar las oportunidades de los talleres públicos, ya sean presenciales o por Zoom, y posiblemente para otros momentos importantes clave. Los anuncios se harán durante los horarios clave de programación o de escucha.

Iconografía

El equipo del Programa ha preparado iconografía que se debe usar para identificar fácilmente el Programa y los conceptos que se necesitan transmitir sin usar palabras. Los íconos o la simbología se usarán en publicaciones de redes sociales, correos electrónicos, volantes, folletos informativos, preguntas frecuentes, material de presentación, hojas informativas y otro material relevante del Programa.

8. Análisis y Evaluación

Las herramientas de análisis y evaluación formales e informales, como las encuestas, las charlas en los talleres, los correos electrónicos y las llamadas telefónicas, son todas parte de una comunicación eficaz; estas herramientas se usarán durante todo el transcurso del Programa. La comunicación y la participación serán un elemento permanente para su análisis en cada taller en persona y se incluirán en las comunicaciones que el equipo del Programa envíe a las tribus, comunidades tribales y comunidades subrepresentadas.

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Attachment E - Yolo RCD Scope of Work for CAAP Support

Exhibit A-2

Yolo County RCD Scope of Work in support of Yolo CAAP

Project Description: This scope of work, an addition to Agreement No. 21-112 and Resolution No. 21-68, outlines the Yolo County Resource Conservation District's (RCD) additional scope of work to support Yolo County on the development of a Climate Action and Adaptation Plan (CAAP).

Start Date: November 22, 2022

Completion Date: November 21, 2023

Total Cost to County for this Additional Scope of Work Not to Exceed: $45,287

Yolo County Staff Contact Person: Kristen Wraithwall x.8047

Task Definition and Schedule: See below.

Task 1: Community Engagement and Equity Strategy

Engagement with farmers, farm workers, private landowners, the Yolo County Farm Bureau, and the agricultural industry and other ag groups (including through direct outreach, interviews, and/or the facilitation of focus group meeting(s)), to ensure their needs and priorities are incorporated into the CAAP effort. This engagement would be guided by the Yolo Resource Conservation District (RCD), with support from County Staff, CivicSpark Fellows (admin support), and consultant team. At least 14 Monthly working group meetings (1 hour each + 2 hours prep and follow up) + a possible round table.

Timeline: Working group formation November – December 2022, Outreach/engagement January – December 2023, Gathering feedback on the draft plan, January - March 2024 (end of time frame).

Estimated hours: 14 meetings x 3 hours = 42 hours for Kate Reza; 20 hours for working group formation effort plus 1 hour/meeting for 7 meetings = 27 hours for Heather Nichols

Cost: $7,230

Task 2 (CAAP Task 3): Develop Reduction Strategies

With consultant support, lead the development of an inventory of natural and working lands emissions by type to complement the GHG inventory update. Develop an overview of current natural and working land management practices sequestering carbon in the County to acknowledge work already taking place by including a public benefit communications section to report multi-benefits include recharge, food security, and cost savings of management, etc. Through Working

Group, develop a suite of carbon sequestration strategies, considering measures such as regenerative agriculture and stewardship and ensure compatibility with the rest of the CAAP. Optional (not budgeted): assess countywide potential for sequestration based on land use and abiotic factors, like topography.

Timeline: November 2022 – November 2023

Estimated hours: 52 weeks x 3 hours/week = 156 hours for Kate Reza; 32 hours for Heather Nichols

Cost: $18,120

Task 3 (CAAP Task 4): Develop Climate Vulnerability Assessment and Adaptation and Resilience Strategies

Contribute to the development of measures to support adaptation and resilience strategies that relate to natural and working lands including regenerative agriculture and open space, transportation and infrastructure, land use and buildings, regional strategies, ecological health, water supply, flood, fire, air quality and wildfire smoke and local food and food hubs. Consultant will provide overall framework for presentation.

Timeline: June 2023 – December 2023.

Estimated hours: 7 months x 3 hours/week = 84 hours for Kate Reza; 2 hours/month = 14 hours for Heather Nichols

Cost: $9,660

Task 5 (CAAP Task 7): Final CAAP

Drafting specific sections and reviews final ag chapter language.

Timeline: September 2023 – March 2024

Estimated hours: 8 hours/month x 7 months = 56 hours for Kate Reza; 7 months x 1 hour/month = 7 hours for Heather Nichols

Cost: $6,160

Heather Nichols, Executive Director, hourly rate: $120
Kate Reza, Program Manager, hourly rate: $95

Total Cost Estimate: $41,170; With 10% contingency: $45,287

11/1/2022

Heather Nichols, Executive Director
Yolo County Resource Conservation District

Date

11/1/2022

Taro Echiburu, Director
Yolo County Department of Community Services

Date

Attachment F - Presentation on Yolo County Agricultural Conservation Priority Plan

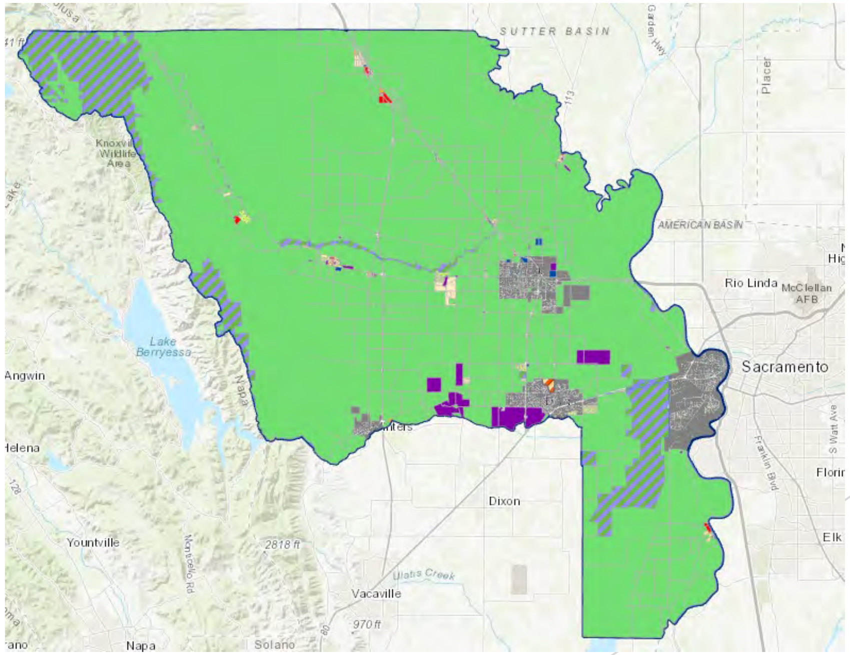
Yolo County Agricultural Conservation Priority Plan

Charlie Tschudin
Natural Resources Planner
November 2022
Charlie.Tschudin@yolocounty.org
(530) 666-8850

Background

- Yolo County 2030 Countywide General Plan
- Yolo County Strategic Plan 2020-2025 goal of Flourishing Agriculture
- Topic of Agricultural Preservation includes success metric of number of agricultural acres permanently protected
- Department of Conservation Sustainable Agricultural Lands Conservation Program (SALC) – land use planning grants
  - Yolo County applied in 2020 SALC grant cycle and awarded funding to develop plan.

- Policy AG-1.14:
- *Preserve agricultural lands using a variety of programs, including the Williamson Act, Farmland Preservation Zones (implemented through the Williamson Act), conservation easements, an Agricultural Lands Conversion Ordinance and the Right-to-Farm Ordinance.*



Anticipated deliverable

- Study on projected agricultural land use conversion;
- the effect of farmland conversion on greenhouse gas emissions;
- Analysis agricultural areas best suited for potential permanent preservation; and
- Strategic plan that will guide the County and its partners in implementation of a publicly-administered mitigation bank.

- *The resulting study will support the policies in the Agriculture and Economic Development Element of the 2030 Countywide General Plan that call for preserving agricultural lands using a variety of programs, including conservation easements, by complementing the County's participation in the Williamson Act program, in addition to other policies aimed at encouraging targeted acquisition of agricultural conservation easements on parcels most threatened by development.*

Outreach to-date

- Yolo County Farm Bureau
- Yolo Land Trust
- Yolo Habitat Conservancy
- Yolo County Dept. of Agriculture
- Yolo County Dept. of Community Services
- Yolo County Administrator's Office
- Four incorporated Cities

- Next Steps
  - Consultant staff finalizing draft plan and fact sheet for public review and comment period (December 2022)
  - Consultant will incorporate feedback into plan
  - Staff introduce final plan to Yolo County Board of Supervisors in Spring 2023

Attachment G – Long Range Calendar

Yolo County Climate Action Commission

Long Range Calendar 2022

UPDATED – November 23, 2022

Month	Topics
February	Early Action Prioritization CAAP Working Groups
March	Ad-Hoc Working Group Meets CAAP Scope of Work Update Review Early Actions with Associated Budgets (Part I) Consider recommending the Board endorse Climate Safe California
April	Ad-Hoc Working Group Meets Review Early Actions with Associated Budgets (Part II) Presentation on Climate Action Efforts in Yolo County
May	Ad-Hoc Working Group Meets CAAP Scope of Work for Request for Proposals (Part I) Future Working Group Development Commission's Roles in State/Federal Advocacy
June	(BOS Consideration of First 6 Early Actions) CAAP Scope of Work for Request for Proposals (Part II) Eligibility Criteria for Yolo Agricultural Retrofits Early Action Project Early Action Grant Strategy Communication Plan Update
July	Presentation on MíoCar EV Ridesharing (BOS Consideration of Early Action Grant Strategy) (Release of CAAP Request for Proposals)
August	Presentation/Introduction from Yolo Resource Conservation District Next-Steps for Working Groups Compensation for Public Meeting Participation
September	Presentation on UC Davis Sustainability/CAP Update Climate Action and Sustainability Website Beta-Test Launch CAAP Working Group(s) (Presentation at California Climate and Energy Collaborative Forum)
October	(Commission Chair Update to BOS)
November	(Contract for CAAP to BOS) (RCD Scope of Work for CAAP Support to BOS) (Compensation Policies to BOS) Update on Yolo County Agricultural Conservation Priority Plan
December	CAAP Kickoff and Introduction from Dudek Update on UC Davis Sustainability Efforts
In 2023	Creation of a Working Group to Find Grant Opportunities Best Practices for Evaluating the Climate Impact of Proposed Development Projects Exploring Collaborations with Universities and Other Jurisdictions Discussion on Food Security, Food Systems, and Food Waste Presentation from Yolo Integrated Waste Management Discussion on Wildfire Safety Emissions Reductions Opportunities