Sustainability Roadmap 2018-2019:

Climate Change Adaptation

Progress Report and Plan for Meeting the Governor's Sustainability Goals for California State Agencies

Agency Name

Edmund G. Brown Jr., Governor

Replace with Agency seal

December 2017

Department Name
Sustainability Road Map 2018-2019: Climate Change Adaptation

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- Do not modify Styles (e.g., do not modify "Normal" font).
- Do not add an extra space between paragraphs or before a heading title.
- Use one space (not two) after each period.
- Use "Table Title", "Table left", and "Table right" styles for content in tables.
- Use "Caption" Style for table and figure captions. Table captions go above the table. Figure captions go below the figure.

Note on nomenclature

In an effort to keep nomenclature consistent across all Energy Reports, please use the following and the acronyms included in the Acronyms appendix:

- Define each acronym the first time you use it (including CA!). Use the acronym for the rest of the document as opposed to switching back and forth between the acronym and the fully spelled out name.
- …

Note on significant figures

Use correct significant figures when reporting numbers in this report, and round appropriately to ensure meaningful numbers. Consult these resources for additional guidance on significant digits and rounding:

http://chem.libretexts.org/Core/Analytical_Chemistry/Quantifying_Nature/Significant_Digits

https://en.wikipedia.org/wiki/Significant_figures

- Numbers in the millions should be presented using the word "million":
  - $20 million – not "$20M" or $20,000,000"

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TABLE OF CONTENTS

Page

Table of Contents ii

List of Tables ii

Acronyms ..... **Error! Bookmark not defined.**

EXECUTIVE SUMMARY 1

SUSTAINABILITY GOALS 2

Executive Order B-30-15 2

Legislative Direction 2

State Resources and Guidance Documents 3

Climate Change Adaptation 4

Climate Change Risks to Facilities 4

Understanding Climate Risk to Existing Facilities 4

Understanding the Potential Impacts of Facilities on Communities 9

Understanding Climate Risk to Planned Facilities 11

Integrating Climate Change into Department Planning and Funding Programs 12

Measuring and Tracking Progress 13

SUSTAINABILITY MILESTONES & TIMELINE 14

DEPARTMENT STAKEHOLDERS 15

LIST OF TABLES

Page

Table 1: Top 5 Facilities Most Affected by Changing Temperature 6

Table 2: Five Facilities that Will Experience the Largest Increase in Extreme Heat Events 6

Table 3: Facilities that Will be Most Impacted by Projected Changes in Precipitation 7

Table 4: Facilities at Risk From Rising Sea Levels 8

Table 5: Facilities located in disadvantaged communities 10

Table 6: Facilities Located in Urban Heat Islands 10

Table 7: Climate Risks to New Facilities 11

Table 8: Extreme Heat Events and New Facilities 11

Table 9: New Facilities and Disadvantaged Communities and Urban Heat Islands 11

Table 10: Integration of Climate Change into Department Planning 12

Table 11: Engagement and Planning Processes 12

Table 12: Climate Change in Funding Programs 13

Acronyms

AB	Assembly Bill
EHT	Extreme Heat Threshold
EO	Executive Order
GCM	Global Circulation Model
GHG	Greenhouse Gas
RCP	Representative Concentration Pathway
SB	Senate Bill

EXECUTIVE SUMMARY

Please provide a one to two page executive summary of the information presented in this report, signed by the department Executive Director. Include a description of the Department, its primary mission and functions, building portfolio and the status of those buildings, challenges, and efforts underway to meet the sustainability objectives.

Executive Director Signature

_____

Executive Director Name
Executive Director

SUSTAINABILITY GOALS

The Governor has directed California State Agencies to demonstrate sustainable operations and to lead the way by implementing sustainability policies set by the state. Sustainability includes the following general initiatives:

- Greenhouse Gas Emissions Reductions
- Climate Change Adaptation
- Building Energy Efficiency and Conservation
- Indoor Environmental Quality (IEQ)
- Water Efficiency and Conservation
- Monitoring Based Building Commissioning (MBCx)
- Environmentally Preferable Purchasing (EPP)
- Financing for Sustainability
- Zero Emission Vehicle (ZEV) Fleet Purchases
- Electric Vehicle Charging Infrastructure
- Monitoring and Executive Oversight

The Governor has issued numerous executive orders directing sustainable state operations. The order relevant to climate adaptation is:

Executive Order B-30-15

EO B-30-15 declared climate change to be a threat to the well-being, public health, natural resources, economy, and environment of California. It established a new interim statewide greenhouse gas emission reduction target of 40 percent below 1990 levels by 2030, and reaffirms California's intent to reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050. To support these goals, this order requires numerous state agencies to develop plans and programs to reduce emissions. It also directs state agencies to take climate change into account in their planning and investment decisions and employ life-cycle cost accounting to evaluate and compare infrastructure investments and alternatives. State agencies are directed to prioritize investments that both build climate preparedness and reduce GHG emissions, prioritize natural infrastructure, and protect the state's most vulnerable populations.

Legislative Direction

Several pieces of legislation were signed in 2015-16 that codified several elements of the EO. These include the following:

- Assembly Bill (AB) 1482 (Gordon, 2015): Requires that the California Natural Resources Agency (CNRA) update the State's adaptation strategy, Safeguarding California, every three years. Directs State agencies to promote climate adaptation in planning decisions

and ensure that state investments consider climate change impacts, as well as the use of natural systems and natural infrastructure. (Public Resources Code Section 71153)

- Senate Bill (SB) 246 (Wieckowski, 2015): Established the Integrated Climate Adaptation and Resiliency Program within the Governor's Office of Planning and Research to coordinate regional and local efforts with state climate adaptation strategies to adapt to the impacts of climate change. (Public Resources Code Section 71354)
- SB 2800 (Quirk, 2016): Requires State agencies to take the current and future impacts of climate change into planning, designing, building, operating, maintaining, and investing in state infrastructure. CNRA will establish a Climate-Safe Infrastructure Working Group to determine how to integrate climate change impacts into state infrastructure engineering. (Public Resources Code Section 71155)

State Resources and Guidance Documents

California has invested significant resources in understanding the risks of climate change to the State and actions available to respond to and reduce these risks. These include the following:

- **Safeguarding California**: The State's climate adaptation strategy organized by sector. Each sector identifies risks from climate change and actions to reduce those risks.
- **Safeguarding California Implementation Action Plans**: Directed under EO B-30-15, the Implementation Action Plans outline the steps that will be taken in each sector to reduce risks from climate change.
- **Building a Resilient California**: Prepared under direction of EO B-30-15, this document provides a framework for State agencies to integrate climate change into planning and investment, including guidance on data selection and analytical approach.
- **California's Climate Change Assessments**: California has completed three comprehensive assessments of climate change impacts on California. Each assessment has included development of projections of climate impacts on scale that is relevant to State planning (i.e., downscaled climate projections). These data are available through Cal-Adapt, an online data visualization and access tool.

CLIMATE CHANGE ADAPTATION

Executive Order B-30-15 directs State Agencies to integrate climate change into all planning and investment. Planning and investment can include the following:

- Infrastructure and capital outlay projects
- Grants,
- Development of strategic and functional plans,
- Permitting,
- Purchasing and procurement,
- Guidance development,
- Regulatory activity,
- Outreach, and education.

This template will focus on the first three of these activities, and follows the guidance created by the Technical Advisory Group developed under EO B-30-15 to assist State Agencies to complete this task. If appropriate, please consider the last five activities in your Roadmap.

Facility climate risk data should be included in Facility Data Sheets as indicated.

Climate Change Risks to Facilities

For all infrastructure, it is important to assess the risk that a changing climate poses to an asset or project (e.g., sea level rise or increasing daily temperatures). It is also important to recognize the impact that an infrastructure project has the surrounding community and the impacts on individual and community resilience (e.g., heat island impacts).

To determine how to consider climate change for a given project or plan or existing infrastructure, this department will consider the following screening questions.

1. What is the lifetime of the facility, planned project or plan?
2. Could it be affected by changing average climate conditions or increases in extreme events over its lifetime?
3. What is the consequence of that disruption?
4. Will that disruption affect vulnerable populations, critical natural systems, critical infrastructure, or other assets?
5. Will that disruption cause irreversible effects or pose an unacceptable risk to public health and safety?

Please describe how this screening process will be integrated into your department's facility operations and project planning processes.

If your department is already taken steps to integrate climate considerations in planning and investment, please describe:

- The approach that has been taken to date
- Whether and how the approach will address the range of activities enumerated above

Address all the sections in this template in the context of the approach that has been taken.

Understanding Climate Risk to Existing Facilities

Using Cal-Adapt and the data provided by GovOps/OTech, collect data on how temperatures are projected to change at each existing facility. Input all requested data into your facility data sheet.

To ensure consistency in planning for climate impacts, use the latest climate change information. Cal-Adapt is the most updated source of climate change data. Global Circulation Models (GCMs) are used to project future climate conditions. Models project future climate conditions under different future emission scenarios that are called Representative Concentration Pathways (RCPs). Different RCPs represent more or less rates and magnitudes of global greenhouse gas (GHG) emission reduction.

Of the 32 internationally-recognized course-resolution GCMs, the State of California has chosen four models to utilize in its climate studies for the Fourth Assessment.[1] The following four models were selected to capture a range of different climate futures:

- Model 1: HadGEM2-ES characterizes a warm and dry future (warm/dry)
- Model 2: CNRM-CM5 characterizes a cool and dry future (cool/wet)
- Model 3: CanESM2 characterizes an average future condition (average)
- Model 4: MIROC5 provides a complement to the above models, and covers a range of outputs

When using Cal-Adapt, data should be collected using these four global circulation models (GCMs) and for a high emissions pathway. This pathway is represented by Representative Concentration Pathway (RCP) 8.5. These model results have been downscaled to provide projections of climate impacts on a finer scale across California.

Other climate data are available from some local research groups. They may be used as long as their use follows the spirit of the work described in the Building a Resilient California guidance document. If alternative data selection methods are employed, please explain.

Risk from Increasing Temperatures

Under a changing climate, temperatures are expected to increase – both at the high and low end. As a result, facilities will experience higher maximum temperatures and increased minimum temperatures. To begin to characterize this risk, complete the following data fields for facilities that will be most affected by changing temperatures. These facilities can be selected for a variety of reasons. When making these selection, consider which facilities experience the largest change in temperature, but also those whose operations are most critical, and/or facilities that serve specific populations or areas.

1 Pierce, D.W., D.R. Cayan, L. Dehann. June 2016. Creating Climate projections to support the 4th California Climate Assessment.

Table 1: Top 5 Facilities Most Affected by Changing Temperature

Facility Name	Annual Mean Maximum Temperature (1961 – 1990)	Annual Mean Maximum Temperature (2031 – 2060)	Annual Mean Max T (2070-2099)	Annual Mean Minimum Temperature (1961 – 1990)	Annual Mean Minimum Temperature (2031 – 2060)	Annual Mean Min T (2070-2099

In addition to changing average temperatures, climate change will increase the number of extreme heat events across the State. Extreme events are likely to be experienced sooner than changes in average temperatures. Using CalAdapt, complete the following table to identify the facilities that will be most impacted by the increase in the number of extreme heat days. As above, consider which facilities will experience the largest change in temperature, but also those whose operations are most critical, and/or facilities that serve specific populations or areas.

Table 2: Five Facilities that Will Experience the Largest Increase in Extreme Heat Events

Facility Name	Extreme heat threshold (EHT)	Average number of days above EHT (1961-1990)	Average number of days above EHT (2031-2060)	Increase in number of days above EHT by mid-century	Avg. # days above EHT (2070-2099)	Increase in Avg. # days above EHT by end of century

Following completion of Tables 1 and 2, discuss the following questions:

- Discuss how temperature affects your facilities and operations. Consider facility performance, structural integrity, occupant health and safety, etc.
- Why did you choose the top 5 facilities in Table 1? Factors to consider in making this selection can include, but are not limited to:
  - Magnitude of temperature change,
  - Sensitivity of operations to changing temperatures,
  - Sensitivity/vulnerability of the population or area served by a facility,
  - Criticality of the facility to avoid disruption,

- How will an increase in extreme heat events affect your facilities? Will it pose a risk to structural integrity? Heating and cooling systems? Occupant health and safety?
- What facilities are likely to be most impacted by an increase in extreme heat events? Are there regions of specific concern, or operations that are more sensitive to temperature?
- Describe strategies that you can employ to reduce the impact of changing temperatures on facility performance and/or to protect occupant health and safety (e.g., additional HVAC capacity, shade structures or tree planting, relocation, etc). For some examples of actions, review the Safeguarding California Implementation Action Plan for your sector, or Preparing California for Extreme Heat: Guidance and Recommendations.
- The end of century results do not need to be planned for, but please include some discussion of how these longer-term estimates of impacts could affect facility performance. Specifically, consider what a worst case scenario could look like and how that can inform facility design, operation, and performance benchmarking.

Risks from Changes in Precipitation

The impacts of climate change on the amount of precipitation that California will receive in the future are slightly less certain that the impacts on temperature. However, it is expected that California will maintain its Mediterranean climate pattern (dry summers and wet winters), but more precipitation will fall as rain than as snow. Larger rains can result in flooding, but will also result in shifts in runoff timing (earlier) and runoff volumes (higher). It will also result in decreased snowpack. To start to understand how this could affect facilities, complete the following table for all facilities, using data from CalAdapt. In identifying facilities most at risk, considerations can include: location, operations, impacts of current precipitation events, the impact of disruption, and criticality of the facility and/or its operations.

Table 3: Facilities that Will be Most Impacted by Projected Changes in Precipitation

Facility Name	Annual Mean Maximum Precipitation (1961 – 1990)	Annual Mean Precipitation (2031 – 2060)	Percent Change by mid-century	Annual Mean Precipitation (2070 – 2099)	Percent change by end of century

Discuss the following after completion of Table 3:

- Discuss how precipitation affects your facilities and operations. Consider facility performance, structural integrity, occupant health and safety, etc.
- Why are the facilities identified in Table 3 the facilities of most concern?
- Identify what facilities are likely to be most impacted by changing precipitation patterns? Why is this?
- Describe strategies that you can employ to reduce the impact of changing precipitation on facility performance and/or to protect occupant health and safety (e.g., rain water

capture, natural infrastructure to minimize flooding, relocation of critical infrastructure such as servers to higher levels, etc)

- The end of century results do not need to be planned for, but please include some discussion of how these longer-term estimates of impacts could affect facility performance. Specifically, consider what a worst case scenario could look like and how that can inform facility design, operation, and performance benchmarking.

Risks from Sea Level Rise

Increasing global temperatures are contributing to rising sea levels. Rising sea levels will result in inundation of coastal areas and increased flooding due to storm surges. The California Ocean Protection Council (OPC) has issued guidance for State agencies on what level of sea level rise to consider. The Guidance document provides the following estimates of sea level rise for the California Coast, which are based on a study by the National Academy of Sciences:

Time Period	North of Cape Mendocino	South of Cape Mendocino
2000 - 2030	-4 to 23 cm (-0.13 to 0.75 ft)	4 to 30 cm (0.13 to 0.98 ft)
2000 – 2050	-3 to 48 cm (-0.1 to 1.57 ft)	12 to 61 cm (0.39 to 2.0 ft)
2000 – 2100	10 to 143 cm (0.3 to 4.69 ft)	42 to 167 cm (1.38 to 5.48 ft)

An accompanying OPC resolution recommends that departments base analyses on estimates of sea level rise in the upper two-thirds of the range.

Several tools are available to visualize rising sea levels. Please select a tool that is best suited to your department's facility locations. Cal-Adapt provides information for the San Francisco Bay and Sacramento-San Joaquin Delta. CoSMoS, a model developed by the National Oceanic and Atmospheric Administration, provides data for larger portions of the California coast. Please consider the location of current and planned facilities relative to the current coastal zone and risks of flowing and inundation, and select the viewer accordingly. For departments with a higher exposure to sea level rise, please select the most inclusive viewer.

- Identify the sea level rise viewer selected, and the time period and level of sea level rise visualized.
- Identify facilities that are at risk from rising sea levels. Please note that these are likely to include facilities that are not currently located in an area that would be considered the coastal zone.
- Discuss actions that can be taken to minimize the risk of rising sea levels. This can include relocation of critical systems (e.g., information technology, ventiliation); flood protection through design or green infrastructure; or relocation).

Table 4: Facilities at Risk From Rising Sea Levels

Natural Infrastructure to Protect Existing Facilities

EO B-30-15 directs State agencies to prioritize the use of natural and green infrastructure solutions. Natural infrastructure is the "preservation or restoration of ecological systems or the utilization of engineered systems that use ecological processes to increase resiliency to climate change, manage other environmental hazards, or both. This may include, but need not be limited to, flood plain and wetlands restoration or preservation, combining levees with restored natural systems to reduce flood risk, and urban tree planting to mitigate high heat days" (Public Resource Code Section 71154(c)(3)).

Please describe ways in which you could employ natural infrastructure to reduce the risks of climate change to your department's various types of existing facilities.

Understanding the Potential Impacts of Facilities on Communities

It is also important to recognize the impact that an infrastructure project has the surrounding community and the impacts on individual and community resilience (e.g., heat island impacts).

Vulnerable Populations

Certain populations are more susceptible to the effects of changing climate conditions, and will have less capacity to recover from changing average conditions and more frequent and severe extreme events. A number of factors contribute to vulnerability, often in overlapping and synergistic ways. These can include a number of social and economic factors, and be determined by existing environmental, cultural, and institutional arrangements. Vulnerable populations can include, but are not limited to, people living in poverty; people with underlying health conditions; incarnated populations; linguistically or socially isolated individuals; communities with less access to healthcare or educational resources; or communities that have suffered historic exclusion or neglect.

Consider populations that your facilities serve and/or are located nearby. For example, prisons or state hospitals serve many populations that are considered vulnerable. In other cases, facilities may be located near communities that have characteristics that could contribute to higher vulnerability.

Discuss how your facilities interact with potentially vulnerable communities.

Disadvantaged Communities

California is required to invest resources in disadvantaged communities (DACs). DACs are identified using CalEnviroScreeen, a tool that ranks census tracts based on a combination social, economic, and environmental factors. While it does not capture all aspects of climate vulnerability, it is one tool that is available, and does include several relevant characteristics. In many cases, disadvantaged communities are more likely to suffer damage under changing climate conditions, including extreme events. The department's facilities located in these communities can contribute or alleviate the vulnerability of these communities.

Use CalEnviroScreen to identify which facilities are located in disadvantaged communities and list them here. Complete Table 5. Disadvantaged communities have CalEnviroScreen scores between 75 – 100.

Table 5: Facilities located in disadvantaged communities

Facility Name	CalEnviroScreen Score	Is it located in a disadvantaged community? Yes/No

After completing Table 5:

- What share of your facilities are located in disadvantaged communities?
- How do these facilities interact with the community? For example, do they provide services such as healthcare or social services? Do they provide access to resources? Are they employment centers?
- Are there ways that the facility(ies) can help to support the community? For example, could they serve as a resource during an emergency, or could they provide access to information and resources? For more examples, refer to the Safeguarding Implementation Action Plan for the Public Health Sector.

Urban Heat Islands

Urban heat islands are areas with localized spikes in temperature, which impact human health, increase pollution, and increase energy demand. Urban heat islands occur during the hot summer months in areas with higher percentages of impervious surface and less vegetation. This is likely in areas with large parking lots, dense development, and lower tree density and shading. Urban heat islands can be mitigated (i.e., reduced) through tree planting and other greening measures, cool roofs (e.g., lighter roofing materials that reflect light), cooler pavements, and other measures.

Using the State's Urban Health Island interactive maps, complete the following table for all facilities.

Table 6: Facilities Located in Urban Heat Islands

Facility Name	Located in an urban heat island (yes/no)

After completing Table 6, please discuss the following:

- How many facilities are located in urban heat islands (or what share)?
- Do those facilities have large parking lots, or other sections of impervious surface?

- What steps are you taking, or can you take, to reduce the facility's contribution to the urban heat island? Actions could include reducing impermeable surface areas surrounding a facility, additional greening, or shading. For additional guidance on actions that can be taken, refer to Preparing California for Extreme Heat: Guidance and Recommendations
- Have you considered urban heat island in your energy plan for facilities?

Understanding Climate Risk to Planned Facilities

For all new facilities that you have planned, please complete the following tables. Use the tools identified above.

Table 7: Climate Risks to New Facilities

Facility Name	Annual Mean Maximum Temperature (1961 – 1990)	Annual Mean Maximum Temperature (2031 – 2060)	Annual Mean Minimum Temperature (1961 – 1990)	Annual Mean Minimum Temperature (2031 – 2060)	Annual Mean Maximum Precipitation (1961 – 1990)	Annual Mean Precipitation (2031 – 2060)

Table 8: Extreme Heat Events and New Facilities

Facility Name	Extreme heat threshold (EHT)	Average number of days above EHT (1961-1990)	Average number of days above EHT (2031-2060)	Increase in number of days above EHT

After completing Tables 7 and 8, please discuss how your facility siting, design, construction, and operation is accounting for these changing conditions.

For any new facility, indicate if it is located in a disadvantaged community or urban heat island.

Table 9: New Facilities and Disadvantaged Communities and Urban Heat Islands

Facility Name	Located in a Disadvantaged Community (yes/no)	Located in an urban heat island (yes/no)

After completing Table 9,

- For each planned facility discuss how siting, design, construction and operation will account for disadvantaged communities and urban heat islands.
- Describe how climate change will affect the full useful life of each planned facility.
- How have you integrated these lifecycle considerations into facility planning, siting, design, construction, and operation?

Natural Infrastructure

EO B-30-15 also directs agencies to prioritize natural and green infrastructure solutions. Natural infrastructure is the "preservation or restoration of ecological systems or the utilization of engineered systems that use ecological processes to increase resiliency to climate change, manage other environmental hazards, or both. This may include, but need not be limited to, flood plain and wetlands restoration or preservation, combining levees with restored natural systems to reduce flood risk, and urban tree planting to mitigate high heat days" (Public Resource Code Section 71154(c)(3)).

Please discuss how you are considering and prioritizing natural infrastructure in new facility design and operation.

Full Life Cycle Cost Accounting

EO B-30-15 directs State agencies to employ full life cycle cost accounting in all infrastructure investment. Lifecycle cost accounting includes:

- Considering initial investment costs, as well as lifetime operation and maintenance costs under changing climate conditions, including changing average conditions and increases in extreme events.
- Applying non-market evaluation methods such as travel cost, avoided costs or contingent valuation to capture hard to quantify benefits and costs

Please discuss how you are employing lifecycle considerations in new facility design and operation.

Integrating Climate Change into Department Planning and Funding Programs

EO B-30-15 extends beyond infrastructure to broader planning efforts. Using the tables below, indicate whether you have taken the following actions in your planning processes.

Table 10: Integration of Climate Change into Department Planning

Plan	Have you integrated climate?	If no, when will it be integrated?	If yes, how has it been integrated?
	Yes/No	Date	Text

Table 11: Engagement and Planning Processes

Plan	Does this plan consider impacts on vulnerable populations?	Does this plan include coordination with local and regional agencies?	Does this plan prioritize natural and green infrastructure?
	Yes/No	Yes/No	Yes/No

Have you included climate consideration in grants and other funding programs? This should include direct grants, proposition funding, and local assistance programs.

Table 12: Climate Change in Funding Programs

Grant or funding program	Have you integrated climate change into program guidelines?	If no, when will it be integrated?	Does this plan consider impacts on vulnerable populations?	Does this program include coordination with local and regional agencies?
	Yes/No	Date		

Measuring and Tracking Progress

Changing climate conditions necessitate an adaptive management approach. An adaptive management approach is informed by tracking changing climate conditions and the performance of a plan or project. Building check points into a project or plan timeline can help to create a system for regular review and, if needed, adjustments.

Discuss the following to explain how your department will track increase resilience and overall progress in integrating climate change into planning and investment.

- What climate impacts are of most concern to your facilities and plans? How will you keep track of how they are changing?
- How will you measure progress toward departmental goals under a changing climate?
- How will you build in flexibility and adaptability into long-term planning?

Recognizing that this is likely a new topic for many departments, please describe the steps your department will take to ensure that the proceeding steps are undertaken for each new investment. Answer the following questions:

- What office or branch will develop a policy to integrate climate change into all infrastructure investment?
- How will your department identify and prioritize natural and green infrastructure options?
- When will that policy be completed?
- How will the policy be integrated in all infrastructure investment.

SUSTAINABILITY MILESTONES & TIMELINE

2012
- EXECUTIVE ORDER B-18-12 & B-16-12 ISSUED
- NEW & RENOVATED BUILDINGS EXCEED T-24 BY 15%

2013
- BUILDINGS <10,000 SQ. FT. MEET CALGREEN TIER 1
- BEGIN WATER USE BENCHMARKING

2015
- LEED-EB CERTIF. FOR ALL EXIST. BLDGS >50,000 SQ. FT.
- REDUCE WATER USE 10%
- 10% OF FLEET LDV PURCHASES ZEV

2016
- REDUCE WATER USE 25% FROM 2013 TO FEB 28, 2016

2018
- 20% ENERGY USE REDUCTION

2020
- 50% OF NEW & RENOVATED BUILDINGS ZNE
- REDUCE WATER USE 20%
- 25% OF FLEET LDV PURCHASES ZEV

2025
- 100% OF NEW & RENOVATED BUILDINGS ZNE
- 50% OF EXISTING BUILDINGS ZNE

DEPARTMENT STAKEHOLDERS

List individuals, offices, and divisions responsible for leading efforts related to each initiative identified in this report. Include their respective titles, roles, responsibilities.

Understanding Climate Risk at Existing Facilities	
Individual or division name	Title, role, responsibilities, managers, etc.

Understanding Climate Risk at Planned Facilities	
Individual or division name	Title, role, responsibilities, managers, etc.

Integrating Climate Change into Department Planning and Funding Programs	
Individual or division name	Title, role, responsibilities, managers, etc.

Measuring and Tracking Progress	
Individual or division name	Title, role, responsibilities, managers, etc.