Memo

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Date: September 20, 2013

To: Erik Pearson, Sara Buizer (City of Hayward)

From: Honey Walters, Erik de Kok, Heather Phillips

CC: Jim Harnish, Ted Holzem (Mintier Harnish)

Subject: **Hayward General Plan Update: Final Draft Climate Action Plan Gap Analysis**

INTRODUCTION

In accordance with the Climate Action Plan (CAP) integration approach outlined in the memorandum dated May 14, 2013, this technical memorandum summarizes the final draft results of the quantitative "gap analysis" process for the Hayward General Plan Update (GPU). The purpose of the gap analysis is two-fold: a.) to ensure that all greenhouse gas (GHG)-reducing actions to be incorporated in the General Plan (including both prior CAP actions and new actions) set the community on course to meet the City's desired GHG reduction targets; and b.) to ensure that specific actions and associated GHG emission reduction calculations are defensible and appropriate for the purposes of California Environmental Quality Act (CEQA) streamlining benefits for proposed projects in the future.

The gap analysis process includes the following steps, which are summarized briefly below and addressed in subsequent sections:

1. Evaluation and adjustments to the 2005 and 2010 community-wide GHG emission inventories;
2. Revisions to the GHG emission projections for 2020, 2040 and 2050;
3. Evaluation of the City's adopted GHG emission reduction targets for 2020 and 2050, and recommended targets for 2020, 2040 and 2050; and
4. Quantification of GHG emission reductions (unchanged or revised actions from the 2009 CAP and new actions) and evaluation of the calculated gap between the estimated GHG reductions and the recommended targets.

1. GREENHOUSE GAS EMISSION INVENTORIES

The City's CAP included an initial baseline GHG inventory prepared by the Local Governments for Sustainability (ICLEI) for year 2005 emissions from community-wide and municipal operations. The purpose of the baseline

inventory is to gain an understanding of the sources and levels of GHG emissions within a jurisdiction, as well as establish a level of GHG emissions against which future GHG emissions can be compared. The 2005 GHG emissions inventory was conducted using ICLEI's Clean Air and Climate Protection (CACP) software. Since the 2005 inventory was conducted, standard GHG emissions estimation methodology and best practices have evolved, including methods contained in ICLEI's CACP software, which was updated in 2009.

An updated inventory for Hayward's community-wide and municipal operations was prepared by StopWaste.org for the year 2010 using ICLEI's CACP 2009 software. The 2005 and 2010 inventories cannot be compared directly due to differences in methodologies for certain sectors, most notably Transportation. A detailed summary of the differences in the two inventories is included in the General Plan Background Report, Section 7.4.

Ascent reviewed both the 2005 and updated 2010 inventories, and minor adjustments to the 2010 inventory sectors are recommended to the Commercial/Residential Energy and Water/Wastewater Treatment sectors. These adjustments will ensure that updates to the projections and quantification of specific actions would be properly assigned based on the City's jurisdictional control. The 2005 and 2010 inventories, along with the adjusted "jurisdictional update" to the 2010 inventory, are summarized below in Table 1. The jurisdictional update consists of reassigning Hayward Water Pollution Control Plant process and fugitive emissions to the Water/Wastewater Treatment sector. In addition, minor adjustments to Transportation sector emissions are recommended to align with vehicle miles traveled (VMT) outputs from the baseline 2010 condition in the traffic modeling conducted by Kittelson Associates for the GPU. Total emissions from all sectors in the 2010 Jurisdictional Inventory are 1,120,803 metric tons of carbon dioxide equivalent (MT CO_2e) emissions.

Table 1: 2005 and 2010 Greenhouse Gas Emission Inventories

	2005 Baseline Inventory (prepared by ICLEI)		2010 Inventory Update (prepared by StopWaste.org)		2010 Jurisdictional Inventory (prepared by Ascent)	
Sector	**MT CO_2e/yr**	**% of total**	**MT CO_2e/yr**	**% of total**	**MT CO_2e/yr**	**% of total**
Residential Energy	158,528	13.4%	154,423	13.8%	154,423	13.8%
Commercial/Industrial Energy[1]	238,226	20.1%	235,693	21.1%	231,719	20.7%
Transportation[2]	734,087	62.0%	700,310	62.6%	702,552	62.6%
Solid Waste	52,438	4.4%	24,048	2.1%	24,048	2.1%
Water/Wastewater Treatment[3]	-	0.0%	4,087	0.4%	8,061	0.7%
Total	**1,183,279**	**100%**	**1,118,561**	**100.0%**	**1,120,803**	**100.0%**

Notes: MT CO_2e/yr = metric tons of carbon dioxide equivalent per year; BART = Bay Area Rapid Transit; VMT = vehicle miles traveled. Totals may not add up to 100 percent due to rounding.

[1]Hayward Water Pollution Control Plant process and fugitive emissions data were included in the 2010 inventory's Commercial/Industrial sector emissions, but not in the 2005 inventory. These were transferred from the 2010 inventory's Commercial/Industrial sector to the Water/Wastewater Treatment sector as part of the Jurisdictional Update.

[2]Transportation emissions in the 2005 inventory included on-road sources only; transportation emissions in the 2010 inventory accounted for both on- and off-road sources, along with BART and Scope 3 air travel. Additionally VMT accounting methods differed between 2005 and 2010. See Background Report, section 7.4, for breakdown of changes between 2005 and 2008 in this sector. On-road mobile sources were revised using EMFAC 2011 (09/05/13) based on Baseline Condition VMT outputs from traffic modeling for EIR.

[3]Water/Wastewater sector emissions were not included in the 2005 inventory, but were included in the 2010 inventory (wastewater only). Process and fugitive emissions (3,974 MT CO_2e) from wastewater treatment were transferred from the commercial/industrial energy sector for the water/wastewater treatment sector in the 2010 Jurisdictional Update. The 4,087 MT CO2e reported in the 2010 inventory update are attributable to the pumping in the City's water distribution system.

Source: Hayward Climate Action Plan (2009), StopWaste.org (2013), Ascent (2013)

2. Greenhouse Gas Emission Projections

GHG emission projections for a community are used to estimate future emission levels in the absence of climate action measures. Projections are based on a continuation of current trends, known as a "business-as-usual" scenario, which typically assume that GHG emissions continue to grow proportionally with population, employment, housing, and other indicators of growth in a community. Business-as-usual GHG emission projections are sometimes adjusted for factors such as advances in technology, legislation mandating changes to activities that would lead to foreseeable reductions, and/or specific local actions that a community has already programmed that would reduce GHG emissions in the future.

The City's adopted CAP included GHG emission projections for target years 2020 and 2050 as compared to the 2005 baseline. The projections were presented according to two scenarios. Scenario 1 was an absolute "business-as-usual" projection based on ICLEI growth rates for transportation, energy usage in the residential and commercial and industrial sectors, and municipal solid waste. Scenario 2 was an "adjusted business-as-usual" projection based on both growth rates applied in Scenario 1 and anticipated reductions from the Renewable Energy Portfolio Standard in California and improving State and Federal vehicle fuel economy standards.

New information is now available that requires the GHG emission projections to be updated. These are summarized briefly below:

- The GHG emissions inventory is now updated for the year 2010 (see Section 1 above for further details). The 2010 jurisdictional inventory was utilized for the projections because it reflects recent economic conditions and contains adjusted GHG emission calculations for various sectors.
- Population, housing and employment data are now available from the Hayward General Plan Update (GPU) Technical Background Report for existing conditions (2010) and projected build-out conditions (2040). These numbers were used in order to maintain consistency with planned growth forecasts in the GPU. Population is expected to increase at an annual growth rate of about 0.8 percent from 144,186 persons in 2010 to 183,533 in 2040. Similarly, households are expected to increase at an annual rate of about 0.9 percent from 45,365 in 2010 to 58,825 in 2040; and employment about 0.9 percent annually from 69,100 in 2010 to 89,900 in 2040.
- VMT data for 2035 "No Project" conditions are available from traffic modeling conducted for the GPU by Kittelson Associates. . The "No Project" VMT data are based on build-out of the currently-adopted Hayward General Plan through 2035. Daily VMT in Hayward for both passenger vehicles and commercial vehicles is expected to increase from 3,369,013 in 2010 to 4,874,526 in 2035, or about 44 percent. New information and forecasting methods are available with respect to State and Federal legislative reductions that apply to the inventory. These include adoption of more stringent fuel economy standards by the California Air Resources Board (ARB) in September 2009 ("Pavley I"), implementation of the 2013 Building Energy Efficiency Standards (California Code of Regulations, Title 24, Part 6) in January 2014, and continued implementation of the California Renewable Portfolio Standard (RPS) implementation by Pacific Gas and Electric (PG&E) through 2020.

Business-As-Usual Emission Projections

The updated community-wide GHG emissions projections are summarized below in Table 2. Under a business-as-usual scenario, community-wide GHG emissions are projected to grow by approximately 8 percent by 2020 and 36 percent by 2040 for Hayward compared to 2010 emissions.

Table 2: Summary of Community-wide Greenhouse Gas Emission Projections (Business-as-Usual)

Sector	GHG Emissions (MT CO_2e/year)				Projection Indicator (Source)
	2010	2020	2040	2050	
Residential Energy	154,424	169,696	200,241	215,514	Households (GPU Background Report)
Commercial/Industrial Energy	231,719	254,969	301,469	324,720	Employment (GPU Background Report)
Transportation[1]	702,552	748,550	982,017	1,086,054	VMT growth (Kittelson Associates 2013) and EMFAC model emission factors (ARB 2011)
Solid Waste	24,048	26,235	30,610	32,798	Population (GPU Background Report)
Water/Wastewater Treatment	8,061	8,794	10,261	10,994	Population (GPU Background Report)
Total	**1,120,803**	**1,208,245**	**1,524,599**	**1,670,080**	

Notes: ARB = California Air Resources Board; EMFAC = Mobile-Source Emission Factor Model;
GHG = greenhouse gas; GPU = General Plan Update; MT CO_2e = metric tons carbon dioxide equivalent;. Totals may not add up to 100 percent due to rounding.

[1] Transportation-related GHG emission projections are non-linear due to competing factors. VMT was projected to increase 44 percent between 2010 and 2035, while mobile-source emission factors are expected to decline over time associated with retirement of older, less-efficient vehicles from the fleet. ARB's EMFAC 2011 model predicts significantly lower emission rates for vehicles in 2020, and 2035 than in 2010. Emission factors are not available in EMFAC beyond fleet year 2035, and thus 2035 emission factors were used to estimate mobile source emissions in years 2040 and 2050

Source: StopWaste.org 2013; Data modeled by Ascent Environmental, Inc. in 2013.

Legislative-Adjusted Emission Projections

State legislation and regulations have been enacted that are expected to reduce GHG emissions over time within the community-wide emissions inventory sectors. Such legislation includes significantly improved fuel economy standards for new vehicles that have yet to be implemented, energy-efficiency building code standards applicable to new development, and renewable energy portfolio standards applicable to utilities. Adjustments for GHG-reducing legislation have been applied to the emission projections, which are summarized in comparison to business-as-usual in Table 3 below. This "adjusted" scenario represents the reasonably foreseeable GHG emission projections for the City in 2020, 2040 and 2050. Based on these adjusted projections, it would appear that State and Federal legislative actions will reduce GHG emissions to about 13 percent below the 2005 baseline without accounting for any local actions. Assumptions associated with each adjustment and associated piece of legislation are described separately below.

Table 3: Summary of Community-wide Business-as-Usual and Legislative-Adjusted Greenhouse Gas Emission Projections

Sector	GHG Emissions (MT CO_2e/year)					
	2020 (BAU)	2020 (Adjusted) [1]	2040 (BAU)	2040 (Adjusted) [1]	2050 (BAU)	2050 (Adjusted)[1]
Residential Energy	169,696	158,749	200,241	184,820	215,514	202,437
Commercial/Industrial Energy	254,969	231,856	301,469	269,388	324,720	296,873
Transportation	748,550	600,764	982,017	738,873	1,086,054	817,151
Solid Waste	26,235	26,235	30,610	30,610	32,798	32,798
Water/Wastewater Treatment	8,794	8,170	10,261	9,532	10,994	10,214
Total	**1,208,245**	**1,025,775**	**1,524,599**	**1,233,223**	**1,670,080**	**1,359,472**

Notes: BAU = Business-as-Usual; GHG = greenhouse gas; MT CO_2e = metric tons carbon dioxide equivalent. Totals may not add up to 100 percent due to rounding.
[1] Emission reductions associated with the Low Carbon Fuel Standard were not included in the legislative-adjusted emissions projection.
Source: StopWaste.org 2013; Data modeled by Ascent Environmental, Inc. in 2013.

Vehicle Emissions Standards

Federal CAFÉ and California-specific Low Emission Vehicle (LEV) Clean Car Standards require increased fuel economy of vehicles. Increased fuel economy has the effect of reducing GHG emissions from vehicles as newer, more fuel-efficient vehicles enter the fleet and older, less-efficient vehicles are retired. In California, LEV standards are sometimes referred to as "Pavley" standards in reference to Assembly Bill (AB) 1493 (2002) drafted by California Senator Fran Pavley. The first set of standards aimed at improving fuel economy is referred to as the "Pavley I" standards, which took effect in 2009. These standards are more stringent than the emission standards used to calculate the business-as-usual GHG emission projections.

ARB has estimated the effectiveness of Pavley I standards on vehicle emission factors in the EMFAC 2011 model and predicts that these standards would reduce GHG emissions by 20 percent in 2020 and 25 percent in 2035 above and beyond a scenario without these standards. The City's 2020, 2040 and 2050 projected VMT activity data were modeled using EMFAC 2011-Scenario Generator (SG) model for analysis years 2020, 2040 and 2050 accounting for Pavley I standards. Legislative-adjusted 2020 GHG emissions for the Transportation sector are estimated to drop below the 2010 baseline GHG emissions. This reveals that reductions in vehicle emissions associated with improvements in technology are expected to outpace growth in VMT from people traveling within or to and from Hayward in year 2020. Based on current projection methods, growth in VMT is expected to surpass the rate of GHG reductions from legislation and technology again by 2040.

EMFAC 2011-SG also estimates a contribution to GHG reduction from the Low Carbon Fuel Standard (LCFS). LCFS was omitted from the adjustment, because the extent to which LCFS would reduce tailpipe emissions of on-road vehicles is not conclusive. In addition, the California Advanced Clean Car (ACC) Standards are also expected to achieve additional GHG reductions from the vehicle fleet. GHG reductions from ACC regulations were not included in the legislative-adjusted projections at this time in an effort to use conservative assumptions. Quantification of precise emission reduction benefits of ACC are less certain at this time, but may be monitored by the City for inclusion in future GHG projection updates.

Energy-Efficiency Standards

Renewable Portfolio Standards

California's Renewable Portfolio Standard (RPS) requires investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 33 percent of total procurement by 2020. RPS applies to PG&E, the electric utility provider serving Hayward. PG&E's portfolio is currently comprised of 19 percent renewable (non-GHG-emitting) electricity-generating sources. Thus, it is anticipated that GHG emissions associated with electricity consumption in Hayward will be reduced by approximately 14 percent by 2020 compared to business-as-usual scenario. GHG emissions associated with projected electricity consumption in the community were adjusted to account for the reduction in GHG emissions associated with increased renewable energy sources in PG&E's portfolio in 2020.

Potential increases in the stringency of the State's RPS requirements could occur beyond 2020 based on recently-introduced legislation. AB 177, introduced by Assemblyman Perez on June 6, 2013, would require electric utilities to supply 51 percent of their procurement from renewable sources by 2030. In order to remain conservative, however, the current statewide RPS requirement of 33 percent by 2020 was carried forward to 2040 and 2050. If AB 177 is signed into law, the legislative-adjusted projections for electricity emissions could be revised at a later time.

California Title 24 Building Energy Efficiency Standards

California's Building Energy Efficiency Standards (California Code of Regulations, Title 24, Part 6) were recently updated to require new buildings to become even more energy-efficient than under the current code. The new 2013 standards, which become effective in January 2014, will increase the efficiency of new construction by 20 percent for residential and 25 percent for nonresidential, compared to the 2008 Title 24 standards currently in effect.

California's Long-Term Energy Efficiency Strategy, adopted in 2008, has set aggressive goals that will likely be implemented through future updates to the Building Energy Efficiency Standards in 2016, 2019, and beyond. By 2020, all new residential construction will be required to achieve zero net energy (ZNE). Similarly, by 2030, all new nonresidential construction will be required to achieve ZNE. However, because the Title 24 regulations implementing the State's ZNE goals have not yet been adopted, ZNE was not assumed for the purposes of legislative-adjusted projections at this time in order to remain conservative.

3. Greenhouse Gas Emission Reduction Targets

The GHG emission reduction targets in the City's 2009 CAP are as follows:

- 6 percent below 2005 levels by 2013;
- 12.5 percent below 2005 levels by 2020; and
- 82.5 percent below 2005 levels by 2050.

While the 2005 and updated 2010 inventories cannot be directly compared, the activity data and GHG emission estimates for the two largest sectors in the inventories (Transportation and Energy) shows that considerable progress has been made towards meeting the 2013 interim target as of 2010. It's highly likely that the City is on track already to achieve the 2013 target. We recommend that 2013 be removed as an "interim" target year given that the target will likely be achieved, and also because the adoption of the GPU is not expected to occur until sometime in 2014.

The year 2020 is still an important target year given the statutory direction provided in the California Global Warming Solutions Act of 2006 (AB 32) to reduce GHG emissions to 1990 levels by 2020 throughout the state. The 2020 target in the CAP aligns community-wide reductions with AB 32. However, 2020 should be seen now as an "interim" target year, given that 2020 is approaching relatively quickly. Additionally, the legislative-adjusted emission projections for 2020 show that the City's emissions could fall to 14 percent below 2005 levels by 2020 without any consideration of local actions, exceeding the total reductions that would have been achieved under the original target of 12.5 percent below 2005 levels by 2020. Thus, the City may wish to consider adjusting the 2020 target to exceed the legislative-adjusted projections. Adjusting the target to 20 percent below 2005 levels by 2020, or approximately 6.7 percent below the legislative-adjusted projected emissions in 2020, would provide an impetus for local action to continue the City's good-faith effort to adopt local GHG reduction measures, and put the City on track to achieve the City's long-term target in 2050.

The GPU planning horizon year is 2040. This is an important consideration with respect to GHG reduction targets because the City's General Plan will serve as the City's official "Plan for the Reduction of Greenhouse Gases" for the purposes of tiering and streamlining the review of GHGs per CEQA Guidelines Section 15183.5. The longer-term reduction potential of measures, particularly with respect to measures in the CAP that would be applicable to new development that is consistent with the Plan, should be evaluated against this horizon year, in addition to meeting the 2020 target.

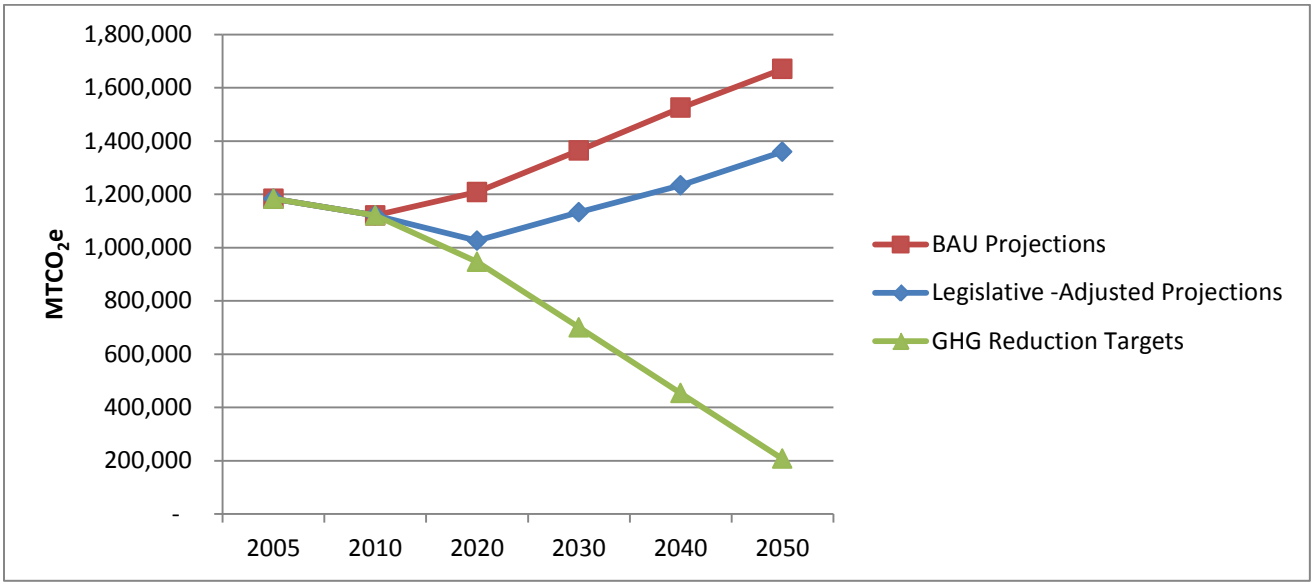
The recommended targets, along with estimated reductions required to achieve the targets, are summarized below in Table 4 and shown in Figure 1.

Table 4: Recommended Greenhouse Gas Emissions Reduction Targets: 2020, 2040 and 2050

Year	GHG Emissions (MT CO_2e/year)							
	Baseline	**BAU Projection**	**Legislative-Adjusted Projection**	**Reduction Targets (Recommended)**	**Net Reductions to Achieve Targets**	**% Below 2005 Baseline**	**% Below BAU**	**% Below Legislative Adjusted**
2005	1,183,279	-	-	-		-	-	-
2010	1,120,803	-	-	-		-	-	-
2020	-	1,208,245	1,025,775	946,623	79,151	20.0%	21.7%	7.7%
2040	-	1,524,599	1,233,223	453,590	779,633	61.7%	70.2%	63.2%
2050	-	1,670,080	1,359,472	207,074	1,152,398	82.5%	87.6%	84.8%

Notes: BAU = Business-as-Usual; GHG = greenhouse gas; MT CO_2e = metric tons carbon dioxide equivalent.
Source: City of Hayward 2009; StopWaste.org 2013; Data modeled by Ascent Environmental, Inc. in 2013.

Figure 1: Greenhouse Gas Emission Projections and Recommended Reduction Targets: 2020 through 2050



Notes: BAU = Business as Usual; GHG = Greenhouse Gas Emissions; MT CO_2e = metric tons of carbon dioxide equivalent
Source: Hayward Climate Action Plan (2009); StopWaste.org (2013); Ascent Environmental, Inc. (2013)

4. Greenhouse Gas Emission Reductions and Estimated Gap

The 2009 CAP was reviewed by City staff and Ascent to determine specific actions that would be incorporated into the GPU. In addition, new or updated actions were identified that would be expected to reduce GHG emissions and achieve the City's sustainability objectives.

Ascent reviewed the technical assumptions and quantification methods from the 2009 CAP, and revised or updated GHG emission reduction estimates where appropriate. Ascent also estimated GHG reductions for the new draft measures. Two methods were employed for calculating GHG reduction effectiveness of the identified CAP strategies, known as "top-down" and "bottom-up". The top-down method applies scaling indicators to the City's GHG emissions inventory to determine the quantity of emissions that would be affected by a strategy. On the other hand, a bottom-up method uses an activity and emissions factor to determine the amount of GHG reduction.

GHG reductions were calculated in a step-wise manner for the future years of 2020, 2040, and 2050. In other words, GHG reductions (MT CO_2e/year) are assessed during a snapshot in time in years 2020, 2040, and 2050. This is a simplified method of characterizing GHG reductions, which would more realistically occur on a continuous basis. However, a step-wise method is appropriate for a planning-level document, since the City's GHG reduction targets and monitoring of CAP implementation progress would be tied to these future years.

Importantly, GHG emission reductions were quantified for measures wherever substantial evidence and reasonable assumptions were available to support calculations. The City has identified numerous programs and policies that were not quantifiable at this time, but are still expected to reduce GHG emissions. Such programs will be addressed qualitatively in the GPU and treated as supporting measures to the strategies that were quantified, and could be tracked for potential quantification in the future.

Summary of Results

Preliminary estimates of GHG emission reductions, along with an estimated emissions reduction "gap", are summarized below in Table 5. Calculations and assumptions supporting the GHG reduction estimates are provided in the attached Excel spreadsheet.

Table 5: Summary of Greenhouse Gas Emissions Reduction Measures Performance

Action Number and Description		GHG Emissions Reduction (MT CO_2e/year)		
		2020	2040	2050
Transportation Sector				
Action 1.1	Commuter Benefits	1,806	2,221	2,456
Action 1.2	Car/Bike Sharing	4,475	5,570	6,118
Action 1.4	Parking Strategies	356	1,139	1,260
Action 1.6	Bicycle Master Plan	244	9,162	10,133
Action 1.7	Pedestrian Master Plan	6,008	7,389	8,172
Energy Sector				
Action 3.7	Finance Energy Efficiency– Single Family	1,458	6,705	11,055
Action 3.8	Finance Energy Efficiency – Multi-Family	1,488	6,796	11,635
Action 3.9	Finance Energy Efficiency - Commercial	556	8,638	17,544
Action 5.1	Finance Renewable Energy – Residential	657	1,854	1,854
Action 5.2	Finance Renewable Energy – Commercial	8,320	19,692	19,692
Action 5.3	Community Choice Aggregation	61,431	71,438	78,520
Action 5.7	Renewable Energy on City Facilities	737	737	737
Solid Waste Sector				
Action 6.1	Solid Waste Diversion	2,099	2,449	2,624
Water & Wastewater Sector				
Action 6.8	Implement Urban Water Management Plan	327	381	409
Carbon Sequestration				
Action 7.1	Carbon Sequestration	-	385	385
Action 7.2	Carbon Sequestration on City Property	-	44	44
Total GHG Emissions Reductions		**89,961**	**144,599**	**172,637**
Recommended GHG Emissions Reduction Target[1]		79,151	779,633	1,152,398
GHG Emissions Reduction Gap (Surplus)		**(10,810)**	**635,034**	**979,761**

Notes:
CEC = California Energy Commission; GHG = greenhouse gas; MT CO_2e = metric tons carbon dioxide equivalent; PG&E = Pacific Gas and Electric;.
[1]Net reductions required to achieve recommended GHG reductions targets for 2020, 2040 and 2050 (see section 2 of this memo for details)
Source: Data estimated by Ascent Environmental, Inc. in 2013. See Attachment for detailed assumptions.

The total estimated GHG emissions reductions from all actions quantified to date (both new and revised) is approximately 89,961 MT CO_2e in 2020, 144,599 MT CO_2e in 2040, and 172,637 MT CO_2e in 2050. The total

estimated reductions in 2020 are more than sufficient to meet the recommended 2020 target, with a 10,810 MT CO_2e surplus of GHG reductions. However, the projected GHG reductions from all actions in 2040 and 2050 fall considerably short of the longer-term targets for these years. Certainly the scale of reductions required to achieve the much more aggressive longer-term targets outlined earlier will require significant improvements in the availability and/or cost of technology, as well as potential increased reductions from ongoing state and federal legislative actions.

Summary

City of Hayward Greenhouse Gas Emissions Inventories - 2005 and 2010

Sources: 2005 inventory: ICLEI, 2008; 2010 inventory: StopWaste.org, January 2013

Sector	2005 MT CO2e/yr	% of total	2010 MT CO2e/yr	% of total
Residential Energy	158,528	13.4%	154,423	13.8%
Commercial/Industrial Energy[1]	238,226	20.1%	235,693	21.1%
Transportation[2]	734,087	62.0%	700,310	62.6%
Solid Waste	52,438	4.4%	24,048	2.1%
Water/Wastewater Treatment[3]		0.0%	4,087	0.4%
Total	**1,183,279**	100%	**1,118,561**	100.0%

Notes:

[1]Hayward Water Pollution Control Plant Process and Fugitive Emissions data were included in the 2010 inventory's Commercial/Industrial sector emissions, but not in the 2005 inventory

[2]Transportation emissions in 2005 included on-road sources only; 2010 accounted for both on- and off-road. Additionally, VMT accounting methods differed between 2005 and 2010. See GPU Background Report, section 7.4, for breakdown of changes betw 2005-2008 in this sector.

[3]Water/Wastewater sector emissions were not included in the 2005 inventory, but were included in the 2010 inventory (wastewater only)

Jurisdictional Update - 2010

Source: Ascent 2013

Sector	2010 MT CO2e/yr	% of total
Residential Energy	154,423	13.8%
Commercial/Industrial Energy[1]	231,719	20.7%
Transportation[2, *]	702,552	62.7%
Solid Waste	24,048	2.1%
Water/Wastewater Treatment[3]	8,061	0.7%
Total	**1,120,803**	100.2%

Notes:

[1]Hayward Water Pollution Control Plant Process and Fugitive Emissions were transferred from the 2010 inventory's Commercial/Industrial sector to the water/wastewater treatment sector

[2]Transportation emissions in 2010 included off-road vehicles, BART, and air travel as well as on-road mobile source emissions.

On-road mobile sources*	627,818.92
Off-road Vehicles	59,605
BART	2,689
Scope 3 Air Travel	12,439

*On-road mobile sources were revised using EMFAC 2011 (09/05/13) based on traffic modeling for EIR.

[3]Process and fugitive emissions from wastewater treatment were transferred from the commercial/industrial energy sector for the water/wastewater treatment sector

Summary

City of Hayward Greenhouse Gas Emissions Projections (Business as Usual)

Sector	2005 MT CO2e/yr	2010 MT CO2e/yr	2010 % of total	2020 MT CO2e/yr	2020 % of total	2040 MT CO2e/yr	2040 % of total	2050 MT CO2e/yr	2050 % of total
Residential Energy		154,423	13.8%	169,696	14.0%	200,241	13.1%	215,514	12.9%
Commercial/Industrial Energy		231,719	20.7%	254,969	21.1%	301,469	19.8%	324,720	19.4%
Transportation		702,552	62.7%	748,550	62.0%	982,017	64.4%	1,086,054	65.0%
Solid Waste		24,048	2.1%	26,235	2.2%	30,610	2.0%	32,798	2.0%
Water/Wastewater Treatment		8,061	0.7%	8,794	0.7%	10,261	0.7%	10,994	0.7%
Total	**1,183,279**	**1,120,803**	100.0%	**1,208,245**	100.0%	**1,524,599**	100.0%	**1,670,080**	100.0%
% below 2005									

(Legislative-Adjusted)

Sector	2020 MT CO2e/yr	2020 % of total	2040 MT CO2e/yr	2040 % of total	2050 MT CO2e/yr	2050 % of total	
Residential Energy	158,749	15.5%	184,820	15.0%	202,437	14.9%	Residential energy was discounted for RPS and 2013 Title 24. See Legislative Reductions Tab.
Commercial/Industrial Energy	231,856	22.6%	269,388	21.8%	296,873	21.8%	Non-residential energy was discounted for RPS and 2013 Title 24. See Legislative Reductions Tab.
Transportation	600,764	58.6%	738,873	59.9%	817,151	60.1%	Transportation emissions were discounted for Pavley I standards using EMFAC 2011 (but does not assume any discounting due to LCFS)
Solid Waste	26,235	2.6%	30,610	2.5%	32,798	2.4%	No legislative reductions were assumed for solid waste
Water/Wastewater Treatment	8,170	0.8%	9,532	0.8%	10,214	0.8%	Water consumption was discounted for RPS
Total	**1,025,775**	100.0%	**1,233,223**	100.0%	**1,359,472**	100.0%	
% below 2005	13%						

Sources:

Residential Energy sector was projected using growth in number of households (see demographic data tab)
Commercial/Industrial Energy sector was projected using growth in employment (see demographic data tab)
Transportation emissions were based on VMT inputs from Kittelson Associates; emissions were estimated using EMFAC 2011. Emission factors are not available beyond fleet year 2035, and thus 2035 emission factors were used to estimate mobile source emissions in years 2040 and 2050
Solid Waste sector was projected using population growth rate (see demographic data tab)
Water/Wastewater treatment sector was projected using population growth rate (see demographic data tab)

Conversion Factors

0.90718474	MT	1	short ton
365	days	1	year
1.01	CO2e	1	CO2

Source: ARB methodology for conversions of EMFAC2011 output to get results for CH4 and N2O.

Summary

City of Hayward Greenhouse Gas Emissions Projections and Proposed Targets

*data updated 9/5/13 by HP

	Baseline Annual GHG (MTCO2e)	BAU	Legislative-Adjusted Annual GHG (MTCO2e)	Reduction Target Annual GHG (MTCO2e)	**Emission Reduction (MTCO2e)**	% below baseline	% below BAU	% below Legislative-Adjusted
2005	1,183,279							
2010	1,120,803							
2020		1,208,245	1,025,775	946,623	**79,151**	20.0%	21.7%	7.7%
2030		1,364,608	1,132,717	700,107				
2040		1,524,599	1,233,223	453,590	**779,633**	61.7%	70.2%	63.2%
2050		1,670,080	1,359,472	207,074	**1,152,398**	82.5%	87.6%	84.8%

Demographic Data

City of Hayward

Sources: Population, Housing and Employment data for 2010 and 2040 from GPU Background Report, Chapter 4.

Source: VMT data calculated for Hayward using Origin-Destination method (RTAC method) by Kittelson Associates. September 5th, 2013 email from Mike Aronson to Erik deKok (Ascent).

	2005	2010	2020	2040	2050
Population		144,186	157,302	183,533	196,649
Annual Average Population growth rate			0.9%	0.8%	0.7%
Households		45,365	49,852	58,825	63,312
Annual Average Households growth rate			1.0%	0.9%	0.8%
Employment		69,100	76,033	89,900	96,833
Annual Average Employment growth rate			1.0%	0.9%	0.8%
Persons/Household		3.18	3.16	3.12	3.11
VMT (daily) Total		3,369,013	3,892,228	4,938,658	5,461,873
MT CO2e/passenger VMT			0.19232	0.19884	0.19884
VMT/capita		23.36574286	24.74371749	26.90882839	27.77477769

Blue text = interpolated value

Purple text = extrapolated value

Energy Consumption by End Use (annual average)

Electricity	**Residential**	**Commercial**
Air Conditioning	9.9%	15.7%
Water Heating	6.2%	0.4%
Space Heating	12.8%	3.4%
Lighting	15.0%	34.2%
Other	43.9%	53.7%

Source: CEC Energy Almanac. 2010. California Electricity Consumption by End Use. PG&E Estimates for year 2020. http://www.energyalmanac.ca.gov/electricity/electricity_stats/index.html

Natural Gas	**Residential**	**Commercial**
Water Heating	44.0%	*no data
Space Heating	44.0%	*no data

Source: CEC Energy Almanac. 2010. California Residential Natural Gas Consumption by End Use. California Energy Commission. CEC-200-2009-012-CMF.

http://www.energyalmanac.ca.gov/naturalgas/residential_use.html. Kavalec, Chris and Tom Gorin, 2009. California Energy Demand 2010-2020, Adopted Forecast.

	2010
Solid Waste Diversion	67.0%

Source: http://www.stopwaste.org/docs/diversion.pdf

Housing Stock	2009-2011 Average
Detached	51.8%
Attached	48.2%

Source: ACS S2504: PHYSICAL HOUSING CHARACTERISTICS FOR OCCUPIED HOUSING UNITS

B25034: YEAR STRUCTURE BUILT - Universe: Housing units

Hayward city, California

	Estimate	Margin of Error
Total:	47,832	+/-1,016
Built 2005 or later	1,748	+/-339
Built 2000 to 2004	2,443	+/-459
Built 1990 to 1999	3,970	+/-527
Built 1980 to 1989	6,482	+/-615
Built 1970 to 1979	10,577	+/-826
Built 1960 to 1969	5,750	+/-601
Built 1950 to 1959	12,427	+/-692
Built 1940 to 1949	2,241	+/-344
Built 1939 or earlier	2,194	+/-441

Source: ACS 2009-2011

Pre-2000 units
43,641.00

Commercial Floor Area (2008)
48,317,391 sq ft

Source: Erik Pearson; 9/10/13 email to Erik deKok, Ascent Environmental

Conversion Factors

0.90718474	MT	1	short ton
365	days	1	year
1.01	CO2e	1	CO2

Source: ARB methodology for conversions of EMFAC2011 output to get results for CH4 and N2O.

Legislative Reductions

Scoping Plan Measure	Emissions Sector	Subsector	% Reduction in 2020	% Reduction in 2040	% Reduction in 2050	Portion of City's Inventory Affected in 2020 (MT CO2e)	Emission Reduction from 2020 Projected Emissions	Portion of City's Inventory Affected in 2040 (MT CO2e)	Emission Reduction from 2040 Projected Emissions	Portion of City's Inventory Affected in 2050 (MT CO2e)	Emission Reduction from 2050 Projected Emissions	Notes:
Federal Fuel Economy Standards; AB 1493 (Pavley I)	Transportation		19.7%	24.8%	24.8%							Source: EMFAC 2011; Notes: 10% contribution from LCFS allocated by EMFAC was eliminated from this estimate because LCFS may not be applicable to tailpipe emissions and would not necessarily affect the City's inventory
Title 24 Building and Appliance Energy Efficiency Standards	Residential Energy	new development	20.0%	20.0%	20.0%	15,272.67	3,054.53	30,545.33	6,109.07	15,272.67	3,054.53	Source: CEC 2012. 2013 Building Energy Efficiency Standards Adoption Hearing Presentation. Applicable to new development-related energy emissions (2020-2010 emissions; 2040-2020 emissions; 2050-2040 emissions)
	Non-Residential Energy	new development	25.0%	25.0%	25.0%	23,250.15	5,812.54	46,500.30	11,625.08	23,250.15	5,812.54	
	Subtotal						8,867.07		17,734.14		8,867.07	
							Scaled % Reduction from 2020 Projected					
Renewable Electricity Standard; Renewable Portfolio Standard (20% by 2010 and 33% by 2020)	Energy	electricity	14.0%	14.0%	14.0%	43.3%	6.1%					Source: California Public Utilities Commission. 2013. Available: http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm PG&E Renewable Portfolio = 19% in 2011; 33% required in 2020. 33% - 19% = 14%; assumed no additional reduction in 2035 Assumes electricity/natural gas split remains constant from 2010
Total												

GHG Reduction Summary

		2020	2040	2050
		MT CO2e/year	MT CO2e/year	MT CO2e/year
Transportation Strategies				
Action 1.1	Commuter Benefits	1,806	2,221	2,456
Action 1.2	Car/Bike Sharing	4,475	5,570	6,118
Action 1.4	Parking Strategies	356	1,139	1,260
Action 1.6	Bicycle Master Plan	244	9,162	10,133
Action 1.7	Pedestrian Master Plan	6,008	7,389	8,172
Energy Strategies				
Action 3.7	Finance Energy Efficiency - Single-Family	1,458	6,705	11,055
Action 3.8	Finance Energy Efficiency - Multi-Family	1,488	6,796	11,635
Action 3.9	Finance Energy Efficiency - Commercial	556	8,638	17,544
Action 5.1	Finance Renewable Energy - Residential	657	1,854	1,854
Action 5.2	Finance Renewable Energy - Commercial	8,320	19,692	19,692
Action 5.3	Community Choice Aggregation	61,431	71,438	78,520
Action 5.7	Renewable Energy at City Facilities	737	737	737
Solid Waste Strategies				
Action 6.1	Solid Waste Diversion	2,099	2,449	2,624
Water & Wastewater Strategies				
Action 6.8	Implement Urban Water Management Plan	327	381	409
Carbon Sequestration				
Action 7.1	Carbon Sequestration	-	385	385
Action 7.2	Carbon Sequestration on City Property	-	44	44
Total Reduction		**89,961**	**144,599**	**172,637**
Target		79,151	779,633	1,152,398
Gap (Surplus)		**(10,810)**	**635,034**	**979,761**

Energy Efficiency and Renewable Energy Actions

Notes:

Action 3.7 Single Family EE Financing	Measure Performance	Sector (Residential Energy)	% of units affected during phase	% of Detached Units	% of eligbile (pre-year 2000 constructed) units	Scaled % Reduction	GHG Reduction (MT CO2e/year)	Aggregate GHG Reduction (MT CO2e/yr)	Eligible Housing Stock (detached units)	Units affected during phase	Notes
On-bill financing incentive											
2014-2017	15%	15.5%	6.6%	51.8%	87.5%	0.1%	716		22,606.04	1,500	Assumes 500 units/year affected under on-bill financing incentive program
2017-2020	15%	15.5%	7.1%	51.8%	84.5%	0.1%	741	1,458	21,106.04	1,500	Assumes homes would be retrofitted to improve energy efficiency by 15%
2040	15%	15.0%	51.0%	51.8%	71.6%	0.4%	5,247	6,705	19,606.04	10,000	Source: 51.8% of occupied units in Hayward are detached. ACS 2009-2011 Housing Characteristics
2050	15%	14.9%	52.1%	51.8%	53.1%	0.3%	4,350	11,055	9,606.04	5,000	Assumes program would apply to all units constructed pre-year 2000. Assumes 2020 households as a proxy for 2020 housing units
									Total	**18,000.00**	

Action 3.8 Multi-Family EE Financing	Measure Performance	Sector (Residential Energy)	% of units affected during phase	% of Attached Units	% of eligbile (pre-year 2000 constructed) units	Scaled % Reduction	GHG Reduction (MT CO2e/year)	Aggregate GHG Reduction (MT CO2e/yr)	Eligible Housing Stock (attached units)	Units affected during phase	Notes
On-bill financing incentive											
2014-2017	15%	15.5%	7.1%	48.2%	87.5%	0.1%	716		21,034.96	1,500	Assumes 500 units/year affected during first 3 years of on-bill financing program
2017-2020	15%	15.5%	7.7%	48.2%	84.5%	0.1%	772	1,488	19,534.96	1,500	Assumes homes would be retrofitted to improve energy efficiency by 15%
2040	15%	15.0%	55.4%	48.2%	71.6%	0.4%	5,308	6,796	18,034.96	10,000	Source: 48.2% of occupied units in Hayward are attached ACS 2009-2011 Housing Characteristics
2050	15%	14.9%	62.2%	48.2%	53.1%	0.4%	4,839	11,635	8,034.96	5,000	Assumes program would apply to all units constructed pre-year 2000. Assumes 2020 households as a proxy for 2020 housing units
									Total	**18,000.00**	

Action 3.9 Commercial EE Financing	Measure Performance	Sector (Commercial Energy)	% of CFA affected during phase	Scaled % Reduction	GHG Reduction	Aggregate GHG Reduction	Eligible Building Stock (sq ft)	Units affected during phase (sq ft)	Notes
On-bill financing incentive									
2017-2020	8%	22.6%	3.0%	0.1%	556	556	48,317,391	1,449,522	Phase 1 (2017-2019) – It is assumed that 3% of commercial units (square footage) will participate in the program during this phase. The goal of the first phase of this program is to reduce electricity use by 8% and reduce natural gas use by 8% in participating commercial units.
2040	20%	21.8%	15.0%	0.7%	8,082	8,638	46,867,869	7,030,180	Phase 2 (2020-2040) – It is assumed that 15% of commercial units (square footage) will participate in the program during this phase. The goal of the first phase of this program is to reduce electricity use by 20% and reduce natural gas use by 20% in participating commercial units.
2050	20%	21.8%	15.0%	0.7%	8,906	17,544	39,837,689	5,975,653	Phase 3 (2041- 2050) – It is assumed that 15% of commercial units (square footage) will participate in the program during this phase. The goal of the first phase of this program is to reduce electricity use by 20% and reduce natural gas use by 20% in participating commercial units.

Action 5.1 Residential Solar Installations	# of systems	total system size (MWh/year available)	PG&E emission factor (lb CO2e/MWh)	Conversion (lb/MT)	GHG reduction (MT CO2e/yr)	Notes
2020	1,041	4,991	290	2,204	657	HDR assumed that 1,041 units would have PV installed by 2020 and 2,857 units by 2035
2040	2,851	14,093	290	2,204	1,854	HDR 4,991 MWh/year available by 2020 and 14,093 MWh/year available by 2035
2050	2,857	14,093	290	2,204	1,854	PG&E's emission factor in 2020 was estimated by CPUC at 290 lb/MWh. CPUC did not estimate emission factor beyond 2020.

Action 5.2 Commercial Solar Installations	total system size (MWh/year available)	PG&E emission factor (lb CO2e/MWh)	Conversion (lb/MT)	GHG reduction (MT CO2e/yr)	Notes
2020	63,234	290	2,204	8,320	HDR assumed that 4,486,770 square feet of commercial would have PV installed by 2020 and 6,757,240 square feet of commerical by 2035
2040	149,659	290	2,204	19,692	HDR assumed 63,234 MWh/year available by 2020 and 149,659 MWh/year available by 2035
2050	149,659	290	2,204	19,692	PG&E's emission factor in 2020 was estimated by CPUC at 290 lb/MWh. CPUC did not estimate emission factor beyond 2020.

Action 5.7 Renewable Energy on City Facilities (WWTP)	total system size (MWh/year available)	PG&E emission factor (lb CO2e/MWh)	Conversion (lb/MT)	GHG reduction (MT CO2e/yr)
2020	5,600	290	2,204	737
2040	5,600	290	2,204	737
2050	5,600	290	2,204	737

Action 5.3 Community Choice Aggregation	Measure Performance	Participation Rate	Subsector (Electricity)	Scaled % Reduction	GHG reduction (MT CO2e/yr)	total
	100%	5%	16%	0.80%	8,256	
2020	50%	90%	12%	5.18%	53,176	61,431
	100%	5%	16%	0.78%	9,598	
2040	50%	90%	11%	5.01%	61,840	71,438
	100%	5%	16%	0.78%	10,557	
2050	50%	90%	11%	5.00%	67,964	78,520

Transportation & Land Use Strategies

Action 1.1: Commuter Benefits		Measure Performance	Sector (Transportation)	Eligible Employers	Scaled % Reduction	GHG Reduction
	2020	1.00%	58.6%	30%	0.18%	1,806
	2040	1.00%	59.9%	30%	0.18%	2,221
	2050	1.00%	60.1%	30%	0.18%	2,456

Notes:
CAPCOA TRT-1; assumes voluntary measure and 50% of employers are eligible (i.e., >50 employees). Applies throughout the City, not just to new employers.

# of eligible employees calculated based on Employer size data from Erik Pearson (6/14 email to Erik deKok, Ascent Environmental

Action 1.2: Car-sharing and Bike-share program		Measure Performance	Sector (Transportation)	Scaled % Reduction	GHG Reduction
Car-sharing	2020	0.7%	58.6%	0.4%	4,205
Bike-sharing					269
					4,475
Car-sharing	2040	0.7%	59.9%	0.4%	5,172
Bike-sharing					398
					5,570
Car-sharing	2050	0.7%	60.1%	0.4%	5,720
Bike-sharing					398
					6,118

CAPCOA TRT-9. 0.7% (car share); Assumes 1 car per 1000 population in urban market at full implementation
CAPCOA TRT-12. 1/3 vehicle trip per day per bicycle. Regional pilot project aims to have 1000 bicycles at full implementation

Assumes 700 bikes by 2020; 1000 bikes by 2040; Assumes that bike share trips replace 1/3 of a 6-mile passenger trip.

Action 1.5: Bicycle Master Plan		Lane miles/square miles	% Increase in lane miles/sq miles	Mode share	Measure Performance	Sector (Transportation)	Scaled % Reduction	GHG Reduction
Existing		0.46		0.36%				
	2020	0.52	11.3%	0.40%	0.04%	58.6%	0.02%	244
	2040			1.6%	1.24%	59.9%	0.74%	9,162
	2050			1.6%	1.24%	60.1%	0.75%	10,133

CAPCOA SDT-5: 1% elasticity in bicycle mode share for every 1% increase in lane miles/square mile (Hayward = 63 square miles)
Assumes addition of 3.3 miles of Class I lane miles by 2020 (Bicycle Master Plan 2007: page 4-8.) 29.2 existing class I + class II lane miles in Hayward (Bicycle MP; page 3-14)
existing bicycle mode share: 0.36% (pg 5-2). Bicycle MP estimates aspirational target of 1.6% bicycle mode share (pg 5-4)

Action 1.4: Parking Strategies		Measure Performance	Sector (Transportation)	Sub-sector (downtown TAZ-generated VMT)	Scaled % Reduction	GHG Reduction
	2020	1.0%	58.6%	5.9%	0.03%	356
	2040	2.6%	59.9%	5.9%	0.09%	1,139
	2050	2.6%	60.1%	5.9%	0.09%	1,260

Downtown TAZ-generated VMT relative to total Hayward VMT obtained from Kittelson Associates. September 16, 2013 email from Mike Aronson to Erik deKok (Ascent)
CAPCOA TRT-14. $1/day pricing = 1% VMT reduction; $3/day pricing = 2.6% VMT reduction
Deakin, E., Harvey, G., Pozdena, R., and Yarema, G., 1996. Transportation Pricing Strategies for California: An Assessment of Congestion, Emissions, Energy and Equity Impacts. Final Report. Prepared for California Air Resources Board (CARB), Sacramento, CA (Table 7.2)

Action 1.6: Pedestrian Master Plan		Measure Performance	Sector (Transportation)	Scaled % Reduction	GHG Reduction
	2020	1.00%	58.6%	0.59%	6,008
	2040	1.00%	59.9%	0.60%	7,389
	2050	1.00%	60.1%	0.60%	8,172

CAPCOA SDT-1. 1-2% reduction. Conservatively assumed 1% reduction

Solid Waste and Recycling Actions

Waste reduction target		Portion of Inventory Affected	Measure Performance	Scaled Measure Performance	GHG Reduction (MT CO2e)	Notes:
75 percent diversion from the waste stream by 2020		2.6%	8.0%	0.2%	2,099	Assumes net increase of 49.9% in diversion (currently 25%);
	2040	2.5%	8.0%	0.2%	2,449	Assumes no additional diversion targets beyond 2020
	2050	2.4%	8.0%	0.2%	2,624	

Water Conservation and Wastewater Strategies

4% Reduction in Water Consumption by 2020		Measure Performance	Sector (water/wastewater)	Scaled % Reduction	GHG Reduction
	2020	4%	0.8%	0.03%	327
	2040	4%	0.8%	0.03%	381
	2050	4%	0.8%	0.03%	409

Notes:

http://www.hayward-ca.gov/CITY-GOVERNMENT/DEPARTMENTS/PUBLIC-WORKS/documents/2011/2010UrbanWaterManagement071811.pdf

Carbon Sequestration

Notes:

Action 7.1 Urban Forestry (Community-wide)		Trees Planted	Carbon Sequestration Rate (MT CO2e/tree/year)	GHG Reduction	
	2020	0.00	0.04	-	Assumes 1750 trees planted per year from 2020-2035.
	2040	10,500	0.04	385	Carbon Sequestration rate 0.0367 MT CO2/year/tree (CalEEMod factor for mixed hardwood)
	2050	10,500	0.04	385	Calculation does not account for additional savings from reduced energy consumption because of shading

Action 7.2 Urban Forestry (Municipal Property)		Trees Planted	Carbon Sequestration Rate (MT CO2e/tree/year)	GHG Reduction	
	2020	0.00	0.04	-	Assumes 200 trees planted per year from 2020-2025
	2040	1,200	0.04	44	Carbon Sequestration rate 0.0367 MT CO2/year/tree (CalEEMod factor for mixed hardwood)
	2050	1,200	0.04	44	