



UNIVERSITY OF CALIFORNIA
SANTA CRUZ



WATER ACTION PLAN

December 2017

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Glossary

- **AY:** Academic Year (September - June)
- **CSP:** Campus Sustainability Plan
- **FY:** Fiscal Year (July - June)
- **LRDP:** UC Santa Cruz Long Range Development Plan
- **Single Pass Cooling:** Single Pass or Once Through cooling systems flow water through a piece of equipment to absorb heat and dispose the water down the drain without recirculation. Replacing and managing these types of systems is a recommended best practice by the International Institute for Sustainable Laboratories (formerly Labs 21), US Office of Energy Efficiency & Renewable Energy, and the EPA. Equipment typically using this type of cooling includes hydraulic equipment, distillation condensers, refrigeration condensers, air compressors, vacuum pumps, electron microscopes, mass spectrometers, lasers, helium recovery, and electromagnets.
- **SCWD:** City of Santa Cruz Water District
- **Turf:** a variety of commonly used grass subspecies chosen for aesthetic/landscaping purposes (lawn) that require inputs such as mowing, chemicals, or irrigation
- **UCOP:** University of California Office of the President
- **UWMP:** City of Santa Cruz Urban Water Management Plan
- **WAP:** Water Action Plan
- **WSCP:** City of Santa Cruz Water Shortage Contingency Plan
- **WWG:** Water Working Group

Executive Summary

The University of California Santa Cruz's 2017 Water Action Plan (WAP) recognizes successes in water conservation and identifies implementable strategies to reduce UC Santa Cruz's potable water demand and to promote healthy watersheds on and around the campus. The 2017 WAP serves as an update to the 2013 WAP; therefore, the information included herein spans the time period of January 2014 through December 2017.

The University of California Board of Regents Sustainable Practices Policy on Sustainable Water Systems states: "Consistent with the Federal Government's Executive Order, [campuses] will reduce growth-adjusted potable water consumption 20% by 2020 and 36% by 2025, when compared to a three-year average baseline of FY 2005-06, FY 2006-07, and FY 2007-08"ⁱ.

UC Santa Cruz has been proactive in water conservation through infrastructural improvements, technological upgrades including leak detection and monitoring software, advanced evapotranspiration irrigation technology, and user conservation behavior including a successful coordinated campus drought response: as a result, campus potable water usage has followed a downward trend while campus population continues to increase. UC Santa Cruz's main campus average historical use over the UCOP designated three year baseline, Fiscal Year (FY) 2005-06, 2006-07, and 2007-08, is 13,924 gallons per weighted campus user. In FY 2016-17, the campus used 8,856 gallons per weighted campus user, reaching a 36.4% reduction from the baseline, surpassing the UC Office of the President's 2020 20% reduction and marginally exceeding the 2025 36% reduction goals.

Over the last 30 years, annual water consumption has remained relatively steady even though UC Santa Cruz enrollment has more than doubled over the same time period. As such, UC Santa Cruz is committed to proactively managing and efficiently using limited water resources; maintaining a positive relationship with and partnering with the City of Santa Cruz Water Department; and promoting education, research, and practice on potable water use reduction and non-potable water development. While UC Santa Cruz has been a leader among the UC campuses in sustainable water systems and watershed management, the campus remains committed to sustaining efforts and practices that support water reduction in future years.

Best Practices & Key Updates from 2013 Water Action Plan

- UC Santa Cruz exceeded the UCOP goal of 20% water reduction by 2020 and marginally exceeded the 36% water reduction by 2025 with 36.4% reduction from the FY 2005-08 baseline.
- The Beacon system is online and operable.
- The student-led Take Back the Tap partial bottled water ban has been implemented.
- UC Santa Cruz received the [2015 Best Practice Award for Water Efficiency](#) at the California Higher Education Sustainability Conference for organizing a successful response to the drought, resulting in an average of a 25% reduction in water consumption over the 2014 drought season.ⁱⁱ
- The campus developed the 2017-22 Campus Sustainability Plan which roadmaps water-related goals, strategies, and actions for implementation.

Key Opportunities

- Develop water reduction targets across campus, by type of use, to further water conservation practices and usage reduction in non-drought conditions.
- Evaluate the use of non-potable water sources for irrigation;
- Identify and prioritize sections of aging piping infrastructure that may have to be replaced to proactively prevent future leakage.
- Remove eligible turf irrigated by potable water;
- Replace single-pass cooling systems, which draw large amounts of potable water;

Introduction

Regents' Policy

The University of California is committed to responsible stewardship of resources and to demonstrating leadership in sustainable business practices. The University's campuses should be living laboratories for sustainability, contributing to the research and educational mission of the University, consistent with available funding and safe operational practices.

Inspired by students' calls for action, the University's institutional commitment to campus sustainability began in June 2003, when the Board of Regents adopted green building and clean energy policy principles. In June 2004, President Dynes issued detailed guidelines for the Policy on Green Building Design and Clean Energy Standards. Reflecting its broadened scope, the policy's name was changed to the [Policy on Sustainable Practices](#). This comprehensive policy established the University as a leader among institutions of higher education in fostering and promoting environmental stewardship.

As a testament to the University of California's commitment to sustainable practices, the Regents Policy includes a section on Sustainable Water Systems. In accordance with the Policy, each UC campus is asked to develop and maintain a Water Action Plan that identifies long-term strategies for achieving sustainable water systems. Each Water Action Plan and the water conservation and efficiency strategies it contains will take into account relevant regional

conditions and regulatory requirements, will recognize historical progress, and will acknowledge current Campus best practices being implemented.

In 2015, the UC Sustainability Steering Committee approved new water policies into the Sustainable Water Systems section of the Sustainable Practices Policy. The policy revision directs campuses to:

- Identify existing single pass cooling systems and constant flow sterilizers and autoclaves in laboratories;
- Connect new equipment requiring liquid cooling to:
 - an existing recirculated building cooling water system;
 - a new local chiller vented to building exhaust or outdoors; or,
 - the campus chilled water system through an intervening heat exchange system, if available.
- Quantify the total square feet of used turf and under-used turf areas on campus.

The policy revision also directs campuses to create a replacement plan for:

- existing single pass cooling systems; and,
- phasing out unused turf irrigated with potable water.

UC Santa Cruz Water Action Plan

This document has been developed in accordance with and to satisfy the Policy on Sustainable Practices stipulations of UC Santa Cruz maintaining an updated WAP.

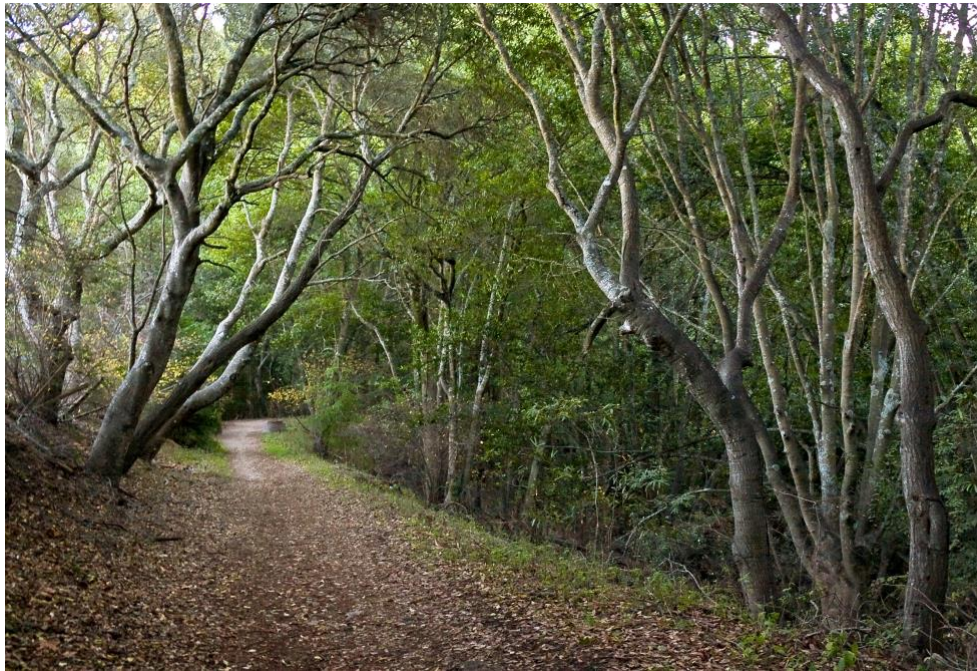
In compiling the WAP, UC Santa Cruz recognizes the limited nature of water resources in our region, its role as a responsible steward of water resources in the community, and that periods of extreme drought and storms may become the new normal instead of the exception as a result of climate change. The document reviews the unique topography of campus and outlines the implications of stormwater and watershed management dependent upon deep ravines, sink holes and swallow holes in a landscape dominated by redwood forest and open meadows. The WAP identifies current and historic potable water usage and trends, details the regional context of the UC Santa Cruz water supply and the recent drought conditions and the campus response, as well as recognizes campus achievements and best practices. The WAP also details academic course offerings, outreach programs, and student-led activities that demonstrate substantial and multifaceted campus engagement on water issues. Lastly, the WAP details future water action planning, opportunities, reporting, and implementation.

Site Overview & Physical Context

The UC Santa Cruz campus is situated at the northwest edge of the City of Santa Cruz. The campus site consists of a series of relatively level marine terraces separated by steep slopes, sloping upwards from south to north. Almost 900 feet of elevation gain exists from south to north, from an elevation of 300 feet at its southern boundary on High Street to an elevation of

about 1,200 feet at its northwestern boundary. The lower, central, north, and upper campus areas roughly correspond with three of the oldest distinct terraces.

UC Santa Cruz is known for its outstanding natural beauty and landscape. The scenic and aesthetic quality of the campus is largely a function of the campus's natural setting and the diversity of its natural features.



A walking path cuts through the forest on UC Santa Cruz's campus.

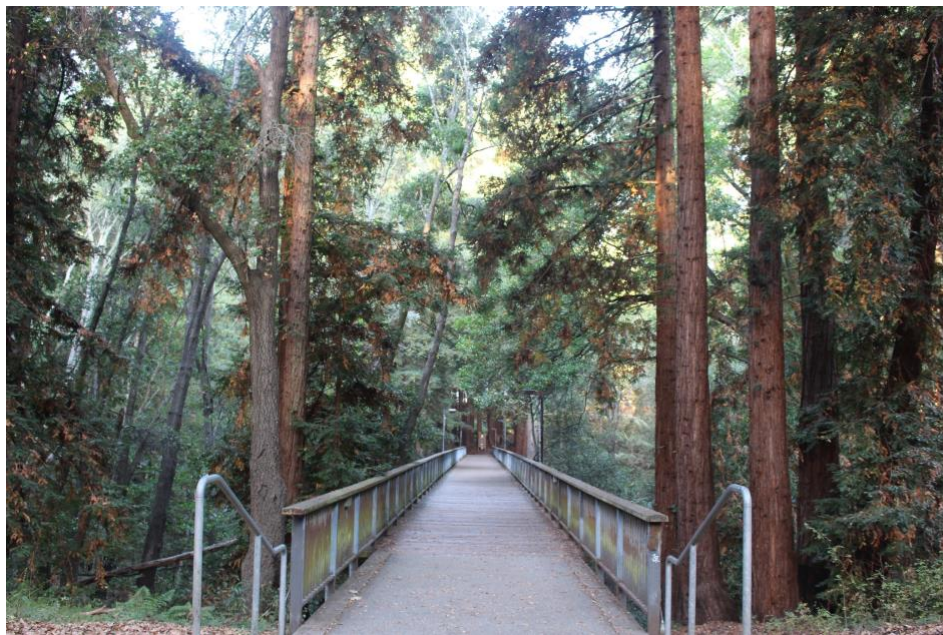
Courtesy: UC Santa Cruz University Relations.

The campus abuts open-space park areas to the north, east and west and residential portions of the City of Santa Cruz to the south. The campus is bounded on the east by the Pogonip City Park and the Henry Cowell Redwoods State Park, on the north by private land, and on the west by Wilder Ranch State Park. Several residential neighborhoods lie to the south of the campus, and the rural residential Cave Gulch neighborhood lies just outside the western campus boundary.

The campus landscape is as varied as its topography. Expansive meadows at the campus' main entrance gradually transition to redwood forests in the central campus and to chaparral and mixed evergreen forests in the undeveloped north and upper campus. Due to the campus' elevation above the surrounding area, sweeping views of the City of Santa Cruz and Monterey Bay are available from several locations on the lower and central campus.

Five watersheds exist on campus, two of which drain off campus. The central and lower portions of the campus are divided roughly in thirds by two steep north-south trending drainages and their tributaries. Jordan Gulch and its tributaries delineate the eastern third of the campus, while Moore Creek and its tributaries delineate the western third. Other drainages include Cave

Gulch, which has its headwaters in the northern part of the campus and runs along the southwestern margin of the campus, and Wilder Creek, which also runs along a portion of the campus's western margin. In some areas of the campus, these creeks form ravines, some as expansive as 70 feet deep and 350 feet wide. A number of smaller drainages originate along the campus's eastern boundary and drain to the Pogonip City Park.



Bridges connect areas of campus separated by ravines. Courtesy: Kristen Lee.

The geology of the upper and north campus consists of weathered schist and granitic rocks, which are overlain in some areas by thin (5- to 30-foot thick) covering of sedimentary deposits. The dispersal of surface flow allows for rainwater to percolate into the ground and recharge a shallow groundwater system. In the north campus, the shallow groundwater feeds forest springs and seeps located along the southern and eastern edge of the north campus. Many of the forest springs are perennial (i.e., flow throughout the year) during years of average and high rainfall.

The southern two-thirds of the campus is underlain by marble and schist bedrock. This portion of the campus is cut by several steep-walled north-south flowing streams, but very little stormwater is conveyed by surface streams to channels downstream of the campus. Instead, most stormwater is captured by the karst aquifer, stored and transmitted via solution channels and caves, and discharged in springs at lower elevations to the east, south and west of the campus.

Regional Water Supply & Planning Context

Hyperlocal Water Supply

The UC Santa Cruz campus receives potable water through nine points of connection to the City of Santa Cruz Water District (SCWD) system. SCWD pumps potable water to three consecutive in-line reservoirs at separate elevations ranging from 400 feet to 1,113 feet at a point in the northern campus. A campus water system then distributes water to campus facilities in eight separate pressure zones.

The table below, included in the [City of Santa Cruz's 2015 Urban Water Management Plan](#) (UWMP), demonstrates that the campus water demand represents approximately 6.5% of the total SCWD service area demand.ⁱⁱⁱ It is worth noting that water demands in 2015 were strongly impacted by two consecutive years of a Stage 3 Water Shortage Emergency, and the University was required to meet a 20% reduction between the months of June and November 2015. The table below is derived from actual billing records and includes the Main and Marine Science Campuses.

Table 4-1. Demands for Potable Water – Actual			
Use Type	2015 Actual		
	Additional Description <i>(as needed)</i>	Level of Treatment When Delivered	Volume (mg)
Single Family	Individually meter dwellings	Drinking Water	835
Multi-Family	2 or more dwelling units	Drinking Water	538
Commercial		Drinking Water	485
Industrial		Drinking Water	43
Industrial	UC Santa Cruz	Drinking Water	160
Institutional/Governmental	Municipal (city) accounts	Drinking Water	35
Landscape	Dedicated Irrigation Accounts	Drinking Water	46
Landscape	Golf Irrigation	Drinking Water	87
Losses		Drinking Water	223
TOTAL			2,452

City of Santa Cruz 2015 Urban Water Management Plan

According to the UWMP, UC Santa Cruz's demand for potable water is projected to constitute 5.9% of the SCWD supply in 2020, 7.3% in 2025, and 9.6% in 2035 under business-as-usual consumption based on data leading up to 2015.^{iv} The table below, which is a forecast, is based on an earlier projection of the UC Santa Cruz demand requirement under the 2005 LRDP, as modified by the City of Santa Cruz during the Water Supply Alternative Committee process. It includes the Main Campus, Marine Science Campus, as well as 2300 Delaware facility. It represents water use that would be expected to occur in the absence of drought or economic downturn. It is noteworthy that neither the 2013 nor 2017 Water Action Plans include 2300 Delaware in the reporting boundaries. It is also noteworthy that at the time of writing of this WAP, UC Santa Cruz was in the early planning stages for: 1) an updated LRDP, and 2)

developing additional campus housing (Student Housing West), which have not been incorporated within these projections due to a lack of final projection numbers at this juncture.

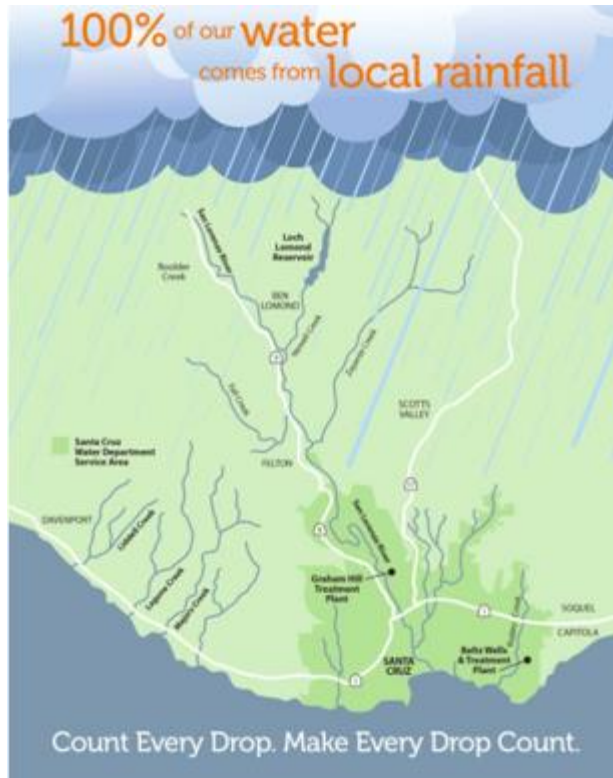
Table 4-3. Demands for Potable Water - Projected						
Use Type	Additional Description	Projected Water Use (mgd)				
		2020	2025	2030	2035	2040-opt
Single Family	Individually metered dwellings	1,277	1,223	1,191	1,170	n/a
Multi-Family	2 or more dwelling units	772	714	690	678	n/a
Commercial		574	541	525	519	n/a
Industrial		56	59	60	61	n/a
Institutional/ Governmental	Municipal (city) accounts	46	42	40	40	n/a
Landscape	Dedicated Irrigation	112	119	134	144	n/a
Landscape	Golf Irrigation	58	52	47	47	n/a
Other	UC Santa Cruz	196	234	271	308	n/a
Water Losses		236	241	247	253	n/a
TOTAL		3,327	3,225	3,205	3,220	n/a

NOTES: David Mitchell, M Cubed, October 2015, and by Maddaus Water Management, February 2016

City of Santa Cruz 2015 Urban Water Management Plan

The SCWD provides water to 95,251 customers through approximately 24,534 service connections in the City of Santa Cruz, the campus, a portion of the unincorporated area of Santa Cruz County, and a small portion of the City of Capitola. The SCWD water service area covers approximately 20 square miles.

The SCWD currently has four water supply sources: 1) surface water diversions from three creeks and one natural spring on the Santa Cruz County North Coast; 2) surface water diversions from San Lorenzo River; 3) surface water from Loch Lomond Reservoir; 4) groundwater extracted from the Purisima Formation by the Live Oak well system. Ninety-four percent of SCWD's water supply comes from local surface waters. The main source of SCWD's water, the San Lorenzo River, makes up 59% of the supply. Other flowing sources include Majors Creek, Laguna Creek and Liddel Spring, which account for 35% of supply. The only reservoir for the City of Santa Cruz is Loch Lomond Reservoir, which holds 2.8 billion gallons. The remaining 6% is produced from the Live Oak wells.

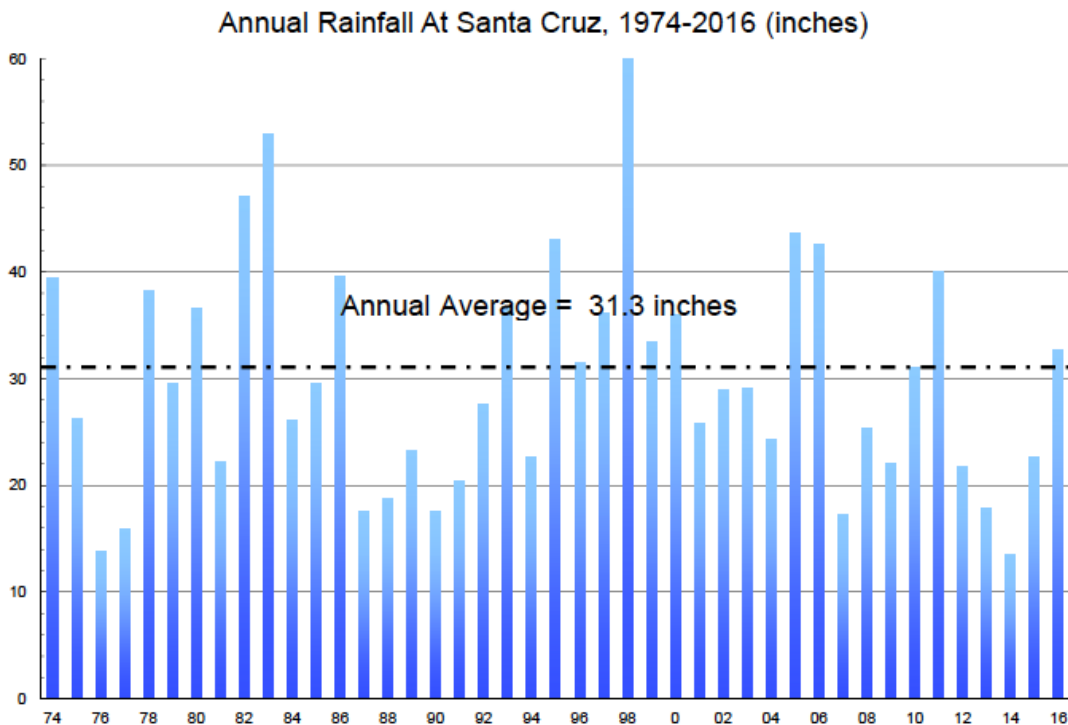


*City of Santa Cruz Water Department website.
Where Does Our Water Come From?*

The SCWD system does not purchase water from state or federal sources, nor does it import water to the region from outside the Santa Cruz area, as the water system is both physically and geographically isolated. The system relies almost exclusively on local surface water sources, whose yield varies greatly depending on the amount of rainfall received during the winter season, during which the majority of runoff is generated. Among the noteworthy aspects of the SCWD system is the only runoff water available to the City is that which originates from rainfall on the ocean side of the Santa Cruz Mountains. This variation and limited geographic area from which runoff occurs results in inconsistency in water supply from year to year. The variation in rainfall and runoff has been a significant constraint in recent years as the Central Coast, as well as the State of California, were held in the grip of a multi-year drought. The system is vulnerable to shortage in extended dry periods or critically dry years, when the flow in local streams and river sources runs low. In understanding the SCWD system, it is important to note that since the WSCP was published in 2009, the City of Santa Cruz has “had to declare a water shortage in five of the past seven years”.^v

“In normal and wet years, when local rainfall and runoff are abundant, the water system is capable of meeting the community’s current total and anticipated annual water requirements; however, in multi-year or critical drought conditions, the combination of very low surface flows in the coast and river sources and depleted storage in Loch Lomond reservoir reduces available supply to a level which cannot support average dry season demands. The existing system is not able to provide a reliable supply during

multi-year droughts or prolonged periods of drier than normal hydrologic conditions within the source watersheds”.^{vi}



City of Santa Cruz historical rainfall

Limited emergency interconnection capability may be possible due to existing interties with a neighboring water district. The primary function of the interties is to allow for the movement of water to the Soquel Creek Water District that currently relies solely on groundwater from a critically over drafted basin.

Water Shortage Contingency Plan

The City of Santa Cruz completed a comprehensive update of its Water Shortage Contingency Plan (WSCP) in 2009. The Plan “describes the conditions which constitute a water shortage, and provides guidelines, actions, and procedures for managing water supply and demands during a declared water shortage”.^{vii} The Plan’s primary focus is “on measures that reduce customer demand for water...because there is so little the City can do in the short run to increase the supply of water”.^{viii} The WSCP contains a set of principles to guide the planning process for water shortage. The Plan “uses a staged approach that classifies a shortage event into one of five levels spanning a range from less than 5 percent up to 50 percent. The overall concept is that water shortages of different magnitudes require different measures to overcome the deficiency. Each stage includes a set of demand reduction measures that become progressively more stringent as the shortage condition worsens”.^{ix}

The Plan includes curtailment allocations for UC Santa Cruz. These allocations, which the City developed in consultation with campus staff, are based on correlation of UC Santa Cruz water use with those of other user classes (e.g., multi-family residential, commercial, irrigation, etc.). Under these allocations, UC Santa Cruz is required to reduce water use by a percentage approximately equal to the system shortfall.

Table 8-4. Water Supply Allocation and Customer Reduction Goals										
Normal Peak Season Demand = 2,473 mil gal	No Deficiency		Stage 2 15% Deficiency		Stage 3 25% Deficiency		Stage 4 35% Deficiency		Stage 5 50% Deficiency	
	Delivery		Delivery		Delivery		Delivery		Delivery	
Customer Category:	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)
Single Family Residential	100	1,031	84%	864	73%	753	62%	639	48%	495
Multiple Residential	100	524	87%	454	78%	411	69%	361	55%	287
Business	100	438	95%	416	92%	402	87%	381	70%	307
UC Santa Cruz	100	132	85%	113	76%	100	66%	87	52%	68
Other Industrial	100	23	95%	22	90%	21	85%	20	67%	15
Municipal	100	48	76%	36	57%	27	41%	20	28%	14
Irrigation	100	110	64%	70	34%	37	12%	13	0%	0
Golf Course Irrigation	100	106	73%	78	51%	54	34%	36	20%	21
Coast Agriculture	100	59	95%	56	90%	53	85%	50	67%	40
Other	100	2	95%	2	90%	2	50%	1	50%	1
Total	100	2,473	85%	2,111	75%	1,861	65%	1,607	50%	1,247
Demand Reduction %, Million gallons	0	0	15%	-362	25%	-612	35%	-866	50%	-1,226

City of Santa Cruz 2009 Water Shortage Contingency Plan

Urban Water Management Plan

The City of Santa Cruz updated the Urban Water Management Plan (UWMP) in 2015. The UWMP recognizes the changing landscape of interrelated and unforeseen factors that have impacted water management in Santa Cruz in the last five years. For accuracy, extensive quoting from the UWMP is including below. The factors include:

- The City of Santa Cruz “has long faced challenges with the reliability of its water supply and had been actively pursuing ocean desalination as a supplemental water source for more than a decade. In Spring 2014, the Santa Cruz City Council changed course and appointed a committee of 14 residents representing diverse viewpoints to take an exhaustive look at the City’s water issues and ways to address them. The Water Supply Advisory Committee (WSAC) worked for 18 months in an open, public, and transparent process to develop recommendations to ensure a more stable and reliable water supply. In addition to more conservation, the WSAC recommended the City embark on a program to enhance regional groundwater storage using in-lieu water exchanges and/or

aquifer storage and recovery with neighboring water districts. Advanced treated recycled water or desalination were recommended as backup plans”.^x

- **Historic drought conditions** year after year shook the state of California, water suppliers, businesses and residents alike. As previously mentioned, the SCWD’s existing system is not able to provide a reliable supply during multi-year droughts or prolonged periods of drier than normal hydrologic conditions within the source watersheds.
- **The establishment of the Sustainable Groundwater Management Act** changes water districts’ approach to groundwater management. In 2014, California “enacted landmark legislation to bring the state’s groundwater basins into a more sustainable regime of pumping and recharge. Facing declining groundwater supplies, the City recently joined together with two overlying water districts and the County of Santa Cruz to form a Joint Powers Agreement for the creation of a local Groundwater Sustainability Agency (GSA) required by the act. The GSA will oversee the preparation of a cooperative groundwater management plan for the Santa Cruz Mid-County Groundwater Basin, the status of which was recently designated by the State to be in a condition of critical overdraft”.^{xi}
- **SCWD’s actual demand has trended significantly below forecasted demand** since 2010. The divergence is thought to have been influenced by the following factors: “the cumulative effects of tighter efficiency standards for appliances and plumbing fixtures, greater investment in conservation, a significant uptick in water rates, an equally significant downturn in economic activity during the Great Recession, and ongoing drought”.^{xii} The sustained dip in demand increases the uncertainty of predicting future water demand for water districts like SCWD.

Water Costs & UC Santa Cruz Rate Increases

Much of the City’s water infrastructure has reached or is reaching the end of its functional lifespan. Therefore, the Santa Cruz Water Department is planning a major infrastructure reinvestment program. In 2014, Santa Cruz City Council “approved a five-year water rate increase and temporary drought-recovery fee designed to fund long-needed infrastructural improvements, grow reserves, and replace revenue lost during mandated rationing”.^{xiii} In June 2016, the SCWD’s Long Range Financial Plan unveiled a [redesigned rate structure](#) that impacts UC Santa Cruz in the coming years:

Water Rates for UCSC							
	Effective date						
Component	07/01/15	07/01/16	10/01/16	07/01/17	07/01/18	07/01/19	07/01/20
Commodity rate	\$4.84	\$5.33	\$6.70	\$7.27	\$7.77	\$8.17	\$8.60
Infrastructure Reinvestment Fee			\$2.40	\$2.68	\$2.82	\$3.13	\$3.46
Elevation surcharge	\$0.20	\$0.20	\$0.42	\$0.46	\$0.49	\$0.51	\$0.54
Rate Stabilization Fee				\$1.00	\$1.00	\$1.00	\$1.00
Total (\$/CCF)	\$5.04	\$5.53	\$9.52	\$11.41	\$12.08	\$12.81	\$13.60

City of Santa Cruz Water District’s Water Rates

UC Santa Cruz Campus Water Use

UC Santa Cruz Water Use Baseline

The UC Board of Regents Sustainable Practices Policy on Sustainable Water Systems states: “Campuses will reduce growth-adjusted potable water consumption 20% by 2020 and 36% by 2025, when compared to a three-year average baseline of FY 2005-06, FY 2006-07, and FY 2007-08”.¹ The campus average baseline water use between FY 05-08 is 212.6 million gallons per year, or 13,924 gallons per weighted campus user with an average of 15,276 weighted campus users.

Calculated in accordance with the UCOP Sustainable Practices Policy, the weighted campus user is a “measurement of an institution’s population that is adjusted to accommodate how intensively certain [groups] use the campus. This figure is used to normalize resource consumption and environmental impact figures in order to accommodate the varied impacts of different population groups”.^{xiv} For example, a student living on campus will use more campus water (through showering, doing laundry, etc.) than a part-time staff member who lives off campus. The weighted campus user formula is calculated by the following formula:

$(A + B + C) + 0.75 * [(D - A) + (E - B) - F]$ where:

A = Number of students resident on-site (annualized headcount);

B = Number of employees resident on-site (annualized headcount);

C = Number of in-patient hospital beds (if applicable);

D = Total full-time equivalent student enrollment (annualized full-time equivalent);

E = Full-time equivalent of employees (staff + faculty) (annualized full-time equivalent);

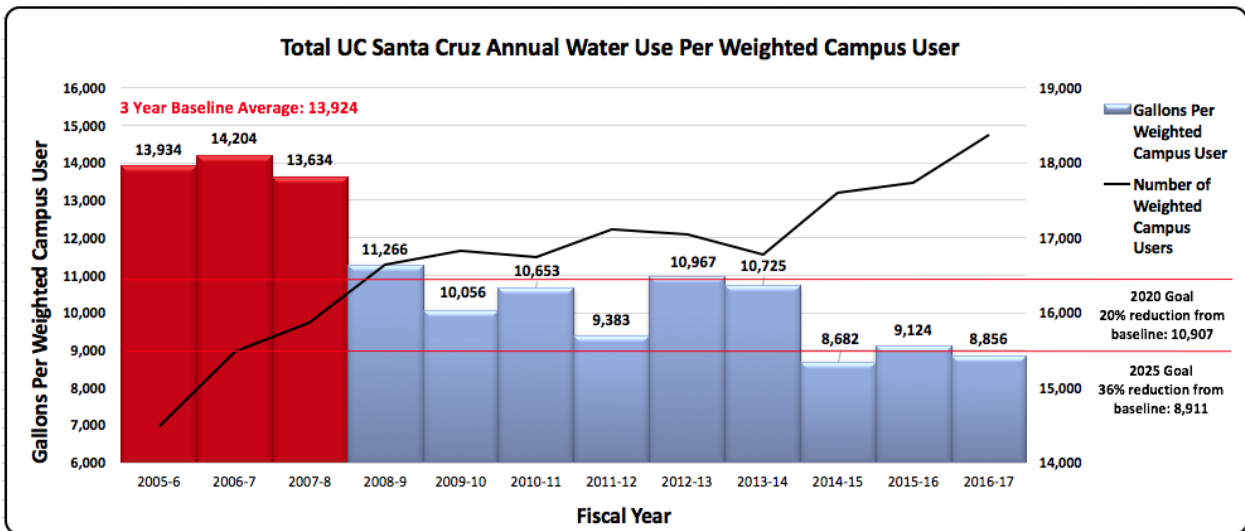
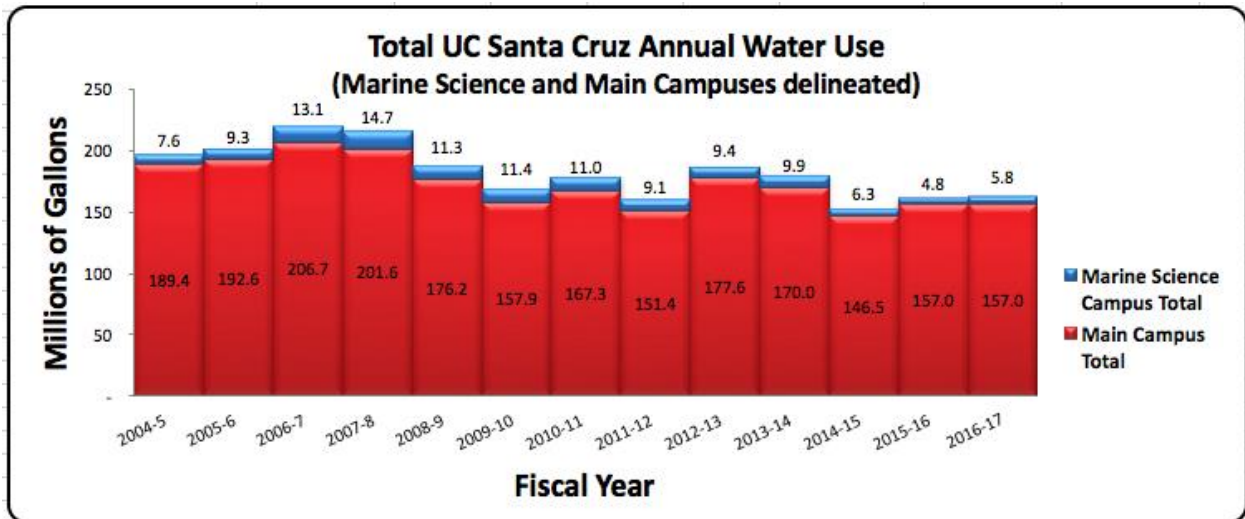
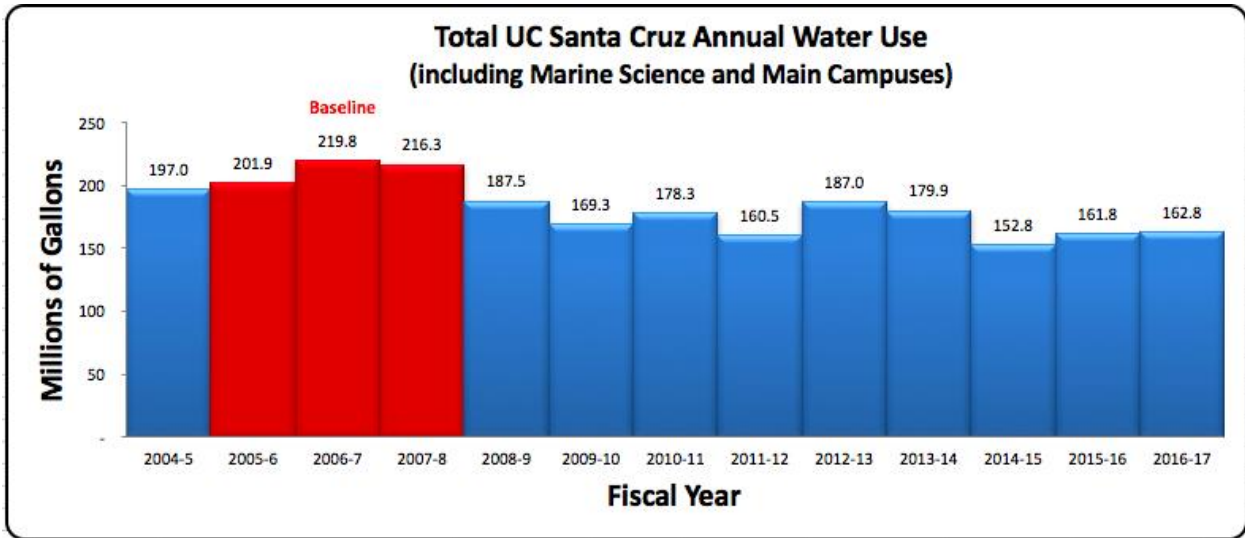
F = Full-time equivalent of students enrolled exclusively in distance education (annualized full-time equivalent).²

Historical Use and Progress

In FY 2016-17, the total campus used 8,856 gallons per weighted campus user, reaching a 36.4% reduction from the baseline, surpassing the 2020 20% and marginally exceeding the 2025 36% UC Office of the President goals. In the charts below, ‘Total UC Santa Cruz’ is defined as main campus, the contiguous campus property at 1156 High Street, and the Marine Science Campus (Long Marine Laboratory).

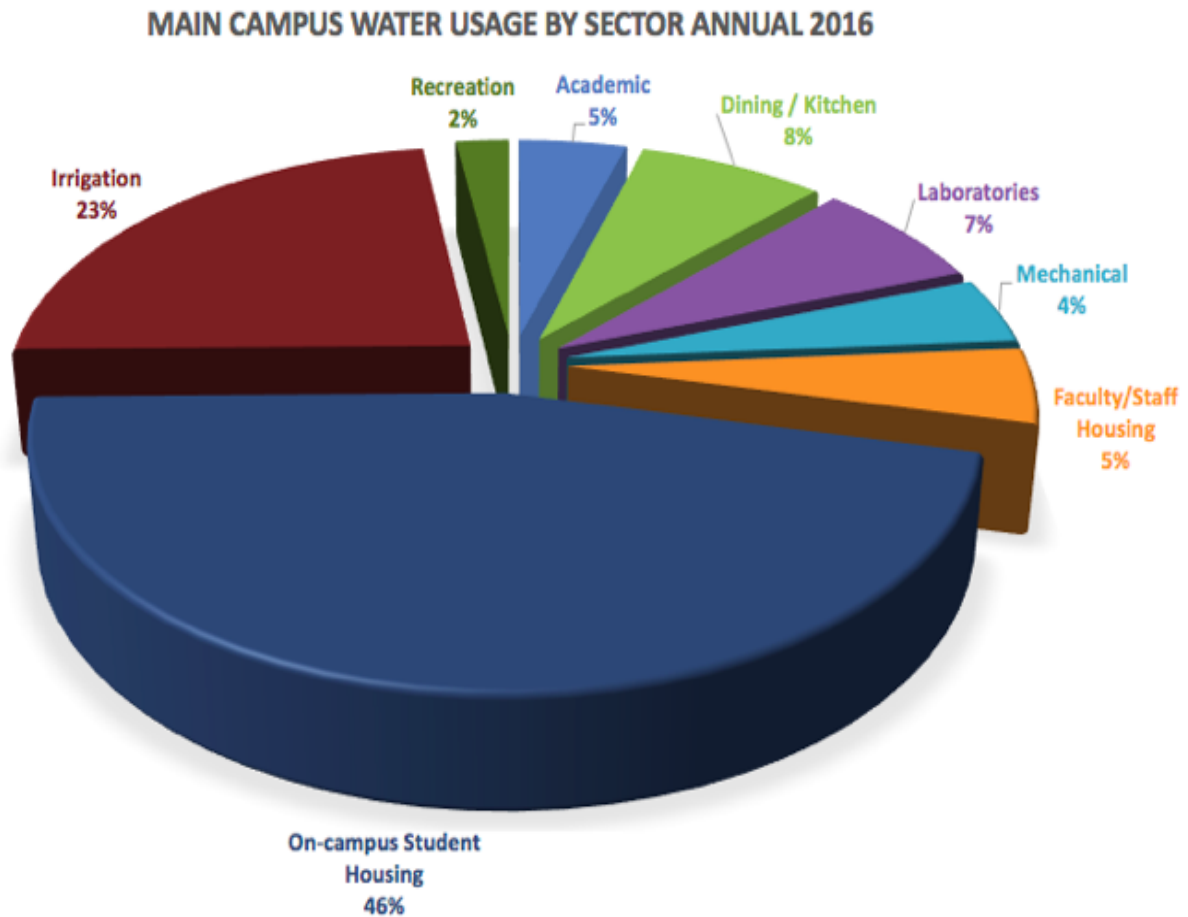
¹ For the 2017 WAP, the FY 2005-08 baseline was standardized and determined by UC Office of the President and was not left to the discretion of the campuses. In the 2013 WAP, UCOP allowed the baseline years to be determined by each campus.

² For more information on the weighted campus user calculation, data, and formula, please reference the Appendix on page 41.

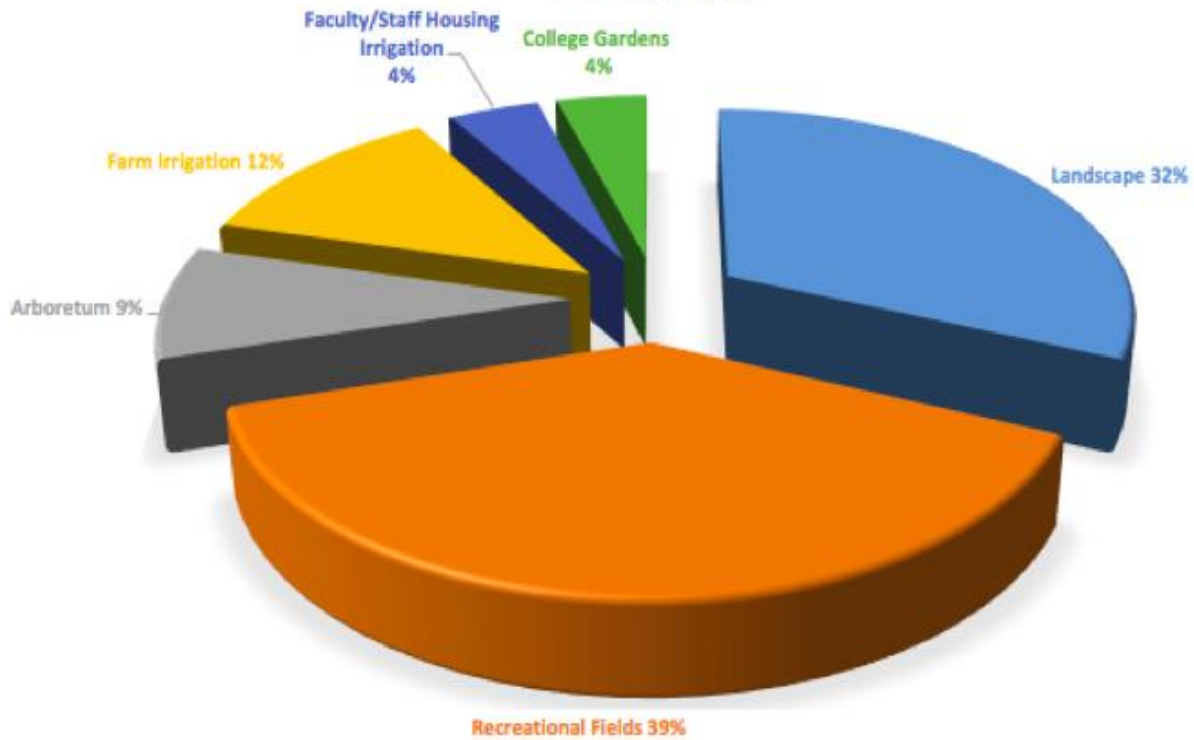


Usage by Sector

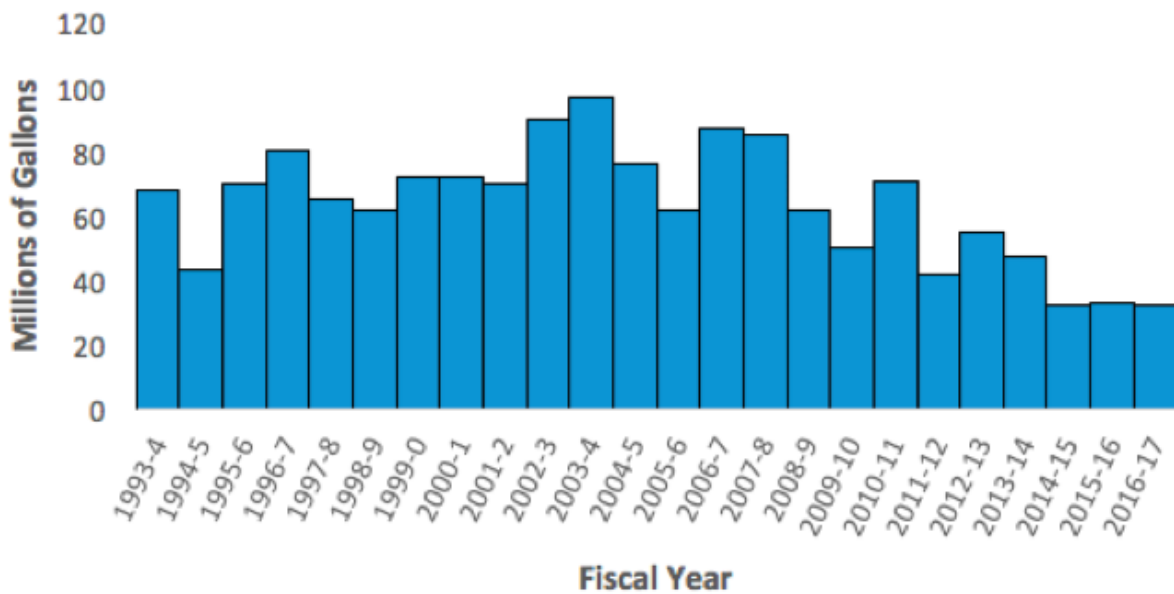
UC Santa Cruz houses over 50% of its student population on campus, totaling almost 9,000 students housed on campus, the largest proportion of students housed on campus across the UC system. Therefore, the fact that 46% of the FY 2016-17 Main Campus Water Usage is residential is unsurprising. UC Santa Cruz also offers residential faculty and staff housing to 266 faculty and staff on campus as well as 668 UC Santa Cruz affiliates, children, and other dependents - this accounts for 5% of UC Santa Cruz water usage. The second largest usage on campus is irrigation at 23%.



LANDSCAPE AND OTHER IRRIGATION USE ANNUAL 2016



Main Campus Annual Irrigation Water Use



Campus Water Conservation Efforts

2013 - 16 Drought Response

With an extremely dry and hot 2013 on the books, California Governor Jerry Brown proclaimed a statewide drought emergency in January 2014. The Santa Cruz City Council responded shortly after, asking all residents within their service area to voluntarily reduce water consumption by 20 percent. In Spring 2014, The City of Santa Cruz declared Stage 3 Water Emergency; under the Stage 3 Water Emergency, UC Santa Cruz was requested to comply with a 20% reduction from 2013 baseline use, which is the midpoint in the range of reductions required. This reduction applied to the Main Campus, Marine Science Campus (also known as Long Marine Laboratory), as well as 2300 Delaware. UC Santa Cruz achieved this reduction for both 2014 and 2015 drought years; meeting the reductions was no small feat.

Representatives of all major water users across campus and operational support, including Grounds Services, the Facilities unit of Colleges, Housing, and Educational Services (CHES), the Farm, the Arboretum, Office of Physical Education, Recreation, and Sports (OPERS) & Conference Services, Physical Planning & Construction Coastal Science Campus, and research laboratories, constituted the membership of the Water Working Group (WWG). The WWG met monthly throughout the 2014 and 2015 drought years to create targets for water reduction across campus units, facilitated by the Sustainability Office, Campus Planning and Physical Plant. The group created and reported on benchmarks which were assigned to each unit.

Between May and October 2014, UC Santa Cruz consistently achieved a 22-28% monthly water use reduction from a 2012-13 peak season baseline and a 33% reduction from the target established in the City's 2009 Water Shortage Contingency Plan for UC Santa Cruz. During this time period, the campus saved 27.8 million gallons of water. This reduction amounted to the equivalent of \$350,000 in annual utility savings, although the campus landscape and operations efforts were not sustainable long term and led to financial, operational, and staffing impacts totaling more than \$181,250 in a short six months. The reductions were attributable to a number of efforts, including, but not limited to:

- 45-60% usage curtailment in landscape and turf irrigation across campus;
- Increased adoption of the campus's web-based water management system, Beacon; and,
- Extensive campus outreach and engagement in water conservation behaviors.



Signage on campus communicates about and normalizes water conservation.

The drought response at UC Santa Cruz was successful for a number of reasons. First, major water users were represented by engaged managers who met on a monthly basis. Second, units were provided with their baseline usage, benchmarks for reduction, and actual usage on a monthly basis. Third, UC Santa Cruz already has a strong culture of water conservation; despite the state of emergency where competition for scarce resources may be expected, participating stakeholders reported that the process was highly collaborative and supportive. It is also notable that a number of participating stakeholders voiced that the experience of meeting the cuts together strengthened the culture of water conservation on UC Santa Cruz's campus.

UC Santa Cruz's water reduction efforts were elevated by both public administrative support and funding: Chancellor Blumenthal's February 2014 letter to the community in support of water conservation brought attention to the drought and the campus' response. In 2014, the campus allocated \$374,000 in water-saving projects including installing time-allocated shower valves at the OPERS Athletic Facility, retrofitting laboratory autoclaves with a water reuse modification system on where applicable, adding sub-meters in unmetered irrigation areas, and installing a system to use seawater for marine mammal pool wash downs.

The Sustainability Office created a five student Water Action and Drought Response Team to assist with the campus's response to the 2014 drought and meeting the City of Santa Cruz's mandatory water use reduction target of 20%. The team conducted a campus-wide audit of all state-funded restroom, kitchen and lab fixtures, posted educational signage to encourage the campus community to report leaks to the Work Order Desk as well as to reduce watering,

assisted with the identification of campus sub-metering needs, engaged with users through tabling at campus events, and created tutorials for users to understand the new Beacon portal.

Staff Spotlights: Drought Champions

Steve Davenport and Randolph Screven, UC Santa Cruz Long Marine Laboratory: On the Water Working Group, Steve and Randolph were representatives for the 100-acre Marine Science campus research site which includes the Long Marine Lab, NOAA Fish Lab, and other research facilities. During the drought, they implemented two projects to conserve water: a seawater pump with corrosion seals, which replaced freshwater and distributed seawater to all coastal science buildings, and hose replacements used to wash marine mammals from freshwater to seawater. These two projects saved 2.6 million gallons of water during the drought.

Roger Edberg, UC Santa Cruz Grounds Services: Roger and the Grounds Services team, comprised of irrigation and turf staff as well as the campus gardeners, significantly decreased water being used on campus landscape and fields. Grounds Services implemented a new evapotranspiration controller system to monitor and adjust watering in accordance with weather conditions. Grounds Services also hosted classes for campus gardeners to more effectively estimate hand watering efficiency. In addition, Grounds Services reduced water use by 55% and closed the East Field, cut back on landscape water use by 60%, and lowered water use for the Lower East Field by 30%.

Elida Erickson, UC Santa Cruz Sustainability Office: Elida's role was co-facilitating the Water Working Group, which involved collaborating with on-campus stakeholders with high water usage. She hired five student interns to create a Water Action and Drought Response Team; the team conducted a campus-wide audit of all restroom, kitchen and lab fixtures, posted educational signage regarding water use restrictions on lawns and in restrooms, assisted with the identification of campus sub-metering needs, and connected with campus users as needed to facilitate improved water usage practices. The Team helped educate students, staff, and departments on conservation practices and tested the flow rate of every single sink and toilet on campus to save water.

Alisa Klaus, UC Santa Cruz Planning Department: During the drought, Alisa worked to solve funding challenges within the University to achieve the necessary cutbacks and advance projects necessary to reduce campus water usage by 20%.

Patrick Testoni, UC Santa Cruz Energy Services: Patrick and his team in the Energy Services unit have installed an extensive metering system (425+ sub-meters), which allowed the campus to set goals for each department's water reduction during the drought. The meters track water usage every hour which allows campus to detect and respond to leaks much more effectively. The meters are linked to the Beacon Advanced Metering Analytics (AMA) software platform, which notifies users when an abnormal amount of water is being used based on a

predetermined flow rate or daily usage. The user gets metrics about recent flows, leak detection, continuous flows, hourly water use, weekly use, and monthly use among other metrics. Patrick believes that the power of good information can go a long way, and this advanced metering system promotes reliability and efficient water use, as well as empowers all campus water users.

Darryl Wong, UC Santa Cruz Center for Agroecology and Food Systems (The Farm):

Darryl oversaw the three key actions that the Farm took to achieve water conservation goals. Firstly, the Farm focused on system maintenance, replacing gaskets on about 150 overhead irrigation joints. Secondly, the Farm revived 10 water sub meters to see how and where water was being used. Student staff checked meters and generated internal water management reports. Lastly, the Farm cut crop production by 20%, which constituted the majority of the water savings. The Farm was hit hard by water use restrictions, as they already employ sustainable, low-water methods of agriculture; the opportunity for potable water use reduction during the drought not as great as if they employed traditional farming methods.

Departmental Contributions to Drought Response and Water Conservation

Arboretum

During the drought, the UC Santa Cruz Arboretum staff undertook measures to reduce water use, including not watering overnight, which had previously been commonplace, as well as converting the vast majority of the outside plant collections to drip irrigation. Changing watering practices allowed the Arboretum to use much less water than the campus budgeted for the continuation of the operation. Unfortunately, the Arboretum lost a number of specimens to drought stress, an unintended consequence of water restrictions.

Currently, with money from a Carbon Fund grant and in collaboration with the Domes Future Garden art installation, the Arboretum is installing two 6,000 gallon tanks to catch water off of the main office building to water plants within dome-shaped greenhouses.



Two newly installed 6,000 gallon rainwater catchment tanks. Courtesy: Martin Quigley.

Center for Agroecology & Food Systems

The mission of the UC Santa Cruz Center for Agroecology & Sustainable Food Systems is to research, develop, and advance sustainable food and agricultural systems that are environmentally sound, economically viable, socially responsible, non-exploitative, and that serve as a foundation for future generations. Through research, education, and outreach programs, the Center works to create agriculture and food systems that sustain both human communities and the environments in which they live – with drought and frequent local water restrictions, water conservation is a core practice at the Farm.



Aerial photo of the Farm. Courtesy: Darryl Wong.

1. **Drip Irrigation:** The Farm currently distributes about 80% of its water through drip irrigation. For field production, newly planted crops are watered in with overhead sprinklers for 10 days (total of 3 irrigations) and then the crop is transitioned to drip for the remainder of its life cycle (20-120 days). Irrigating the farm via drip lines is the most efficient method of irrigation, allowing for greater uniformity of water distribution. Some crops are raised exclusively on drip irrigation.
2. **Dry Farming:** Dry farming is the practice of planting crops soon after the last rain and then not irrigating the plants for the remainder of their life cycle. The farm currently dry farms a small portion of its crop every year, including tomatoes, beans, and wheat. Dry farmed tomatoes tend to have high acid, high sugar, and lots of flavor.
3. **Water monitoring:** After the 2009 water restrictions, the Farm developed an internal water monitoring system by installing 10 additional sub-meters to track water use at different locations on the Farm. This program was designed to measure applied irrigation against crop evapotranspiration to help guide students in more precision irrigation. The Farm initially implemented hard-wired tension-o-meters in 2015 in response to the 2014 drought with Measure 44 money. In 2017, the Farm updated this system to be wireless and to provide mobile reading. The new wireless irrigation sensor technology allows staff to remotely read irrigation sensors in the field that results in more accuracy in irrigation. Because the Farm is a teaching space utilized for the Farm & Garden Ecological Horticulture Apprenticeship Program, Farm staff's ability to readily identify over- and under-watering in specific areas is critical to student learning. CASFS has plan to demonstrate this technology to local growers as a cost-effective irrigation management system.

4. **Leak prevention:** In response to the 2013-16 drought, the Farm inventoried irrigation infrastructure and replaced all gaskets in both main and delivery lines to stop leaks before they occurred.

Dining

As previously mentioned, UC Santa Cruz houses 8,962 students on campus, 53% of the student population, all of whom are required to have meal plans. This large residential student population necessitates an extensive network of on-campus dining options, including dining halls, cafes, coffee carts, and more. Dining Services, including on-campus kitchens, accounts for 8% of UC Santa Cruz's annual water budget.

During the drought response, Dining Services was responsible for all food services entities on campus including dining and vending locations. Dining Services approached meeting the reduction targets in a multifaceted manner. They first convened a large meeting to engage the various stakeholders like vendors, Colleges, Housing, and Educational Services staff, and employees around the targets they were responsible for meeting. Dining Facilities also looked to target areas that had the largest water reduction potential. One example of this effort is College 9/10 Dining Hall, which has a daily traffic of over 5,500 people and also offers public restrooms. There, Dining implemented instant-off water technologies and reduced urinal flushes to a half a gallon. To ensure behavioral compliance, Dining Services, whose staff was already trained on water conservation techniques, retrained all their employees on employing water conservation techniques and to be vigilant about water use and leaks. Dining Services staff also frequently utilized the Beacon platform to identify and proactively fix leaks within their facilities, limiting unnecessary water loss. With these efforts, Dining Services demonstrated leadership during drought response and exceeded their percentage reduction goal.

As an ongoing effort at employee professional development and education, Dining Services also offers Dining University to all of its full-time employees. Dining University consists of an all-day training on a specific subject once per quarter. Each June, Dining University's theme is sustainability and staff are engaged in hands-on, educational activities on topics like water conservation to refresh their knowledge and to provide them with updates on campus efforts, policy and system-wide goals.

Landscape Operations

Grounds Services is committed to water conservation and focuses on three programs to reduce water use in landscape and irrigation.

1. **Annual preventative maintenance program:** staff have regular scheduled maintenance activities that keep irrigation systems running efficiently by fixing leaking components and adjusting sprinkler heads to reduce overspray and provide appropriate water application rates.

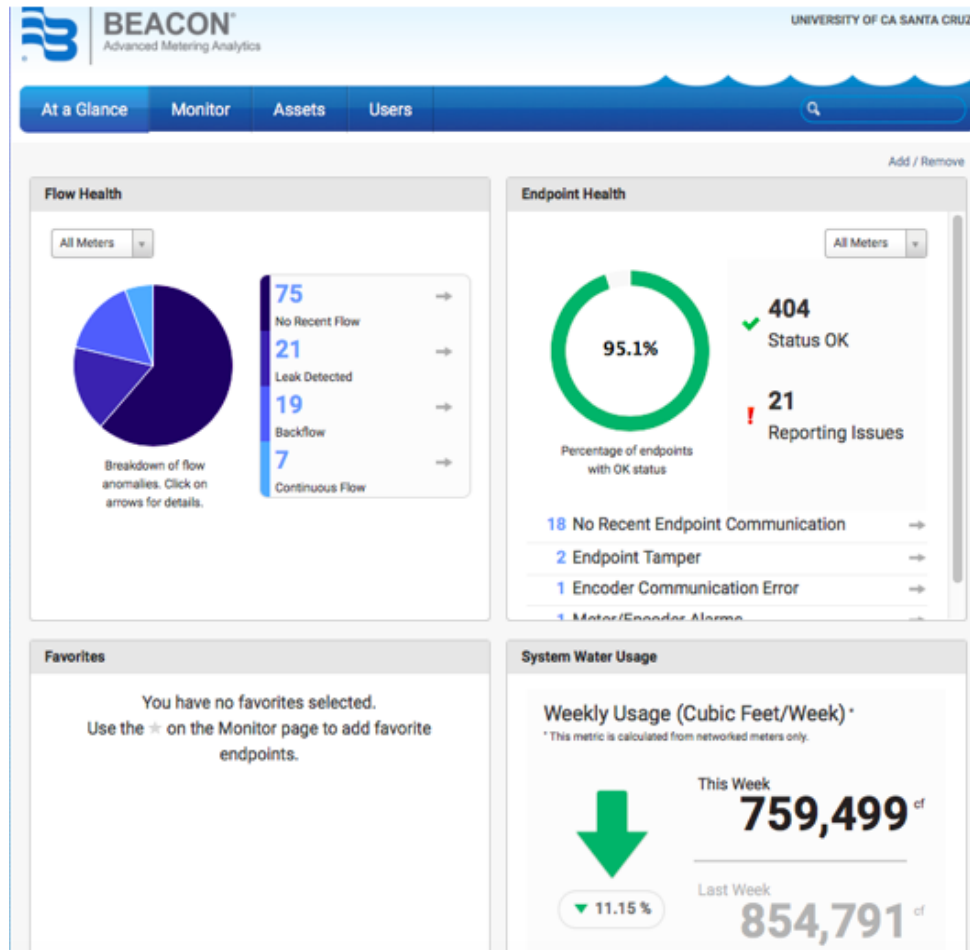
2. **Monitoring landscape water demand:** staff evaluate and adjust irrigation schedules on manually programmed automatic controllers across campus based on evapotranspiration data. Irrigation station information for each manual controller has been built into a spreadsheet workbook so that run times for all irrigation controllers can be calculated by entering the current local evapotranspiration data in one cell. Evapotranspiration is a measure of the total water lost from the soil by evaporation from the soil surface and through transpiration, or water taken through plant roots and evaporated from leaf surfaces. Wind, sun, and temperature are all factors that can affect the evapotranspiration rate.
3. **Automatic system monitoring:** a centralized system automatically monitors campus weather conditions, updates remote irrigation controller schedules by radio, and monitors usage for leaks or electrical problems. The Rain Master Evolution system involves a central computer, two weather stations, and “satellite” controllers in the field, with a communication system linking the components. Irrigation systems can calculate watering needs based on whichever weather station most closely matches the individual satellite location, which communicates with the cloud. This system is now in use at 30 major landscape installations, and will be included with all future construction on campus. UC Santa Cruz’s automatic system monitoring is extraordinary because the system runs on the Advanced EvapoTranspiration mode, which has the capacity to create and be responsive to individual zone details including scale, plant type, soil type, and environmental conditions; UC Santa Cruz Grounds Services has created approximately 1,000 unique zones on campus based on the previous details. This is essentially concierge irrigation for each zone. The system also monitors for leaks and arrests water flow based upon a predetermined range. The system not only has the ability to detect and automatically arrest water flow in lateral lines, but also in main lines using a flow sensor and a master valve. This feature of the system allows for large water savings from potential leaks or breaks. Lastly, the system generates a centralized list of overflow conditions, which speeds staff response time to leaks and also identifies the general location of the problem..

Utility Management Operations

UC Santa Cruz’s Physical Plant Energy Services Department has been instrumental in potable water conservation through both infrastructural and technological upgrades. The Department has undertaken extensive metering of campus - currently, there are 425+ water sub-meters on the UC Santa Cruz campus, all of which are routinely maintained and upgraded with the latest metering technology.

Staff estimate that 95% of the sub-meters are connected to the Beacon Advanced Metering Analytics (AMA) software platform, a web-based software tool which provides hourly interval data water consumption data, which allows campus to detect and respond to leaks much more effectively. Beacon notifies users when an abnormal amount of water is being used based on a predetermined flow rate or daily usage. The user gets metrics about recent flows, leak detection, continuous flows, hourly water use, weekly use, and monthly use among other

metrics. The combination of a heavily sub-metered campus and the use of BEACON AMA has revealed numerous leaks around campus that were previously unidentified.



Screenshot of the UC Santa Cruz Beacon AMA platform

2017 Drought Outlook in Santa Cruz

In April 2017, Governor Jerry Brown declared that California's drought emergency was officially over for the majority of the state, including Santa Cruz. The City of Santa Cruz Water Department website states:

Due to good winter rains, the San Lorenzo River cumulative runoff easily surpassed 120,000 acre feet, classifying Water Year 2017 as Wet...even though this year water supply is plentiful and forecasts show healthy supply and demand, the City of Santa Cruz is committed to ensuring conservation and long-term water efficiency continues as a way of life. The City is actively investing in programs, education, and incentives to help customers adopt sustainable practices and make changes that result in permanent

water savings. **While the City is not under emergency water use restrictions, the waste of water is always prohibited under the City’s Water Waste Regulations”.**^{xv}

Watershed & Stormwater Management

UC Santa Cruz is active in the management of the natural stormwater system and the unique topography of campus informs how stormwater is managed. The management and maintenance of UCSC’s watersheds is a collaborative effort by Physical Plant Grounds Department, UC Santa Cruz Natural Reserve, and Environmental Health & Safety. Each department is responsible for aspects of maintenance, restoration, construction, and protection.

UC Santa Cruz relies heavily on natural drainages to manage stormwater on its campus. In addition, the campus has constructed a variety of engineered facilities that convey runoff to the natural drainage channels. These facilities include stormwater detention basins and vaults, urban contaminant removal systems, bio filtration, piping, engineered channels, catch basins, and bio swales.

Unlike pipe or gutter drainage systems, natural stream channels are rapidly evolving and dynamic – they change seasonally and, in some locations, on a storm-by-storm basis. On the UC Santa Cruz campus, canyons with drainage channels vary in depth from 10 to 80 feet and in width at the top from 30 to 400 feet.



A pipe drainage system conveys runoff into a natural drainage.

There are five watersheds on campus and two of the watersheds drain water that have the opportunity to leave campus. As a result of the karst topography, with sinkholes distributed in the channels and elsewhere throughout the central and lower campus, most stormwater runoff from campus development reaches the karst aquifer by way of sinkholes and swallow holes and does not flow off campus. Due to the role of sinkholes within the drainages, channelized surface flows are largely captured by sinkholes which reduces discharge of surface flows to downstream campus channels and off-campus areas. The in-channel sinkholes play a critical role in the successful operation of the campus' drainage system. Any water diverted from a project to a sinkhole must undergo prior treatment as specified in performance requirements of the post-construction standards.

The Campus is implementing a Stormwater Management Program (SWMP) in compliance with the Phase II National Pollution Discharge Elimination System (NPDES) program. UC Santa Cruz operates on a municipal permit which requires operators of small municipal separate storm sewer systems (MS4s) in urbanized areas and operators of small construction sites to implement programs and practices to control polluted stormwater runoff. The UC Santa Cruz SWMP was approved by the California Regional Water Quality Control Board (RWQCB) in April 2009. The Stormwater Master Plan aims to improve the health of campus watersheds and provides a list of project to help improve the health of the watershed. The entities on campus that jointly manage stormwater address high priority projects on an annual basis.

Through Campus Design Standards, UC Santa Cruz manages both quality and quantity of stormwater using various structural techniques. Stormwater management systems for new development must meet the Central Coast Post-Construction performance standards developed under the campus' SWMP and incorporated into Campus Standards.

The Campus' planning process for new development projects encourages the incorporation of non-structural stormwater management strategies at an early stage of project design. The goal is to develop systems that maintain and mimic the natural hydrology of campus watersheds.

As technology and engineering concepts on protection of watersheds have changed over time, so have the designs used. Most stormwater runoff from impervious development on Campus is directed to detention facilities where the water is metered out at a specified rate. The discharged water is usually released to an area where the water will have a chance to infiltrate through the natural soil media which provides treatment and quantity reduction. Some other techniques used to control stormwater quality and quantity are: level spreaders, vegetated swales, rain gardens, tree boxes, pervious pavement, retention and detention ponds, and rock swales and step pools.

UC Santa Cruz Grounds Department is responsible for maintaining campus lands, including the stormwater drainage systems. The campus is in the process of implementing a multi-phase stormwater infrastructure improvement project to improve the health of campus watersheds. To some extent, problems in the watersheds are the result of older campus development, which followed standards for design of stormwater drainage systems that are now outdated.

Regulation requires UC Santa Cruz to provide documentation of maintenance on drainage units. This involves not only regular inspection of engineered facilities such as catch basins and detention vaults, but inspection and maintenance of major sinkholes and natural drainage channels, which can be difficult to access. The mostly volunteer Site Stewardship program provides critical work on drainages.

Targeted Potable Water Reduction Activities

Turf Removal and Replacement

To comply with the requirements set forth by the Water Action Plan policy language, UC Santa Cruz has quantified the total square feet of campus turf area, as well as identified used and underused turf areas. On the UC Santa Cruz campus, a significant percentage of turf square footage exists in the Colleges: therefore, the first effort at identifying turf for replacement and removal focused on the Colleges. Future efforts will expand to identify turf located outside of the College programming areas.

<i>UCSC Turf Square Footage and Usage</i>	
Total Turf Square Footage	953,519
Total Used Turf Square Footage	939,318
Total Under-Used Turf Square Footage	14,201

Through turf walk-throughs with Colleges, Housing, and Educational Services' (CHES) staff (including College Administrative Officers, College Gardeners and Supervisors), Grounds staff (including Irrigation and Turf Specialists), and Sustainability Office staff, approximately 14,201 square feet of under-used turf has been identified for either replacement with low-water use alternatives or removal. The approach that UC Santa Cruz took towards turf replacement and removal was not simply based on use, however; it was a collective decision-making process with multiple stakeholder groups that considered a number of factors, including:

- General health and sightliness (including shade, compaction from walking paths, propensity for flooding or erosion, gopher intrusion, etc.);
- Labor and efficiency of care (including maintenance difficulties like mowing steep grades and working around class or work hours by Turf crew or consistently problematic areas for Gardening staff); and,
- Frequency of student use for leisure or events programming.

A total of 11 lawns make up 14,201 square feet of turf identified for replacement or removal: two lawns will be removed entirely through future construction and replaced with non-permeable surfaces; five will be replaced with mulch*; three will be replaced by combining an extension of current low-water use permeable landscaping and mulch; one lawn will be redesigned and re-landscaped to mitigate a significant grade in order to increase space utilization for student recreation and programming.

The potable water savings from these removals and replacements will equal approximately 339,305 gallons or 45,362 CF annually, which accounts for 1.4% of the irrigation and landscaping water budget or 0.22% of the total campus potable usage for FY 2016-17. It must be noted, however, that the installation of new plantings, regardless of their characteristic low-water use, will require an increase in potable water application during the first year or two to allow the plant to fully establish themselves. Full savings on turf's replacements can be expected to be realized within three years.

Total Potable Water Reduction Expected through Turf Removal and Replacement

Total Under-used Turf Square Footage	Annual Gallons of Potable Water Reduced through Turf Removal or Replacement	Annual Cubic Feet (CF) of Potable Water Reduced through Turf Removal or Replacement
14,201	339,305	45,362

UC Santa Cruz plans to take advantage of the City of Santa Cruz's Turf Replacement Rebate program, which allows commercial customers of the Santa Cruz Water Department to either remove or convert turf to a low-water use permeable landscape for a rebate of \$1.00 per square foot.

*To ensure the health and longevity of mature trees surrounding three of the five turf areas identified for removal, mulching or a combination of permeable landscaping and mulching, care has been taken to lower to crop coefficient to 0.2 from 0.8. Watering will still occur but at a reduced rate to assess the response of the trees in the first year.

Single-pass cooling device identification, replacement, or removal

UC Santa Cruz completed an autoclave inventory in 2015 as part of the drought response.

To communicate with labs and facilities managers about single-pass cooling systems, UC Santa Cruz will utilize the Green Labs and Facilities Maintenance networks. The communications will address updates in policy language, the flooding threat single-pass cooling systems pose to the lab environment, and funding solutions to cost-share the retrofit or replacement of these systems. In Spring and Summer Quarters 2018, the Sustainability Office will work with the

campus partners to conduct an inventory of all single-pass cooling systems in use on campus to assess which units are eligible for retrofit or replacement cost-sharing opportunities.

Four funding sources are available to the campus to assist in the retrofit or replacement of single-pass cooling systems. Three of these sources are campus-based: Campus Sustainability Plan Grants, Carbon Fund Grants, and Green Labs Certification funding. At the system-wide level, the UCOP Be Smart about Safety funding source could also assist in the cost-sharing of the retrofit and replacement of single-pass cooling systems, especially costly autoclaves. UC Santa Barbara utilized the Be Smart about Safety funding after a single-pass cooling related flood damaged millions of dollars of laboratory equipment and rendered null innumerable hours of research and staff time. UC Santa Cruz has also experienced a flood that resulted from a single-pass cooling system and plans to apply for this source of funding to eliminate this flooding threat in campus laboratories.

In AY 2017-18, the Green Labs Program within the Sustainability Office will be providing approximately \$4,000 to fund the purchase of 18 Condensyn waterless condensers for the UC Santa Cruz Chemistry Department and will work in conjunction with Facilities Management staff to outreach to departments outside of Chemistry to aid in the adoption of these condensers.



The student-led Green Labs Team assesses an on-campus laboratory. Courtesy: UC Santa Cruz University Relations.

Waterless condensers are a tool that can be used in Chemistry labs for condensation reactions. Normally, labs would use water-intensive methods for condensation reactions such as single pass cooling, constantly flowing water overnight, or using fish pumps to pump ice cold water continuously through the system. By replacing these methods with waterless condensers, all water and energy use from this reaction will be eliminated. Implementing waterless condensers can save up to 761 gallons of water per condensation reaction (based on a 24 hour reaction time) and \$2,878 per year (assuming one condensation reaction per day). Typical condensation reactions run from one to three days; anecdotally, labs that have participated in Green Labs run

on average three condensation reactions per month. Extrapolating on the aforementioned savings and anecdote, the Green Labs Program assumes that an average lab can save up to 6,849 gallons of water per month utilizing these waterless condensers.

Education & Outreach

Student Involvement in Water Reduction & Conservation

Water-related Measure 44 Funded Projects

Project Clearinghouse is an online library of sustainability projects funded by Student Fee Measure 44 (also known as Carbon Fund), that promote student engagement, bringing research to life, and using the campus as a living lab. Examples of [water-related projects that have been funded on campus](#) include the development of an organic garden at Colleges Nine and Ten; the Green Labs initiative to help research labs reduce waste, water, and energy usage; a stormwater outreach campaign; the Take Back the Tap campaign; and the Wellness Center rainwater harvesting project.

Blueprint for a Sustainable Campus

Every academic year, the Student Environmental Center drafts the [Blueprint for a Sustainable Campus](#). This document describes the student vision for sustainability across the campus, and identifies potential projects that are eligible for funding through a student fee measure. Most of the input for this document is elicited from campus stakeholders through workshops on specific topics, including water, and the annual large-scale Earth Summit event.

Student voices are included in the 2017-18 document related to water conservation and embedded water in food and articulates their vision for a more sustainable campus through:

- More transparency on campus farm/garden water usage;
- Capture rainwater and stormwater to use on crops, Arboretum, and landscaping;
- Reduce water usage in [student] bathroom[s];
- Less meat and dairy in dining halls and more widespread vegetarian-based food days.

The Blueprint provides a platform for students' ideas and energy that is not officially overseen or approved by the campus administration.

Take Back the Tap

Take Back the Tap is a student-led campaign at UC Santa Cruz to end the sale and distribution of single-use water bottles on campus. After six years of student-led organizing and discussions with campus administration, Take Back the Tap won a partial ban on the sale of single-use plastic water bottles on campus in February 2017. The "partial ban entails that all

campus housing, cafes, vending machines, and dining halls will cease the sale of water bottles”.^{xvi} To facilitate the transition to personal, reusable water bottle use, the initiative simultaneously aims to create more public water access for students by supporting the retrofit of drinking fountains into water bottle refill stations across campus; since 2014, Take Back the Tap has campaigned for the installation of 17 water refill stations.

Stormwater

The Stormwater Management Program has developed education and outreach materials aimed at educating the campus community on the importance of stormwater protection, and looking at stormwater as a resource to be valued. Staff training provides information on the regulations that apply to the campus and best practices to protect water quality and the environment. The Stormwater Program hires student interns to help with implementation of the Program. Student interns provide valuable connections with their peers for educational opportunities. The Stormwater Program has developed a [Facebook page](#) as a means of connecting with the campus community and providing educational materials. The [Cleanwater webpage](#) provides information about the Program, brochures about various stormwater topics, information on how to report a stormwater concern, and how to volunteer or become an intern.

Student Employment

UC Santa Cruz employs many students to work on water-related issues and outreach on campus in a variety of offices. Departments including Grounds Services, CHES-Facilities, Physical Plant, Environmental Health & Safety and the Sustainability Office employ approximately 12 student staff per quarter in non-drought conditions.



*Energy Services installs a cellular water meter during the drought.
Courtesy: Santa Cruz Sentinel.*

Energy Services employs three student interns who undertake a number of tasks, including, but not limited to:

- making Beacon training videos for onboarding new building managers;
- meeting with Facilities Managers to sign them up on Beacon and set up leak alerts for their area;
- reading meters;
- providing meter maintenance;
- troubleshooting meters that give bad data or are not communicating with Beacon;
- bringing new meters online;
- identifying and investigating leaks.

Academic Courses

Eight UC Santa Cruz departments, including Anthropology, Earth & Planetary Sciences, Ecology & Evolutionary Biology, Electrical Engineering, Environmental Studies, Ocean Sciences, Politics, and Sociology, offer 24 courses that have water in their course description. Course material ranges from water policy to hydrology, with concentrations in surface water, groundwater, saltwater and freshwater. Interdisciplinary lenses to water issues also abound through Anthropology, Film, and Geology. Eight of the 28 courses have the word ‘water’ in their name.

Opportunities & Strategies

Campus Sustainability Plan

UC Santa Cruz underwent a planning year during 2016-17 for the [new Campus Sustainability Plan \(CSP\)](#). The updated CSP is a five-year plan and spans from 2017-22, extending the length of the Plan from three years in past planning cycles. The prior 2013-2016 CSP set targets in nine different sustainability topic areas. However, the 2017-2022 CSP was organized differently, by thematic areas, such as Natural Environment & Infrastructure and Materials Management & Food Systems, to expose synergies in topics that were previously siloed.

The topic of water fell under the Natural Environment & Infrastructure quadrant of the CSP, which also included Transportation, Stormwater, Land & Habitat, Stewardship. Goals identified within this topic area were aligned with UC Office of the President’s Sustainable Practices Policy language. In developing the CSP, overarching goals were established, supported by up to five strategies to forward the goal, and supported further by “first-year actions” to execute and make significant progress on within the first fiscal year. Campus collaborators, cost estimates and potential funding sources were identified for many first-year actions.

Below are the water-related goals, strategies and first-year actions in the 2017-2022 CSP:

Natural Environment & Infrastructure Goal 1: Conduct an assessment to address intersectional campus infrastructure needs that include and support sustainable transportation systems, reduce water consumption, manage stormwater, and steward campus natural and cultivated lands.	
Strategy	First-Year Action
1.1: Develop a framework to define, identify, and prioritize built and natural infrastructure improvement projects.	1.1.a: Establish a working group to address intersectional campus infrastructure gaps and needs.
1.2: Measure effects of human activity on campus lands, watersheds, and infrastructure.	1.2.a: Conduct an analysis to establish a baseline to quantify human impact on campus natural and cultivated lands.

Screenshot of UC Santa Cruz Campus Sustainability Plan water-related language

Natural Environment & Infrastructure Goal 2: Achieve UC Office of the President Sustainable Practices Policy goal to reduce potable water usage by 36% by weighted campus user by 2025 from a 2005-08 baseline.	
Strategy	First-Year Action
2.1: Increase the use of non-potable water on campus.	2.1.a: Launch an update to the Campus Water Reuse Study.
	2.1.b: Develop and implement an evaluation and monitoring program to assess potential impacts from groundwater use from the existing well as an irrigation source.
2.2: Reduce potable water use through technological innovations and physical improvements.	2.2.a: Compile and update a centralized list of proposed water infrastructure and fixture improvements along with their relative cost and water saving potential.
2.3: Improve communication about water management, use, and conservation to the campus and local community.	2.3.a: Increase the adoption and utilization of the Beacon leak detection software among building managers through trainings and one-on-one consultations.
2.4: Identify new sources of funding for both potable water reduction and non-potable sourced development projects.	2.4.a: Develop a life-cycle cost based funding model to account for potable water rate increases.

Screenshot of UC Santa Cruz Campus Sustainability Plan water-related language

The campus plans to execute and make significant progress on the first-year actions listed above within FY 2017-18. Many first-year actions may be carried into subsequent years of the five-year plan, depending on various factors including resources, capacity, campus priorities, and more. First-year actions will be monitored and reported on annually by the Sustainability Office, as campus committees work to update actions annually based on previous progress. Annual reports can be found online at <https://sustainability.ucsc.edu>.

The Water Action Planning Committee, the body that assisted in the direction and compilation of this document, identified additional opportunities that can continue to move UC Santa Cruz forward on water issues and extrapolate on Campus Sustainability Plan language.

- In line with CSP Strategy 2.3, the Water Action Planning Committee sees an opportunity to introduce the idea of the water/energy nexus to the student body and campus community through water communications campaign. The water/energy nexus highlights the ecological and sociological impacts of moving water, particularly focusing

on high energy-intensity involved with moving water in California from source to point of consumption. While the Santa Cruz Water District draws all its water from local sources (see Hyperlocal Water Source section above), communicating the high energy use associated with moving water to the student body and campus community is a chance to highlight a quintessential interdisciplinary sustainability predicament.

- In line with CSP first-year action 2.2a, projects improving water infrastructure may include the identification and prioritization of physical or infrastructural improvements such as sections of aging piping infrastructure that may have to be replaced to proactively prevent future leakage. Leakage rates and associated water loss in a distribution system of this age can range from 10-15%.^{xvii}

Funding

There are currently three internal campus funding sources that can support water conservation efforts on campus: the Campus Sustainability Plan Grant, the Carbon Fund, and a funding pool open to any UC Santa Cruz Certified Green Lab.

First, the Campus Sustainability Plan Grant serves as a funding mechanism to support the implementation of projects and programs that forward the Goals, Strategies, and First-Year Actions identified in the 2017-22 Campus Sustainability Plan. Priority is given to proposals that demonstrate the ability to bring to fruition a specific first-year action.

Second, the Carbon Fund is a granting body that funds student, staff, and community projects that reduce carbon emissions. The annual grants provide funding, support, and participation in sustainability projects on campus and in the community that directly reduce greenhouse gas emissions, conduct relevant research, or implement educational programs.

Third, all UCSC Certified Green Labs which have completed the self-assessment, walk-through, and follow up through the student-led UCSC Green Labs program are eligible for a pool of money for projects that increase energy efficiency, reduce water waste, and/or contribute to green procurement.

The 2017-2022 Campus Sustainability Plan has not only set goals for the future, but also internally identified collaborating units and funding sources to realize those goals. In 2016, the Sustainability Office hired a full-time staff member who spends a portion of their time researching external funding options and providing support campus entities to pursue sustainability-related funding. In line with CSP Strategy 2.4, the campus sees many opportunities in the exploration of external sources to aid in funding water-related projects that can lessen the dependence upon central or programmatic funds.

Reporting

As mentioned in the Campus Sustainability Plan section, UC Santa Cruz plans to execute and make significant progress on the first-year actions listed above within FY 2017-18. First-year

actions will be monitored and reported on annually by the Sustainability Office, as campus committees work to update actions annually based on previous progress.

On turf replacement and single-pass cooling replacement, the Sustainability Office will coordinate respectively with College Administrative Officers and Grounds Services to ensure turf replacement projects are completed and with Green Labs Team and Facilities Maintenance to ensure that single-pass cooling systems are replaced or retrofitted. In both potable water reduction initiatives, the Sustainability Office staff will also empower campus partners spearheading these projects with both internal and external funding guidance and support.

UC Santa Cruz will continue to report annually to UC Office of the President's Sustainability Office the most updated water data, including, but not limited to metrics such as: annual water usage, weighted campus user, and water and sewer rates.

Conclusion

UC Santa Cruz has demonstrated a strong commitment to and consistent leadership in proactively managing and efficiently using limited water resources. Over the last 30 years, annual water consumption has remained relatively steady even though UC Santa Cruz enrollment has more than doubled over the same time period. UC Santa Cruz remains committed to positively collaborating with the City of Santa Cruz to meet water reduction goals as a good neighbor and as part of the Santa Cruz community.

While the most recent drought has ended in the Central Coast region at the time of writing of this WAP, the challenge in the coming years will be maintaining the progress on water reduction and continuing education to ensure that water conservation behavior continues to persist. UC Santa Cruz exceeded the 2020 20% reduction two years ahead of schedule and marginally exceeded the 2025 36% reduction. Before setting more stringent water reduction goals, however, campus must first assess whether the downward trend in usage persists post-drought. Achieving a 36.4% reduction from the 2005-08 baseline took a significant amount of work from many campus partners; maintaining the success the campus has experienced is of vital importance. The primary opportunities to reduce the projected demand on UC Santa Cruz's campus include exploring alternative, non-potable sources of water and continuing to find efficiencies in potable water usage across campus.

While it is too early in the planning processes of both the UC Santa Cruz Long Range Development Plan and Student Housing West to fully understand both the policy and development impacts on water planning, more clarity can be expected over the course of the next year. However, California's recent catastrophic drought and myriad associated impacts necessitates a future where mitigating the effects of the next drought through proactive planning is the new normal.

References

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- ^{iv} Ibid.
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- ^{xiii} JM Brown. "Santa Cruz Council OKs Water Rate Hike." *Santa Cruz Sentinel*, 23 Sept. 2014, www.santacruzsentinel.com/article/zz/20140923/NEWS/140929204
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UC Santa Cruz, *Executive Summary of Comprehensive Settlement Agreement Annual Report*. December 14, 2016. http://lrpd.ucsc.edu/MonitoringReports/2015-16_Settlement_Report.ExecSum.pdf

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Appendix

Physical boundaries and scope

The 2017 UC Santa Cruz Water Action Plan physical boundaries include the Main Campus contiguous property at 1156 High Street, as well as the Marine Science Campus (also known as Long Marine Laboratory). Neither the 2013 nor 2017 Water Action Plans include 2300 Delaware or the properties of Scott's Valley Center or Silicon Valley Center in the reporting scope.

Weighted campus user calculation, data, and formula

The current weighted campus user calculation used for the 2017 WAP is different from that of the 2013 WAP. The reason for this is that the University of California system strives to stay consistent with best practices and methodologies used nationally for calculating sustainability metrics. The current weighted campus user calculation used in the 2017 WAP is consistent with the methodology laid out by the Sustainability Tracking, Assessment, and Rating System (STARS) [technical manual](#) from the [Association for the Advancement of Sustainability in Higher Education \(AASHE\)](#). The nationally accepted weighted campus user calculation methodology changed from using headcounts to Full-Time Equivalent (FTE) in the 2.0 version of STARS, which gives a more accurate depiction of water consumption based on user type.

It is important to note that the updated weighted campus user calculation used for the 2017 WAP do not produce a more favorable or rosy picture of UC Santa Cruz' campus water usage. Rather, the current weighted campus user calculation reduces the number of weighted campus users on campus comparatively to the former calculation, thus decreasing the denominator and increasing the number of gallons per user.

These numbers are meant for reporting purposes on previous performance only and cannot be used for accurate extrapolation or projection for future water usage or future enrollment numbers.

Supporting data to calculate UC Santa Cruz usage, weighted campus user, and gallons per weighted campus user metrics:

Fiscal Year Data	Weighted Campus User (WCU)	Potable Water Use (gallons)	Per Capita Potable Water Use (gpy/WCU)	
FY05-06	14,487	201,860,000	13,934	
FY06-07	15,477	219,830,000	14,204	
FY07-08	15,864	216,290,000	13,634	
Average Weighted Campus User Policy Baseline			15,276	
Average Potable Water Use Policy Baseline			212,660,000	
Average Gallons Per Weighted Campus User Policy Baseline			13,924	
2020 Policy Goal (20% Reduction)			10,907	
2025 Policy Goal (36% Reduction)			8,911	
Current Reduction From Baseline			36.40%	
2020 Goal Met			YES	
2025 Goal Met?			YES	
				% Reduction from Baseline
FY16-17	18,380	162,779,760	8,856	36%
FY15-16	17,736	161,811,848	9,124	34%
FY14-15	17,597	152,774,512	8,682	38%
FY13-14	16,778	179,940,000	10,725	23%
FY12-13	17,049	186,970,000	10,967	21%
FY11-12	17,105	160,490,000	9,383	33%
FY10-11	16,736	178,280,000	10,653	23%
FY09-10	16,834	169,280,000	10,056	28%
FY08-09	16,646	187,540,000	11,266	19%

Data for both Charts entitled 'Total UC Santa Cruz Annual Water Use'												
	Baseline											
(in Millions of Gallons)	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Marine Science Campus Total	9.28	13.14	14.73	11.29	11.42	11.01	9.07	9.37	9.91	6.30	4.78	5.83
Main Campus Total	192.58	206.68	201.56	176.24	157.86	167.27	151.42	177.60	170.04	146.47	157.04	156.95
Total	201.86	219.83	216.29	187.54	169.28	178.28	160.49	186.97	179.94	152.77	161.81	162.78
Data for Chart entitled 'Total UC Santa Cruz Annual Water Use per Weighted Campus User'												
	Baseline											
	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Gallons per Weighted Campus User	13,934.00	14,204.00	13,634.00	11,266.00	10,056.00	10,653.00	9,383.00	10,967.00	10,725.00	8,682.00	9,124.00	8,856.00
Number of Weighted Campus Users	14,487.00	15,477.00	15,864.00	16,646.00	16,834.00	16,736.00	17,105.00	17,049.00	16,778.00	17,597.00	17,736.00	18,380.00

Water Planning & Reporting 3 qrt average on-campus (or snapshot)	2005-06			2006-07			2007-08			2008-09		
	FTE		headcount	FTE		headcount	FTE		headcount	FTE		headcount
	Full time	Part time		Full time	Part time		Full time	Part time		Full time	Part time	
on-campus enrollment*			14254			14619			15000			15823
on-campus students**			6199			6511			6612			6937
on-campus faculty/staff**			279			259			277			252
on-campus dependents**			509			509			518			537
off-campus												
Employees												
Faculty	486	164.02		501	177.34		495	188.8		527	186.13	
Staff	2137	828.07		2224	857.59		2317	855.19		2422	840.47	
	2623	992.09	3615.09	2725	1034.93	3759.93	2812	1043.99	3855.99	2949	1026.6	3975.6
Former Weighted Campus User Calculation			14506.545			14961.215			15335.245			16834.4525
Updated Weighted Campus User Calculation			14486.5			15476.698			15864.243			16646.2

Water Planning & Reporting 3 qrt average on-campus (or snapshot)	2009-10			2010-11			2011-12			2012-13			2013-14		
	FTE		headcount	FTE		headcount	FTE		headcount	FTE		headcount	FTE		headcount
	Full time	Part time		Full time	Part time		Full time	Part time		Full time	Part time		Full time	Part time	
on-campus enrollment*			16063			16173			16436			16487			16300
on-campus students**			6709			7031			7965			7915			7683
on-campus faculty/staff**			286			301			380			298			303
on-campus dependents**			573			575			593			667			666
off-campus															
Employees															
Faculty	426	258.82		504	173.73		509	166.75		489	193.61		481	140.22	
Staff	2279	801.45		2287	732.74		2188	725.07		2118	706.62		2078	708.88	
	2705	1060.27	3765.27	2791	906.47	3697.47	2697	891.82	3588.82	2607	900.23	3507.23	2559	849.1	3408.1
Former Weighted Campus User Calculation									15471.375			17490.865			17231.3
Updated Weighted Campus User Calculation			16834.453			16735.853			17104.865			17048.923			16777.575

Water Planning & Reporting 3 qrt average on-campus (or snapshot)	2014-15			2015-16			2016-17		
	FTE		headcount	FTE		headcount	FTE		headcount
	Full time	Part time		Full time	Part time		Full time	Part time	
on-campus enrollment*			17049			17085			17870
on-campus students**			8293			8543			8803
on-campus faculty/staff**			301			314			266
on-campus dependents**			650			617			668
off-campus									
Employees									
Faculty	501	195.56		511	190		539	210	
Staff	2129	722.94		2146	763		2107	758	
	2630	918.5	3548.5	2657	953	3610	2646	968	3614
Former Weighted Campus User Calculation			18017			18114.25			18806.25
Updated Weighted Campus User Calculation			17596.625			17735.5			18380.25

Weighted campus user formula

$(A + B + C) + 0.75 * [(D - A) + (E - B) - F]$ where:

A = Number of students resident on-site (annualized headcount);

B = Number of employees resident on-site (annualized headcount);

C = Number of in-patient hospital beds (if applicable);

D = Total full-time equivalent student enrollment (annualized full-time equivalent);

E = Full-time equivalent of employees (staff + faculty) (annualized full-time equivalent);

F = Full-time equivalent of students enrolled exclusively in distance education (annualized full-time equivalent).

'C' = 0 as there are no in-patient hospital beds operated on campus. UC Santa Cruz enrollment data removes off-campus enrollees thus 'F' = 0.

Questions or Clarification

For questions or clarification on the data, please e-mail Kristen Lee, Sustainability Programs Manager, Sustainability Office, UC Santa Cruz at Klee122@ucsc.edu.