

Planning Study

for

**University of California, San Diego
Clean Water Utility Initiative**

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1.0 PROJECT DESCRIPTION

The University of California, San Diego (UCSD) uses nearly 800 million gallons of water a year and does not have an effective system in place to comprehensively measure, monitor, and manage this valuable resource. The 1,200-acre UCSD campus has a population of over fifty thousand, 54 acres of turf landscaping, as well as buildings and associated infrastructure built over many decades, creating a complicated and sometimes aging water infrastructure that is not water efficient, lacks a system to effectively monitor and track water consumption, and does not have the infrastructure needed to meet pending water reduction mandates or permit requirements to control sources of pollutants discharging into protected coastal waters.

The UCSD Clean Water Utility Initiative (CWUI) is a comprehensive “end to end” approach to responsible water management that integrates green infrastructure, water and energy conservation, pollution prevention, resource protection, and innovative technology into all aspects of UCSD’s water system. The purpose of the CWUI is to position UCSD as a model and proactive leader in practicing and promoting responsible water utility management - both in terms of quality (addresses point and non-point source pollution) and quantity (supports water conservation).

UCSD's CWUI includes a suite of “shovel ready” green infrastructure improvements that are necessary to execute an integrated campus-wide management approach to pollution prevention, resource protection, new technology application, and water and energy conservation. The CWUI's initial focus is to proactively respond to mandates outlined in California's Climate Action Plan and Ocean Plan by continuing a commitment to protect the ocean while significantly reducing water consumption by applying innovative green technology to record, reduce, recycle and reuse.

Unlike municipalities who have limited control over their water users, UCSD has oversight of the entire water program from the time the water comes in to the campus to the time it goes out and is in a unique position to successfully implement the “shovel ready” projects under this initiative. The CWUI project (1) addresses nonpoint source pollution by implementing environmentally innovative urban retrofit low impact development projects that will eliminate dry weather flows and treat storm water run-off; (2) addresses point source pollution with the retrofit of sanitary and industrial wastewater infrastructure, including the treatment of waste seawater flows prior to discharge into the Pacific Ocean; (3) supports state-wide water and energy conservation efforts through the construction of recycled water distribution systems, installation of efficient water fixtures, irrigation system retrofits, turf replacement with low water/drought resistant landscaping, and water collection and reuse; and (4) advances green infrastructure and innovative technology for responsible water management using the campus as a test bed to demonstrate new conservation tools to water users statewide.

Implementation of the CWUI will:

- decrease UCSD’s potable water consumption by more than 180,000,000 gallons of water per year, reducing the energy use associated with water conveyance, pumping, heating and treatment;
- create more than 700 local jobs, rolling into almost 1,100 jobs at the state level, and increase local and state sales of materials and equipment;
- advance innovative technology for responsible water management;

- protect highly valued ocean resources; and
- establish an energy and water efficient seawater distribution system for world-renowned oceanographic and climate research.

2.0 PROJECT OBJECTIVES

2.1 Water and Energy Conservation Objectives

On February 27, 2009, California Governor Schwarzenegger declared that California's water supply is in a state of emergency, reiterating his call for local governments to cut their use of water by 20% and directing state agencies to take immediate action to put financial resources behind projects and initiatives that local agencies have to increase water efficiency and water conservation.

UCSD is the third largest water consumer in the City of San Diego, using nearly 800 million gallons of water per year. The CWUI project will reduce UCSD's potable water consumption by more than 20% per year, significantly reducing UCSD's demand on the State's water supply and supporting the Governor's request to enact water conservation measures in facilities and landscaping.

A large portion of the energy used in California (electricity and natural gas) is for water distribution and treatment. The CWUI project will measurably reduce potable water demands from the State's water supply by recording, reducing, recycling, and reusing the water on campus. This will, in turn, conserve the energy associated with water conveyance, pumping, heating and treatment. The largest energy footprint for water processing and conveyance occurs in water- scarce southern California.

2.2 Water Quality Objectives

The UCSD storm water utility conveyance system includes components that date back to pre-campus days and are in need of improvements to meet water conveyance requirements of the campus as it exists today. The failure and deterioration of the existing storm water utility infrastructure system results in flooding and erosion when storm water run-off exceeds the capacity of the conveyance system. Inefficient landscape irrigation causes overwatering and nonpoint source flow. A suite of infrastructure improvements, source controls, and storm water/urban run-off treatment controls are needed to improve campus-wide storm water conveyance systems and reduce pollutant loadings to impaired receiving waters.

UCSD discharges waste seawater effluent from oceanographic research at Scripps Institution of Oceanography into the adjacent Pacific Ocean and the San Diego Marine Life Refuge, an Area of Special Biological Significance (ASBS) designated by the State Water Resources Control Board (SWRCB) and Coastal Commission as containing fragile or valuable biological communities that deserve special protections.

UCSD also discharges storm water and urban run-off (e.g., dry weather flows such as irrigation run-off) into four valuable and impaired water bodies:

- Pacific Ocean, including the San Diego Marine Life Refuge, designated as ASBS #31 and a Critical Coastal Area (CAA);

- Los Penasquitos Lagoon;
- San Diego Bay; and
- The San Diego River.

These discharges are regulated by several National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater Permits and a Waste Discharge Permit (for seawater and storm water discharges into the ocean). The CWUI includes a suite of infrastructure improvements, environmentally innovative urban retrofit LID projects, and source controls that will reduce or eliminate point and nonpoint pollution sources (e.g., dry weather flows) that discharge into these water bodies.

2.2.1 Non-Point Source Pollution

The CWUI project implements infrastructure improvements, LID projects, and source control management measures to eliminate dry weather flows and reduce storm water pollution sources. The CWUI project includes source control measures identified in the La Jolla Shores Integrated Coastal Watershed Management Plan that target identified pollutants of concern and support upcoming and existing TMDLs.

2.2.2 Point Source Pollution

2.2.2.1 Scripps Institution of Oceanography (SIO) Seawater System

Scripps Institution of Oceanography (SIO) at UCSD is one of the oldest and largest centers for marine science research, graduate training, and public service in the world. SIO has maintained a seawater system to support its research and teaching mission since 1910. The high quality filtered seawater is a critical resource in numerous marine biology and oceanographic research and teaching activities. Waste seawater from SIO is discharged to the Pacific Ocean, into the San Diego Marine Life Refuge ASBS. The UCSD Campus is regulated under a National Pollutant Discharge Elimination Program (NPDES) Permit No. CA010723 for the discharge of waste seawater from SIO into the Pacific Ocean and San Diego Marine Life Refuge ASBS.

To support the point source water quality objectives related to the SIO Seawater System, it is critical that the seawater infrastructure improvements occur throughout the system, from influent pump stations, through distribution, treatment, diversion, and discharge.

2.2.2.2 UCSD Sanitary Sewer System

Elements of UCSD's sanitary sewer system are more than 40 years old. Various pipelines and connections are deteriorated and are operating below acceptable levels of service. In order to address point source water quality objectives related to the UC San Diego sanitary sewer system, rehabilitation or replacements must take place at Reville, Pepper Canyon, Muir College, Gilman Drive, Mesa Housing, and Hillcrest Medical Center or these systems may contribute to point source pollution due to long-term leaks or sewage spills caused by pipeline or manhole failures.

To prevent the accidental discharge of sanitary waste to protected coastal waters, it is critical to implement sanitary sewer utility infrastructure repairs/replacements in these high priority locations.

2.3 Beneficial Use Objectives

The Clean Water Utility Initiative project area discharges to waters that support a myriad of designated beneficial uses identified in the Water Quality Control Plan for the San Diego Basin (9) (Basin Plan) and Ocean Plan. The La Jolla coastal environment supports the designated beneficial uses of Contact Recreation (REC-1), Commercial/Sport Fishing (COMM), Shellfish Harvesting (SHELL), Preservation of Biological Habitats of Special Significance (BIOL), Rare, Threatened or Endangered Species (RARE) and Marine Habitat (MAR). In addition, the Ocean Plan has designated the marine area as having special biological significance that warrants further protection.

Los Penasquitos Lagoon supports the designated beneficial uses of Contact Recreation (REC-1), Non-contact Water Recreation (REC-2), Preservation of Biological Habitats of Special Significance (BIOL), Estuarine Habitat (EST), Wildlife Habitat (WILD), Rare, Threatened or Endangered Species (RARE), and Marine Habitat (MAR), Migration of Aquatic Organisms (MIGR), Spawning, Reproduction and/or Early Development (SPWN), and Shellfish Harvesting (SHELL).

Designated beneficial uses supported by San Diego Bay include Industrial Service Supply (IND), Navigation (NAV), Contact Recreation (REC-1), Non-contact Water Recreation (REC-2), Commercial/Sport Fishing (COMM), Preservation of Biological Habitats of Special Significance (BIOL), Estuarine Habitat (EST), Wildlife Habitat (WILD), Rare, Threatened or Endangered Species (RARE), and Marine Habitat (MAR), Migration of Aquatic Organisms (MIGR), protection of spawning, reproduction and/or early development (SPWN), and Shellfish Harvesting (SHELL).

Designated beneficial uses supported by the San Diego River include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Service Supply (IND), PROC, Contact Recreation (REC-1), Non-contact Water Recreation (REC-2), Wildlife Habitat (WILD), Warm Freshwater Habitat (WARM), Cold Freshwater Habitat (COLD).

To protect these beneficial uses and preserve the unique resources the areas provide, a holistic water resources system is required that addresses pollutant loadings to receiving waters originating from non-point and point sources, through the integration of effective and efficient infrastructure and source control management measures.

2.4 Green Innovation and Infrastructure Objectives

UCSD's commitment to environmental sustainability involves a long history of environmental and energy conservation curriculum, as well as current initiatives to encourage innovative research and guide "green" improvements in campus operations and infrastructure. UCSD's Sustainability 2.0 Initiative, for example, is a campus-wide program dedicated to identifying funding for and coordinating innovative research collaborations between researchers, students, and facilities and operations staff. Similarly, UCSD's draft Climate Action Plan (CAP) identifies measures that the campus can implement over the next several decades to reduce energy and water usage, greenhouse gas emissions, air emissions, and material consumption. The CAP also describes how sustainability can be integrated throughout the educational curriculum so that all students are encouraged during their academic career at UCSD to reflect on

sustainability issues and contemplate creative solutions to the ever increasing demands that are put on the planet's finite resources.

As a progressive living laboratory for sustainability solutions, the campus will be an early adopter for real-world tools and leading-edge technologies. The combination of water system infrastructure projects, water conservation projects, seawater distribution system improvements, storm water treatment and pollution prevention projects, and sanitary sewer infrastructure replacement projects in the CWUI will enable the campus to advance innovative technology for responsible water management using the campus as a test bed to demonstrate new conservation tools to water users statewide.

3.0 PROPOSED SOLUTIONS AND ALTERNATIVES FOR LISTED OBJECTIVES

The comprehensive water management system created by the CWUI will include water management tools to assess the physical condition and operating capabilities of all existing water systems (potable, sewer, recycled, storm water, and seawater), track and measure water consumption, and monitor the effectiveness of conservation measures and pollution prevention controls.

This will include installing automated water meters throughout campus to track water consumption and usage types. This will enable UCSD to identify areas where water conservation measures can be effectively implemented, perform accurate water audits, and respond to water leaks and other water system issues quickly. In addition, infrastructure improvements in the Potable Water System, such as Water Transmission Line Replacements will prevent potential catastrophic pipe failure resulting in large volumes of potable water being wasted as well as discharging into the environment and carrying sediment and debris into the storm drain system.

3.1 Water and Energy Conservation Solutions

The CWUI is aligned with the goals of UC San Diego's CAP to reduce water consumption and supports the infrastructure needed for sustainability and responsible water management. Conservation projects will result in the significant reduction of water usage and energy consumption.

The CWUI includes the following water conservation projects:

- Increase recycled water distribution throughout campus, reducing the use of potable water;
- Irrigation system retrofits (replace sprinkler heads with low water nozzles and install innovative moisture sensors, developed at UCSD) to reduce water use, maximize water efficiency, and prevent irrigation overflows into the storm water conveyance system;
- Retrofit high consumption water fixtures with water efficient fixtures;
- Turf replacement with drought tolerant landscaping; and
- Collection and reuse of water from fire sprinkler/hydrant flushing activities and rooftop HVAC condensation units

These projects will decrease UCSD's use of potable water by more 180 million gallons per year, reducing UCSD's demand from the State water supply by more than 20%. This significant water savings will result in reducing energy consumption associated with water conveyance, pumping, heating and treatment.

3.2 Water Quality Solutions

3.2.1 Nonpoint source pollution prevention

The CWUI mitigates storm water runoff; encourages environmentally sensitive project planning, design, and construction; and corrects nonpoint source and storm drainage pollution problems.

Storm water pollution prevention projects include a suite of infrastructure projects to improve campus-wide storm water conveyance systems and urban retrofit LID projects and source controls to reduce pollutant loading to receiving waters (Pacific Ocean, Los Penasquitos Lagoon, and San Diego Bay).

The ASBS Protection Project includes the implementation of management measures that will eliminate dry weather flow discharges and measurably reduce pollutants of concern (heavy metals, organics, bacteria, and sediment) in urban and storm water runoff that discharge into the San Diego Marine Life Refuge ASBS. The source and site controls were selected based on their effectiveness at protecting the ASBS from pollutants of concern and include:

- wash racks and sewer connections to eliminate the discharge of wash water from marine activities into the storm water conveyance system;
- pollution prevention controls for material storage areas;
- erosion and sediment controls;
- LID projects including an innovative ecology embankment/media filter that are designed to treat and eliminate or reduce dry weather flows and storm water run-off prior to discharge into the ocean and ASBS.

UCSD's innovative "Wedge" project is a model for environmentally sensitive project planning, design, and construction. This urban retrofit LID project will turn an existing impervious paved area into a "regenerative" open space storm water pollution prevention and treatment area that will (1) reduce runoff peak discharges; (2) infiltrate and treat runoff; (3) include educational opportunities; and (4) include demonstrations of innovative green technologies (e.g., solar forest).

Additional LID projects such as pervious paving and slope stabilization will be implemented in selected locations across the campus to reduce nonpoint source pollutant loadings of sediment, heavy metals, bacteria, and nutrients. Storm water treatment controls at the UCSD Hillcrest Medical Center will include the filtration and detention of storm water runoff prior to discharge to the San Diego River.

3.2.2 Point Source Pollution Prevention

Point source pollution prevention projects address seawater distribution, effluent treatment and discharge at SIO, as well as infrastructure improvements to campus sanitary sewer systems to reduce pollution loading to receiving waters.

3.2.2.1 Scripps Institution of Oceanography (SIO) Seawater System

UCSD is responsible for the management of industrial wastewater (seawater effluent) that is used for oceanographic research at SIO. The CWUI includes the following seawater distribution treatment system controls and facility and infrastructure improvements:

1. Holding tank installation and sanitary sewer connection to discharge medicated seawater to the sanitary sewer system during off-peak hours, eliminating the discharge of medicated seawater to the ocean;
2. Ozonation treatment system to treat incoming seawater to eliminate parasites and reduce the need for chemical medications and resultant seawater discharges to the sanitary sewer system;
3. Install NIS treatment systems to treat waste seawater from tanks that contain animals and plants that are not local to California (non-indigenous species) and prevent the accidental release of non-native species into the ASBS adjacent to SIO;
4. Consolidate all of the NPDES permitted seawater outfalls into one outfall, reducing the number of point source discharges to the ocean.
5. Increase the water and energy efficiency of the seawater distribution utility by retrofitting the existing pier pump station with energy efficient pumps, renewing the sand filter system to reduce the number of filter flushes required to maintain the system, and replacing and automating seawater pumps to maximize water and energy efficiency.
6. Retrofit or replace old seawater holding tanks and piping to prevent the discharge of corroded materials into the ocean and to maintain the ability to provide seawater for oceanographic and climate research.

3.2.2.2 UCSD Sanitary Sewer System

The CWUI sewer system infrastructure projects will rehabilitate or replace deteriorating or leaking pipelines and connections in several critical locations: Revelle, Pepper Canyon, Muir College, Gilman Drive, Mesa Housing, and UCSD Hillcrest Medical Center. This work will address UC San Diego sanitary sewer systems as a potential contributor to point source pollution due to long-term leaks or sewage spills caused by pipeline or manhole failures.

3.3 Protection of Beneficial Uses

The CWUI will protect the beneficial uses of the La Jolla Shores coastline, Los Penasquitos Lagoon, San Diego River, and San Diego Bay by reducing pollutant loading from nonpoint sources through implementation of management measures to eliminate dry weather flows and treat stormwater flows. The project will reduce point source pollutant loading to the ocean through improvements to the seawater utility distribution system (including treatment controls) at SIO, as well as infrastructure improvements to campus sanitary sewer systems.

3.4 Green Innovation and Infrastructure Solutions

UCSD's sustainability initiatives and draft Climate Action Plan illustrate the University's commitment to being a leader in responsible and sustainable water management. As UCSD has management control over the entire water utility system, the campus is in a unique position to successfully implement innovative and effective management measures as well as green infrastructure improvements.

For example, a non-intrusive environmental monitoring system for soil moisture and surface temperature, developed at UCSD, will be installed and assessed at selected locations as a demonstration to optimize irrigation water use. This new water technology, which can be installed near the irrigation controller housing (avoiding cable runs), indirectly calculates soil moisture from the temperature of the grass surface using an infrared surface temperature sensor, thereby indicating when additional moisture is needed. This novel monitoring system will automatically provide actual grass water consumption and soil moisture data to the irrigation controller to adjust watering to weather and soil conditions and eliminate irrigation overflows by not irrigating saturated soils.

Another innovative non-point source pollution prevention project included in the CWUI is an ecology embankment/media filter, a linear, flow-through storm water treatment system that uses natural processes to remove total suspended solids, organics, bacteria, oil & grease, and metals, as well as infiltrate dry weather flows, eliminating this type of discharge onto the beach. This sustainable system is completely passive (requires no energy or mechanical treatment) and uses native vegetation for evaporation-transpiration of water. As an added benefit and in support of other watershed protection efforts, the technology is transferable.

As a progressive living laboratory, UCSD will implement green infrastructure as wide ranging as campus-wide water recycling to as specific as creating a system to collect and reuse water from fire system test flushing and condensation from HVAC units. These sustainability solutions illustrate how UCSD is fast becoming an early adopter for real-world tools and leading-edge technologies.

4.0 ECONOMIC BENEFITS

UCSD is the third largest employer in San Diego County, behind the federal and state governments. Investing in the campus infrastructure through the CWUI will promote and protect much needed jobs locally and throughout the State as the construction industry is stimulated for (1) project construction and implementation, and (2) construction materials and equipment. It is estimated that the UCSD CWUI will create more than 700 local jobs, rolling into nearly 1,100 jobs at the state level, and increase local and state sales of materials and equipment.

Investing in the CWUI will also conserve local resources (water and energy). In addition, the implementation, integration, and display of innovative green projects will create a valuable teaching resource for water users and resource conservationists statewide.

Economic benefits to the university, calculated based on expected water usage reductions from conservation measures, will exceed 180 million gallons of potable water reductions annually. These water utility savings will be augmented by the resulting reduction in energy usage and do not take into account cost avoidances such as any potential fines that may be levied by water agencies for non-compliance with mandatory reductions, or costs related to catastrophic infrastructural failures.

The legacy of the CWUI will be a responsible and sustainable water management program at UCSD that conserves and protects valuable resources and can be used as a model state-wide.